SREE GOKULAM PUBLIC SCHOOL CHENGALPET

CLASS X – MATHEMATICS
SUPPORT MATERIAL

2025 – 2026

INDEX

CLASS X – MATHEMATICS

SUBJECT CODE – 041

SESSION 2025 – 2026

COURSE STRUCTURE

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		Pair of Linear Equations in Two Variables	
		Quadratic Equations	
		Arithmetic Progression	
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VII	Statistics & Probability	Statistics	**11**
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		Total	**80**

Internal Assessment	**20 marks**
Pen Paper Test & Multiple Assessment	10 marks
Portfolio	05 marks
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CHAPTER 1 – REAL NUMBERS

Key Concepts

Rational Numbers

The numbers which can be represented in the form of $\frac{p}{q}$ where $q \neq 0$ and p and q are integers are called rational numbers.

Irrational Numbers

Irrational numbers are the numbers which are non-terminating and non-repeating.

Fundamental Theorem of Arithmetic

Every composite number can be expressed (factorised) as a product of primes, and this factorisation is unique, apart from the order in which the prime factors occur.

Theorem

Let p be a prime number. If p divides a^2, then p divides 'a', where 'a' is a positive integer.

Results

- Rational and irrational numbers together constitute **Real numbers**.
- A number ends with the digit zero if and only if it has either 2 or 5 as its prime factors.
- The sum, difference, product and quotient of two irrational numbers need not always be irrational number.
- There are more irrational numbers than rational numbers between two consecutive numbers.
- **Highest Common Factor (HCF)** is the product of the smallest power of each common prime factor in the numbers.
- **Lowest Common Multiple (LCM)** is the product of the greatest power of each prime factor, involved in the numbers.

Formulae

- **HCF (a, b) x LCM(a, b) = a x b where a and b are positive integers.**
- **LCM (p, q, r) = $\frac{p.q.r.HCF(p,q,r)}{HCF(p,q).HCF(q,r).HCF(p,q)}$ where p, q and r are three numbers.**
- **HCF (p, q, r) = $\frac{p.q.r.LCM(p,q,r)}{LCM(p,q).LCM(q,r).LCM(p,q)}$ where p, q and r are three numbers.**

Prime Factorisation Method to find HCF and LCM

- HCF(a, b) = Product of the smallest power of each common prime factor in the numbers.
- LCM(a, b) = Product of the greatest power of each prime factors, involved in the numbers.

Note: HCF of two numbers is always less than or equal to their LCM. Also, LCM is always a multiple of HCF.

a^n where n is a natural number can end with digit 0, if prime factors of 'a' contain 2^m x 5^n, where m and n are natural numbers.

MULTIPLE CHOICE QUESTIONS

1. HCF of co-primes a and b is

a) ab b) 1 c) a d) b

2. The LCM and HCF of two rational numbers are equal, then the numbers must be

a) prime b) co-prime c) composite d) equal

3. If the LCM of 'a' and 18 is 36 and the HCF of 'a' and 18 is 2, then a = ...

a) 2 b) 3 c) 4 d) 1

4. The smallest number which gives remainders 8 and 12 when divided by 28 and 32 respectively is...

a) 180 b) 240 c) 204 d) 210

5. The smallest 4-digit number divisible by 15, 24 and 36 is

a) 1000 b) 1208 c) 1800 d) 1080

6. The largest number which exactly divides 280 and 1245 leaving remainders 4 and 3 respectively is

a) 36 b) 54 c) 138 d) 72

7. The sum of two numbers is 1215 and their HCF is 81, then the possible numbers of pairs of such numbers are

a) 2 b) 3 c) 4 d) 5

8. If $a = (2^2 \times 3^3 \times 5^4)$ and $b = (2^3 \times 3^2 \times 5)$ then $HCF(a, b) = ?$

a) 90 b) 180 c) 360 d) 540

9. The HCF of two numbers is 27 and their LCM is 162. If one of the numbers is 54, what is the other number?

a) 36 b) 45 c) 9 d) 81

10. The product of two numbers is 1600 and their HCF is 5. The LCM of the numbers is

a) 8000 b) 1600 c) 320 d) 1605

11. If p, q are two consecutive natural numbers, then H.C.F. (p, q) is

a) p b) q c) 1 d) pq

12. Product of two co-prime numbers is 117. Their L.C.M. should be

a) 1 b) 117 c) equal to their H.C.F d) lies between 1 to 117

13. LCM of the given number 'x' and 'y' where y is a multiple of 'x' is given by

a) x b) y c) xy d) $\frac{x}{y}$

14. Three farmers have 490 kg, 588 kg and 882 kg of wheat respectively. Find the maximum capacity of a bag so that the wheat can be packed in exact number of bags.

a) 98 kg b) 290 kg c) 200 kg d) 350 kg

15. The least number that is divisible by all the numbers from 1 to 5 (both inclusive) is

a) 5 b) 60 c) 20 d) 100

16. If the HCF of 65 and 117 is 13, LCM of 65 and 117 is 45 x a, then value of a is

a) 9 b) 11 c) 13 d) 17

17. Two numbers are in the ratio 15:11, if their HCF is 13, then numbers will be

a) 195 & 143 b) 190 & 140 c) 185 & 163 d) 185 & 143

18. If HCF(a, 8) = 4, LCM(a, 8) = 24, then a is

a) 8 b) 10 c) 12 d) 14

19. Find the largest number which divides 129 and 545, leaving remainders 3 and 5 respectively.

a) 81 b) 18 c) 545 d) 129

20. Find the least number which when divided by 35, 56 and 91 leaves the same remainder 7 in each case.

a) 3640 b) 7 c) 3647 d) None of these

21. Two positive integers m and n are expressed as $m = p^5q^2$ and $n = p^3q^4$ where p and q are prime numbers. The LCM of m and n is

(a) p^8q^6 (b) p^3q^2 (c) p^5q^4 (d) $p^5q^2 + p^3q^4$

22. If two positive integers p and q can be expressed as $p = 18a^2b^4$ and $q = 20a^3b^2$, where a and b are prime numbers then LCM(p, q) is

(a) $2a^2b^2$ (b) $180a^2b^2$ (c) $12a^2b^2$ (d) $180a^3b^4$

23. If $a = 2^2 \times 3^x, b = 2^2 \times 3 \times 5, c = 2^2 \times 3 \times 7$ and LCM(a, b, c) = 3780, then x is equal to

(a) 1 (b) 2 (c) 3 (d) 0

24. If $3825 = 3^x \times 5^y \times 17^z$, then the value of x + y – 2z is

(a) 0 (b) 1 (c) 2 (d) 3

25. If the product of two co-prime numbers is 553, then their HCF is

(a) 1 (b) 553 (c) 7 (d) 79

26. If the prime factorisation of 2520 is $2^3 \times 3^a \times b \times 7$, then the value of a + 2b is

(a) 12 (b) 10 (c) 9 (d) 7

27. If HCF(98, 28) = m and LCM(98, 28) = n, then the value of n - 7m is

(a) 0 (b) 28 (c) 98 (d) 198

28. If $(-1)^n + (-1)^8 = 0$, then n is

(a) any positive integer (b) any negative integer

(c) any odd number (d) any even number

29. The greatest number which divides 70 and 125, leaving remainders 5 and 8 respectively, is

(a) 13 (b) 65 (c) 875 (d) 1750

30. If $1080 = 2^p \times 3^q \times 5$, then $(p - q)$ is equal to

(a) 6 (b) -1 (c) 1 (d) 0

31. If $a^b = 32$, where ' a ' and ' b ' are positive integers, then the value of b^{ab} is

(a) 72 (b) 5^{10} (c) 2^{10} (d) 5^{12}

32. If x is the LCM of 4, 6, 8 and y is the LCM of 3, 5, 7 and p is the LCM of x and y, then which of the following is true?

(a) p = 35x (b) p = 4y (c) p = 8x (d) p = 16y

33. If $x = ab^3$ and $y = a^3b$, where a and b are prime numbers, then $[\text{HCF}(x, y) - \text{LCM}(x, y)]$is

(a) $1 - a^3b^3$ (b) ab(1 – ab) (c) $ab - a^4b^4$ (d) ab(1 – ab)(1 + ab)

34. Let $x = a^2b^3c^n$ and $y = a^3b^mc^2$, where a, b, c are prime numbers. If LCM of x and y is $a^3b^4c^3$ then value of m + n is

(a) 10 (b) 7 (c) 6 (d) 5

35. For any prime number p. if p divides a^2, where a is any real number then p also divides

(a) a (b) $a^{\frac{1}{2}}$ (c) $a^{\frac{3}{2}}$ (d) $a^{\frac{1}{8}}$

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: The HCF of two numbers is 18 and their product is 3072. Then their LCM = 169.

Reason: If a, b are two positive integers, then HCF x LCM = a x b.

2. Assertion: 12^n ends with the digit zero, where n is natural number.

Reason: Any number ends with digit zero, if its prime factor is of the form $2^m \times 5^n$, where m, n are natural numbers.

3. Assertion: $\sqrt{x}$ is an irrational number, where x is a prime number.

Reason: Square root of any prime number is an irrational number.

4. Assertion: For any two positive integers a and b, HCF (a, b) x LCM (a, b) = a x b

Reason: The HCF of two numbers is 8 and their product is 280. Then their LCM is 40.

5. Assertion: 3 is a rational number.

Reason: The square roots of all positive integers are irrationals.

6. Assertion: HCF(11, 17) is 1.

Reason: If p and q are prime numbers, then HCF(p, q) = 1

7. Assertion: If LCM = 182, product of integers is 26 x 91, then HCF = 13.

Reason: LCM x Product of integers = HCF.

8. Assertion: 4^n ends with digit 0 for some natural number n.

Reason: For a number 'x' having 2 and 5 as its prime factors, x^n always ends with digit 0 for every natural number n.

CASE STUDY BASED QUESTIONS

1. To enhance the reading skills of grade X students, the school nominates you and two of your friends to set up a class library. There are two sections - Section A and Section B of grade X. There are 32 students in Section A and 36 students in Section B.

i) What is the minimum number of books you will acquire for the class library, so that they can be distributed equally among students of Section A or Section B?

a) 144 b) 128 c) 288 d) 272

ii) If the product of two positive integers is equal to the product of their HCF and LCM is true, then the HCF (32, 36) is .....

a) 2 b) 4 c) 6 d) 8

iii) 36 can be expressed as a product of its primes as

a) $2^2 \times 3^2$ b) $2^1 \times 3^3$ c) $2^3 \times 3^1$ d) $2^0 \times 3^0$

iv) $7 \times 11 \times 13 \times 15 + 15$ is a

a) Prime number b) Composite number

c) Neither prime nor composite d) None of the above

v) If p and q are positive integers such that $p = ab^2$ and $q = a^2b$, where a and b are prime numbers, then the LCM (p, q) is .....

a) ab b) a^2b^2 c) a^3b^2 d) a^3b^3

2. Klick has a camera that takes film that allows 24 exposures, whereas Snapp has a camera that takes film that allows 36 exposures. Both of them want to be take the same number of photographs and complete their rolls of film.

i) Minimum number of exposures that should be taken by each

a) 24 b) 36 c) 72 d) 12

ii) Number of rolls Klick should buy

a) 6 b) 3 c) 2 d) 12

iii) Number of rolls Snap should buy

a) 6 b) 3 c) 2 d) 12

iv) Which Mathematical concept was used in finding minimum number of exposures taken by each

a) HCF b) LCM c) Neither HCF nor LCM d) Fundamental theorem of Arithmetic

3. Swathi wants to organize her birthday party. She was happy on her birthday. She is very health conscious. So decided to serve fruits only to the guests. She has 36 apples, 60 bananas at home and decided to serve them. She wants to distribute the fruits among guests. She does not want to discriminate among guests, so she decided to distribute the fruits equally among all.

i) How many maximum guests Swathi can invite?

a) 12 b) 120 c) 6 d) 180

ii) How many apples and bananas will each guests get?

a) 3 apples 5 bananas b) 5 apples 3 bananas c) 2 apples 4 bananas d) 4 apples 2 bananas

iii) Vedika decide to add 42 mangoes. In this case how many maximum guests Swathi invite?

a) 12 b) 120 c) 6 d) 180

iv) If Swathi decide to add 3 more mangoes and instead 6 apples, in this case how many maximum guests Swathi can invite?

a) 12 b) 30 c) 15 d) 24

v) How many total fruits will each guest get from case (iii)?

a) 36 b) 60 c) 17 d) 23

4. Sandhya on the very first day of her job in a bank, noticed that there are six bells which keep on tolling at regular intervals. She noticed that toll of their intervals are 2, 4, 6, 8, 10, 12 minutes respectively. If all the six bells commence tolling together, at 10 a.m., then answer the following questions:

Based on the given information, answer the following questions:

(i) At what time will they again toll together?

(ii) How many times these bells will toll together during the working hours of Sandhya's job, if Sandhya works for 8 hours in a day?

5. A seminar is being conducted by an Educational Organisation, where the participants will be educators of different subjects. The number participants in Hindi, English and Mathematics are 60, 84 and 108 respectively

(i) In each room the same number of participants are to be seated and all of them being in the same subject, hence find the maximum number of participants that can accommodated in each room.

(ii) What is the minimum number of rooms required during the event?

(iii) Find the LCM of 60, 84 and 108.

(iv) Find the Product of HCF and LCM of 60, 84 and 180.

6. A seminar is being conducted by an educational organisation, where the participants will be educators of different subjects. The number of participants in Hindi, English and Mathematics are 60, 84 and 108 respectively.

Based on the above information, answer the following:

(i) Find the sum of the powers of each prime factor of 108.

(ii) In each room the same number of participants are to be seated and all of them being in the same subject, hence find the maximum number of participants that can accommodated in each room?

(iii) What is the minimum number of rooms required during the event?

(iv) Find the LCM of 60, 84 and 108.

7. In a morning walk, Naveeka, Arjun and Vedant step off together, their steps measuring 240 cm, 90 cm, 120 cm respectively. They want to go for a juice shop for a health issue, which is situated near by them.

Based on the above information, answer the following:

(i) Find the sum of the powers of all common prime factors of the numbers 240, 90 and 120.

(ii) Find the minimum distance of shop from where they start to walk together, so that one can cover the distance in complete steps.

(iii) Find the number of common steps covered by all of them to reach the juice shop.

8. Khushi wants to organize her birthday party. She was happy on her birthday. She is very health conscious, thus she decided to serve fruits only. She has 36 apples and 60 bananas at home and decided to serve them. She wants to distribute fruits among guests. She does not want to discriminate among guests so she decided to distribute equally among all.

Based on the above information, answer the following questions

(i) How many maximum guests Khushi can invite at the most?

(ii) How many apples and bananas will each guest get?

(iii) If Khushi decides to add 42 mangoes also. In this case how many maximum guests Khushi can invite?

(iv) If khushi decides to add 3 more mangoes and instead 6 apples, in this case how many maximum guests khushi can invite?

9. Indian Army is the third biggest military contingent in the World next to USA and China. However, there are many firsts that make Indian army stand out in the world, making us all Indians very proud. Knowing them, will help you celebrate Republic Day with greater vigour and gratitude. On 71th republic day Parade in Delhi Captain RS Meel is planning for parade of following two group: (a) First group of Army contingent of 624 members behind an army band of 32 members. (b) Second group of CRPF troops with 468 soldiers behind the 228 members of bikers. These two groups are to march in the same number of columns. This sequence of soldiers is followed by different states Jhanki which are showing the culture of the respective states.

(i) What is the maximum number of columns in which the army troop can march?

(ii) What is the maximum number of columns in which the CRPF troop can march?

(iii) What should be subtracted with the numbers of CRPF soldiers and the number of bikers so that their maximum number of column is equal to the maximum number of column of army troop?

(iv) What should be added with the numbers of CRPF soldiers and the number of bikers so that their maximum number of column is equal to the maximum number of column of army troop?

10. Teaching Mathematics through activities is a powerful approach that enhance student's understanding and engagement. Keeping this in mind, Ms.Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250.

Now, Mukta asked some questions as given below to the students:

(i) What is the least prime number used by students?

(ii) How many students are in the class?

(iii) What is the highest prime number used by students?

(iv) Which prime number has been used maximum times?

VERY SHORT ANSWERS

1. Atul, Ravi and Tarun go for a morning walk. They step off together and their steps measure 40 cm, 42 cm and 45 cm respectively. What is the minimum distance each should walk so that each can cover the same distance in complete steps?

2. The LCM of two numbers is 14 times their HCF. The sum of LCM and HCF is 600. If one number is 280, then find the other number.

3. If two positive integers X and Y are expressible in terms of primes as $X = p^2q^3$ and $Y = p^3q$ what can you say about their LCM and HCF. Is LCM a multiple of HCF? Explain.

4. Find the largest number which divides 70 and 125 leaving remainder 5 and 8 respectively.

5. Show that 12^n cannot end with the digit 0 or 5 for any natural number n.

6. There is a circular path around a sports field, Priya takes 18 min. to drive one round of the field, while Ravish takes 12 minutes for the same. Suppose they both start at the same point and at the same time and go in the same direction. After how many minutes will they meet again at the starting point?

7. Explain why $(17 \times 5 \times 11 \times 3 \times 2 + 2 \times 11)$ is a composite number?

8. The length, breadth and height of a room are 8 m 50 cm, 6 m 25 cm and 4 m 75 cm respectively. Find the length of the longest rod that can measure the dimensions of the room exactly.

9. A class of 20 boys and 15 girls is divided into n groups so that each group has x boys and y girls. Find x, y and n.

10. Three alarm clocks ring at intervals of 4, 12 and 20 minutes respectively. If they start ringing together, after how much time will they next ring together?

11. In a school, there are two sections of class X. There are 40 students in the first section and 48 students in the second section. Determine the minimum number of books required for their class library so that they can be distributed equally among students of both sections.

12. Find the smallest number which is divisible by both 644 and 462.

13. Two numbers are in the ratio 4:5 and their HCF is 11. Find the LCM of these numbers.

SHORT ANSWERS

1. Prove that $\sqrt{7}$ is an irrational number.

2. Prove that $\sqrt{3} + \sqrt{5}$ is irrational.

3. Find the largest number that will divide 398, 436 and 542 leaving remainders 7, 11, and 15 respectively.

4. In a seminar on the topic 'liberty and equality' the numbers of participants from Hindi, Social Science and English department are 60, 84 and 108 respectively. Find the minimum number of rooms required if in each room the same number of participants are to be seated and all of them being in the same subject.

5. Prove that $\frac{2+\sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

6. Given that $\sqrt{3}$ irrational, hence show that $5 - \frac{2\sqrt{3}}{7}$ is irrational.

7. Given that $\sqrt{5}$ irrational, hence show that $\frac{4\sqrt{5}-3}{2}$ is irrational.

8. A school has invited 42 Mathematics teachers, 56 Physics teachers and 70 Chemistry teachers to attend a Science workshop. Find the minimum number of tables required, if the same number of teachers are to sit at a table and each table is occupied by teachers of the same subject.

9. Prove that $(\sqrt{2} + \sqrt{3})^2$ is an irrational number, given that $\sqrt{6}$ is an irrational number.

10. Prove that $\frac{1}{\sqrt{5}}$ is an irrational number.

11. Three sets of Physics, Chemistry and Mathematics books have to be stacked in such a way that all the books are stored subject-wise and the height of each stack is the same. The number of Physics books is 144, the number of Chemistry books is 180 and the number of Mathematics books is 192. Assuming that the books are of same thickness, determine the number of stacks of Physics, Chemistry and Mathematics books.

12. Prove that $\left(5\sqrt{3}+\frac{2}{3}\right)$ is an irrational number given that $\sqrt{3}$ is an irrational number.

13. Prove that $\left(4\sqrt{2}+\frac{5}{3}\right)$ is an irrational number given that $\sqrt{2}$ is an irrational number.

14. Let x and y be two distinct prime numbers and $p = x^2y^3, q = xy^4, r = x^5y^2$. Find the HCF and LCM of p. q and r. Further check if $\text{HCF}(p,q,r) \times \text{LCM}(p,q,r) = p \times q \times r$ or not.

LONG ANSWERS

1. Three sets of English, Hindi and Sociology books dealing with cleanliness have to stacked in such a way that all the books are stored topic-wise and height of each stack is the same. The number of English books is 96, number of Hindi books is 240 and the number of Sociology books is 336. Assuming that the books are of same thickness, determine the number of stacks of English, Hindi and Sociology books.

2. Prove that $\sqrt{5}$ is an irrational number. Hence show that $3+2\sqrt{5}$ is also an irrational number.

3. Prove that $\sqrt{\text{p}}+\sqrt{\text{q}}$ is irrational, where p and q are primes.

4. A fruit vendor has 990 apples and 945 oranges. He packs them into baskets. Each basket contains only one of the two fruits but in equal number. Find the number of fruits to be put in each basket in order to have minimum number of baskets.

5. A circular field has a circumference of 360km. Three cyclist start together and can cycle 48km, 60km and 72km a day, round the field. When will the meet again?

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. The HCF of two numbers a and b is 5 and their LCM is 200. Find the product ab.

a) 1 b) 1000 c) 40 d) None of these.

2. In a school there are two sections, namely A and B, of class X. There are 30 students in section A and 28 students in section B. Find the minimum number of books required for their class library so that they can be distributed equally among students of section A or section B.

a) 58 b) 420 c) 2 d) None of these

3. The LCM of two prime numbers p and q (p > q) is 221, the value of 3p – q is

a) 4 b) 28 c) 38 d) 48

4. Assertion: The H.C.F. of two numbers is 16 and their product is 3072. Then their L.C.M. = 162.

Reason: If a and b are two positive integers, then H. C. F.× L. C. M. = a × b

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. 144 cartons of Coke cans and 90 cartons of Pepsi cans are to be stacked in a canteen. If each stack is of the same height and if it contains equal cartons of the same drink, what would be the greatest number of cartons each stack would have?

6. Given that HCF (306, 1,314) = 18. Find LCM (306, 1,314).

7. Show that $5\sqrt{6}$ is an irrational number.

SECTION C

Each carry 3 marks

8. Find the greatest number that will divide 382, 509 and 636 leaving remainders 4, 5 and 6 respectively.

9. Prove that $(3 + 2\sqrt{5})^2$ is irrational.

SECTION D

Each carry 5 marks

10. Find the largest number which on dividing 1251, 9377 and 15628 leaves remainders 1, 2 and 3 respectively.

11. Show that there is no positive integer n, for which $\sqrt{n-1} + \sqrt{n+1}$ is rational.

SECTION E

12. Today, she has planned a prime number game. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number the last student got 173250. He told this number to Shalvi in class. Now she asked some questions to the students as given below.

Today, she has planned a prime number game. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number the last student got 173250. He told this number to Shalvi in class. Now she asked some questions to the students as given below.

i) How many students are in the class?

ii) What is the highest prime number used by student? (Or) What is the least prime number used by students?

iii) Which prime number has been used maximum times?

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. b) 1 2. d) equal 3. c) 4 4. c) 204 5. d) 1080 6. c) 138 7. c) 4 8. b) 180 9. d) 81	1. (d) Assertion (A) is false but reason (R) is true. 2. (d) Assertion (A) is false but reason (R) is true. 3. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 4. (c) Assertion (A) is true but reason (R) is false. 5. (c) Assertion (A) is true but reason (R) is false.	1. i) c) 288 ii) b) 4 iii) a) $2^2 \times 3^2$ iv) Composite number v) b) a^2b^2 2. i) c) 72 ii) c) 3 iii) c) 2 iv) b) LCM	1. 2520 2. 80 3.LCM = p^3q^3, HCF = p^2q. LCM is a multiple of HCF. 4. 13 5. Proof. 6. 3 minutes 7. It has more than	1. Proof 2. Proof 3. 17 4. 12 and 21 5. Proof 6. Proof 7. Proof 8. 14, 12 9. Proof	1. 48, 2, 5 and 7. 2. Proof 3. Proof 4. 45 5. 30 days.

10. c) 320 11. c) 1 12. b) 117 13. b) y 14. a) 98 kg 15. b) 60 16. c) 13 17. a) 195 & 143 18. c) 12 19. b) 18 20. c) 3647 21. (c) p^5q^4	6. (a)Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 7. (c)Assertion (A) is true but reason (R) is false. 8. (d) Assertion (A) is false but Reason (R) is true	3. i) a) 12 ii) a) 3 apples 5 bananas iii) c) 6 iv) c) 15 v) d) 23 4. i) 12 noon ii) 4 5. i) 12 ii) 21 iii) 3780 iv) 45360	two factors. 8. 25cm 9. n = 7, x = 4 and y = 3 10. 1 hour 11. 240 12. 21252 13. 220	11. 12, 15, 16 14. HCF$(p,q,r) = xy^2$, LCM$(p,q,r) = x^5y^4$, HCF$(p,q,r) \times$ LCM$(p,q,r) \neq p \times q \times r$	

22. (d) $180a^3b^4$ 23. (c) 3 24. (c) 2 25. (a) 1 26. (a) 12 27. (c) 98 28. (c) any odd number 29. (a) 13 30. (d) 0 31. (b) 5^{10} 32. (a) p = 35x		6. i) 5 ii) 12 iii) 21 iv) 3780 7. i) 3 ii) 720cm iii) 30 8. i) 12 ii) 3 apples & 5 bananas iii) 6 iv) 15			

33. (d) ab(1 – ab)(1 + ab) 34. (b) 7 35. (a) a		9. i) 16 ii) 12 iii) 4 Soldiers, 4 bikes iv) 12 Soldiers, 12 bikes 10. i) 3 ii) 7 iii) 11 iv) 5			

UNIT TEST

1. b) 1000

2. b) 420

3. c) 38

4. (d) Assertion (A) is false but Reason (R) is true.

5. 18

6. 22,338

7. Proof

8. 126

9. Proof

10. 625

11. Proof

12. i) 7 ii) 11 or 2 iii) 5

CHAPTER 2 – POLYNOMIALS

Key Concepts

Polynomial

An expression consisting of the sum of two or more terms each of which is the product of a constant and a variable raised to an integral power.

An algebraic expression of the form: $a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots\ldots\ldots + a_n x^n \ldots\ldots$ in which a_0, a_1, a_2, $a_3 \ldots a_n$ are coefficients and x is a variable having non-negative integral exponents is called a polynomial in x.

Degree of Polynomial

The degree of a polynomial in one variable is the largest exponent in the polynomial.

Types of Polynomials

Constant Polynomial

A polynomial of degree 0 is called a constant polynomial.

Linear Polynomial

A polynomial of degree 1 is called a linear polynomial.

Quadratic Polynomial

A polynomial of degree 2 is called a quadratic polynomial.

Cubic Polynomial

A polynomial of degree 3 is called a cubic polynomial.

Standard form of a Polynomial

If the terms in a polynomial are written in ascending or descending powers of the variable in it, then the polynomial is said to be in Standard Form.

Value of Polynomial

If p(x) is a polynomial in x and if a is any real number, then the value of polynomial obtained by replacing x by a in p(x) and it is denoted by p(a).

Zero of polynomial

If p(x) is a polynomial in x and if 'a' is any real number, such that p(a) = 0, then 'a' is called a zero of the polynomial p(x).

For any linear polynomial ax + b, zero of the polynomial will be given by the expression P(- $\frac{b}{a}$).

Remark

In general, the number of zeroes a polynomial depends upon the degree of the polynomial. A polynomial of degree 'n' has 'n' zeroes.

Geometrical Meaning of the Zeroes of a Polynomial

The graph of a polynomial p(x) of degree n can intersects or touches the x axis at at-most n points. The number of real zeroes of the polynomial is the number of times its graph touches or intersects x axis.

Graph of Polynomials

Linear Polynomial: The graph of a linear polynomial p(x) = ax + b is a straight line that intersects X-axis at one point only.

Quadratic Polynomial: (i) Graph of a quadratic polynomial p(x) = ax^2 + bx + c is a parabola which opens upwards, if a > 0 and intersects X-axis at a maximum of two distinct points.

(ii) Graph of a quadratic polynomial p(x) = ax^2 + bx + c is a parabola which opens downwards, if a < 0 and intersects X-axis at a maximum of two distinct points.

Results

- **A linear polynomial has at-most one real zero.**
- **A quadratic polynomial has at-most two real zeroes.**
- **A cubic polynomial has at-most three real zeroes.**
- **In general, the number of zeroes of a polynomial depends upon the degree of the polynomial. A polynomial of degree 'n' has 'n' zeroes.**

Formulae

Relationship between zeroes and coefficients of a linear polynomial

For a quadratic polynomial $ax^2 + bx + c$, $a \neq 0$.

- Sum of the zeroes $(\alpha + \beta) = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2} = -\frac{b}{a}$
- Product of zeroes $(\alpha\beta) = \frac{\text{constant term}}{\text{coefficient of } x^2} = \frac{c}{a}$.

Formation of Quadratic Polynomial

If α, β are the zeroes of quadratic polynomial then the polynomial can be formed as $p(x) = x^2 - (\alpha + \beta)x + \alpha\beta$.

Results

For a quadratic polynomial $ax^2 + bx + c$

- If the zeros are both positive, then a and c have the same sign and b has the opposite sign.
- If the zeros are both negative then a, b and c have the same sign.

Some Important Identities

- $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$
- $(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$
- $\alpha - \beta = \pm\sqrt{(\alpha + \beta)^2 - 4\alpha\beta}$
- $\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$
- $\alpha^4 + \beta^4 = (\alpha^2 + \beta^2)^2 - 2(\alpha\beta)^2$ **(Or)** $\alpha^4 + \beta^4 = \{(\alpha + \beta)^2 - 2\alpha\beta\}^2 - 2(\alpha\beta)^2$

MULTIPLE CHOICE QUESTIONS

1. The zeros of the polynomial $x^2 - 2x - 3$ are

a) –3, 1 b) –3, –1 c) 3, –1 d) 3, 1

2. The zeros of the polynomial $4x^2 + 5\sqrt{2}x - 3$ are

a) $-3\sqrt{2}, \sqrt{2}$ b) $-3\sqrt{2}, \frac{\sqrt{2}}{2}$ c) $\frac{-3\sqrt{2}}{2}, \frac{\sqrt{2}}{4}$ d) none of these

3. If one zero of the quadratic polynomial $(k-1)x^2 + kx + 1$ is -4 then the value of k is

a) $\frac{-5}{4}$ b) $\frac{5}{4}$ c) $\frac{-4}{3}$ d) $\frac{4}{3}$

4. It is given that the difference between the zeros of $4x^2 - 8kx + 9$ is 4 and $k > 0$. Then, $k = ?$

a) $\frac{1}{2}$ b) $\frac{3}{2}$ c) $\frac{5}{2}$ d) $\frac{7}{2}$

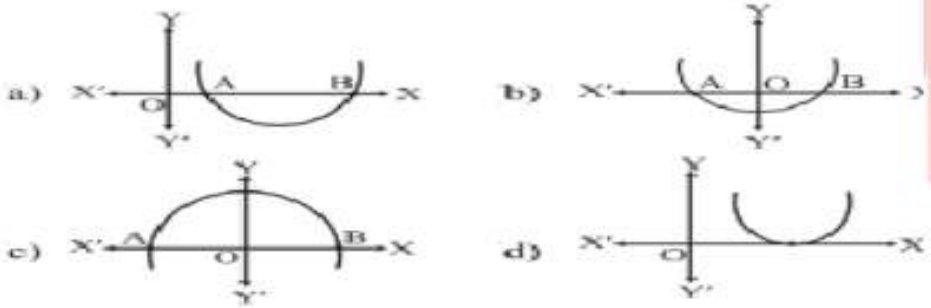
5. If a and b are zeroes of the polynomial $2t^2 - 4t + 3$, then the value of $a^2b + ab^2$ is

a) $\frac{3}{4}$ b) 2 c) 3 d) 4

6. The zeroes of the polynomial $x^2 - 3x - m(m+3)$ are

a) m, m + 3 b) -m, m + 3 c) m, -(m + 3) d) -m, -(m + 3)

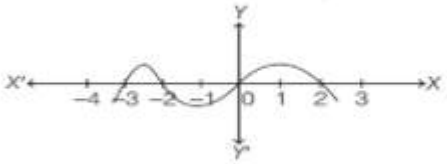
7. Which of the following is/are not graph of a quadratic polynomial?



8. The graph of the polynomial p(x) is given as below, the zeroes of p(x) are

a) -3, -2, 0 and 0 b) -2, 0, 2 and 3

c) -3, -2, 0 and 2 d) -3, 0, 2 and 3



9. If one zero of the polynomial $p(x) = -8x^2 + (k+5)x + 36$ are negative to each other, then the value of k is

a) -5 b) 5 c) 4 d) 3

10. If α and β are zeroes of the polynomial $p(x) = x^2 - p(x+1) + c$ such that $(\alpha+1)(\beta+1) = 0$ then the value of c is

a) -1 b) 1 c) $-\frac{1}{2}$ d) $\frac{1}{2}$

11. Suppose α and β are zeroes of the quadratic polynomial $p(x) = x^2 - (k+5)x + 3(2k-3)$ such that $\alpha + \beta = \frac{\alpha\beta}{2}$, then the value of k is

a) $\frac{19}{3}$ b) - $\frac{19}{4}$ c) $\frac{19}{4}$ d) none of these

12. If one zero of the polynomial $p(x) = 2x^2 - 5x - (2k+1)$ is twice the other zero, then the value of k is

a) $\frac{17}{9}$ b) - $\frac{17}{9}$ c) $\frac{9}{17}$ d) none of these

13. If the square of difference of the zeroes of the quadratic polynomial $p(x) = x^2 + px + 45$ is equal to 144, then the value of p are

a) ± 9 b) ± 12 c) ± 15 d) ± 18

14. If one zero of the quadratic polynomial $2x^2 - 3x + p$ is 3, then its other zero is

a) $\frac{-3}{2}$ b) $\frac{3}{2}$ c) $\frac{1}{2}$ d) $\frac{-1}{2}$

15. If the degree of polynomial p(x) is n, then the maximum number of zeroes it can have is

a) n b) n^2 c) n^3 d) none of these

16. Zeroes of the polynomial $4x^2 - 9$ are

a) $\pm\frac{2}{3}$ b) $\pm\frac{3}{2}$ c) $\pm\frac{5}{2}$ d) none of these

17. If p(x) is a polynomial of degree one and p(a) = 0, then a is said to be:

a) Zero of p(x) b) Value of p(x) c) Constant of p(x) d) none of the above

18. Zeroes of a polynomial can be expressed graphically. Number of zeroes of polynomial is equal to number of points where the graph of polynomial is:

a) Intersects x-axis b) Intersects y-axis c) Intersects y-axis or x-axis d) None of the above

19. What is the number of zeroes that a linear polynomial has/have?

a) 0 b) 1 c) 2 d) 3

20. The graph of the polynomial $ax^2 + bx + c$ is an upward parabola if

a) a > 0 b) a < 0 c) a = 0 d) a = 1

21. If the sum of the zeroes of the polynomial p(x) = $p(x) = 2x^2 - k\sqrt{2}x + 1$ is $\sqrt{2}$, then the value of k is

(a) $\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) $\frac{1}{2}$

22. The zeroes of a polynomial $x^2 + px + q$ are twice the zeroes of the polynomial $4x^2 - 5x - 6$. The value of p is

(a) $-\frac{5}{2}$ (b) $\frac{5}{2}$ (c) -5 (d) 10

23. If α and $\beta(\alpha > \beta)$are the zeroes of the polynomial $-x^2 + 8x + 9$, then $(\alpha - \beta)$ is equal to

(a) -10 (b) 10 (c) ±10 (d) 8

24. What should be subtracted from the polynomial $x^2 - 16x + 30$, so that 15 is the zero of the resulting polynomial?

(a) 30 (b) 14 (c) 15 (d) 16

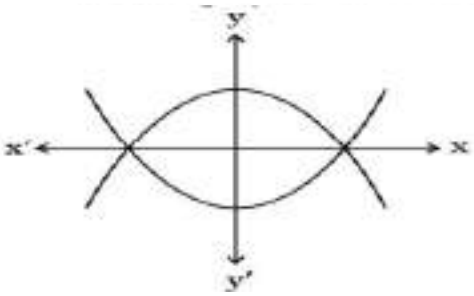
25. A quadratic polynomial, one of whose zeroes is $2 + \sqrt{5}$ and the sum of whose zeroes is 4 is

(a) $x^2 + 4x - 1$ (b) $x^2 - 4x - 1$ (c) $x^2 - 4x + 1$ (d) $x^2 + 4x + 1$

26. If and are the zeroes of polynomial $3x^2 + 6x + k$ such that $\alpha + \beta + \alpha\beta = -\frac{2}{3}$, then the value of k is

(a) 8 (b) 8 (c) 4 (d) 4

27. Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is



(a) 3 (b) 5 (c) 2 (d) 4

28. If -4 is a zero of the polynomial $p(x) = x^2 - x - (2 + 2k)$, then the value of k is

(a) 3 (b) 9 (c) 6 (d) -9

29. If one zero of the polynomial $q(x) = (p^2 + 4)x^2 + 65x + 4p$ is reciprocal of the other, then the value of p is

(a) 1 (b) -1 (c) 2 (d) -2

30. If α and β are the zeroes of the polynomial $p(x) = x^2 - ax - b$, then the value of $(\alpha + \beta + \alpha\beta)$ is

(a) a + b (b) –a – b (c) a – b (d) –a + b

31. Zeroes of the polynomial $p(x) = x^2 - 3\sqrt{2}x + 4$ are

(a) $2, \sqrt{2}$ (b) $2\sqrt{2}, \sqrt{2}$ (c) $4\sqrt{2}, -\sqrt{2}$ (d) $\sqrt{2}, 2$

32. If α and β are zeroes of the polynomial $p(x) = kx^2 - 30x + 45k$ and $\alpha + \beta = \alpha\beta$, then value of k is

(a) $-\frac{2}{3}$ (b) $-\frac{3}{2}$ (c) $\frac{3}{2}$ (d) $\frac{2}{3}$

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: $P(x) = 4x^3 – x^2 + 5x^4 + 3x – 2$ is a polynomial of degree 3.

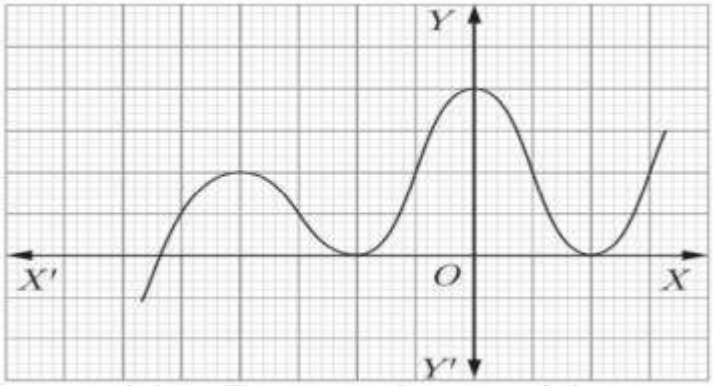
Reason: The highest power of x in the polynomial P(x) is the degree of the polynomial.

2. Assertion: If one zero of poly-nominal $p(x) = (k^2 + 4)x^2 + 13x + 4k$ is reciprocal of other, then $k = 2$.

Reason: If $(x – a)$ is a factor of $p(x)$, then $p(a) = 0$ i.e. a is a zero of $p(x)$.

3. Assertion: The graph $y = f(x)$ is shown in figure, for the polynomial f (x). The number of zeros of f(x) is 3.

Reason: The number of zero of the polynomial f(x) is the number of points of which f(x) cuts or touches the axes.



4. Assertion: Degree of a zero polynomial is not defined.

Reason: Degree of a non-zero constant polynomial is 0.

5. Assertion: If the sum of the zeroes of the quadratic polynomial $x^2 – 2kx + 8$ is 2 then value of k is 1.

Reason: Sum of zeroes of a quadratic polynomial $ax^2 + bx + c$ is $\frac{-b}{a}$.

6. Assertion: If the product of the zeroes of the quadratic polynomial $x^2 + 3x + 5k$ is -10 then value of k is -2.

Reason: Sum of zeroes of a quadratic polynomial $ax^2 + bx + c$ is $\frac{-b}{a}$

7. Assertion: A quadratic polynomial, sum of whose zeroes is 8 and their product is 12 is $x^2 – 20x + 96$.

Reason: If α and β be the zeroes of the polynomial f(x), then polynomial is given by $f(x) = x^2 - (\alpha + \beta)x + \alpha\beta$.

8. Assertion: A quadratic polynomial having 4 and 3 as zeroes is $x^2 - 7x - 12$.

Reason: The quadratic polynomial having α and β as zeroes is given by $p(x) = x^2 - (\alpha + \beta)x + \alpha\beta$.

9. Assertion: Zeroes of $f(x) = x^2 - 4x - 5$ are $5, -1$.

Reason: The polynomial whose zeros are $2 + \sqrt{3}, 2 - \sqrt{3}$ is $x^2 - 4x + 7$.

10. Assertion: If α and β be the zeroes of the polynomial $x^2 + 2x - 15$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is $\frac{2}{15}$.

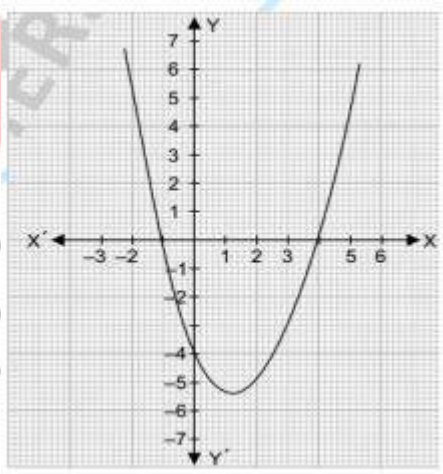
Reason: If α and β be the zeroes of the polynomial $ax^2 + bx + c$, then $\alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{c}{a}$.

11. Assertion: If the graph of a polynomial touches x-axis at only one point, the polynomial cannot be a quadratic polynomial.

Reason: A polynomial of degree n (n > 1) can have at most n zeroes.

CASE STUDY BASED QUESTIONS

1. If we jerk a stretched rope certain waves are produced on the rope. The figure given below shows a part of the wave. Answer the given questions by looking at the figure:



i) The shape which is shown in the graph is

a) spiral b) ellipse c) linear d) parabola

ii) How many zeroes are there for the polynomial?

a) 2 b) 3 c) 1 d) 0

iii) The graph of $y = ax^2 + bx + c$, opens upwards if

a) $a \geq 0$ b) $a = 0$ c) $a < 0$ d) $a > 0$

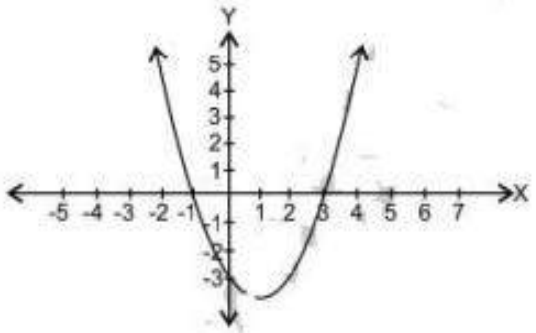
iv) The expression of the given polynomial is

a) $x^2 - 3x - 4$ b) $x^2 + 3x - 4$ c) $x^2 - 3x + 4$ d) $x^2 + 3x + 4$

v) The zeroes of the polynomial are

a) 1, – 4 b) –1, – 4 c) –1, 4 d) 1, 4

2. A park in Shakti Nagar in Delhi has swings made of rubber and iron chain. Kanishka who is studying in class X has noticed that this is a Mathematical shape, she has learned in Maths class. She drew the shape of the swing on her notebook as shown. Following questions raised in her mind.



i) The shape of the curve is

a) spiral b) ellipse c) linear d) parabola

ii) How many zeroes are there for the polynomial (shape of the swing)?

a) 2 b) 3 c) 1 d) 0

iii) The zeroes of the polynomial shown above are

a) –1, 5 b) –1, 3 c) 3, 5 d) – 4, 2

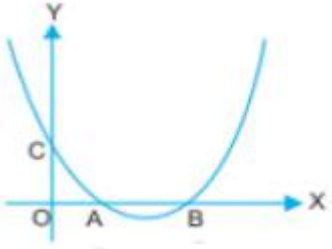
iv) The expression of the polynomial is

a) $x^2 + 2x - 3$ b) $x^2 - 2x + 3$ c) $x^2 - 2x - 3$ d) $x^2 + 2x + 3$

v) The value of the polynomial if x = 1 is

a) –4 b) 5 c) – 5 d) 6

3. The below curve represents a polynomial p(x). The curve meets the x-axis at A and B, and the y-axis at C. Also OA = 2 units and AB = 4 units. Observe the below diagram and answer the questions that follow.



i) p(x) is a _____ polynomial.

a) linear b) quadratic c) cubic d) biquadratic

ii) Zeros of p(x) are

a) 0 and 2 b) 2 and 4 c) 2 and 6 d) 0, 2 and 6

iii) The graph of parabola $ax^2 + bx + c$ opens upwards, then

a) a > 0 b) a = 0 c) a < 0 d) a ≤ 0

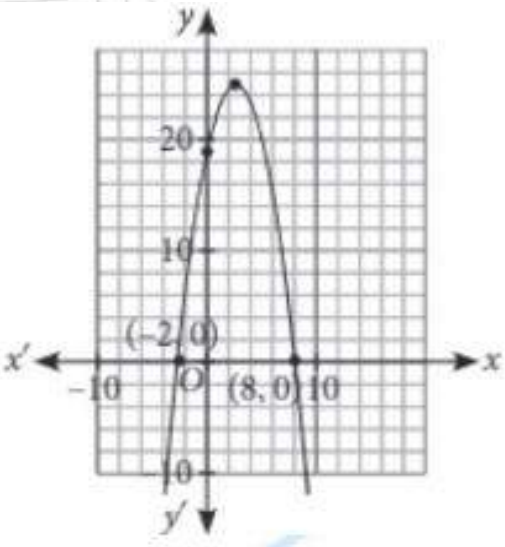
iv) p(x) = _____

a) $x^2 - 8x + 12$ b) $x^2 - 8x - 12$ c) $x^2 + 8x + 12$ d) $x^2 + 8x - 12$

v) The coordinates of C are

a) (12, 0) b) (– 12, 0) c) (0, – 12) d) (0, 12)

4. Priya and her husband Aman who is an architect by profession, visited France. They went to see Mont Blanc Tunnel which is a highway tunnel between France and Italy, under the Mont Blanc Mountain in the Alps, and has a parabolic cross-section. The mathematical representation of the tunnel is shown in the graph.



Based on the above information, answer the following questions.

i) The zeroes of the polynomial whose graph is given, are

a) -2, 8 b) -2, -8 c) 2, 8 d) -2, 0

ii) What will be the expression of the polynomial given in diagram?

a) $x^2 - 6x + 16$ b) $-x^2 + 6x + 16$ c) $x^2 + 6x + 16$ d) $-x^2 - 6x - 16$

iii) What is the value of the polynomial represented by the graph, when x = 4?

a) 22 b) 23 c) 24 d) 25

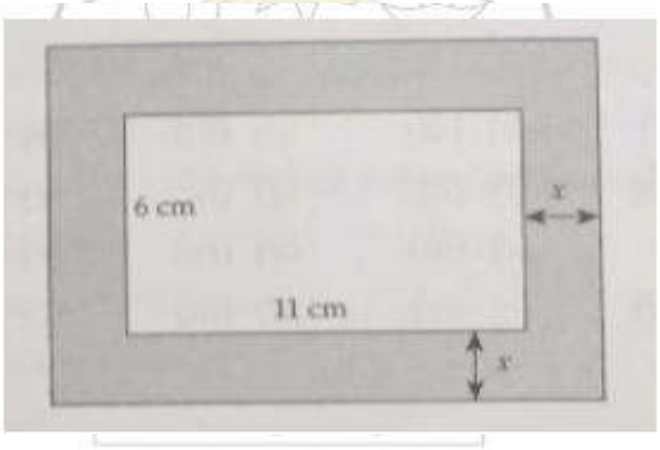
iv) If the tunnel is represented by $-x^2 + 3x - 2$. Then its zeroes are

a) -1, -2 b) 1, -2 c) -1, 2 d) 1, 2

v) If one of the zero is 4 and sum of zeroes is - 3, then representation of tunnel as a polynomial is

a) $x^2 - x + 24$ b) $-x^2 - 3x + 28$ c) $x^2 + x + 28$ d) $x^2 - x + 28$

5. A company is going to make frames as part of a new product they are launching. The frame will be cut out of a piece of steel as shown in the diagram below.



The inside of the frame has to be 11cm by 6cm and the width of the frame is x cm from each side. Based on the above information, answer the following questions:

i) The length of outer rectangle is

a) 11 + x b) 11 + 2x c) 11 – x d) 11 – 2x

ii) The expression for the area of outer rectangle is

a) (11 + 2x)(6 + 2x) b) (11 – 2x)(6 – 2x)

c) 2[(11 + 2x) + (6 + 2x)] d) none of these

iii) The polynomial formed by the area of the outer rectangle is a

a) constant polynomial b) linear polynomial

c) quadratic polynomial d) cubic polynomial

iv) The zeroes of the polynomial formed cuts the x-axis at

a) $-\frac{17}{4}$ b) $\frac{11}{2}, 3$ c) $-11, -\frac{3}{2}$ d) $-\frac{11}{2}, -3$

v) The graph of the polynomial formed cut the x-axis at

a) 1 point b) 2 points c) 3 points d) will not intersect the x axis

6. The figure given here shows the path of a diver, when she takes a jump from the diving board. Clearly it is a parabola. Annie was standing on a diving board, 48 feet above the water level. She took a dive into the pool. Her height (in feet) above the water level at any time 't' in seconds is given by the polynomial h(t) such that $h(t) = -16t^2 + 8t + k$.

i) What is the value of k?

a) 0 b) -48 c) 48 d) $\frac{48}{-16}$

ii) At what time will she touch the water in the pool?

a) 30 seconds b) 2 seconds c) 1.5 seconds d) 0.5 seconds

iii) Rita's height (in feet) above the water level is given by another polynomial p(t) with zeroes – 1 and 2. Then p(t) is given by

a) $t^2 + t - 2$ b) $t^2 + 2t - 1$ c) $24t^2 - 24t + 48$ d) $-24t^2 + 24t + 48$

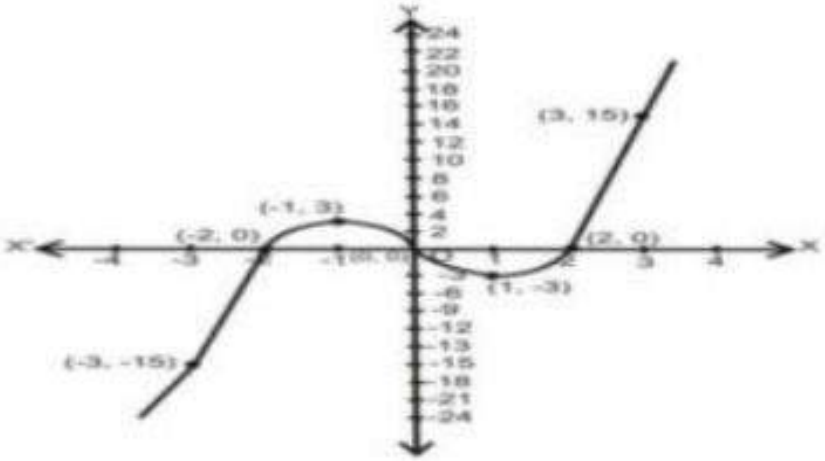
iv) A polynomial q(t) with sum of zeroes as 1 and the product as – 6 is modelling Anu's height in feet above the water at any time t (in seconds). Then q(t) is given by

a) $t^2 + t + 6$ b) $t^2 + t - 6$ c) $-8t^2 + 8t + 48$ d) $8t^2 - 8t + 48$

v) The zeroes of the polynomial r(t) = – 12t2 + (k – 3)t + 48 are negative of each other. Then k is

a) 3 b) 0 c) – 1.5 d) – 3

7. One day, due to heavy storm an electric wire got bent as shown in the figure. It followed some mathematical shape of curve. Answer the following questions below.



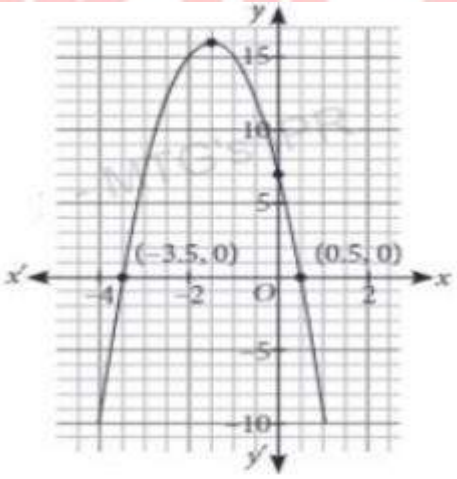
i) How many zeroes are there for the polynomial (shape of the wire)

ii) Find the zeroes of the polynomial.

iii) Find the quadratic polynomial whose zeroes are -3 and 4

iv) If one zero of the polynomial $x^2 - 5x - 6$ is 6 then find the other zero

8. Just before the morning assembly a teacher of kindergarten school observes some clouds in the sky and so she cancels the assembly. She also observes that the cloud has a shape of the polynomial. The mathematical representation of a cloud is show in the figure.



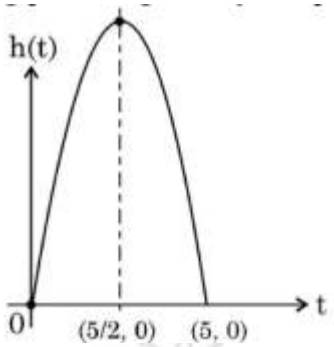
(i) Find the zeroes of the polynomial represented by the graph.

(ii) What will be the expression for the polynomial represented by the graph?

(iii) What will be the value of the polynomial represented by the graph when x = 3?

(iv) If α and β are the zeroes of the polynomial $f(x) = x^2 + 2x - 8$, then find $\alpha^4 + \beta^4$.

9. A ball is thrown in the air so that t seconds after it is thrown its height h meter above its starting point is given by the polynomial $h = 25t - 5t^2$.



Observe the graph of the polynomial and answer the following questions:

(i) Write zeroes of the given polynomial.

(ii) Find the maximum height achieved by ball.

(iii) After throwing upward, how much time did the ball take to reach to the height of 30m?

(iv) Find the two different values of t when the height of the ball was 20m?

VERY SHORT ANSWERS

1. If one zero of the polynomial $(a^2 + 9)x^2 + 13x + 6a$ is reciprocal of the other, find the value of a.

2. If (x + a) is a factor of the polynomial $2x^2 + 2ax + 5x + 10$, find the value of a.

3. If α and β are the zeros of the polynomial $2x^2 + 7x + 5$, find the value of $\alpha + \beta + \alpha\beta$.

4. If α and β are the zeros of the polynomial $f(x) = 5x^2 - 7x + 1$, find the value of $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$.

5. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - 5x + 6$, then find the value of $\alpha^4 + \beta^4$.

6. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - 6x + k$, find the value of k if $3\alpha + 2\beta = 20$.

7. Find the value of k such that the polynomial $x^2 - (k + 6)x + 2(2k - 1)$ has sum of its zeroes equal to half of their product.

8. If α and β are the zeroes of the quadratic polynomial $p(x) = 4x^2 + 4x + 1$, then find a quadratic polynomial whose zeroes are 2α and 2β.

9. Find the value of p, for which one root of the quadratic polynomial $px^2 - 14x + 8 = 0$ is 6 times the other.

10. If α and β are the zeroes of the polynomial $f(x) = x^2 - 6x + k$, find the value of k, such that $\alpha^2 + \beta^2 = 40$.

11. If one zero of the quadratic polynomial $2x^2 - 3x + p$ is 3, find the other zero. Also, find the value of p.

12. If α and β are the zeroes of the polynomial $p(x) = 4x^2 - 5x - 1$, find the value of $\alpha^4\beta^3 + \alpha^3\beta^4$.

13. If the sum of the zeroes of the quadratic polynomial $p(x) = kx^2 - 4x + 2k$ is same as their product, find the value of k.

14. If one zero of the quadratic polynomial $p(x) = 4x^2 - 8kx + 8x - 9$ is negative of the other, then find the zeroes.

15. If –5 is one of the zeroes of $2x^2 + px - 15$ and the quadratic polynomial $p(x^2 + x) + k$ has both the zeroes equal to each other. Find k.

16. Find the zeroes of the polynomial $p(x) = x^2 + \frac{4}{3}x - \frac{4}{3}$.

17. If p and q are zeroes of the polynomial $p(y) = 21y^2 - y - 2$, then find the value of $(1 - p)(1 - q)$.

18. If ' α ' and ' β ' are the zeroes of the polynomial $p(y) = y^2 - 5y + 3$, then find the value of $\alpha^4\beta^3 + \alpha^3\beta^4$.

19. If the sum of the zeroes of the polynomial

$p(x) = (p+1)x^2 + (2p+3)x + (3p+4)$ is -1, then find the value of p.

SHORT ANSWERS

1. Find the zeros of the quadratic polynomial $2\sqrt{3}x^2 - 5x + \sqrt{3}$ and verify the relationship between the zeros and the coefficients.

2. If $x = \frac{2}{3}$ and $x = -3$ are the roots of the quadratic polynomial $ax^2 + 7x + b$, then find the values of a and b.

3. If α and β are the zeros of the polynomial $f(x) = x^2 - 5x + k$ such that $\alpha - \beta = 1$, then find the value of k.

4. If α and β are the zeros of the polynomial $f(x) = 6x^2 + x - 2$, find the value of $\left(\frac{\alpha}{\beta} + \frac{\beta}{\alpha}\right)$.

5. If α and β are the zeros of the polynomial $f(x) = x^2 + x - 2$, find the value of $\left(\frac{1}{\alpha} - \frac{1}{\beta}\right)$.

6. If α and β are the zeroes of the quadratic polynomial $p(x) = ax^2 + bx + c$, then evaluate the following: i) $\alpha^3 + \beta^3$ ii) $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$

7. If α and β are the zeroes of the quadratic polynomial $p(x) = ax^2 + bx + c$, then evaluate the following: i) $\alpha^2 - \beta^2$ ii) $\alpha^3\beta^2 + \alpha^2\beta^3$

8. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - 1$, then find the quadratic equation whose zeroes are $\frac{2\alpha}{\beta}$ and $\frac{2\beta}{\alpha}$.

9. If the zeroes of the quadratic polynomial $x^2 + px + q$ are double in value to the zeroes of $2x^2 - 5x - 3$, find the values of p and q.

10. If p and q are zeroes of the polynomial $x^2 - 4x + 3$, show that $\frac{1}{p} + \frac{1}{q} - 2pq + \frac{14}{3} = 0$.

11. If α and β are the zeroes of the quadratic polynomial $p(x) = 21y^2 - y - 2$, find a quadratic polynomial whose zeroes are 2α and 2β.

12. If α and β are the zeroes of the quadratic polynomial $f(x) = 2x^2 - 5x + 7$, find the quadratic polynomial whose zeroes are $2\alpha + 3\beta$ and $3\alpha + 2\beta$.

13. Find the quadratic polynomial whose zeroes are square of the zeroes of the polynomial $x^2 - x - 1$.

14. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - 2x + 3$, then form a quadratic polynomial whose zeroes are α + 2 and β + 2.

15. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 + 4x + 3$, form a quadratic polynomial whose zeroes are $1 + \frac{\beta}{\alpha}$ and $1 + \frac{\alpha}{\beta}$.

16. Find a quadratic polynomial whose sum of the zeroes is 8 and difference of the zeroes is 2.

17. If α and β are the zeroes of the polynomial $p(x) = x^2 - (k+5)x + (5k+1)$ such that $\alpha + \beta = \frac{\alpha\beta}{3}$, then find the value of k.

18. If α, β are the zeroes of the polynomial $3x^2 - 13x - 10$, then find the value of $(3\alpha + 1)(3\beta + 1)$.

19. If α and β are zeroes of the polynomial $p(x) = x^2 - 2x - 1$, then find the value of $\frac{1}{2\alpha} + \frac{1}{2\beta} + 3\alpha\beta$.

20. Obtain the zeroes of the polynomial $7x^2 + 18x - 9$. Hence, write a polynomial each of whose zeroes is twice the zeroes of given polynomial.

21. Obtain the zeroes of the polynomial $p(x) = 2x^2 - 5x - 3$. Hence, obtain a polynomial each of whose zeroes is one less than each of the zero of p(x).

LONG ANSWERS

1. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - 3x - 2$, find a quadratic equation whose zeroes are $\frac{1}{2\alpha+\beta}$ and $\frac{1}{2\beta+\alpha}$.

2. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - 2x + 3$, find a quadratic polynomial whose zeros are $\frac{\alpha-1}{\alpha+1}, \frac{\beta-1}{\beta+1}$.

3. If α and β are the zeroes of the quadratic polynomial $p(x) = 2x^2 + 5x + k$ satisfying the relation $\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$, then find the value of k.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. If 2 and –3 are the zeroes of the quadratic polynomial $x^2 + (a + 1)x + b$, then the value of a + b is

a) –5 b) 0 c) 6 d) –6

2. If two zeroes of a quadratic polynomial are $5 - 3\sqrt{2}$ and $5 + 3\sqrt{2}$, then the quadratic polynomial is

a) $x^2 – 10x – 7$ b) $x^2 – 10x + 6$ c) $x^2 – 10x + 14$ d) $x^2 – 10x + 7$

3. The zeroes of the quadratic polynomial $x^2 + 99x + 127$ are

a) both positive b) both negative c) one positive and one negative d) both equal

4. Assertion: If zeroes of the polynomial f(x) = 5x2 – 11x – (k – 3) are reciprocal of each other, then k = -2

Reason: The product of the zeroes of the polynomial ax2 + bx + c is $\frac{-c}{a}$.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. Form a quadratic polynomial, one of whose zeroes is $2 + \sqrt{3}$ and sum of zeroes is 4.

6. If α and β are the zeroes of the quadratic polynomial $p(x) = 5x^2 + 5x + 1$ then find the value of $\alpha^{-1} + \beta^{-1}$.

7. If one zero of the quadratic polynomial $f(x) = 4x^2 - 8kx + 8x - 9$ is negative of the other, then find the zeros of $kx^2 + 3kx + 2$.

SECTION C

Each carry 3 marks

8. Show that $\frac{1}{2}$ and $\frac{-3}{2}$ are the zeroes of the polynomial $4x^2 + 4x - 3$ and verify the relationship between zeroes and coefficient of polynomial.

9. If product of the zeroes of the polynomial $kx^2 + 41x + 42$ is 7, then find the zeroes of the polynomial $(k - 4)x^2 + (k + 1)x + 5$.

SECTION D

Each carry 5 marks

10. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - p(x + 1) - c$, show that $(\alpha + 1)(\beta + 1) = 1 - c$.

11. If α and β are the zeroes of the quadratic polynomial $2x^2 - 5x + 7$, then find a quadratic polynomial whose zeroes are $(3\alpha + 4\beta)$ and $(4\alpha + 3\beta)$.

SECTION E

12. Mrs.A is a Mathematics Teacher. She knows how important Mathematics assignments are. These help to review classwork, to include study habits, to learn to use resources etc.

Today she prepared the following assignment on application of relation between the zeroes α and β and the coefficient of a quadratic polynomial $x^2 + x - 6$.

i) Find the value of $\alpha + \beta$.

ii) Evaluate $\alpha - \beta$ (Or) Find the value of $\alpha^2 + \beta^2$.

iii) Find the value of $\alpha^3 + \beta^3$.

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. c) $3, -1$ 2. c) $\frac{-3\sqrt{2}}{2}, \frac{\sqrt{2}}{4}$ 3. b) $\frac{5}{4}$ 4. c) $\frac{5}{2}$ 5. c) 3 6. b) -m, m + 3 7. d) 8. c) -3, -2, 0 and 2 9. a) -5	1. (d) Assertion (A) is false but reason (R) is true. 2. (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A). 3. (c) Assertion (A) is true but reason (R) is false.	1. i) d ii) a iii) d iv) a v) c 2. i) d ii) a iii) b iv) c v) a 3. i) b ii) c iii) a iv) a v) d 4. i) a ii) b iii) c iv) d v) b 5. i) b ii) a iii) c iv) d v) b 6. i) c ii) b iii) d	1. $a = 3$ 2. $a = 2$ 3. -1 4. 7 5. -56 6. -16 7. 7 8. $p(x) = k(x^2 + 2x + 1)$ 9. p = 3	1. $\frac{\sqrt{3}}{2}, \frac{1}{\sqrt{3}}$ 2. $a = 3, b = -6$ 3. $k = 6$ 4. $\frac{-25}{12}$ 5. $\frac{-3}{2}$ 6. i) $\frac{-b^3+3abc}{a^3}$ ii) $\frac{-b^3+3abc}{a^2c}$ 7. i) $\frac{-b\sqrt{b^2-4ac}}{a^2}$ ii) $\frac{-bc^2}{a^3}$	1. $k\left\{x^2 - \frac{9}{16}x + \frac{1}{16}\right\}$ 2. $k\left\{x^2 - \frac{2}{3}x + \frac{1}{3}\right\}$ 3. k = 2

10. a) -1 11. c) $\frac{19}{4}$ 12. b) $-\frac{17}{9}$ 13. d) ± 18 14. a) $\frac{-3}{2}$ 15. a) n 16. b) $\pm\frac{3}{2}$ 17. a) Zero of p(x) 18. (a) Intersects x-axis 19. b) 1 20. a) a > 0	4. (b)Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A). 5. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 6. (b)Both assertion (A) and reason (R) are true but reason	iv) c v) a 7. i) 3 ii) -2, 0, 2 iii) $x^2 - x - 12$ iv) -1 8. i) -3.5 & 0.5 ii) $x^2 + 3x + 1.75$ iii) 19.75 iv) 272 9. i) 0 and 5 ii) $\frac{125}{4}$ or 31.25m iii) t = 2 iv) t = 1 & 4	10. k = -2 11. p = -9, other zero is $\frac{-3}{2}$ 12. $\frac{-5}{256}$ 13. k = 2 14. $\frac{-3}{2}$ and $\frac{3}{2}$ 15. $k = \frac{7}{4}$ 16. Zeroes are $\frac{2}{3}, -2$ 17. $\frac{6}{7}$ 18. 135 19. p = - 2	8. $k(x^2 + 4x + 4)$ 9. $p = -5, q = -6$ 10. Proof. 11. $21x^2 - 2y - 8$ 12. $2x^2 - 25x + 82$ 13. $x^2 - 3x + 1$ 14. $x^2 - 6x + 11$ 15. $3x^2 - 16x + 16$. $x^2 - 8x + 15$ 17. k = 7 18. -16 19. -4 20. $x^2 + \frac{36}{7}x -$ $\frac{36}{7}$ or $7x^2 + 36x -$	

21. (b) 2 22. (a) $-\frac{5}{2}$ 23. (b) 10 24. (c) 15 25. (b) $x^2 - 4x - 1$ 26. (d) 4 27. (c) 2 28. (b) 9 29. (c) 2 30. (c) a – b 31. (b) $2\sqrt{2}, \sqrt{2}$ 32. (d) $\frac{2}{3}$	(R) is not the correct explanation of assertion (A). 7. (d)Assertion (A) is false but reason (R) is true. 8. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 9. (c)Assertion (A) is true but reason (R) is			36 21. $x^2 - \frac{1}{2}x -$ 3 or $2x^2 - x - 6$	

	false. 10. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 11. (d) Assertion (A) is false but Reason (R) is true.				

UNIT TEST

1. d) –6

2. d) $x^2 - 10x + 7$

3. b) both negative

4. (c) Assertion (A) is true but Reason (R) is false.

5. $x^2 - 4x + 1$

6. -5

7. -1 and -2

8. Verification

9. $\frac{-5}{2}$ and -1

10. Proof

11. $2x^2 - 35x + 157$

12. i) -1 ii) ±5 (Or) 13 iii) -19

CHAPTER 3 – PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Key Concepts

Linear Equation in two variables

An equation of the form $ax + by + c = 0$, where a, b, and c are real numbers such that a and b are not both zero is called a linear equation in two variables.

Pair of Linear Equations in two variables

Two linear equations in same two variables x and y are called pair of linear equations in two variables.

General form of Pair of Linear Equations

The general form of pair of linear equations in two variables is $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ where a_1, a_2, b_1, b_2, c_1, c_2 are real numbers.

Solution

The solution of pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ is the ordered pair (x, y) which satisfies both the equations.

Consistent or Independent System

A system of simultaneous linear equations is said to be consistent, if it has atleast one solution.

Dependent System

A system which represents a pair of equivalent equations and has an infinite number of solutions is called as dependent system or consistent with infinite solutions.

Inconsistent System

A system of simultaneous linear equations is said to be inconsistent if it has no solution.

Result

Ratio	Graphical Representation	Algebraic Interpretation	Consistency
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Intersecting Lines	Unique Solution	Consistent
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Co-incident Lines	Infinitely many solutions	Consistent
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	Parallel Lines	No solution	In-consistent

(i) The graph of x = constant is a line parallel to the y-axis.

(ii) The graph of y = constant is a line parallel to the x-axis.

(iii) The graph of y = ± x is a line passing through the origin.

Algebraic Methods for Solving a Pair of Linear Equations

Substitution Method

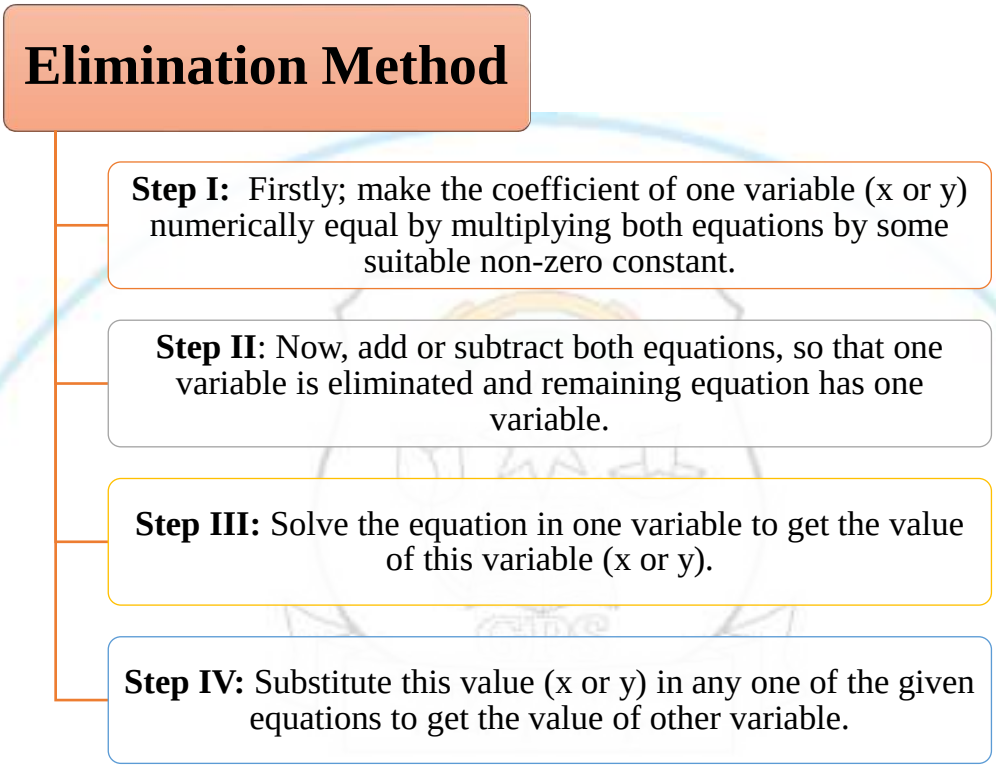
Steps used in this method to solve a pair of linear equations are given below.

Substitution Method

- **Step I:** Find the value of one variable x (or y) in terms of other variable i.e., y (or x) form an equation
- **Step II:** Substitute this value of x (or y) in other equation, then it reduces to a linear equation in one variable. i.e., in term of y (or x) which can be sloved easily.
- **Step III:** Substitute the value of y (or x) obtained in step II in the equation which is used to obtain the value of other variable in step I.

Elimination Method

Steps used in this method to solve a pair of linear equations are given below.



Remarks

- The speed of the boat downstream is the sum of speed of boat in still water and speed of the stream.
- The speed of the boat upstream is the difference of speed of boat in still water and speed of the stream.

Relative Speed

Suppose two bodies are moving at a different speed in the same direction.

Let the speed of 1st body be x km/hr and the speed of the 2nd body is y km/hr.

So, their relative speed is = (x – y) km/hr [x > y]

MULTIPLE CHOICE QUESTIONS

1. If $2x + 3y = 12$ and $3x - 2y = 5$ then

a) $x = 2, y = 3$ b) $x = 2, y = -3$ c) $x = 3, y = 2$ d) $x = 3, y = -2$

2. If $x - y = 2$ and $\frac{2}{x+y} = \frac{1}{5}$ then

a) $x = 4, y = 2$ b) $x = 5, y = 3$ c) $x = 6, y = 4$ d) $x = 7, y = 5$

3. If $29x + 37y = 103$ and $37x + 29y = 95$ then

a) $x = 1, y = 2$ b) $x = 2, y = 1$ c) $x = 3, y = 2$ d) $x = 2, y = 3$

4. The system $kx - y = 2$ and $6x - 2y = 3$ has a unique solution only when

a) $k = 0$ b) $k \neq 0$ c) $k = 3$ d) $k \neq 3$

5. The system $x + 2y = 3$ and $5x + ky + 7 = 0$ has no solution, when

a) $k = 10$ b) $k \neq 10$ c) $k = \frac{-7}{3}$ d) $k = -21$

6. If the lines given by $3x + 2ky = 2$ and $2x + 5y + 1 = 0$ are parallel then the value of k is

a) $\frac{-5}{4}$ b) $\frac{2}{5}$ c) $\frac{3}{2}$ d) $\frac{15}{4}$

7. For what values of k do the equations $kx - 2y = 3$ and $3x + y = 5$ represent two lines intersecting at a unique point?

a) $k = 3$ b) $k = -3$ c) $k = 6$ d) all real values except -6

8. The pair of equations $x + 2y + 5 = 0$ and $-3x - 6y + 1 = 0$ has

a) a unique solution b) exactly two solutions c) infinitely many solutions d) no solution

9. In a cyclic quadrilateral ABCD, it is being given that $\angle A = (x + y + 10)^\circ$, $\angle B = (y + 20)^\circ$, $\angle C = (x + y - 30)^\circ$ and $\angle D = (x + y)^\circ$. Then, $\angle B = ?$

a) 70° b) 80° c) 100° d) 110°

10. If a pair of linear equations is consistent then their graph lines will be

a) parallel b) always coincident c) always intersecting d) intersecting or coincident

11. The graphs of the equations $6x - 2y + 9 = 0$ and $3x - y + 12 = 0$ are two lines which are

a) coincident b) parallel c) intersecting exactly at one point d) perpendicular to each other

12. The graphs of the equations $5x - 15y = 8$ and $3x - 9y = \frac{24}{5}$ are two lines which are

a) coincident b) parallel c) intersecting exactly at one point d) perpendicular to each other

13. Two lines are given to be parallel. The equation of one of the lines is 3x – 2y = 5. The equation of the second line can be:

a) 9x + 8y = 7 b) –12x – 8y = 7 c) –12x + 8y = 7 d) 12x + 8y = 7

14. If $ax + by = a^2 - b^2$ and $bx + ay = 0$, then the value of $(x + y)$ is

a) $a^2 - b^2$ b) $a + b$ c) $a - b$ d) $a^2 + b^2$

15. The angles of a triangle are x, y and 40°. The difference between the two angles x and y is 30°. The value of 2x + y is

a) 225° b) 230° c) 140° d) 150°

16. If x = a, y = b is the solution of the equations x – y = 2 and x + y = 4, then a ÷ b =

a) 1 b) –2 c) 2 d) 3

17. For what values of a and b does the following pair of equations have an infinite number of solutions? 2x + 3y = 7; a(x + y) – b (x – y) = 3a + b – 2

a) 3 and 1 b) 5 and 1 c) 4 and 3 d) 5 and –2

18. For what values of p and q the system of equations, 2x + 3y = 7; (p + q + 1)x + (p + 2q + 2)y = 4 (p + q) + 1 will represent coincident lines ?

a) 1, 5 b) 3, 5 c) 4, 3 d) 3, 2

19. Two numbers are in the ratio 5:6. If 8 is subtracted from each of the numbers, the ratio becomes 4:5, then the numbers are

a) 25 and 30 b) 40 and 48 c) 30 and 36 d) 45 and 54

20. The length and breadth of a field if its area is 540 m^2 and perimeter is 96 m are

a) 36 m and 15 m b) 18 m and 30 m c) 9 m and 60 m d) 25 m and 21.6 m

21. The sum of the digits of a two-digit number is 9. If 27 is added to it, the digits of the number get reversed. The number is:

a) 45 b) 72 c) 63 d) 36

22. The graph of y = 5 is a line parallel to the

a) x-axis b) y-axis c) both axis d) none of these

23. What type of straight lines will be represented by the system of equations 2x + 3y = 5 and 4x + 6y = 7?

a) intersecting b) parallel c) coincident d) none of these

24. The sum of numerator and denominator of a fraction is 12. If the denominator is increased by 3, the fraction becomes $\frac{1}{2}$. The fraction is

a) $\frac{5}{12}$ b) $\frac{7}{12}$ c) $\frac{5}{7}$ d) $\frac{7}{5}$

25. Shipra gave a note of ₹ 2,000 for a pair of jeans worth ₹ 500. She was returned 11 notes in denominations of ₹ 200 and ₹ 100. Which pair of equations can be used to find the number of ₹ 200 notes, x, and the number of ₹ 100 notes y? How many notes of ₹ 200 did she get?

a) x + y = 11 and 200x + 100y = 1500; 4 b) x = y + 11 and 200x + 100y = 2000; 4

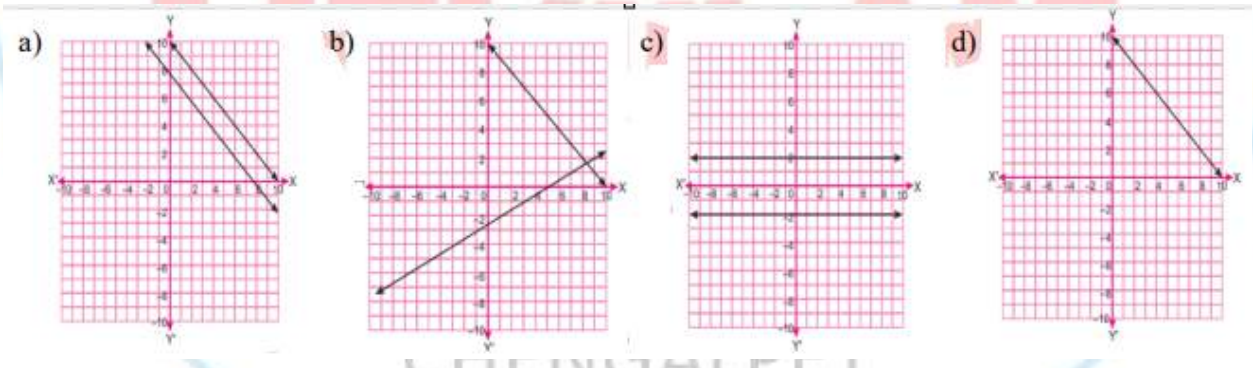
c) x + y = 15 and 200x + 100y = 1800; 10 d) x + y = 15 and 100x + 200y = 1800; 12

26. In the equations shown below, a and b are unknown constants. 3ax + 4y = −2 2x + by = 14

If (–3, 4) is the solution of the given equations, what are the values of a and b?

a) a = 5, b = 2 b) a = 5, b = –2 c) a = 2, b = 5 d) a = –2, b = 5

27. Which of these linear equations have a unique solution?



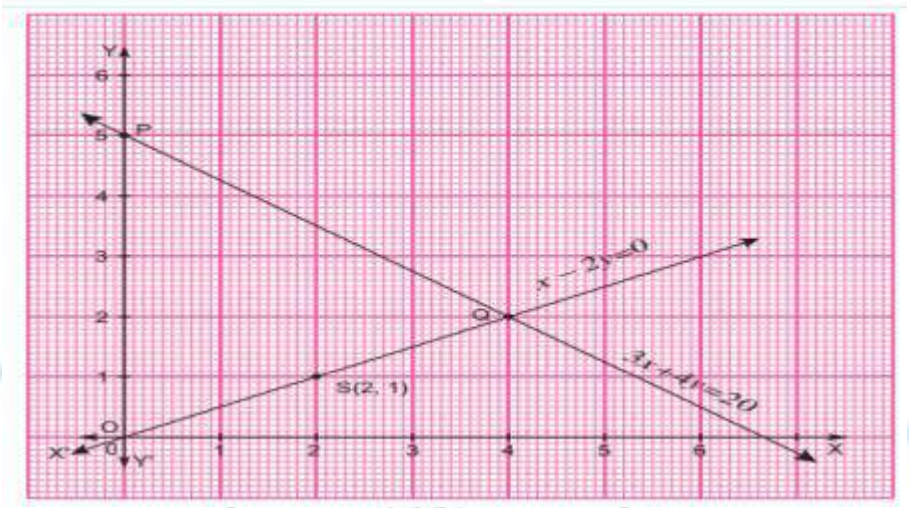
28. The sum of two numbers is 1000 and the difference between their squares is 256000, then the numbers are

a) 616 and 384 b) 628 and 372 c) 564 and 436 d) None of them

29. Two numbers are in the ratio 1:3. If 5 is added to both the numbers, the ratio becomes 1:2. The numbers are

a) 4 and 12 b) 5 and 15 c) 6 and 18 d) 7 and 21

30. The coordinates of the vertices of triangle formed between the lines and y-axis from the graph is



a) (0, 5), (0, 0) and (6.5, 0)
b) (4, 2), (6, 0) and (6.5, 0)
c) (4, 2), (0, 0) and (0, 5)
d) none of these

31. The pair of equations x = 2a and y = 3b (a, b ≠ 0) graphically represents straight lines which are:

(a) coincident
(b) parallel
(c) intersecting at (2a, 3b)
(d) intersecting at (3b, 2a)

32. The value of 'p' for which the pair of linear equations (3p + 5)x + 2y – 7 = 0 and 10x – 2y + 7 = 0 has infinitely many solutions is

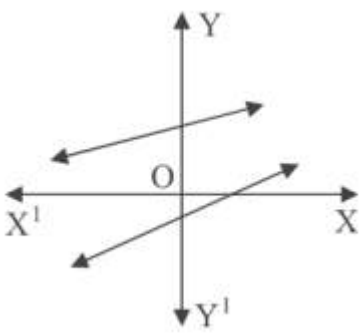
(a) -5 (b) 5 (c) $\frac{5}{3}$ (d) $\frac{3}{5}$

33. If (k, 3) is the point of intersection of the lines represented by x + py = 6 and x = 15, then (k, p) will be

(a) (15, 3) (b) (15, –3) (c) (3, 15) (d) (–15, 3)

34. In the given figure, graphs of two linear equations are shown. The pair of these linear equation is

(a) consistent with unique solution
(b) consistent with infinitely many solutions
(c) inconsistent
(d) inconsistent but can be made consistent by extending these lines



35. If ax + by = $a^2 - b^2$ and bx + ay = 0, then value of x + y is

(a) $a^2 - b^2$ (b) a + b (c) a – b (d) $a^2 + b^2$

36. Two lines are given to be parallel. The equation of one of these lines is 5x – 3y = 2. The equation of the second line can be

(a) -15x – 9y = 5 (b) 15x + 9y = 5 (c) 9x – 15y = 6 (d) -15x + 9y = 5

37. If x = 1 and y = 2 is a solution of the pair of linear equations 2x - 3y + a = 0 and 2x + 3y b = 0, then

(a) a = 2b (b) 2a = b (c) a + 2b = 0 (d) 2a + b = 0

38. The line represented by the equation x y = 0 is

(a) parallel to x-axis (b) parallel to y-axis

(c) passing through the origin (d) passing through the point (3, 2)

39. The value of 'p' for which the equations px + 3y = p – 3, 12x + py = p has infinitely many solutions

(a) -6 only (b) 6 only (c) ± 6 (d) Any real number except ±6

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: The linear equations x – 2y – 3 = 0 and 3x + 4y – 20 = 0 have exactly one solution.

Reason: The linear equations 2x + 3y – 9 = 0 and 4x + 6y – 18 = 0 have a unique solution.

2. Assertion: If the pair of lines are coincident, then we say that pair of lines is consistent and it has a unique solution.

Reason: If the pair of lines are parallel, then the pair has no solution and is called inconsistent pair of equations.

3. Assertion: The graph of the linear equations 3x + 2y = 12 and 5x – 2y = 4 gives a pair of intersecting lines.

Reason: The graph of linear equations $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$ gives a pair of intersecting lines if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

4. Assertion: The graphic representation of the equations x + 2y = 3 and 2x + 4y + 7 = 0 gives a pair of coincident lines.

Reason: The graph of linear equations $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$ gives a pair of coincident lines if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

5. Assertion: The value of k for which the system of equations 3x + ky = 0, 2x – y = 0 has a unique solution is $k \neq -\frac{3}{2}$.

Reason: The system of linear equations $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$ has a unique solution if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

6. The value of k for which the system of linear equations 3x – 4y = 7 and 6x - 8y = k have infinite number of solution is 14.

Reason: The system of linear equations $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$ has a unique solution if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

7. Assertion: A pair of linear equations has no solution if it is represented by intersecting lines graphically.

Reason: If the pair of lines are intersecting, then the pair has unique solution and is called consistent pair of equations.

8. Assertion: The pair of linear equations 2px + 3y = 7. 2x + y = 6 has exactly one solution for all real values of p except 5.

Reason: Let $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$ be two linear equations and if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, then the pair of equations represents unique solution.

9. Assertion: The pair of linear equations 5x – 6y = 7 and 7x – 8y = 9 has a unique solution.

Reason: Let $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$ be two linear equations and if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, then the pair of linear equations represent parallel lines and they have no solution.

10. Assertion: When k = 1, then linear equations 4x – (3k + 2)y = 20 and (11k – 3)x – 10y = 40 have infinitely many solutions.

Reason: $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$ have infinitely many solutions if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

11. Assertion: The pair of linear equations px +3y+59=0 and 2x + 6y + 118 = 0 will have infinitely many solutions if p = 1.

Reason: If the pair of linear equations px +3y+19=0 and 2x + 6y + 157 = 0 has a unique solution, then $p \neq 1$.

CASE STUDY BASED QUESTIONS

1. Teachers and students of class X of a school had gone to Nandan Kannan for study tour. After visiting different places of Nandan Kannan, lastly, they visited bird's sanctuary and deer park. Rohan is a clever boy and keen observer. He put the question to his friends "How many birds are there and how many deer are there (at particular time) in Nandan Kannan?" Rahul's friend, Nishitha gave the correct answer as follows:

'Nishitha answered that total animals have 1000 eyes and1400 legs.'

Based on the above information, answer the following questions

i) If x and y be the number of birds and deer respectively, what is the equation of total number of eyes?

ii) What is the equation of total number of legs?

iii) How many birds are there in the Zoo?

iv) How many deer are there in the Zoo?

v) Total number of animals (birds and deer)

2. From Rajiv Chowk Metro station, if Charu buys 4 tickets to Karol Bagh and 6 tickets to Hauz Khas, then total cost is ₹92, but if she buys 6 tickets to Karol Bagh and 10 tickets to Hauz Khas, then total cost is ₹148.

Based on the above information, answer the following questions

i) Write the algebraically the situation 1.

ii) Express the situation 2 algebraically.

iii) Find the fare from Rajiv Chowk to Karol Bagh.

iv) Find the fare from Rajiv Chowk to Hauz Khas.

3. Mr. Manoj arranged a lunch partly for some of his friends. The expense of the lunch is partly constant and partly proportional to the number of guests. The expenses amount to ₹650 for 7 guests and ₹970 for 11 guests.

Denote the constant expense by x and proportional expense per person by y and answer the following questions:

i) Represent both the situations algebraically.

ii) Find the proportional expense for each person.

iii) Write the cost of fixed expenses of party.

iv) If there are 15 guests at the lunch party, then what amount Mr. Manoj has to pay?

4. Mr Pawan Mishra is the owner of a famous amusement park in Hajaribagh in Jharkhand. The ticket charge for the park is ₹150 per child and ₹250 per adult. One day the cashier of the park found that 300 tickets were sold and ₹55000 were collected.

Answer the following questions:

i) Let the number of children visited be x and the number of adults visited be y. Which of the following is the correct system of equations?

ii) How many children visited the amusement park?

iii) How many adults visited the amusement park?

iv) How much amount will be collected if 250 children and 350 adults visit the amusement park?

5. During examination in a school, seats are arranged in rows. If 3 students are extra in a row, there would be 1 row less. If 3 students are less in a row there would be 2 rows more.

Answer the following questions:

i) If x be the number of students in each row and y be the number of rows, then represent the above as system of linear equations.

ii) Find the total number of rows in the class.

iii) Find the number of students in each row.

iv) What is the total number of students in the class?

6. Sanjeev a student of class X, goes to Yamuna river with his friends. When he saw a boat in the river, then he wants to sit in boat. So his all friends are ready to sit with him. In this order, Sanjeev is sitting on a boat which upstream at a speed of 8 km/h and downstream at a speed of 16 km/h. When Sanjeev is in the boat, some questions are arises in the mind, then answer the given questions.

(i) Find the speed of boat in still water.

(ii) Determine the speed of stream.

(iii) Find the average speed of stream and boat in still water.

7. Akhila went to a fair in her village. She wanted to enjoy rides on the giant wheel and play hoopla (a game in which you throw a ring on the items kept in a stall and if the ring covers any

object completely you get it). The number of times she played hoopla is half the number of times she rides the giant wheel. If each ride costs ₹3 and a game of hoopla costs ₹4 and she spent 20 in the fair.

Based on the above information, solve the following questions:

(i) Write the representation of given statement algebraically.

(ii) Find the number of times she played hoopla and rides the giant wheel.

(iii) Find the intersection points of the line $3x + 4y = 20$ on x and y-axes.

8. The residents of a housing society at Jaipur decided to build a rectangular garden to beautify the garden. One of the members of the society made some calculations and informed that if the length of the rectangular garden is increased by 2m and the breadth reduced by 2 m, the area gets reduced by 12 sq. m. However, when the length is decreased by 1 m and breadth increased by 3m, the area of the rectangular garden is increased by 21 sq. m.

Based on the above information, solve the following questions:

(i) Express the above situation algebraically.

(ii) Find the dimensions of that rectangular park.

(iii) Find the value of k for which the system of equations $x + y - 4 = 0$ and $2x + ky = 3$ has no solution.

9. Gagan went to a fare. He ate several rural delicacies such as jalebis, chaat etc. He also wanted to play the ring game in which a ring is thrown on the items displayed on the table and the balloon shooting game. The cost of three balloon shooting games exceeds the cost of four ring games by 4. Also, the total cost of three balloon shooting games and four ring games is 20. Based on the above information, solve the following questions:

(i) Taking the cost of one ring game to be x and that of one balloon game as y, find the pair of linear equations describing the given statement.

(ii) Find the cost of one ring game and one balloon game.

(iii) Find the total cost of five ring games and eight balloon games.

(iv) Cost of which game is more and by how much?

10. Points A and B representing Chandigarh and Kurukshetra respectively are lamost 90km apart from each other on the highway. A car starts from Chandigarh and another from Kurukshetra at the same time. If these cars go in the same direction, they meet in 9 hours and if these cars go in opposite direction the meet in $\frac{9}{7}$ hours. Let X and Y be two cars starting from points A and B respectively and their speeds be x km/hr and y km/hr respectively.

Based on the above information, answer the following:

(i) When both cars move in the same direction, then represent the situation algebraically.

(ii) When both cars move in the opposite direction, then represent the situation algebraically.

(iii) Find the speed of the cars X and Y.

11. Mr.Manoj Jindal arranged a lunch party for some of his friends, The expense of the lunch are partly constant and partly proportional to the number of guests. The expenses amount to ₹ 650 for 7 guests and ₹ 970 for 11 guests.

Denote the constant expense by ₹ x and proportional expense per person by ₹ y. Based on the information, answer the following questions:

(i) Represent the above situations algebraically.

(ii) Find the proportional expense for each person.

(iii) Determine the constant expense for the party.

(iv) If there would be 15 guests at the lunch party, then what amount Mr.Jindal has to pay?

12. Two schools ‘P’ and ‘Q’ decided to award prizes to their students for two games of Hockey Rs. x per students and Cricket Rs. y per student. School ‘P’ decided to award a total of Rs. 9500

for the two games to 5 and 4 students respectively; while school 'Q' decided to award Rs. 7,370 for the two games to 4 and 3 students respectively.

Based on the above information, answer the following questions:

(i) Represent the following information algebraically (in terms of x and y).

(ii) What is the prize amount for hockey?

(iii) Prize amount on which game is more and by how much?

(iv) What will be the total prize amount if there are 2 students each from two games?

13. A coaching institute of Mathematics conducts classes in two batches I and II and fees for rich and poor children are different. In batch I, there are 20 poor and 5 rich children, whereas in batch II, there are 5 poor and 25 rich children. The total monthly collection of fees from batch I is Rs.9000 and from batch II is Rs. 26,000. Assume that each poor child pays x per month and each rich child pays y per month.

Based on the above information, answer the following questions:

(i) Represent the information given above in terms of x and y.

(ii) Find the monthly fee paid by a poor child.

(iii) If there are 10 poor and 20 rich children in batch II, what is the total monthly collection of fees from batch II?

(iv) Find the difference in the monthly fee paid by a poor child and a rich child.

14. Essel world is one of India's largest amusement parks that offeres a diverse range of thrilling rides, water attractions and entertainment options for visitors of all ages. The park is known for its iconic "Water Kingdom" section, making it a popular destination for family outings and fun-filled adventure. The ticket charges for the park are ₹ 150 per child and ₹ 250 per adult.

On a day, the cashier of the park found that 300 tickets were sold and an amount of ₹ 55000 was collected.

Based on the above, answer the following questions:

(i) If the number of children visited be x and the number of adults visited be y, then write the given situation algebraically.

(ii) How many children visited the amusement park that day?

(iii) How many adults visited the amusement park that day?

(iv) How much amount will be collected if 250 children and 100 adults visit the amusement park?

15. A school is organizing a grand cultural event to show the talent of its students. To accommodate the guests, the school plans to rent chairs and tables from a local supplier. It finds that rent for each chair is ₹ 50 and for each table is ₹ 200. The school spends ₹ 30,000 for renting the chairs and tables. Also, the total number of items (chairs and tables) rented are 300.

If the school rents ' x ' chairs and ' y ' tables, answer the following questions :

(i) Write down the pair of linear equations representing the given information.

(ii) Find the number of chairs and number of tables rented by the school.

(OR)

If the school wants to spend a maximum of ₹27,000 on 300 items (tables and chairs), then find the number of chairs and tables it can rent.

(iii) What is maximum number of tables that can be rented in ₹30,000 if no chairs are rented?

VERY SHORT ANSWERS

1. If $2x + y = 23$ and $4x - y = 19$, find the values of $5y - 2x$ and $\frac{y}{x} - 2$.

2. Solve for x and y by using the method of substitution. 43x + 67y = –24; 67x + 43y = 24.

3. Find the solution of the pair of equations: $\frac{x}{10} + \frac{y}{5} = 1$ and $\frac{x}{8} + \frac{y}{6} = 15$. Hence find α if y = α x + 1.

4. The sum of the numerator and denominator of a fraction is 3 less than twice the denominator. If the numerator and denominator are decreased by 1, the numerator becomes half the denominator. Determine the fraction.

5. The taxi charges in a city comprise of a fixed charge together with the charge of the distance covered. For a journey of 10 km the charge paid is ₹ 75 and for a journey of 15 km the charge paid is ₹ 110. What will a person have to pay for travelling 25 km?

6. Five years ago, a man was thrice as old as his son and ten years later he will be twice as old as his son. Find the present ages of the man and his son.

7. If twice the son's age in years is added to father's age, the sum is 70. But, if twice the father's age is added to the son's age, the sum is 95. Find the ages of father and son.

8. Find c if the system of equations $cx + 3y + (3 - c) = 0$; $12x + cy - c = 0$ has infinitely many solutions?

9. For what value of k, the following pair of linear equations have infinitely many solutions: $2x + 3y = 7$ and $(k + 1)x + (2k - 1)y = 4k + 1$.

10. For what value of k, will the following pair of equations have infinitely many solutions: $2x + 3y = 7$ and $(k + 2)x - 3(1 - k)y = 5k + 1$.

11. The angles of a triangle are x, y and 40^o. The difference between two angles x and y is 30^o. Find x and y.

12. Two numbers are in the ratio 3:4. If 6 is added to each number, the ratio becomes 7:8. Find the numbers.

13. A fraction becomes $\frac{4}{5}$ if 2 is added to both numerator and denominator. However, if 4 is subtracted from both numerator and denominator, then fraction becomes $\frac{1}{2}$. Find the fraction.

14. Two years ago, Shiva was thrice as old as his daughter and six years later, he will be four years older than twice her age. How old are they now?

15. The sum of two numbers is 8. If their sum is four times their difference, find the numbers.

16. Solve the following system of equations algebraically: $30x + 44y = 10$, $40x + 55y = 13$.

17. Solve the following system of equations algebraically: $37x + 63y = 137$, $63x + 37y = 163$.

18. The cost of 2kg apples and 1kg grapes on a day was found to be ₹320. The cost of 4kg apples and 2kg grapes was found to be ₹600.If a cost of 1kg of apples and 1kg of grapes is ₹x and ₹y respectively, represent the given situation algebraically as a system of equations and check whether the system so obtained is consistent or not.

19. Solve for x and y: $\sqrt{2}x + \sqrt{3}y = 5$ and $\sqrt{3}x - \sqrt{8}y = -\sqrt{6}$.

SHORT ANSWERS

1. Draw the graph of each of the following equations: 2y – x = 8 and 5y – x = 14 and y – 2x = 1 From the graph, read the vertices of the triangle obtained.

2. Solve the following system of linear equations graphically: 3x + y – 11 = 0 and x – y – 1 = 0 Shade the region bounded by these lines and y-axis. Also, find the area of the region bounded by these lines and y-axis. Also find the vertices.

3. Draw the graphs of the equations: 4x – y – 8 = 0 and 2x – 3y + 6 = 0 Also, determine the vertices of the triangle formed by the lines and the x-axis. Also, find the area of the triangle.

4. Solve for x and y: $\frac{x+1}{2} + \frac{y-1}{3} = 8; \frac{x-1}{3} + \frac{y+1}{2} = 9$. Use method of Elimination.

5. Solve for x and y: $\frac{bx}{a} - \frac{ay}{b} + (a + b) = 0; bx - ay + 2ab = 0$.

6. Solve for x and y: $(a - b)x + (a + b)y = a^2 - 2ab - b^2; (a + b)(x + y) = a^2 + b^2$.

7. A fraction is such that if the numerator is multiplied by 3 and the denominator is reduced by 3, we get $\frac{18}{11}$. But if the numerator is increased by 8 and the denominator is doubled, we get, $\frac{2}{5}$. Find the fraction.

8. Seven times a given two-digit number is equal to four times the number obtained by interchanging the digits and the difference of the digits is 3. Find the number.

9. The sum of the digits of a two-digit number is 12. The number obtained by reversing the order of the digits of the given number exceeds the given number by 18. Find the two-digit number.

10. Five times the age of a man is twelve times the age of his son. 5 years ago, the ratio of their ages was 11:4. Find their present ages.

11. If in a rectangle, the length is increased and breadth is reduced each by 2 m, the area is reduced by 28 sq. m. If, however, the length is reduced by 1 m and breadth increased by 2 m, the area increases by 33 sq. m. Find the area of the rectangle.

12. The area of a rectangle remains the same if the length is increased by 7 metres and the breadth is decreased by 3 metres. The area remains unaffected if the length is decreased by 7 metres and breadth is increased by 5 metres. Find the dimensions of the rectangle.

13. Find the values of a and b for which the following pair of linear equations have an infinite number of solutions: $2x + 3y = 7, (a - b)x + (a + b)y = 3a + b - 2$.

14. Find the values of m and n for which the following system of linear equations has infinitely many solutions: $3x + 4y = 12, (m + n)x + 2(m - n)y = (5m - 1)$.

15. Find the value of k for which the pair of linear equations $(3k + 1)x + 3y - 2 = 0, (k^2 + 1)x + (k - 2)y - 5 = 0$ has no solutions.

16. The sum of the digits of a 2-digit number is 12. Seven times the number is equal to four times the number obtained by reversing the order of the digits. Find the number.

17. Find the values of x and y from the following pair of linear equations: 62x + 43y = 167, 43x + 62y = 148.

18. The two angles of a right angled triangle other than $90°$ are in the ratio 2:3. Express the given situation algebraically as a system of linear equations in two variables and hence solve it.

19. Solve the following system of equations graphically: 2x – y – 2 = 0 and -4x + y + 4 = 0. Also, find the absolute difference between the ordinates of the points where given lines cut y-axis.

20. Solve the following system of equation graphically: 2x + y = 5 an 4x – y = 7. Hence, write the coordinates of the points where given lines meet y-axis.

LONG ANSWERS

1. On selling a TV at 5% gain and a fridge at 10% gain, a shopkeeper gains ₹ 3250. But, if he sells the TV at 10% gain and the fridge at 5% loss, he gains ₹ 1500. Find the actual cost price of TV and that of the fridge.

2. A man invested an amount at 12% per annum simple interest and another amount at 10% per annum simple interest. He received an annual interest of ₹2600. But, if he had interchanged the amounts invested, he would have received ₹140 less. What amounts did he invest at the different rates?

3. A train covered a certain distance at a uniform speed. If the train had been 6 kmph faster, it would have taken 4 hours less than the scheduled time. And, if the train were slower by 6 kmph, it would have taken 6 hours more than the scheduled time. Find the length of the journey.

4. A man can row downstream 20 km in 2 hours, and upstream 4 km in 2 hours. Find his speed of rowing in still water. Also, find the speed of the current.

5. A man invested an amount at 10% per annum and another amount at 8% per annum simple interest. Thus, he received ₹1350 as annual interest. Had he interchanged the amounts invested, he would have received ₹45 less as interest. What amounts did he invest at different rates?

6. Ten years ago, the age of the father was four times that of his son. Five years ago, the age of the father was three times the age of his son. Find their present ages.

7. Two years ago, a father was five times as old as his son. Two years later, his age will 8 more than three times the age of the son. Find the present ages of father and son.

8. A railway fare for half-ticket costs half of the full fare but reservation charges are the same on a half ticket as on a full ticket. Priya reserved first class full ticket from station A to station B costing ₹2300. Her friend Jatin reserved first class full ticket and first-class half ticket from station A to station B cost ₹3500. Find the fare of full ticket and reservation charges.

9. Vijay had some bananas and he divided them into two lots A and B. He sold the first lot at the rate of ₹2 for 3 bananas and the second lot at the rate of ₹1 per banana and got total of ₹400. If he had sold the first lot at the rate of ₹1 per banana and the second lot at the rate of ₹4 for 5 bananas, his total collection would have been ₹460. Find the total number bananas he had.

10. If three times the greater of two numbers is divided by the smaller one, we get 4 as the quotient and 3 as the remainder. Also, if seven times the smaller number is divided by greater one, we get 5 as the quotient and 1 as the remainder. Find the numbers.

11. Vijay invested certain amounts of money in two schemes A and B, which offer interest at the rate of 8% per annum and 9% per annum, respectively. He received ₹ 1,860 as the total annual interest. However, had he interchanged the amounts of investments in the two schemes, he would have received ₹ 20 more as annual interest. How much money did he invest in each scheme?

12. A bag contains some red and blue balls. Ten percent of the red balls, when added to twenty percent of the blue balls, give a total of 24. If three times the number of red balls exceeds the number of blue balls by 20, find the number of red and blue balls.

13. The perimeter of an isosceles triangle is 32 cm. If each equal side is $\frac{5}{6}$ th of the base, find the area of the triangle.

14. A man lent a part of his money at 10% p.a. and the rest at 15% p.a. His income at the end of the year is ₹ 1,900. If he had interchanged the rate of interest on the two sums, he would have earned ₹ 200 more. Find the amount lent in both cases.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. If a pair of linear equations is consistent, then the lines will be:

a) parallel b) always coincident c) intersecting or coincident d) always intersecting

2. The values of x and y in $\frac{4}{x} + 5y = 7$ and $\frac{3}{x} + 4y = 5$ are

a) $\frac{1}{2}, 1$ b) $\frac{1}{3}, -1$ c) $\frac{1}{3}, 2$ d) $\frac{5}{2}, 3$

3. Two numbers are in the ratio 5:6. If 8 is subtracted from each of the numbers, the ratio becomes 4:5, then the numbers are

a) 25 and 30 b) 40 and 48 c) 30 and 36 d) 45 and 54

4. Assertion: Mukesh has some goats and hens in his shed. Upon counting, Mukesh found that the total number of legs is 112 and the total number of heads is 40. Then the number of hens in shed are 34.

Reason: The linear equations used in assertion are 4x + 2y = 112 and x + y = 40.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. There are 10 paise and 25 paise coins in a purse. If there are 60 coins whose value is ₹8.25, find the number of coins of each kind.

6. Solve: 99x + 101y = 499; 101x + 99y = 501. Use method of Elimination.

7. Find the value of k for which the system of equations 3x + y = 1, (2k – 1)x + (k – 1)y = (2k + 1) has no solution (inconsistent).

SECTION C

Each carry 3 marks

8. The denominator of a fraction is 4 more than twice the numerator. When both the numerator and denominator are decreased by 6, then the denominator becomes 12 times the numerator. Determine the fraction.

9. A two-digit number is obtained by either multiplying the sum of its digits by 8 and adding 1 or by multiplying the difference of digits by 13 and adding 2. Find the number. How many such numbers exist?

SECTION D

Each carry 5 marks

10. A train covered a certain distance at a uniform speed. If the train would have been 10 km/h faster, it would have taken 2 hours less than the schedule time. And, if the train were slower by 10 km/hr, it would have taken 3 hours more than the schedule time. Find the distance covered by the train.

11. Five times the age of a man is twelve times the age of his son. 5 years ago, the ratio of their ages was 11:4. Find their present ages.

SECTION E

12. One day Mahima visited a shopping mall with her mother. There, she observed different stores, such as Shoe store, Clothes store, Fruit store etc.

Price List of Shoe Store	
Types of Shoes	Price (₹)
Casual	500
Formal	350
Sports	750

Price List of Cloth Store	
Types of Clothes	Price (₹)
T-Shirt	300
Trouser	600
Blazer	2000

Price List of Fruit Store	
Fruits	Price (₹)
Apple	70 per kg
Orange	40 per kg
Guava	30 per kg

i) Mahima's mother purchased x trousers and y kg oranges for ₹1400. She also purchased x pairs of sport shoes and y kg apple for ₹1850. Write the equations relates x and y? [1 mark]

(Or)

Mahima bought a Blazer and gave eleven notes in denominations of ₹200 and ₹100. Which pair of equations can be used to find the number of ₹200 notes as x and the number of ₹100 notes as y? [1 mark]

ii) Mahima's mother bought 5 kg fruit in which there are oranges and guavas. She paid ₹160. Find the weight of oranges and guavas. [2 marks]

iii) Write the condition of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ has unique solution. [1 mark]

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. c) x = 3, y = 2 2. c) x = 6, y = 4 3. a) x = 1, y = 2 4. d) $k \neq 3$ 5. a) k = 10 6. d) $\frac{15}{4}$ 7. d) all real values except -6 8. d) no solution 9. b) 80° 10. d) intersecting or	1. (c) Assertion (A) is true but reason (R) is false. 2. (d) Assertion (A) is false but reason (R) is true. 3. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 4. (d) Assertion (A) is	1. i) x + y = 500 ii) x + 2y = 700 iii) 300 iv) 200 v) 500 2. i) $2x + 3y = 46$ ii) $3x + 5y = 74$ iii) ₹ 8 iv) ₹ 10 3.i) $x + 7y = 650$, $x + 11y = 970$ ii) ₹ 80 iii) ₹ 90 iv) ₹ 1290 4. i) x + y = 300;	1. $\frac{-5}{7}$ 2. x = 1, y = –1 3. $-\frac{1}{2}$ 4. $\frac{4}{7}$ 5. ₹ 180 6. 50 years and 20 years 7. 40 years, 15 years 8. c = 6 9. k = 5	1. A(2, 5), B(–4, 2) and C(1, 3). 2. Area = 18 sq. units and vertices of the triangle are P(0, 11), R (0, –1) and Q(3, 2). 3. Area = 10 sq. units 4. x = 7 and y = 13 5. x = -a and y = b 6. $x = a + b$ & $y = \frac{-2ab}{a+b}$. 7. $\frac{12}{25}$	1.₹25000 and ₹20000 2. ₹15000 and ₹8000 3. 720km 4. 6km/hr & 4km/hr 5. ₹ 8500 & ₹6250 6. 50 years & 20 years 7. 42 years & 10 years 8. ₹2200 & ₹ 100 9. 500

coincident

11. b) parallel

12. a) coincident

13. c) –12x + 8y = 7

14. c) a − b

15. a) 225°

16. d) 3

17. b) 5 and 1

18. d) 3, 2

19. b) 40 and 48

20. (b) 18 m and 30 m

false but reason (R) is true.

5. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

6. (c) Assertion (A) is true but reason (R) is false.

7. (d) Assertion (A) is false but reason (R) is true.

3x + 5y = 1100

ii) 200 iii)10

iv) ₹125000

5. i) –x + 3y = 3

2x – 3y = 6

ii) 4 iii) 9 iv) 36

6. i) 12

ii) 4

iii) 8

7. i) x - 2y = 0 &

3x + 4y = 20

ii) 4 & 3

iii) $\left(\frac{20}{3}, 0\right)$ and (0,5)

8. i) x – y = 4,

10. k = 4

11. 85^o & 55^o

12. 18 and 24

13. $\frac{6}{8}$

14. 38 years & 14 years

15. 5 & 3

16. $x = \frac{1}{5}$ & $y = \frac{1}{11}$

17. x = 2, y = 1

18. System is not consistent

19. $x = \sqrt{2}$ & $y = \sqrt{3}$

8. 36

9. 57

10. 60 years, 25 years

11. 253 sq. m.

12. 28 m, 15 m

13. a = 5 and b = 1

14. m = 5 and n = 1

15. k = -1

16. 48

17. x = 2 and y = 1

18. $x = 36°, y = 54°$

19. x = 1, y = 0 &

10. 18 and 25

11. 12000 & 10000

12. 40 & 100

13. $48cm^2$

14. ₹ 10000 & ₹ 6000

21. b) 72 22. a) x-axis 23. b) parallel 24. c) $\frac{5}{7}$ 25. a) x + y = 11 and 200x + 100y = 1500; 4 26. c) a = 2, b = 5 27. b) 28. b) 628 and 372 29. b) 5 and 15 30. c) (4, 2), (0, 0) and (0, 5) 31. (c) intersecting at	8. (d) Assertion (A) is false but reason (R) is true. 9. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). 10. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	3x – y = 24 ii) 10m, 6m iii) k = 2 9. i) 4x - 3y = -4 & 4x + 3y = 20 ii) (2, 4) iii) 42 iv) (2) 10. i) x – y = 10 ii) x + y = 70 iii) 40km.hr & 30km/hr 11. i) x + 7y = 650 &		absolute difference = 2 20. (0, 5) & (0, -7)	

(2a, 3b) 32. (a) -5 33. (b) (15, –3) 34. (d) inconsistent but can be made consistent by extending these lines 35. (c) a – b 36. (d) -15x + 9y = 5 37. (b) 2a = b 38. (c) passing through the origin 39. (b) 6 only	11. (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).	x + 11y = 970 ii) ₹80 iii) (₹90) iv) ₹1290 12. i) 5x + 4y = 9500 & 4x + 3y = 7370 ii) ₹980 iii) Cricket, 170 iv) ₹4260) 13. i) 20x + 5y = 9000 & 5x + 25y = 26000 ii) ₹200 iii) ₹2200 iv) ₹800 14. i) $x + y =$			

		$300,150\,x\,+$ $250\,y\,=\,55000$ ii) 200 iii) 100 iv)₹ 62500 15. (i) x + y = 300 and x + 4y = 600 (ii) 200 and 100 (OR) 220 and 80 (iii) 150			

UNIT TEST

1. c) intersecting or coincident

2. b) $\frac{1}{3}, -1$

3. b) 40 and 48

4. (d) Assertion (A) is false but Reason (R) is true

5. Number of 10 paise coins is 45 and number of 25 paise coins is 15.

6. x = 3; y = 2.

7. k = 2

8. $\frac{7}{18}$

9. 41

10. 600 km.

11. 60 years, 25 years

12. i) 600x + 40y = 1400 and 750x + 70y = 1850 (Or) x + y = 11 and 200x + 100y = 2000 ii) 1 kg and 4 kg iii) (b) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

CHAPTER 4 – QUADRATIC EQUATIONS

Key Concepts

Quadratic Equation

A quadratic equation in the variable x is of the form $ax^2 + bx + c = 0$, where a, b, c are real numbers and $a \neq 0$.

Roots of Quadratic Equation

A real number α is said to be a solution/root of the equation $ax^2 + bx + c = 0$ if $a\alpha^2 + b\alpha + c = 0$.

Methods to find roots of Quadratic Equation

- If $ax^2 + bx + c = 0$ can be reduced to the product of two linear factors, then the root of the quadratic equation $ax^2 + bx + c = 0$ can be found by equating each factor to zero.
- Roots of the quadratic equation $ax^2 + bx + c = 0$ can be obtained by using the formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Nature of Roots

For the equation $ax^2 + bx + c = 0$, $a \neq 0$ expression $D = b^2 - 4ac$ is discriminant.

(a) If $b^2 - 4ac > 0$, the quadratic equation has two distinct real roots

(b) If $b^2 - 4ac = 0$, the quadratic equation has two real and equal roots

(c) If $b^2 - 4ac < 0$, the quadratic equation has no real roots.

Results

For quadratic equation, $ax^2 + bx + c = 0$, $a \neq 0$

- If $a + b + c = 0$ then roots of the quadratic equation are 1 and $\frac{c}{a}$.
- If $a + c = b$ or $a - b + c = 0$ the roots of the quadratic equation are -1 and $-\frac{c}{a}$

MULTIPLE CHOICE QUESTIONS

1. Value of k for which the quadratic equation $2x^2 - kx + k = 0$, has equal roots is:

a) 1 b) 2 c) 5 d) 0, 8

2. If $\frac{1}{2}$ is a root of the equation $x^2 + kx - \frac{5}{4}$, then the value of k is:

a) 2 b) –2 c) $\frac{1}{4}$ d) $\frac{1}{2}$

3. The quadratic equation $2x^2 - \sqrt{5}x + 1 = 0$ has

a) Two distinct real roots b) Two equal real roots

c) No real roots d) More than 2 real roots

4. If the sum of a number and its reciprocal is $\frac{10}{3}$, then, the number is

a) $\frac{2}{3}$ b) 3 c) 4 d) 10

5. If $\frac{4}{x} - 3 = \frac{5}{2x+5}$, where $x \neq 0, \frac{-3}{2}$, then $x =$

a) 1, 2 b) –1, –2 c) 1, –2 d) 2, –3

6. Two numbers differ by 4 and their product is 192. The numbers are:

a) 12 and 16 b) 10 and 6 c) 20 and 24 d) 18 and 14

7. Roots of the equation $\sqrt{(3x^2 - 2)} = 2x - 1$ are

a) 3, 1 b) 4, 1 c) 3, 2 d) 2, 3

8. The ratio of the sum and product of the roots of the equation $7x^2 - 12x + 18 = 0$ is

a) 7:12 b) 7:18 c) 3:2 d) 2:3

9. If the sum of the roots of the equation $kx^2 + 2x + 3k = 0$ is equal to product of the roots then the value of k is

a) $\frac{1}{3}$ b) $\frac{-1}{3}$ c) $\frac{2}{3}$ d) $\frac{-2}{3}$

10. If the equation $x^2 + 2(k + 2)x + 9k = 0$ has equal roots then $k =$?

a) 1 or 4 b) –1 or 4 c) 1 or – 4 d) –1 or – 4

11. If the equation $x^2 - kx + 1 = 0$ has no real roots then

a) $k < -2$ b) $k > 2$ c) $-2 < k < 2$ d) none of these

12. For what values of k, the equation $kx^2 - 6x - 2 = 0$ has real roots?

a) $k \leq \frac{-9}{2}$ b) $k \geq \frac{-9}{2}$ c) $k \leq -2$ d) none of these

13. The roots of equation $x + \frac{16}{x} = 10$ are:

a) 4, 6 b) 4, 4 c) 4, 5 d) 2, 8

14. If $\frac{x}{2} + \frac{6}{x} = 4$, then the value of x are:

a) –6 and –2 b) +6 and –2 c) –6 and 2 d) 6 and 2

15. Product of the age of a child five years ago with his age nine years after is 15. His present age is:

a) 4 years b) 6 years c) 5 years d) none of these

16. If $px^2 + 3x + q = 0$ has two roots $x = -1$ and $x = -2$, the value of $q - p$ is:

a) –1 b) 1 c) 2 d) –2

17. If the roots of $5x^2 - kx + 1 = 0$ are real and distinct then

a) $-2\sqrt{5} < k < 2\sqrt{5}$ b) $k > 2\sqrt{5}$ only c) $k < -2\sqrt{5}$ only d) either $k > 2\sqrt{5}$ or $k < -2\sqrt{5}$

18. The perimeter of a rectangle is 82 m and its area is 400 m^2. The breadth of the rectangle is

a) 25 m b) 20 m c) 16 m d) 9 m

19. The length of a rectangular fi eld exceeds its breadth by 8 m and the area of the field is 240 m^2. The breadth of the field is

a) 20 m b) 30 m c) 12 m d) 16 m

20. The roots of the equation $2x^2 - 6x + 7 = 0$ are

a) real, unequal and rational b) real, unequal and irrational c) real and equal d) imaginary

21. Roots of the quadratic equation $3x^2 - 2\sqrt{6}x + 2 = 0$ are

a) $\sqrt{\frac{2}{3}}, \sqrt{\frac{2}{3}}$ b) $-\sqrt{\frac{2}{3}}, \sqrt{\frac{2}{3}}$ c) $-\sqrt{\frac{2}{3}}, -\sqrt{\frac{2}{3}}$ d) $-\sqrt{\frac{2}{3}}, \sqrt{\frac{3}{2}}$

22. If $\frac{3}{x+1}-\frac{1}{2}=\frac{2}{3x-1}$, where $x \neq -1, \frac{1}{3}$, then $x =$

a) 1, 2 b) 1, 3 c) 2, 3 d) 3, 5

23. If the sum of the squares of two consecutive natural numbers is 421, then the numbers are:

a) 14 and –15 b) 14 and 15 c) 13 and 15 d) –13 and –15

24. Roots of the quadratic equation $\frac{1}{3}x^2-\sqrt{11}x+1=0$ are

a) $\frac{3\sqrt{11}\pm\sqrt{87}}{2}$ b) $\frac{3\sqrt{7}\pm\sqrt{87}}{2}$ c) $\frac{5\sqrt{11}\pm\sqrt{7}}{2}$ d) $\frac{7\sqrt{87}\pm\sqrt{11}}{2}$

25. If x = 1 is a common root of the equations $ax^2 + ax + 3 = 0$ and $x^2 + x + b = 0$, then the value of a ÷ b =

a) $\frac{3}{4}$ b) $\frac{4}{3}$ c) $\frac{-3}{4}$ d) $\frac{-4}{3}$

26. If sinα and cosα are the roots of the equation $px^2 + qx + r = 0$ then $q^2 =$

(a) p^2-2pr (b) p^2+2pr (c) p^2-pr (d) p^2+pr

27. If x = 5 is a solution of the quadratic equation $2x^2+(k-1)x+10=0$, then the value of k is

(a) 11 (b) -11 (c) 13 (d) -13

28. If the roots of equation $ax^2+bx+c=0, a\neq 0$ are real and equal, then which of the following relation is true?

(a) $a=\frac{b^2}{c}$ (b) $b^2=ac$ (c) $ac=\frac{b^2}{4}$ (d) $c=\frac{b^2}{a}$

29. If the discriminant of the quadratic equation $3x^2-2x+c=0$ is 16, then the value of c is

(a) 1 (b) 0 (c) -1 (d) $\sqrt{2}$

30. The ratio of the sum and product of the roots of the quadratic equation $5x^2-6x+21=0$ is

(a) 5:21 (b) 2:7 (c) 21:5 (d) 7:2

31. The value of ' a ' for which $ax^2 + x + a = 0$ has equal and positive roots is

(a) 2 (b) -2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

32. If $x^2 + bx + b = 0$ has two real and distinct roots, then the value of b can be

(a) 0 (b) 4 (c) 3 (d) -3

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: If one root of the quadratic equation $6x^2 - x - k = 0$ is $\frac{2}{3}$, then the value of k is 2.

Reason: The quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ has almost two roots.

2. Assertion: $(2x - 1)^2 - 4x^2 + 5 = 0$ is not a quadratic equation.

Reason: An equation of the form $ax^2 + bx + c = 0$, $a \neq 0$, where a, b, c $\in$ R is called a quadratic equation.

3. Assertion: The roots of the quadratic equation $x^2 + 2x + 2 = 0$ are imaginary

Reason: If discriminant $D = b^2 - 4ac < 0$ then the roots of quadratic equation $ax^2 + bx + c = 0$ are imaginary.

4. Assertion: $3x^2 - 6x + 3 = 0$ has repeated roots.

Reason: The quadratic equation $ax^2 + bx + c = 0$ have repeated roots if discriminant $D > 0$.

5. Assertion: The values of x are $-\frac{a}{2}$, a for a quadratic equation $2x^2 + ax - a^2 = 0$.

Reason: For quadratic equation $ax^2 + bx + c = 0,\ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

6. Assertion: The equation $8x^2 + 3kx + 2 = 0$ has equal roots then the value of k is $\pm\frac{8}{3}$.

Reason: The equation $ax^2 + bx + c = 0$ has equal roots if D = 0.

7. Assertion: Sum and product of roots of $2x^2 - 3x + 5 = 0$ are $\frac{3}{2}$ and $\frac{5}{2}$ respectively.

Reason: If α and β are the roots of $ax^2 + bx + c = 0,\ a \neq 0$ then sum of roots $\alpha + \beta = -\frac{b}{a}$ and product of roots = $\alpha\beta = \frac{c}{a}$.

CASE STUDY BASED QUESTIONS

1. Kavita and her mother Bhawna went for a small picnic. After having their morning breakfast, Kavita insisted to travel in a motorboat. The speed of the motorboat was 18 km/hr in still water. Kavita, being a Mathematics student wanted to know the speed of current. So, she noted the time for upstream and downstream. She found that for covering the distance of 24 km, the boat took 1 hour more for upstream than downstream.

Answer the following questions:

i) Let the speed of stream be x km/hr, then speed of the motorboat upstream be

a) 18 km/hr b) (18 + x) km/hr c) (18 – x) km/hr d) $\frac{18}{x}$ km/hr

ii) What is the relation between speed, distance and time?

a) distance = speed × time b) distance = speed ÷ time

c) distance = speed – time d) none of these

iii) Which is the correct quadratic equations for the given condition?

a) $x^2 + 48x - 324 = 0$ b) $x^2 - 48x - 324 = 0$ c) $-x^2 + 48x - 324 = 0$ d) $x^2 + 48x + 324 = 0$

iv) What is the speed of the stream?

a) 8 km/h b) 6 km/h c) 4 km/h d) 9 km/h

v) How much time did the motorboat take going downstream?

a) 60 minutes b) 120 minutes c) 180 minutes d) none of these

2. Nikasha and Kanishka are very close friends. Nikasha owns a Honda City and Kanishka owns Tyota Corolla. They go for a picnic by their cars. Kanishka's car travels at x km/hr while Nikasha's car travels at 5 km/hr more than Nikasha's car. Nikasha's car takes 1 hour less than Kanishka's car in covering 360 km. Answer the following questions:

i) What will be the distance covered by Nikasha's car in 5 hours?

a) 5(x + 5) km b) 2(x + 5) km c) (2x + 5) km d) 3x + 10 km

ii) Which of the following quadratic equation describe the condition?

a) $x^2 + 5x - 1500 = 0$ b) $x^2 + 5x - 1800 = 0$ c) $x^2 + 10x - 1500 = 0$ d) $2x^2 + 5x - 1500 = 0$

iii) What is the speed of the Nikasha's car?

a) 45 km/h b) 50 km/h c) 40 km/h d) 35 km/h

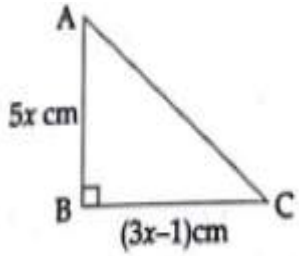
iv) How much time did Nikasha take to cover 360 km?

a) 9 hrs b) 10 hrs c) 8 hrs d) 7 hrs

v) How much time did Kanishka take to travel 360 km?

a) 7 hours b) 8 hours c) 10 hours d) 6 hours

3. There is a triangular playground as shown in the below figure. Many children and people are playing and walking in the ground.



As we see in the above figure of right angled triangle playground, the of the sides are 5x cm and (3x – 1) cm and the area of the triangle is 60 sq.cm.

Answer the following questions

i) Find the value of x.

ii) Find the length of AB and BC.

iii) Find the length of the side AC

iv) Calculate the perimeter of the triangle

4. The two gears in the figure resemble two circles which touch each other externally. The sum of their areas is 130π sq.cm and distance between their centres is 14cm.

i) Taking the radius of one circle to be x cm, represent the quadratic equation for the situation.

ii) Find the radii of the two circle.

iii) Find the roots of the quadratic equation $a^2x^2 - 3abx + 2b^2 = 0$.

iv) Find the value of p which the quadratic equation x(x – 4) + p = 0 has real and distinct roots.

5. The speed of a motorboat is 20km/hr. For covering the distance of 15km the boat took 1 hour more for upstream than downstream.

Answer the following questions

i) If the speed of the stream is x km/hr, then what is the speed of the motorboat in upstream?

ii) If the speed of the stream is x km/hr, then what is the speed of the motorboat in downstream?

iii) Find the speed of the current.

iv) Find the time taken by the motorboat to cover 15km upstream.

6. Raj and Ajay are very close friends. Both the families decide to go to Ranikhet by their own cars. Raj's car travels at a speed of x km/h while Ajay's car travels 5 km/h faster than Raj's car. Raj took 4 hours more than Ajay to complete the journey of 400 km.

i) What will be the distance covered by Ajay's car in two hours?

ii) What is the speed of Raj's car?

iii) How much time took Ajay to travel 400 km?

7. John and Jivanti are playing with marbles. They mixed up their marbles without knowing, how many marbles they had before mixing. But now they have 45 marbles altogether. While playing they lost 10 marbles. Since they are not knowing the number of marbles they had in the beginning, so they agreed that both of them lost 5 marbles each, and the product of the number of marbles they now have is 124. Now they want to know the number of marbles each one brought to play. Help them.

(i) If John had 'x' marbles then write the expression for number of marbles Jivanti had.

(ii) Represent the above information in the form of a quadratic equation.

(iii) Find the no. of marbles with John by solving a quadratic equation.

8. Noida authority decided to make a park for the people, so that the persons make them physically fit and take a fresh air. A grassy park is in the form of rectangle having length 20 m and breadth 14 m. At the centre of the park, there is a rectangular pool, which is at a distance of equal width around it, there is a path having an area of 120 m^2.

Based on the given information, solve the following questions:

(i) If the centre pool is at x metre distance from around the park, then write the length and breadth of the pool (in metre).

(ii) If the area of path is 120 m^2, then express the quadratic equation in terms of x.

(iii) Determine the nature of the roots of the equation obtained above.

(iv) Find the width of the pool.

9. In cricket match of world cup 2016, Ashwin took 2 wickets less than twice the number of wickets taken by Ishant. The product of the numbers of wickets taken by these two is 24.

Based on the above information, solve the following questions:

(i) If Ishant took x wickets in the world cup, then find the wickets taken by Ashwin.

(ii) Represent the above situation in form of quadratic equation.

(iii) Discuss the nature of the roots of the above obtained quadratic equation.

(iv) Find the number of wicket taken by Ashwin.

10. In the picture given below, one can see a rectangular in-ground swimming pool installed by a family in their backyard. There is a concrete sidewalk around the pool of width x m. The outside edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.

Based on the given information, solve the following questions:

(i) Write the representation of the length and breadth of the pool algebraically

(ii) Form a quadratic equation in terms of x.

(iii) Find the length and width of the sidewalk around the pool.

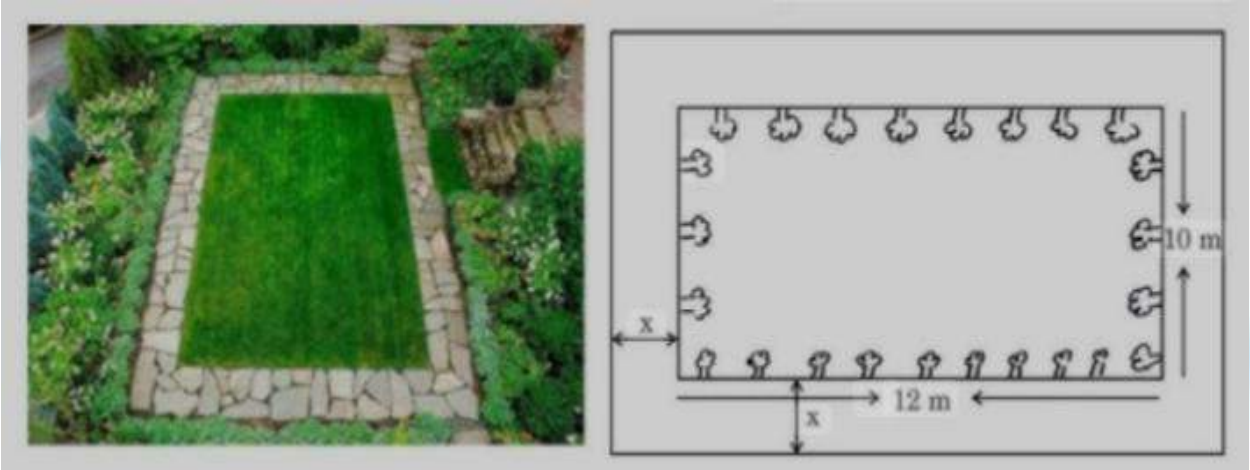
11. A rectangular floor area can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, it would take only 128 tiles to cover the floor.

(i) Assuming the original length of each side of a tile be x units, make a quadratic equation from the above information.

(ii) Write the corresponding quadratic equation in standard form.

(iii) Find the value of x, the length of side of a tile by factorization.

12. A garden designer is planning a rectangular lawn that is to be surrounded by a uniform walkway.



The total area of the lawn and the walkway is 360 square metres. The width of the walkway is same on all sides. The dimensions of the lawn itself are 12 metres by 10 metres.

Based on the information given above, answer the following questions :

(i) Formulate the quadratic equation representing the total area of the lawn and the walkway, taking width of walkway = x m.

(ii) Solve the quadratic equation to find the width of the walkway ' x '.

(OR)

If the cost of paving the walkway at the rate of ₹ 50 per square metre is ₹ 12,000, calculate the area of the walkway.

(iii) Find the perimeter of the lawn.

VERY SHORT ANSWERS

1. Solve for x: $\sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0$.

2. Solve for x: $x^2 - (\sqrt{3} + 1)x + \sqrt{3} = 0$.

3. Solve for x: $4x^2 - 4ax + (a^2 - b^2) = 0$.

4. Solve: $12abx^2 - (9a^2 - 8b^2)x - 6ab = 0$.

5. Solve: $\sqrt{2x + 9} + x = 13$

6. Solve: $9x^2 - 9(a + b)x + (2a^2 + 5ab + 2b^2) = 0$.

7. If the roots of the quadratic equation $(a - b)x^2 + (b - c)x + (c - a) = 0$ are equal prove that 2a = b + c.

8. If the equation $(1 + m^2)x^2 + 2mcx + (c^2 - a^2) = 0$ has equal roots, prove that $c^2 = a^2(1 + m^2)$

9. The sum of the squares of two consecutive odd numbers is 394. Find the numbers.

10. A two-digit number is four times the sum of the digits. It is also equal to 3 times the product of digits. Find the number.

11. The altitude of a right-angled triangle is 8 more than its base. If the hypotenuse is 40cm, then find the length of the base.

12. Divide 12 into two parts such that the sum of the squares is 74.

13. Find the value of c for which the quadratic equation $4x^2 - 2(c + 1)x + (c + 4) = 0$ has equal roots.

14. If $\sin\theta$ and $\cos\theta$ are roots of the equation $ax^2 + bx + c = 0$, prove that $a^2 - b^2 + 2ac = 0$.

15. Find the value of k for which the quadratic equation $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0$, $k \neq -1$ has equal roots.

16. Solve the following quadratic equation by factorization method: $\frac{x+3}{x-4} - \frac{6-x}{x} = 3$.

17. Find the value(s) of k, so that the quadratic equation $4x^2 + kx + 1 = 0$ has real and equal roots.

SHORT ANSWERS

1. Find the roots of the quadratic equation: $\frac{1}{x+3} + \frac{1}{2x-1} = \frac{11}{7x+9}; x \neq -3, \frac{1}{2}, -\frac{9}{7}$.

2. Solve for x: $\frac{x+1}{x-1}+\frac{x-2}{x+2}=4-\frac{2x+3}{x-2}; x \neq 1,-2,2.$

3. Solve for x: $\frac{x+3}{x-2}-\frac{1-x}{x}=\frac{17}{4}; x \neq 0,2.$

4. Solve for x: $3\left(\frac{3x-1}{2x+3}\right)-2\left(\frac{2x+3}{3x-1}\right)=5; x \neq \frac{1}{3}, \frac{-3}{2}.$

5. Solve for x: $2\left(\frac{x}{x+1}\right)^2-5\left(\frac{x}{x+1}\right)+2=0; x \neq -1.$

6. Solve for x: $\frac{2x}{x-3}+\frac{1}{2x+3}+\frac{3x+9}{(x-3)(2x+3)}=0 \left[x \neq 3,-\frac{3}{2}\right]$

7. $\frac{2}{x+1}+\frac{3}{2(x-2)}=\frac{23}{5x}; x \neq 0,-1,2$

8. $2\left(\frac{x-1}{x+3}\right)-7\left(\frac{x+3}{x-1}\right)=5; x \neq -3,1$

9. A two-digit number is such that the product of its digits is 18. When 63 is subtracted from the number, the digits interchange their places. Find the number.

10. The age of a man is twice the square of the age of his son. Eight years hence, the age of the man will be 4 years more than three times the age of his son. Find their present ages.

11. The diagonal of a rectangular fi eld is 16 m more than the shorter side. If the longer side is 14 m more than the shorter side then find the lengths of the sides of the field.

12. A two-digit number is 4 times the sum of its digits and twice the product of its digits. Find the number.

13. In a class test Raveena got a total of 30 marks in English and Mathematics. Had she got 2 more marks in Mathematics and 3 marks less in English then the product of her marks obtained would have been 210. Find the individual marks obtained in two subjects.

14. The denominator of a fraction is one more than twice its numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction.

15. Three consecutive natural numbers are such that the square of the middle number exceeds the difference of the squares of the other two by 60. Find the numbers.

16. In a two-digit number, the digit at the unit's place is 5 less than the digit at the ten's place. The product of the digits is 36. Find the number.

17. Find the value of c for which the quadratic equation $(c+1)x^2 - 6(c+1)x + 3(c+9) = 0; c \neq -1$ has real and equal roots.

LONG ANSWERS TYPE QUESTIONS

1. A train travels a distance of 90 km at a constant speed. Had the speed been 15 km/hr more, it would have taken 30 minutes less for the journey. Find the original speed of the train.

2. An aeroplane left 30 minutes later than its scheduled time and in order to reach its destination 1500 km away in time, it had to increase its speed by 250 km/h from its usual speed. Determine its usual speed.

3. A boat whose speed is 18 km/hr in still water takes 1 hour more to go 24 km upstream, than to return downstream to the same spot. Find the speed of the stream.

4. A takes 6 days less than the time taken by B to finish a piece of work. If both A and B together can finish it in 4 days, find the time taken by B to finish the work.

5. Two pipes running together can fill a cistern in $3\frac{1}{13}$ minutes. If one pipe takes 3 minutes more than the other to fill it, find the time in which each pipe would fill the cistern.

6. In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100 km/hr and time of flight increased by 30 minutes. Find the original duration of the flight.

7. A motorboat whose speed in still water is 24 km/hr, takes 1 hour more to go 32 km upstream than to return downstream to the same spot. Find the speed of the stream.

8. In a rectangular part of dimensions 50 m × 40 m a rectangular pond is constructed so that the area of grass strip of uniform breadth surrounding the pond would be 1184 m^2. Find the length and breadth of the pond.

9. A train travels at a certain average speed for a distance of 63 km and then travels at a distance of 72 km at an average speed of 6 km/hr more than its original speed. If it takes 3 hours to complete the total journey, what is the original average speed?

10. The total cost of a certain length of a piece of cloth is ₹200. If the piece was 5 m longer and each metre of cloth costs ₹2 less, the cost of the piece would have remained unchanged. How long is the piece and what is its original rate per metre?

11. A takes 10 days less than the time taken by B to finish a piece of work. If both A and B together can finish the work in 12 days, find the time taken by B to finish the work.

12. One pipe can fill a cistern in (x + 2) hours and the other pipe can fill the same cistern in (x + 7) hours. If both the pipes when opened together take 6 hours to fill the empty cistern, find the value of x.

13. The time taken by a person to cover 150 km was $2\frac{1}{2}$ hrs more than the time taken in the return journey. If he returned at a speed of 10 km/hr more than the speed of going, what was the speed per hour in each direction?

14. If a boy's age and his father's age amount together to 24 years. Fourth part of the product of their ages exceeds the boy's age by 9 years. Find how old they are.

15. A two-digit number is 5 times the sum of its digits and is also equal to 5 more than twice the product of its digits. Find the number.

16. If Nidhi were 7 years younger than what she actually is, then the square of her age (in years) would be 1 more than 5 times her actual age. What is her present age?

17. A shopkeeper buys a number of books for ₹ 1,800. If he had bought 15 more books for the same amount, then each book would have cost him ₹ 20 less. Find how many books he bought initially.

18. In a flight of 2800km an aircraft was slowed down due to bad weather. Its average speed is reduced by 100km/h and by doing so the time of flight is increased by 30 minutes. Find the original duration of the flight.

19. The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$. Find the fraction.

20. Find the value of k for which the quadratic equation $(k+1)x^2 - 2(3k+1)x + (8k+1) = 0$ has real and equal roots.

21. The age of a man is twice the square of the age of his son. Eight years hence, the age of the man will be 4 years more than three times the age of his son. Find their present ages.

22. The perimeter of a right triangle is 60 cm and its hypotenuse is 25 cm. Find the lengths of other two sides of the triangle.

23. A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. Find the speed of the train.

24. A two-digit number is such that the product of its digits is 12. When 36 is added to this number, the digits interchange their places. Find the number.

25. A student scored a total of 32 marks in class tests in Mathematics and Science. Had he scored 2 marks less in Science and 4 marks more in Mathematics, the product of his marks would have been 253. Find his marks in the two subjects.

26. The time taken by a person to travel an upward distance of 150 km was $2\frac{1}{2}$ hours more than the time taken in the downward return journey. If he returned at a speed of 10 km/h more than the speed while going up, find the speeds in each direction.

27. The numerator of a fraction is 3 less than its denominator. If 2 is added to both numerator and denominator, then the sum of the new fraction and the original fraction is $1\frac{9}{20}$. Find the original fraction.

28. A train travelling at a uniform speed for 360 km would have taken 48 minutes less to travel the same distance if its speed were 5 km/h more. Find the original speed of the train.

29. A 2-digit number is seven times the sum of its digit and two more than 5 times the product of its digits. Find the number.

30. Find the value(s) of p for which the quadratic equation given as $(\mathrm{p}+4)x^2-(\mathrm{p}+1)x+1=0$ has real and equal roots. Also, find the roots of the equation(s) so obtained.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. Roots of the quadratic equation $4x^2 - 4px + (p^2 - q^2) = 0$ are

a) $\frac{p \pm q}{2}$ b) $\frac{p \pm q}{3}$ c) $\frac{q \pm p}{5}$ d) $\frac{p \pm q}{8}$

2. Roots of the equation $(x - 1)^2 - 5(x - 1) - 6 = 0$ are:

a) (7, 0) b) (6, 0) c) (7, 6) d) (6, –7)

3. If $\frac{1}{x-2} + \frac{2}{x-1} = \frac{6}{x}$ (where $x \neq 0,1,2$), then $x =$

a) $3, \frac{2}{3}$ b) $5, \frac{7}{3}$ c) $3, \frac{4}{3}$ d) $7, \frac{5}{3}$

4. Assertion: $4x^2 - 12x + 9 = 0$ has repeated roots.

Reason: The quadratic equation $ax^2 + bx + c = 0$ have repeated roots if discriminant $D > 0$.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. Find the value of k for which the given quadratic equation has real and equal roots $x^2 + k(4x + k - 1) + 2 = 0$.

6. Divide 16 into two parts such that twice the square of the larger part exceeds the square of the smaller part by 164.

7. Solve: $x^2 - (1 + \sqrt{2})x + \sqrt{2} = 0$.

SECTION C

Each carry 3 marks

8. Solve for x: $\frac{x-1}{x-2}+\frac{x-3}{x-4}=3\frac{1}{3}(x\neq 2,4)$

9. The perimeter of a right-angled triangle is five times the length of its shortest side. The numerical value of the area of the triangle is 15 times the numerical value of the length of the shortest side. Find the length of the three sides of the triangle.

SECTION D

Each carry 5 marks

10. Some students arranged a picnic. The budget for food was ₹240. Because four students of the group failed to go, the cost of food to each student got increased by ₹5. How many students went for the picnic?

11. Seven years ago, Varun's age was five times the square of Swati's age. Three years hence Swati's age will be two fifths of Varun's age. Find their present ages.

SECTION E

12. Raghav has a field with total area 1260m^2. He uses it to grow wheat and rice. The land used to grow wheat land is rectangular in shape while the rice land is in the shape of a square. The length of wheat land is 3 meters more than twice the length of rice land.

Answer the following questions

i) If the length of the rice land is x metre, find the total length of the field in metre. [1mark]

(Or)

Find the perimeter of the field. [1 mark]

ii) If the total area of the field is 1260 m^2, find the value of x. [2 marks]

iii) Find the area of wheat land. [1 mark]

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. d) 0, 8 2. a) 2 3. c) No real roots 4. b) 3 5. c) 1, –2 6. a) 12 and 16 7. a) 3, 1 8. d) 2:3 9. d) $\frac{-2}{3}$ 10. a) 1 or 4	1. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). 2. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 3. (a) Both Assertion	1. i) c ii) a iii) a iv) b v) a 2. i) a ii) b iii) c iv) a v) b 3. i) x = 3 ii) 15cm and 8 cm iii) 17cm iv) d) 40cm 4. i) $x^2 - 14x + 33 =$ 0 ii) 3 and 11 iii) $\frac{b}{a}, \frac{2b}{a}$ iv) $p < 4$ 5. i) 20 – x ii) 20 + x	1. $x = \frac{-\sqrt{2}}{\sqrt{3}}$ or $x = \sqrt{6}$ 2. $x = 1$ or $x = \sqrt{3}$ 3. $x = \frac{a-b}{2}$ or $x = \frac{a+b}{2}$ 4. $x = \frac{-2b}{3a}$ or $x = \frac{3a}{4b}$ 5. $x = 8$ or $x = 20$ 6. $x = \frac{2a+b}{3}$ 0r $x = \frac{a+2b}{3}$ 7. Proof 8. Proof	1. $x = 3$ or $x = -17$ 2. $x = \frac{6}{5}$ or $x = -5$ 3. $x = \frac{-2}{9}$ or $x = 4$ 4. $x = 0$ or $x = -7$ 5. $x = 1$ or $x = -2$ 6. $x = -1$ 7. $x = -\frac{23}{11}$ or $x = 4$ 8. $x = -1$ or $x = \frac{-23}{5}$ 9. 92 10. 4 years and 32	1. 45km/hr 2. 750km/h 3. 6km/hr 4. 12 days 5. 8 minutes. 6. 3 hours 30 minutes 7. 8km/hr 8. Length = 34m and breadth = 24m 9. 42km/hr 10. Length of the

11. c) $-2 < k < 2$ 12. b) $k \geq \frac{-9}{2}$ 13. d) 2, 8 14. d) 6 and 2 15. b) 6 years 16. b) 1 17. d) either $k > 2\sqrt{5}$ or $k < -2\sqrt{5}$ 18. c) 16 m 19. c) 12 m 20. d) imaginary	(A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 4. (c) Assertion (A) is true but Reason (R) is false. 5. (d) Assertion (A) is false but Reason (R) is true. 6. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct	iii) 10 km/hr iv) $1\frac{1}{2}$ hours. 6. i) 2(x + 5) km ii) 20 km/hr iii) 16 hours 7. i) (45 – x) ii) $x^2 - 45x + 324 = 0$ iii) 9 or 36 8. i) (20-2x) m and (14-2x) m) ii) $x^2 - 17x + 30 = 0$ iii) Real and distinct roots iv) 2m	9. 13 and 15 10. 24 11. 24cm 12. 7 and 5 13. c = –3 or c = 5 14. Proof 15. k = 3 16. x = 8 or x = -3 17. $k = \pm 4$	years 11. Length = 24m and breadth = 10m 12. 36 13. 12, 18 or 13, 17 14. $\frac{3}{7}$ 15. 9, 10 and 11 16. 94 17. c = 3	piece of cloth is 20 m and rate per meter is ₹10. 11. 30 days. 12. x = 8 13. 20km/hr & 30km/hr 14. 22 years & 2 years 15. 45 16. 16 years 17. 30 books 18.

21. a) $\sqrt{\frac{2}{3}}, \sqrt{\frac{2}{3}}$

22. b) 1, 3

23. b) 14 and 15

24. a) $\frac{3\sqrt{11}\pm\sqrt{87}}{2}$

25. a) $\frac{3}{4}$

26. (b) $p^2 + 2pr$

27. (b) -11

28. (c) $ac = \frac{b^2}{4}$

29. (c) -1

30. (b) 2:7

explanation of Assertion (A).

7. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

9. i) (2x-2)

ii) $x^2 - x - 12 = 0$

iii) Roots are real and distinct

iv) 6 wickets

10. i) (12 - 2x) m and (7 - 2x)m

ii) $2x^2 - 19x + 42 = 0$

iii) 9m & $\frac{3}{2}$m

11. i) $200x^2 = 128(x + 1)^2$

ii) $9x^2 - 32x - 16 = 0$

iii) x = 4

12. (i) $x^2 + 11x -$

$\frac{7}{2}$hrs or 3hrs30min

19. $\frac{3}{7}$

20. k = 0 and 3

21. 4 & 32

22. 15cm & 20cm

23. 40km/h

24. 26

25. 19, 13 or 7, 25

26. 20 km/h and 30 km/h

27. $\frac{7}{10}$

28. 45 km/h

31. (d) $-\frac{1}{2}$ 32. (d) -3		$60 = 0$ (ii) 4m (OR) $240m^2$ (iii) 44m			29. 42 30. $p = 5, -3,$ $x = \frac{1}{3}, \frac{1}{3}$ & $x =$ $-1, -1.$

UNIT TEST

1. a) $\frac{p \pm q}{2}$

2. a) (7, 0)

3. c) $3, \frac{4}{3}$

4. (c) Assertion (A) is true but Reason (R) is false.

5. k = -1 or $\frac{2}{3}$

6. 10 and 6

7. $1, \sqrt{2}$

8. $5, \frac{5}{2}$

9. 16cm, 30 cm and 34cm.

10. 16

11. 9 years and 27 years

12. i) 3x + 3 (Or) 8x + 6 ii) 20 iii) 860m^2

CHAPTER 5 – ARITHMETIC PROGRESSION

Key Concepts

Sequence

Some numbers arranged in a definite order, according to a definite rule, are said to form a sequence.

Arithmetic Progression

An arithmetic progression is a list of numbers in which each term is obtained by adding a fixed number d to the preceding term, except the first term.

A sequence is called an arithmetic progression (AP), if the difference of any of its terms and the preceding term is always the same. i.e., $a_n - a_{n-1}$ = constant.

Term

Each of the number in the list of arithmetic progression is called a term of an A.P

Common difference of A.P

The difference between the two successive terms of an A.P is called the common difference.

$$d = a_2 - a_1 = a_3 - a_2 = ... = a_n - a_{n-1}$$

Finite and Infinite Arithmetic Progression

The arithmetic progression having finite number of terms is called a finite arithmetic progression.

The arithmetic progression having infinite number of terms is called an infinite arithmetic progression.

General Form of an Arithmetic Progression

The general form of an A.P is a, a+ d, a+ 2d, a+3d…..

If the A.P a, a + d, a + 2d…… λ is reversed to λ , λ -d, -2d……a, then λ the common difference changes to negative of original sequence common difference.

General Term or n^{th} term of an A.P

The general term of an A.P is given by: $\mathbf{a_n = a + (n - 1)d}$, where a is the first term and d is the common difference.

The n^{th} term of an A.P is the difference of the sum to first n terms and the sum to first (n-1) terms of it. i.e $a_n = S_n - S_{n-1}$.

Number of Terms in A.P

The number of terms in an A.P can be obtained by $n = \frac{l-a}{d} + 1$, where l is last term of an A.P.

Consider an AP whose first term is a, common difference is d and number of terms is n.

When n is odd, $\left(\frac{n+1}{2}\right)$ th term is the middle term. So, in this case the middle term is given by $a + \left(\frac{n+1}{2}\right) d$.

When n is even, $\frac{n}{2}$ th term and $\left(\frac{n}{2} + 1\right)$ th terms are middle terms. So, in the case the middle term is given by $a + \left(\frac{n}{2} - 1\right) d$ and $a + \frac{nd}{2}$

Special Numbers of A.P

- Three special numbers in A.P are a – d, a, a + d.
- Four special numbers in A.P are a – 3d, a – d, a + d, a + 3d.

Results

If a, b, c, are in AP, then

- (a + k), (b + k), (c + k) are in AP
- (a – k), (b – k), (c – k) are in AP
- ak, bk, ck, are in AP.
- $\frac{a}{k}, \frac{b}{k}, \frac{c}{k}$ are in A.P
- b = $\frac{a+c}{2}$

Sum of n term of an A.P

Sum of n terms of an A.P is given by: $S_n = \frac{n}{2}[2a + (n - 1)d]$ or $S_n = \frac{n}{2}[a + l]$.

Note: We use the 1st Form of the Sum Formula, when the common difference d is known and use the 2nd Form when the last term *l* is known.

MULTIPLE CHOICE QUESTIONS

1. The common difference of the A.P $\frac{1}{3q}, \frac{1-6q}{3q}, \frac{1-12q}{3q}, \ldots$ is

a) q b) −q c) −2 d) 2

2. If k, 2k – 1 and 2k + 1 are three consecutive terms of an A.P., then the value of k is

a) 2 b) 3 c) –3 d) 5

3. The next term of the A.P. $\sqrt{18}, \sqrt{50}, \sqrt{95}, \ldots$ is

a) $\sqrt{146}$ b) $\sqrt{128}$ c) $\sqrt{162}$ d) $\sqrt{200}$

4. The value of $a_{30} - a_{20}$ for the A.P 2, 7, 12, 17, ... is

a) 100 b) 10 c) 50 d) 20

5. In an A.P., if a = −10, n = 6 and a_n = 10, then the value of d is

a) 0 b) 4 c) −4 d) $\frac{10}{3}$

6. If the sum of first m terms of an A.P. is $2m^2 + 3m$, then what is its second term?

a) 9 b) 10 c) 11 d) 12

7. If the 10th term of an A.P.is 52 and 17th term is 20 more than the 13th term, then find the A.P.

a) 40, 45, 50,..... b) 45, 50, 55,..... c) 17, 22, 27,..... d) 7, 12, 17,.....

8. The number of terms in the A.P. 3, 6, 9, 12,...., 111 is

a) 25 b) 40 c) 37 d) 30

9. For what value of n, are the nth terms of two A.P.'s 52, 54, 56, ... and 4, 12, 20, ... equal?

a) 11 b) 12 c) 10 d) 9

10. Three numbers in an A.P. have sum 18. Its middle term is

a) 6 b) 8 c) 3 d) 2

11. In an A.P., the sum of first n terms is $\frac{3n^2}{2} + \frac{13}{2}n$. Find its 15^{th} term.

a) 45 b) 50 c) 60 d) 75

12. Find the sum of first 15 multiples of 8.

a) 840 b) 1020 c) 960 d) 920

13. Find the sum of first 10 terms of the A.P x – 8, x – 2, x + 4, ...

a) 10x + 210 b) 10x + 190 c) 5x + 190 d) 5x + 210

14. The sum (– 6) + (0) + (6) + ... upto 13^{th} term =

a) 390 b) 1380 c) 378 d) 1830

15. If the common difference of an A.P. is 5, then what is $a_{18} - a_{13}$?

a) 5 b) 20 c) 25 d) 30

16. In an AP, if $d = -4, n = 7, a_n = 4$, then a is:

a) 6 b) 7 c) 20 d) 28

17. In an AP, if $a = 3.5, d = 0, n = 101$, then a_n will be:

a) 0 b) 3.5 c) 103.5 d) 104.5

18. The 11 th term of the AP $-5, \frac{-5}{2}, 0, \frac{5}{2}, \ldots$ is:

a) –20 b) 20 c) –30 d) 30

19. Which term of the AP: 21, 42, 63, 84, ... is 210?

a) 9^{th} b) 10^{th} c) 11^{th} d) 12^{th}

20. Two APs have the same common difference. The first term of one of these is –1 and that of the other is –8. Then the difference between their 4^{th} terms is:

a) –1 b) –8 c) 7 d) –9

21. The sum of first five multiples of 3 is:

a) 45 b) 55 c) 65 d) 75

22. If the sum of n terms of an A.P. is $3n^2 + 5n$, then which of its term is 164?

a) 25^{th} b) 26^{th} c) 27^{th} d) 28^{th}

23. If 3rd and the 9th terms of an AP are 4 and –8 respectively, then which term of the AP is zero?

a) 3^{rd} b) 4^{th} c) 5^{th} d) 6^{th}

24. The sum of first 25 terms of an AP, whose n^{th} term is given by $a_n = 7 - 3n$ is:

a) 500 b) 600 c) 700 d) –800

25. 1 + 3 + 5 + 7 ... + 199 =

a) 9000 b) 10000 c) 11000 d) 12000

26. If the common difference of an A.P is 7, then $a_{25} - a_{21}$ is equal to

(a) 14 (b) 20 (c) 28 (d) 35

27. The common difference of the A.P. $\frac{1}{2q}, \frac{1-2q}{2q}, \frac{1-4q}{2q}$ ... ...is

(a)-1 (b) 1 (c)-2q (d) 2q

28. If k + 7, 2k – 2 and 2k + 6 are three consecutive terms of an A.P, then the value of k is

(a) 15 (b) 17 (c) 5 (d) 1

29. The 7^{th} term from the end of the A.P. : – 8,– 5, –2, ...,49 is :

(a) 67 (b) 13 (c) 31 (d) 10

30. Two A.P.s have the same first term. The common difference of the first A.P. is – 3 and of the second A.P. is – 5. The difference of the 6^{th} term of the second A.P. from that of the first A.P. is

(a) 2 (b) – 8 (c) – 10 (d) 10

31. In an A.P., if the first term a = 7, n^{th} term $a_n = 84$ and the sum of first n terms $s_n = \frac{2093}{2}$, then n is equal to

(a) 22 (b) 24 (c) 23 (d) 26

32. The common difference of the A.P $\frac{1}{2x}, \frac{1-4x}{2x}, \frac{1-8x}{2x}$, ... is

(a) -2x (b) -2 (c) 2 (d) 2x

33. If the sum of first n terms of an A.P is $3n^2 + 4n$ and its common difference is 6, then its first term is

(a) 7 (b) 4 (c) 6 (d) 3

34. Three numbers in A.P have the sum 30. What is its middle term?

(a) 4 (b) 10 (c) 16 (d) 8

35. If the sum of first m terms of an AP is $2m^2 + 3m$, then its second term is

(a) 10 (b) 9 (c) 12 (d) 4

36. Three numbers in AP have the sum 30. What is its middle term?

(a) 4 (b) 10 (c) 16 (d) 8

37. The 11^{th} and 13^{th} term of an AP are 39 and 45, respectively. What is the common difference of the AP?

(a) 42 (b) 21 (c) 6 (d) 3

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: Let the positive numbers a, b, c be in A.P., then $\frac{1}{bc}, \frac{1}{ac}, \frac{1}{ab}$ are also in A.P.

Reason: If each term of an A.P. is divided by a non-zero constant, then the resulting sequence is also in A.P.

2. Assertion: Common difference of the AP $-5, -1, 3, 7, \ldots\ldots\ldots$ is 4.

Reason: Common difference of the AP a, a + d, a + 2d,.....is given by d = 2nd term − 1st term.

3. Assertion: The sum of series with n^{th} term an = 9 – 5n is -465 when number of terms n = 15.

Reason: Given series in A.P. and sum of n terms of an A.P. is $S_n = \frac{n}{2}[2a + (n-1)d]$.

4. Assertion: Three consecutive terms 2k + 1, 3k + 3 and 5k – 1 form an AP than k is equal to 6.

Reason: In an AP a, a + d, a + 2d, ….. the sum to n terms of the AP is $S_n = \frac{n}{2}[2a + (n-1)d]$.

5. Assertion: If n^{th} term of an AP is 7 - 4n, then its common differences is -4.

Reason: Common difference of an AP is given by $d = a_{n+1} - a_n$.

6. Assertion: Sum of first hundred even natural numbers divisible 5 is 500.

Reason: Sum of first n terms of an AP is given by $S_n = \frac{n}{2}[a + \ell]$ where $\ell =$ last term.

7. Assertion: If S_n is the sum of first n terms of an AP then its n^{th} term an is given by $a_n = S_n - S_{n-1}$.

Reason: The 10^{th} term of the AP 5, 8, 11, 14, …. is 35.

8. Assertion: Common difference of the AP: $5, 1, -3, -7, \ldots$ is 4.

Reason: Common difference of the AP: $a_1, a_2, a_3, \ldots, a_n$ is obtained by $d = a_n - a_{n-1}$.

9. Assertion: For an A.P., $3, 6, 9, \ldots, 198$, 10^{th} term from the end is 168.

Reason: If 'a' and 'l' are the first term and last term of an A.P with common difference 'd', then n^{th} term from the end of the given A.P is $l - (n-1)d$.

CASE STUDY BASED QUESTIONS

1. In a class the teacher asks every student to write an example of A.P. Two friends Geeta and Madhuri writes their progressions as –5, –2, 1, 4, ... and 187, 184, 181, ... respectively. Now, the teacher asks various students of the class the following questions on these two progressions. Help students to find the answers of the questions.

i) Find the 34^{th} term of the progression written by Madhuri.

a) 286 b) 88 c) –99 d) 190

ii) Find the sum of common difference of the two progressions.

a) 6 b) –6 c) 1 d) 0

iii) Find the 19^{th} term of the progression written by Geeta.

a) 49 b) 59 c) 52 d) 62

iv) Find the sum of first 10 terms of the progression written by Geeta.

a) 85 b) 95 c) 110 d) 200

v) Which term of the two progressions will have the same value?

a) 31 b) 33 c) 32 d) 30

2. Amit was playing a number card game. In the game, some number cards (having both +ve or –ve numbers) are arranged in a row such that they are following an arithmetic progression. On his first turn, Amit picks up 6^{th} and 14^{th} card and finds their sum to be –76. On the second turn he picks up 8^{th} and 16^{th} card and finds their sum to be –96.

i) What is the difference between the numbers on any two consecutive cards?

a) 7 b) –5 c) 11 d) –3

ii) The number on first card is,

a) 12 b) 3 c) 5 d) 7

iii) What is the number on the 19^{th} card?

a) –88 b) –83 c) –92 d) –102

iv) What is the number on the 23rd card?

a) –103 b) –122 c) –108 d) –117

v) The sum of numbers on the first 15 cards is

a) –840 b) –945 c) –427 b) –420

3. The given figure shows playing cards stacked together. 42 cards are stacked in the manner. 12 cards are in the bottom row, 10 in the next row, 8 in the row next to it and so on. Based on the above situation, answer the following questions:

i) The total number of rows in which the cards are stacked is:

a) 7 b) 6 c) 8 d) 9

(ii) The number of cards in the top row is:

a) 4 b) 6 c) 1 d) 2

iii) The mathematical concept applied in solving the above problem is:

a) Linear equations b) Probability

c) Arithmetic Progression d) Coordinate Geometry

(iv) The number of cards in the third row is:

a) 6 b) 7 c) 8 d) 10

(v) The number of cards in the seventh row is:

a) 1 b) 0 c) 2 d) 6

4. Your elder brother wants to buy a car and plans to take loan from a bank for his car. He repays his total loan of ₹1,18,000 by paying every month starting with the first instalment of ₹1000. If he increases the instalment by ₹100 every month, answer the following:

i) Find the amount paid by him in 30th instalment.

ii) Calculate the amount paid by him in the 30 instalments.

iii) What amount does he still have to pay after 30th instalment?

iv) If total instalments are 40 then amount paid in the last instalment?

v) Find the ratio of the 1^{st} instalment to the last instalment.

5. In a pathology lab, a culture test has been conducted. In the test, the number of bacteria taken into consideration in various samples is all 3-digit numbers that are divisible by 7, taken in order. On the basis of above information, answer the following questions

i) How many bacteria are considered in the fifth sample?

ii) How many samples should be taken into consideration?

iii) Find the total number of bacteria in the first 10 sample.

iv) How many bacteria are there in the 7^{th} sample from the last?

6. In the month of April to June 2022, the exports of passenger cars from India increased by 26% in the corresponding quarter of 2021–22, as per a report. A car manufacturing company planned to produce 1800 cars in 4^{th} year and 2600 cars in 8^{th} year. Assuming that the production increases uniformly by a fixed number every year.

Based on the above information answer the following questions.

i) Find the production in the 1^{st} year.

ii) Find the production in the 12^{th} year.

iii) Find the total production in first 10 years.

iv) In which year the total production will reach to 15000 cars?

7. While playing a treasure hunt game, some clues(numbers) are hidden in various spots collectively forms an A.P. If the number on the n^{th} spot is $20 + 4n$, then the answer the following questions to help the player in spotting the clues.

i) Which number is on the first spot?

ii) Which number is on the $(n - 2)^{th}$ spot?

iii) What is the sum of all the numbers on the first 10 spots?

(iv) Which spot is numbered as 116?

8. In a class the teacher asks every student to write an example of AP. Two boys Aryan and Roshan writes their progressions as -5,-2, 1,4 ..... and 187, 184, 181,..... respectively.Now the teacher asks the various students of the class the following questions on this progressions. Help students to find the answers of the following.

(i) Find the sum of common difference of the two progressions.

(ii) Find the 34^{th} term of the progression written by Roshan.

(iii) Find the sum of first 10 terms of the progression written by Aryan.

(iv) Which term of the two progressions will have the same value?

9. A school has decided to plant some endangered trees on 51st World Environment Day in the nearest park. They have decided to plant those trees in few concentric circular rows such that each succeeding row has 20 more trees than the previous one. The first circular row has 50 trees.

Based on the above given information, answer the following questions:

(i) How many trees will be planted in the 10^{th} row?

(ii) How many more trees will be planted in the 8^{th} row than in the 5^{th} row?

(iii) If 3200 trees are to be planted in the park, then how many rows are required?

(iv) If 3200 trees are to be planted in the park, then how many trees are still left to be planted after the 11^{th} row?

10. Treasure hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize.

While playing a treasure hunt game, some clues(numbers) are hidden in various spots collectively forming an A.P. If the number on the n^{th} spot is $20 + 4n$, then answer the following questions to help the players in spotting the clues:

(i) Which number is on first spot?

(ii) Which spot is numbered as 112?

(iii) What is sum of all the numbers on the first 10 spots?

(iv) Which number is on the $(n-2)^{th}$ spot?

11. A school is organizing a charity run to raise funds for a local hospital. The run is planned as a series of rounds around a track, with each round being 300 metres. To make the event more challenging and engaging, the organizers decide to increase the distance of each subsequent round by 50 metres. For example, the second round will be 350 metres, the third round will be 400 metres and so on. The total number of rounds planned is 10.

Based on the information given above, answer the following questions:

(i) Write the fourth, fifth and sixth term of the Arithmetic Progression so formed.

(ii) Determine the distance of the 8^{th} round.

(iii) Find the total distance run after completing all 10 rounds.

(OR)

If a runner completes only the first 6 rounds, what is the total distance run by the runner?

12. Cable cars at hill stations are one of the major tourist attractions. On a hill station, the length of cable car ride from base point to top most point on the hill is 500m. Poles are installed at equal intervals on the way to provide support to the cable on which car moves. The distance of first pole from base point is 200m and subsequent poles are installed at equal interval of 150m. Further, the distance of last pole from the top is 300m.

Based on the above information, answer the following questions using Arithmetic Progression:

(i) Find the distance of 10^{th} pole from the base.

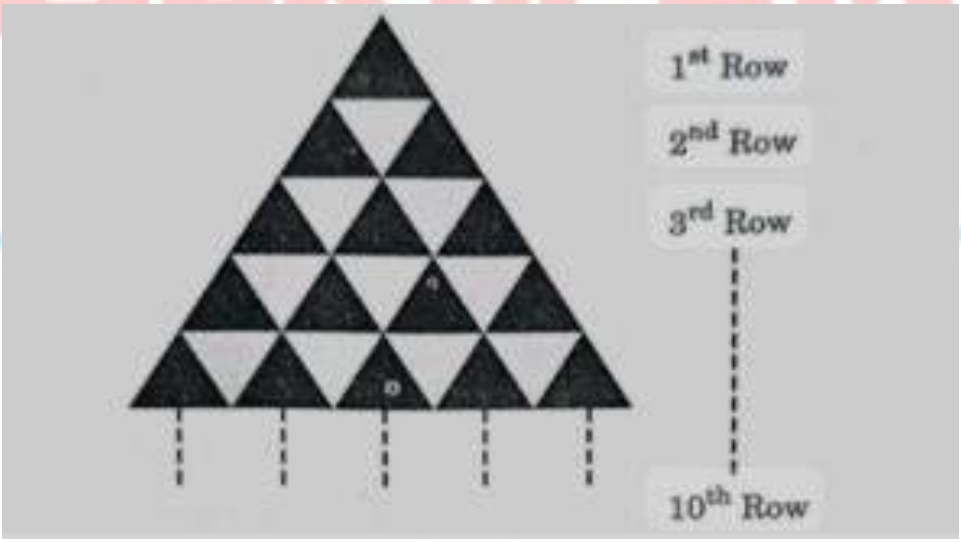
(ii) Find the distance between 15^{th} pole and 25^{th} pole.

(iii) Find the time taken by cable car to reach 15^{th} pole from the top if it is moving at the speed of 5m/s and coming from top.

(OR)

Find the total number of poles installed along the entire journey.

13. In an equilateral triangle of side 10cm, equilateral triangles of side 1cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.



Based on given information, answer the following questions using Arithmetic Progression.

(i) How many triangles will be there in bottom most row?

(ii) How many triangles will be there in fourth row from the bottom?

(iii) Find the total number of triangles of side 1cm each till 8^{th} row.

(OR)

How many more number of triangles are there from 5^{th} row to 10^{th} row than in first 4 rows? Show working.

14. Pankaj wants to participate in the push-up challenge. He can currently make 3000 push-ups in one hour. But he wanted to achieve a target of 3900 push-ups in one-hour. With each day of practice, he is able to make 5 more push-ups in one hour as compared to the previous day. On first day of practice, he do 3000 push-ups and continues to practice regularly till his target is achieved.

Based on the above information, answer the following questions:

(i) Form an AP representing the number of push-ups per day.

(ii) Find the total number of push-ups performed by Pankaj in starting first week.

(iii) Find the minimum number of days Pankaj needs to practice before his goal is achieved.

(OR)

On which day, Pankaj performed 3500 push-ups?

VERY SHORT ANSWERS

1. Which term of the A.P 3, 15, 27, 39,…… will be 120 more than its 21^{st} term?

2. The 15^{th} term of an AP is 3 more than twice its 7^{th} term. If the 10th term of the AP is 41, then find its n^{th} term.

3. The 9^{th} term of an AP is zero. Prove that its 29^{th} term is double of its 19^{th} term.

4. Find how many integers between 200 and 500 are divisible by 8?

5. Divide 24 in three parts such that they are in AP and their product is 440.

6. Find the 20th term from the last term of the A.P.: 3, 8, 13, ... 253.

7. If 7 times the 7^{th} term of an A.P. is equal to 11 times its 11^{th} term, then find its 18^{th} term.

8. Find the middle term of the A.P. 213, 205, 197, ...37.

9. Solve the equation: 1 + 4 + 7 + 10 + ... + x = 287.

10. How many terms of an A.P. 9, 17, 25, ... must be taken to give a sum of 636?

11. The 19^{th} term of an AP is equal to three times its 6^{th} term. If its 9^{th} term is 19, find the AP.

12. Find the value of the middle most term (s) of the AP: –11, –7, –3, ..., 49.

13. For an A.P., show that $a_p + a_{p+2q} = 2a_{p+q}$.

14. Which term of the AP: 114,109,104, ... is the first negative term?

15. The sides of a right-angled triangle are in AP. Show that they are in the ratio 3:4:5.

SHORT ANSWERS

1. The sum of the 2^{nd} and the 7^{th} term of an A.P. is 30. If its 15^{th} term is 1 less than twice its 8^{th} term, find the A.P.

2. If S_n denotes the sum of first n terms of an A.P., prove that $S_{30} = 3[S_{20} - S_{10}]$.

3. If m times the m^{th} term of an A.P. is equal to n times its n^{th} term, then find the (m + n)th term of the A.P.

4. The sum of the first seven terms of an A.P is 182. If its 4^{th} and the 17^{th} terms are in the ratio 1:5, find the A.P.

5. If the p^{th}, q^{th}, r^{th} terms of an A.P. be x, y, z respectively, show that x(q – r) + y(r – p) + z(p – q) = 0.

6. The sum of three numbers in A.P. is 21 and the sum of their squares is 155. Find the numbers.

7. Divide 32 into four parts which are in AP such that the product of extremes to the product of means is 7:15.

8. If sum of the first 6 terms of an AP is 36 and that of the first 16 terms is 256, find the sum of first 10 terms.

9. If in an A.P., the sum of first m terms is n and the sum of its first n terms is m, then prove that the sum of its first (m + n) terms is –(m + n).

10. If the sum of first four terms of an A.P. is 40 and that of first 14 terms is 280. Find the sum of its first n terms.

11. The sum of four numbers in A.P. is 42. If the product of extreme terms is 90; find the numbers.

12. If $(p + 1)^{th}$ term of an AP is twice the $(q + 1)^{th}$ term, prove that $(3p + 1)^{th}$ term is twice the $(p + q + 1)^{th}$ term.

13. If the sum of the 3^{rd} and the 8^{th} terms of an AP is 7 and the sum of the 7^{th} and the 14^{th} terms is –3, find the 10^{th} term.

14. In an AP, prove that $a_{m+n} + a_{m-n} = 2a_m$.

15. The interior angles of a polygon are in arithmetic progression. The smallest angle is 120° and the common difference is 5°. Find the number of sides in the polygon.

16. In an A.P, the sum of three consecutive terms is 24 and the sum of their squares is 194. Find the numbers.

17. The ratio of the 10^{th} term to its 30^{th} term of an A.P is 1:3 and the sum of its first six terms is 42. Find the first term and the common difference of A.P.

18. A man starts his job with a certain monthly salary and earns a fixed increment every year. If his salary was ₹ 15,000 after 4 years of service and ₹ 18,000 after 10 years of service, what was his starting salary and what was the annual increment?

19. If the sum of the first 14 terms of an A.P is 1050 and the first term is 10, then find the 20^{th} term and the n^{th} term.

20. A sum of ₹ 2,000 is invested at 7% per annum simple interest. Calculate the interests at the end of 1^{st}, 2^{nd} and 3^{rd} year. Do these interests form an AP? If so, find the interest at the end of the 27^{th} year.

21. Find the sum of all 3-digit natural numbers which are divisible by 11.

LONG ANSWERS

1. If the ratio of the sum of the first n terms of two A.P.'s is (7n + 1):(4n + 27), then find the ratio of their 9^{th} terms.

2. The sum of three numbers in A.P. is 12 and sum of their cubes is 288. Find the numbers.

3. The ratio of the sums of first m and first n terms of an A.P. is $m^2:n^2$. Show that the ratio of its m^{th} and n^{th} terms is (2m – 1):(2n – 1).

4. If the first term of an A.P. is 2 and the sum of first five terms is equal to one-fourth of the sum of the next five terms, find the sum of the first 30 terms.

5. The ratio of the 11^{th} term to the 18th term of an A.P. is 2:3. Find the ratio of 5^{th} term to the 21^{st} term, and also the ratio of the sum of the first 5 terms to the sum of the first 21 terms.

6. The sum of first sixteen terms of an A.P. is 112 and the sum of its next fourteen terms is 518. Find the A.P.

7. The sum of the first five terms of an A.P. and the sum of first seven terms of the same A.P. is 167. If the sum of the first ten terms of this A.P. is 235, find the sum of its first twenty terms.

8. Let the sum of first n, 2n, 3n terms of an AP be S_1, S_2 and S_3 respectively show that $S_3 = 3(S_2 - S_1)$.

9. If S_1, S_2, S_3 be the sums of n terms of 3 arithmetic progressions, the first term of each being 1 and the respective common differences are 1, 2, 3, then prove that $S_1 + S_3 = 2S_2$.

10. The sum of four consecutive numbers is an AP is 32 and the ratio of the product of first and the last term to the product of two middle terms is 7:15. Find the numbers.

11. The sum of first and eight terms of an A.P is 32 and their product is 60. Find the first term and common difference of the A.P. Hence, also find the sum of its first 20 terms.

12. In an A.P of 40 terms, the sum of first 9 terms id 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P. Also, find the sum of all the terms of the A.P.

13. The sum of the third term and the seventh term of an AP is 6 and their product is 8. Find the sum of the first sixteen terms of the AP.

14. The minimum age of children eligible to participate in a painting competition is 8 years. It is observed that the age of the youngest boy was 8 years and the ages of the participants, when seated in order of age, have a common difference of 4 months. If the sum of the ages of all the participants is 168 years, find the age of the eldest participant in the painting competition.

15. An AP consists of 'n' terms whose n^{th} term is 4 and the common difference is 2. If the sum of 'n' terms of AP is -14, then find 'n.. Also, find the sum of the first 20 terms.

16. The sum of the first six terms of an arithmetic progression is 42. The ratio of the 10th term to the 30th term is 1:3. Calculate the first and the thirteenth terms of the AP.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. The first four terms of an AP whose first term is 3x + y and common difference is x – y are

a) 3x + y, 2x + 2y, x + 3y, 4y b) 3x – y, 2x – 2y, x – 3y, 4y

c) 3x + y, 2x, x – y, -2y d) 3x + y, 4x, 5x – y, 6x – 2y

2. The common difference of an AP, the sum of whose n terms is S_n, is

a) $S_n - 2S_{n-1} + S_{n-2}$ b) $S_n - 2S_{n-1} - S_{n-2}$ c) $S_n + S_{n+1}$ d) $S_n - S_{n-1}$

3. If 9^{th} term of an AP be zero, then the ratio of its 29^{th} and 19^{th} term is:

a) 1:2 b) 2:1 c) 1:3 d) 3:1

4. Assertion: The sum of the first n terms of an AP is given by $S_n = 3n^2 - 4n$. Then its n^{th} term $a_n = 6n - 7$.

Reason: n^{th} term of an AP, whose sum to n terms S_n, is given by $a_n = S_n - S_{n-1}$

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. If 7 times the 7^{th} term of an AP is equal to 11 times its 11^{th} terms, then find its 18^{th} term.

6. Find the number of natural numbers between 101 and 999 which are divisible by both 2 and 5.

7. Find x, if $3x^2 + 4x + 4, 2x^2 + 3x + 3$ and $3x + 8$ are three consecutive terms are in AP such that $x \in N$.

SECTION C

Each carry 3 marks

8. Divide 56 into four parts which are in AP such that the ratio of product of extremes to the product of means is 5: 6.

9. The sum of first six term of an A.P is 42. The ratio of the 10^{th} term to its 30^{th} term is 1:3. Calculate the first and 13^{th} term of the A.P.

SECTION D

Each carry 5 marks

10. If S_n denote the sum of the first n terms of an A.P., prove that $S_{30} = 3(S_{20} - S_{10})$.

11. If the sum of p terms of an A.P. is q and the sum of q terms is p, show that the sum of (p + q) terms is – (p + q).

SECTION E

12. Meena's mother start a new shoe shop. To display the shoes, she put 3 pairs of shoes in 1^{st} row, 5 pairs in 2^{nd} row, 7 pairs in 3^{rd} row and so on.

On the basis of above information, answer the following questions

(i) Find the difference of pairs of shoes in 17^{th} row and 10^{th} row.

(ii) On next day, she arranges x pairs of shoes in 15^{th} row, then find x.

(iii) If She puts a total of 120 pairs of shoes, then find the number of rows required

(Or)

(iv) If She puts a total of 120 pairs of shoes, then how many shoes will be there in last row?

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. c) −2 2. b) 3 3. c) $\sqrt{162}$ 4. c) 50 5. b) 4 6. a) 9 7. d) 7, 12, 17, ... 8. c) 37 9. d) 9	1. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 2. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 3. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 4. (b) Both Assertion (A) and	1. i) b ii) d iii) a iv) a v) b 2. i) b ii) d iii) b iv) a v) d 3. i) b ii) d iii) c iv) c v) b 4. i) 3900 ii) 73500 iii) 44500 iv) 5900 v) 10:49 5. i) 133 ii) 128 iii) 1365 iv) 952 6. i) 1200 ii) 3400	1. 31st term 2. 4n + 1 3. Proof 4. 37 5. 5, 8, 11 or 11, 8, 5 6. 158 7. 0 8. 125 9. 40 10. 12	1. 1, 5, 9, ... 2. Proof 3. (m + n)th term of the AP is 0. 4. 2, 10, 18, ... 5. Proof 6. 5, 7, 9 7. 2, 6, 10, 14 or 14, 10, 6, 2 8. 100 9. Proof	1. $\frac{24}{19}$ 2. 2, 4 and 6, or 6, 4 and 2. 1 3. Proof 4. – 2550 5. 1: 3 and 5: 49 6. –8, –6, –4,… 7. 970 8. Proof 9. Proof 10. 2, 6, 10, 14,

10. a) 6

11. b) 50

12. c) 960

13. b) 50

14. a) 390

15. c) 25

16. d) 28

17. b) 3.5

18. b) 20

19. b) 10^{th}

20. c) 18

Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

5. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

6. (d) Assertion (A) is false but Reason (R) is true.

7. (c) Assertion (A) is true but Reason (R) is false.

8. (d) Assertion (A) is false, but Reason (R) is true.

9. (d) Assertion (A) is false, but

iii) 21000 iv) 13

7. i) 24 ii) 12 + 4n

iii) 420 iv) 24

8. i) 0

ii) 88

iii) 85

iv) n = 33

9. i) 230

ii) 60

iii) 16

iv) 1550

10. i) 24

11. 3, 5, 7, ...

12. 17 and 21

13. Proof

14. 24^{th} term

15. Proof

16. 7, 8, 9 or 9, 8, 7

17. a = 2 and d = 2

18. ₹ 13,500 and ₹ 5,00

19. 200, 10n

20. ₹ 3780

21. 44550

10. n(n + 6) or $(n^2 + 6n)$

11. 6, 9, 12 and 15.

12. Proof

13. -1

14. Proof

15. 9

or 14, 10, 6, 2

11. d = ±4 and S_{20} = 800 or -160

12. a = 5, d = 3 and $S_{40} = 2540$

13. 20

14. 13 years

15. n = 7, sum = 220

16. 2 & 26

21. a) 45 22. c) 27^{th} 23. c) 5^{th} 24. c) 700 25. b) 10000 26. (c) 28 27. (a)-1 28. (b) 17 29. (c) 31 30. (d) 10	Reason (R) is true.	ii) 23 iii) 420 iv) 12 + 4n 11. (i) 450, 500, 550 (ii) 650m (iii) 5250m (OR) 2250 12. (i) 1550m (ii) 1500m (iii) 480 seconds or 8 minutes (OR) 31 13. (i) 19 (ii) 13			

31. (c) 23 32. (b) -2 33. (a) 7 34. (b) 10 35. (b) 9 36. (b) 10 37. (d) 3		(iii) 64 (OR) 68 14. i) 3000, 3005, 3010, …., 3900 ii) 624450 iii) 180 (OR) 101			

UNIT TEST

1. d) 3x + y, 4x, 5x – y, 6x – 2y

2. a) $S_n - 2S_{n-1} + S_{n-2}$

3. b) 2:1

4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

5. 0

6. 89

7. 4

8. 8, 12, 16, 20

9. 2 and 26

10. Proof

11. Proof

12. i) 14 ii) 31 iii) 10 (Or) 2

CHAPTER 6 - TRIANGLES

Key Concepts

Similar Figures

Two figures having the same shapes are called the similar figures.

Similar Polygons

Two triangles are said to be similar if (i) their corresponding angles are equal (ii) their corresponding sides are in proportional.

Criterion for Similarity of Triangles

AAA Similarity

If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio (or proportion) and hence the two triangles are similar.

AA Similarity

If two angles of one triangle are respectively equal to two angles of another triangle, then the two triangles are similar.

SSS Similarity

If in two triangles, sides of one triangle are proportional to(i.e., in the same ratio of) the sides of the other triangle, then their corresponding angles are equal and hence the two triangles are similar.

SAS Similarity

If one angle of a triangle is equal to one angle of the other triangle and the sides including these angles are proportional, then the two triangles are similar.

Important Theorems

Basic Proportionality Theorem (Thales Theorem)

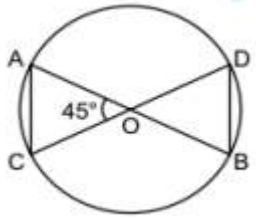
If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

Converse of Basic Proportionality Theorem

If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.

MULTIPLE CHOICE QUESTIONS

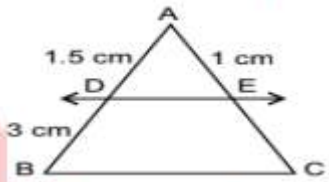
1. In the figure, O is the point of intersection of two chords AB and CD such that OB = OD. Then triangles OAC and ODB are:



a) equilateral but not similar b) isosceles but not similar

c) equilateral and similar d) isosceles and similar

2. In the given figure, if DE || BC, then length of EC is:

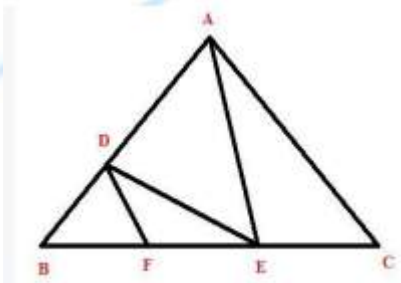


a) 5 cm b) 4 cm c) 3 cm d) 2 cm

3. In ΔABC, D and E are points on the sides AB and AC respectively such that DE || BC. If AD = 4x – 3, AE = 8x – 7, BD = 3x – 1 and CE = 5x – 3, then the value of x is:

a) 3 cm b) 2 cm c) 1.5 cm d) 1 cm

4. In the given figure, DE || AC and DF || AE. If the lengths of BF and FE are 4cm and 5cm respectively, then the length of EC is:



a) 11.25 cm b) 9.6 cm c) 12.5 cm d) 13.2 cm

5. D and E are respectively the points on the sides AB and AC of a triangle ABC such that AD = 2 cm, BD = 3 cm, BC = 7.5 cm and DE || BC. Then, length of DE (in cm) is:

a) 2.5 b) 3 c) 5 d) 6

6. If in two triangles ABC and PQR, $\frac{AB}{QR} = \frac{BC}{PR} = \frac{CA}{PQ}$, then

a) $\triangle PQR \sim \triangle CAB$ b) $\triangle PQR \sim \triangle ABC$ c) $\Delta CBA \sim \Delta PQR$ d) $\triangle BCA \sim \triangle PQR$

7. Two poles of height 6 m and 11 m stand vertically upright on a plane ground. If the length of shadow of smaller pole is 12 m, then length of shadow of bigger pole is

a) 22 m b) 14 m c) 13 m d) 11 m

8. It is given that, $\Delta ABC \sim \Delta EDF$ such that AB = 5 cm, AC = 7 cm, DF = 15 cm and DE = 12 cm then the sum of the remaining sides of the triangles is

a) 23.05 cm b) 16.8 cm c) 6.25 cm d) 24 cm

9. If ΔABC and ΔDEF are similar triangles such that $\angle A = 57°$ and $\angle E = 83°$ then $\angle C$ is

a) 33^o b) 30^o c) 40^o d) 83^o

10. In ΔABC, DE || BC and AD = 4cm, AB = 9cm. AC = 13.5 cm then the value of EC is

a) 6 cm b) 7.5 cm c) 9 cm d) none of these

11. ΔABC is such that AB = 3 cm, BC = 2 cm and CA = 2.5 cm. If $\Delta DEF \sim \Delta ABC$ and FE = 4 cm, then the perimeter of ΔDEF is

a) 12 cm b) 13 cm c) 14 cm d) 15 cm

12. A street light bulb is fixed on a pole 6 m above the level of the street. If a woman of height 1.5m casts a shadow of 3 m, find how far she is away from the base of the pole is

a) 12 m b) 10 m c) 9 m d) 11 m

13. A 15 metres high tower casts a shadow 24 meters long at a certain time and at the same time, a telephone pole casts a shadow 16 meters long then the height of the telephone pole is

a) 12 m b) 10 m c) 9 m d) 11 m

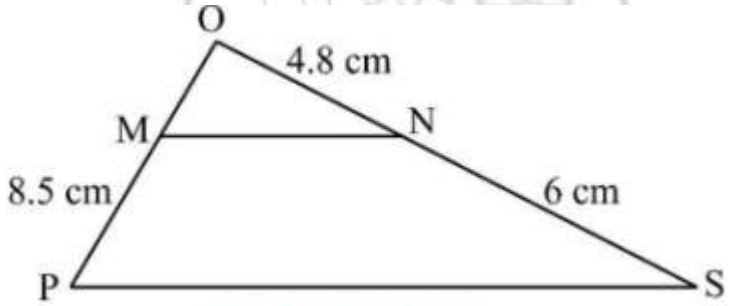
14. ABCD is a trapezium in which AB ‖ DC and P and Q are points on AD and BC, respectively such that PQ ‖ DC . If PD = 18 cm, BQ = 35 cm and QC = 15 cm, then AD is

a) 20 cm b) 40 cm c) 60 cm d) 80 cm

15. A vertical stick of length 7.5 m casts a shadow 5 m long on the ground and at the same time a tower casts a shadow 24 m long then the height of the tower is

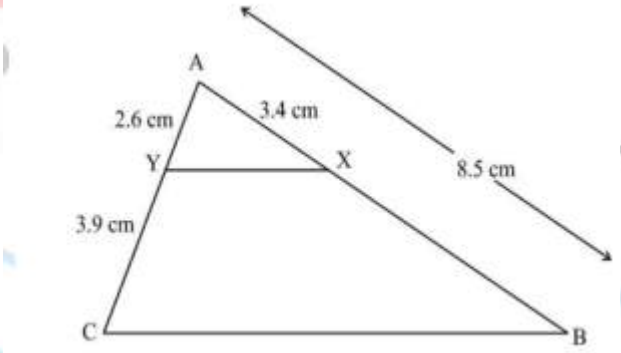
a) 20 m b) 40 m c) 60 m d) 36m

16. In the given figure, if M and N are points on the sides OP and OS respectively of ΔOPS, such that MN||PS, then the length OP is



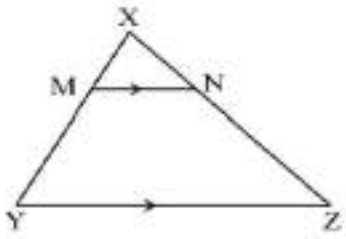
(a) 6.8 cm (b) 17cm (c) 15.3 cm (d) 9.6 cm

17. In the figure, X and Y are two points on the sides AB and AC respectively in ΔABC, such that AX = 3.4 cm, AB = 8.5 cm, AY = 2.6 cm and YC = 3.9 cm. Which of the following relation is correct?



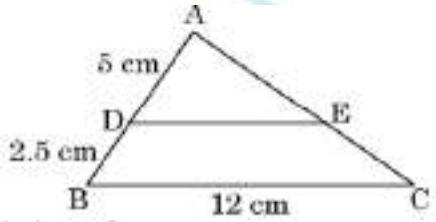
(a) BC = 2XY (b) 3BC = 2XY (c) BC is not parallel to XY (d) BC || XY

18. In ΔXYZ, XY = 6cm. If M and N are two points on XY and XZ respectively such that MN || YZ and XN = $\frac{1}{4}$XZ, then the length of XM is



(a) 1.2 cm (b) 1.5 cm (c) 2 cm (d) 4 cm

19. In the given figure ΔABC is shown. DE is parallel to BC. If AD = 5cm, DB = 2.5cm and BC = 12cm, then DE is equal to



(a) 10cm (b) 6cm

(c) 8cm (d) 7.5cm

20. If a vertical pole of length 7.5cm casts a shadow 5m long on the ground and at the same time, a tower casts a shadow 24m long, t hen the height of the tower is

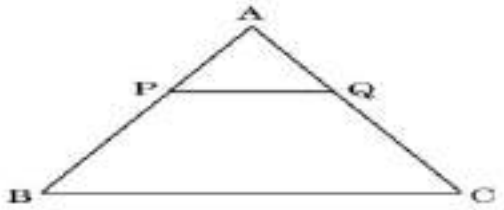
(a) 20m (b) 40m (c) 60m (d) 36m

21. In triangles ABC and DEF, $\angle B = \angle E, \angle F = \angle C$ and $AB = 3DE$. Then, the two triangles are

(a) congruent but not similar (b) congruent as well as similar

(c) neither congruent nor similar (d) similar but not congruent

22. In the given figure, PQ||BC. If $\frac{AP}{PB} = \frac{4}{13}$ and $AC = 20 \cdot 4$cm, then the length of AQ is

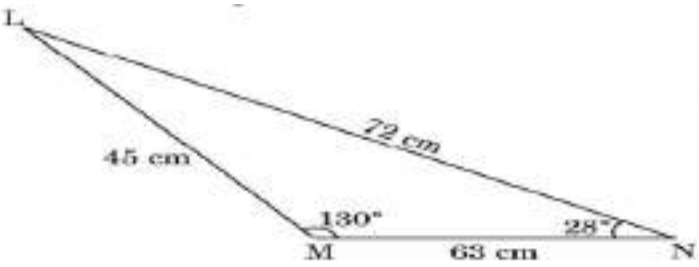


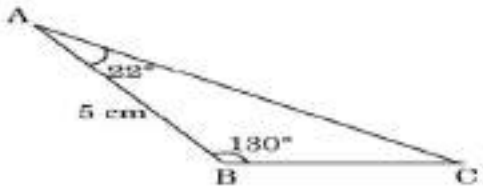
(a) 2.8cm (b) 5.8cm (c) 3.8cm (d) 4.8cm

23. If in two triangles $\triangle$ DEF and $\triangle$ PQR, $\angle D = \angle Q$ and $\angle R = \angle E$, then which of the following is not true?

(a) $\frac{DE}{QR} = \frac{DF}{PQ}$ (b) $\frac{EF}{PR} = \frac{DF}{PQ}$ (c) $\frac{EF}{RP} = \frac{DE}{QR}$ (d) $\frac{DE}{PQ} = \frac{EF}{RP}$

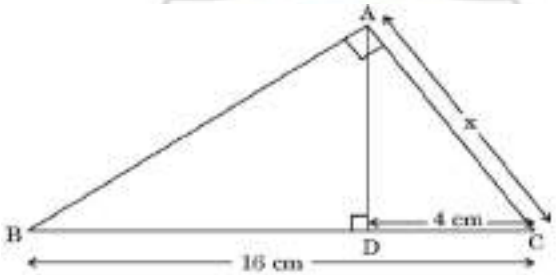
24. The measurements of ΔLMN and ΔABC are shown in the figure given below. The length of side AC is





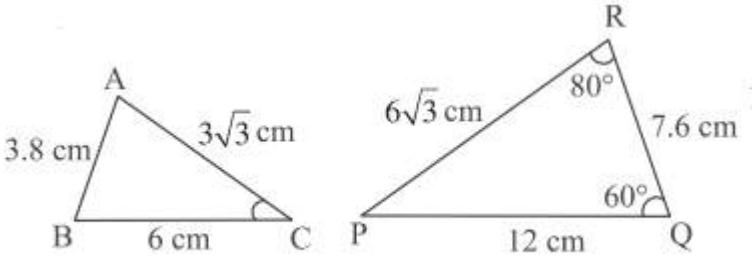
(a) 16 cm (b) 7 cm (c) 8 cm (d) 4 cm

25. In the given figure, in $\triangle ABC, AD \perp BC$ and $\angle BAC = 90°$. If $BC = 16cm$ and $DC = 4$ cm, then the value of x is



(a) 4 cm (b) 5 cm (c) 8 cm (d) 3 cm

26. $\triangle$ ABC and $\triangle$ PQR are shown in the adjoining figures. The measure $\angle C$ is

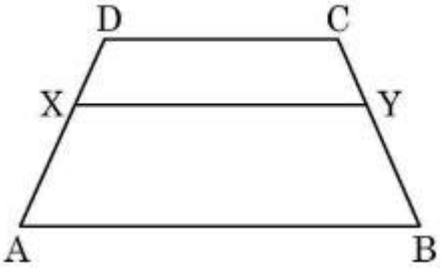


(a) 140° (b) 80° (c) 60° (d) 40°

27. E and F are points on the sides AB and Ac respectively of a $\triangle$ ABC such that $\frac{AE}{EB} = \frac{AF}{FC} = \frac{1}{2}$. Which of the following relation is true?

(a) EF = 2BC (c) BC = 2EF (c) EF = 3BC (d) BC = 3EF

28. In the adjoining figure, ABCD is a trapezium in which XY||AB||CD. If $AX = \frac{2}{3}AD$, then CY:YB is



(a) 2:3 (b) 3:2 (c) 1:3 (d) 1:2

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: A line drawn parallel to any one side of a triangle intersects the other two sides proportionally.

Reason: Parallel lines cannot be drawn to any one side of a triangle.

2. E and F are the points on the sides PQ and PR respectively of a triangle PQR. PE = 4 cm, QE = 4.5cm, PF = 8 cm and RF = 9 cm.

Assertion: EF is not parallel to QR

Reason: In a triangle if two sides are divided proportionally by a line then the line is parallel to the third side.

3. Assertion : D and E are points on the sides AB and AC respectively of a ΔABC such that DE ∥ BC then the value of x is 4, when AD = x cm, DB = (x – 2) cm, AE = (x + 2) cm and EC = (x – 1) cm. Reason : If a line is parallel to one side of a triangle then it divides the other two sides in the same ratio.

4. Assertion: If a line intersects sides AB and AC of a Δ ABC at D and E respectively and is parallel to BC, then $\frac{AD}{AB} = \frac{AE}{AC}$.

Reason: If a line is parallel to one side of a triangle, then it divides the other two sides in the same ratio.

5. Assertion: ABCD is a trapezium with DC || AB. E and F are points on AD and BC respectively such that EF || AB. Then $\frac{AE}{ED} = \frac{BF}{FC}$.

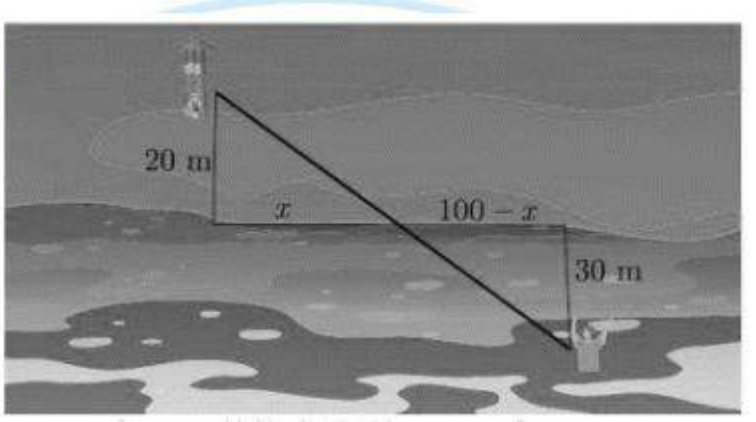
Reason: Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.

6. Assertion: ABCD is a trapezium with DC || AB. E and F are points on AD and BC respectively, such that EF || AB. Then $\frac{\text{AE}}{\text{ED}} = \frac{\text{BF}}{\text{FC}}$.

Reason: Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.

CASE STUDY BASED QUESTIONS

1. Swimmer in Distress: A lifeguard located 20 metre from the water spots a swimmer in distress. The swimmer is 30 metre from shore and 100 metre east of the lifeguard. Suppose the lifeguard runs and then swims to the swimmer in a direct line, as shown in the figure.

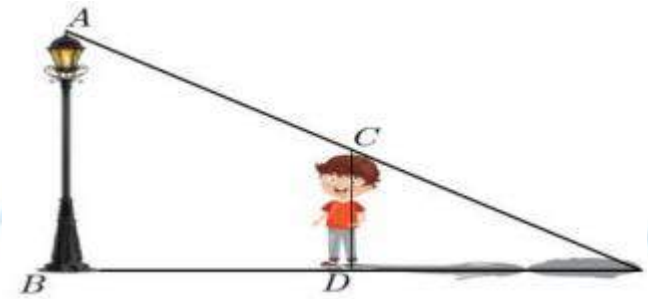


i) How far east from his original position will he enter the water? (Hint: Find the value of x in the sketch).

ii) Which similarity criterion of triangle is used?

iii) What is the distance of swimmer from the shore?

2. Rohan is very intelligent in maths. He always try to relate the concept of maths in daily life. One day he is walking away from the base of a lamp post at a speed of 1 m/s. Lamp is 4.5 m above the ground.



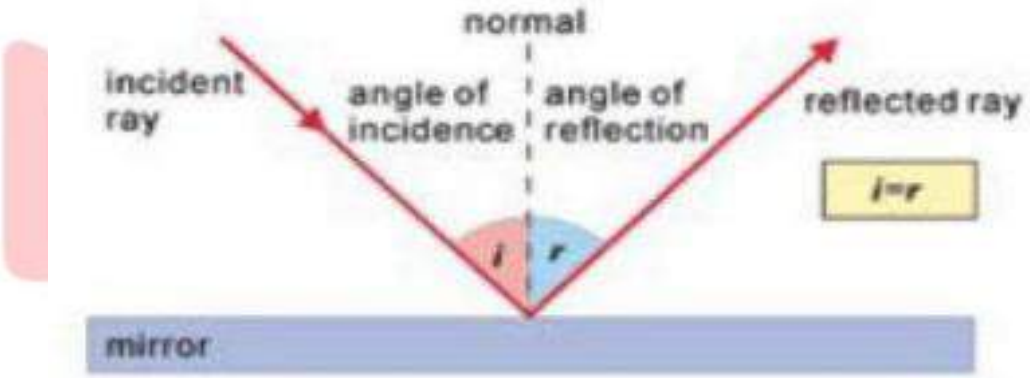
i) If after 2 second, length of shadow is 1 meter, what is the height of Rohan?

ii) What is the minimum time after which his shadow will become larger than his original height?

iii) What is the distance of Rohan from pole at this point?

iv) What will be the length of his shadow after 4 seconds?

3. The law of reflection states that when a ray of light reflects off a surface, the angle of incidence is equal to the angle of reflection.



Ramesh places a mirror on level ground to determine the height of a pole (with traffic light fired on it). He stands at a certain distance so that he can see the top of the pole reflected from the mirror. Ramesh's eye level is 1.5 m above the ground. The distance of Ramesh and the pole from the mirror are 1.8 m and 6 m respectively.

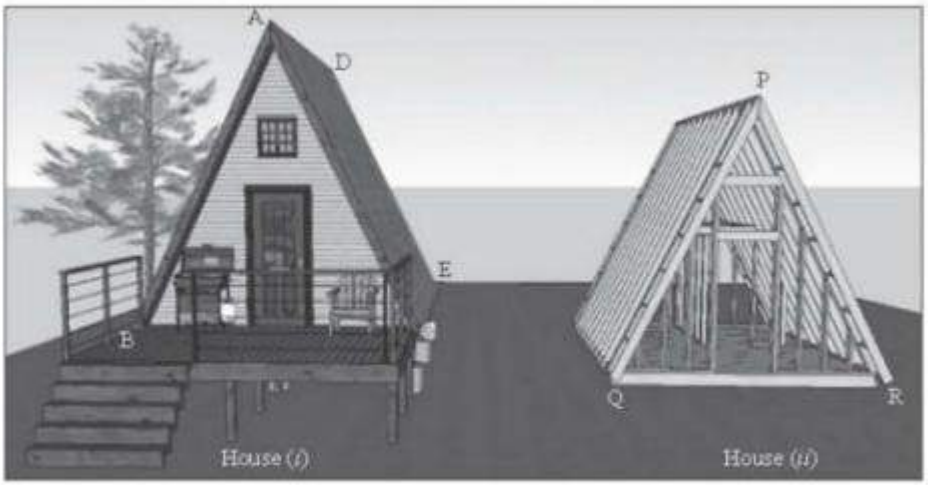
i) Which criterion of similarity is applicable to similar triangles?

ii) What is the height of the pole?

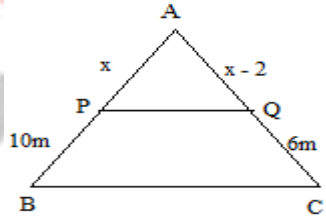
iii) Now Ramesh moves behind such that distance between pole and Ramesh is 13 meters. He places mirror between him and pole to see the reflection of light in right position. What is the distance between mirror and Ramesh?

iv) What is the distance between mirror and pole?

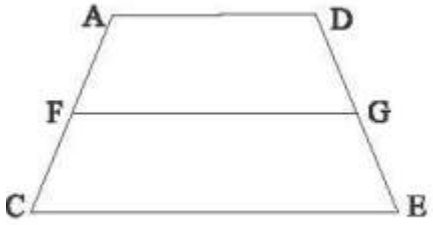
4. A Frame House: A frame-house is a house constructed from a wooden skeleton, typically covered with timber board. The concept of similar triangles is used to construct it. Look at the following picture:



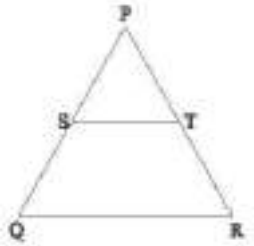
i) The front view of house (i) is shown along side in which point P on AB is joined with point Q on AC. If PQ || BC, AP = x m, PB = 10m, AQ = (x – 2)m, QC = 6m, then find the value of x



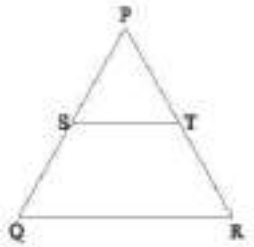
ii) The side view of house (i) is shown below in which point F on AC is joined with point G on De. If ACED is a trapezium with AD || CE, F and G are points on non-parallel sides AC and DE respectively such that FG is parallel to AD, then $\frac{AF}{FC} =$



iii) The front view of house (ii) is shown along side in which point S on PQ is joined with point T on PR. If $\frac{PS}{QS} = \frac{PT}{TR}$ and $\angle PST = 70°, \angle QPR = 50°$, then find angle $\angle QRP$.



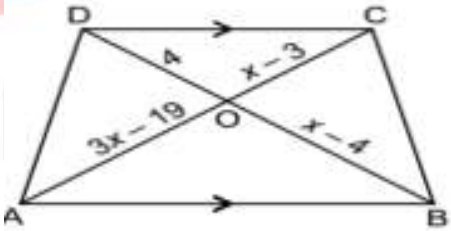
iv) Again consider the front view of house (ii). If S and T are points on side PQ and PR respectively such that ST || QR and PS:SQ = 3:1. Also TP = 6.6m, then find PR.



VERY SHORT ANSWERS

1. In ΔABC, D and E are points on the sides AB and AC respectively such that DE || BC. If AD = 4x – 3, AE = 8x – 7, BD = 3x – 1 and CE = 5x – 3, find the value of x.

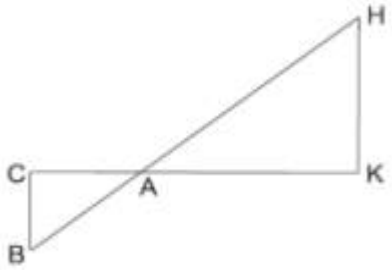
2. In the given figure, AB is parallel to CD. If OA = 3x – 19, OB = x – 4, OC = x – 3 and OD = 4, determine x.



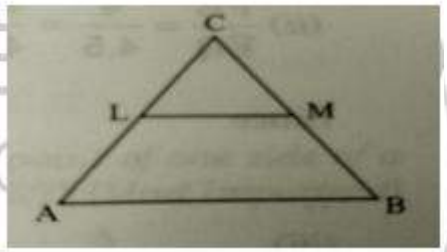
3. Prove that the line segment joining the mid-points of the adjacent sides of a quadrilateral form a parallelogram.

4. A vertical stick 12cm long casts a shadow 8cm long on the ground. At the same time, a tower casts a shadow 40m long on the ground. Determine the height of the tower.

5. In the adjoining figure, ΔAHK is similar to ΔABC. If AK = 10 cm, BC = 3.5 cm and HK = 7 cm, find AC.



6. In the given figure, LM || AB. If AB = x – 3, AC = 2x, BM = x – 2, BC = 2x + 3, find the value of x.

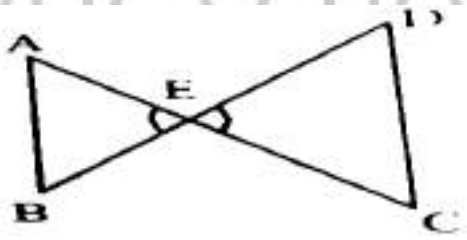


7. D and E are respectively the points on the sides AB and AC of a ΔABC such that AB = 5.6cm, AD = 1.4cm, AC = 7.2cm and AE = 1.8cm. Show that DE || BC.

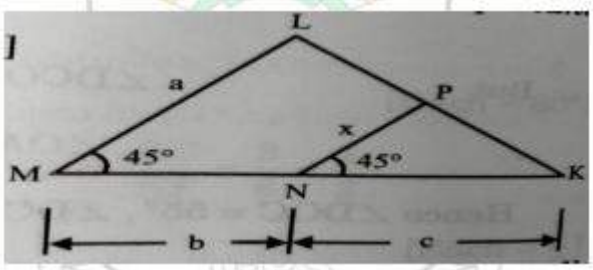
8. From the side PQ of ΔPQR cut off segment PL = QS. Draw LM || PQ and ST || PR. Show that MT || PQ.

9. In ΔABC, points P, Q and R lie on sides BC, CA and AB respectively. If BP = PC, PQ || AB and QR || BC. Prove that RP || CA.

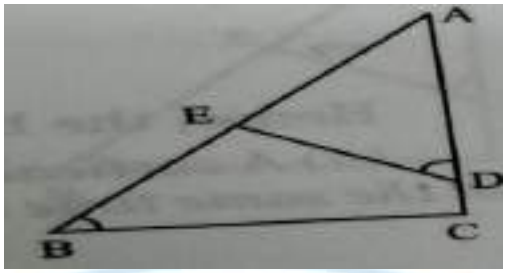
10. In given figure, $\frac{EA}{EC} = \frac{EB}{ED}$, prove that (i) ΔEAB ~ ΔECD (ii) AB || CD.



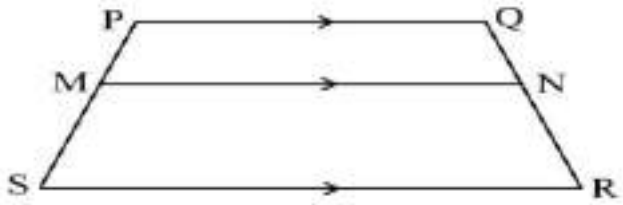
11. In given figure, express x in terms of a, b and c.



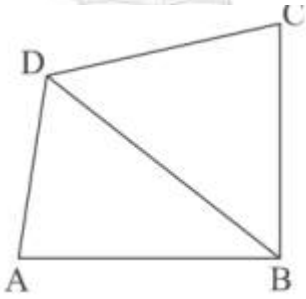
12. In given figure, if ∠ADE = ∠B, AD = 4.8cm, AE = 7.2cm, BE = 4cm and BC = 8cm, find DE.



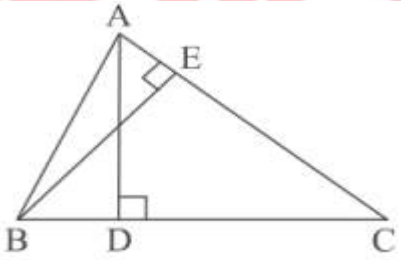
13. PQRS is a trapezium with PQ y SR. If M and N are two points on the non-parallel sides PS and QR respectively, such that MN is parallel to PQ, then show that $\frac{PM}{MS} = \frac{QN}{NR}$.



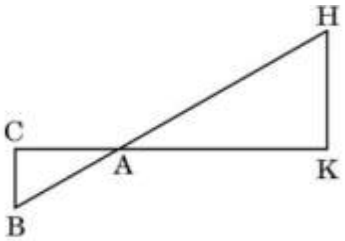
14. In the given figure, ABCD is a quadrilateral. Diagonal bisects ∠B and ∠D both. Prove that (i) △ ABD ~△ CBD (ii) AB = BC.



15. In ΔABC, altitudes AD and BE are drawn. If AD = 7cm, BE = 9cm and EC = 12cm then find the length of CD.

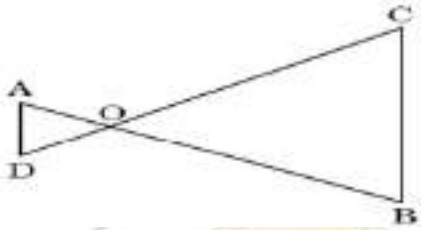


16. In the given figure, △ AHK ~△ ABC. If AK = 8cm, BC = 3.2cm and HK = 6.4cm, then find the length of AC.



17. If $\Delta ABC \sim \Delta PQR$ in which AB = 6 cm, BC = 4 cm, AC = 8 cm and PR = 6 cm, then find the length of (PQ + QR).

18. In the given figure, $OA \cdot OB = OC \cdot OD$. Show that $\angle A = \angle C$ and $\angle B = \angle D$.



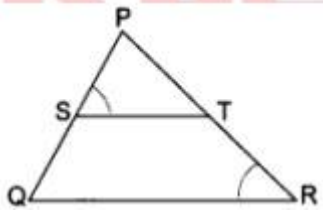
19. AD and PS are medians of triangles ABC and PQR respectively such that $\triangle ABD \sim \triangle PQS$. Prove that $\triangle ABC \sim \triangle PQR$.

SHORT ANSWERS

1. A vertical pole of length 6 m casts a shadow 4 m long on the ground and at the same time a tower casts a shadow 28 m long. Find the height of the tower.

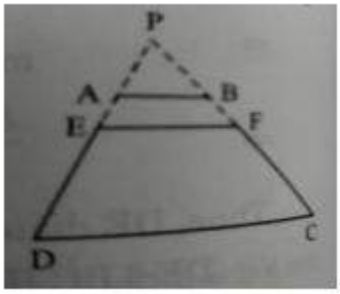
2. If the diagonals of a quadrilateral divide each other proportionally, prove that it is a trapezium.

3. In the given Fig., $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle PST = \angle PRQ$. Prove that PQR is an isosceles triangle.

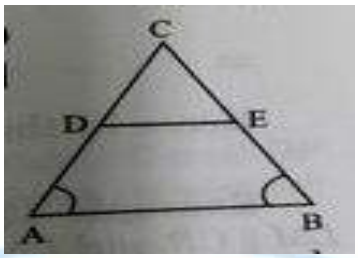


4. ABC is a triangle in which AB = AC and D is a point on AC such that $BC^2 = AC \times CD$. Prove that BD = BC.

5. In a figure, if EF || DC || AB, prove that $\frac{AE}{ED} = \frac{BF}{FC}$.

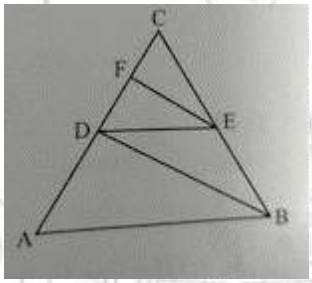


6. In the figure, prove that AD = BE if ∠A = ∠B and DE || AB.

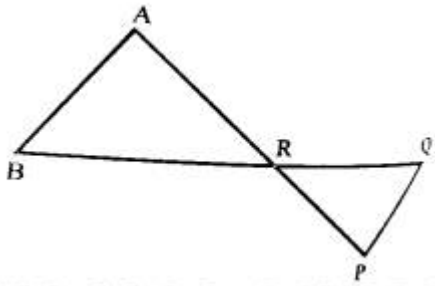


7. P is the mid-point of the side BC of Δ. If Q is the mid-point of AP and BQ when produced meets AC in L, prove that LA = $\frac{1}{3}$CA.

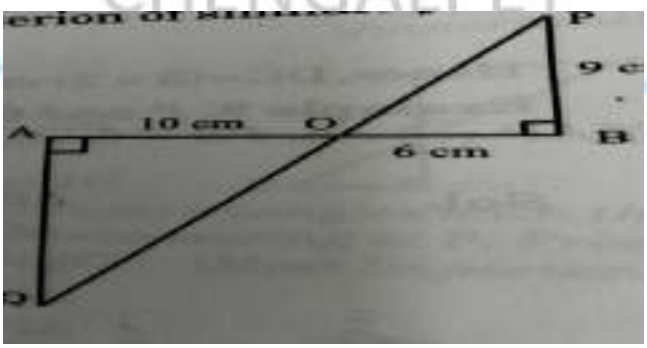
8. In the given figure, AB || DE and BD || EF, prove that DC^2 = CF x AC.



9. In the given figure, △ABR ~ △PQR. If PQ = 30cm. AR = 45cm, AP = 72cm, QR = 42cm, find PR, AB and BR.

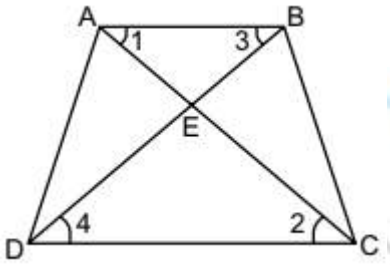


10. In given figure, QA and PB are perpendicular to AB. If AO = 10cm, BO = 6cm and PB = 9cm. Find AQ.



11. The perimeter of two similar triangles are 30cm and 20cm respectively. If one side of first triangle is 12cm, determine the corresponding side of the other triangle.

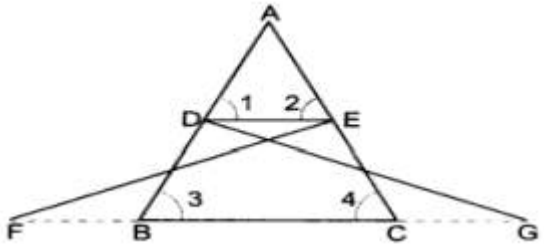
12. In the given figure, ABCD is a trapezium with AB || DC. If ΔAED is similar to ΔBEC, prove that AD = BC.



LONG ANSWERS

1. Prove that, if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

2. In Fig, $\triangle$ FEC $\cong\triangle$ GDB and $\angle 1 = \angle 2$. Prove that $\triangle$ ADE $\sim\triangle$ ABC.

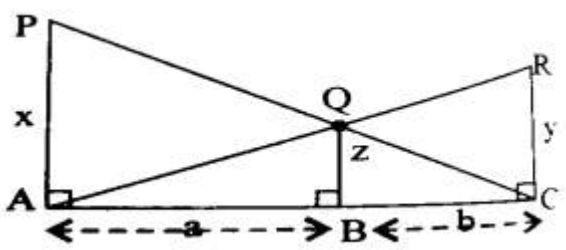


3. Sides AB and AC and median AD of a triangle ABC are respectively proportional to sides PQ and PR and median PM of another triangle PQR. Show that ΔABC ~ ΔPQR.

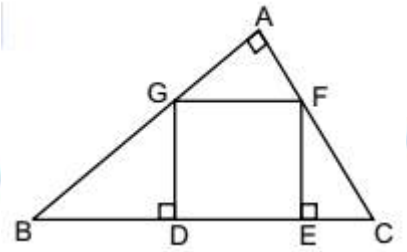
4. In trapezium ABCD, AB||DC and DC = 2AB. EF || AB, where E and F lie on BC and AD respectively, such that $\frac{BE}{EC} = \frac{4}{3}$. Diagonal DB intersects EF at G. Prove that 7EF = 11AB.

5. ABCD is a parallelogram, P, Q, R and S are the points of trisection of sides AB, BC, CD and DA respectively. Prove that PQRS is a parallelogram.

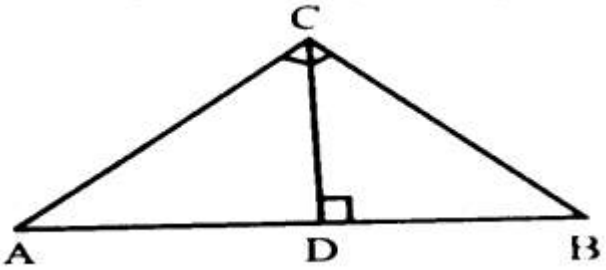
6. In the given figure, PA, QB and RC each perpendicular to AC and AP = x, QB = z, RC = y, AB = a and BC = b. Prove that $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$.



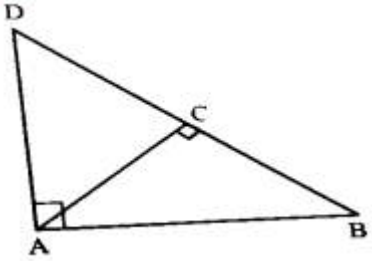
7. In the figure, EFGD is a square and ∠BAC = 90°. Prove that (i) △AGF ~ △DBG (ii) △AGF ~ △EFC (iii) ΔDBG ~ DEFC (iv) DE^2 = BD × EC.



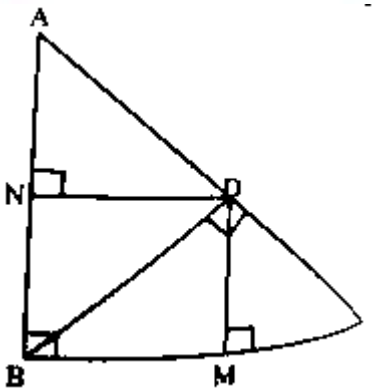
8. In given figure, ∠ACB = 90° and CD ⊥ AB, prove that $\frac{CB^2}{CA^2} = \frac{BD}{AD}$.



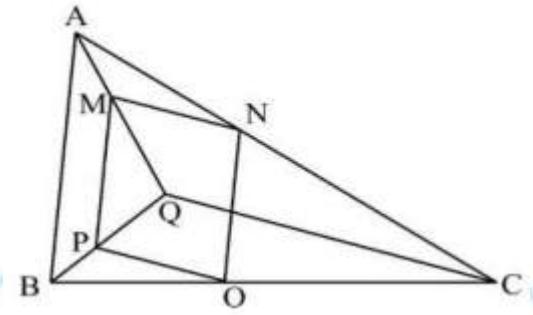
9. ABD is a triangle in which $\angle DAB = 90°$ and $AC \perp BD$. Prove that (i) $AB^2 = BC \times BD$ (ii) $AC^2 = BC \times DC$ (iii) $AD^2 = BD \times CD$.



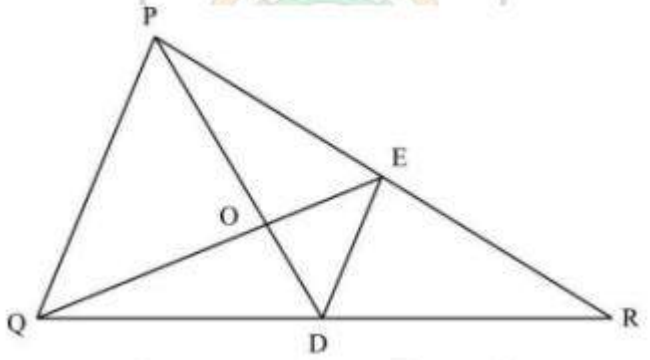
10. ABC is a right triangle with $\angle ABC = 90°$, $BD \perp AC$, $DM \perp BC$ and $DN \perp AB$. Prove that (i) $DM^2 = DN \times MC$ (ii) $DN^2 = DM \times AN$.



11. In the given figure, MNOP is a parallelogram and AB || MP. Prove that QC || PO.



12. In the given figure, two medians PD and QE of D PQR meet each other at O.



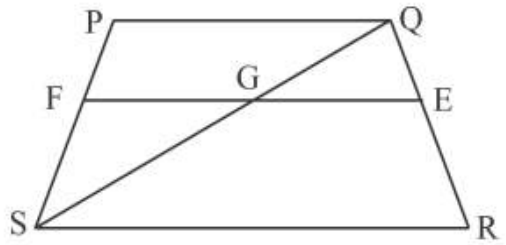
Prove that

(i) $\Delta POQ \sim \Delta DOE$

(ii) PO = 2 OD

(iii) $PO = \frac{2}{3}PD$

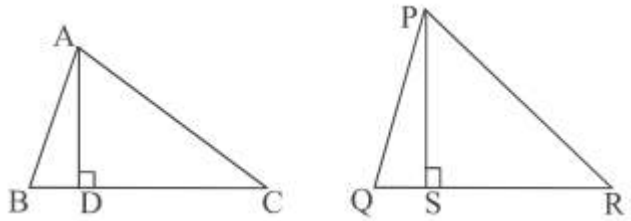
13. In trapezium PQRS, PQ || SR and SR = 2PQ. A line segment FE drawn parallel to PQ intersects PS at F and QR at E such that $\frac{QE}{ER} = \frac{3}{4}$. Diagonal QS intersects FE at G. Prove that $\frac{FE}{PQ} = \frac{10}{7}$.



14. The diagonal BD of a parallelogram ABCD intersects the line segment AE at the point F, where E is any point on the side BC. Prove that DF x EF = FB x FA.

15. In $\triangle ABC$, if $AD \perp BC$ and $AD^2 = BD \times DC$, then prove that $\angle BAC = 90°$.

16. The corresponding sides of $\triangle ABC$ and $\triangle PQR$ are in the ratio 3:5, $AD \perp BC$ and $PS \perp QR$ as shown in the following figures:



(i) Prove that $\triangle ADC \sim \triangle PSR$.

(ii) If $AD = 4\text{cm}$, find the length of PS.

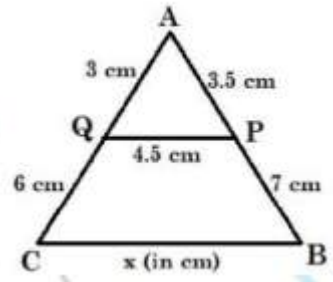
(iii) Using (ii) find ar ($\triangle ABC$) : ar ($\triangle PQR$).

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

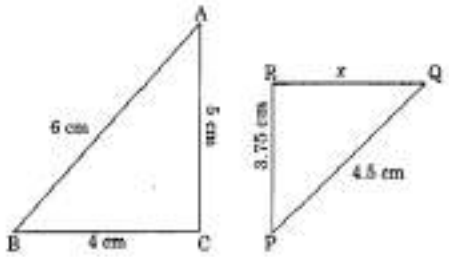


1. In the given figure, write the value of x.

a) 9 cm b) 10.5 cm

c) 13.5 cm d) 12 cm

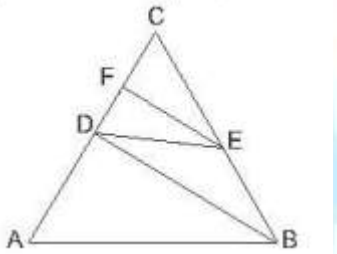
2. In the given figure ΔABC ~ ΔPQR. The value of x is



(a) 2.5 cm (b) 3.5 cm

(c) 2.75 cm (d) 3 cm

3. If in the given figure, AB ∥ DE and BD ∥ EF, then DC^2 =



a) CF + AC b) CF x AC

c) CF + 2AC d) None of these

4. Assertion: D and E are points on the sides AB and AC respectively of a ΔABC such that AD = 5.7cm, DB = 9.5cm, AE = 4.8cm and EC = 8cm then DE is not parallel to BC.

Reason: If a line divides any two sides of a triangle in the same ratio, then it is parallel to the third side.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

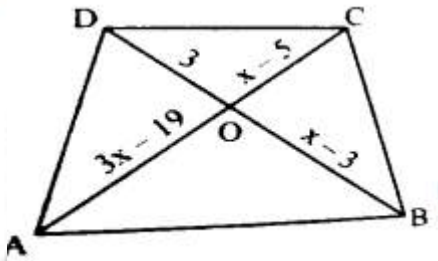
(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. In given figure, DE || BC. If AD = x, DB = x – 2, AE = x + 2 and EC = x – 1, find the value of x.

6. In figure, AB || DC, find the value of x.



7. In △ABC, DE || BC. If AC = 6.4cm, AE = 4cm, BC = 3.5cm and BD = 3cm. Find AD and DE.

SECTION C

Each carry 3 marks

8. In given figure, △ABR ~ △PQR. If PQ = 40cm, AR = 60cm, AP = 82cm and QR = 55cm, find PR and BR.

9. P and Q are points on sides AB and AC respectively of △ABC. If AP = 3cm, PB = 6cm, AQ = 5cm and QC = 10cm, show that BC = 3PQ.

SECTION D

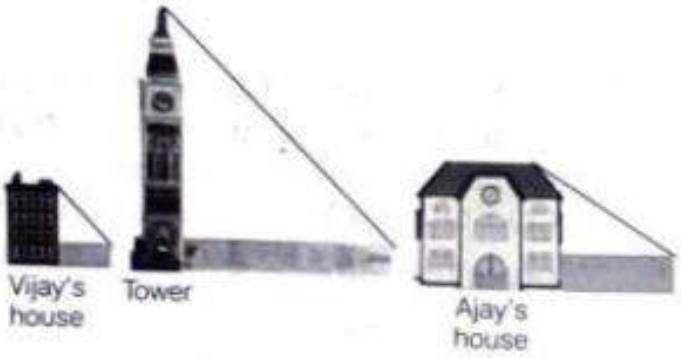
Each carry 5 marks

10. Prove that the line segments joining the mid-points of the sides of a triangle form four triangles each of which is similar to the original triangle.

11. ABCD is a parallelogram. P is themed-point of the side CD. BP meets diagonal AC at X. Prove that 3AX = 2AC.

SECTION E

12. Vijay is trying to find the average height of a tower near his house. He is using the properties of similar triangles. The height of Vijay's house, if 20m when Vijay's house casts a shadow 10m long on the ground. At the same time, the tower casts a shadow 50m long on the ground and the house of Ajay casts 20m shadow on the ground.



i) What is the height of the tower?

ii) What will be the length of the shadow of the tower when Vijay's house casts a shadow of 12m?

iii) What is the height of Ajay's house?

iv) When the tower casts a shadow of 40m, same time what will be the length of the shadow of Ajay's house?

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. d) isosceles and similar 2. d) 2 cm 3. d) 1 cm 4. a) 11.25 cm 5. b) 3 6. a) $\triangle$ PQR $\sim\triangle$ CAB 7. a) 22 m 8. a) 23.05 cm 9. c) 40^o	1. (c) Assertion (A) is true but Reason (R) is false. 2. (d) Assertion (A) is false but Reason (R) is true. 3. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1. i) 40 metres ii) AA iii) 60 metres 2. i) 150 metres ii) 3 sec iii) 3 metres iv) 2 metres 3. i) AA criterion ii) 5 metres iii) 3 metres iv) 10 metres 4. i) c) 5m ii) $\frac{DG}{GE}$	1. x = 1 2. x = 11 or 8. 3. Parallelogram 4. 60m 5. 5 cm 6. 9 7. DE || BC 8. MT || PQ. 9. RP || CA 10. (i) ΔEAB ~ ΔECD	1. 42m 2. Trapezium 3. Isosceles Triangle 4. BD = BC 5. $\frac{AE}{ED} = \frac{BF}{FC}$ 6. DE || AB 7. LA = $\frac{1}{3}$CA 8. DC^2 = CF x AC. 9. 27cm, 50cm & 70cm	1. Proof 2. $\triangle$ ADE $\sim\triangle$ ABC 3. ΔABC ~ ΔPQR 4. 7EF = 11AB 5. PQRS is a parallelogram 6. $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$ 7. (i) $\triangle$AGF ~ $\triangle$DBG (ii) $\triangle$AGF ~ $\triangle$EFC (iii) ΔDBG ~ DEFC

10. b) 7.5 cm 11. d) 15 cm 12. c) 9 m 13. b) 10 m 14. c) 60 cm 15. d) 36m 16. (c) 15.3 cm 17. (d) BC || XY 18. (b) 1.5 cm 19. (c) 8cm 20. (d) 36m 21. (d) similar but not	4. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 5. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 6. (a) (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the	iii) 60° iv) 8.8m	(ii) AB || CD 11. x = $\frac{ac}{b+c}$ 12. 3.4cm 13. Proof 14. Proof 15. $\frac{28}{3}$ or 9.33cm 16. AC = 4 17. 7.5cm	10. 15cm 11. 8cm 12. AD = BC	(iv) $DE^2 = BD \times EC$. 8. $\frac{CB^2}{CA^2} = \frac{BD}{AD}$ 9. (i) $AB^2 = BC \times BD$ (ii) $AC^2 = BC \times DC$ (iii) $AD^2 = BD \times CD$. 10. (i) $DM^2 = DN \times MC$ (ii) $DN^2 = DM \times AN$. 11. Proof 12. Proof

congruent 22. (d) 4.8cm 23. (d) $\frac{DE}{PQ} = \frac{EF}{RP}$ 24. (c) 8 cm 25. (c) 8 cm 26. (d) 40° 27. (d) BC = 3EF 28. (d) 1:2	correct explanation of Assertion (A)				13. Proof 16. (ii) PS $= \frac{20}{3}$ cm (iii) ar(△ ABC): ar(△ PQR) = 9: 25

UNIT TEST

1. c) 13.5 cm

2. (d) 3 cm

3. b) CF x AC

4. (d) Assertion (A) is false but Reason (R) is true.

5. x = 4

6. 8 or 9

7. 5cm and 2.2cm

8. 22cm & 150cm

9. BC = 3PQ

10. Proof

11. 3AX = 2AC

12. i) 100m ii) 60m iii) 40m iv) 40m

CHAPTER 7 – COORDINATE GEOMETRY

Key Concepts

Cartesian Co-ordinate System

This system has X-axis called abscissa and Y-axis called ordinate. (0, 0) is the origin. Both the axes divide the Cartesian plane into four parts called quadrants.

Distance Formula

The distance between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ in the cartesian plane is given by $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

The distance of a point P(x, y) from the origin O (0, 0) is given by $d = \sqrt{x^2 + y^2}$.

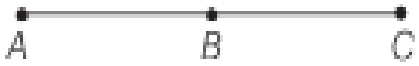
Results

- **In triangle, sum of lengths of any two sides is greater than the length of third side.**
- **Parallelogram – prove that the opposite sides are equal**
- **Rectangle – prove that the opposite sides are equal and the diagonals are equal.**
- **Rhombus – prove that the four sides are equal**
- **Square – prove that the four sides are equal and the diagonals are equal.**
- **Isosceles triangle – prove any two sides are equal.**
- **Equilateral triangle – prove that all three sides are equal.**
- **Right triangle – prove that sides of triangle satisfy Pythagoras theorem.**
- **Isosceles Right Triangle - prove any two sides are equal and sides of triangle satisfies Pythagoras theorem.**

Note: The co-ordinates of a point on the X-axis are of the form (x, 0) and that of the point on Y-axis are (0, y).

Condition of Collinearity of Three Points

Points A B, and C are collinear, if they lie on the same straight line. e.g., B lies between A and C, if AB + BC = AC.



Section Formulae

Internal Division

The coordinates of the point P(x, y) which divides the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ internally in the ratio $m_1 : m_2$, are $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$.

Mid-Point

The coordinates of the point P(x, y) which is the mid - point of the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ are $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.

Centroid of the triangle

If $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ be the vertices of the triangle Centroid of the triangle is given by $G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$.

Result: The centroid of the triangle divides the median in the ratio of 2: 1.

MULTIPLE CHOICE QUESTIONS

1. If the distance between the points (2, –2) and (–1, x) is 5, one of the value of x is:

a) –2 b) 2 c) –1 d) 1

2. The mid-point of the line segment joining the points A(–2, 8) and B(–6, –4) is:

a) (–4, –6) b) (2, 6) c) (–4, 2) d) (4, 2)

3. The distance of the point P(2, 3) from the x-axis is:

a) 2 b) 3 c) 1 d) 5

4. The distance of the point P(–6, 8) from the origin is:

a) 8 b) $2\sqrt{7}$ c) 10 c) 6

5. AOBC is rectangle whose three vertices are A(0, 3), O(0, 0) and B(5, 0). The length of its diagonal is:

a) 5 b) 3 c) $\sqrt{34}$ d) 4

6. If the coordinates of one end of a diameter of circle are (2, 3) and the coordinates of its centre are (–2, 5), then the coordinates of the other end of the diameter are:

a) (–6, 7) b) (6, –7) c) (6, 7) d) (–6, –7)

7. The fourth vertex D of a parallelogram ABCD whose three vertices A(–2, 3), B(6, 7) and C(8, 3) is:

a) (0, 1) b) (0, –1) c) (–1, 0) d) (1, 0)

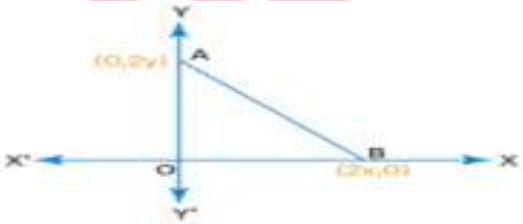
8. The vertices of a parallelogram in order are A(1, 2), B(4, y), C(x, 6), D(3, 6), then the value of x and y respectively are :

a) 6, 2 b) 3, 6 c) 5, 6 d) 1, 4

9. If P $\left(\frac{a}{3}, 4\right)$ is the mid-point of the line segment, joining the points Q(–6, 5) and R(–2, 3), then the value of a is:

a) –4 b) –12 c) 12 d) –6

10. The coordinates of the point which is equidistant from the three vertices of the ΔAOB as shown in the figure is:



a) (a) (x, y) b) (y, x) c) $\left(\frac{x}{2}, \frac{y}{2}\right)$ d) $\left(\frac{y}{2}, \frac{x}{2}\right)$

11. A line intersects the y-axis and x-axis at the points P and Q, respectively. If (2, –5) is the mid-point of PQ, then the coordinates of P and Q respectively are:

a) (0, –5) and (2, 0) b) (0, 10) and (–4, 0) c) (0, 4) and (–10, 0) d) (0, –10) and (4, 0)

12. If the centroid of the triangle formed by (7, x), (y, –6) and (9, 10) is (6, 3), then the value of x and y respectively are:

a) 5, 3 b) 5, 2 c) –3, 2 d) 6, 5

13. The ratio in which P(4, m) divides the line segment joining the points A(2, 3) and B(6, –3) is :

a) 1:2 b) 2:1 c) 1:3 d) 1:1

14. If A(5, 1), B(1, 5) and C(–3, –1) are the vertices of ΔABC, then length of median AD is:

a) $\sqrt{35}$ units b) $\sqrt{37}$ units c) $\sqrt{33}$ units d) $\sqrt{31}$ units

15. ABCD is a rectangle, whose three vertices are B(4, 0), C(4, 3) and D(0, 3), then the length of one of its diagonals is:

a) 7 units b) 6 units c) 6.5 units d) 5 units

16. If the distances of P(x, y) from A(5, 1) and B(–1, 5) are equal, then:

a) x = y b) 3x = 5y c) 5x = 2y d) 3x = 2y

17. The perimeter of triangle formed by the points (0, 0), (2, 0) and (0, 2) is:

a) 4 units b) 6 units c) $6\sqrt{2}$ units d) $4 + 2\sqrt{2}$ units

18. The ratio in which the line joining the points (5, 3) and (–1, 6) is divided by y-axis is:

a) 5:3 b) 2:3 c) 4:5 d) 5:1

19. If the point P(6, 3) divides the line joining A(4, 2) and B(8, 4), then:

a) $AP = \left(\frac{1}{3}\right) AB$ b) $AP = PB$ c) $PB = \left(\frac{1}{3}\right) AB$ d) $AP = AB$

20. Two of the vertices of a ΔABC are A(–1, 4) and B(5, 2) and its centroid is (0, –3). The coordinates of the vertex C are:

a) (4, 3) b) (4, 15) c) (–4, –15) d) (–15, –4)

21. PQ is a diameter of a circle with centre O(2, – 4). If the coordinates of the point P are (– 4, 5), then the coordinates of the point Q will be

(a) (– 3, 4.5) (b) (– 1, 0.5) (c) (4, – 5) (d) (8, – 13)

22. The ratio in which the line segment joining the points A(– 2, – 3) and B(3, 7) is intersected internally by the y-axis is:

(a) 3 : 2 (b) 2 : 3 (c) 3 : 7 (d) 7 : 3

23. A line segment joining the points P(–5, 11) and Q is divided internally by the point M(2, –3) such that PM : MQ = 7 : 2. The coordinates of Q are

(a) (4, – 7) (b) (27.5, – 52) (c) (– 7, 4) (d) $\left(\frac{4}{9}, \frac{1}{9}\right)$

24. AD is a median of ΔABC with vertices A(5, -6), B(6, 4) and C(0, 0). Length of AD is equal to

(a) $\sqrt{68}$ units (b) $2\sqrt{15}$ units (c) $\sqrt{101}$ units (d) 10 units

25. XOYZ is a rectangle with vertices X(-3, 0), O(0, 0), Y(0, 4) and Z(x, y). The length of its each diagonal is

(a) 5 units (b) $\sqrt{5}$ units (c) $x^2 + y^2$ units (d) 4 units

26. The mid-point of the line segment joining the points P(4, 5) and Q(4, 6) lies on

(a) x-axis (b) y-axis (c) origin (d) neither x-axis nor y-axis

27. The end points of a diameter of circle are (2, 4) and (3, 1). The length of its radius is

(a) $\frac{5\sqrt{2}}{2}$ units (b) $5\sqrt{2}$ units (c) $3\sqrt{2}$ units (d) $\pm\frac{5\sqrt{2}}{2}$ units

28. The coordinates of the end points of a diameter of a circle are (5, 2) and (5, -2). The length of the radius of the circle is

(a) ±2 (b) ±4 (c) 2 (d) 4

29. The points (-5, 0), (5, 0) and (0, 4) are the vertices of a triangle which is a/an

(a) right-angled triangle (b) isosceles triangle

(c) equilateral triangle (d) scalene triangle

30. The line represented by $\frac{x}{4} + \frac{y}{6} = 1$, intersects x-axis and y-axis respectively at P and Q. The coordinates of the mid-point of line segment PQ are

(a) (2, 3) (b) (3, 2) (c) (2, 0) (d) (0, 3)

31. Two of the vertices of ΔPQR are P(1, 5) and Q(5, 2). The coordinates of a point which divides PQ in the ratio 2:1 are

(a) (3, -3) (b) (5, 5) (c) (3, 3) (d) (5, 1)

32. AOBC is a rectangle whose three vertices are A(0, 2), O(0, 0) and B(4, 0). The square of the length of its diagonal is equal to

(a) 36 (b) 20 (c) 16 (d) 4

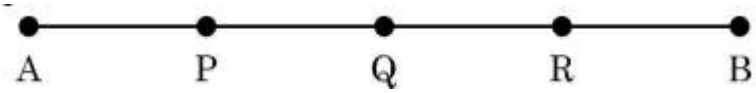
33. If the mid-point of the line segment joining the points (a, 4) and (2, 2b) is (2, 6), then the value of (a + b) is given by:

(a) 6 (b) 7 (c) 8 (d) 16

34. The distance of a point A from x-axis is 3 units. Which of the following cannot be coordinates of the point A?

(a) (1, 3) (b) (-3, -3) (c) (-3, 3) (d) (3, 1)

35. In the figure given below, points P, Q, R divides the line segment AB in four equal parts,



The point Q divides PB in the ratio

(a) 1:3 (b) 2:3 (c) 1:2 (d) 1:1

36. The point P divides the line segment AB in the ratio 3:1 as shown below:

The value of $\frac{AB}{PB}$ is

(a) 3 (b) $\frac{1}{4}$ (c) 4 (d) $\frac{1}{3}$

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: The point which divides the line joining the points A(1, 2) and B(- 1, 1) internally in the ratio 1: 2 is $\left(\frac{-1}{3}, \frac{5}{3}\right)$.

Reason: The coordinates of the point P(x, y) which divides the line segment joining the points A(x_1 , y_1) and B(x_2 , y_2) in the ratio m_1 : m_2 is $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$.

2. Assertion: The point on the x - axis which if equidistant from the points A(- 2, 3) and B(5, 4) is (2, 0).

Reason: The coordinates of the point P(x, y) which divides the line segment joining the points A(x_1 , y_1) and B(x_2 , y_2) in the ratio m_1 : m_2 is $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$.

3. Assertion: Ratio in which the line 3x + 4y = 7 divides the line segment joining the points (1, 2) and (- 2, 1) is 3:5.

Reason: The coordinates of the point P(x, y) which divides the line segment joining the points A(x_1 , y_1) and B(x_2 , y_2) in the ratio m_1 : m_2 is $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$.

4. Assertion: C is the mid-point of PQ, if P is (4, x), C is (y, - 1) and Q is (- 2, 4), then x and y respectively are -6 and 1.

Reason: The mid-point of the line segment joining the points P(x_1 , y_1) and Q(x_2 , y_2) is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

5. Assertion: The point (0, 4) lies on y -axis.

Reason: The x co-ordinate on the point on y -axis is zero.

6. Assertion: The value of y is 6, for which the distance between the points P(2, - 3) and Q(10, y) is 10.

Reason: Distance between two given points A(x_1 , y_1) and B(x_2 , y_2) is given by, AB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

7. Assertion: The possible values of x for which the distance between the points A(x, - 1) and B(5, 3) is 5 units are 2 and 8.

Reason: Distance between two given points A(x_1 , y_1) and B(x_2 , y_2) is given by, AB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

8. Assertion: If the points A(4, 3) and B(x, 5) lies on a circle with the centre O(2,3) then the value of x is 2.

Reason: The mid-point of the line segment joining the points P(x_1 , y_1) and Q(x_2 , y_2) is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

9. Assertion: Mid-point of a line segment divides line in the ratio 1:1.

Reason: The ratio in which the point (– 3, k) divides the line segment joining the points (– 5, 4) and (– 2, 3) is 1:2.

10. Assertion: Centroid of a triangle formed by the points (a, b), (b, c) and (c, a) is at origin, then a + b + c = 0.

Reason: If $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ be the vertices of the triangle Centroid of the triangle is given by $G = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$.

11. Assertion: The point which divides the line segment joining the points A(1, 2) and B(-1, 1) internally in the ratio 1:2 is $\left(\frac{-1}{3}, \frac{5}{3}\right)$.

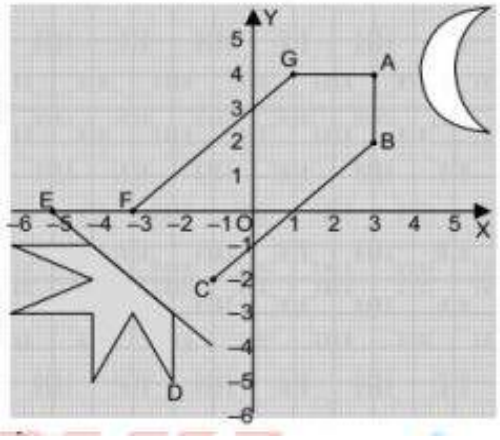
Reason: The coordinates of the point which divides the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$.

12. Assertion: Mid-point of a line segment divides the line segment in the ratio 1:1.

Reason: The ratio in which the point (-3, k) divides the line segment joining the points (-5, 4) and (-2, 3) is 1:2.

CASE STUDY BASED QUESTIONS

1. The diagram shows a model of Rocket which is made on a graph paper. Look at the model and answer the following questions:



i) The mid-point of the segment joining the points F and G is:

a) (–1, 2) b) (2, –1) c) (–2, 1) d) none

ii) The distance of the point A from the x-axis is:

a) 4 units b) 3 units c) 1 unit d) none

iii) The distance between the points A and C is:

a) $\sqrt{13}$ b) $2\sqrt{13}$ c) $3\sqrt{13}$ d) none

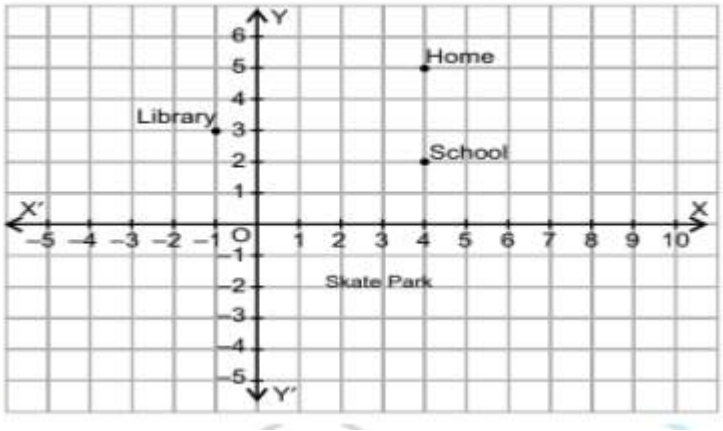
iv) The co-ordinates of the point which divides the line segment joining the points A and B in the ratio 1:3 internally is:

a) (4, 2.5) b) (3, 3) c) (3, 3.5) d) none

v) The coordinates of D are:

a) (–1, 0) b) (– 4, –1) c) (– 2, –5) d) (–4, 0)

2. Two brothers Mahesh and Sudhir were at home and have to reach school. Mahesh went to library first to return a book and the reaches school directly whereas Sudhir went to Skate Park first to meet his friend and then reaches school directly. The places have been shown in a coordinate plane. Here all distances are in km.

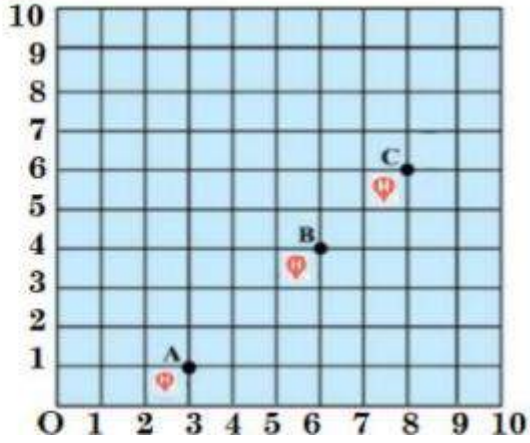


i) How far is school from their home?

ii) What is the extra distance travelled by Mahesh in reaching his school?

iii) What is the extra distance travelled by Sudhir in reaching his school?

3. Mr Pankaj Chugh aged 50 years, is a senior Maths teacher and is living in New Delhi. As per the government's directive, he had taken his first dose of COVID-19 vaccine in the month of April 2021 in a city hospital. Now he wants to take his second dose of the vaccine. The following map is showing three vaccination centers around his home. Let O represents his home. Vaccination centers are at A, B and C as shown in the figure below.



i) According to the figure, in which ratio vaccination centre B dividing the line joining vaccination centre A and C?

ii) Assuming that Mr Chugh went to center B and vaccine doses are finished. Then what is the closest distance he has to cover to reach another vaccination center?

iii) Find the distance between his home to the vaccination center C.

iv) Calculate the distance between the vaccination centers A and C.

4. In a cinema hall, peoples are seated at a distance of 1m from each other, to maintain the social distance due to CORONA virus pandemic. Let three peoples sit at the points P, Q and R whose coordinates are (6, −2), (9, 4) and (10, 6) respectively.

Based on the above information, answer the following

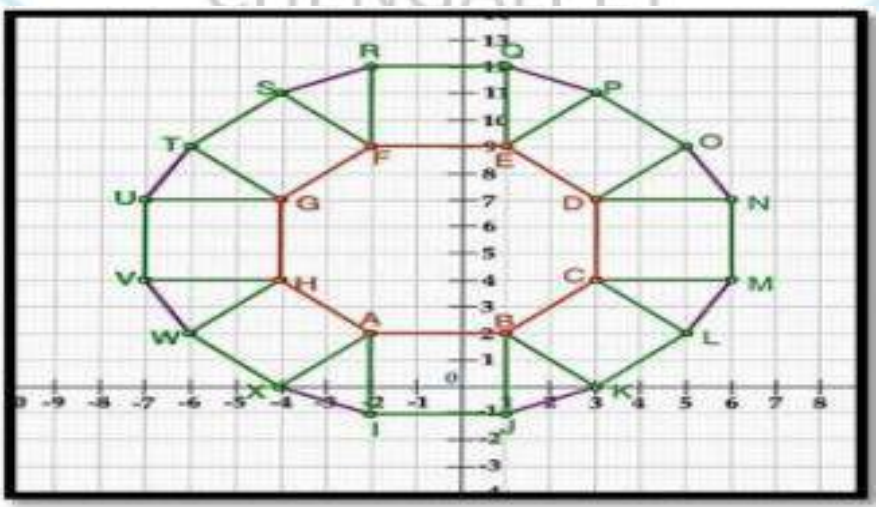
i) Find the distance between P and R.

ii) Find the midpoint of the line segment joining P and R.

iii) If a point A lie on the straight-line joining Q and R such that it divides the distance between them in the ratio of 1: 2. Then find the coordinates of A.

iv) Find the ratio in which Q divides the line segment joining P and R.

5. A craftsman thought of making a floor pattern after being inspired by the above design. To ensure accuracy in his work, he made the pattern on the Cartesian plane. He used regular octagons, squares and triangles for his floor tessellation pattern.



Use the above figure to answer the questions that follow:

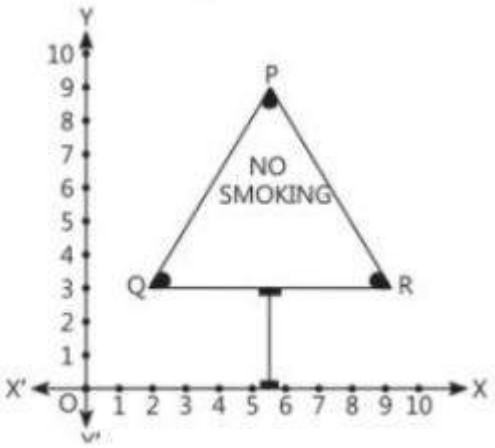
i) What is the length of the line segment joining points B and F?

ii) The centre ‘Z’ of the figure will be the point of intersection of the diagonals of quadrilateral WXOP. Then what are the coordinates of Z?

iii) What are the coordinates of the point on y axis equidistant from A and G?

iv) What is the area of Trapezium AFGH?

6. All of the persons know that smoking is injurious to health. So, some college students decided to start a campaign. To raise social awareness about hazards of smoking, they started "NO SMOKING" campaign. Some students were asked to prepare campaign banners in the shape of triangle which is as shown in the figure:



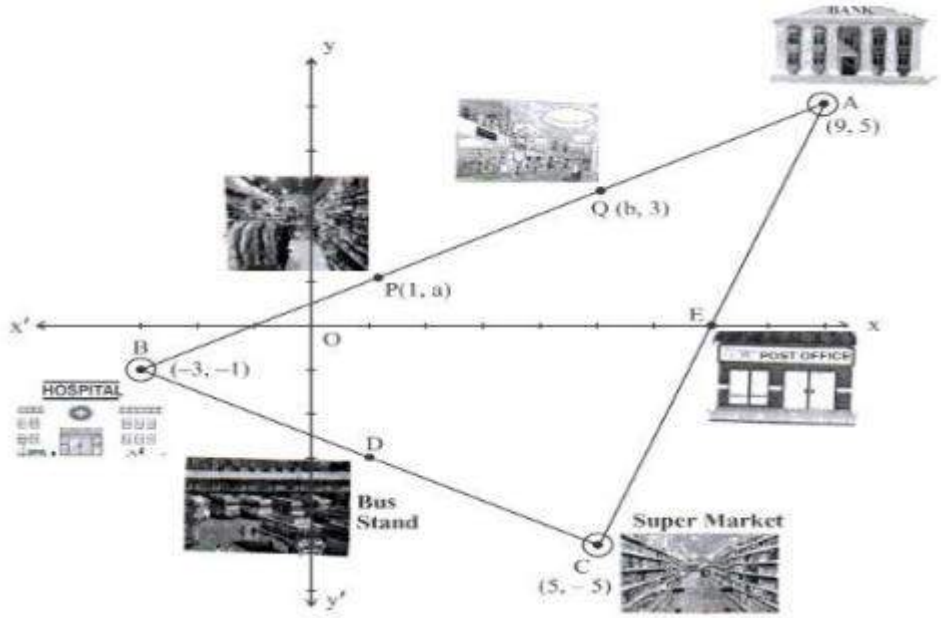
Based on the above information, solve the following questions:

(i) Find the coordinates of the mid-point of Q and R.

(ii) Find the point on X-axis, which is equidistant from points Q and R.

(iii) Find the centroid of the triangle PQR.

7. Partha, a software engineer, lives in Jerusalem for his work. He lives in the most convenient area of the city from where bank, hospital, post office and supermarket can be easily accessed. In the graph, the bank is plotted as A(9, 5), hospital as B(– 3, – 1) and supermarket as C(5, – 5) such that A, B, C form a triangle.



Based on the above given information, answer the following questions:

(i) Find the distance between the bank and the hospital.

(ii) In between the bank and the supermarket, there is a post office plotted at E which is their mid-point. Find the coordinates of E.

(iii) In between the hospital and the supermarket, there is a bus stop plotted as D, which is their mid-point. If Partha wants to reach the bus stand from the bank, then how much distance does he need to cover?

(iv) P and Q are two different garment shops lying between the bank and the hospital, such that BP = PQ = QA. If the coordinates of P and Q are (1, a) and (b, 3) respectively, then find the values of 'a' and 'b'.

VERY SHORT ANSWERS

1. P(–2, 5) and Q(3, 2) are two points. Find the co-ordinates of the point R on PQ such that PR = 2QR.

2. Find the ratio in which P(4, m) divides the line segment joining the points A(2, 3) and B(6, – 3). Hence find m.

3. In what ratio does the point P(– 4, 6) divide the line segment joining the points A(– 6, 10) and B(3, – 8)?

4. If the line segment joining the points A(2, 1) and B(5, – 8) is trisected at the points P and Q, find the coordinates P.

5. The x-coordinate of a point P is twice its y-coordinate. If P is equidistant from Q(2, –5) and R(–3, 6), find the co-ordinates of P.

6. If the point P(x, y) is equidistant from the points Q(a + b, b – a) and R(a – b, a + b), then prove that bx = ay.

7. Prove that the point (3, 0), (6, 4) and (–1, 3) are the vertices of a right angled isosceles triangle.

8. If the mid-point of the line segment joining A $\left[\frac{x}{2}, \frac{y+1}{2}\right]$ and B(x + 1, y – 3) is C(5, – 2), find x, y.

9. If A (5, 2), B (2, – 2) and C (–2, t) are the vertices of a right angled triangle with ∠B = 90°, then find the value of t.

10. Show that the points $(a, a), (-a, -a)$ and $(-\sqrt{3}a, \sqrt{3}a)$ are the vertices of the equilateral triangle.

11. Find the area of a rhombus if its vertices are (3, 0), (4, 5), (–1, 4) and (–2, –1) taken in order.

12. ABCD is a rectangle, whose three vertices are B(4, 0), C(4, 3) and D(0, 3). Find the length of one of its diagonals.

13. Prove that the points (2, –2), (–2, 1) and (5, 2) are the vertices of a right triangle. Also, find the area of this triangle.

14. Find the length of the median AP of the triangle ABC whose vertices are A(1, –1), B(0, 4) and C(–5, 3).

15. Prove that the diagonals of a rectangle bisect each other and are equal.

16. In what ratio is the line segment joining the points (3, -5) and (-1, 6) divided by the line y = x?

17. Points A(-1, y) and B(5, 7) lie on a circle with centre O(2, -3y) such that AB is a diameter of the circle. Find the value of y. Also find the radius of the circle.

18. The coordinates of the centre of a circle are (2a, a - 7). Find the value(s) of 'a' if the circle passes through the point (11, -9) and has diameter $10\sqrt{2}$ units.

19. Find the length of the median through the vertex B of ABC with vertices A(9, 2), B(3, 7) and C(1, 10).

20. Find the coordinates of the point C which lies on the line AB produced such that AC = 2BC, where coordinates of points A and B are (-1, 7) and (4, -3) respectively.

21. The coordinates of the end points of the line segment AB are A(-2, -2) and B(2, -4). P is the point on AB such that $BP = \frac{4}{7}AB$. Find the coordinates of point P.

SHORT ANSWERS

1. The line segment joining the points A(3, 2) and B(5, 1) is divided at the point P in the ratio 1:2 and it lies on the line 3x – 18y + k = 0. Find the value of k.

2. If the point C(– 1, 2) divides internally the line segment joining A(2, 5) and B(x, y) in the ratio 3:4, find the coordinates of B.

3. The line segment joining the points A(2, 1) and B(5, –8) is trisected at the points P and Q such that P is nearer to A. If P also lies on the line given by 2x – y + k = 0, find the value of k.

4. Find the ratio in which the line x – 3y = 0 divides the line segment joining the points (–2, – 5) and (6, 3). Find the coordinates of the point of intersection.

5. If coordinates of two adjacent vertices of a parallelogram are (3, 2), (1, 0) and diagonals bisect each other at (2, – 5), find coordinates of the other two vertices.

6. The centre of a circle is (2a, a – 7). Find the values of a if the circle passes through the point (11, –9) and has diameter $10\sqrt{2}$ units.

7. If two vertices of an equilateral triangle be $(0,0), (3,\sqrt{3})$, find its third vertex.

8. Show that DABC, where A(–2, 0), B(2, 0), C(0, 2) and DPQR where P(–4, 0), Q(4, 0) and R(0, 4) are similar triangles.

9. The medians of a triangle meet at (0, -3) and its two vertices are (-1, 4) and (5, 2). Find the third vertex of the triangle.

10. If (a, b) is the mid-point of the line segment joining the points A(10, –6) and B(k, 4) and a – 2b = 18, find the value of k and the distance AB.

11. ABCD is a rectangle formed by the points A(-1, -1), B(-1, 6), C(3, 6) and D(3, -1). P, Q, R and S are mid-points of sides AB, BC, CD and DA respectively. Show that diagonals of quadrilateral PQRS bisect each other.

12. Find the ratio in which the y-axis divides the line segment joining the points (5, -6) and (-1, - 4). Also find the point of intersection.

13. If the mid-point of the line segment joining the points A(3, 4) and B(k, 6) is P(x, y) and x + y - 10 = 0, then find the value of k.

14. Find a relation between x and y such that P(x, y) is equidistant from the points A(3, 5) and B(8, 1). Hence, write the coordinates of the points on x-axis and y-axis which are equidistant from points A and B.

LONG ANSWERS TYPE QUESTIONS

1. Find the vertices of the triangle the mid-points of whose sides are (3, 1), (5, 6) and (–3, 2).

2. The base BC of an equilateral triangle ABC lies on y-axis. The co-ordinates of point C are (0, – 3). The origin is the mid-point of the base. Find the co-ordinates of the point A and B. Also find the co-ordinates of another point D such that BACD is a rhombus.

3. If P(9a – 2, – b) divides the line segment joining A(3a + 1, – 3) and B(8a, 5) in the ratio 3:1. Find the values of a and b.

4. Find the centre of a circle passing through the points (6, –6), (3, –7) and (3, 3).

5. Find the coordinates of the centroid of a triangle whose mid points of the sides are (–1, 6), (5, 6) and (2, 0).

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. The co-ordinates of vertex A of ΔABC are (– 4, 2) and a point D which is mid-point of BC are (2, 5). The coordinates of centroid of ΔABC are

a) (0,4) b) $\left(-1,\frac{7}{2}\right)$ c) $\left(-2,\frac{7}{3}\right)$ d) (0,2)

2. The distance between the points (a cos q + b sin q, 0) and (0, a sin q – b cos q) is:

a) a^2+b^2 b) a^2-b^2 c) $\sqrt{a^2+b^2}$ d) $\sqrt{a^2-b^2}$

3. The point which lies on the perpendicular bisector of the line segment joining the points A(–2, –5) and B(2, 5) is

a) (0, 0) b) (0, 2) c) (2, 0) d) (–2, 0)

4. Assertion: The point on the X -axis which if equidistant from the points A(- 2, 3) and B(5, 4) is (2, 0)

Reason: The coordinates of the point P(x, y) which divides the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ in the ratio $m_1:m_2$ is $\left(\frac{m_1x_2+m_2x_1}{m1+m_2},\frac{m_1y_2+m_2y_1}{m1+m2}\right)$

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. Points A (−1, y) and B(5, 7)lie on a circle with centre O(2, −3y).Find the value(s) of y. Hence, find the radius of the circle.

6. Find the ratio in which the point P(m, 6) divides the join of A(–4, 3) and B(2, 8). Also, find the value of ‘m’.

7. If Q(0, 1) is equidistant from P(5, –3) and R(x, 6), find the value of x. Also, find the distance QR.

SECTION C

Each carry 3 marks

8. The line segment joining the points (3, –4) and (1, 2) is trisected at the points P and Q. If the coordinates of P and Q are (p, –2) and $\left(\frac{5}{3}, q\right)$ respectively, find the value of p and q.

9. Find a relation between x and y such that the point (x, y) is equidistant from the point (3, 6) and (–3, 4).

SECTION D

Each carry 5 marks

10. A(6, 6), B(12, 6), C(14, 2) and D (3, 2) are the vertices of a trapezium ABCD. Perpendicular AP divides DC in the ratio 3:8. Find the area of the trapezium.

11. If the mid-point P of the line joining (3, 4) and (k, 7) is (x, y) and the line 2x + 2y + 1 = 0 passes through P, find the value of k. Also, find the co-ordinates of P.

SECTION E

12. In a city, a circular park is situated with center O(3, 3). There are two exit gates P and Q which are opposite to each other. The location of exit gate ‘P’ is (5, 3).

i) Find the location of exit gate ‘Q’.

ii) What will be the distance between two exit gates P and Q?

iii) If a pole R(x, 5) is standing on a boundary of a circular park that is equidistant from P and Q then, find the value of ‘x’.

(Or)

In what ratio does the center O (3, 3) divides the line segment joining the points P and Q?

ANSWERS

MCQ	A – R Questions	Case Study	Short Answers I	Short Answers II	Long Answers
1. b) 2 2. c) (–4, 2) 3. b) 3 4. c) 10 5. c) $\sqrt{34}$ 6. a) (–6, 7) 7. b) (0, –1) 8. a) 6, 2 9. b) –12 10. a) (x, y)	1. (d) Assertion (A) is false but reason (R) is true. 2. (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A). 3. (d) Assertion (A) is false but reason (R) is true. 4. (a) Both assertion (A) and reason (R)	1. i) a ii) a (iii) b (iv) c v) c 2. i) 3km ii) 7.48km iii) 4.33km 3. i) 3:2 ii) $2\sqrt{2}$ iii) 10 iv) $5\sqrt{2}$ 4. i) $4\sqrt{5}$ units ii) (8, 2) iii) $\left(\frac{28}{3}, \frac{14}{3}\right)$ iv) 3:1 5. i) $\sqrt{58}$ units ii) $\left(\frac{-1}{2}, \frac{11}{2}\right)$ iii)	1. $R\left(\frac{4}{3}, 3\right)$ 2. m = 0 3. 2: 7 4. (3, – 2). 5. (16, 8) 6. Proof 7. Proof 8. x = 6 and y = -1 9. t = 1 10. Proof	1. 19 2. (–5, –2). 3. k = – 8. 4. $\left(\frac{9}{2}, \frac{3}{2}\right)$ 5. (1, – 12) and (3, – 10) 6. 3, 5 7. $(0, 2\sqrt{3})$ or $(3, -\sqrt{3})$. 8. Proof 9. (-4, -15)	1. (–1, 7), (–5, –3), (11, 5) 2. $(-3\sqrt{3}, 0)$ 3. a = 1, b = -3 4. (3, -2)

11. d) (0, –10) and (4, 0) 12. b) 5, 2 13. d) 1:1 14. b) $\sqrt{37}$ units 15. d) 5 units 16. d) 3x = 2y 17. d) $4+2\sqrt{2}$ units 18. d) 5:1 19. b) AP = PB 20. c) (–4, –15) 21. (d) (8, – 13)	are true and reason (R) is the correct explanation of assertion (A). 5. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 6. (d) Assertion (A) is false but reason (R) is true. 7. (a) Both assertion (A) and reason (R) are true and reason	(0,5.7) iv) 10 sq. units 6. i) $\left(\frac{11}{2},3\right)$ ii) $\left(\frac{11}{2},0\right)$ iii) $\left(\frac{17}{3},5\right)$ 7. i) $6\sqrt{5}$ units ii) (7, 0) iii) $8\sqrt{2}$ units iv) a = 1 & b = 5	11. 24 sq. units. 12. 5 units 13. 12.5 sq. units. 14. $\frac{\sqrt{130}}{2}$. 15. Proof 16. 8:7 17. y = -1 and radius = 5 units 18. a = 5, 3 19. $\sqrt{58}$ units 20. (9, -13)	10. a = 16, AB = $2\sqrt{61}$ units. 11. Proof 12. $\left(0,-\frac{13}{3}\right)$ 13. k = 7 14. (2, 0) and (0, -2)	

22. (b) 2 : 3 23. (a) (4, – 7) 24. (a) $\sqrt{68}$ units 25. (a) 5 units 26. (b) y-axis 27. (a) $\frac{5\sqrt{2}}{2}$ units 28. (c) 2 29. (b) isosceles triangle 30. (a) (2, 3) 31. (c) (3, 3) 32. (b) 20	(R) is the correct explanation of assertion (A). 8. (b) Both assertion (A) and reason (R) are true and but reason (R) is not the correct explanation of assertion (A). 9. (c) Assertion (A) is true but Reason (R) is false. 10. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct		21. $\left(-\frac{2}{7}, -\frac{20}{7}\right)$		

33. (a) 6 34. (d) (3, 1) 35. (c) 1:2 36. (c) 4	explanation of assertion (A). 11. (d) Assertion (A) is false , but Reason(R) is true. 12. (c) Assertion (A) is true but Reason (R) is false				

UNIT TEST

1. a) (0,4)

2. c) $\sqrt{a^2 + b^2}$

3. a) (0, 0)

4. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

5. y = -1, Radius = 5 and y = 7, Radius = $\sqrt{793}$.

6. $3: 2; m = \frac{-2}{5}$

7. $\pm 4; \sqrt{41}$

8. $\frac{7}{3}, 0$

9. $3x + 4y - 5 = 0$

10. 24 sq. units

11. $-15; \left(-6, \frac{11}{2}\right)$

12. i) (1. 3) ii) 4 units iii) 3 (Or) 1:1

CHAPTER 8 – INTRODUCTION TO TRIGONOMETRY

Key Concepts

Trigonometric Ratios of the angle

In trigonometry, we deal with relations between the side and angles of a triangle.

Ratios of the sides of a right-angled triangle with respect to its acute angles are called trigonometric ratios of the angle.

Six Trigonometric Ratios

$\sin\theta = \frac{\text{Opposite Side}}{\text{Hypotenuse}}$ $\quad$ $\operatorname{cosec}\theta = \frac{\text{Hypotenuse}}{\text{Opposite Side}}$

$\cos\theta = \frac{\text{Adjacent Side}}{\text{Hypotenuse}}$ $\quad$ $\sec\theta = \frac{\text{Hypotenuse}}{\text{Adjacent Side}}$

$\tan\theta = \frac{\text{Opposite Side}}{\text{Adjacent Side}}$ $\quad$ $\cot\theta = \frac{\text{Adjacent Side}}{\text{Opposite Side}}$

Relations between Trigonometric Ratios

(a) Reciprocal Relations

(i) $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$ (or) $\sin\theta = \frac{1}{\operatorname{cosec}\theta}$ (or) $\operatorname{cosec}\theta \times \sin\theta = 1$

(ii) $\sec\theta = \frac{1}{\cos\theta}$ (or) $\cos\theta = \frac{1}{\sec\theta}$ (or) $\sec\theta \times \cos\theta = 1$

(iii) $\cot\theta = \frac{1}{\tan\theta}$ (or) $\tan\theta = \frac{1}{\cot\theta}$ (or) $\cot\theta \times \tan\theta = 1$

(b) Quotient Relations

(i) $\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\quad$ (ii) $\cot\theta = \frac{\cos\theta}{\sin\theta}$

Trigonometric ratios for angle of measure 0°, 30°, 45°, 60° and 90° in tabular form

θ	0^o	30^o	45^o	60^o	90^o
sinθ	0	$1/2$	$\frac{1}{\sqrt{2}}$	$\sqrt{3}/2$	1
cosθ	1	$\sqrt{3}/2$	$\frac{1}{\sqrt{2}}$	$1/2$	0
tanθ	0	$1/\sqrt{3}$	1	$\sqrt{3}$	Not Defined
cosecθ	Not Defined	2	$\sqrt{2}$	$2/\sqrt{3}$	1
secθ	1	$2/\sqrt{3}$	$\sqrt{2}$	2	Not Defined
cotθ	Not Defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

Trigonometric Identities

An equation involving trigonometric ratios of an angle is said to be a trigonometric identity if it is satisfied for all values of θ for which the given trigonometric ratios are defined.

Identity 1
$\sin^2\theta + \cos^2\theta = 1$

- $\sin^2\theta = 1 - \cos^2\theta$
- $\cos^2\theta = 1 - \sin^2\theta$

Identity 2
$\text{cosec}^2\theta - \cot^2\theta = 1$

- $\text{cosec}^2\theta = 1 + \cot^2\theta$
- $\cot^2\theta = \text{cosec}^2\theta - 1$

Identity 3
$\sec^2\theta - \tan^2\theta = 1$

- $\sec^2\theta = 1 + \tan^2\theta$
- $\tan^2\theta = \sec^2\theta - 1$

Representation of a Trigonometric Ratio in Terms of Any Other Trigonometric Ratio

	$\sin\theta$	$\cos\theta$	$\tan\theta$	$\cot\theta$	$\sec\theta$	$\operatorname{cosec}\theta$
$\sin\theta$	$\sin\theta$	$\sqrt{(1-\cos^2\theta)}$	$\frac{\tan\theta}{\sqrt{(1+\tan^2\theta)}}$	$\frac{1}{\sqrt{(1+\cot^2\theta)}}$	$\frac{\sqrt{(\sec^2\theta-1)}}{\sec\theta}$	$\frac{1}{\operatorname{cosec}\theta}$
$\cos\theta$	$\sqrt{(1-\sin^2\theta)}$	$\cos\theta$	$\frac{1}{\sqrt{(1+\tan^2\theta)}}$	$\frac{\cot\theta}{\sqrt{(1+\cot^2\theta)}}$	$\frac{1}{\sec\theta}$	$\frac{\sqrt{(\operatorname{cosec}^2\theta-1)}}{\operatorname{cosec}\theta}$
$\tan\theta$	$\frac{\sin\theta}{\sqrt{(1-\sin^2\theta)}}$	$\frac{\sqrt{(1-\cos^2\theta)}}{\cos\theta}$	$\tan\theta$	$\frac{1}{\cot\theta}$	$\sqrt{(\sec^2\theta-1)}$	$\frac{1}{\sqrt{(\operatorname{cosec}^2\theta-1)}}$
$\cot\theta$	$\frac{\sqrt{(1-\sin^2\theta)}}{\sin\theta}$	$\frac{\cos\theta}{\sqrt{(1-\cos^2\theta)}}$	$\frac{1}{\tan\theta}$	$\cot\theta$	$\frac{1}{\sqrt{(\sec^2\theta-1)}}$	$\sqrt{\operatorname{cosec}^2\theta-1}$
$\sec\theta$	$\frac{1}{\sqrt{(1-\sin^2\theta)}}$	$\frac{1}{\cos\theta}$	$\sqrt{(1+\tan^2\theta)}$	$\frac{\sqrt{(1+\cot^2\theta)}}{\cot\theta}$	$\sec\theta$	$\frac{\operatorname{cosec}\theta}{\sqrt{(\operatorname{cosec}^2\theta-1)}}$
$\operatorname{cosec}\theta$	$\frac{1}{\sin\theta}$	$\frac{1}{\sqrt{(1-\cos^2\theta)}}$	$\frac{\sqrt{(1+\tan^2\theta)}}{\tan\theta}$	$\sqrt{(1+\cot^2\theta)}$	$\frac{\sec\theta}{\sqrt{(\sec^2\theta-1)}}$	$\operatorname{cosec}\theta$

MULTIPLE CHOICE QUESTIONS

1. If $x = r\sin\theta$ and $y = r\cos\theta$ then, the value of $x^2 + y^2$ is:

a) r b) r^2 c) $\frac{1}{r}$ d) 1

2. If $3\sec\theta - 5 = 0$ then, $\cot\theta$ is equal to:

a) $\frac{5}{3}$ b) $\frac{4}{5}$ c) $\frac{3}{4}$ d) $\frac{3}{5}$

3. If $\theta = 45°$ then, $\sec\theta\cot\theta - \operatorname{cosec}\theta\tan\theta$ is:

a) 0 b) 1 c) $2\sqrt{2}$ d) $\sqrt{2}$

4. Triangle TRY is a right-angled isosceles triangle then, cosT + cosR + cosY is:

a) $\sqrt{2}$ b) $2\sqrt{2}$ c) $1 + 2\sqrt{2}$ d) $1 + \frac{1}{\sqrt{2}}$

5. If $\sin(A - B) = \frac{1}{2}$ and $\cos(A + B) = \frac{1}{2}$ then, A and B will be, respectively:

a) $15°, 45°$ b) $45°, 15°$ c) $45°, 45°$ d) $30°, 60°$

6. $(1 + \tan\theta + \sec\theta)(1 + \cot\theta - \operatorname{cosec}\theta) = ?$

a) 0 b) 1 c) 2 d) -1

7. In triangle ABC, right angled at B, If $\tan A = \frac{4}{3}$, then the value of cosC is

a) $\frac{3}{5}$ b) $\frac{4}{5}$ c) 1 d) None of these

8. In ΔOPQ, right-angled at P, OP = 7 cm and OQ – PQ = 1 cm, then the values of sin Q is

a) $\frac{7}{25}$ b) $\frac{24}{25}$ c) 1 d) None of these

9. If $3\cot\theta = 2$, then the value of $\frac{4\sin\theta - 3\cos\theta}{2\sin\theta + 6\cos\theta}$ is

a) $\frac{3}{2}$ b) $\frac{1}{2}$ c) $\frac{1}{3}$ d) None of these

10. The value of $2(\sin^4 30° + \cos^4 60°) - (\tan^2 60° + \cot^2 45°) + 3\text{cosec}^2 60°$ is

a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{4}$ d) None of these

11. If $\cos\theta = \frac{1}{2}, \sin\varphi = \frac{1}{2}$ then value of $\theta + \varphi$ is

a) 30° b) 60° c) 90° d) 120°

12. If $\sin A + \sin^2 A = 1$, then the value of the expression $(\cos^2 A + \cos^4 A)$ is

a) 1 b) $\frac{1}{2}$ c) 2 d) 3

13. If $\triangle ABC$ is right angled at C, then the value of $\cos(A + B)$ is

a) 0 b) 1 c) $\frac{1}{2}$ d) $\frac{\sqrt{3}}{2}$

14. If θ is an acute angle and $\tan\theta + \cot\theta = 2$, then the value of $\sin^3\theta + \cos^3\theta$ is

a) 1 b) $\frac{1}{2}$ c) $\frac{\sqrt{2}}{2}$ d) $\sqrt{2}$

15. $\sec\theta(1 - \sin\theta)(\sec\theta + \tan\theta) =$

a) 0 b) $\frac{1}{2}$ c) 1 d) none of these

16. If $\sqrt{3}\tan\theta = 3\sin\theta$, then $\sin^2\theta - \cos^2\theta =$

a) $\frac{1}{2}$ b) 1 c) $\frac{1}{3}$ d) $\frac{1}{\sqrt{3}}$

17. If $\tan\theta + \cot\theta = 2$, then $\tan^{1000}\theta + \cot^{100}\theta =$

a) 100 b) $\frac{1}{100}$ c) -2 d) 2

18. $(1 + \tan^2\theta)(1 - \sin\theta)(1 + \sin\theta) =$

a) 0 b) –1 c) 1 d) 2

19. If $\text{cosec}\,\theta - \sin\theta = a$, $\sec\theta - \cos\theta = b$, then $a^2 b^2(a^2 + b^2 + 3) =$

a) 3 b) –3 c) 1 d) –1

20. If $\tan\theta = \frac{2}{\sqrt{5}}$, then $\frac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta} =$

a) $\frac{1}{3}$ b) $\frac{5}{7}$ c) $\frac{1}{9}$ d) $\frac{\sqrt{5}}{9}$

21. The value of $\left(\sin^2\theta + \frac{1}{1+\tan^2\theta}\right)$ is

(a) 0 (b) 2 (c) 1 (d) – 1

22. If $\tan^2\theta + \cot^2\alpha = 2$, where $\theta = 45°$ and $0° \leq \alpha \leq 90°$, then the value of α is

(a) 30° (b) 45° (c) 60° (d) 90°

23. If $\cos\theta = \frac{x}{y}, (x, y \neq 0)$, then $\tan\theta$ is equal to

(a) $\frac{y}{\sqrt{y^2-x^2}}$ (b) $\frac{x}{\sqrt{x^2+y^2}}$ (c) $\frac{\sqrt{y^2-x^2}}{x}$ (d) $\frac{x}{\sqrt{y^2-x^2}}$

24. If $5\tan\theta = 2$, then the value of $\frac{10\sin\theta - 2\cos\theta}{5\sin\theta + 3\cos\theta}$ is

(a) $\frac{2}{5}$ (b) $\frac{5}{2}$ (c) 1 (d) $\frac{46}{31}$

25. If $\sec\theta - \tan\theta = m$, then the value of $\sec\theta + \tan\theta$ is

(a) $1 - \frac{1}{m}$ (b) $m^2 - 1$ (c) $\frac{1}{m}$ (d) –m

26. If $\cos(\alpha + \beta) = 0$, then value of $\cos\left(\frac{\alpha+\beta}{2}\right)$ is equal to

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) 0 (d) $\sqrt{2}$

27. If $\sin\theta = \cos\theta, (0° < \theta < 90°)$, then value of $(\sec\theta \cdot \sin\theta)$ is

(a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$ (c) 1 (d) 0

28. If $\cos\theta = \frac{\sqrt{3}}{2}$ and $\sin\phi = \frac{1}{2}$, then $\tan(\theta + \phi)$ is

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$ (c) 1 (d) not defined

29. If $\sin\alpha = \frac{\sqrt{3}}{2}, \cos\beta = \frac{\sqrt{3}}{2}$, then $\tan\alpha \cdot \tan\beta$ is

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$ (c) 1 (d) 0

30. If $\sin\theta = 1$, then the value of $\frac{1}{2}\sin\left(\frac{\theta}{2}\right)$ is

(a) $\frac{1}{2\sqrt{2}}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{2}$ (d) 0

31. If $\frac{x}{3} = 2\sin A, \frac{y}{3} = 2\cos A$, then the value of $x^2 + y^2$ is

(a) 36 (b) 9 (c) 6 (d) 18

32. If $4\sec\theta - 5 = 0$, then the value of $\cot\theta$ is

(a) $\frac{3}{4}$ (b) $\frac{4}{5}$ (c) $\frac{5}{3}$ (d) $\frac{4}{3}$

33. If θ is an acute angle and $7 + 4\sin\theta = 9$, then the value of θ is

(a) 90° (b) 30° (c) 45° (d) 60°

34. The value of $\tan^2\theta - \left(\frac{1}{\cos\theta} \times \sec\theta\right)$ is

(a) 1 (b) 0 (c) -1 (d) 2

35. If $\alpha + \beta = 90°$ and $\alpha = 2\beta$, then $\cos^2\alpha + \sin^2\beta$ is equal to

(a) 0 (b) $\frac{1}{2}$ (c) 1 (d) 2

36. The value of $(\tan A\text{cosec}A)^2 - (\sin A\sec A)^2$ is

(a) 0 (b) 1 (c) -1 (d) 2

37. If $7\cos^2\theta + 3\sin^2\theta = 4$, then the value of θ is

(a) $90°$ (b) $30°$ (c) $45°$ (d) $60°$

38. If $\sin 30°\tan 45° = \frac{\sec 60°}{k}$, then the value of k is

(a) 4 (b) 3 (c) 2 (d) 1

39. If $\sin\theta = \cos\theta (0° < \theta < 90°)$, then the value of $\sec\theta \cdot \sin\theta$ is

(a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$ (c) 0 (d) 1

40. If $\tan 3\theta = \sqrt{3}$, then $\frac{\theta}{2}$ equals

(a) $60°$ (b) $30°$ (c) $20°$ (d) $10°$

41. If $\sin 4\theta = \frac{\sqrt{3}}{2}$, then $\frac{\theta}{3}$ equals

(a) $60°$ (b) $15°$ (c) $20°$ (d) $5°$

42. $\tan 2A = 3\tan A$ is true, when the measure of $\angle A$ is

(a) $90°$ (b) $60°$ (c) $45°$ (d) $30°$

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: If $x = 2\sin^2\theta$ and $y = 2\cos^2\theta + 1$ then the value of $x + y = 3$.

Reason : For any value of $\theta, \sin^2\theta + \cos^2\theta = 1$

2. Assertion: Sin A is the product of Sin and A.

Reason: The value of sinθ increases as θ increases.

3. Assertion: $(\cos^4 A - \sin^4 A)$ is equal to $2\cos^2 A - 1$.

Reason : The value of $\cos\theta$ decreases as θ increases.

4. Assertion: If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta = y\cos\theta$, then $x^2 + y^2 = 1$.

Reason : For any value of $\theta, \sin^2\theta + \cos^2\theta = 1$

5. Assertion: The value of $\sin 60°\cos 30° + \sin 30°\cos 60°$ is 1.

Reason : $\sin 90° = 1$ and $\cos 90° = 0$.

6. Assertion: The value of $2\tan^2 45° + \cos^2 30° - \sin^2 60°$ is 2.

Reason: Value of $\tan 45° = 1, \cos 30° = \frac{\sqrt{3}}{2}$ and $\sin 60° = \frac{\sqrt{3}}{2}$

7. Assertion: If $\cos A + \cos^2 A = 1$ then $\sin^2 A + \sin^4 A = 1$.

Reason: $\sin^2 A + \cos^2 A = 1$, for any value of A.

8. Assertion: The value of $\frac{\sin^3\theta+\cos^3\theta}{\sin\theta+\cos\theta} + \sin\theta\cos\theta$ is 1

Reason: $\sin^2 A + \cos^2 A = 1$, for any value of A.

9. Assertion: The value of $\frac{2\tan 30°}{1+\tan^2 30°}$ is $\frac{\sqrt{3}}{2}$

Reason : $\cot A$ is not defined for $A = 0°$.

10. Assertion: The value of $\sec A(1 - \sin A)(\sec A + \tan A)$ is 1.

Reason : $1 + \tan^2 A = \sec^2 A$, for any value of A.

11. Assertion: If $\sin A = \frac{1}{3}(0° < A < 90°)$, then the value of $\cos A$ is $\frac{2\sqrt{2}}{3}$

Reason: For every angle $\theta, \sin^2\theta + \cos^2\theta = 1$.

12. Assertion: For an acute angle θ, $\sin\theta = \frac{3}{5} \Rightarrow \cos\theta = -\frac{4}{5}$.

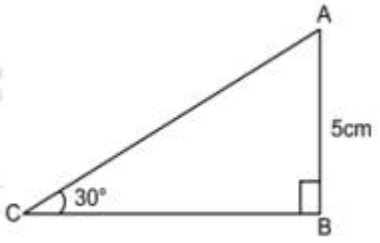
Reason: For any value of θ, $(0° \le \theta \le 90°)$, $\sin^2\theta + \cos^2\theta = 1$.

13. Assertion: For an acute angle $\theta, \sec\theta = 3 \Rightarrow \tan\theta = 2\sqrt{2}$.

Reason: $\sec^2\theta = 1 - \tan^2\theta$ for all values of θ.

CASE STUDY BASED QUESTIONS

1. A right triangle is a triangle in which one angle is a right angle (90°). The relation between the sides and angles of a right triangle is the basis of trigonometry. During the environment awareness campaign, a student of class-X made a cardboard ABC in the form of a right triangle, right angled at B, AB = 5 cm and ∠ACB = 30°.



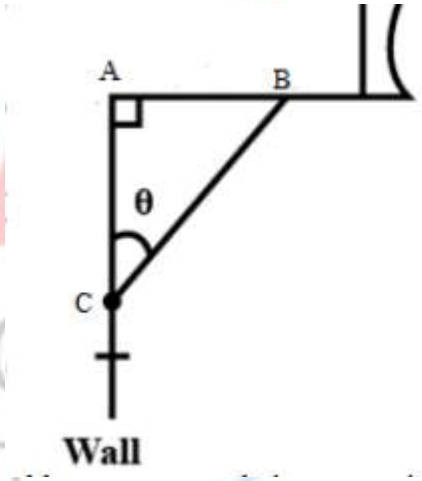
i) Find length of side BC.

ii) Evaluate the length of AC.

iii) Find tanA.

iv) Evaluate $\sin(A + C)$.

2. The rod AB of a TV disc antenna is fixed at right angle to the wall and a rod BC supporting the disc as shown in the figure. AB = 4m, and BC = 8m.



Answer the following questions

(i) Find the value of tanθ.

(ii) Find the value of θ.

(iii) Evaluate $\sin^2 C + \sin^2 B$.

(iv) Determine the value of value of sinA + tanB.

3. Kings and queens used the Tower in times of trouble to protect their possessions and themselves. Arms and armour were made, tested and stored here until the 1800s. The Tower also controlled the supply of the nation's money. All coins of the realm were made at the Tower Mint from the reign of Edward I until 1810. Kings and queens also locked away their valuables and jewels at the Tower and even today, the Crown Jewels are protected by a garrison of soldiers. A

tower stands vertically on the ground. From a point on the ground, which is 15 m away from the foot of the tower, the angle of elevation of the top of the tower is found to be 60°.

i) Find the height of the tower in the above situation.

ii) If the above tower casts a shadow of length $2\sqrt{3}$ m on the ground when the sun's elevation is 60°. Find the height of the tower.

iii) The angle of elevation of the top of a tower from a point on the ground 30 m away from the foot of the tower is 30°. Find the height of the tower.

iv) In the above situation if AB = 30 m and AC = 60 m. Find ∠A.

4. The Circus Arts Program is one of the most popular activities at Camp Lohikan. It brings a level of excitement and enthusiasm to the camp experience that can't be found at home or in school. A circus artist is climbing a 20 m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground such that the angle made by the rope with the ground level is 30°.

i) Find the height of the pole in the above situation.

ii) In the above situation, if AB = 5 m and ∠ ACB = 30° then find the length of the side BC.

iii) In the above situation, if the height of pole is 3 m and the length of rope is 6 m then find ∠ACB.

iv) Find the value of $2\tan^2 45° + \cos^2 30° - \sin^2 60°$.

5. Kite flying is also a major part of Makar Sankranti, although the states of Gujarat and Rajasthan indulge in this with a lot more enthusiasm. Makar Sankranti is a major harvest festival celebrated in India and is dedicated to the Sun God, Surya. It is the first major festival to be celebrated in India and usually takes place in January, this year the festival will be celebrated on January 14. Aditya flying a kite at a height of 60 m above the ground. He attached the string to

the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is 60°.

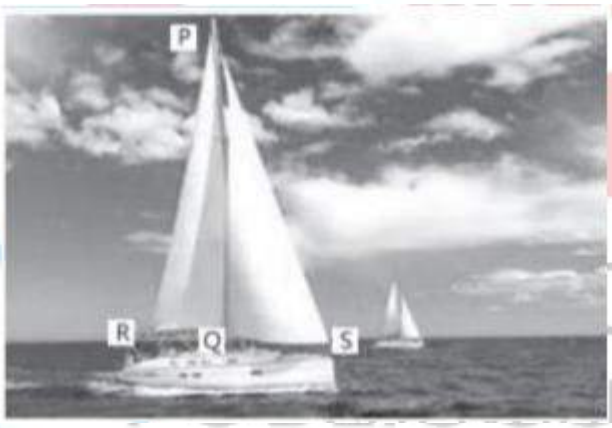
i) In the above situation, find the length of the string, assuming that there is no slack in the string.

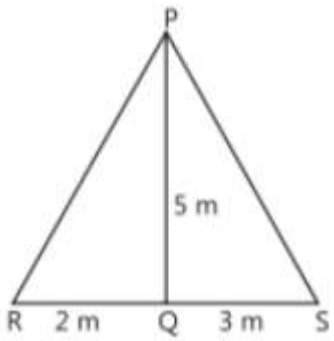
ii) The string of a kite is 100 m long and it makes an angle of 60° with the horizontal. If these is no slack in the string, find the height of the kite from the ground.

iii) A kite is flying at a height of 30 m from the ground. The length of string from the kite to the ground is 60 m. Assuming that there is no slack in the string, find the angle of elevation of the kite at the ground.

iv) Find the value of $(\sin^2 30° - \sec^2 60° + 4\cot^2 45°)$.

6. A sailing boat with triangular masts is as shown below. Two right triangles can be observed Triangles PQR and PQS, both right-angled at Q. The distance QR = 2 m and QS = 3 m and height PQ = 5 m.





Based on the above information, solve the following questions:

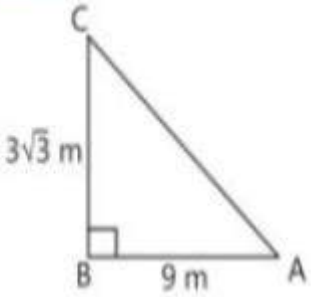
(i) Find the value of cosecR.

(ii) Find the value of tanS + cotR.

(iii) Determine the value of $\sin^2 R - \cos^2 S$.

(iv) Find the value of $\sin^2 S + \cos^2 R$.

7. Three friends-Sanjeev, Amit and Digvijay are playing hide and seek in a park. Sanjeev and Amit were supposed to hide and Digvijay had to find both of them. If the positions of three friends are at A, B and C respectively as shown in the figure and forms a right-angled triangle such that AB = 9 m, BC= $3\sqrt{3}$ m and B = 90°.



Based on the above information, solve the following questions:

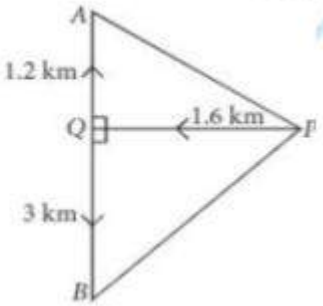
(i) Find the measure of $\angle A$ by using trigonometric ratio.

(ii) Find the measure of ∠C by using trigonometric ratio.

(iii) Find the value of cos2A.

(iv) Find the value of $\sin\left(\frac{C}{2}\right)$.

8. Two aeroplanes leave an airport one after the other. After moving on runway, one flies due North and other flies due South. The speed of two aeroplanes is 400km/hr and 500km/hr respectively. Considering PQ as runway and A and B are any two points in the path followed by two planes, then answer the following.



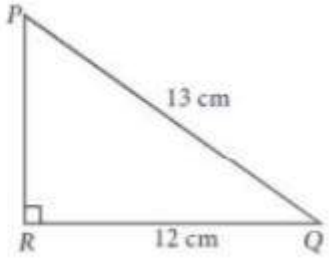
(i) Find tan θ; if $\angle APQ = \theta$.

(ii) Find cotB.

(iii) Find secA.

(iv) Find coesecB.

9. Anitha, a student of class 10 has to made a project on 'Introduction to Trigonometry'. She decides to make a bird house which is triangular in shape. She uses cardboard to make the bird house as shown in the figure. Considering the front side of bird house as right angled triangle PQR, right angled at R. Based on the information, answer the following questions:

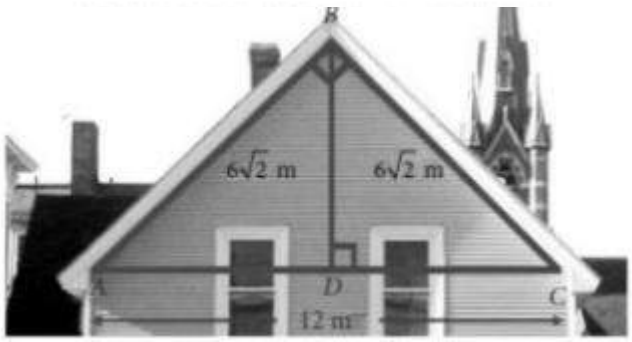


(i) If $\angle PQR = \theta$, then find $\cos\theta$.

(ii) Find the value of $\frac{\tan\theta}{1+\tan^2\theta}$.

(iii) Find the value of $\cot^2\theta - \text{cosec}^2\theta$.

10. Aanya and her father go to meet her friend Juhi for a party. When they reached to Juhi's place, Aanya saw the roof of the house, which is triangular in shape. If she imagined the dimensions of the roof as given in figure, then answer the following questions:



(i) If D is the mid-point of AC, then find BD.

(ii) Find the value of sinA + cosC.

(iii) Find the value of $\tan^2 C + \tan^2 A$.

VERY SHORT ANSWERS

1. If $\tan A = \frac{3}{4}$, find the value of $\frac{1}{\sin A} + \frac{1}{\cos A}$.

2. If $\sqrt{3}\sin\theta - \cos\theta = 0$ and $0° < \theta < 90°$, find the value of θ.

3. Evaluate $\frac{3\tan^2 30° + \tan^2 60° + \operatorname{cosec} 30° - \tan 45°}{\cot^2 45°}$

4. Prove that: $1 + \frac{\cot^2 \alpha}{1+\operatorname{cosec} \alpha} = \operatorname{cosec} \alpha$

5.Prove that $\frac{(\sin^4\theta + \cos^4\theta)}{1 - 2\sin^2\theta\cos^2\theta} = 1$

6. If $\sin\theta = \frac{3}{4}$, find $\sqrt{\frac{\operatorname{cosec}^2\theta - \cot^2\theta}{\sec^2\theta - 1}}$.

7. If $\cot\theta = \frac{3}{4}$, find $\sqrt{\frac{\sec\theta - \operatorname{cosec}\theta}{\sec\theta + \operatorname{cosec}\theta}}$.

8. If $\sin\theta = \frac{m}{n}$, find $\frac{\tan\theta + 4}{4\cot\theta + 1}$.

9. In ΔABC, right angled at B, AB = 24 cm, BC = 7 cm. Determine, (i) tan A, sec A (ii) cosec C, cot C.

10. If $\cot\theta = \frac{15}{8}$, then evaluate $\frac{(2+2\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(2-2\cos\theta)}$.

11. If $\tan\theta = \frac{1}{\sqrt{3}}$, prove that $7\sin^2\theta + 3\cos^2\theta = 4$.

12. Evaluate: $\frac{3\sec^2 30° + \tan^2 60° + 5\cos^2 90° + 4\cos^2 45°}{\sec 60° - \cot^2 30° + \operatorname{cosec} 30°}$.

13. If $A = 30°$, verify that $\cos 2A = \frac{1 - \tan^2 A}{1 + \tan^2 A}$.

14. If cos (40° + x) = sin 30°, find the value of x.

15. If $\frac{3}{4}\tan^2 30° - 2\sin^4 60° + 2\cot 45° = x^2\cos^3 60°$, find the value of x.

16. Solve: $\sqrt{3}\tan 2x = \cos 60° + \sin 45° \cdot \cos 45°$

17. A rhombus of side 14 cm has two angles of 60° each. Find the lengths of the diagonals of the rhombus.

18. If A and B are acute angles such that $\tan A = \frac{1}{2}$, $\tan B = \frac{1}{3}$ and $\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \cdot \tan B}$, find A + B.

19. If θ is an acute angle and $\tan\theta + \cot\theta = 2$, find the value of $\tan^7\theta + \cot^7\theta$.

20. In $\triangle PQR$, right angled at Q, $PQ = 3$cm and $PR = 6$cm. Determine $\angle QPR$ and $\angle PRQ$.

21. If $\cos(A + B) = \frac{1}{2}$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, where $0 \leq A + B \leq 90°$, then find the value of sec(2A – 3B).

22. Find the value of x such that $3\tan^2 60° - x\sin^2 45° + \frac{3}{4}\sec^2 30° = 2\text{cosec}^2 30°$.

23. Evaluate: $2\sqrt{2}\cos 45°\sin 30° + 2\sqrt{3}\cos 30°$.

24. If A = 60° and B = 30°, verify that sin(A + B) = sinA cosB + cosA sinB.

25. If $x\cos 60° + y\cos 0° + \sin 30° - \cot 45° = 5$, then find the value of x + 2y

26. Evaluate: $\frac{\tan^2 60°}{\sin^2 60° + \cos^2 30°}$

27. If $\tan A = \sqrt{3}$; where A is an acute angle, then find the value of $\frac{\sin^2 A}{1 + \cos^2 A}$.

28. If $4k = \tan^2 60° - 2\text{cosec}^2 30° - 2\tan^2 30°$, then find the value of k.

29. If $\tan A + \cot A = 6$, then find the value of $\tan^2 A + \cot^2 A - 4$.

30. Find the value of x for which $(\sin A + \text{cosec}A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$.

31. Evaluate the following: $\frac{3\sin 30° - 4\sin^3 30°}{2\sin^2 50° + 2\cos^2 50°}$.

32. It is given that sin(A – B) = sinA cosB – cosA sinB. Use it to find the value of sin 15°.

33. If $\sin A = y$, then express cos A and tan A in terms of y.

SHORT ANSWERS

1. Prove that $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1 = 0$.

2. Prove that: $\frac{\cot\theta + \operatorname{cosec}\theta - 1}{\cot\theta - \operatorname{cosec}\theta + 1} = \frac{1+\cos\theta}{\sin\theta}$.

3. If $\sec\theta = x + \frac{1}{4x}$, prove that $\sec\theta + \tan\theta = 2x$ or $\frac{1}{2x}$.

4. Prove that: $\frac{\cos^3\theta + \sin^3\theta}{\cos\theta + \sin\theta} + \frac{\cos^3\theta - \sin^3\theta}{\cos\theta - \sin\theta} = 2$

5. Prove that: $(\cot\theta - \operatorname{cosec}\theta)^2 = \frac{1-\cos\theta}{1+\cos\theta}$.

6. If $\sec\theta = \frac{5}{4}$, prove that $\frac{3\sin\theta - 4\sin^3\theta}{4\cos^3\theta - 3\cos\theta} = \frac{3\tan\theta - \tan^3\theta}{1 - 3\tan^2\theta}$.

7. Find acute angles A and B, if $\sin(A + 2B) = \frac{\sqrt{3}}{2}$ and $\cos(A + 4B) = 0, A > B$.

8. If $\sin(A + B + C) = 1; \cot(A + B) = \frac{1}{\sqrt{3}}$ and $\sec(A + C) = 2$, find A, B anc C, when they are acute.

9. Prove that: $\frac{\tan\theta - \cot\theta}{\sin\theta \cdot \cos\theta} = \sec^2\theta - \operatorname{cosec}^2\theta = \tan^2\theta - \cot^2\theta$.

10. If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that $\tan\theta + \cot\theta = 1$.

11. If $\frac{\cos\alpha}{\cos\beta} = m$ and $\frac{\cos\alpha}{\sin\beta} = n$, prove that $(m^2 + n^2)\cos^2\beta = n^2$.

12. If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, show that $\cos\theta - \sin\theta = \sqrt{2}\sin\theta$

13. Prove that: $(\sin\theta + \sec\theta)^2 + (\cos\theta + \operatorname{cosec}\theta)^2 = (1 + \sec\theta\operatorname{cosec}\theta)^2$

14. Show that: $(\sec A - \operatorname{cosec} A)(1 + \tan A + \cot A) = \tan A\sec A - \cot A\operatorname{cosec} A$

15. Prove that $\frac{\tan\theta + \sec\theta - 1}{\tan\theta - \sec\theta + 1} = \frac{1+\sin\theta}{\cos\theta}$.

16. Prove that $\left(\frac{1+\tan^2 A}{1+\cot^2 A}\right) = \frac{(1-\tan A)^2}{(1-\cot A)^2}$

17. Prove that $\left(\tan\alpha + \frac{1}{\cos\alpha}\right)^2 + \left(\tan\alpha - \frac{1}{\cos\alpha}\right)^2 = 2\left(\frac{1+\sin^2\alpha}{1-\sin^2\alpha}\right)$

18. Prove that $\frac{\operatorname{cosec}^2\theta - \sec^2\theta}{\operatorname{cosec}^2\theta + \sec^2\theta} = \frac{3}{4}$, if $\tan\theta = \frac{1}{\sqrt{7}}$

19. If $\sin\theta + \cos\theta = p$ and $\sec\theta + \operatorname{cosec}\theta = q$, then prove that $q(p^2 - 1) = 2p$.

20. Prove that $\sqrt{\sec^2\theta + \operatorname{cosec}^2\theta} = \tan\theta + \cot\theta$.

21. Prove that : $\left(1+\frac{1}{\tan^2\theta}\right)\left(1+\frac{1}{\cot^2\theta}\right) = \frac{1}{\sin^2\theta - \sin^4\theta}$

22. Prove that : $\sqrt{\frac{\operatorname{cosec}\theta-1}{\operatorname{cosec}\theta+1}} + \sqrt{\frac{\operatorname{cosec}\theta+1}{\operatorname{cosec}\theta-1}} = 2\sec\theta$

23. Prove that : $\frac{\cot A - 1}{2 - \sec^2 A} = \frac{\cot A}{1+\tan A}$

24. Prove that : $\sqrt{\sec^2\theta + \operatorname{cosec}^2\theta} = \tan\theta + \cot\theta$

25. If $\operatorname{cosec}\theta = x + \frac{1}{4x}$, prove that $\operatorname{cosec}\theta + \cot\theta = 2x$ or $\frac{1}{2x}$.

26. Prove the following trigonometry identity: $\frac{1+\operatorname{cosec} A}{\operatorname{cosec} A} = \frac{\cos^2 A}{1-\sin A}$.

27. Let 2A + B and A + 2B be acute angles such that $\sin(2A + B) = \frac{\sqrt{3}}{2}$ and tan(A + 2B) = 1. Find the value of cot(4A – 7B).

LONG ANSWERS TYPE QUESTIONS

1. Prove that $\frac{\sin A - \cos A + 1}{\sin A + \cos A - 1} = \frac{1}{\sec A - \tan A}$

2. Prove that $\frac{\tan^2 A}{\tan^2 A - 1} + \frac{\operatorname{cosec}^2 A}{\sec^2 A - \operatorname{cosec}^2 A} = \frac{1}{1 - 2\cos^2 A}$.

3. Prove that $\frac{1}{1+\sin^2\theta} + \frac{1}{1+\cos^2\theta} + \frac{1}{1+\sec^2\theta} + \frac{1}{1+\operatorname{cosec}^2\theta} = 2$

4. If $\sec\theta + \tan\theta = p$, then find the value of $\operatorname{cosec}\theta$.

5. Prove that: $\frac{\cos\theta - \sin\theta + 1}{\cos\theta + \sin\theta - 1} = \operatorname{cosec}\theta + \cot\theta$.

6. Show that: $\frac{\tan\theta}{1+\sec\theta} - \frac{\tan\theta}{1-\sec\theta} = 2\operatorname{cosec}\theta$

7. Prove that: $\tan^2 A - \tan^2 B = \frac{\cos^2 B - \cos^2 A}{\cos^2 B \cdot \cos^2 A} = \frac{\sin^2 A - \sin^2 B}{\cos^2 A \cdot \cos^2 B}$.

8. If $\operatorname{cosec}\theta - \sin\theta = m$ and $\sec\theta - \cos\theta = n$, prove that $(m^2 n)^{2/3} + (mn^2)^{2/3} = 1$

9. Show that $\frac{\tan^2 A}{\tan^2 A - 1} + \frac{\operatorname{cosec}^2 A}{\sec^2 A - \operatorname{cosec}^2 A} = \frac{1}{1 - 2\cos^2 A}$

10. Prove that: $(1 + \cot\theta + \tan\theta)(\sin\theta - \cos\theta) = \frac{\sec\theta}{\operatorname{cosec}^2\theta} - \frac{\operatorname{cosec}\theta}{\sec^2\theta}$.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. If $\sqrt{3}\tan\theta = 1$, then $\sin^2\theta - \cos^2\theta =$

a) $\frac{-1}{2}$ b) $\frac{1}{2}$ c) $\frac{3}{2}$ d) $\frac{5}{2}$

2. The value of $2(\sin^2 45° + \cot^2 30°) - 6(\cos^2 45° - \tan^2 30°)$ is

a) 6 b) 3 c) 2 d) 4

3. The value of $4(\sin^4 30° + \cos^4 60°) - 3(\cos^2 45° - \sin^2 90°)$ is

a) $\frac{1}{2}$ b) 1 c) 2 d) 3

4. Assertion: The value of $\sin\theta = \frac{4}{3}$ in not possible.

Reason: Hypotenuse is the largest side in any right-angled triangle.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. ABC is a triangle, right angled at A. If ∠C = 60°, ∠B = 30°, and BC = 3 cm, find the remaining parts of ΔABC.

6. If $\tan(A - B) = \frac{1}{\sqrt{3}}$ and $\sin(A + B) = \frac{\sqrt{3}}{2}, 0° < (A + B) \leq 90°, A > B$, then find A and B.

7. Prove that: $\sin^6\theta + \cos^6\theta + 3\sin^2\theta \cdot \cos^2\theta = 1$.

SECTION C

Each carry 3 marks

8. Show that: $(1 + \cot A + \tan A)(\sin A - \cos A) = \sin A \cdot \tan A - \cot A \cdot \cos A$.

9. Prove that: $\frac{(1+\cot\theta+\tan\theta)(\sin\theta-\cos\theta)}{(\sec^3\theta-\operatorname{cosec}^3\theta)} = \sin^2\theta\cos^2\theta$.

SECTION D

Each carry 5 marks

10. If $\tan x = n\tan y$ and $\sin x = m\sin y$, prove that $\cos^2 x = \frac{m^2-1}{n^2-1}$.

11. If $\cot\theta + \tan\theta = x$ and $\sec\theta - \cos\theta = y$, prove that $(x^2y)^{2/3} - (xy^2)^{2/3} = 1$

SECTION E

12. 'Skysails' is that genre of engineering science that uses extensive utilization of wind energy to move a vessel in the sea water. The 'Skysails' technology allows the towing kite to gain a height of anything between 100 metres – 300 metres. The sailing kite is made in such a way that it can be raised to its proper elevation and then brought back with the help of a 'telescopic mast' that enables the kite to be raised properly and effectively.

Based on the following figure related to sky sailing, answer the questions:

i) In the given figure, if $\sqrt{3}\tan 2\theta - 3 = 0$, where θ is acute angle, then find the value of θ. [1mark]

ii) What should be the length of the rope of the kite sail in order to pull the ship at the angle (calculated above) and be at a vertical height of 300 m? [2 marks]

(Or)

What should be the distance BC in order to pull the ship at the angle (calculated above) and be at a vertical height of 300 m? [2 marks]

iii) If the length of the rope, AC = 200m and θ = 30°, then find the vertical height AB.

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. b) r^2 2. c) $\frac{3}{4}$ 3. a) 0 4. a) $\sqrt{2}$ 5. b) $45°, 15°$ 6. c) 2 7. b) $\frac{4}{5}$ 8. a) $\frac{7}{25}$ 9. c) $\frac{1}{3}$	1. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 2. (d) Assertion (A) is false but reason (R) is true. 3. (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct	1. i) $5\sqrt{3}$cm ii) 10 cm iii) $\sqrt{3}$ iv) 1 2. i) $\frac{1}{\sqrt{3}}$ ii) 30° iii) 1 iv) $1+\sqrt{3}$ 3. i) $15\sqrt{3}$m ii) 6 m iii) $10\sqrt{3}$m iv) 60° 4. i) 10 m ii) $5\sqrt{3}$m iii) 30° iv) 2 5. i) $40\sqrt{3}$m ii)	1. $\frac{35}{12}$ 2. $\theta = 30°$. 3. 5 4. Proof 5. Proof 6. $\frac{\sqrt{7}}{3}$ 7. $\frac{1}{\sqrt{7}}$ 8. $\frac{m}{\sqrt{n^2-m^2}}$ 9. (i) $\frac{7}{24}, \frac{25}{24}$ (ii) $\frac{25}{24}, \frac{7}{24}$	1. Proof 2. Proof 3. Proof 4. Proof 5. Proof 6. Proof 7. $A = 30°, B = 15°$ 8. A = B = C = 30^o 9. Proof 10. Proof	1. Proof 2. Proof 3. Proof 4. $\text{cosec}\,\theta = \frac{p^2+1}{p^2-1}$ 5. Proof 6. $2\text{cosec}\theta$ 7. Proof 8. 1

10. c) $\frac{1}{4}$

11. c) 90°

12. a) 1

13. a) 0

14. b) $\frac{1}{2}$

15. c) 1

16. c) $\frac{1}{3}$

17. d) 2

18. c) 1

19. c) 1

20. c) $\frac{1}{9}$

explanation of assertion (A)

4. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

5. (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

6. (a) Both assertion

$50\sqrt{3}$m

iii) 30° iv) $\frac{1}{4}$

6. i) $\frac{\sqrt{29}}{5}$

ii) $\frac{31}{15}$

iii) $\frac{589}{986}$

iv) $\frac{861}{986}$

7. i) 30°

ii) 60°

iii) $\frac{1}{2}$

iv) $\frac{1}{2}$

8. i) $\frac{3}{4}$

10. $\frac{225}{64}$

11. 4

12. 9

13. $\frac{1}{2}$

14. 20°

15. ± 3

16. 15°

17. 14cm & $14\sqrt{3}$cm.

18. 45°

19. 2

20. 30° & 60°

11. n^2

12. $\sqrt{2}\sin\theta$

13. Proof

27. $\sqrt{3}$

21. (c) 1 22. (b) 45° 23. (c) $\frac{\sqrt{y^2-x^2}}{x}$ 24. (a) $\frac{2}{5}$ 25. (c) $\frac{1}{m}$ 26. (a) $\frac{1}{\sqrt{2}}$ 27. (c) 1 28. (a) $\sqrt{3}$ 29. (c) 1 30. (a) $\frac{1}{2\sqrt{2}}$ 31. (a) 36	(A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) 7. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) 8. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct	ii) $\frac{15}{8}$ iii) $\frac{5}{3}$ iv) $\frac{17}{8}$ 9. i) $(\frac{12}{13})$ ii) $(\frac{60}{169})$ iii) (-1) 10. i) 6m ii) $\sqrt{2}$ iii) 2	21. $\sqrt{2}$ 22. x = 4 23. 4 24. Verification 25. x + 2y = 11 26. 2 27. $\frac{3}{5}$ 28. $k = -\frac{17}{12}$ 29. 30 30. x = 7 31. $\frac{1}{2}$		

32. (d) $\frac{4}{3}$ 33. (b) 30° 34. (c) -1 35. (b) $\frac{1}{2}$ 36. (b) 1 37. (d) 60° 38. (a) 4 39. (d) 1 40. (d) 10° 41. (d) 5° 42. (d) 30°	explanation of assertion (A) 9. (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A) 10. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) 11. (a) Both assertion		32. $\frac{\sqrt{3}-1}{2\sqrt{2}}$ or $\frac{\sqrt{6}-\sqrt{2}}{4}$ 33. $\sqrt{1-y^2}$ & $\frac{y}{\sqrt{1-y^2}}$		

	(A) and (R) are true. Reason(R) is the correct explanation of Assertion (A) 12. (d) Assertion (A) is false, but Reason (R) is true. 13. (d) Assertion (A) is false, but Reason (R) is true.				

UNIT TEST

1. a) $\frac{-1}{2}$

2. a) 6

3. c) 2

4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

5. $AC = 1.5\text{cm}, AB = 1.5\sqrt{3}\text{cm}$

6. $45°, 15°$

7. 1

8. Proof

9. Proof

10. Proof

11. 1

12. i) 30° ii) 600 m (Or) $300\sqrt{3}$m iii) 100 m

CHAPTER 9 – SOME APPLICATIONS OF TRIGONOMETRY

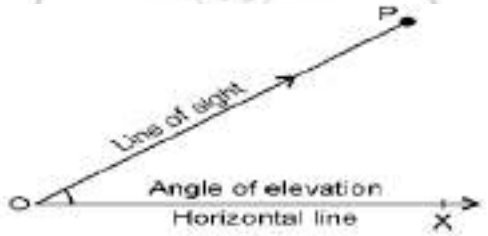
Key Concepts

Line of sight

When an observer looks from a point O at an object P, then the line OP is called the line of sight.

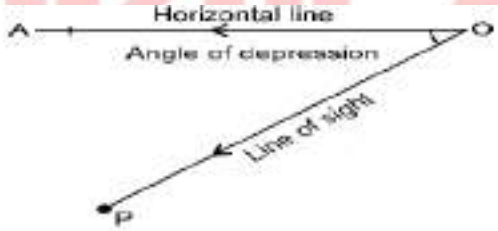
Angle of elevation

The angle of elevation of an object viewed is the angle formed by the line of sight with the horizontal when it is above the horizontal level. i.e. the case when we raise our head to look the object.



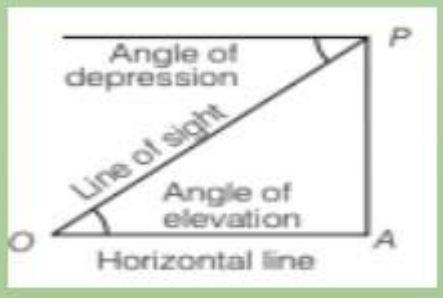
Angle of Depression

The angle of depression of an object viewed is the angle formed by the line of sight with the horizontal when it is below the horizontal level. i.e., the case when we lower our head to look at the object.



(i) The angle of elevation of a point P as seen from a point O is always equal to the angle of depressions of O as seen from P.

(ii) The angles of elevation and depressions are always acute angles.



(iii) If the observer moves towards the perpendicular line(tower/building), then the angle of elevation increases and if the observer moves away from the perpendicular line(tower/building), then the angle of elevation decreases.

(iv) If the height of the tower is doubled and the distance between the observer and foot of the tower is also doubled, then the angle of elevation remains same.

(v) If the angle of elevation of Sun, above a tower decreases, then the length of shadow of a tower increases and vice-versa.

MULTIPLE CHOICE QUESTIONS

1. From a point on the ground, which is 15 m away from the foot of a vertical tower, the angle of elevation of the top of the tower, is found to be 60°. The height of the tower (in metres) is

a) $5\sqrt{3}$ b) $15\sqrt{3}$ c) 15 d) 7.5

2. A lamp post $5\sqrt{3}$m high casts a shadow 5 m long on the ground. The Sun's elevation at this moment is

a) 30° b) 45° c) 60° d) 90°

3. The length of the shadow of a tower standing on level ground is found to be 2x metres longer when the Sun's elevation is 30° than when it was 45°. The height of the tower (in metres) is

a) $(\sqrt{3}+1)$x b) $(\sqrt{3}-1)$x c) $2\sqrt{3}$x d) $3\sqrt{2}$x

4. If two towers of height h_1 and h_2 subtend angles of 60° and 30° respectively at the mid-point of the line joining their feet, then $h_1:h_2$ is

a) 3:1 b) $\sqrt{3}:1$ c) $1:\sqrt{3}$ d) 1:3

5. Suppose a straight vertical tree is broken at some point due to storm and the broken part is inclined at a certain distant from the foot of the tree. If the top of broken part of a tree touch the ground at a point whose distance from foot of the tree is equal to height of remaining part, then its angle of inclination is

a) 30° b) 60° c) 45° d) none of these

6. The angle of depression of a car parked on the road from the top of a 150 m high tower is 30°. The distance of the car from the tower (in metres) is

a) $50\sqrt{3}$ b) $150\sqrt{3}$ c) $150\sqrt{2}$ d) 75

7. The length of shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. The angle of elevation of sun is:

a) 45° b) 30° c) 60° d) 90°

8. A ladder, leaning against a wall, makes an angle of 60° with the horizontal. If the foot of the ladder is 9.5m away from the wall. The length of the ladder is

a) 10 b) 16m c) 18m d) 19m

9. The length of a string between a kite and a point on the ground is 85 m. If the string makes an angle θ with the ground level such that $\tan\theta = \frac{15}{8}$, then the height of the kite is

a) 75 m b) 78.05 m c) 226 m d) None of these

10. The top of two poles of height 20 m and 14 m are connected by a wire. If the wire makes an angle of 30° with the horizontal, then the length of the wire is

a) 12 m b) 10 m c) 8 m d) 6 m

11. An observer, 1.5 m tall is 20.5 m away from a tower 22 m high, then the angle of elevation of the top of the tower from the eye of the observer is

a) 30° b) 45° c) 60° d) 90°

12. The tops of two towers of heights x and y, standing on a level ground subtend angles of 30° and 60° respectively at the centre of the line joining their feet. Then, x:y is

a) 1:2 b) 2:1 c) 1:3 d) 3:1

13. On the level ground, the angle of elevation of a tower is 30°. On moving 20 m nearer, the angle of elevation is 60°. The height of the tower is

a) 10m b) $10\sqrt{3}$m c) 15m d) 20m

14. In a rectangle, the angle between a diagonal and a side is 30° and the length of this diagonal is 8 cm. The area of the rectangle is

a) 16cm^2 b) $\frac{16}{\sqrt{3}}\text{cm}^2$ c) $16\sqrt{3}\text{cm}^2$ d) $8\sqrt{3}\text{cm}^2$

15. From the top of a hill, the angles of depression of two consecutive km stones due east are found to be 30° and 45°. The height of the hill is

a) $\frac{1}{2}(\sqrt{3}-1)$km b) $\frac{1}{2}(\sqrt{3}+1)$km c) $(\sqrt{3}-1)$km d) $(\sqrt{3}+1)$km

16. If the length of the shadow on the ground of a pole is $\sqrt{3}$ times the height of the pole, then the angle of elevation of the sun is

(a) 30° (b) 45° (c) 60° (d) 90°

17. A kite is flying at a height of 150 m from the ground. It is attached to a string inclined at an angle of 30° to the horizontal. The length of the string is

(a) $100\sqrt{3}$m (b) 300m (c) $150\sqrt{2}$m (d) $150\sqrt{3}$m

18. A ladder 14 m long leans against a wall. If the foot of the ladder is 7 m from the wall, then the angle of elevation of the top of the wall is

(a) 15° (b) 30° (c) 45° (d) 60°

19. A 30m long rope is tightly stretched and tied from the top of pole to the ground. If the rope makes an angle 60° with the ground, the height of the pole is

(a) $10\sqrt{3}$m (b) $30\sqrt{3}$m (c) 15m (d) $15\sqrt{3}$m

20. An observer 1.8m tall stands away from a chimney at a distance of 38.2m along the ground. The angle of elevation of top of chimney from the eyes of observer is 45°. The height of chimney above the ground is

(a) 38.2m (b) 36.4m (c) 40m (d) $(38.2)\sqrt{2}$m

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: If the height and length of the shadow of a man are the same, then the angle of elevation of the Sun is 45°.

Reason: The value of tan 45° = 0.

2. Assertion: Mohini looks at a top of tree and angle made is 45°. She moves 10 m back and again looks at the top of tree, but this time angle made is 30°, then height of the tree is $\frac{10}{\sqrt{3}-1}$ m.

Reason: The angle of elevation and depression can be acute or obtuse angle.

3. Assertion: The height of an observer is h m. He stands on a horizontal ground at a distance $\sqrt{3}h$ m from a vertical pillar of height 4h m. The angle of elevation of the top of the pillar as seen by the observer is $60°$.

Reason : The value of $\tan 60° = \sqrt{3}$.

4. Assertion: If a vertical tower of height 50 m casts a shadow of length $50\sqrt{3}$m, then the angle of elevation of the Sun is 60°.

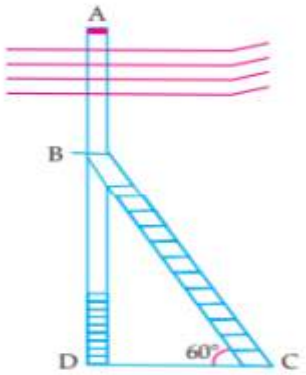
Reason: If the angle of elevation of the Sun decreases, then the length of shadow of a tower increases.

5. Assertion: A ladder 16 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, then the height of the wall is 8 m.

Reason: The value of $\sin 60° = \frac{\sqrt{3}}{2}$.

CASE STUDY BASED QUESTIONS

1. An electrician has to repair an electric fault on the pole of height 5 m. She needs to reach a point 1.3 m below the top of the pole to undertake the repair work (see figure).



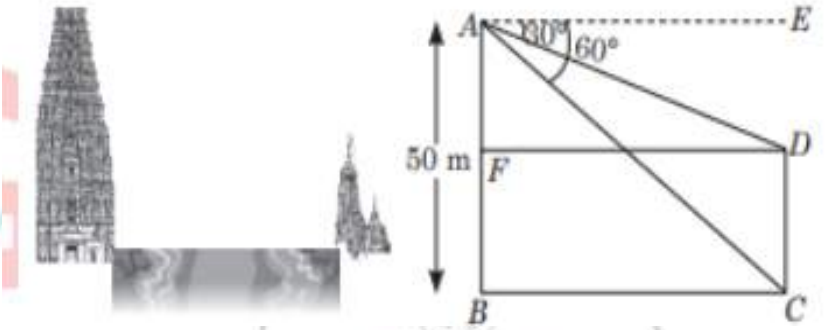
i) What is the length of BD?

ii) What should be the length of ladder, when inclined at an angle of 60° to the horizontal?

iii) How far from the foot of pole should she place the foot of the ladder?

iv) If the horizontal angle is changed to 30°, then what should be the length of the ladder?

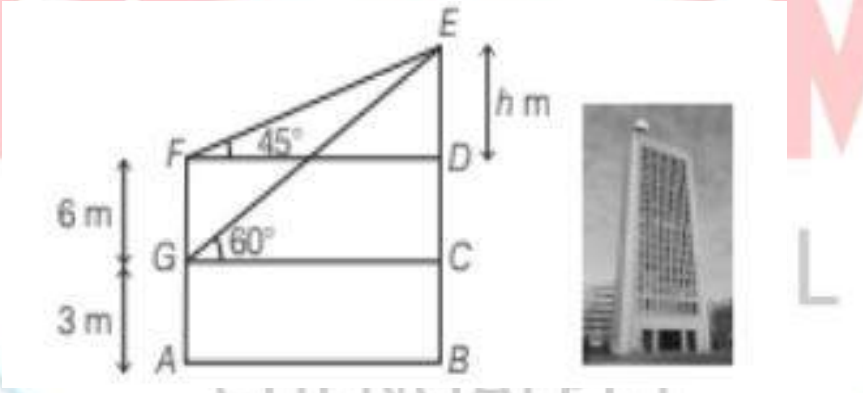
2. There are two temples on each bank of a river. One temple is 50 m high. A man, who is standing on the top of a 50 m high temple, observed from the top that the angle of depression of the top and foot of other temples are 30° and 60° respectively. (Take $\sqrt{3} = 1.73$)



i) Find the width of the river.

ii) Evaluate the height of the other temple.

3. There are two balconies in a house. First balcony is at a height of 3 m above the ground and other balcony is 6 m vertically above the lower balcony. Ankit and Radha are sitting inside the two balconies at points G and F, respectively. At any instant, the angles of elevation of a Parachute from these balconies are observed to be 60° and 45° as shown below.



Based on the above information, answer the following questions.

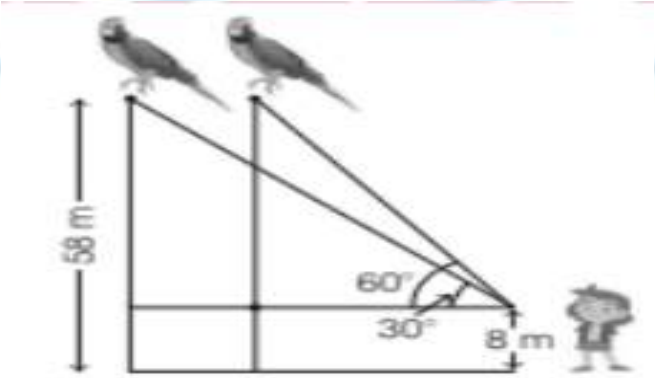
i) Who is closer to the Parachute?

ii) Find the value of DF.

iii) Find the height of the Parachute from the ground.

iv) If the Parachute is moving towards the building, then what you can say about both angles of elevation?

4. A girl 8 m tall spots a parrot sitting on the top of a building of height 58 m from the ground. The angle of elevation of the parrot from the eyes of girl at any instant is 60°. The parrot flies away horizontally in such a way that it remained at a constant height from the ground. After 8 s, the angle of elevation of the parrot from the same point is 30°.



Based on the above information, answer the following questions. (Take $\sqrt{3} = 1.73$)

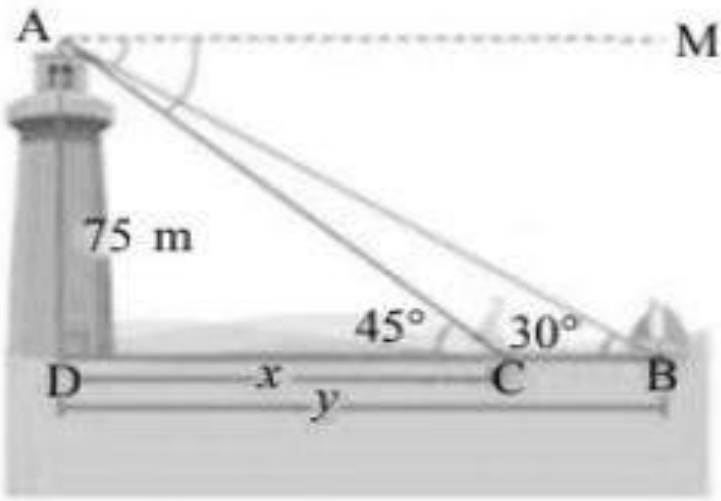
(i) Find the distance of first position of the parrot from the eyes of the girl.

(ii) Find the distance between the girl and the building.

(iii) How much distance covers parrot covers?

(iv) Find the speed of the parrot in 8s.

5. A lighthouse is a tower with a bright light at the top and serves as a navigational aid and also warns ships of dangerous areas. In the given figure, a man on top of a 75 m high lighthouse is observing two ships approaching towards its base. Observe the figure carefully and answer the following questions:



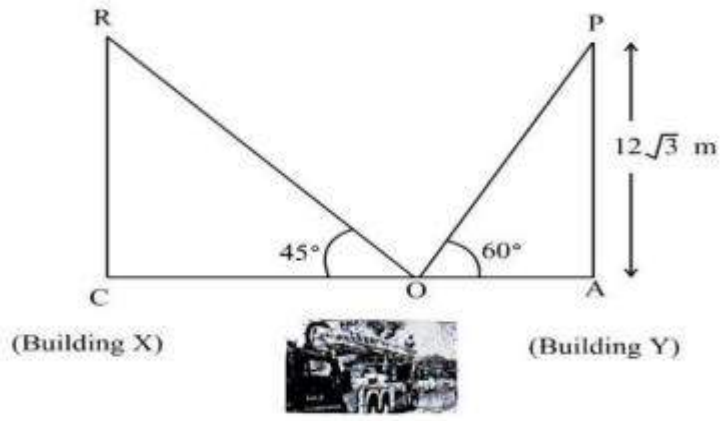
i) Find the distance of ship B from the foot of the lighthouse.

ii) Find the distance of ship C from the foot of the lighthouse.

iii) Determine the distance between the two ships.

iv) What would have been the distance between the two ships if the ships were on either side of the lighthouse?

6. Due to short circuit, a fire has broken out in New Home Complex. Two buildings, namely X and Y have mainly been affected. The fire engine has arrived and it has been stationed at a point which is in between the two buildings. A ladder at point O is fixed in front of the fire engine. The ladder inclined at an angle 60° to the horizontal is leaning against the wall of the terrace (top) of the building Y. The foot of the ladder is kept fixed and after some time it is made to lean against the terrace (top) of the opposite building X at an angle of 45° with the ground. Both the buildings along with the foot of the ladder, fixed at 'O' are in a straight line.



Based on the above given information, answer the following questions:

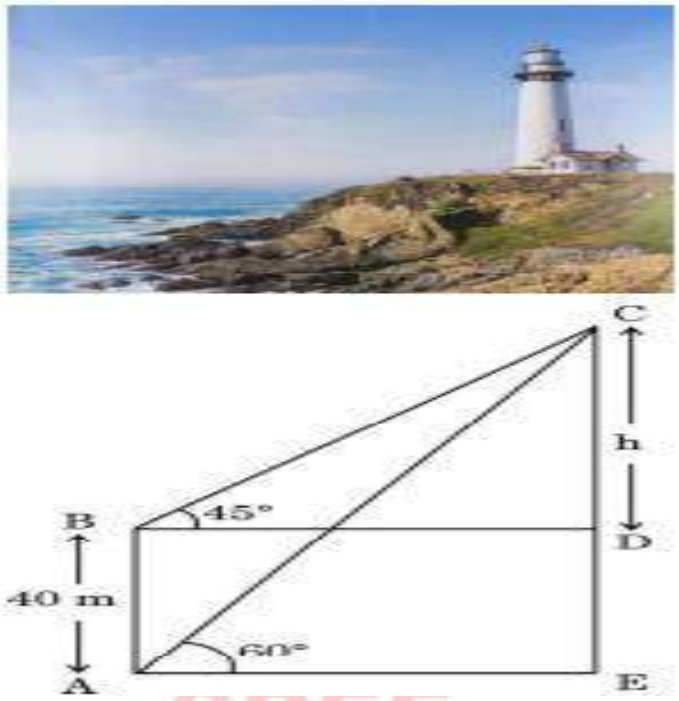
(i) Find the length of the ladder.

(ii) Find the distance of the building Y from point 'O', i.e. OA.

(iii) Find the horizontal distance between the two buildings.

(iv) Find the height of the building X.

7. Amrita stood near the base of a lighthouse, gazing up at its towering height. She measured the angle of elevation to the top and found it to be $60°$. Then, she climbed a nearby observation deck, 40 metres higher than her original position and noticed the angle of elevation to the top of lighthouse to be $45°$.



Based on the above given information, answer the following questions:

(i) If CD is h metres, find the distance BD in terms of ' h '.

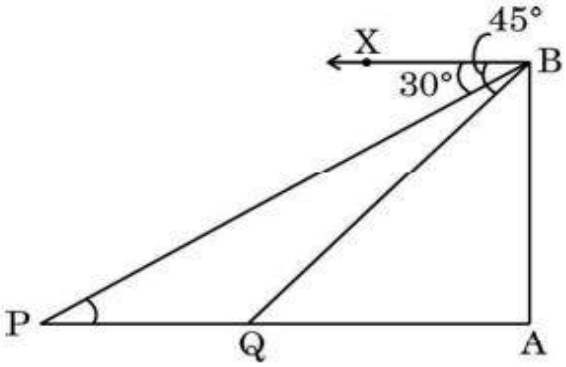
(ii) Find distance BC in terms of ' h '.

(iii) Find the height CE of the lighthouse [Use $\sqrt{3} = 1 \cdot 73$]

(OR)

Find the height CE of the lighthouse [Use $\sqrt{3} = 1 \cdot 73$]

8. A lighthouse stands tall on a cliff by the sea, watching over ships that pass by. One day a ship is seen approaching the shore and from the top of the lighthouse, the angles of depression of the ship are observed to be $30°$ and $45°$ as it moves from point P to point Q. The height of the lighthouse is 50 metres.



Based on the information given above, answer the following questions:

(i) Find the distance of the ship from the base of the lighthouse when it is at point Q, where the angle of depression is 45°.

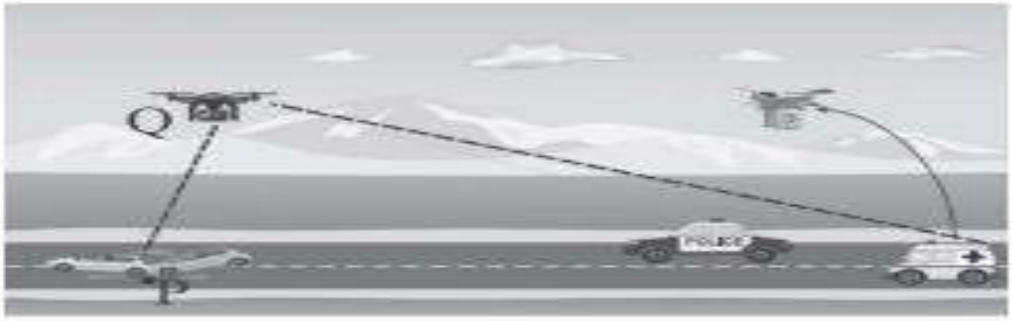
(ii) Find the measures of ∠PBA and ∠QBA.

(iii) Find the distance travelled by the ship between points P and Q.

(OR)

If the ship continues moving towards the shore and takes 10 minutes to travel from Q to A, calculate the speed of the ship in km/h, from Q to A.

9. A drone was used to facilitate movement of an ambulance on the straight highway to a point P on the ground where there was an accident. The ambulance was travelling at the speed of 60km/hr. The drone stopped at point Q, 100m vertically above the point P. The angle of depression of the ambulance was found to be 30°at a particular instant.



Based on the above information, answer the following questions:

(i) Represent the above situation with the help of a diagram.

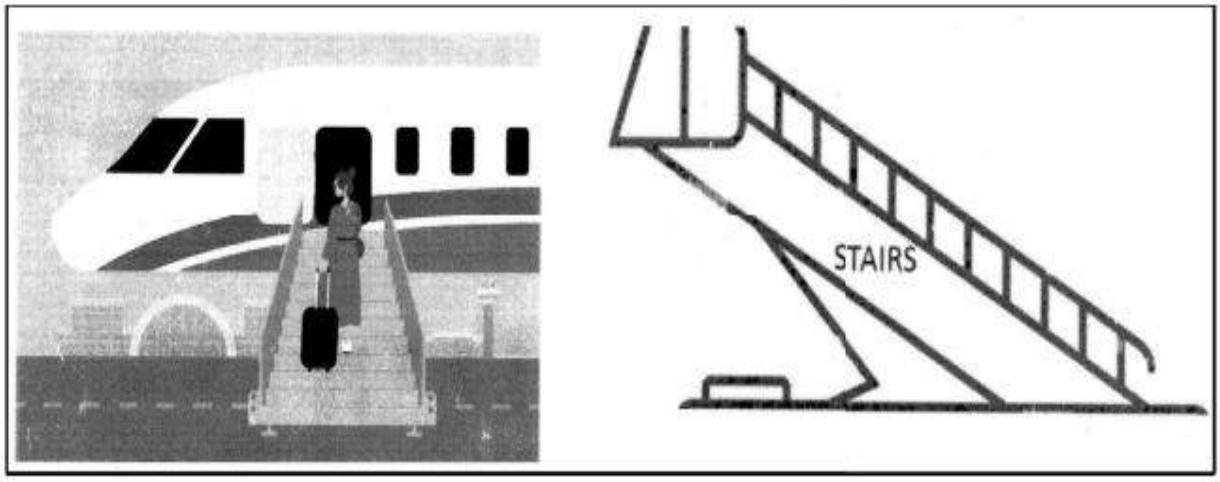
(ii) Find the distance between the ambulance and the site of accident (P) at the particular instant. (Use $\sqrt{3} = 1.73$)

(iii) Find the time (in seconds) in which the angle of depression changes from $30°$ to $45°$.

(OR)

How long (in seconds) will the ambulance take to reach point P from a point T on the highway such that angle of depression of the ambulance at T is $60°$ from the drone?

10. Passenger boarding stairs, sometimes referred to as boarding ramps, stair cars or aircraft steps, provide a mobile means to travel between the aircraft doors and the ground. Larger aircraft have door sills 5 to 20 feet (1 foot = 30cm) high. Stairs facilitate safe boarding and de-boarding.



An aircraft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

Based on given information answer the questions given in part (i) and (ii).

(i) Find the angle at which stairs are inclined to reach the door sill 15feet high above the ground.

(ii) Find the length of stairs used to reach the door sill.

Further answer any one of the following questions:

(iii) If the 20 feet long stairs is inclined at an angle of 60°to reach the door sill, then find the height of the door sill above the ground. (Use $\sqrt{3} = 1.732$)

(OR)

What should be the shortest possible length of stairs to reach the door sill of the plane 20 feet above the ground, if the angle of elevation can exceed 30°? Also, find the horizontal distance of base of stair car from the plane.

VERY SHORT ANSWERS

1. From the top of a 7 m high building the angle of elevation of the top of a tower is 60° and the angle of depression of its foot is 45°. Find the height of the tower.

2. The tops of two towers of height x and y, standing on the ground, subtend the angles of 30° and 60° respectively at the centre of the line joining their feet, then find x:y.

3. From the top of light house, 40 m above the water, the angle of depression of a small boat is 60°. Find how far the boat is from the base of the light house.

4. An observer 1.5 metres tall is 20.5 metres away from a tower 22 metres high. Determine the angle of elevation of the top of the tower from the eye of the observer.

5. The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it is 60°. Find the height of the tower.

6. From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45°, respectively. If the bridge is at a height of 3 m from the banks, find the width of the river.

7. The length of a string between a kite and a point on the ground is 85 m. If the string makes an angle θ with the ground level such that $\tan\theta = \frac{15}{8}$ then find the height of the kite from the ground. Assume that there is no slack in the string.

SHORT ANSWERS

1. From the top of a 120 m high tower, a man observes two cars on the opposite sides of the tower and in straight line with the base of tower with angles of depression as 60° and 45°. Find the distance between two cars.

2. The shadow of a tower at a time is three times as long as its shadow when the angle of elevation of the sun is 60°. Find the angle of elevation of the sun at the time of the longer shadow.

3. The angles of depression of the top and bottom of a 50 m high building from the top of a tower are 45° and 60° respectively. Find the height of the tower and the horizontal distance between the tower and the building. (Use $\sqrt{3} = 1.73$)

4. A man standing on the deck of a ship, which is 10 m above water level, observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of hill as 30°. Find the distance of the hill from the ship and the height of the hill.

5. A 7 m long flagstaff is fixed on the top of a tower standing on the horizontal plane. From point on the ground, the angles of elevation of the top and bottom of the flagstaff are 60° and 45° respectively. Find the height of the tower correct upto one place of decimal. (Use $\sqrt{3} = 1.73$)

6. An observer finds the angle of elevation of the top of a tower from a certain point on the ground is 30°. If the observer moves 20 metres towards base of the tower, the angle of elevation of the top increases by 15°. Find the height of the tower.

7. The lower window of a house is at a height of 2 m above the ground and its upper window is 4 m vertically above the lower window. At certain instant, the angles of elevation of a balloon from these windows are observed to be 60° and 30° respectively. Find the height of the balloon above the ground.

8. A tree, 12 m high, is broken by the wind in such a way that its top touches the ground and makes an angle 60° with the ground. At what height from the bottom, the tree is broken by the wind?

9. Two men on either side of the cliff 80 m high observe the angles of elevation at the top of the cliff to be 30° and 60° respectively. Find the distance between the two men.

10. From a point P on the ground, the angle of elevation of the top of a tower is 30° and that of the top of a flagstaff fixed on the top of the tower is 45°. If the length of the flagstaff is 5 m, find the height of the tower. (Use $\sqrt{3} = 1.73$)

11. A person standing on the bank of the river, observes that the angle subtended by a tree on the opposite bank is 60°. When he retreats 20 m from the bank, he finds the angle to be 30°. Find the height of the tree and breadth of the river.

12. An aeroplane when at a height of 3600 meters, passes vertically over another aeroplane at an instant when their angles of elevation at the same observation point are 45° and 30° respectively. How many metres higher is the first plane from the second?

13. From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower.

14. As observed from the top of a 100 m high lighthouse from the sea level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships. (Use $\sqrt{3} = 1.73$)

15. From a balloon vertically above a straight road, the angles of depression of two cars at an instant are found to be 45° and 60°. If the cars are 100 m apart, find the height of the balloon.

LONG ANSWERS

1. The two palm trees are of equal heights and are standing opposite to each other on either side of the river, which is 80 m wide. From a point O between them on the river the angles of elevation of the top of the trees are 60° and 30°, respectively. Find the height of the trees and the distances of the point O from the trees. (Use $\sqrt{3} = 1.73$)

2. The angles of depression of the top and bottom of a building 50 meters high as observed from the top of a tower are 30° and 60° respectively. Find the height of the tower, and also the horizontal distance between the building and the tower.

3. A vertical tower stands on horizontal plane and is surmounted by a vertical flag-staff of height 6m. The angles at a point on the bottom and top of the flag-staff with the ground are 30° and 45° respectively. Find the height of the tower. (Use $\sqrt{3} = 1.73$)

4. The angle of elevation of the top of a building from the foot of a tower is 30° and the angle of elevation of the top of a tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building.

5. A moving boat observed from the top of a 150 m high cliff, moving away from the cliff. The angle of depression of the boat changes from 60° to 45° in 2 minutes. Find the speed of the boat.

6. The angle of elevation of the top Q of a vertical tower PQ from a point A on the ground is 60° and at a point B, 40 metres vertically above A, the angle of elevation is 45°. Find the height of tower PQ and distance AQ.

7. The angle of elevation of a jet fighter from a point A on the ground is 60°. After a flight of 15 seconds, the angle of elevation changes to 30°. If the jet is flying at a speed of 720 km/hr, find the constant height. ($\sqrt{3} = 1.732$)

8. Amit standing on a horizontal plane, finds a bird flying at a distance of 200 m from him at an elevation of 30°. Deepak standing on the roof of 50 metres high building, finds the angle of elevation of the same bird to be 45°. Both Amit and Deepak are on opposite sides of the bird. Find the distance of bird from Deepak.

9. The angle of elevation θ of a vertical tower from a point on the ground is such that its tangent is $\frac{5}{12}$. On walking 192 metres towards the tower in the same straight line, the tangent of the angle of elevation φ is found to be $\frac{3}{4}$. Find the height of the tower.

10. A fire in a building B is reported on telephone to two fire stations E and F, 10 km apart from each other on a straight road. E observes that the fire is at an angle of 60° to the road and F observes that it is at an angle of 45° to the road. Which station should send its team and how much will this team have to travel? [Take $\sqrt{3} = 1.73$ and $\sqrt{2} = 1.4$].

11. A tower, in a city, is 150 m high and a multi-storeyed hotel at the city centre is 20 m high. The angle of elevation of the top of the tower from the top of hotel is 30°. A building, h metres high, is situated on the straight road connecting the tower with the city centre at a distance of 200 m from the tower. Find the value of h, if the top of the hotel, and top of the building and top of the tower are in a straight line. Also, find the distance of the tower from city centre. ($\sqrt{3} = 1.732$).

12. A man in a boat rowing away from a lighthouse of 100 m high takes 2 minutes to change the angle of elevation of the top of the lighthouse from 60° to 30°. Find the speed of the boat in metres per minute. ($\sqrt{3} = 1.732$).

13. The angle of elevation of an aeroplane from a point A on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. If the plane is flying at a constant height of $3600\sqrt{3}$m, find the speed of the plane in km/h.

14. From a point on the ground, the angle of elevation of the top of tower is observed to be 60°. From a point 40 m vertically above the first point of observation, the angle of elevation of the top of the tower is 30°. Find the height of the tower and its horizontal distance from the point of observation.

15. The angle of elevation of a cloud from a point 60 m above the surface of the water of a lake is 30° and the angle of depression of its shadow in water of the lake is 60°. Find the height of the cloud from the surface of the water.

16. A pole of 6m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point P on the ground is 60° and the angle of depression of the point from the top of the tower is 45°. Find the height of the tower and the distance of point P from the foot of the tower. (Use $\sqrt{3} = 1.73$)

17. From the top of a building 60m high, the angles of depression of top and bottom of the vertical lamp post are observed to be 30^o and 60^o respectively. (i) Find the horizontal distance between the building and the lamp post. (ii) Find the distance between the tops of the building and the lamp post.

18. The angle of elevation of an aircraft from a point A on the ground is 60^o. After a flight of 30 seconds, the angle of elevation changes to 30^o. The aircraft is flying at a constant height of $3500\sqrt{3}$m at a uniform speed. Find the speed of the aircraft.

19. Two ships are sailing in the sea on either side of a lighthouse. The angles of depression to the two ships as observed from the top of the lighthouse are $60°$ and $45°$, respectively. If the distance between the ships is $100\left(\frac{1+\sqrt{3}}{\sqrt{3}}\right)$m, then find the height of the lighthouse.

20. The angles of depression of the top and the bottom of an 8 m tall building from the top of another multi-storeyed building are $30°$ and $45°$, respectively. Find the height of the multi-storeyed building and the distance between the two buildings.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. If the elevation of the sun changes from 30° to 60° then the difference between the lengths of shadows of a pole 15 m high, is

a) 7.5m b) 15m c) $10\sqrt{3}$m d) $5\sqrt{3}$m

2. If the angles of elevation of a tower from two points distant a and b (a > b) from its foot and in the same straight line from it are 30° and 60° respectively, then the height of the tower is:

a) $\sqrt{a+b}$ b) $\sqrt{ab}$ c) $\sqrt{a-b}$ d) $\sqrt{a}+\sqrt{b}$

3. If the height and length of the shadow of a man are the same, then the angle of elevation of the sun is

a) 30° b) 60° c) 45° d) 15°

4. Assertion (A): When we move towards the object, angle of elevation decreases.

Reason (R): As we move towards the object, it subtends large angle at our eye than before.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. An observer, 1.7 m tall, is $20\sqrt{3}$ m away from a tower. The angle of elevation from the eye of observer to the top of tower is 30°. Find the height of tower.

6. From a point P on the ground the angle of elevation of the top of a 10 m tall building is 30°. A flag is hosted at the top of the building and the angle of elevation of the top of the flagstaff from P is 45°. Find the length of the flagstaff. [Take $\sqrt{3} = 1.732$]

7. The angle of elevation of the top of a tower at a point on the ground is 30°. What will be the angle of elevation, if the height of the tower is tripled?

SECTION C

Each carry 3 marks

8. Two pillars of equal heights stand on either side of a road which is 100 m wide. At a point on the road between the pillars, the angles of elevation of the tops of the pillars are 60° and 30°. Find the height of each pillar and position of the point on the road. [Take $\sqrt{3} = 1.732$]

9. A boy standing on a horizontal plane finds a bird flying at a distance of 100 m from him at an elevation of 30°. A girl standing on the roof of 20-metre-high building finds the angle of elevation of the same bird to be 45°. Both the boy and the girl are on opposite sides of the bird. Find the distance of bird from the girl.

SECTION D

Each carry 5 marks

10. The angles of depression of the top and bottom of an 8 m tall building from the top of a multi-storeyed building are 30° and 45° respectively. Find the height of the multi-storeyed building and the distance between the two buildings.

11. The angle of elevations of an aeroplane from a point on the ground is 60°. After a flight of 15 seconds the angle of elevation changes to 30°. If the aeroplane is flying at a constant height of $1500\sqrt{3}$m, find the speed of the aeroplane in km/hr.

SECTION E

12. A cyclist is climbing through a 20 m long rope which is highly stretched and tied from the top of a vertical pole to the ground as shown below.

Based on the above information, answer the following questions.

i) Find the height of the pole, if angle made by rope with the ground level is 60°.

ii) If the angle made by the rope with the ground level is 60°, then find the distance between artist and pole at ground level.

iii) If the angle made by the rope with the ground level is 45°. Find the height of the pole.

iv) If the angle made by the rope with the ground level is 45° and 3 m rope is broken, then find the height of the pole.

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. b) $15\sqrt{3}$ 2. c) $60°$ 3. a) $(\sqrt{3}+1)$x 4. a) 3:1 5. c) $45°$ 6. b) $150\sqrt{3}$ 7. b) $30°$ 8. d) 19m 9. a) 75 m 10. a) 12 m	1. (c) Assertion (A) is true but Reason (R) is false. 2. (c) Assertion (A) is true but Reason (R) is false. 3. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 4. (d) Assertion (A)	1. i) 3.7 m ii) 4.28 m iii) 2.14m iv) 7.4m 2. i) 28.90m ii) 33.33 m 3. i) Radha is closer to the Parachute because the angles of elevation of Parachute from these balconies are observed to be $45°$. So, Radha is closer to the Parachute than Ankit. ii) h m iii) $3(4+\sqrt{3})$m iv) (c) If the Parachute is moving towards the building, then both angles	1. $7(1+\sqrt{3})$m 2. 1: 3 3. $\frac{40\sqrt{3}}{3}$ m 4. $45°$ 5. 34.64 m 6. $3(\sqrt{3}+1)$m 7. 75 m	1. 189·28 m. 2. $\theta = 30°$ 3. 118.25 m. 4. 40m 5. 9.6 m 6. $10(\sqrt{3}+1)$m 7. 8 m 8. 5.52 m 9. 184.8 m 10. 6.8 m	1. 20 m and 60 m 2. 75m and 43.30 m 3. 8.19 m. 4. $\frac{50}{3}$ 5. 19.02 km/h 6. 109.3 metres. 7. 2598 m 8. $50\sqrt{2}$m 9. 180 m. 10. E must send its

11. b) 45° 12. c) 1:3 13. b) $10\sqrt{3}$m 14. c) $16\sqrt{3}$cm^2 15. b) $\frac{1}{2}(\sqrt{3}+$ 1)km 16. (a) 30° 17. (b) 300m 18. (d) 60° 19. (d) $15\sqrt{3}$m 20. (c) 40m	is false but Reason (R) is true. 5. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).	of elevation will decrease. 4. i) $\frac{100}{\sqrt{3}}$m ii) $\frac{50}{\sqrt{3}}$m iii) 57.80m iv) 7 225. m/s 5. i) $75\sqrt{3}$m ii) 75 m iii) $75(\sqrt{3}-1)$m iv) $75(\sqrt{3}+1)m$ 6. i) $24m$ ii) $12m$ iii) $12(1+\sqrt{2})m$ iv) $12\sqrt{2}$m 7. (i) h m		11. 17.32 m 12. 1521.147 m 13. $7(\sqrt{3}+$ 1) metres. 14. 73.2 m 15. $50(3+\sqrt{3})$m	team to B and this team will have to travel 7.3 km to reach B. 11. 34.5 metres & 225.16 metres. 12. 57.74 m/min 13. 864 km/h 14. 60 m 15. 120 m. 16. h = d = 8.19m. 17. 34.64m & 20m 18. $\frac{700}{3}$ or 233.3m/

		(ii) $\sqrt{2}$h m (iii) 94.6m (OR) 50m 8. (i) 50m (ii) 60° & 45° (iii) $50(\sqrt{3}-1)$m (OR) 0.3km/hr 9. (ii) 173m (iii) $\frac{219}{50}$ or 4.4 seconds (OR) $2\sqrt{3}$ or 3.5 seconds 10. (i) 45° (ii) $15\sqrt{2}$ ft. or 21.21 ft. approx			s approx. 19. 100m 20. $(12+4\sqrt{3})$m

		(iii) 17.32 feet (OR) $20\sqrt{3}$ ft. or 34.64 ft. approx			

UNIT TEST

1. c) $10\sqrt{3}$m

2. b) $\sqrt{ab}$

3. b) 60°

4. (d) Assertion (A) is false but reason (R) is true.

5. 21.7m

6. 7.32 m

7. 60°

8. 43.3m

9. $30\sqrt{2}$

10. 18.93 m

11. 720 km/hr.

12. i) $10\sqrt{3}$m ii) 10m iii) $10\sqrt{2}$m iv) $\frac{17}{\sqrt{2}}$m

CHAPTER 10 – CIRCLES

Key Concepts

Circle

A circle may be regarded as a collection of points in a plane at a fixed distance from a fixed point. The fixed point is called the centre of the circle. The fixed distance between the centre of the circle and the circumference, is called radius.

The perimeter of the circle is referred to as the circumference of the circle.

Tangent

A tangent to a circle is a line that intersects the circle only at one point.

Point of Contact

The common point of the circle and the tangent is called point of contact.

Length of Tangent

The length of the segment of the tangent from the external point P and the point of contact with the circle is called the length of the tangent.

Secant

A line, which intersects the circle in two distinct points, is called a secant.

Chord

A chord of a circle is a line segment joining any two points on the circumference.

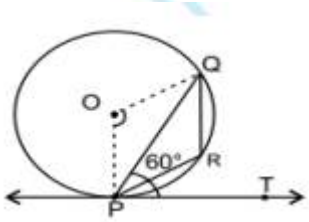
Results

- A tangent to a circle is a special case of the secant when the two end points of the corresponding chord coincide.
- There is no tangent to a circle passing through a point lying inside the circle.
- There are exactly two tangents to a circle through a point outside the circle.
- At any point on the circle there can be one and only one tangent.
- The tangent at any point of a circle is perpendicular to the radius through the point of contact.

- The lengths of the tangents drawn from an external point to a circle are equal.
- The centre lies on the bisector of the angle between the two tangents.
- There can be infinite number of chords passing through a point which is inside the circle.
- Tangents drawn at the end points of a diameter of a circle are parallel.

MULTIPLE CHOICE QUESTIONS

1. In the figure, PQ is a chord of circle and PT is the tangent at P such that ∠QPT = 60°, then ∠POQ is equal to:



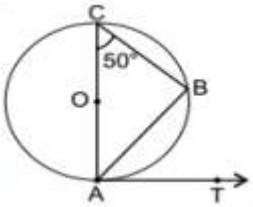
a) 135° b) 150°

c) 120° d) 110°

2. If the radii of two concentric circles are 4 cm and 5 cm, then the length of each chord of one circle which is tangent to the other circle is:

a) 3 cm b) 6 cm c) 9 cm d) 1 cm

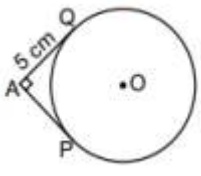
3. In the figure, AB is a chord of circle and AOC is its diameter such that ∠ACB = 50°. If AT is the tangent to the circle at the point A, then ∠BAT is equal to:



a) 65° b) 60°

c) 50° d) 40°

4. In the figure, the pair of tangents AP and AQ drawn from an external point A to a circle with centre O are perpendicular to each other and length of each tangent is 5 cm. Then radius of the circle is:



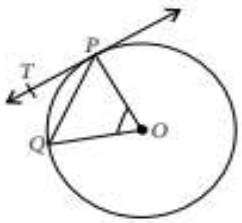
a) 10 cm b) 7.5 cm

c) 5 cm d) 2.5 cm

5. If tangents PA and PB from a point P to a circle with centre O are inclined to each other at an angle of 80°, then ∠POA is equal to:

a) 50° b) 60° c) 70° d) 80°

6. In the given figure, O is the centre of a circle, PQ is a chord and PT is the tangent at P, ∠POQ = 70°, then ∠TPQ is equal to



a) 55° b) 70°

c) 45° d) 35°

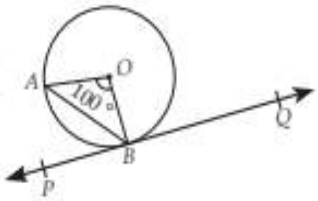
7. A chord of a circle of radius 10 cm subtends a right angle at its centre. The length of the chord (in cm) is

a) $5\sqrt{2}$ b) $10\sqrt{2}$ c) $\frac{5}{\sqrt{2}}$ d) $10\sqrt{3}$

8. The length of the tangent drawn from a point 8 cm away from the centre of circle of radius 6 cm is

a) $\sqrt{7}$cm b) $2\sqrt{7}$cm c) 10cm d) 5cm

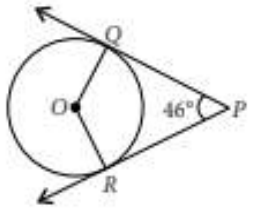
9. In figure, PQ is tangent to the circle with centre at O, at the point B. If ∠AOB = 100°, then ∠ABP is equal to



a) 50° b) 40°

c) 60° d) 80°

10. In the given figure, PQ and PR are two tangents to a circle with centre O. If ∠QPR = 46°, then ∠QOR is



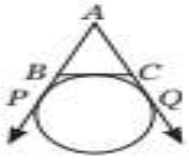
a) 67° b) 134°

c) 44° d) 46°

11. From a point Q, the length of the tangent to a circle is 12 cm and the distance of Q from the centre is 15 cm. The radius of the circle is

a) 9 cm b) 12 cm c) 15 cm d) 24.5 cm

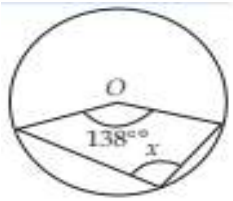
12. In the given figure, AP, AQ and BC are tangents to the circle. If AB = 5 cm, AC = 6 cm and BC = 4 cm, then the length of AP (in cm) is



a) 7.5 b) 15

c) 10 d) 9

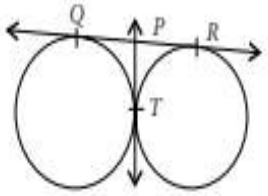
13. In the diagram, O is the centre of the circle, then the value of x is



a) 111° b) 123°

c) 69° d) 49°

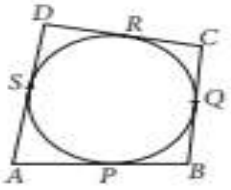
14. In the given figure, QR is a common tangent to the given circles touching externally at the point T. The tangent at T meets QR at P. If PT = 3.8cm, then the length of QR is



a) 3.8 b) 7.6

c) 5.7 d) 1.9

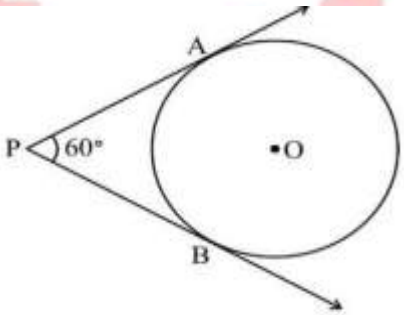
15. In the given figure, a quadrilateral ABCD is drawn to circumscribe a circle such that its sides AB, BC, CD and DA touch the circle at P, Q, R and S respectively. If AB = x cm, BC = 7cm, CR = 3cm and AS = 5cm, then x is



a) 10 b) 9

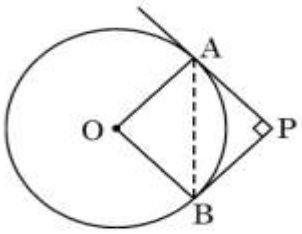
c) 8 d) 7

16. In the given figure, PA and PB are two tangents drawn to the circle with centre O and radius 5 cm. If ∠APB = 60°, then the length of PA is



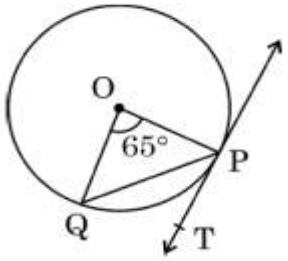
(a) $\frac{5}{\sqrt{3}}$ cm (b) $5\sqrt{3}$cm (c) $\frac{5}{\sqrt{3}}$ cm (d) 10cm

17. In the given figure, tangents PA and PB to the circle centred at O, from point P are perpendicular to each other. If PA = 5cm, then length of AB is



(a) 5cm (b) $5\sqrt{2}$cm (c) $2\sqrt{5}$cm (d) 10cm

18. In the given figure, PT is tangent to a circle with centre O. Chord PQ subtends an angle of 65° at the centre. The measure of ∠QPT is

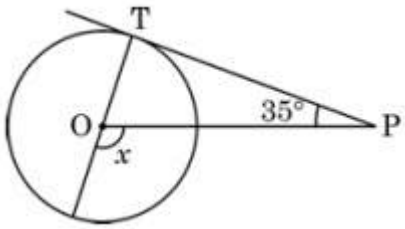


(a) 65° (b) 57.5° (c) 67.5° (d) 32.5°

19. Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is

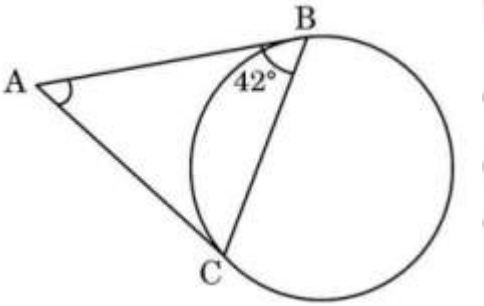
(a) 4 (b) 3 (c) 2 (d) 1

20. In the given figure, if PT is a tangent to a circle with centre O and ∠TPO = 35°, then the measure of ∠x is



(a) 110° (b) 115° (c) 120° (d) 125°

21. In the given figure, AB and AC are tangents to the circle. If ∠ABC = 42°, then the measure of ∠BAC is

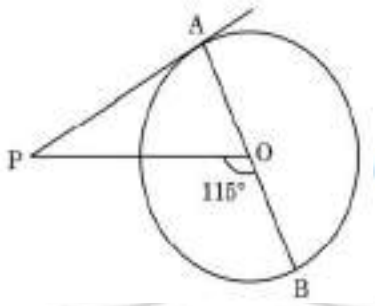


(a) 96° (b) 42° (c) 106° (d) 86°

22. The tangents drawn at the extremities of the diameter of a circle are always

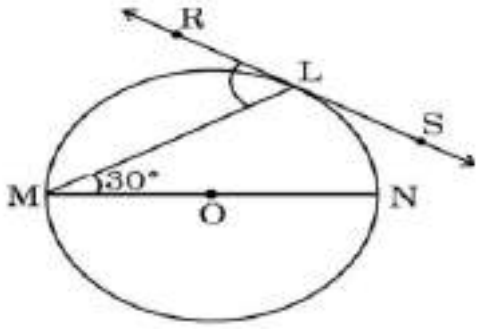
(a) parallel (b) perpendicular (c) equal (d) intersecting

23. In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle POB = 115°$, then $\angle APO$ is equal to



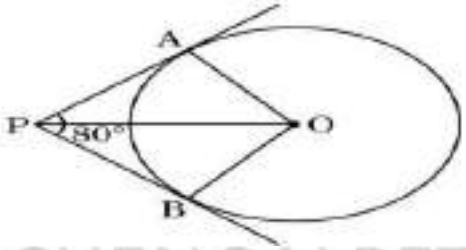
(a) $25°$ (b) $65°$ (c) $90°$ (d) $35°$

24. In the given figure, RS is the tangent to the circle at the point L and MN is the diameter. If $\angle NML = 30°$, then $\angle RLM$ is



(a) $30°$ (b) $60°$ (c) $90°$ (d) $120°$

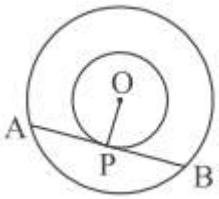
25. If tangents PA and PB drawn from an external point P to the circle with centre O are inclined to each other at an angle of $80°$ as shown in the given figure, then the measure of $\angle POA$ is



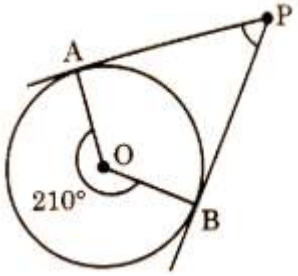
(a) $40°$ (b) $50°$ (c) $60°$ (d) $80°$

26. In the adjoining figure, AB is the chord of the larger circle touching the smaller circle. The centre of both the circles is O. If AB = 2r and OP = r, then the radius of larger circle is

(a) 2r (b) 3r (c) $2\sqrt{2}r$ (d) $\sqrt{2}r$

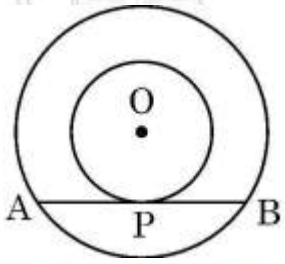


27. In the adjoining figure, PA and PB are tangents to a circle with centre O. The measuring of angle APB is



(a) 210° (b) 150° (c) 105° (d) 30°

28. In the adjoining figure, the sum of radii of two concentric circles is 16cm. The length of chord AB which touches the inner circle at P is 16cm. The difference of the radii of the given circles is



(a) 8cm (b) 4cm (c) 2cm (d) 3cm

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

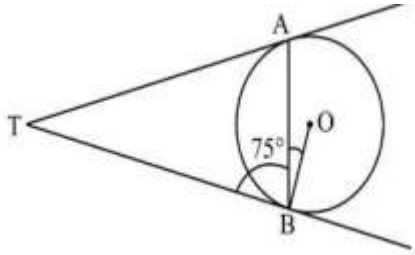
(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: TA and TB are two tangents drawn from an external point T to a circle with centre 'O'. If ∠TBA = 75° then ∠ABO = 25°.



Reason: The tangent drawn at any point of a circle is perpendicular to the radius through the point of contact.

2. Assertion: The tangent drawn at the end points of a diameter of a circle are parallel.

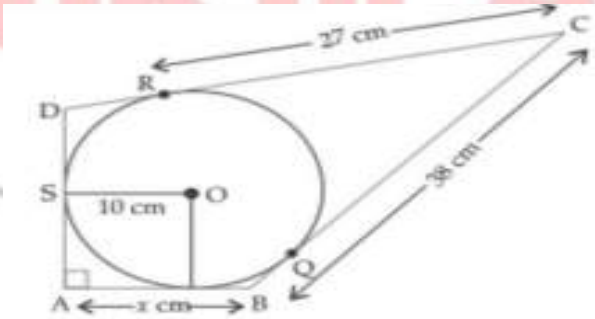
Reason: Diameter of a circle is the longest chord.

3. Assertion: Tangents drawn at the end points of a diameter of a circle are always parallel to each other.

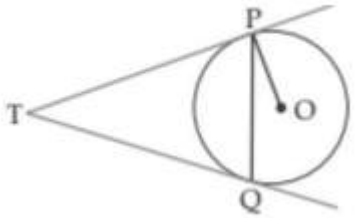
Reason: The lengths of tangents drawn to a circle from a point outside the circle are always equal.

VERY SHORT ANSWERS

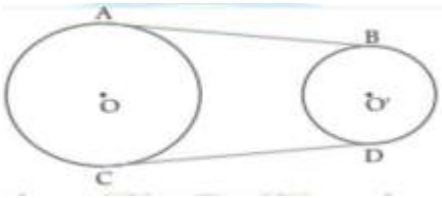
1. In the figure, quadrilateral ABCD is circumscribing a circle with centre O and AD ^ AB. If radius of incircle is 10 cm, then find the value of x.



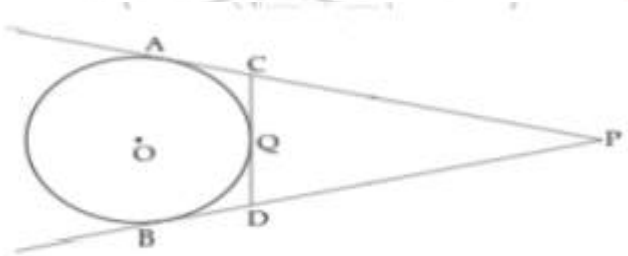
2. In the given figure, two tangents TP and TQ are drawn to circle with centre O from an external point T. Prove that ∠PTQ = 2∠OPQ.



3. In the fig, AB and CD are common tangents to two circles of unequal radii. Prove that AB = CD.

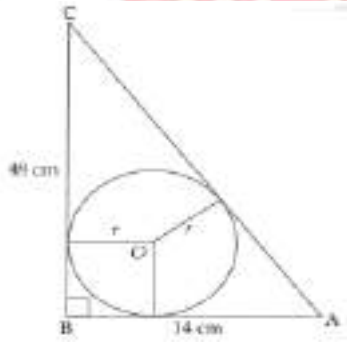


4. In the given figure, PA and PB are tangents to the circle from an external point P. CD is another tangent touching the circle at Q. If PA = 12 cm, QC = DQ = 3 cm, then find PC + PD.



5. Prove that the tangents drawn at the end points of a chord of a circle make equal angles with the chord.

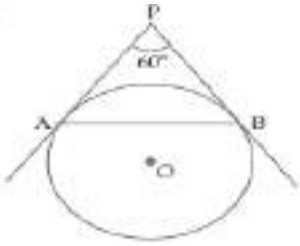
6. In Fig, ABC is a triangle in which ∠B = 90°, BC = 48 cm and AB = 14 cm. A circle is inscribed in the triangle, whose centre is O. Find radius of incircle.



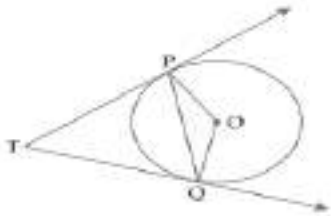
7. Prove that the tangents drawn at the end points of a chord of a circle make equal angles with the chord.

8. In given figure, O is the centre of the circle and LN is a diameter. If PQ is a tangent to the circle at K and $\angle KLN = 30°$, find ∠PKL.

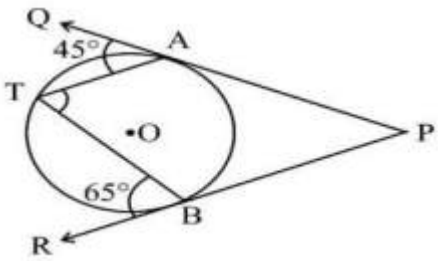
9. In Fig., AP and BP are tangents to a circle with centre O, such that AP = 5 cm and ∠APB = 60°. Find the length of chord AB.



10. In the given figure PQ is chord of length 6 cm of the circle of radius 6 cm. TP and TQ are tangents to the circle at points P and Q respectively. Find ∠PTQ.

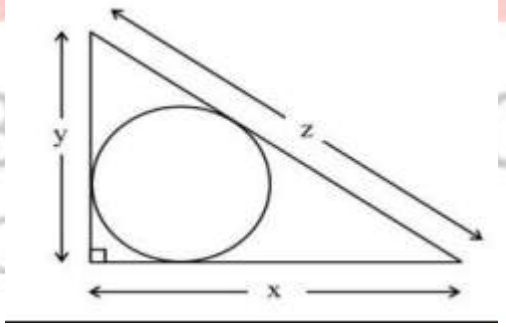


11. In the given figure, PAQ and PBR are tangents to the circle with centre 'O' at the points A and B respectively. If T is a point on the circle such that ∠QAT = 45° and ∠ TBR = 65°, then find ∠ATB.

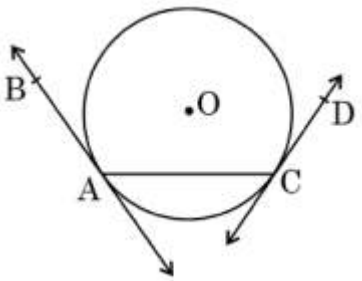


12. Two concentric circles have radii 4 cm and 5 cm. XY is a chord of the outer circle which touches the inner circle. Find the length of XY.

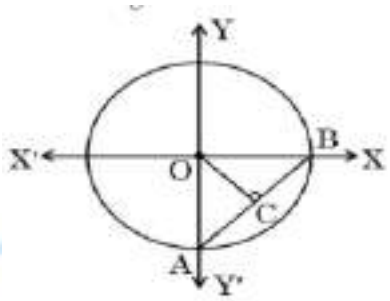
13. In the given figure, x, y and z are the sides of a right triangle, where z is the hypotenuse. Prove that the radius r of the circle which touches the sides of the triangle is given by r = $\frac{x+y-z}{2}$.



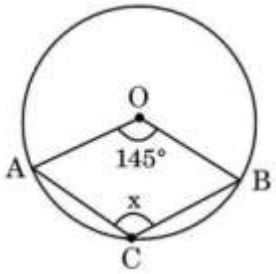
14. In the given figure, AB and CD are tangents to circle centred at O. Is ∠BAC = ∠DCA?Justify your answer.



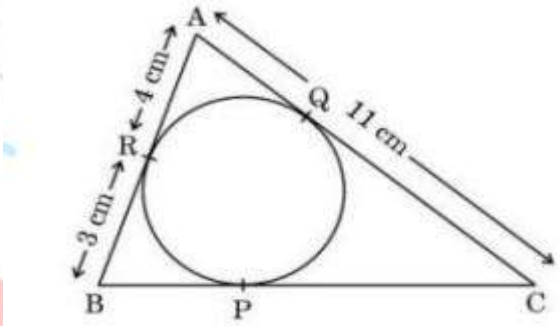
15. In the given figure, a circle centred at origin O has radius 7cm, OC is median of ΔOAB. Find the length of median OC.



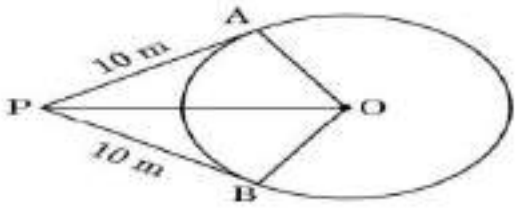
16. In the given figure, O is the centre of the circle. If $\angle AOB = 145°$, then find the value of x.



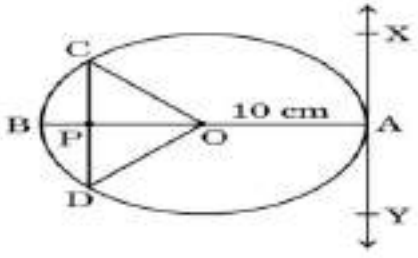
17. In the given figure, ΔABC is circumscribing a circle. Find the length of BC, if AR = 4cm, BR = 3cm and AC = 11cm.



18. A person is standing at P outside a circular ground at a distance of 26 m from the centre of the ground. He found that his distances from the points A and B on the ground are 10 m (PA and PB are tangents to the circle). Find the radius of the circular ground.



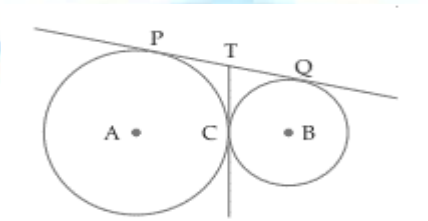
19. At point A on the diameter AB of a circle of radius 10 cm, tangent XAY is drawn to the circle. Find the length of the chord CD parallel to XY at a distance of 16 cm from A.



SHORT ANSWERS

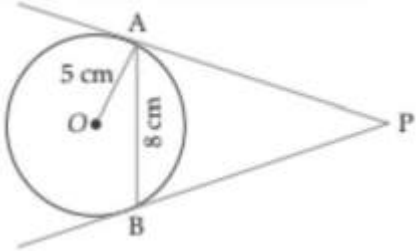
1. Prove that the parallelogram circumscribing a circle is a rhombus.

2. In given Fig., two circles touch each other at the point C. Prove that the common tangent to the circles at C, bisects the common tangent at P and Q.

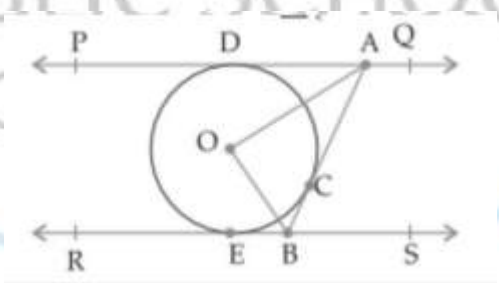


3. If a circle touches the side BC of a triangle ABC at P and extended sides AB and AC at Q and R respectively, prove that AQ = $\frac{1}{2}(AB + BC + CA)$.

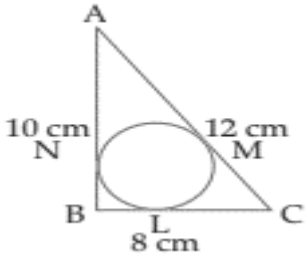
4. In figure AB is a chord of length 8 cm of a circle of radius 5 cm. The tangents to the circle at A and B intersect at P. Find the length of AP.



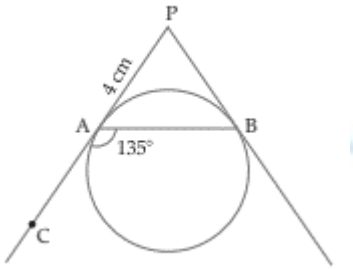
5. In Figure PQ and RS are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting PQ at A and RS at B. Prove that ∠AOB = 90°.



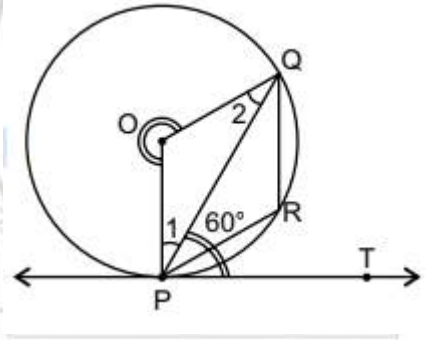
6. In the given figure a circle is inscribed in a ΔABC having sides BC = 8 cm, AB = 10 cm and AC = 12cm. Find the length BL, CM and AN.



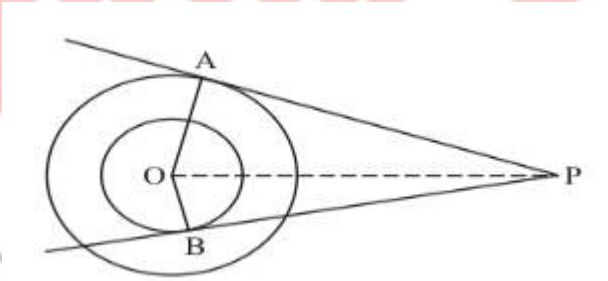
7. In the given figure, PA and PB are tangents to a circle from an external point P such that PA = 4 cm and ∠BAC = 135°. Find the length of chord AB.



8. In the given figure, PQ is a chord of a circle and PT is the tangent at P such the ∠QPT = 60°. Find ∠PRQ.



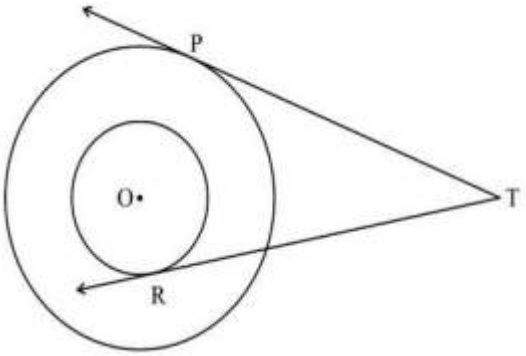
9. In the given figure, there are two concentric circles with centre O and radii 5 cm and 3 cm. PA and PB are tangents to these circles from an external point P. If PA = 12 cm, then find the length of PB.



10. The tangents PA and PB are drawn to the circle with centre O, such that ∠APB=120^{o}. Prove that OP = 2AP.

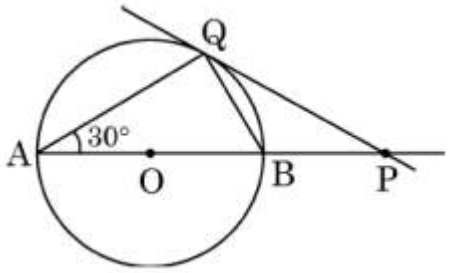
11. If a hexagon PQRSTU circumscribes a circle, prove that PQ + RS + TU = QR + ST + UP.

12. In the given figure, two concentric circles have radii 3 cm and 5 cm. Two tangents TR and TP are drawn to the circles from an external point T such that TR touches the inner circle at R and TP touches the outer circle at P. If TR = $4\sqrt{10}$cm, then find the length of TP.

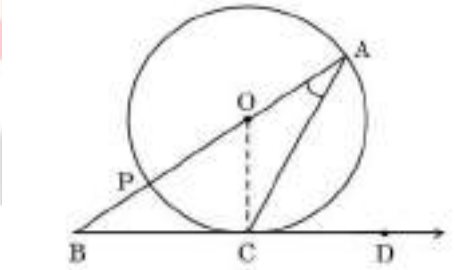


13. A circle with centre O and radius 8cm is inscribed in a quadrilateral ABCD in which P, Q, R, S are the points of contact as shown. If AD is perpendicular to DC, BC = 30cm and BS = 24cm, then find the length DC.

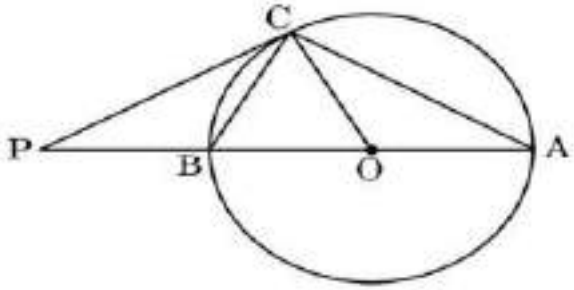
14. In the given figure, PQ is tangent to a circle centred at O and $\angle BAQ = 30°$; show that BP = BQ.



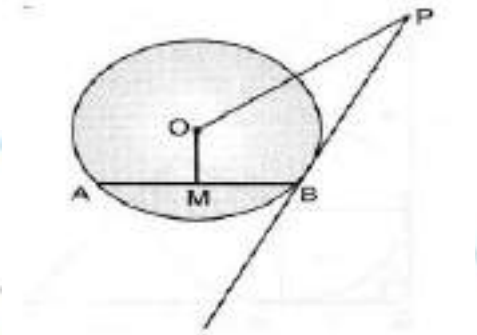
15. In the given figure, O is the centre of the circle and BCD is tangent to it at C. Prove that $\angle BAC + \angle ACD = 90°$.



16. In the given figure, PC is a tangent to the circle at C. AOB is the diameter which when extended meets the tangent at P. Find $\angle CBA$ and $\angle BCO$, if $\angle PCA = 110°$.



17. In the given figure, PB is a tangent to the circle with centre O at B. AB is a chord of the circle of length 24 cm and at a distance of 5 cm from the centre of the circle. If the length PB of the tangent is 20 cm, find the length of OP.



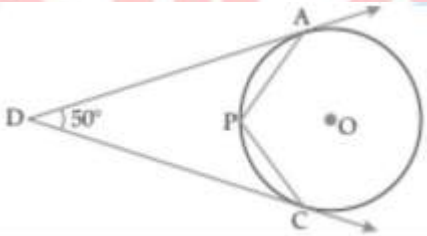
18. Rectangle ABCD circumscribe the circle of radius 10cm. Prove that ABCD is a square. Hence, find the perimeter ABCD.

LONG ANSWERS

1. Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

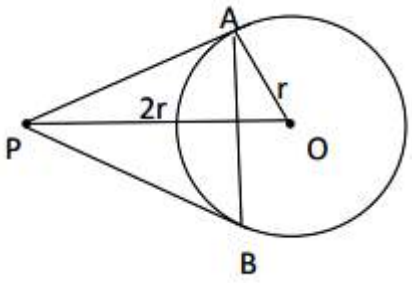
2. a, b and c are the sides of a right triangle, where c is the hypotenuse. A circle, of radius r, touches the sides of the triangle. Prove that $r = \frac{a+b-c}{2}$.

3. In the given figure, O is the centre of the circle. Determine ∠APC, if DA and DC are tangents and ∠ADC = 50°.

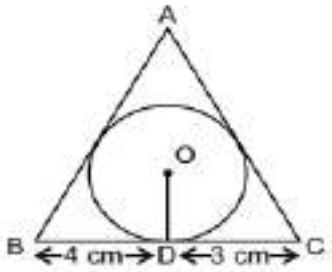


4. PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q intersect at a point T. Find the length of TP.

5. From a point P, two tangents PA and PB are drawn to a circle C(O, r). If OP = 2r, show that ΔAPB is equilateral.



6. In the figure, a triangle ABC is drawn to circumscribe a circle of radius 2 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 4 cm and 3 cm respectively. If area of $\Delta ABC = 21\ cm^2$, then find the lengths of sides AB and AC.



UNIT TEST

Duration: 1 hour **Marks: 25**

SECTION A

Each carry 1 mark

1. How many tangents can a circle have from a point lying inside the circle?

a) 2 b) infinitely many c) 1 d) none of these

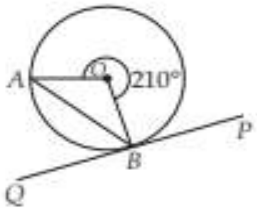
2. Two concentric circles of radii a and b where a > b, are given, the length of a chord of the larger circle which touches the other circle is

a) $\sqrt{a^2 - b^2}$ b) $2\sqrt{a^2 - b^2}$ c) $\sqrt{a^2 + b^2}$ d) $2\sqrt{a^2 + b^2}$

3. If AB is chord of a circle with centre O & PQ is a tangent to the circle at B with reflex $\angle AOB = 210°$, then $\angle ABQ =$

a) 105° b) 150°

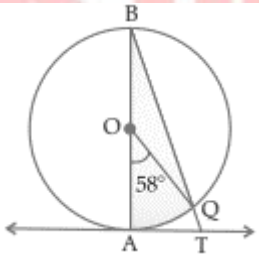
c) 210° d) 75°



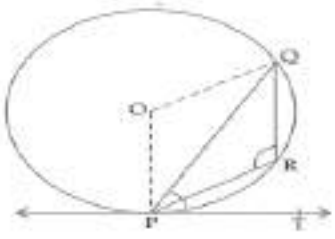
SECTION B

Each carry 2 marks

4. In given figure, AB is the diameter of a circle with center O and AT is a tangent. If ∠AOQ = 58°, find ∠ATQ.



5. In figure, PQ is a chord of a circle centre O and PT is a tangent. If ∠QPT = 60°, find ∠PRQ.



6. A circle touches all the four sides of a quadrilateral ABCD. Prove that AB + CD = BC + DA.

SECTION C

Each carry 3 marks

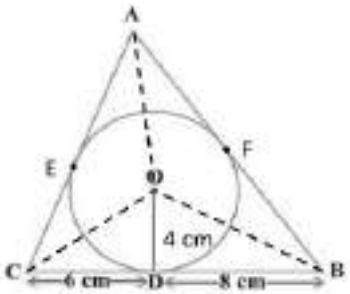
7. Prove that the lengths of two tangents drawn from an external point to a circle are equal.

8. Two tangents PQ and PR are drawn from an external point to a circle with centre O. Prove that QORP is a cyclic quadrilateral.

SECTION D

Each carry 5 marks

9. A ΔABC is drawn to circumscribe a circle of radius 4 cm such that segments BD and DC into which BC is divided are of lengths 8 cm and 6 cm respectively. Find the sides AB and AC.



10. Two tangents making an angle of 120° with each other are drawn to a circle of radius 6 cm. Find the length of each tangent.

ANSWERS

MCQ	A – R Questions	Very Short Answers	Short Answers	Long Answers
1. c) 120° 2. b) 6 cm 3. c) 50° 4. c) 5 cm 5. a) 50° 6. d) 35° 7. b) $10\sqrt{2}$ 8. b) $2\sqrt{7}$cm 9. a) 50° 10. b) 134° 11. a) 9 cm	1. (d) Assertion (A) is not true but Reason (R) is true. 2. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanantion for Assertion. 3. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation for	1. 21 cm 2. Proof 3. Proof 4. 9cm 5. Proof 6. 6cm 7. Proof 8. 60° 9. 5cm 10. 120°	1. Proof 2. Proof 3. Proof 4. $6\frac{2}{3}$cm 5. Proof 6. 3cm, 5cm and 7cm 7. $4\sqrt{2}$cm 8. 120° 9. $4\sqrt{10}$cm 10. OP = 2AP	1. Proof 2. Proof 3. 115° 4. $\frac{20}{3}$cm 5. Proof 6. 7.5cm and 6.5cm

12. a) 7.5 13. a) 111° 14. b) 7.6 15. b) 9 16. (b) $5\sqrt{3}$cm 17. (b) $5\sqrt{2}$cm 18. (d) 32.5° 19. (c) 2 20. (d) 125° 21. (a) 96° 22. (a) parallel	Assertion.	11. 70° 12. 6cm 13. Proof 14. $\angle BAC = \angle DCA$ 15. $\frac{7\sqrt{2}}{2}$cm 16. $x = 107.5^\circ$ 17. 10cm 18. 24m 19. 16cm	11. Proof 12. 12cm 13. 14cm 14. Proof 16. $\angle OBC = \angle OCB = 70^\circ$ 17. $\sqrt{569}$cm 18. 80cm	

23. (a) 25° 24. (b) 60° 25. (b) 50° 26. (d) $\sqrt{2}r$ 27. (d) 30° 28. (b) 4cm				

UNIT TEST

1. d) none of these

2. b) $2\sqrt{a^2 - b^2}$

3. d) 75°

4. 61°

5. 120°

6. AB + CD = BC + DA.

7. Proof

8. Proof

9. $\angle AOB = 90°$.

10. $2\sqrt{3}$cm

CHAPTER 11 – AREAS RELATED TO CIRCLES

Key Concepts

Circle

A circle may be regarded as a collection of points in a plane at a fixed distance from a fixed point. The fixed point is called the centre of the circle. The fixed distance between the centre of the circle and the circumference, is called radius.

A tangent to a circle is a line that intersects the circle only at one point.

The perimeter of the circle is referred to as the circumference of the circle.

Chord

A chord of a circle is a line segment joining any two points on the circumference.

Arc

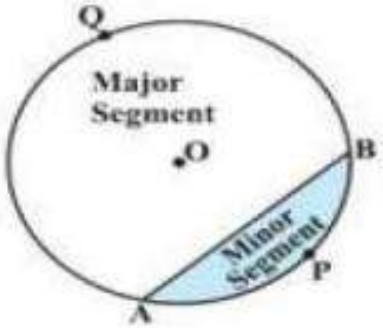
An arc of a circle is a part of the circumference.

Diameter

A diameter of a circle is a chord which passes through the centre of the circle.

Segment of a Circle

The portion (or part) of a circular region enclosed between a chord and the corresponding arc is called a segment of the circle.



Sector of a Circle

The portion (or part) of the circular region enclosed by the two radii and the corresponding arc is called a sector of the circle.

Perimeter of Circle

P = 2πr units

Area of Circle

A = πr^2 sq. units

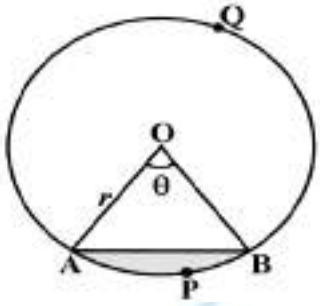
Perimeter of Semi-Circle

P = πr + d (or) r(π + 2) units

Area of Semi-Circle

A = $\frac{1}{2}\pi r^2$ sq. units

Area of Sector and Length of Sector



Area of the sector of angle θ = $\frac{\theta}{360^o}$ x πr^2 sq. units

Length of an arc of a sector of angle θ = $\frac{\theta}{360^o}$ x 2πr units.

Area of Minor Segment APB = Area of the sector OAPB – Area of ΔOAB

Area of Minor Segment AQB = Area of Circle – Area of minor segment APB

Area of Major sector OAQB = Area of circle – Area of minor sector OAPB

Area of a ring or Area of enclosed between two concentric circles

A = π(R + r)(R – r) sq.units.

Results

- The distance moved by a rotating wheel in one revolution is equal to the circumference of the wheel.
- The number of revolutions completed by a rotating wheel in one minute = $\frac{Distance\ moved\ in\ one\ minute}{Circumference\ of\ the\ wheel}$.
- The sum of the arcs of major and minor sectors of a circle is equal to the circumference of the circle.
- The sum of the areas of major and minor sectors of a circle is equal to the area of the circle.
- Angle described by minute hand in 60 minutes = 360°.
- Angle described by minute hand in one minute = 6°.
- Angle described by hour hand in 12 hours = 360°.
- Angle described by hour hand in 1 hour = 30°.
- Angle described by hour hand in one minute = $\frac{1}{2}°$.

Some Important Formulae

(i) Area of triangle $= \frac{1}{2} \times$ Base $\times$ Height

(ii) Area of equilateral triangle $= \frac{\sqrt{3}}{4} \times (\text{Side})^2$

(iii) Area of rectangle = Length $\times$ Breadth

(iv) Area of square $= (\text{Side})^2$

MULTIPLE CHOICE QUESTIONS

1. Perimeter of a sector of a circle whose central angle is 90° and radius 7 cm is

a) 35 cm b) 25 cm c) 77 cm d) 7 cm

2. The area of a circle that can be inscribed in a square of side 10 cm is

a) 40π cm² b) 30π cm² c) 100π cm² d) 25π cm²

3. In a circle of diameter 42 cm, if an arc subtends an angle of 60° at the centre, where $\pi = \frac{22}{7}$ then length of arc is

a) 11 cm b) $\frac{22}{7}$ cm c) 22 cm d) 44 cm

4. The perimeter of a sector of radius 5.2 cm is 16.4 cm, the area of the sector is

a) 31.2 cm² b) 15 cm² c) 15.6 cm² d) 16.6 cm²

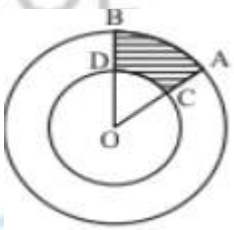
5. The diameter of a circle whose area is equal to sum of the areas of the two circles of radii 40 cm and 9 cm is

a) 41 cm b) 49 cm c) 82 cm d) 62 cm

6. The area of minor segment made by a chord which subtends right angle at the centre of a circle of radius 10cm is

a) 24.5 cm^2 b) 25.5 cm^2 c) 24.5 cm^2 d) 28.5 cm^2

7. The figure shows two concentric circles with centre O and radii 3.5cm and 7cm. If $\angle BOA = 40°$, then the area of the of the shaded region is



a) $\frac{77}{6}$ cm^2 b) $\frac{76}{6}$ cm^2

c) $\frac{73}{6}$ cm^2 d) None of these

8. The sum of the areas of two circles, which touch each other externally, is 153 π. If the sum of their radii is 15, then the ratio of the larger to the smaller radius is

a) 4:1 b) 2:1 c) 3:1 d) None of these

9. The area of a circular ring formed by two concentric circles whose radii are 5.7 cm and 4.3 cm respectively is (Take $\pi = 3.1416$)

a) 43.98 sq.cm b) 53.67 sq. cm c) 47.24 sq.cm d) 38.54 sq.cm

10. A sector is cut from a circular sheet of radius 100 cm, the angle of the sector being 240^o. If another circle of the area same as the sector is formed, then radius of the new circle is

a) 79.5 cm b) 81.6 cm c) 83.4 cm d) 88.5 cm

11. If the circumference of a circle increases from 4π to 8π, then its area is

a) halved b) doubled c) tripled d) quadrupled

12. If the ratio of the areas of the two circles is 25:16, then the ratio of their circumferences is

a) $\frac{25}{16}$ b) $\frac{4}{5}$ c) $\frac{5}{4}$ d) $\frac{500}{625}$

13. Area of a sector to circle of radius 6 cm is 9π cm^2, then the length arc of the corresponding arc of the circle is

a) 6π cm b) $3\ \pi$ cm c) $5\ \pi$ cm d) $8\ \pi$ cm

14. The length of an arc of a circle with radius 12 cm is $10\ \pi$ cm. The central angle of this arc is

a) 120^o b) 6^o c) 75^o d) 150^o

15. A copper wire when bent in the form of a square encloses an area of $225cm^2$. If the same wire is bent into the form of a circle, then the area of the circle is $\left(\text{Use } \pi = \frac{22}{7}\right)$

a) $\frac{900}{\pi}\,cm^2$ b) $\frac{\pi}{900}\,cm^2$ c) $\frac{700}{\pi}\,cm^2$ d) $\frac{\pi}{700}\,cm^2$

16. Radii of two circles are 4 cm and 3 cm respectively. There is another circle, which is having area equal to the sum of the areas of two circles whose radii are known. Find the diameter (in cm) of the third circle.

a) 5 b) 7 c) 0 d) 14

17. The ratio of areas of two circles whose ratio of circumferences is in the ratio of 3:1 will be

a) 3:1 b) 1:3 c) 1:9 d) 9:1

18. Area of a square is same as area of a circle. What will be the ratio of their perimeters?

a) 1:1 b) $2:\sqrt{\pi}$ c) $\pi:\sqrt{2}$ d) None of these

19. The angle through which the minute hand of the clock moves from 8 to 8:35 is:

a) 210° b) 90° c) 60° d) 45°

20. Area of a quadrant of circle whose circumference is 22 cm is: ($\pi = \frac{22}{7}$)

a) 3.5 cm^2 b) 3.5 cm c) 9.625 cm^2 d) 17.25 cm^2

21. The diagonals of a rhombus ABCD intersect at O. Taking 'O' as the centre, an arc of radius 6 cm is drawn intersecting OA and OD at E and F respectively. The area of the sector OEF is

(a) $9\pi cm^2$ (b) $3\pi cm^2$ (c) $12\pi cm^2$ (d) $18\pi cm^2$

22. If the length of an arc of a circle subtending an angle 60° at its centre is 22 cm, then the radius of the circle is

(a) $\sqrt{21}$cm (b) 21cm (c) $\sqrt{42}$cm (d) 42cm

23. If the sector of a circle with diameter 14 cm makes an angle 90° at the centre, then the perimeter of the sector is

(a) 25 cm (b) 11 cm (c) 36 cm (d) 22 cm

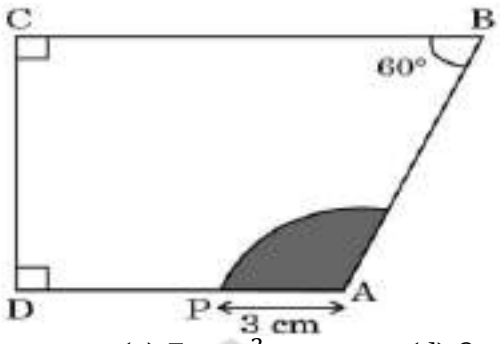
24. If an arc subtends an angle of 90°at the centre of a circle, then the ratio of its length to the circumference of the circle is

(a) 2:3 (b) 1:4 (c) 4:1 (d) 1:3

25. The area of the sector of a circle of radius 12cm is $60\pi cm^2$. The central angle of this sector is

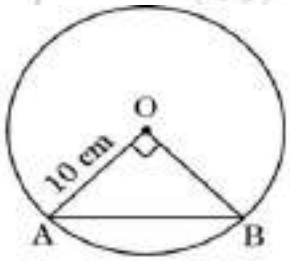
(a) 120° (b) 6° (c) 75° (d) 150°

26. If in the given figure, $\angle C = \angle D = 90°, \angle B = 60°$ and $AP = 3cm$, then the area of the shaded region is



(a) $3\pi cm^2$ (b) $6\pi cm^2$ (c) $7\pi cm^2$ (d) $9\pi cm^2$

27. A chord of a circle of radius 10cm subtends a right angle at its centre. The length of the chord (in cm) is



(a) $5\sqrt{2}$ (b) $10\sqrt{2}$ (c) $\frac{5}{\sqrt{2}}$ (d) 5

28. If a sector of a circle has an area of 40π sq. units and a central angle of $72°$, the radius of the circle is

(a) 200 units (b) 100 units (c) 20 units (d) $10\sqrt{2}$ units

29. A piece of wire 20 cm long is bent into the form of an arc of a circle of radius $\frac{60}{\pi}$. The angle subtended by the arc at the centre of the circle is

(a) $30°$ (b) $60°$ (c) $90°$ (d) $50°$

30. An arc of a circle is of length 5π cm and the sector it bounds has an area of 20π cm^2. Its radius is

(a) 10 cm (b) 1 cm (c) 5 cm (d) 8 cm

31. If a large circular pizza is divided into 5 equal sectors, then the central angle of each sector will be

(a) 60° (b) 90° (c) 45° (d) 72°

32. If an arc of a circle of diameter 10 cm subtends an angle of 144° at the centre of the circle, then the length of the arc is

(a) 2π cm (b) 4 π cm (c) 5 π cm (d) 6 π cm

33. If the area of a sector of circle of radius 36 cm is $54\pi cm^2$,, then the length of the corresponding arc of the sector is

(a) 8 π cm (b) 6 π cm (c) 4 π cm (d) 3 π cm

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: If the circumference of a circle is 176 cm, then its radius is 28 cm.

Reason: Circumference = 2π × radius.

2. Assertion: If the outer and inner diameter of a circular path is 10m and 6m, then area of the path is 16π m^2.

Reason: If R and r be the radius of outer and inner circular path respectively then area of path = $\pi (R^2 - r^2)$.

3. Assertion: If a wire of length 22 cm is bent in the shape of a circle, then area of the circle so formed is 40 cm^2.

Reason: Circumference of the circle = length of the wire.

4. Assertion: If the circumference of two circles are in the ratio 2:3, the ratio of their areas is 4:9.

Reason: The circumference of a circle of radius r is $2\pi r$ and its area is πr^2.

5. Assertion: Area of the square inscribed in a circle of radius r is $2r^2$ sq.units.

Reason: Area of the major segment of a circle = Area of circle – Area of minor segment.

CASE STUDY BASED QUESTIONS

1. It is a clock that uses a pendulum, a swinging weight, as its timekeeping element. From its invention in 1656 by Christiaan Huygens, the pendulum clock was the world's most precise timekeeper, accounting for its widespread use. Their greater accuracy allowed for the faster pace of life which was necessary for the Industrial Revolution. The home pendulum clock was replaced by less-expensive, synchronous, electric clocks in the 1930s and 40s. Pendulum clocks are now kept mostly for their decorative and antique value. Dhriti bought a pendulum clock for her living room. the clock contains a small pendulum of length 45 cm. the minute hand and hour hand of the clock are 14 cm and 6 cm long respectively.

i) What is the area swept by the minute hand in 14 minutes?

ii) What is the angle described by hour hand in 10 minutes?

iii) What is the distance covered by the tip of hour hand in 3.5 hours?

iv) If the tip of pendulum covers 66 cm in complete oscillation, what is the angle described by pendulum at the centre?

2. Raju put a fence around a circular field and the total cost came upto ₹ 6000 at ₹ 30 per metre. He now wants to plough the field.

Using the information given, answer the following questions:

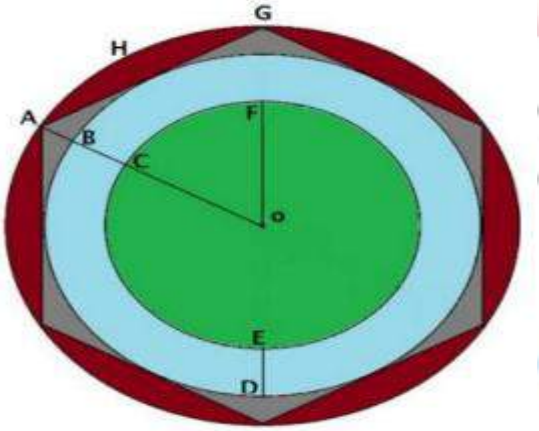
i) What is the perimeter of field?

ii) What is the radius of field?

iii) Calculate is the area of the field.

iv) Find the cost of ploughing the field at the rate of ₹. 1.50 per m^2.

3. In a village, there was no playground for children. If a child had to practice for any sports then the child had to go to the city stadium which is 20 km from the village. But village has a circular unused land and villagers decided to convert this unused land into a football ground, with athletic track around it, so that children can practice their choice of sports in village itself. Villagers also planned six seating areas with chairs (brown colour) and six seating area without chairs (grey colour) as shown in the figure. Athletic track (light blue) is between the football ground (light green) and seating area. The distance between the centre of the ground and the boundary of the stadium is 140 m, width of the athletic track is 30 m and AB is 20 m.



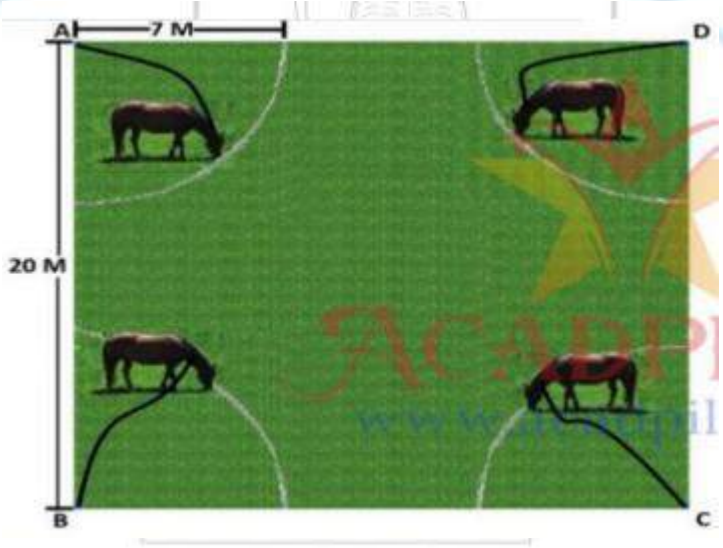
i) What is the area of the football ground?

ii) What is the length of the athletic track (inner boundary)?

iii) What is the length of the athletic track (outer boundary)?

iv) How much area is allocated for six seating corners with chairs?

4. A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around each horse and let them freely move and graze separately in their own area. ($\pi = 3.14$)



i) Find the total area of the field in which these horses can graze. $\left(\pi = \frac{22}{7}\right)$

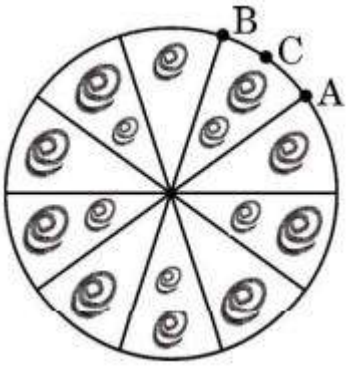
ii) How much the length of the rope of each horse be increased so that they can graze in maximum area without encroaching in each other's area (new length of rope after increase)?

iii) What is the area of the field that is left un-grazed after increasing the length of the rope? ($\pi = 3.14$)

iv) If the length of the rope is increased as per part (ii) above, find the cost of fencing around every horse so that the owner leave these horses untied inside these fenced areas, if the cost per meter length of the fencing is ₹50.

5. A brooch is a decorative piece often worn on clothing like jackets, blouses or dresses to add elegance. Made from precious metals and decorated with gemstones, brooches come in many shapes and designs.

One such brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in the figure.



Based on the above given information, answer the following question :

(i) Find the central angle of each sector.

(ii) Find the length of the arc ACB.

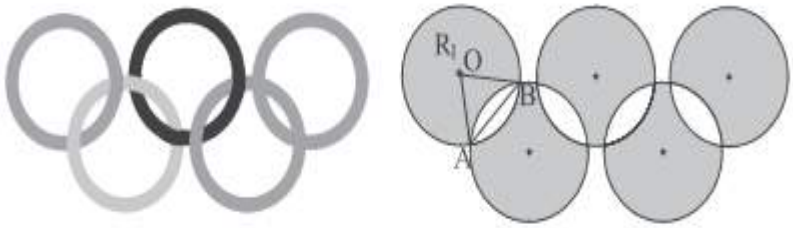
(iii) Find the area of each sector of the brooch.

(OR)

(iii) Find the total length of the silver wire used.

6. The Olympic symbol comprising five interlocking rings represents the union of the five continents of the world and meeting of athletes from all over the world at the Olympic games. In order to spread awareness about Olympic games, students of class X took part in various activities organized by the school. One such group of students made 5 circular rings in the school lawn with the help of ropes. Each circular ring required 44m of rope.

Also, in the shaded regions as shown in the figure, students made rangoli showcasing various sports and games. It is given that $\triangle$ OAB is an equilateral triangle and all unshaded regions are congruent.



Based on the above information, answer the following questions:

(i) Find the radius of each circular ring.

(ii) What is the measure of $\angle$AOB ?

(iii) Find the area of shaded region R_1.

(OR)

Find the length of rope around the unshaded regions.

7. A farmer has a circular piece of land. He wishes to construct his house in the form of largest possible square within the land as shown below.

The radius of circular piece of land is 35m.

Based on the given information, answer the following questions:

(i) Find the length of wire needed to fence the entire land.

(ii) Find the length of each side of the square land on which house will be constructed.

(iii) The farmer wishes to grow grass on the shaded region around the house. Find the cost of growing the grass at the rate of ₹50per square meter.

(OR)

Find the ratio of area of land on which house is built to remaining area of circular piece of land.

VERY SHORT ANSWERS

1. The short and long hands of a clock are 4 cm and 6 cm long respectively. Find the sum of distances travelled by their tips in 2 days. $\left[\pi = \frac{22}{7}\right]$

2. A bicycle wheel makes 5000 revolutions in moving 11 km. Find the diameter of the wheel.

3. The circumference of a circular park is 660 m. A 7 m wide path surrounds it. Find the cost of putting gravel on the path at the rate of ₹ 10 per m2 and the cost of fencing the outer boundary at the rate of ₹6 per metre.

4. A wire when bent in the form of a square, encloses an area of 121 sq. cm. If the same wire is bent in the form of a circle, find the area of the circle.

5. The minute hand of a clock is 20 cm long. Find the area on the face of the clock described by the minute hand between 8 am and 8:45 am.

6. What is the area of the circle, the circumference of which is equal to the perimeter of a square of side 11 cm?

7. Two concentric circles have their areas in the ratio 9:16 and the radius of the inner circle is 7 cm. Calculate the diameter of the outer circle.

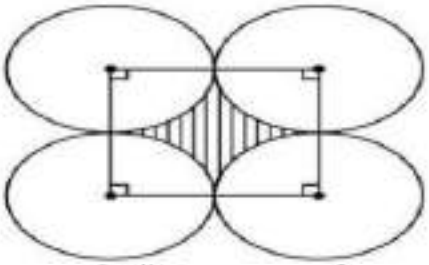
8. If the difference between the circumference and the radius of a circle is 37 cm, then find, the circumference (in cm) of the circle.

9. The circumference of a circle is 22cm. Calculate the area of its quadrant (in cm^2).

10. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

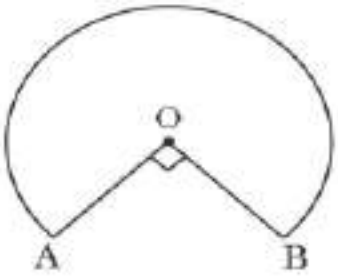
11. A chord is subtending an angle of 90° at the centre of a circle of radius 14 cm. Find the area of the corresponding minor segment of the circle.

12. Find the area of the shaded region if length of radius of each circle is 7 cm. Each circle touches the other two externally.

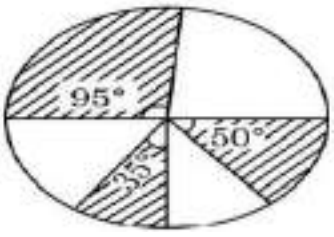


13. The perimeter of a certain sector of a circle of radius 5.6m is 20. Find the area of the sector.

14. In the given figure, the shape of the top of a table is that of a sector of a circle with centre O and $\angle AOB = 90°$. If AO = OB = 42 cm, then find the perimeter of the top of the table.



15. In the given figure, three sectors of a circle of radius 5 cm, making angles $35°, 50°$ and $95°$ at the centre are shaded. Find the area of the shaded region. [Use $\pi = \frac{22}{7}$]



SHORT ANSWERS

1. Find the area of the minor segment of a circle of radius 14 cm, when the angle of the corresponding sector is 60°.

2. A chord AB of circle of radius 14 cm makes a right angle at the centre of the circle. Find the area of major and minor segments. (Use π = 3.14)

3. A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope. Find (i) The area of that part of the field in which the horse can graze. (ii) The increase in the grazing area if the rope were 10 m long instead of 5 m.

4. Find the area of the segment shown in the figure if radius of the circle is 21 cm and ∠AOB = 120°.

5. A cow is tied with a rope of length 14 m at the corner of a rectangular field of dimensions 20 m × 16 m. Find the area of the field in which the cow can graze. Also find the area of remaining part.

6. The circumference of a circular park is 660 m. A 7 m wide path surrounds it. Find the cost of putting gravel on the path at the rate of ₹10 per m^2 and the cost of fencing the outer boundary at the rate of ₹6 per metre.

7. The cost of fencing a circular field at the rate of ₹24 per metre is ₹5280. If the field is to be ploughed at the rate of ₹0.50 per m^2, find the cost of ploughing the field. $\left(\pi = \frac{22}{7}\right)$

8. Find the area of the major segment APB, in the figure of a circle of radius 35 cm and ∠AOB = 90°. $\left(\pi = \frac{22}{7}\right)$

9. A chord of a circle of radius 14 cm subtends an angle of 120° at the centre. Find the area of the corresponding minor segment of the circle. [Use $\pi = \frac{22}{7}$ and $\sqrt{3} = 1.73$]

10. The wheels of a car are of diameter 80 cm each. How many complete revolutions does each wheel make in 10 minutes when the car is travelling at a speed of 66 km per hour?

11. The length of the hour hand of a clock is 10 cm. Find the area of the minor sector swept by the hour hand of the clock between 5 a.m. to 8 a.m. Also, find the area of the major sector.

12. A chord of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding minor segment. [Use $\pi = 3{\cdot}14$]

LONG ANSWERS

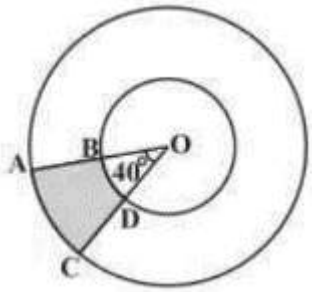
1. A round table cover has six equal designs, as shown in the figure. If the radius of the cover is 28 cm, find the cost of making the designs at the rate of ₹ 0.35 per cm^2 . [Use $\sqrt{3} = 1.7$]

2. Two circles touch externally. The sum of their areas is 130π sq.cm and the distance between their centres is 14cm. Find the radii of the circles.

3. Two circles touch internally. The sum of their areas is 169π sq.cm and distance between their centres is 7cm. Find the radii of the circles.

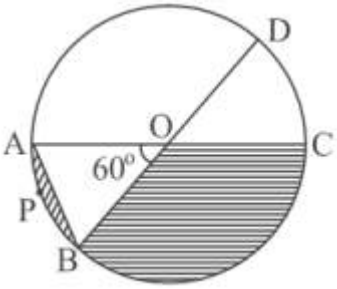
4. Find the difference of the areas of two segments of a circle formed by a chord of length 5cm subtending an angle of 90^o at the centre.

5. Find the area of the shaded region in Fig., if radii of the two concentric circles with centre O are 7 cm and 14 cm, respectively and AOC = 40°.



6. An arc of a circle of radius 21cm subtends an angle of 60^o at the centre. Find (i) the length of the arc (ii) the area of the minor segment of the circle made by the corresponding chord.

7. In the given figure, diameter AC and BD of the circle intersect at O. If $\angle AOB = 60°$ and OA = 10cm, then



(i) find the length of the chord AB.

(ii) find the area of shaded region. (Take $\pi = 3.14$ and $\sqrt{3} = 1.73$)

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. Which constant ratio is denoted by $\pi(pi)$?

a) $\frac{\text{diameter}}{\text{circumference}}$ b) $\frac{\text{area}}{\text{circumference}}$ c) $\frac{\text{circumference}}{\text{diameter}}$ d) $\frac{\text{area}}{\text{diameter}}$

2. If the diameter of a semi-circular protractor is 14 cm, then the perimeter of the protractor is:

a) 26 cm b) 14 cm c) 28 cm d) 36 cm

3. The outer and inner diameters of a circular ring are 34 cm and 32 cm respectively. The area of the ring is:

a) 66π b) 60π c) 33π d) 29π

4. Assertion: The area of circular playground is 22176m^2, the cost of fencing this ground at the rate of ₹50 per m is ₹26400.

Reason: If R and r be the radius of outer and inner circular path, then the area of the ring will be $\pi(R^2 - r^2)$.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. The diameter of the wheel of a bus is 140 cm. How many revolutions per minute must the wheel make in order to keep a speed of 66 km per hour?

6. Find the area of a quadrant of a circle, where the circumference of circle is 44cm. [Use $\pi = \frac{22}{7}$]

7. A copper wire, when bent in the form of a square, encloses an area of 484 cm^2. If the same wire is bent in the form of a circle, find the area enclosed by it.

SECTION C

Each carry 3 marks

8. A chord of a circle of radius 12 cm subtends an angle of 120° at the centre. Find the area of the corresponding segment of the circle. (Use $\pi = 3.14$ and $\sqrt{3} = 1.73$)

9. The short and long hands of a clock are 4 cm and 6 cm long respectively. Find the sum of distances travelled by their tips in 2 days.

SECTION D

Each carry 5 marks

10. Find the difference of the areas of a sector of angle 120^o and its corresponding major sector of a circle of radius 21 cm.

11. The cost of fencing a circular field at the rate of Rs. 24 per metre is Rs. 5280. The field is to be ploughed at the rate of Rs. 0.50 per m^2. Find the cost of ploughing the field.

SECTION E

12. A horse is tied to a peg at one corner of a square shaped grass field of sides 15m by means of a 5m long rope (see the given figure).

i) What is the area of the grass field?

ii) Find the area of that part of the field in which the horse can graze.

iii) Evaluate the grazing area if the rope were 10m long instead of 5m.

iv) Determine the increase in the grazing area if the rope were 10m long instead of 5m.

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. b) 25 cm 2. d) 25π cm^2 3. c) 22 cm 4. c) 15.6 cm^2 5. c) 82 cm 6. d) 28.5 cm^2 7. a) $\frac{77}{6}$ cm^2 8. a) 4:1 9. a) 43.98 sq.cm 10. b) 81.6 cm	1. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 2. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of	1. i) 59.4cm^2 ii) 5^o iii) 11 iv) 42^0 2. i) 200m ii) 31.81m iii) 3181.81m^2 iv) ₹4773 3. i) 8100πm^2 ii) 180πm iii) 240πm iv) $117600\left(\frac{2\pi-3\sqrt{3}}{12}\right)$ 4. i) b) 154m^2 ii) 10m iii) 86m^2 iv) ₹3140	1. 1910.85 cm. 2. 220 cm 3. ₹4224 4. 154cm^2 5. $\frac{6600}{7}$ cm^2 6. 154cm^2 7. $\frac{56}{3}$ cm 8. 44 cm 9. $\frac{77}{8}$ cm^2	1. $\left(\frac{308}{3}-49\sqrt{3}\right)$ cm^2 2. 559.58cm^2 3. 19.625m^2 and 58.875m^2 4. $\left(462-\frac{441\sqrt{3}}{4}\right)$ cm^2. 5. 166m^2 6. ₹47740 & ₹4224 8. 3500cm^2 9. 120.56cm^2 10. 4375	1. ₹162.68. 2. 3 and 11 3. 5 and 12 4. $(\frac{25\pi}{4}+\frac{25}{2})$cm^2 5. 51.33cm^2 6. (i) 22cm (ii) 40.05cm^2 7. 10cm, 113.75cm^2 approx.

11. d) quadrupled 12. c) $\frac{5}{4}$ 13. b) 3 π cm 14. d) 150^{o} 15. a) $\frac{900}{\pi}cm^2$ 16. c) 0 17. d) 9:1 18. c) $\pi:\sqrt{2}$ 19. a) 210° 20. c) 9.625 cm^2 21. (a) $9\pi cm^2$	Assertion (A). 3. (d) Assertion (A) is false but Reason (R) is true. 4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 5. (d) Assertion (A) is false but Reason (R) is	5. (i) 36° (ii) 11mm (iii) $\frac{385}{4}mm^2$ or $96.25mm^2$ (OR) 285 mm 6. (i) 7m (ii) 60° (iii) $\left(\frac{308}{3}+\frac{49\sqrt{3}}{2}\right)m^2$ or $145.05m^2$ (approx.) (OR) $\frac{176}{3}$m or 58.66m (approx.) 7. (i) 220m (ii) $\frac{70}{\sqrt{2}}$ or $35\sqrt{2}$m	10. $\frac{154}{3}cm^2$ 11. $56cm^2$ 12. 42 cm^2 13. $24.64m^2$ 14. 282cm 15. $\frac{275}{7}cm^2$ or $39.29cm^2$	11. $\frac{1650}{7}$ or $235.71cm^2$ approx. 12. $28.5cm^2$	

22. (b) 21cm 23. (a) 25 cm 24. (b) 1:4 25. (a) $120°$ 26. (a) $3\pi cm^2$ 27. (b) $10\sqrt{2}$ 28. (d) $10\sqrt{2}$ units 29. (b) $60°$ 30. (d) 8 cm 31. (d) $72°$ 32. (b) $4\ \pi$ cm 33. (d) $3\ \pi$ cm	true.	(iii) ₹ 35000 (OR) 7:4			

UNIT TEST

1. c) $\frac{\text{circumference}}{\text{diameter}}$

2. d) 36 cm

3. c) 33π

4. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

5. 250

6. 38.5cm^2

7. 616cm^2

8. 88.44cm^2

9. 1910.86cm

10. 462cm^2

11. ₹1925

12. i) $225m^2$ ii) 19.625m^2 iii) 78.5m^2 iv) 58.875m^2

CHAPTER 12 – SURFACE AREAS AND VOLUMES

Key Concepts

Surface Area

It is the sum of the total exposed area of three dimensional solid objects.

Volume

It is the amount of space occupied by an object.

Cuboid

A cuboid has six faces. Let the length of cuboid be ‘l’, breadth be ‘b’ and height be ‘h’.

- Volume = l x b x h.
- Lateral Surface Area 2(l + b)h
- Total Surface Area = 2(lb + bh + hl)
- Length of the diagonal = $\sqrt{l^2 + b^2 + h^2}$.

Cube

A cube has six identical faces. Let each edge of a cube be ‘a’.

- Volume = a^3.
- Lateral Surface Area = $4a^2$
- Total Surface Area = $6a^2$
- Diagonal = $\sqrt{3}a$.

Right Circular Cylinder

A solid obtained by revolving a rectangular lamina about one of its sides is called a right circular cylinder. Let ‘r’ be the base radius and ‘h’ be the vertical height of a cylinder.

- Volume = $\pi r^2 h$
- Curved Surface Area = $2\pi rh$
- Total Surface Area = $2\pi r(h + r)$.

Hollow Cylinder

Solid like pipes are in the shape of hollow cylinder. Let 'R' be the external radius, 'r' be the internal radius and 'h' be the height of a hollow cylinder.

- Area of cross-section = $\pi(R^2 - r^2)$
- Volume = $\pi h(R^2 - r^2)$
- Curved Surface Area = $2\pi h(R + r)$
- Total Surface Area = $2\pi(R + r)(R - r + h)$
- Thickness of cylinder = R – r.

Right Circular Cone

A solid obtained by revolving a right-angled triangular lamina about any side (other than the hypotenuse) is called a right circular cone. Let 'r' be the base radius, 'h' be the vertical height and 'l' be the slant height of a right circular cone.

- Volume = $\frac{1}{3}\pi r^2 h$
- Curved Surface Area = πrl
- Total Surface Area = $\pi r(l + r)$
- Slant height (l) = $\sqrt{r^2 + h^2}$.

Sphere

A sphere is a solid obtained on revolving a circle about any of its diameters. Let 'r' be the radius of sphere.

- Volume = $\frac{4}{3}\pi r^3$
- Curved Surface Area = $4\pi r^2$.

Hemisphere

When a sphere is cut by a plane through its centre into two equal parts, then each part is called a hemisphere.

- Volume = $\frac{2}{3}\pi r^3$
- Curved Surface Area = $2\pi r^2$
- Total Surface Area = $3\pi r^2$.

Note:

- For Surface area of combination of the solid objects, only look at the uppermost/the exposed portions of the objects.
- For volume of the combination the solid objects, simply take the sum of the volume of all the objects involved.
- The total surface area of the solid formed by the combination of solids is the sum of the curved surface area of each of the individual parts.

MULTIPLE CHOICE QUESTIONS

1. The surface area of a sphere is 616 cm^2. Its radius is

a) 7 cm b) 14 cm c) 21 cm d) 28 cm

2. A cylinder and a cone are of same base radius and of same height. The ratio of the volume of the cylinder to that of the cone is

a) 2:1 b) 3:1 c) 2:3 d) 3:2

3. A piece of paper is in the shape of a semi-circular region of radius 10 cm. It is rolled to form a right circular cone. The slant height is

a) 5 cm b) 10 cm c) 15 cm d) 20 cm

4. The base radii of two circular cones of the same height are in the ratio 3:5. The ratio of their volumes are

a) 9:25 b) 5:3 c) 9:5 d) 3:25

5. The curved surface area of glass having radii 3 cm and 4 cm respectively and slant height 10 cm is

a) 55 cm^2 b) 110 cm^2 c) 220 cm^2 d) 440 cm^2

6. The volume of the largest right circular cone that can be cut out from a cube of edge 4.2 cm is

a) 9.7 cm^3 b) 77.6 cm^3 c) 58.2 cm^3 d) 19.4 cm^3

7. If a marble of radius 2.1 cm is put into a cylindrical cup full of water of radius 5cm and height 6 cm, then how much water flows out of the cylindrical cup?

a) 38.8 cm^3 b) 55.4 cm^3 c) 19.4 cm^3 d) 471.4 cm^3

8. The number of balls of radius 1cm that can be made from a solid sphere of radius 4cm is

a) 64 b) 16 c) 12 d) 4

9. A sphere of 6cm radius is dropped into a cylindrical vessel partly filled with water. The radius of the vessel is 8cm. If the sphere is submerged completely, then the surface area of the water rises by

a) 2cm b) 3cm c) 4cm d) 4.5cm

10. A solid is hemispherical at the bottom and conical above. If the surface areas of two parts are equal, then the ratio of the radius and height of the conical part is

a) 1:3 b) 1: $\sqrt{3}$ c) $\sqrt{3}$: 1 d) 1:1

11. From a right circular cylinder of radius 10cm and height 21cm, a right circular cone of same base radius is removed. If the volume of the remaining portion is 4400cm^3, then the height of the cone removed is

a) 15cm b) 18cm c) 21cm d) 24cm

12. A right cylindrical vessel is full with water. How many cones have the same diameter and height as those of the right cylinder will be needed to store that water?

a) 2cm b) 3cm c) 4cm d) 5cm

13. If the height and the diameter of a right circular cylinder are 32cm and 6cm respectively, then the radius of the sphere whose volume is equal to the volume of the cylinder is

a) 3cm b) 4cm c) 6cm d) None of these

14. A spherical iron ball is dropped into a cylindrical vessel of base diameter 14cm containing water. The water level is increased by $9\frac{1}{3}$cm. What is the radius of the ball?

a) 3.5cm b) 7cm c) 9cm d) 12cm

15. A solid cube of side 5.5cm is dropped into a cylindrical vessel partly filled with water. The diameter of the vessel is 11cm. If the cube is wholly submerged, the level of water will rise by

a) 3.75cm b) 0.75cm c) 1.75cm d) 2.85cm

16. A sphere of copper is dropped into a cylinder of radius r and height h(>4r) which is half filled with water. If the diameter of the sphere is $\frac{r}{2}$, the water will raise through which one of the following?

a) $\frac{4r}{3}$ b) $\frac{r}{48}$ c) $\frac{r}{4}$ d) $\frac{r}{6}$

17. The volume of a cuboid is twice the volume of a cube. If the dimensions of the cuboid are 9cm, 8cm and 6cm, the total surface area of the cube is

a) $72cm^2$ b) $216cm^2$ c) $432cm^2$ d) $108cm^2$

18. A sphere of radius 5cm exactly fits into a cubical box. The ratio of the surface area of the box and the surface area of the sphere is

a) 19:9 b) 21:11 c) 23:13 d) 25:13

19. A cuboid of size 8cm x 4cm x 2cm is cut into cubes of equal size 1cm side. What is the ratio of the surface area of the original cuboid to the surface areas of the all the unit cubes so formed?

a) 13:4 b) 8: 3 c) 7:24 d) 7: 12

20. A right circular cylinder having a diameter 12cm and height 15cm is full of icecream. The icecream is to be filled in cones of height 12cm and diameter 6cm having a hemispherical shape on the top. The number of cones which can be filled with icecream is

a) 15 b) 12 c) 10 d) None of these

21. A rectangular sheet of paper 40cm x 22cm is rolled to form a hollow cylinder of height 40cm. The radius of the cylinder is

a) 3.5cm b) 5.3cm c) 2.5cm d) 5

22. If the radius of the base of a right circular cylinder is halved keeping the height same then the ratio of the volume of the cylinder thus obtained to the volume of the original cylinder is

a) 1:2 b) 2:1 c) 1:4 d) 4:1

23. The volume and the surface area of a sphere are numerically equal, then the radius of sphere is

a) 1 unit b) 2 units c) 3 units d) None of these

24. A rectangular sheet of paper 40 cm × 22 cm is rolled to form a hollow cylinder of height 40 cm. The radius of the cylinder (in cm) is:

a) 3.5cm b) 5.3cm c) 2·5cm d) 5cm

25. A cone of height 7 cm and base radius 3 cm is curved from a rectangular block of wood 10 cm × 5 cm × 2 cm. The percentage of wood wasted is:

a) 34% b) 46% c) 54% d) 66%

26. A cap is cylindrical in shape, surmounted by a conical top. If the volume of the cylindrical part is equal to that of the conical part, then the ratio of the height of the cylindrical part to the height of the conical part is

(a) 1:2 (b) 1:3 (c) 2:1 (d) 3:1

27. A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together is

(a) 1:1 (b) 1:4 (c) 2:3 (d) 3:2

28. The volume of the largest right circular cone that can be carved out from a solid cube of edge 2cm is

(a) $\frac{4\pi}{3}$ cu cm (b) $\frac{5\pi}{3}$ cu cm (c) $\frac{8\pi}{3}$ cu cm (d) $\frac{2\pi}{3}$ cu cm

29. The diameter of a wheel is 63 cm. The distance travelled by the wheel in 100 revolutions is:

(a) 99 m (b) 198 m (c) 63 m (d) 136 m

30. On the top face of the wooden cube of side 7cm, hemispherical depressions of radius 0.35cm are to be formed by taking out the wood. The maximum number of depressions that can be formed is

(a) 400 (b) 100 (c) 20 (d) 10

31. A cone of height 12cm and slant height 13cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is

(a) 17cm (b) 18cm (c) 22cm (d) 23cm

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: Total surface area of the cylinder having radius of the base 14 cm and height 30 cm is 3872 cm^2.

Reason: If r be the radius and h be the height of the cylinder, then total surface area = $2\pi rh + 2\pi r^2$.

2. Assertion: If the height of a cone is 24 cm and diameter of the base is 14 cm, then the slant height of the cone is 15 cm.

Reason: If r be the radius and h the slant height of the cone, then slant height = $\sqrt{h^2 + r^2}$.

3. Assertion: If the radius of a cone is halved and volume is not changed, then height remains same.

Reason: If the radius of a cone is halved and volume is not changed then height must become four times of the original height.

4. Assertion: If a ball is in the shape of a sphere has a surface area of 221.76 cm^2, then its diameter is 8.4 cm.

Reason: If the radius of the sphere be r, then surface area, $S = 4\pi r^2$, i. e. $r = \frac{1}{2}\sqrt{\frac{S}{\pi}}$

5. Assertion: No. of spherical balls that can be made out of a solid cube of lead whose edge is 44 cm, each ball being 4 cm. in diameter, is 2541.

Reason: Number of balls = $\frac{\text{Volume of one ball}}{\text{volume of lead}}$.

6. Assertion: Two cubes each of edge length 10cm are joined together. The total surface area of newly formed cuboid is $1200cm^2$.

Reason: Area of each surface of cube of side 10cm is $100cm^2$.

7. Assertion: If we join two hemispheres of same radius along their bases, then we get a sphere.

Reason: Total Surface Area of a sphere of radius r is $3\pi r^2$.

CASE STUDY BASED QUESTIONS

1. The students of Class 10 were taken on a factory visit to see how the vehicles tyres were being manufactured. The factory visit was a new experience for all of them as they could see the manufacturing process from very close. The students saw lot of tanks which were made of stainless steel (including lid and base) to store water. The biggest tank was marked with height 13 m and diameter 3 m. Every manufacturing unit needs storage tank for water.

Based on the above information, answer the following questions:

i) What is the formula for calculating total surface area of the tank?

ii) Calculate the total surface area of the tank whose dimensions are marked.

iii) How much water can be stored in the tank?

iv) Calculate the area of stainless-steel sheets required to make the tank without lid?

2. Mathematics teacher Swathi of a school took her 10^{th} standard students to show Red fort. It was a part of their educational trip. The teacher had interest in history as well. She narrated the facts of Red Fort to students. Then the teacher said in this monument one can find combination of solid figures. There are 2 pillars which are cylindrical in shape. Also 2 domes at the corners which are hemispherical 7 smaller domes at the centre. Flag hoisting ceremony on Independence Day takes place near these domes.

i) How much cloth material is required to cover 2 big dome?

ii) Evaluate the curved surface area of two pillars if height of the pillar is 7m and radius of the base is 1.4m.

iii) Calculate the volume of the hemisphere if its radius is 3.5m.

iv) Find the ratio of sum of volumes of two hemispheres of radius 1cm each to the volume if sphere of radius 2cm.

3. In the month of December 2020, it rained heavily throughout the day over the city of Hyderabad. Anil observed the raindrops as they reached him. Each raindrop was in the shape of a hemisphere surmounted by a cone of the same radius of 1 mm. Volume of one of such drops is $3{\cdot}14\ mm^3$.

Anil collected the rainwater in a pot having a capacity of $1099cm^3$. [Use $\sqrt{2} = 1.4$]

Based on the above information, answer the following:

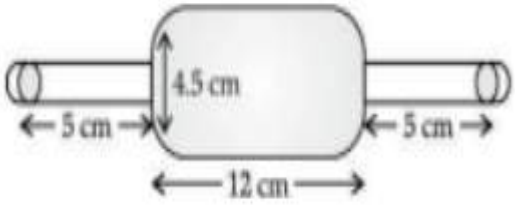
i) Find the total height of the drop.

ii) Evaluate the total surface area of the drop.

iii) As the drop fell into the pot, it changed into sphere, what will be the radius of the sphere?

iv) How many drops will fill the pot completely?

4. Swathi is studying in X standard. While helping her mother in kitchen, she saw rolling pin made of steel and empty from inner side, with two small hemispherical ends as shown in the figure.



Based on the above information, answer the following:

i) Find the curved surface area of two identical cylindrical parts, if the diameter is 2.5cm and length of each part is 5cm.

ii) Find the volume of big cylindrical part.

iii) Calculate the volume of two hemispherical ends having diameter 2.5cm.

iv) Evaluate the curved surface area of two hemispherical ends.

5. Arun a X standard student makes a project on corona virus in science for an exhibition in his school. In this project, he picks a sphere which has volume 38808cm^3 and 11 cylindrical shapes, each of volume 1540cm^3 with length 10 cm.

Based on the above information, answer the following:

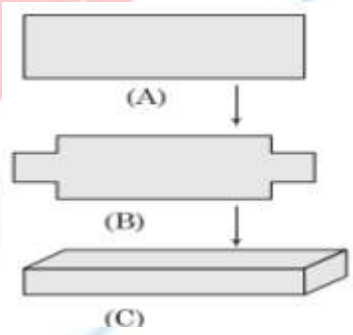
i) Find the diameter of the base of the cylinder.

ii) Find the diameter of the sphere.

iii) Calculate the curved surface area of the one cylindrical shape.

iv) Evaluate the total area covered by cylindrical shapes on the surface of sphere.

6. A company manufactures boxes for gift packing. A group of employees of this company prepares cuboidal shaped boxes. For this they follow the given process.



1. Take a rectangular cardboard.

2. Cut a square of same size at each corner.

3. Fold the remaining part and fix with the help of gum and paper.

4. The box id ready.

Length and breadth of cardboard box are 61cm and 46cm the squares are cut at each corner of rectangle are of side 8cm. Boxes are covered with rectangular cuboidal lid of same size.

Based on the above information, answer the following questions:

i) Swathi purchased 6 glasses of cylindrical shape to gift her friend Uma. The height of the glass is 12cm and diameter 7cm. If the glasses are packed in the gift box then find the remaining volume in the box.

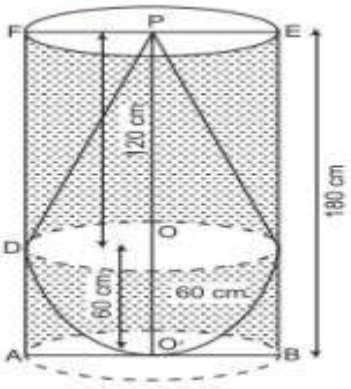
ii) Harini wanted to gift wrap the box, find the area of gift-wrapping paper to wrap the box.

iii) Vanya packed some balls of radius 3.5cm in the box. Find the maximum number of balls which can be packed in the box C.

iv) If Vihaan puts 5 such boxes keeping one above the other, find the total surface area of the shape so formed.

7. In one corner of the drawing room, a flower basket is kept inside the glass, lies on the table. The basket is designed in such a way that everyone pleases to see it.

The shape of flower basket is hemisphere with radius 60cm and upper shape is conical with height 120cm from the bottom surface.



i) Find the capacity of the class.

ii) Evaluate the volume of the cone.

iii) Calculate the curve surface area of hemisphere.

iv) If the cost of painting the glass outside is ₹1.20 per m^2, find the total cost of painting the CSA of the glass.

8. The word circus has the same root as circle. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd.

A circus tent is cylindrical upto height o 8m and conical above it. The diameter of the base is 28m and total height of tent is 18.5m.

Based on the above, answer the following questions:

(i) Find the slant height of the conical part.

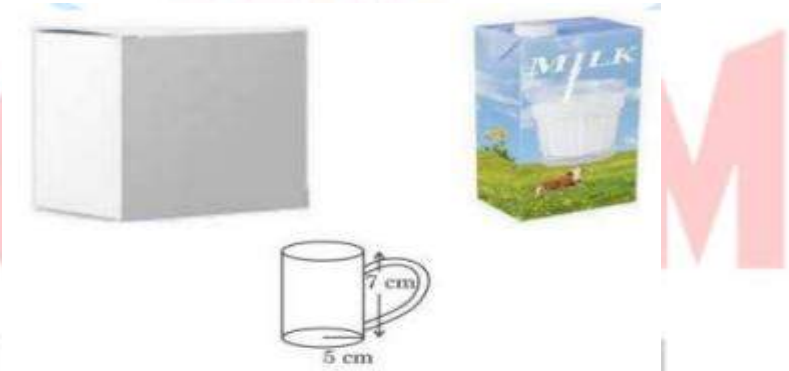
(ii) Determine the floor area of the tent.

(iii) Find the area of the cloth used for making tent.

(iv) Find the total volume of air inside an empty tent.

9. Tamper proof tetra packed milk guarantee both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health conscious individuals.

500ml milk is packed in a cuboidal container of dimensions 15cm x 8cm x 5cm. These milk packets are then packed in cuboidal cartons of dimensions 30cm x 32cm x 15cm.



Based on the above information, answer the following questions:

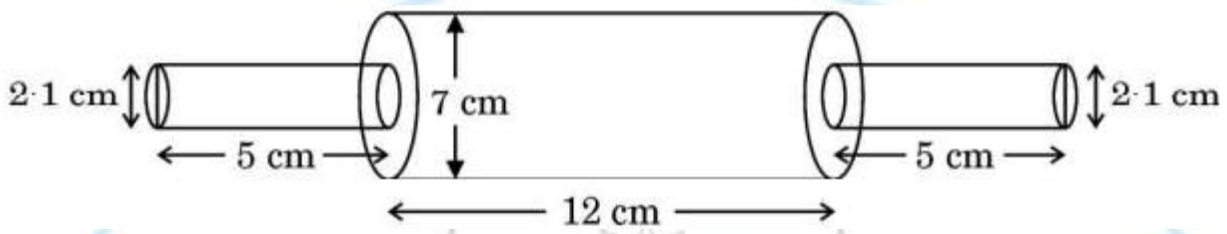
(i) Find the volume of the cuboidal carton.

(ii) Find the total surface area of a milk packet.

(iii) How many milk packets can be filled in a carton?

(iv) How much milk can the cup (shown in the figure) hold?

10. A skilled carpenter decided to craft a special rolling pin for the local baker. He carefully joined three cylindrical pieces of wood - two small ones on the ends and one larger in the centre to create a perfect tool. The baker loved the rolling pin, as it rolled out the smoothest dough for breads and pastries.



The length of the bigger cylindrical part is 12 cm and diameter is 7 cm and the length of each smaller cylindrical part is 5 cm and diameter is 2·1 cm.

Based on the above information, answer the following questions :

(i) Find the volume of the bigger cylindrical part.

(ii) Find the curved surface area of the bigger cylindrical part.

(iii) Find the ratio of the volume of the bigger cylindrical part to the total volume of the two smaller (identical) cylindrical parts.

(OR)

Find the sum of the curved surface areas of the two identical smaller cylindrical parts.

VERY SHORT ANSWERS

1. The volume of a right circular cylinder with its height equal to the radius is $25\frac{1}{7}\text{cm}^3$. Find the height of the cylinder. $\left(\text{Use } \pi = \frac{22}{7}\right)$.

2. A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface areas of the hemispherical part and the conical part are equal, then find the ratio of the radius and the height of the conical part.

3. From a solid right circular cylinder of height 14 cm and base radius 6 cm, a right circular cone

of same height and same base removed. Find the volume of the remaining solid.

4. A right circular cylinder and a cone have equal bases and equal heights. If their curved surface areas are in the ratio 8:5, show that the ratio between radius of their bases to their height is 3:4.

5. A cylindrical glass tube with radius 10 cm has water upto a height of 9 cm. A metal cube of 8 cm edge is immersed completely. By how much the water level will rise in the glass tube?

6. Two cones have their heights in ratio 1:3 and radii in the ratio 3:1. What is the ratio of their volumes?

7. A cubical ice-cream brick of edge 22 cm is to be distributed among some children by filling ice-cream cones of radius 2 cm and height 7 cm up to its brim. How many children will get the ice cream cones?

8. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14mm and the diameter of the capsule is 5 mm. Find its surface area.

9. The length, breadth and height of a rectangular solid are in the ratio 5:4:2. If the total surface area is 1216 cm^2, find the length, breadth and height of the solid. Also, find the volume of the solid.

10. The cost of painting the total outside surface of a closed cylindrical oil tank at 50 paise per sq. decimetre is ₹198. The height of the tank is 6 times the radius the base of the tank. Find its volume correct to 2 decimal places.

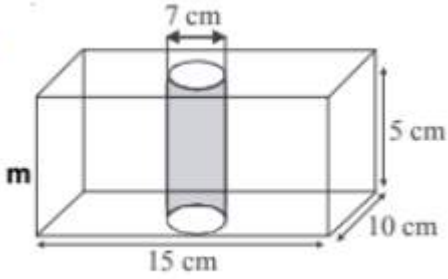
11. The diameter of a garden roller is 1.4 m and it is 2 m long. How much area will it cover in 5 revolutions? $\left(\text{ Take } \pi = \frac{22}{7}\right)$.

12. A cylindrical jar of radius 6 cm contains oil. Iron spheres, each of radius 1.5 cm are inserted in the oil. How many spheres are necessary to raise the level of oil by 2 cm?

13. A cylinder, whose height is two-thirds of its diameter, has the same volume as a sphere of radius 4 cm. Calculate the radius of the base of the cylinder.

14. Three equal cubes are placed side by side in a row. Find the ratio of the surface area of the new cuboid so formed to the sum of the surface areas of the three cubes.

15. In the given figure, from a cuboidal solid metallic block of dimensions 15 cm × 10 cm × 5 cm a cylindrical hole of diameter 7cm is drilled out. Find the surface area of the remaining block. $\left(\text{ Take } \pi = \frac{22}{7}\right)$.



16. An iron pole consisting of a cylindrical portion 110cm height and of base diameter 12cm is surmounted by a cone 9cm high. Find the mass of the pole given that $1cm^3$ of iron has 8g mass(approx.).

17. A cylindrical pencil is sharpened to produce cone at one end with no overall loss of length. If the diameter of the pencil is 1cm and the length of the conical portion is 2cm. Calculate the volume of the shavings. Give your answer correct to two places of decimals. $\left(\text{ Use } \pi = \frac{22}{7}\right)$

18. Determine the ratio of the volume of a cube to that of a sphere which will exactly fit inside the cube.

19. A solid is made by joining a hemisphere and a cone on the same base but on opposite side. If volume of the solid is $\frac{32}{3}\pi$ cubic cm and height of the cone is 4cm, then find the base radius.

20. Two cylindrical cans have bases of the same size. The diameter of each is 14cm. One of the cans is 1cm high and the other is 20cm high. Find the ratio of their volumes.

SHORT ANSWERS

1. A solid is in the form of a cylinder with hemispherical end. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. $\left(\text{Use } \pi = \frac{22}{7}\right)$

2. A cylindrical tank of radius 40 cm is filled upto height 3.15 m by an other cylindrical pipe with the rate of 2.52 km/h in $\frac{1}{2}$ hour. Calculate the diameter of cylindrical pipe?

3. A heap of rice is in the form of a cone of base diameter 24 m and height 3.5 m. Find the volume of the rice. How much canvas cloth is required to just cover the heap?

4. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius on its circular face. The total height of the toy is 15.5 cm. Find the total surface area of the toy.

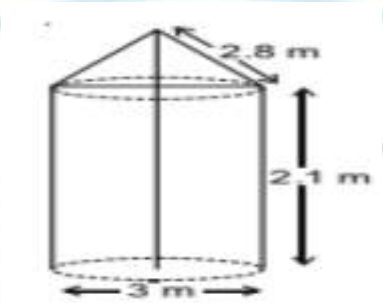
5. A vessel is in the form of hemispherical bowl surmounted by a hollow cylinder of same diameter. The diameter of the hemispherical bowl is 14cm and the total height of the vessel is 13cm. Find the total surface area of the vessel. $\left[\text{Use } \pi = \frac{22}{7}\right]$

6. A wooden toy was made by scooping out a hemisphere of same radius from each end of a solid cylinder. If the height of the cylinder is 10cm, and its base is of radius 3.5cm, find the volume of wood in the toy. $\left[\text{Use } \pi = \frac{22}{7}\right]$

7. Due to sudden floods, some welfare associations jointly requested the government to get 100 tents fixed immediately and offered to contribute 50% of the cost. If the lower part of each tent is of the form of a cylinder of diameter 4.2 m and height 4 m with the conical upper part of same diameter but height 2.8 m, and the canvas to be used costs ₹100 per sq. m, find the amount, the association will have to pay.

8. A cubical block of side 10 cm is surmounted by a hemisphere. What is the largest diameter that the hemisphere can have? Find the cost of painting the total surface area of the solid so formed, at the rate of ₹ 5 per sq. cm. [Use π = 3.14]

9. In figure, a tent is in the shape of a cylinder surmounted by a conical top of same diameter. If the height and diameter of cylindrical part are 2.1 m and 3 m respectively and the slant height of conical part is 2.8 m, find the cost of canvas needed to make the tent if the canvas is available at the rate of ₹ 500/sq. metre. $\left[\text{Use } \pi = \frac{22}{7}\right]$



10. A sphere of diameter 12 cm, is dropped in a right circular cylindrical vessel, partly filled with water. If the sphere is completely submerged in water, the water level in the cylindrical vessel rises by $3\frac{5}{9}$ cm. Find the diameter of the cylindrical vessel.

11. A building is in the form of a cylinder surmounted by a hemispherical dome. The base diameter of the dome is equal to $\frac{2}{3}$ of the total height of the building. Find the height of the building, if it contains $67\frac{1}{21}$ m^3 of air.

12. A circus tent is in the form of a right circular cylinder and a right circular cone above it. The diameter and the height of the cylindrical part of the tent are 126 m and 5 m respectively. The total height of the tent is 21 m. Find the total surface area of the tent. Also, find the cost of the tent, if the canvas used costs ₹12 per square meter. $\left[\text{Use } \pi = \frac{22}{7}\right]$

13. An iron pillar has some part in the form of a right circular cylinder and remaining in the form of a right circular cone. The radius of the base of each of cone and cylinder is 8 cm. The cylindrical part is 240 cm high and the conical part is 36 cm high. Find the weight of the pillar, if one cu. cm of iron weights 7.8 grams.

14. Swathi has a vessel in the form of an inverted cone, open at the top of height 11cm and radius of top as 2.5cm and is full of water. Metallic spherical balls, each of diameter 0.5cm are put in the vessel due to which $\frac{2}{5}^{th}$ of the water in the vessel flows out. Find how many balls were put in the vessel.

15. A metallic cylinder has radius 3cm and height 5cm. To reduce its weight, a conical hole is drilled in the cylinder. The conical hole has a radius of $\frac{3}{2}$cm and its depth is $\frac{8}{9}$cm. Calculate the ratio of the of the volume of metal left in the cylinder to the volume of the metal taken out in conical shape.

16. 50 circular plates each of radius 7cm and thickness $\frac{1}{2}$cm are placed on above another to form a solid right circular cylinder. Find the total surface area and the volume of the cylinder so formed.

17. A solid cylinder of base radius 7cm and height 24cm is surmounted by a cone of same base radius and same vertical height. A hemisphere surmounts the cylinder at the other end. Find the surface area of the solid.

18. A water tank open at the top is hemispherical at the bottom and cylinder above it. If the radius of the hemisphere is 12cm and the total capacity of the tank is $3312\pi m^3$, find the ratio of the surface areas of the spherical and cylindrical portions.

19. The height of a solid cylinder is 15cm and the diameter of its base is 7cm. Two equal conical holes each of radius 3cm and height 4cm are cut off. Find the volume of the remaining solid.

20. A cylindrical can of internal diameter 21cm contains water. A solid sphere whose diameter is 10.5cm is lowered into the cylindrical can. The sphere is completely immersed in water. Calculate the rise in the water level, assuming that no water over flows.

21. The difference between the outer and inner radii of a hollow right circular cylinder of length 14cm is 1cm. If the volume of the metal used in making the cylinder is 176cm^3. Find the outer and inner radii of the cylinder.

22. The inner and outer radii of a hollow cylinder surmounted on a hollow hemisphere of same radii are 3cm and 4cm respectively. If height of the cylinder is 14cm, then find its total surface area (inner and outer).

23. A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\frac{1408}{21}$m^3 of air, find the height of the cylindrical part. $\left(\text{Use } \pi = \frac{22}{7}\right)$

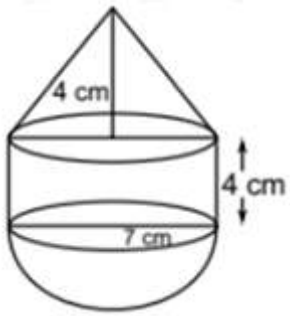
LONG ANSWERS

1. A toy in the shape of right circular cylinder with a hemisphere on one end and a cone on the other end. The height and radius of the cylinder are 13cm and 5cm respectively. The radii of the hemispherical and conical parts are the same as that of the cylindrical part. Calculate the surface area of the toy of height of the conical part is 12cm.

2. A petrol tank is a cylinder of diameter 21cm and length 18cm fitted with conical ends each of axis length 9cm. Determine the capacity of the tank.

3. A tent in the shape of a right circular cylinder surmounted by a right circular cone. The height of the cylindrical and the conical parts are 40m and 21m respectively. If the base diameter of the tent is 56m, find the area of the required canvas to make this tent, if 20% of the area is consumed in folding and sewing.

4. The figure represents a solid consisting of a right circular cylinder with a hemisphere at one end and a cone at the other end. Their common radius is 7cm. The height of the cylinder and cone are of each 4cm. Find the volume of the solid.



5. A vessel of hollow cylinder fitted with a hemispherical bottom of the same base. The depth of the cylinder is $4\frac{2}{3}$m and the diameter of hemisphere is 3.5m. Calculate the volume and the internal surface area of the vessel.

6. A solid wooden toy is in the form of a hemi-sphere surmounted by a cone of same radius. The radius of hemi-sphere is 3.5cm and the total wood used in the making of toy is $166\frac{5}{6}$cm^3. Find the height of the toy. Also, find the cost of painting the hemi-spherical part of the toy at the rate of ₹10 per cm^2. $\left[\text{Use } \pi = \frac{22}{7}\right]$

7. A conical vessel of radius 6cm and height 8cm is completely filled with water. A sphere is lowered into the water and its size is such that when it touches the sides, it is just immersed. What fraction of water overflows?

8. A sphere is placed inside an inverted hollow conical vessel of base radius 5cm and vertical height 12cm. If the highest point of the sphere is at the plane of the base of the cone, find the radius of the sphere. Also, find the ratio of the volumes of the sphere and conical vessel.

9. A cylindrical vessel with diameter 16cm and height 10.5cm is full of water. A solid cone of base radius 7cm and height 9cm is completely immersed in it. Find the volume of (i) water displaced from the cylindrical vessel (ii) water left in the vessel.

10. A cracker rocket is in the shape of right circular cone standing on a right circular cylinder. If height of the conical portion is half the height of the cylinder portion, radius of the cylinder is 3.5cm, whereas the radius of the conical portion is two times of the cylinder. Total height of the solid is 21cm, find the volume of the rocket.

11. The largest possible hemisphere is drilled out from a wooden cubical block of side 21 cm such that the base of the hemisphere is on one of the faces of the cube. Find:

(i) the volume of wood left in the block,

(ii) the total surface area of the remaining solid.

12. A solid toy is in the form of a hemisphere surmounted by a right circular cone. Ratio of the radius of the cone to its slant height is 3:5. If the volume of the toy is 240π cm^3, then find the total height of the toy.

13. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0·5 cm, are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.

14. A wooden cubical die is formed by forming hemispherical depression on each face of the cube such that face 1 has one depression, face 2 has two depressions and so on. The sum of number of hemispherical depressions on opposite faces is always 7. If the edge of the cubical die measures 5cm and each hemispherical depression is of diameter 1.4cm, find the total surface area of the die so formed.

15. From one of the faces of a solid wooden cube of side 14cm, maximum number of hemispheres of diameter 1.4cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.

16. From a solid cylinder of height 24cm and radius 5cm, two cones of height 12cm and radius 5cm are hollowed out. Find the volume and surface area of the remaining solid.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. Two cones have their heights in the ratio 1:3 and radii in the ratio 3:1, then the ratio of their volumes is

a) 1:3 b) 3:1 c) 2: 3 d) 3:2

2. A heap of rice is in the form of a cone of base diameter 24 m and height 3.5 m. How much canvas as cloth is required to just cover the heap?

a) 105.5 m^2 b) 471.42 m^2 c) 173.5 m^2 d) None of these

3. If two cubes of edge 3cm each are joined end to end, then the surface area of the resulting cuboid is

a) $90cm^2$ b) $95cm^2$ c) $92cm^2$ d) $94cm^2$

4. Assertion: Total surface area of the cylinder having radius of the base 14 cm and height 30 cm is 3872 cm^2.

Reason: If r be the radius and h be the height of the cylinder, then total surface area = ($2\pi rh + 2\pi r^2$).

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. The area of the base of a right circular cylinder is 15400 cm^2 and its volume is 92400 cm^3. Find the area of its curved surface.

6. Lead spheres of diameter 6 cm are dropped into a cylindrical beaker containing some water and are fully submerged. If the diameter of the beaker is 18 cm and the water rises by 40 cm, find the number of lead spheres dropped in the water.

7. Three cubes each of 5cm edge are joined end to end. Find the surface area of the resulting cuboid.

SECTION C

Each carry 3 marks

8. An iron pillar consists of a cylindrical portion 2.8 m high and 20 cm in diameter and a cone 42 cm high is surmounting it. Find the weight of the pillar, if 1 cm3 of iron weighs 7.5 g.

9. From a solid cylinder whose height is 8 cm and radius 6 cm a conical cavity of height 8 cm and of base radius 6 cm is hollowed out. Find the volume of the remaining solid correct to the two places of decimal. Also, find the total surface area of the remaining solid. (π = 3.1416).

SECTION D

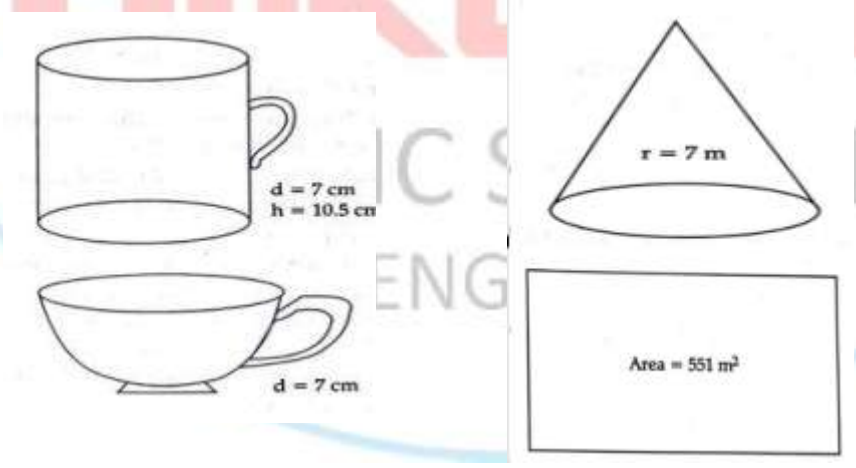
Each carry 5 marks

10. A solid consisting of a right cone standing on a hemisphere is placed upright in a right circular cylinder full of water and touches the bottom. Find the volume of water left in the cylinder, if the radius of the cylinder is 60 cm and its height is 180 cm, the radius of the hemisphere is 60 cm and height of the cone is 120 cm, assuming that the hemisphere and the cone have common base.

11. A toy is in the form of a right circular cylinder closed at one end and with hemisphere on the other end. The height and the radius of the base of the cylinder are 15cm and 6cm respectively. The radius of the hemisphere and the base of the cylinder are the same. Calculate the total surface area and the volume of the toy. If the toy is painted at the rate of ₹2.50 per 10cm^2, fid the cost of painting the toy. ($\pi = 3.14$)

SECTION E

12. Adventure camps are the perfect place for the children to practice decision making for themselves without parents and teachers guiding their every move. Some students of a school reached for adventure at Sakleshpur. At the camp, the waiters served some students with a welcome drink in a cylindrical glass and some students in a cylindrical glass and some in hemispherical cup whose dimensions are shown below. After that they went form a jungle trek was enjoyable but tiring. As dusk fell, it was time to take shelter. Each group of four students was given a canvas of area 551m^2. Each group had to make a conical tent to accommodate all the four students. Assuming that all the stitching and wasting incurred while cutting, would amount to 1m^2, the students put the tents. The radius of the tent is 7m.



Based on the above information, answer the following questions:

i) Calculate the volume of the cylindrical cup.

ii) Evaluate the volume of the hemispherical cup.

iii) Find the height of the conical tent prepared to accommodate four students.

iv) How much space on the ground is occupied by each student in the conical tent?

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. a) 7 cm 2. b) 3:1 3. b) 10 cm 4. a) 9:25 5. c)$220cm^2$ 6. d) 19.4 cm^3 7. a) 38.8 cm^3 8. a) 64 9. d) 4.5cm 10. b) 1: $\sqrt{3}$	1. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 2. (d) Assertion (A) is false but Reason (R) is true. 3. (d) Assertion (A) is false but Reason (R) is true.	1. i) $2\pi rh + 2\pi r^2$ ii) $136.6m^2$ iii) $91.9m^3$ iv) $129.6m^2$ 2. i) $78.57m^2$ ii) $123.2m^2$ iii) $89.83m^3$ iv) 1: 8 3. i) 2mm ii) $10.68mm^2$	1. 2 cm. 2. 1: $\sqrt{3}$ 3. $1056cm^3$ 4. Proof 5. 1.629 cm. 6. 3:1 7. 363 8. $220mm^2$ 9. $2560cm^3$ 10. 509.14cu. dm	1. 680.17 cm^3 2. 4cm 3. $528m^3$ and $471.4m^2$ 4. $214.5cm^2$ 5. $1144cm^2$ 6. $205.251cm^3$ 7. ₹.379500 8. ₹ 3392.85 9. ₹16500	1. $770cm^2$ 2. $8316cm^3$ 3. $12650m^2$ 4. $1540cm^3$ 5. $56.15m^3, 70\frac{7}{12}m^2$ 6. ₹ 770 7. $\frac{3}{8}$. 8. $\frac{10}{3}$, 40:81 9. $462cm^3$, $1650cm^3$ 10. $898.26cm^3$

11. c) 21cm

12. b) 3cm

13. c) 6cm

14. b) 7cm

15. c) 1.75cm

16. b) $\frac{r}{48}$

17. b) $216cm^2$

18. b) 21:11

19. c) 7:24

20. c) 10

21. a) 3.5cm

4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

5. (c) Assertion (A) is true but Reason (R) is false.

6. (d) Assertion (A) is not true but Reason (R) is true.

7. (c) Assertion (a) is true, but Reason

iii) $\left(\frac{3}{4}\right)^{1/3}$

iv) 350000

4. i) $78.57cm^2$

ii) $190.93cm^3$

iii) $8.18cm^3$

iv) $19.64cm^2$

5. i) 14cm

ii) 42cm

iii) $440cm^2$

iv) $1694cm^2$

6. i) $8028cm^3$

11. $44m^2$

12. 16

13. 4cm

14. 7:9

15. $583cm^2$

16. 102.28kg

17. $1.05cm^3$

18. 6: π

19. 2cm

20. 1:2

10. 18cm

11. 6m

12. $14850m^2$, ₹1,78,200

13. 395.3664kg

14. 440

15. 133:2

16. $1408cm^2$, $3850cm^3$

17. 609 π cm^2

18. 4:5

19. $502.1cm^3$

20. 1.75cm

21. 2.5cm and 1.5cm

11. 6835.5 cm^3

& 2992.5 cm^2

12. 14cm

13. 100

14. $182.34cm^2$

15. 100 & $1330cm^2$

16. $\frac{8800}{7}$ or $1257.14cm^3$ approx

&

$\frac{8140}{7}$ or $1162.85cm^2$ approx

22. c) 1:4 23. a) 1 unit 24. a) 3.5cm 25. a) 34% 26. (b) 1:3 27. (c) 2:3 28. (d) $\frac{2\pi}{3}$ cu cm 29. (b) 198 m 30. (b) 100 31. (a) 17cm	(R) is false.	ii) 3900cm^2 iii) 28 iv) 8700cm^2 7. i) $\frac{14.256}{7}$ m^3 ii) 0.45m^3 iii) 1.102m^2 iv) ₹ 57.02 8. i) 17.5m ii) 616m^2 iii) 1474m^2 iv)7084m^2		22. $\frac{5566}{7}$ cm^2 or 795.14cm^2 approx. 23. r = 2m and h = 4m	

		9. i) $14400cm^3$ ii) $470cm^2$ iii) 24 iv) 550cm^3 or 550ml 10. (i) 462cm^3 (ii) 264cm^2 (iii) 3080: 231 (OR) 66cm^2			

UNIT TEST

1. b) 3:1

2. b) 471.42 m^2

3. a) 90cm^2

4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

5. $2640 cm^2$

6. 90

7. $350 cm^2$

8. 693 kg

9. $603.19 cm^3, 603.19 cm^2$

10. $1.1314 m^3$

11. $904.32 cm^2, 2147.76 cm^3, ₹226.08$

12. i) $404.25 cm^3$ ii) $89.83 cm^3$ iii) 24m iv) $38.5 m^2$

CHAPTER 13 – STATISTICS

Key Concepts

Class Mark

Class Mark = $\frac{Lower\ class\ limit + Upper\ class\ limit}{2}$

Class size

Class size (h) = Upper limit – Lower limit

Mean

The arithmetic mean is a mathematical representation of the typical value of a series of numbers, computed as the sum of all the numbers in the series divided by the count of all numbers in the series. The arithmetic mean is sometimes referred to as the average or simply as the mean.

(i) **Direct Method**

$\bar{x} = \frac{\Sigma fx}{\Sigma f}$, where f is frequency

(ii) **Assumed Mean Method**

$\bar{x}$ = A + $\frac{\Sigma fd}{\Sigma f}$, where A is assumed mean and d = x – A.

Mode

Mode is that value among the observations which occurs most often i.e, the value of the observation having the maximum frequency. If in a data more than one value have the same frequency, then the data is said to be multi-modal.

In a grouped frequency distribution, the class which has the maximum frequency is called modal class.

Mode = $l + (\frac{f_1 - f_0}{2f_1 - f_0 - f_2})$ x h

Where l = lower limit

h = class size

f_0 = frequency of the class preceding the modal class

f_1 = frequency of the modal class

f_2 = frequency of the class succeeding the modal class.

Median

A median is the middle number in a sorted list of numbers. To determine the median value in a sequence of numbers, the numbers must first be arranged in value order from lowest to highest. If there is an odd amount of numbers, the median value is the number that is in the middle, with the same amount of numbers below and above. If there is an even amount of numbers in the list, the middle pair must be determined, added together and divided by two to find the median value. The median can be used to determine an approximate average.

Median = $l + \left(\frac{\frac{n}{2} - cf}{f}\right)$ x h,

l = lower limit of the median class

cf = cumulative frequency of the class preceding the median class

f = frequency of the median class

h = class size

Empirical Formula

3 Median = Mode + 2 Mean.

MULTIPLE CHOICE QUESTIONS

1. The mean weight of a class of 35 students is 45kg. If the weight of a teacher be included, the mean weight increases by 500 grams, then the weight of the teacher is

a) 63 kg b) 61 kg c) 64 kg d) 70 kg

2. In the following distribution

Monthly Income Range (in ₹)	No. of Families
Income more than ₹ 10,000	100
Income more than ₹ 13,000	85
Income more than ₹ 16,000	69
Income more than ₹ 19,000	50
Income more than ₹ 22,000	33
Income more than ₹ 25,000	13

The number of families having income range (in ₹) 16,000 – 19,000 is

a) 15 b) 16 c) 17 d) 19

3. Mean of the following frequency distribution is

Class	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Frequency	8	12	10	11	9

a) 25. 3 b) 25.2 c) 24 d) 25.5

4. The numbers 3, 5, 7 and 9 have their respective frequencies x – 2, x + 2 , x – 3 and x + 3. If the arithmetic mean is 6.5, then the value of x is

a) 3 b) 4 c) 5 d) 6

5. If the mean of the numbers 27 + x, 31 + x, 89 + x, 107 + x, 156 + x is 82, then the mean of 130 + x, 126 + x, 68 + x, 50 + x, 1 + x is

a) 75 b) 157 c) 82 d) 80

6. In a frequency distribution, the mid value of a class is 10 and the width of the class is 6. The lower limit of the class is

a) 6 b) 7 c) 8 d) 12

7. If the mean of the observations x, x + 3, x + 5, x + 7 and x + 10 is 9, then the mean of the last three observations is

a) $10\frac{1}{3}$ b) $10\frac{2}{3}$ c) $11\frac{1}{3}$ d) $11\frac{2}{3}$

8. For the data (2, 9, x + 6, 2x + 3, 5, 10, 5) if mean is 7, then mode is

a) 3 b) 5 c) 9 d) 10

9. The mean of 5 observation is 15. If the mean of first three observations is 14 and last three observations is 17, then the third observation is:

a) 18 b) 19 c) 17 d) 20

10. If the difference of mode and median of a data is 24, then the difference of median and mean is

a) 12 b) 24 c) 8 d) 36

11. The times (in seconds) taken by 150 athletes to run a 110 m hurdle race are tabulated below

Class	13.8 - 14	14 – 14.2	14.2 – 14.4	14.4 – 14.6	14.6 – 14.8	14.8 - 15
Frequency	2	4	5	71	48	20

The number of athletes who completed the race in less than 14.6 s is

a) 11 b) 71 c) 82 d) 130

12. For the following distribution

Marks	No. of students
Below 10	3
Below 20	12
Below 30	27
Below 40	57
Below 50	75
Below 60	80

The modal class is

a) 10-20 b) 20-30 c) 30-40 d) 50-60

13. Mode of the following grouped frequency distribution is

Class	3 - 6	6 - 9	9 - 12	12 - 15	15 - 18	18 - 21	21 - 24
Frequency	2	5	10	23	21	12	3

a) 13.6 b) 15.6 c) 14.6 d) 16.6

14. If the number of runs scored by 11 players of a cricket team of India are 5, 19, 42, 11, 50, 30, 21, 0, 52, 36, 27, then median is

a) 30 b) 32 c) 36 d) 27

15. Consider the following frequency distribution

Class	0 - 5	6 - 11	12 - 17	18 - 23	24 - 29
Frequency	13	10	15	8	11

The upper limit of the median class is

a) 17 b) 17.5 c) 18 d) 18.5

16. If $d_i = x_i - 13, \sum f_i d_i = 30$ and $\sum f_i = 120$, then mean $\bar{x}$ is equal to

a) 13 b) 12.75 c) 13.25 d) 14.25

17. Life time of electric bulbs are given in the following frequency distribution.

Life time (in hours)	250 - 300	300 - 350	350 - 400	400 - 450	450 - 500
No. of bulbs	5	14	21	12	10

The class mark of the modal class is

a) 350 b) 375 c) 400 d) 150

18. The modal class of data given below is 10–15, then

Class Interval	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25
Frequency	8	6	f	4	3

a) f < 9 b) f ≥ 9 c) f > 9 only d) f < 3

19. If the median of the data: 6, 7, x – 2, x, 17, 20 written in ascending order, is 16. Then x is equal to

a) 15 b) 16 c) 17 d) 18

20. If mode of a series exceeds its mean by 12, then mode exceeds the median by

a) 4 b) 8 c) 6 d) 10

21. For some data $x_1, x_2, \ldots\ldots x_n$ with respective frequencies $f_1, f_2, \ldots.. f_n$, the value of $\sum_1^n f_i(x_i - \bar{x})$ is equal to

(a) $n\bar{x}$ (b) 1 (c) $\sum f_i$ (d) 0

22. Mode and Mean of a data are 15x and 18x, respectively. Then the median of the data is

(a) x (b) 11x (c) 17x (d) 34x

23. What is the mode of a data if median and mean of the same data are 9·6 and 10·5, respectively?

(a) 7·8 (b) 12·3 (c) 8·4 (d) 7

24. If the mean of $2,9, x + 6, 2x + 3, 5, 10, 5$ is 7, then the value of x is

(a) 9 (b) 6 (c) 5 (d) 3

25. The mean of seven observations is 17. If the mean of the first four observations is 15 and that of the last four observations is 18, then the fourth observation is:

(a) 14 (b) 13 (c) 12 (d) 10

26. If x(median) + y (mean) = z(mode); is the empirical relationship between mean, median and mode, then value of x + y + z is

(a) 6 (b) 3 (c) 2 (d) 1

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: The arithmetic mean of the following given distribution is 13.81.

x	4	7	10	13	16	19
f	7	10	15	20	25	30

Reason: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$.

2. Assertion: If the number of runs scored by 11 players of a cricket team of India are 5, 19, 42, 11, 50, 30, 21, 0, 52, 36, 27 then median is 30.

Reason : Median $= \left(\frac{n+1}{2}\right)^{th}$ value, if n is odd.

3. Assertion: If the value of mode and mean is 60 and 66 respectively, then the value of median is 64.

Reason: Median = $\frac{1}{2}$(mode + 2 mean)

4. Assertion: If the arithmetic mean of 5, 7, x, 10, 15 is x, then x = 9.25.

Reason: If x_1, x_2, x_3, ..., x_n are n values of a variable X, then the arithmetic mean of these values is given by $\frac{x_1+x_2+x_3+\cdots+x_n}{2n}$.

5. Assertion: Consider the following frequency distribution:

Class	10 -15	15 - 20	20 - 25	25 - 30	30 - 35
Frequency	5	9	12	6	8

The modal class is 10 – 15.

Reason: The class having maximum frequency is called the modal class.

6. Assertion: Consider the following frequency distribution:

Class	3 - 6	6 - 9	9 - 12	12 -15	15 - 18	18 - 21
Frequency	2	5	21	23	10	12

The mode of the above data is 12.4

Reason: The value of the variable which occurs most often is the mode.

7. Assertion: If for a certain frequency distribution, l = 24.5, h = 4, f_0 = 14, f_1 = 14, f_2 = 15, then the value of mode is 25.

Reason: Mode of a frequency distribution is given by: Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$.

CASE STUDY BASED QUESTIONS

1. Education with vocational training is helpful in making a student self-reliant and to help and serve the society. Keeping this in view, a teacher made the following table giving the frequency distribution of a student undergoing vocational training from the training institute.

Age (in years)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-above
No. of participants	62	132	96	37	13	8	6	4	4	3

i) Median class of the above data is:

a) 20 - 24 b) 20.5 - 24.5 c) 19.5 - 24.5 d) 24.5 - 29.5

(ii) Model class of the above data is:

a) 20-24 b) 19.5-24.5 c) 25-29 d) 24.5-29.5

iii) The empirical relationship between mean, median, mode is :

a) Mode = 3 Median + 2 Mean b) Mode = 3 Median – 2 Mean

c) Mode = 3 Mean + 2 Median d) 3 Mode = Median – 2 Mean

iv) If mode = 80 and mean = 110, then the median is:

a) 200 b) 500 c) 190 d) 100

v) The mode is the:

a) middlemost frequent value b) least frequent value

c) maximum frequent value d) none of these

2. The age-wise participation of students of a school in the International Yoga day Celebration that was held in the school ground is shown in the following distribution. By analysing the data given below answer the questions that follow:

If in all 181 students participated, then answer the following questions:

Age(in years)	5 - 7	7 - 9	9 - 11	11 - 13	13 - 15	15 - 17	17 - 19
Number of students	x	15	18	30	50	48	x

i) The median class of the data is:

a) 9 - 11 b) 11 - 13 c) 13 - 15 d) 15 - 17

ii) The value of missing frequency(x) is:

a) 12 b) 10 c) 13 d) 14

iii) The modal class is:

a) 13 - 15 b) 11 - 13 c) 15 - 17 d) 17 - 19

iv) The class mark of the modal class is:

a) 17 b) 16 c) 15 d) 14

v) The sum of lower limits of the median class and upper limit of modal class is:

a) 26 b) 28 c) 30 d) 32

3. Transport department of a city wants to buy some Electric buses for the city. For which they want to analyse the distance travelled by existing public transport buses in a day.

The following data shows the distance travelled by 60 existing public transport buses in a day.

Daily distance travelled (in km)	200 – 209	210 - 219	220 - 229	230 - 239	240 - 249
Number of buses	4	14	26	10	6

i) Determine the median class.

ii) Find the cumulative frequency of the class preceding the median class.

iii) Evaluate the median of the distance travelled.

iv) If the mode of the distance travelled is 223.78 km, then find the mean of the distance travelled by the bus.

4. An electric scooter manufacturing company wants to declare the mileage of their electric scooters. For this, they recorded the mileage (km/charge) of 50 scooters of the same model. Details of which are given in the following table.

Mileage(km/charge)	100 - 120	120 - 140	140 - 160	160 - 180
No. of scooters	7	12	18	13

i) Write the empirical relationship between mean, mode and median.

ii) Find the average mileage.

iii) Obtain the modal value of the given data.

iv) Determine the median of the given data.

5. Air Quality Index: AQI is an index for reporting air quality daily. The purpose of the AQI is to help people know how the local air quality impacts their health. The Environmental Protection Agency (EPA) calculates the AQI for five major air pollutants:

1. Ground-level ozone

2. Particle pollution/particulate matter (PM2.5/pm 10)

3. Carbon Monoxide

4. Sulphur dioxide

5. Nitrogen dioxide

The higher the AQI value, the greater the level of air pollution and the greater the health concerns.

AIQ	270 - 280	280 - 290	290 - 300	300 - 310	310 - 320	320 - 330	Total
No. of weeks	4	10	14	20	24	8	80

Based on the above information, answer the following questions.

i) Estimate the mean AQI.

ii) In which class does the median of distribution lie?

iii)In which class does the mode of distribution lie?

iv) What is the median AQI?

6. BINGO is game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it. The participant cancels the number of the card when called out a number written on the ball selected at random. Whosever cancels all the numbers on his/her card, say BINGO and wins the game.

The table given below, shows the data of one such game where 48 balls were used before Tara said 'BINGO'.

Numbers announced	Number of times
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

Based on the above information, answer the following:

(i) Write the median class.

(ii) When first ball was picked up, what was the probability of calling out an even number?

(iii) Find median of the given data.

(iv) Find the mode of the given data.

7. Vocational training complements traditional education by providing practical skills and hands-on experience. While education equips individuals with a broad knowledge base, vocational training focuses on job-specific skills, enhancing employability thus making the student self-reliant. Keeping this in view, a teacher made the following table given the frequency distribution of students/adults undergoing vocational training from the training institute.

Age (in years)	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54
No. of participants	62	132	96	37	13	11	10	4

From the above, answer the following questions:

(i) What is the lower limit of the modal class of the above data?

(ii) Find the median class of the above data.

(iii) Find the number of participants of age less than 50 years who undergo vocational training.

(iv) Give the empirical relationship between mean, median and mode.

8. The India Meteorological Department observes seasonal and annual rainfall every year in different sub-divisions of our country. It helps them to compare and analyse the results.

The table below shows sub-divisions wise seasonal (monsoon) rainfall (in mm) in 2023.

Rainfall (mm)	**No. of Sub-Divisions**
200 – 400	3
400 – 600	4
600 – 800	7
800 – 1000	4
1000 – 1200	3
1200 – 1400	3

Based on the information given above, answer the following questions:

(i) Write the modal class.

(ii) Find the median of the given data.

(OR)

Find the mean rainfall in the season.

(iii) If a sub-division having at least 800 mm rainfall during monsoon season is considered a good rainfall sub-division, then how many sub-divisions had good rainfall ?

VERY SHORT ANSWERS

1. Find the mean of the following distribution:

Class	3 - 5	5 - 7	7 - 9	9 - 11	11 - 13
Frequency	5	10	10	7	8

2. Find the mode of the following data:

Class Interval	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100	100 - 120	120 - 140
Frequency	6	8	10	12	6	5	3

3. Find the unknown values in the following table:

Class Interval	Frequency	Cumulative Frequency
0 - 10	5	5
10 - 20	7	x_1
20 – 30	x_2	18
30 - 40	5	x_3
40 - 50	x_4	30

4. Find the mean of the following data:

x	4	6	9	10	15
f	5	10	10	7	8

5. If the mean of the following distribution is 7.5. find the value of the missing frequency f.

Variable(x)	5	6	7	8	9	10	11	12
Frequency(f)	20	17	16	10	f	6	7	6

6. If the mean of the following distribution is 6, find the value of p.

x	2	4	6	10	p + 5
f	3	2	3	1	2

7. Find the arithmetic mean for the following frequency distribution.

x	76	79	82	85	88
f	10	36	84	54	16

8. Find the mode of the following frequency distribution.

Marks	10 - 20	20 - 30	30 – 40	40 - 50	50 - 60
No. of Students	12	35	45	25	13

9. Find the mode of the following frequency distribution.

Expenditure on food	300-309	310-319	320-329	330-339	340-349	350-359	360-369	370-379	Total
No. of workers	10	20	24	38	48	27	17	6	190

10. Find the median of the following frequency distribution.

Marks obtained	20	25	35	40	50
No. of Students	5	11	24	16	5

11. Find the median of the following date.

Marks	20	25	35	40	50
No. of Students	5	10	24	16	5

12. The lengths of 40 leaves of a plant are measured to the nearest millimetre and the data obtained is represented in the following table.

Length (in mm)	118 - 126	127 - 135	136 - 144	145 - 153	154 - 162	163 - 171	172 - 180
No. of leaves	3	5	9	12	5	4	2

Find the median length of leaves.

SHORT ANSWERS

1. The median of the following data is 16. Find the missing frequencies a and b, if the total of the frequencies is 70.

Class Interval	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 – 35	35 - 40
Frequency	12	a	12	15	b	6	6	4

2. The mode of the following data is 67. Find the missing frequency x.

Class	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90
Frequency	5	x	15	12	7

3. The mean of the following distribution is 25.2. Find the missing frequency m?

Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Frequency	8	m	10	11	9

4. The arithmetic mean of the following distribution is 50. Find the value of p.

Class Interval	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100
Frequency	17	p	32	24	19

5. Find the mean of the following frequency distribution.

Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Frequency	7	10	15	8	10

6. The mode of the following series is 154. Find the missing frequency f.

Class Interval	120 - 130	130 - 140	140 - 150	150 - 160	160 - 170
Frequency	2	8	f	20	8

7. The following table shows the marks obtained by 100 students of class X in a school during a particular academic session. Find the mode of this distribution.

Marks	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60	Less than 70	Less than 80	Less than 90
No. of Students	10	15	30	50	72	85	90	95	100

8. Find the mode of the following distribution.

Height(in cm)	Above 30	Above 40	Above 50	Above 60	Above 70	Above 80
Number of plants	34	30	27	19	8	2

9. The median of the following frequency distribution is 35. Find the value of x.

Income	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
Frequency	2	3	x	6	5	3	2

10. Find the median of the following data

Profit(in rupees)	More than or equal to 5	More than or equal to 10	More than or equal to 15	More than or equal to 20	More than or equal to 25	More than or equal to 30	More than or equal to 35
No. of shops	30	28	16	14	10	7	3

LONG ANSWERS

1. Daily wages of 110 workers, obtained in a survey, are tabulated below:

Daily Wages	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200	200 - 220	220 - 240
No. of Workers	10	15	20	22	18	12	13

Compute the mean daily wages and modal daily wages of these workers.

2. If the median of the following frequency distribution is 32.5. Find the values of f_1 and f_2.

Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 – 50	50 - 60	60 - 70	Total
Frequency	f_1	5	9	12	f_2	3	2	40

3. Literacy rates of 40 cities are given in the following table. If it is given that mean literacy rate is 63.5, then find the missing frequencies x and y.

Literacy rate (in %)	35-40	40-45	40-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90
Number of cities	1	2	3	x	y	6	8	4	2	3	2

4. On annual day of a school, 400 students participated in the function. Frequency distribution showing their ages is as shown in the following table:

Age (in years)	5 - 7	7 - 9	9 - 11	11 - 13	13 - 15	15 - 17	17 - 19
No. of Students	70	120	32	100	45	28	5

Find mean and median of the above data.

5. The mean of the following distribution is 48.7. Evaluate the missing frequencies corresponding to classes 40 – 50 and 50 – 60 respectively.

Class Interval	20 - 30	30 – 40	40 - 50	50 - 60	60 - 70	70 - 80	Total
Frequency	13	18	3x + 2	2y + 3	12	10	100

6. The mean of the following data is 42. Find the missing frequencies x and y, if the total frequency is 100.

Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 – 50	50 - 60	60 - 70	70 - 80
Frequency	7	10	x	13	y	10	14	9

7. The following table shows the ages of the patients admitted in a hospital during a year.

Age (in years)	5 - 15	15 – 25	25 - 35	35 - 45	45 - 55	55 - 65
No. of patients	6	11	21	23	14	5

Find the mode and the mean of the data given above. Compare and interpret the two measures of central tendency.

8. If the mode of the following date is 45 find x and y if $\Sigma f_i = 50$.

Class	10 - 20	20 - 30	30 - 40	40 – 50	50 - 60	60 - 70	70 - 80
Frequency	4	8	x	12	10	4	y

9. If the median of the following frequency distribution is 32.5, find the value of x and y

Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 – 50	50 - 60	60 - 70	Total
Frequency	x	5	9	12	y	3	2	40

10. If the median of the following frequency distribution is 46, find the missing frequencies x and y.

Class Interval	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	Total
Frequency	12	30	x	65	y	25	18	230

11. Find the missing frequency ‘f’ in the following table, if the mean of the given data is 18. Hence, find the mode.

Daily Allowance	11 - 13	13 - 15	15 - 17	17 - 19	19 - 21	21 - 23	23 - 25
No. of Children	7	6	9	13	f	5	4

12. Medical check-up was carried out for 35 students of a class and their weights were recorded as follows.

Weight(in kg)	38 - 40	40 - 42	42 - 44	44 - 46	46 - 48	48 - 50	50 - 52
Number of Students	3	2	4	5	14	4	3

Find the difference between the mean weight and median weight.

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. The mean and mode of a frequency distribution are 28 and 16 respectively. The median is

a) 22 b) 23.5 c) 24 d) 24.5

2. The mean of 15 numbers is 25. If each number is multiplied by 4, mean of the new numbers is

a) 60 b) 100 c) 10 d) none of these

3. The mean, mode and median of the observations, 7, 7, 5, 7 and x are the same. Then the observation x is

a) 10 b) 9 c) 8 d) 7

4. Assertion: The arithmetic mean of the following frequency distribution is 25.

Class Interval	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	Total
Frequency	12	30	x	65	y	25	18	230

Reason: $\text{Mean}(\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i}$, where $x_i = \frac{1}{2}$(lower limit + upper limit) of i^{th} class interval and f_i is its frequency.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. Calculate the mode of the following data:

Daily wages (in ₹)	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200	200 - 220	220 - 240
No. of workers	10	15	20	22	18	12	13

6. Form the frequency distribution table for the following data:

Marks (Out of 90)	Number of students
More than or equal to 80	4
More than or equal to 70	6
More than or equal to 60	11
More than or equal to 50	17
More than or equal to 40	23
More than or equal to 30	27
More than or equal to 20	30
More than or equal to 10	32
More than or equal to 0	34

7. Find the median of the following data:

Height(in cm)	Less than 120	Less than 140	Less than 160	Less than 180	Less than 200
No. of students	12	26	34	40	50

SECTION C

Each carry 3 marks

8. Find the value of p, if the mean of the following distribution is 20.

x	15	17	19	20 + p	23
f	2	3	4	5	6

9. Compute the median marks for the following data.

Marks	0 & above	10 & above	20 & above	30 & above	40 & above	50 & above
No. of students	50	46	40	20	10	3

SECTION D

Each carry 5 marks

10. The mean of the following data is 19. Find the missing frequencies x and y, if the total frequency is 80.

Class	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40
Frequency	6	8	x	19	20	y	8	3

11. Find the values of frequencies x and y in the following frequency distribution table if N = 100 and median is 32.

Mark	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
No. of students	10	x	25	30	y	10

SECTION E

12. A stopwatch was used to find the time that it took a group of students to run 100m.

Time (in sec)	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100
No. of students	8	10	13	6	3

Based on the above data, answer the following:

i) Estimate the mean time taken by a student to finish the race.

ii) What will be the upper limit of the modal class?

iii) Find the sum of lower limits of median class and modal class.

iv) How many students finished the race within 1 minute?

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers	Long Answers
1. a) 63 kg 2. d) 19 3. b) 25.2 4. c) 5 5. a) 75 6. b) 7 7. c) $11\frac{1}{3}$ 8. c) 9 9. a) 18 10. a) 12 11. c) 82 12. c) 30-40 13. b) 15.6 14. d) 27	1. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 2. (d) Assertion (A) is false but Reason (R) is true. 3. (c) Assertion (A) is true but Reason (R) is false. 4. (c) Assertion (A) is true but Reason (R) is false.	1. i) c ii) b iii) b iv) d v) b 2. i) c ii) b iii) a iv) d v) b 3. i) 219.5 – 229.5 ii) 18 iii) 224.12 km iv) 224.29 km 4. i) 3 Median = Mode + 2 Mean ii) 144. 8 km/charge iii) 150.91	1. 8.15 2. 65. 3. $x_1 = 12$, $x_2 = 6$, $x_3 = 23$ and $x_4 = 7$ 4. 9 5. 8 6. 7 7. 82.45 8. 33.33 9. ₹ 342.73.	1. a = 8, b = 7 2. x = 8 3. 12 4. 28 5. 25.8 6. 12 7. 41.82. 8. 63.75 9. 5 10. 17.5	1. ₹ 170.19 and ₹166.67 2. $f_1 = 3$ and $f_2 = 6$ 3. x = 5 and y = 4. 4. 10.17 and 9.625 5. 20 & 27 6. 12 & 25 7. 36. 8 years & 35.37 8. 10 & 2 9. 3 & 6

15. b) 17.5 16. c) 13.25 17. b) 375 18. b) $f \geq 9$ 19. c) 17 20. b) 8 21. (d) 0 22. (c) 17x 23. (a) 7·8 24. (d) 3 25. (b) 13 26. (c) 2	5. (d) Assertion (A) is false but Reason (R) is true. 6. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). 7. (d) Assertion (A) is false but Reason (R) is true.	iv) 146.67 5. i) 304.25 ii) 300 – 310 iii) 310 – 320 iv) 306 6. i) 30 – 45 ii) $\frac{37}{75}$ iii) 40.5 iv) 51 7. i) 19.5 ii) 19.5 – 24.5 iii) 361 iv) Mode = 3 Median – 2 Mean	10. 35 11. 35 12. 146.75		10. 34 & 46 11. f = 20, mode = 19.95 12. 0.7kg

		8. (i) 600 – 800 (ii) 742.8 mm (OR) 775 mm (iii) 10			

UNIT TEST

1. c) 24

2. b) 100

3. b) 9

4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

5. ₹ 166.67.

6.

Marks	0 -10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90
No. of students	2	2	3	4	6	6	5	2	4

7. 138.57

8. p = 1

9. 27.5

10. x = 10, y = 6

11. x = 9 and y = 16

12. i) 43 ii) 60 iii) 80 iv) 31

CHAPTER 14 - PROBABILITY

Key Concepts

Probability

Probability is a concept which numerically measures the degree of certainty of the occurrence of events.

Random Experiment

A random experiment is one in which the exact outcome cannot be predicted before conducting the experiment. However, one can list out all possible outcomes of the experiment.

Sample Space

The set of all possible outcomes of a random experiment is called its sample space and it is denoted by the letter S.

Sure event

The sample space of a random experiment is called sure or certain event as any one of its elements will surely occur in any trail of the experiment.

Impossible event

An event which will not occur on any account is called an impossible event. It is denoted by φ.

Favourable outcomes

The outcomes corresponding to the occurrence of the desired event are called favourable outcomes of the event.

Classical Definition of Probability

A be any event, P(A) denotes is probability and it is defined as follows

$$P(A) = \frac{Number\ of\ favorable\ outcomes}{Total\ number\ of\ outcomes}$$

Results

- The probability of an event A lies between 0 and 1, both inclusive. That is $0 \leq P(A) \leq 1$.
- The probability of sure event is 1.
- The probability of impossible event is 0.

Remarks

- The word **unbiased** means each outcome is equally likely to occur. For example, an unbiased die indicates that each of the outcomes 1, 2, 3, 4, 5 or 6 has equal chances to occur.
- The pack or deck of playing cards consists of 52 cards, 26 of red colour and 26 of black colour. There are four suits each of 13 cards namely hearts (♥), spades (♠), diamonds (♦) and clubs (♣). Each suit contains ace, king, queen, jack or knave, 10, 9, 8, 7, 6, 5, 4, 3, 2. There are 4 aces, 4 kings, 4 queens, 4 jacks, 4 tens, and so on in a pack. Kings, queens, and jacks are called face cards (or) picture cards.

MULTIPLE CHOICE QUESTIONS

1. A card is selected at random from a well shuffled deck of 52 cards. The probability of its being a face card is

a) $\frac{3}{13}$ b) $\frac{4}{13}$ c) $\frac{6}{13}$ d) $\frac{9}{13}$

2. A bag contains 3 red balls, 5 white balls and 7 black balls. What is the probability that a ball drawn from the bag at random will be neither red nor black?

a) $\frac{1}{5}$ b) $\frac{1}{3}$ c) $\frac{7}{15}$ d) $\frac{8}{15}$

3. If the probability of an event is p, the probability of its complementary event will be:

a) p – l b) p c) 1 – p d) $1 - \frac{1}{p}$

4. A girl calculates that the probability of her winning the first prize in a lottery is 0.08. If 6000 tickets are sold, how many tickets has she bought?

a) 40 b) 240 c) 480 d) 750

5. An unbiased die is tossed once. The probability of getting a multiple of 2 or 3 is

a) $\frac{1}{6}$ b) $\frac{5}{6}$ c) $\frac{1}{2}$ d) $\frac{2}{3}$

6. A letter is chosen at random from the word 'MATHEMATICS'. What is probability that it will be a vowel?

a) $\frac{1}{2}$ b) $\frac{3}{8}$ c) $\frac{3}{11}$ d) $\frac{4}{11}$

7. A letter is chosen at random from the letter of the word 'ASSASSINATION', then the probability that the letter chosen is a vowel and is in the form of $\frac{6}{2x+1}$, then value of x is

a) 5 b) 6 c) 7 d) 8

8. Two unbiased coins are tossed then the probability of getting no heads is $\frac{m}{n}$, then $(m+n)^2$ is

a) 1 b) 4 c) 5 d) 25

9. If three coins are tossed together, then the probability of getting two head is

a) $\frac{1}{8}$ b) $\frac{3}{8}$ c) $\frac{5}{8}$ d) None of these

10. Two dice are thrown together, the probability that sum of the two numbers will be a multiple of 4 is

a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{8}$ d) $\frac{1}{4}$

11. A number x is selected from the numbers 1, 2, 3 and then a second number y is randomly from the numbers 1, 4, 9, then the probability that the product xy of the two numbers will be less than 9 is

a) $\frac{3}{7}$ b) $\frac{4}{9}$ c) $\frac{5}{9}$ d) $\frac{7}{9}$

12. One ticket is drawn at random from a bag containing tickets numbered 1 to 40. The probability that the selected ticket has a number, which is a multiple of 7, is

a) $\frac{1}{7}$ b) $\frac{1}{8}$ c) $\frac{1}{5}$ $\frac{7}{40}$

13. A school has five houses A, B, C, D and E. A class has 23 students, 4 from house A, 8 from house B, 5 from house C, 2 from house D and rest from house E. A single student is selected at random to be the class monitor. The probability that the selected student is not from A, B and C is

a) $\frac{4}{23}$ b) $\frac{6}{23}$ c) $\frac{8}{23}$ d) $\frac{17}{23}$

14. The probability of getting a bad egg in a lot of 400 is 0.035. The number of bad eggs in the lot is

a) 7 b) 14 c) 21 d) 28

15. The probability that the drawn card from a pack of 52 cards is neither an ace nor a spade is

a) $\frac{9}{13}$ b) $\frac{19}{26}$ c) $\frac{10}{13}$ d) $\frac{35}{52}$

16. Two dice are thrown at a time, then the probability that the difference of the numbers shown on the dice is 1 is

a) $\frac{3}{16}$ b) $\frac{5}{18}$ c) $\frac{7}{36}$ d) $\frac{7}{18}$

17. A numbers from 1 to 100 was chosen at random. What is the probability that this number is a prime number between 75 and 85?

a) $\frac{1}{10}$ b) $\frac{1}{50}$ c) $\frac{1}{25}$ d) $\frac{7}{100}$

18. For an event E, $P(E) + P(\bar{E}) = x$, then the value of $x^3 - 3$ is

a) -2 b) 2 c) 1 d) -1

19. A dice thrown twice, the probability of getting 4, 5 or 6 in the first throw and 1, 2, 3 or 4 in the second in the second throw is

a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{1}{2}$ d) $\frac{1}{4}$

20. In a family of 3 children, the probability of having at least one boy is

a) $\frac{3}{4}$ b) $\frac{1}{8}$ c) $\frac{5}{8}$ d) $\frac{7}{8}$

21. All queens, jacks and aces are removed from a pack of 52 playing cards. The remaining cards are well-shuffled and one card is picked up at random from it. The probability of that card to be a king is

(a) $\frac{1}{10}$ (b) $\frac{1}{13}$ (c) $\frac{3}{10}$ (d) $\frac{3}{13}$

22. The probability of getting a chocolate flavoured ice cream at random, in a lot of 600 ice creams is 0.055. The number of chocolate flavoured ice creams in the lot is

(a) 33 (b) 55 (c) 11 (d) 44

23. Two dice are thrown at the same time and the product of the numbers appearing on them is noted. The probability that the product of the numbers lies between 8 and 13 is

(a) $\frac{7}{36}$ (b) $\frac{5}{36}$ (c) $\frac{2}{9}$ (d) $\frac{1}{4}$

24. From the data 1, 4, 7, 9, 16, 21, 25, if all the even numbers are removed, then the proability of getting at random a prime number from the remaining is

(a) $\frac{2}{5}$ (b) $\frac{1}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$

25. Two dice are rolled together. The probability of getting sum of numbers on the two dice as 2, 3 or 5 is

(a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{5}{36}$ (d) $\frac{4}{9}$

26. Two dice are rolled together. The probability of getting the sum of the two numbers to be more that 10 is

(a) $\frac{1}{9}$ (b) $\frac{1}{6}$ (c) $\frac{7}{12}$ (d) $\frac{1}{12}$

27. Two dice are thrown together. The probability that they show different number is

(a) $\frac{1}{6}$ (b) $\frac{5}{6}$ (c) $\frac{1}{3}$ (d) $\frac{2}{6}$

28. The probability of guessing the correct answer to certain question is $\frac{x}{6}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then the value of x is

(a) 2 (b) 3 (c) 4 (d) 6

29. A bag contains 3 red balls, 5 white balls and 7 black balls. The probability that a ball drawn from the bag at random will be neither red nor black is

(a) $\frac{1}{3}$ (b) $\frac{1}{5}$ (c) $\frac{7}{15}$ (d) $\frac{8}{15}$

30. A card is selected at random from a deck of 52 playing cards. The probability of it being a red face card is

(a) $\frac{3}{13}$ (b) $\frac{2}{13}$ (c) $\frac{1}{2}$ (d) $\frac{3}{26}$

31. The probability of drawing an even prime number out of numbers from 1 to 30 is

(a) $\frac{1}{30}$ (b) $\frac{4}{15}$ (c) $\frac{7}{30}$ (d) 0

32. If all the red face cards are removed from the deck of 52 playing cards, then the probability of getting a black jack from the remaining cards is

(a) $\frac{2}{46}$ (b) $\frac{2}{52}$ (c) $\frac{4}{48}$ (d) $\frac{2}{23}$

33. If for any event E, $P(E) + P(\overline{E}) = q$, then the value of $q^2 - 3$ is

(a) 0 (b) -2 (c) 2 (d) 1

34. A die is thrown once. The probability of getting a number which is not a factor of 36, is

(a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{5}{6}$

35. If in a lottery, there are 10 prizes and 30 blanks, then the probability of winning a prize is

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{3}{4}$ (d) $\frac{2}{3}$

36. The number of red balls in a bag is 10 more than the number of black balls. If the probability of drawing a red ball at random from this bag is $\frac{3}{5}$, then the total number of balls in the bag is

(a) 50 (b) 60 (c) 80 (d) 40

37. A pair of dice is thrown. The probability that sum of numbers appearing on top faces is atmost 10 is

(a) $\frac{1}{11}$ (b) $\frac{10}{11}$ (c) $\frac{5}{6}$ (d) $\frac{11}{12}$

38. A bag contains red balls and black balls in the ratio 3:7. A ball drawn at random. The probability that ball so drawn is black in colour is

(a) $\frac{3}{7}$ (b) 0.3 (c) 0.7 (d) $\frac{1}{7}$

39. The probability of getting a composite number greater than 3 on throwing a die is

(a) $\frac{1}{6}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$

40. A piggy bank contains ₹ 1 coins and ₹ 2 in the ratio 9:11 respectively. The piggy bank is accidently dropped and a coin pops out of it. The probability that it is a ₹ 2 is

(a) $\frac{9}{11}$ (b) 0.45 (c) 0.55 (d) $\frac{1}{11}$

41. A bag contains red coloured, blue coloured and green coloured balls in the ratio 2:3:4. A ball is drawn at random at random from the given bag. The probability that the ball so drawn being not blue of colour is

(a) $\frac{1}{9}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{8}{9}$

ASSERTION AND REASON TYPE QUESTIONS

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

1. Assertion: In a cricket match a batsman hits a boundary 9 times out of 45 balls he plays. The probability that in a given throw he does not hit the boundary is $\frac{4}{5}$.

Reason: P(E) + P (not E) = 1.

2. Assertion: The probability of a sure event is 1.

Reason: Let E be an event. Then $0 \leq P(E) \leq 1$.

3. Assertion: It is given that in a group of 3 students, the probability of 2 students not having the same birthday is 0.992, then the probability that the 2 students have the same birthday is 0.128.

Reason: If n(A) = 1 and n(S) = 13, then P(A) = $\frac{1}{3}$.

4. Assertion: The probability of winning a game is 0.4, then the probability of losing it is 0.6.

Reason: P(E) + P (not E) = 1.

5. Assertion: An even is very unlikely to happen. Its probability is 0.0001.

Reason: Reason: If P(A) denote the probability an event A, then $0 \leq P(A) \leq 1$.

6. Assertion: When two coins are tossed simultaneously then the probability of getting no tail is $\frac{1}{4}$.

Reason: The probability of getting head (i.e no tail) in one toss of a coin is $\frac{1}{2}$.

7. Assertion: In rolling a dice, the probability of getting number 8 is zero.

Reason: Its an impossible event.

8. Assertion: In a simultaneously throw a pair of dice. The probability of getting a double is $\frac{1}{6}$.

Reason: Probability of an event may be negative.

9. Assertion: The probability of getting a prime number when a die is thrown once is $\frac{2}{3}$.

Reason: Prime numbers on a die are 2, 3, 5.

10. Assertion: If a box contains 5 white, 2 red and 4 black marbles, then the probability of not drawing a white marble from the box is $\frac{5}{11}$.

Reason: $P(\bar{E}) = 1 - P(E)$, where E is any event.

11. Assertion: The probability of selecting a number at random from the numbers 1 to 20 is 1.

Reason: For any event E, if P(E) = 1, then E is called a sure event.

CASE STUDY BASED QUESTIONS

1. On a weekend Rani was playing cards with her family. The deck has 52 cards. If her brother drew one card.

i) Find the probability of getting a king of red colour.

ii) Find the probability of getting a face card.

iii) Find the probability of getting a jack of hearts.

iv) Find the probability of getting a red face card.

v) Find the probability of getting a spade.

2. Rahul and Ravi planned to play Business (board game) in which they were supposed to use two dice.

i) Ravi got first chance to roll the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 8?

ii) Rahul got next chance. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 13?

iii) Now it was Ravi's turn. He rolled the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is less than or equal to 12?

iv) Rahul got next chance. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is equal to 7?

v) Now it was Ravi's turn. He rolled the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is greater than 8?

3. In a play zone, Sujesa is playing arcade game which consists of 50 teddy bears, 40 pokemons, 30 tigers and 60 monkeys. Sujesa picks a puppet at random.

i) Find the probability of getting a tiger.

ii) Write the probability of getting a monkey.

iii) What is the probability of getting a teddy bear?

iv) Find the probability of not getting a monkey.

4. Teacher wants to distribute chocolates in his class on farewell party. The chocolates are of three types: Milk chocolate, White chocolate and Dark chocolate. If the total number of students in the class is 66 and everyone gets a chocolate, then answer the following questions.

i) If the probability of distributing milk chocolates is $\frac{1}{3}$, then find the number of milk chocolates teacher has.

ii) If the probability of distributing dark chocolates is $\frac{5}{11}$, then find the number of milk chocolates teacher has.

iii) Find the probability of distributing white chocolate.

iv) Find the probability of distributing both milk and white chocolate.

5. In a toy shop, there is a spinning wheel for their customers. The spinning wheel has different types of prizes as shown in figure. A customer can only spin the wheel after buying something from the shop.

On the basis of above information answer the following questions.

i) If Mr. Mehta spins the wheel, then find the probability that he gets 15% discount.

ii) If Mrs. Rita spins the wheel, then find the probability of getting video game.

iii) Deepak spins the wheel, find the probability that the wheel stops at basket.

iv) Find the probability that one customer wins 75% discount.

6. In the month of May, the weather forecast department gives the prediction of weather for the month of June. The given table shows the probabilities of forecast of different days:

Days	Sunny	Cloudy	Partiallly cloudy	Rainy
Probability	$\frac{1}{2}$	x	$\frac{1}{5}$	y

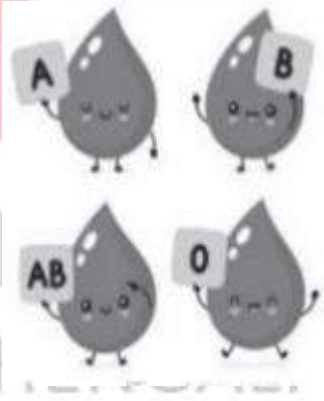
(i) Find the number of sunny days in June.

(ii) Find the value of x, if the number of cloudy days in June is 5.

(iii) Find the probability of the day that is not rainy.

(iv) If sum of x and y is $\frac{3}{10}$, then find the number of rainy days in June.

7. Blood group describes the type of blood a person has. It is a classification of blood on the presence of absence of inherited antigenic substances on the surface of red blood cells. Blood types predict whether a serious reaction will occur in a blood transfusion. In a sample of 50 people, 21 had type O blood, 22 had type A, 5 had type B and rest had type AB blood group.



(i) What is the probability that a person chosen at random had type O blood?

(ii) What is the probability that a person chosen at random had type AB blood group?

(iii) What is the probability that a person chosen at random had neither type A nor type B blood group?

(iv) What is the probability that person chosen at random had either type A or type B or type O blood group?

8. Vivek is very fond of collecting balls of different colours. He has a total of 25 balls in his basket out of which five balls are red in colour and eight are white. Out of the remaining balls, some are green in colour and the rest are pink.

Based on the above information, solve the following questions:

(i) If the probability of drawing a pink ball is twice the probability of drawing a green ball, then find the number of pink balls.

(ii) Find the probability of drawing a ball of colour other than green colour.

(iii) Find the probability of drawing either a green or white ball.

(iv) What is the probability that drawn ball is neither a pink nor a white ball?

9. Rohit wants to distribute chocolates in his class on his birthday. The chocolates are of three types: milk chocolate, white chocolate and dark chocolate. If the total number of students in the class is 54 and everyone gets a chocolate, then answer the following questions:

(i) If the probability of distributing milk chocolates is $\frac{1}{3}$, then find the number of milk chocolates Rohit has.

(ii) Find the number of dark chocolates Rohit has if the probability of distributing dark chocolate is $\frac{4}{9}$.

(iii) Evaluate the probability of distributing white chocolate.

(iv) Find the probability of distributing both milk and white chocolate.

10. In a party, some children decided to play musical chair game. In the game, the person playing the music has been advised to stop the music at any time in the interval of 3 minutes after he start the music in each turn. On the basis of the given information, answer the following questions:

(i) What is the probability that the music will stop within first 30 seconds after starting?

(ii) Find the probability that the music will stop within 45 seconds after starting.

(iii) Find the probability that the music will not stop after 2 minutes after starting.

(iv) What is the probability is that the music will not stop within first 60 seconds after starting?

11. Rahul goes to a fete Mussoorie. There he saw a game having prizes – wall clock, power banks, puppets and water bottles. The game consists of a box having cards inside it, bearing the numbers 1 to 200 one on each card. A person has to select a card at random. Now the winning of prizes has the following conditions:

Wall clock – If the number on the selected card is a perfect square.

Power Bank – If the number on the selected card is multiple of 3

Puppet – If the numbers of the selected card is divisible by 10.

Water bottle – If the number of the selected card is a prime number more than 100 but less than 150.

Better luck next time – If the number on the selected card is perfect cube.

On the basis of above information, answer the following questions:

(i) Find the probability of winning a puppet a puppet.

(ii) Find the probability of winning a water bottle.

(iii) What is the probability of getting a wall clock?

(iv) Find the probability of getting 'Better luck next time'.

12. Two friends were playing a game with two dice. Anju has a blue dice and Nithish has a grey dice. They decided to throw both the dice simultaneously and note down all the possible outcomes appearing on the top of both the dice.

On the basis of above information, answer the following questions:

(i) Find the probability of getting the sum of numbers on two dice is 16.

(ii) Find the probability that both the numbers are prime numbers.

(iii) What is the probability that product of two numbers is odd?

(iv) Find the probability that difference between numbers is zero.

13. Four friends are playing with cards. One of them hides all the 2's, 5's and jacks from the deck of 52 cards and then shuffles the remaining cards. Now, he tells to one of his friends to pick a card at random from the remaining cards.

On the basis of above information, answer the following questions:

(i) Find the probability of getting '6 of spade'.

(ii) Find the probability of getting a black diamond.

(iii) What is the probability of getting a face card?

(iv) What is the probability of getting a red card?

14. In a toy shop, there is a spinning wheel for their customers. The spinning wheel has different types of prizes as shown in the figure. A customer can only spin the wheel after buying something from the shop.

On the basis of above information, answer the following questions:

(i) If Mr.Sharma spins the wheel, then what is the probability that he gets 100% discount?

(ii) If Anita spins the wheel, find the probability of getting no prize.

(iii) Anush spine the wheel, find the probability that the wheel stops at soccer ball.

(iv) What is the probability that one customer wins 15% discount.

15. Mr.Verma is a production manager in a factory that makes footballs. On one day, he noticed that at every 100 pieces produced in the factory, 15 are defective. If the total number of footballs produced in one day in the factory is 22000, then answer the following questions:

(i) Find the total number of defective footballs produced in one day.

(ii) A football is selected at random, then find the probability of selecting defective football.

(iii) A football is selected at random, then find the probability of selecting non-defective football.

16. Two families – Gupta's and Singhal's are lived in a colony. Gupta family has two children while Singhal family has 3 children.

On the basis of above information, answer the following questions:

(i) Find the probability that Mr.Singhal has exactly 2 girls and 1 boy.

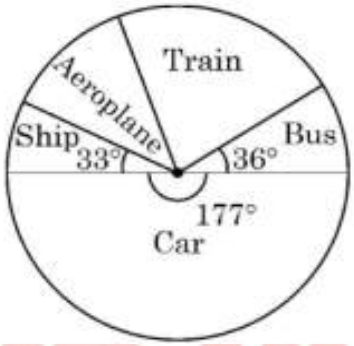
(ii) Find the probability that Gupta has atleast 1 boy.

(iii) Find the probability that Singhal has no boy.

(iv) Find the sum of probabilities that both families have exactly two girls.

17. In a survey on holidays, 120 peopke were asked to state which type of transport they used on their last holiday. The following pie chart shows the result of the survey.

Observe the pie chart and answer the following questions:



(i) If one person is selected at random, find the probability that he/she travelled by bus or ship.

(ii) Which is most favourite mode of transport and how many people used it?

(iii) A person is selected at random, If the probability that he did not use train is $\frac{4}{5}$, find the number of people who used train.

(iv) The probability that randomly selected person used aeroplane is $\frac{7}{60}$. Find the revenue collected by air company at the rate of ₹5000 per person.

18. Rahul is a lucky charm for his cricket team. He has a jar of cards with numbers from 10 to 74. Before each match, he draws a card from the jar. If the card bears an even number, the team wins. If the number is even and divisible by 5, they win by a big margin. If the number is an odd

number less than 30, they win by a small margin. And if the number is a prime number between 50 and 74, they lose.

Answer the following questions if Rahul draws a card today:

(i) What is the probability that Rahul draws a card with an even number?

(ii) What is the probability that Rahul draws a card with an odd number less than 30?

(iii) What is the probability that Rahul draws a card with a prime number between 50 and 74?

(OR)

What is the probability that Rahul draws a card with an even number divisible by 5?

VERY SHORT ANSWERS

1. A die is thrown twice. Find the probability that (i) 5 will come up at least once. (ii) 5 will not come up either time.

2. A die is thrown once. Find the probability of getting (i) a composite number, (ii) a prime number.

3. An integer is chosen at random between 1 and 100. Find the probability that it is (i) divisible by 8. (ii) not divisible by 8.

4. A card is drawn at random from a well shuffled deck of 52 cards. Find the probability of getting

neither a red card nor a queen.

5. Two different dice are thrown together. Find the probability that the product of the number appeared is less than 18.

6. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball from the bag is thrice that of a red ball, find the number of blue balls in the bag.

7. Two coins are tossed simultaneously. Find the probability of getting (i) exactly 1 head (ii) at most 1 head (iii) at least 1 head.

8. Ravi throws two different dice together and finds the product of the two numbers obtained. Prabu throws a die and squares the number obtained. Who has the better chance to get the number 25?

9. Two different dice are thrown together. Find the probability that the numbers obtained have (i) even sum (ii) even product.

10. Cards marked with numbers 3, 4, 5, ….., 50 are placed in a box and mixed thoroughly. A card is drawn at random from the box. Find the probability that the selected card bears a perfect square number.

11. A game consists of tossing a coin 3 times and noting the outcome each time. If getting the same result in all the tosses is a success, find the probability of losing the game.

12. One card is drawn from a pack of 52 cards. Find the probability that: (i) the card drawn is a king (ii) the card drawn is black and a king.

13. Swathi and Hamida are friends. What is the probability that both will have: (i) different birthdays? (ii) the same birthday?

14. What is the probability that a leap year, selected at random will contains 53 Sundays?

15. If 65% of the population has black hair, 25% has brown hair and the remaining has white hair, what is the probability that a person selected at random has (i) white hair (ii) brown or black hair.

16. Two friends Anil and Ashraf were born in the December month in the year 2010. Find the probability that: (i) they share same date of birth (ii) they have different dates of birth.

17. While shuffling a pack of 52 cards, one card was accidently dropped. Find the probability that the dropped card (i) is not a face card (ii) is a black king.

SHORT ANSWERS

1. Two different dice are thrown together. Find the probability that the number obtained (i) have a sum less than 7 (ii) have a product less than 16 (iii) is a doublet of odd numbers.

2. A bag contains 15 white and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, find the number of black balls in the bag.

3. Three different coins are tossed together. Find the probability of getting (i) exactly two heads. (ii) at least two heads (iii) at least two tails.

4. From a pack of 52 playing cards, Jacks, Queens and Kings of red colour are removed. From the remaining, a card is drawn at random. Find the probability that drawn card is: (i) a black king, (ii) a card of red colour, (iii) a card of black colour.

5. From a deck of 52 playing cards, Jacks and kings of red colour and Queen and Aces of black colour are removed. The remaining cards are mixed and a card is drawn at random. Find the probability that the drawn card is (i) A black Queen (ii) A card of red colour (iii) A Jack of black colour.

6. Cards numbered 11 to 60 are kept in a box. If a card is drawn at random from the box, find the probability that the number on the drawn card is (i) an odd number, (ii) a perfect square number, (iii) divisible by 5, (iv) a prime number less than 20.

7. A box contains 100 red balls, 200 yellow balls and 50 blue balls. If a ball is drawn at random from the box, then find the probability that it will be (i) a blue ball, (ii) not a yellow ball, (iii) neither yellow nor a blue ball.

8. A bag contains white, black and red balls only. A ball is drawn at random from the bag. If the probability of getting a white ball is $\frac{3}{10}$ and that of a black ball is $\frac{2}{5}$ then find the probability of getting a red ball. If the bag contains 20 black balls then find the total number of balls in the bag.

9. Two different dice are rolled together. Find the probability of getting (i) the sum of numbers on two dice to be 5, (ii) even number on both dice, (iii) a doublet.

10. A card is drawn at random from a well-shuffled deck of 52 playing cards. Find the probability that the card drawn is (i) a card of spades or an ace, (ii) a black king, (iii) neither a jack nor a king, (iv) either a king or a queen.

11. All the black face cards are removed from a pack of 52 playing cards. The remaining cards are well shuffled and then a card is drawn at random. Find the probability of getting a (i) face card, (ii) red card, (iii) black card, (iv) king.

12. The probability of selecting a blue marble at random from a jar that contains only blue, black and green marbles is $\frac{1}{5}$. The probability of selecting a black marble at random from the jar is $\frac{1}{4}$. If the jar contains 11 green marbles, find the total number of marbles in the jar.

13. Two dice are thrown simultaneously. Find the probability of getting: (i) an even number as the sum (ii) the sum as a prime number (iii) a total of at least 10 (iv) a multiple of 3 as the sum.

14. If 2 black kings and 2 red aces are removed from a deck of 52 cards, find the probability of getting (i) an ace of heart (ii) a king (iii) an ace (iv) a heart (v) a red card.

15. A bag contains 12 balls, out of which x are white. (i) If one ball is drawn at random, what is the probability that it will be a white ball? (ii) If 6 more white balls are put in the bag, the probability of drawing a white ball will become double than that in (i), find x.

16. Two dice are thrown at the same time. Determine the probability that the difference of the numbers on the two dice is 2.

17. Two dice are rolled together. Find the probability of getting : (i) a multiple of 2 on one and a multiple of 3 on the other die. (ii) the product of two numbers on the top of the two dice is a perfect square number.

18. If 65% of the population has black eyes, 25% have brown eyes and the remaining have blue eyes, what is the probability that a person selected at random has: (a) blue eyes (b) brown or black eyes.

19. All face cards of spades are removed from a pack of 52 playing cards and the remaining pack is shuffled well. A card is then drawn at random from the remaining pack. Find the probability of getting: (a) a face card (b) an ace or a jack

UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. In a survey, it is found that every fifth person possess a vehicle. The probability of a person 'not possessing the vehicle' is:

a) $\frac{1}{5}$ b) $\frac{4}{5}$ c) $\frac{3}{5}$ d) 1

2. A coin is tossed 1000 times and 560 times a 'tail' occurs. The empirical probability of occurrence

of a Head in this case is:

a) 0.50 b) 0.56 c) 0.44 d) 0.056

3. A man is known to speak truth 3 out of 4 times. He throws a die and a number other than six comes up, then the probability that he reports it is a six is

a) $\frac{3}{4}$ b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) 1

4. Assertion: If a die is thrown, the probability of getting a number less than 3 and greater than 2 is zero.

Reason: Probability of an impossible event is zero.

Reason:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. Cards marked with numbers 5 to 50 are placed in a box and mixed thoroughly. A card is drawn from the box at random. Find the probability that the number on the taken out card is (i) a prime number less than 10 (ii) a number which is a perfect square.

6. If a number is chosen at random from the numbers -3, -2, -1, 0, 1, 2, 3. What is the probability that $x^2 < 4$?

7. 20 tickets on which numbers 1 to 20 are written mixed thoroughly and then a ticket is drawn at random out of them. Find the probability that the number on the drawn ticket is a multiple of 3 or 7.

SECTION C

Each carry 3 marks

8. Two different dice are thrown together. Find the probability that (i) the sum of the numbers appeared is less than 7. (ii) the product of the numbers appeared is less than 18.

9. A die has its faces marked 0, 1, 1, 1, 6, 6. Two such dice are thrown together and the total score is recorded. (i) How many different scores are possible? (ii) What is the probability of getting a total of 7?

SECTION D

Each carry 5 marks

10. The king, the jack and the 10 of spades are lost from a pack of 52 cards and a card is drawn from the remaining cards after shuffling. Find the probability of getting a (i) red card (ii) black jack (iii) red king (iv) 10 of hearts.

11. A pair of dice is thrown once. Find the probability of (i) getting a total of 5 on two dice, (ii) getting a multiple of 2 on one dice and a multiple of 3 on the other.

SECTION E

12. A die is numbered in such a way that its faces show the numbers 1, 3, 3, 4, 2, 6. It is thrown twice and the product of the score is noted. Complete the table and answer the questions below:

	1	**3**	**3**	**4**	**2**	**6**
1	1	3	3	4	2	6
3		9		12		
3			9			18
4				16		
2			6			12
6		18		24	12	

i) Write the probability of getting the product as 18.

ii) Find the probability of getting the product, as an odd number.

iii) What is the probability of getting the product as at least 10?

iv) Determine the probability of getting the product a number which is not a multiple of 3.

ANSWERS

MCQ	A – R Questions	Case Study	Very Short Answers	Short Answers
1. a) $\frac{3}{13}$ 2. b) $\frac{1}{3}$ 3. c) 1 – p 4. c) 480 5. d) $\frac{2}{3}$ 6. $\frac{4}{11}$ 7. b) 6 8. d) 25 9. b) $\frac{3}{8}$	1. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 2. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). 3. (d) Assertion (A) is	1. i) $\frac{1}{26}$ ii) $\frac{3}{13}$ iii) $\frac{1}{52}$ iv) $\frac{3}{13}$ v) $\frac{1}{4}$ 2. i) $\frac{5}{36}$ ii) 0 iii) 1 iv) $\frac{1}{6}$ v) $\frac{5}{18}$ 3. i) $\frac{1}{6}$ ii) $\frac{1}{3}$ iii) $\frac{5}{18}$ iv) $\frac{2}{3}$ 4. i) 22 ii) 30 iii) $\frac{7}{33}$ iv) $\frac{6}{11}$ 5. i) $\frac{1}{5}$ ii) $\frac{1}{10}$	1. $\frac{11}{36}$ and $\frac{25}{36}$ 2. $\frac{1}{3}$ and $\frac{1}{2}$ 3. $\frac{6}{49}$ and $\frac{43}{49}$ 4. $\frac{6}{13}$ 5. $\frac{13}{18}$ 6. 15 7. $\frac{1}{2}, \frac{3}{4}, \frac{3}{4}$ 8. Prabu 9. $\frac{1}{2}, \frac{3}{4}$	1. $\frac{5}{12}, \frac{25}{36}$ and $\frac{1}{12}$ 2. 45 3. $\frac{3}{8}, \frac{1}{2}$ and $\frac{1}{2}$ 4. $\frac{1}{23}, \frac{10}{23}$ and $\frac{13}{23}$ 5. 0, $\frac{1}{2}, \frac{1}{22}$ 6. $\frac{1}{2}, \frac{2}{25}, \frac{1}{5}, \frac{2}{25}$ 7. $\frac{1}{7}, \frac{3}{7}, \frac{2}{7}$ 8. $\frac{3}{10}$, 15 9. $\frac{1}{9}, \frac{1}{4}, \frac{1}{6}$

10. d) $\frac{1}{4}$

11. c) $\frac{5}{9}$

12. b) $\frac{1}{8}$

13. b) $\frac{6}{23}$

14. b) 14

15. a) $\frac{9}{13}$

16. b) $\frac{5}{18}$

17. b) $\frac{1}{50}$

18. -2

19. a) $\frac{1}{3}$

false but Reason (R) is true.

4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

5. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

6. (b) Both Assertion

iii) $\frac{1}{5}$ iv) $\frac{1}{10}$

6. i) 15

ii) $\frac{1}{6}$

iii) $\frac{13}{15}$

iv) 4

7. i) $\frac{21}{50}$

ii) $\frac{1}{25}$

iii) $\frac{23}{50}$

iv) $\frac{24}{25}$

8. i) 8)

10. $\frac{1}{8}$

11. $\frac{3}{4}$

12. $\frac{1}{13}, \frac{1}{26}$

13. $\frac{364}{365}, \frac{1}{365}$

14. $\frac{2}{7}$

15. $\frac{1}{10}, \frac{9}{10}$

16. $\frac{1}{31}$ & $\frac{30}{31}$

17. $\frac{10}{13}$ & $\frac{1}{26}$

10. $\frac{4}{13}, \frac{1}{26}, \frac{11}{13}, \frac{2}{13}$

11. $\frac{3}{23}, \frac{13}{23}, \frac{10}{23}, \frac{1}{23}$

12. 20

13. $\frac{1}{2}, \frac{5}{12}, \frac{1}{6}, \frac{1}{3}$

14. 0, $\frac{1}{24}, \frac{1}{24}, \frac{1}{4}, \frac{1}{2}$

15. $\frac{x}{12}, \frac{x+6}{18}$, 3

16. $\frac{2}{9}$

17. (i) $\frac{11}{36}$ (ii) $\frac{2}{9}$

18. $\frac{1}{10}$ & $\frac{9}{10}$

19. $\frac{9}{49}$ & $\frac{1}{7}$

20. d) $\frac{7}{8}$ 21. (a) $\frac{1}{10}$ 22. (a) 33 23. (a) $\frac{7}{36}$ 24. (b) $\frac{1}{5}$ 25. (a) $\frac{7}{36}$ 26. (d) $\frac{1}{12}$ 27. (b) $\frac{5}{6}$ 28. (a) 2 29. (a) $\frac{1}{3}$	(A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). 7. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 8. (c) Assertion (A) is true but Reason (R) is false. 9. (d) Assertion (A) is	ii) $\frac{21}{25}$ iii) $\frac{12}{25}$) iv) $\frac{9}{25}$ 9. i) 18 ii) 24 iii) $\frac{2}{9}$ iv) $\frac{5}{9}$ 10. i) $\frac{1}{6}$ ii) $\frac{1}{4}$ iii) $\frac{1}{3}$		

30. (d) $\frac{3}{26}$ 31. (a) $\frac{1}{30}$ 32. (a) $\frac{2}{46}$ 33. (b) -2 34. (c) $\frac{1}{6}$ 35. (a) $\frac{1}{4}$ 36. (a) 50 37. (d) $\frac{11}{12}$ 38. (c) 0.7 39. (b) $\frac{1}{3}$	false but Reason (R) is true. 10. (d) Assertion (A) is false but Reason (R) is true. 11. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)	iv) $\frac{2}{3}$ 11. i) $\frac{1}{10}$ ii) $\frac{1}{20}$ iii) $\frac{7}{100}$ iv) $\frac{1}{40}$ 12. i) 0) ii) $\frac{1}{4}$ iii) $\frac{1}{4}$ iv) $\frac{1}{6}$ 13. i) $\frac{1}{40}$		

40. (c) 0.55 41. (c) $\frac{2}{3}$		ii) 0 iii) $\frac{1}{5}$ iv) $\frac{1}{2}$ 14. i) $\frac{1}{10}$ ii) $\frac{3}{10}$ iii) $\frac{1}{5}$ iv) $\frac{1}{5}$ 15. i) 3300 ii) $\frac{3}{20}$ iii) $\frac{17}{20}$		

		16. i) $\frac{1}{4}$ ii) $\frac{2}{3}$ iii) $\frac{1}{4}$ iv) $\frac{7}{12}$ 17. i) $\frac{23}{120}$ ii) 59 iii) $\frac{1}{5}$ & 24 iv) ₹70,000 18. (i) $\frac{33}{65}$ (ii) $\frac{2}{13}$		

		(iii) $\frac{6}{65}$ (OR) $\frac{7}{65}$		

UNIT TEST

1. b) $\frac{4}{5}$

2. c) 0.44

3. b) $\frac{1}{4}$

4. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

5. $\frac{1}{23}, \frac{5}{46}$

6. $\frac{3}{7}$

7. $\frac{2}{5}$

8. $\frac{5}{12}, \frac{13}{18}$

9. 6, $\frac{1}{3}$

10. $\frac{26}{49}, \frac{1}{49}, \frac{2}{49}, \frac{1}{49}$

11. $\frac{1}{9}, \frac{11}{36}$

12. i) $\frac{1}{18}$ ii) $\frac{1}{4}$ iii) $\frac{7}{18}$ iv) $\frac{1}{4}$

MATHEMATICS STANDARD – Code No.041
SAMPLE QUESTION PAPER
CLASS – X (2025-26)

Maximum Marks: 80 **Time: 3 hours**

General Instructions:

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions. All Questions are compulsory.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Question numbers 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion- Reason based questions of 1 mark each.
4. In Section B, Question numbers 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Question numbers 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Question numbers 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Question numbers 36-38 are case study-based questions carrying 4 marks each with sub parts of the values of 1, 1 and 2 marks each respectively.
8. There is no overall choice. However, an internal choice in 2 questions of Section B, 2 questions of Section C and 2 questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Draw neat and clean figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.
10. Use of calculators is not allowed.

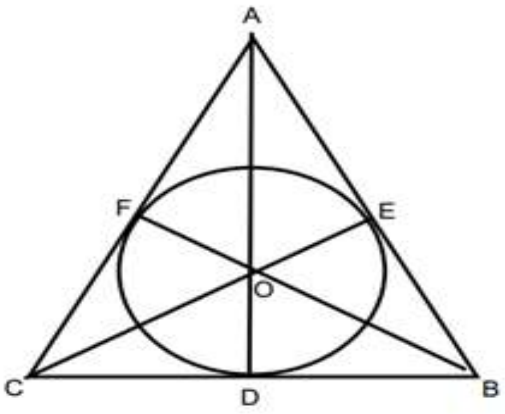
(Section A) **Section A consists of 20 questions of 1 mark each.**		
Q.No.	**Questions**	**Marks**
1.	If $a = 2^2 \times 3^x$,$b = 2^2 \times 3 \times 5$,$c = 2^2 \times 3 \times 7$ and LCM $(a, b, c) = 3780$, then x is equal to (A) 1 (B) 2 (C) 3 (D) 0	**1**
2.	The shortest distance (in units) of the point (2,3) from y-axis is (A) 2 (B) 3 (C) 5 (D) 1	**1**
3.	If the lines given by 3*x* +2k*y* =2 and 2*x*+5*y* +1=0 are not parallel, then k has to be (A) $\frac{15}{4}$ (B) $\neq\frac{15}{4}$ (C) any rational number (D) any rational number having 4 as denominator	**1**

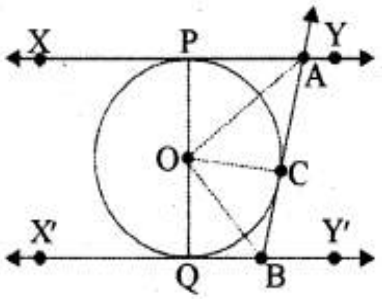
*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26

4.	A quadrilateral ABCD is drawn to circumscribe a circle. If BC=7cm, CD=4cm and AD=3cm, then the length of AB is (A) 3cm (B) 4cm (C) 6cm (D) 7cm	**1**
5.	If $sec\theta + tan\theta = x$,then $sec\theta - tan\theta$ will be (A) x (B) x^2 (C) $\frac{2}{x}$ (D) $\frac{1}{x}$	**1**
6.	Which one of the following is not a quadratic equation? (A) $(x+2)^2 = 2(x+3)$ (B) $x^2 + 3x = (-1)(1-3x)^2$ (C) $x^3 - x^2 + 2x + 1 = (x+1)^3$ (D) $(x+2)(x+1) = x^2 + 2x + 3$	**1**
7.	Given below is the picture of the Olympic rings made by taking five congruent circles of radius 1cm each, intersecting in such a way that the chord formed by joining the point of intersection of two circles is also of length 1cm.Total area of all the dotted regions (assuming the thickness of the rings to be negligible) is  (A) $4[\frac{\pi}{12} - \frac{\sqrt{3}}{4}]$ cm^2 (B) $[\frac{\pi}{6} - \frac{\sqrt{3}}{4}]$ cm^2 (C) $4[\frac{\pi}{6} - \frac{\sqrt{3}}{4}]$ cm^2 (D) $8[\frac{\pi}{6} - \frac{\sqrt{3}}{4}]$ cm^2 **For Visually Impaired candidates** The area of the circle that can be inscribed in a square of 6 cm is (A) 36πcm^2 (B) 18πcm^2 (C) 12πcm^2 (D) 9πcm^2	**1**
8.	A pair of dice is tossed. The probability of not getting the sum eight is (A) $\frac{5}{36}$ (B) $\frac{31}{36}$ (C) $\frac{5}{18}$ (D) $\frac{5}{9}$	**1**
9.	If $2\sin 5x = \sqrt{3}$,$0^\circ \leq x \leq 90^o$, then x is equal to (A) 10^o (B) 12^o (C) 20^o (D) 50^o	**1**
10.	The sum of two numbers is 1215 and their HCF is 81, then the possible pairs of such numbers are (A) 2 (B) 3 (C) 4 (D) 5	**1**

***Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26**

11.	If the area of the base of a right circular cone is 51cm^2 and it's volume is 85cm^2, then the height of the cone is given as (A) $\frac{5}{6}$ cm (B) $\frac{5}{3}$cm (C) $\frac{5}{2}$cm (D) 5cm	**1**
12.	If zeroes of the quadratic polynomial ax^2 + bx +c (a, c ≠0) are equal, then (A) c and b must have opposite signs (B) c and a must have opposite signs (C) c and b must have same signs (D) c and a must have same signs	**1**
13.	The area (in cm^2) of a sector of a circle of radius 21cm cut off by an arc of length 22cm is (A) 441 (B) 321 (C) 231 (D) 221	**1**
14.	If ∆ABC ~∆DEF, AB=6cm, DE=9cm, EF=6cm and FD=12cm, then the perimeter of ∆ABC is (A) 28cm (B) 28.5cm (C) 18cm (D) 23cm	**1**
15.	If the probability of the letter chosen at random from the letters of the word "Mathematics" to be a vowel is $\frac{2}{2x+1}$, then x is equal to (A) $\frac{4}{11}$ (B) $\frac{9}{4}$ (C) $\frac{11}{4}$ (D) $\frac{4}{9}$	**1**
16.	The points A(9,0), B(9, -6) ,C(-9,0) and D(-9,6) are the vertices of a (A) Square (B) Rectangle (C) Parallelogram (D) Trapezium	**1**
17.	The median of a set of 9 distinct observation is 20.5. If each of the observations of a set is increased by 2,then the median of a new set (A) is increased by 2 (B) is decreased by 2 (C) is two times the original number (D) Remains same as that of original observations	**1**
18.	The length of a tangent drawn to a circle of radius 9 cm from a point at a distance of 41cm from the centre of the circle is (A) 40cm (B) 9cm (C) 41cm (D) 50cm	**1**
	DIRECTIONS: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. **Choose the correct option:** (A) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (B) Both assertion (A) and reason (R) are true and reason (R) is not the explanation of assertion (A) (C) Assertion (A) is true but reason (R) is false. (D) Assertion (A) is false but reason (R) is true.	

19.	**Assertion (A):** The number 5^n cannot end with the digit 0, where n is a natural number **Reason (R):** A number ends with 0, if its prime factorization contains both 2 and 5	**1**
20.	**Assertion (A):** If cosA + $\cos^2$A=1, then $\sin^2$A + $\sin^4$A =1 **Reason (R):** $\sin^2$A + $\cos^2$A =1	**1**
	(Section – B) **Section B consists of 5 questions of 2 marks each.**	
21.(A) **(B)**	The A.P 8, 10, 12,……. has 60 terms. Find the sum of last 10 terms. **OR** Find the middle term of A.P 6,13, 20, ……., 230	**2**
22.	If $sin(A+B) = 1$ and $cos(A-B) = \frac{\sqrt{3}}{2}$,$0° < A, B < 90°$, find the measure of angles A and B.	**2**
23.	If AP and DQ are medians of triangles ABC and DEF respectively, where ∆ABC~ ∆DEF, then prove that $\frac{AB}{DE} = \frac{AP}{DQ}$	**2**
24. **(A)** **(B)**	A horse, a cow and a goat are tied, each by ropes of length 14m, at the corners A, B and C respectively, of a grassy triangular field ABC with sides of lengths 35m, 40m and 50 m. Find the area of grass field that can be grazed by them. **OR** Find the area of the major segment (in terms of π) of a circle of radius 5cm, formed by a chord subtending an angle of 90˚ at the centre.	**2**
25.	A ∆ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC are of lengths 10 cm and 8 cm respectively. Find the lengths of the sides AB and AC, if it is given that ar(∆ABC) = 90cm^2  **For Visually Impaired candidates:** A circle is inscribed in a right-angled triangle ABC, right angled at B. If BC=7cm and AB=24cm, find the radius of the circle	**2**

	(Section – C) **Section C consists of 6 questions of 3 marks each.**	
26.	In Figure, XY and X′Y′ are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting XY at A and X′Y′ at B. Prove that ∠ AOB = 90°  **For Visually Impaired candidates:** Two tangents PA and PB are drawn to a circle with centre O from an external point P. Prove that ∠APB= 2(∠OAB)	**3**
27.	In a workshop, the number of teachers of English, Hindi and Science are 36, 60 and 84 respectively. Find the minimum number of rooms required, if in each room the same number of teachers are to be seated and all of them being of the same subject.	**3**
28.	Find the zeroes of the quadratic polynomial $2x^2 - (1 + 2\sqrt{2})\,x + \sqrt{2}$ and verify the relationship between the zeroes and coefficents of the polynomial.	**3**
29.	If $sin\theta + cos\theta = \sqrt{3}$,then prove that $tan\theta + cot\theta = 1$ **OR** Prove that $\frac{cosA - sinA + 1}{cosA + sinA - 1}$ =cosecA + cotA	**3**
30.	On a particular day, Vidhi and Unnati couldn't decide on who would get to drive the car. They had one coin each and flipped their coin exactly three times. The following was agreed upon: 1. If Vidhi gets two heads in a row, she would drive the car 2. If Unnati gets a head immediately followed by a tail, she would drive the car. Who has greater probability to drive the car that day? Justify your answer.	**3**
31.(A)	The monthly income of Aryan and Babban are in the ratio 3:4 and their monthly expenditures are in ratio 5:7. If each saves ₹ 15,000 per month, find their monthly incomes. **OR**	**3**
(B)	Solve the following system of equations graphically: $2x + y$ =6, $2x - y$ – 2=0. Find the area of the triangle so formed by two lines and x -axis. **For Visually Impaired candidates**: Five years hence, fathers age will be three times the age of son. Five years ago, father was seven times as old as his son. Find their present ages.	

(Section – D)
Section D consists of 4 questions of 5 marks each

32. A train travels at a certain average speed for a distance of 63km and then travels at a distance of 72km at an average speed of 6km/hr more than its original speed. If it takes 3 hours to complete the total journey, what is the original average speed? **5**

33. Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the sameratio. **5**

Hence in ΔPQR, prove that a line ℓ intersects the sides PQ and PR of a ΔPQR at L and M respectively such that LM II QR. If PL = 5.7cm, PQ=15.2cm and MR=5.5cm, then find the length of PM (in cm)

34.(A) From a solid right circular cone, whose height is 6cm and radius of base is 12cm, a right circular cylindrical cavity of height 3cm and radius 4cm is hollowed out such that bases of cone and cylinder form concentric circles. Find the surface area of the remaining solid in terms of π. **5**

OR

(B) An empty cone of radius 3cm and height 12cm is filled with ice-cream such that the lower part of the cone which is $(\frac{1}{6})^{th}$ of the volume of the cone is unfilled (empty) but a hemisphere is formed on the top. Find the volume of the ice-cream.

35.(A) If the mode of the following distribution is 55, then find the value of x. Hence, find the mean. **5**

Class Interval	$0-15$	$15-30$	$30-45$	$45-60$	$60-75$	$75-90$
Frequency	10	7	x	15	10	12

OR

(B) A survey regarding heights (in cm) of 51 girls of class X of a school was conducted and the following data was obtained:

Heights (in cm)	Number of girls
less than 140	04
less than 145	11
less than 150	29
less than 155	40
less than 160	46
less than 165	51

Find the median height of girls. If mode of the above distribution is 148.05, find the mean using empirical formula.

(Section – E)
Section E consists of 3 case study-based questions of 4 marks each.

36. In a class, the teacher asks every student to write an example of A.P. Two boys Aryan and Roshan writes the progression as $-5, -2, 1, 4, \ldots\ldots$ and 187, 184, 181, …. respectively. Now the teacher asks his various students the following questions on progression.

Help the students to find answers for the following:

i. Find the sum of the common difference of two progressions. **1**

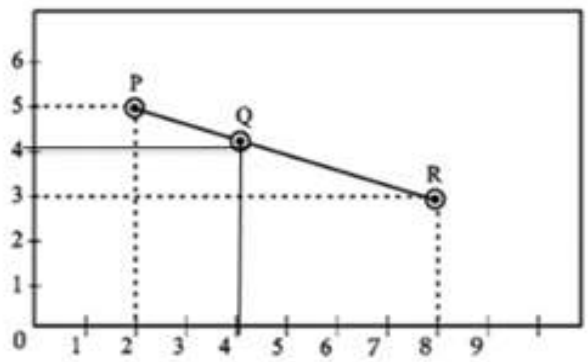
ii. Find the 34^{th} term of progression written by Roshan. **1**

iii. (A) Find the sum of first 10 terms of the progression written by Aryan. **2**

OR

(B) Which term of the progressions will have the same value? **2**

37. A group of class X students goes to picnic during winter holidays. The position of three friends Aman, Kirti and Chahat are shown by the points P, Q and R



(i) Find the distance between P and R. **1**

(ii) Is Q, the midpoint of PR? Justify by finding midpoint of PR. **1**

(iii) (A) Find the point on x-axis which is equidistant from P and Q. **2**

OR

(B) Let S be a point which divides the line joining PQ in ratio 2:3. Find the coordinates of S. **2**

For Visually Impaired Candidates:

A group of class X students goes to picnic during winter holidays. Aman, Kirti and Chahat are three friends. The position of three friends Aman, Kirti and Chahat are shown by the points P, Q and R.
The co-ordinates of P (2,5), Q (4,4) and R (8,3) are given.

(i) Find the distance between P and R. **1**

(ii) Is Q the midpoint of PR? Justify by finding midpoint of PR. **1**

(iii) (A) Find the point on x-axis which is equidistant from P and Q. **2**

OR

(B) Let S be a point which divides the line joining PQ in ratio 2:3. Find the coordinates of S. **2**

38.	India gate (formerly known as All India war memorial) is located near Karthavya path. (formerly Rajpath) at New Delhi. It stands as a memorial to 74187 soldiers of Indian Army, who gave their life in the first world war. This 42m tall structure was designed by Sir Edwin Lutyens in the style of Roman triumphal arches. A student Shreya of height 1 m visited India Gate as a part of her study tour. 	
	i. What is the angle of elevation from Shreya's eye to the top of India Gate, if she is standing at a distance of 41m away from the India Gate?	**1**
	ii. If Shreya observes the angle of elevation from her eye to the top of India Gate to be 60^{o}, then how far is the she standing from the base of the India Gate?	**1**
	iii. (A) If the angle of elevation from Shreya's eye changes from 45° to 30°, when she moves some distance back from the original position. Find the distance she moves back.	**2**
	OR	
	(B) If Shreya moves to a point which is at a distance of $\frac{41}{\sqrt{3}}$m **from** the India Gate, then find the angle of elevation made by her eye to the top of India Gate.	**2**

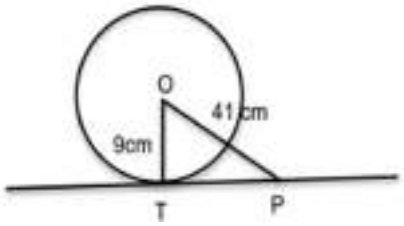
***Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26**

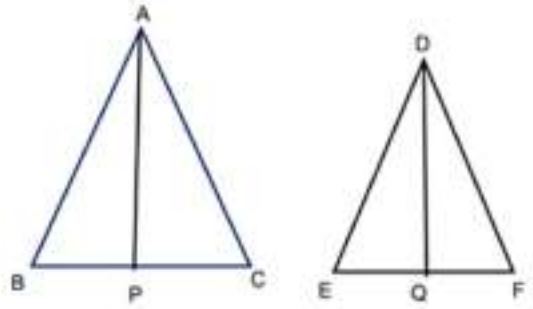
MATHEMATICS STANDARD – Code No.041
MARKING SCHEME
CLASS – X (2025-26)

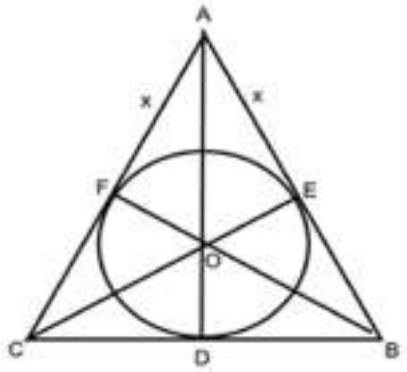
Maximum Marks: 80 **Time: 3 hours**

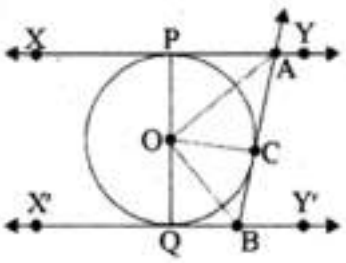
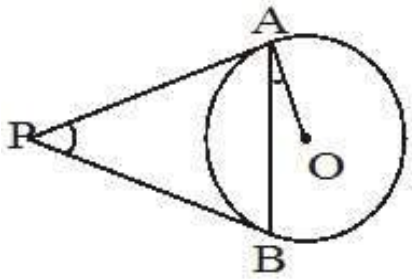
Q.No.	Section A	Marks
1.	(C) 3 LCM$(a, b, c) = 2^2 \times 3^x \times 5 \times 7 = 3780$ $140 \times 3^x = 3780$ $3^x = 27 = 3^3$ $x = 3$	**1**
2.	(A) 2 As shortest distance from (2, 3) to y-axis is the x coordinate, i.e., 2.	**1**
3.	(B) $k \neq \frac{15}{4}$ $\frac{3}{2} \neq \frac{2k}{5}$, hence $k \neq \frac{15}{4}$	**1**
4.	(C) 6cm AB+CD=AD+BC AB+4=3+7 AB=6cm	**1**
5.	(D) $\frac{1}{x}$ $\frac{1}{sec\theta+tan\theta} = \frac{(sec\theta-tan\theta)}{(sec\theta+tan\theta)(sec\theta-tan\theta)} = \frac{(sec\theta-tan\theta)}{1}$ = secϴ-tanϴ	**1**
6.	(D) $(x+2)(x+1) = x^2+2x+3$, so, $x^2+3x+2 = x^2+2x+3$ gives $x-1=0$ It's not a quadratic equation.	**1**
7.	D) $8[\frac{\pi}{6} - \frac{\sqrt{3}}{4}]$ cm^2  Required Area=8 × area of one segment (with r = 1cm and $\theta = 60^\circ$) $=8x\ (\frac{60^\circ}{360^\circ} \text{ x } \pi \text{ x } 1^2 - \frac{\sqrt{3}}{4} \text{ x } 1^2)$ $= 8[\frac{\pi}{6} - \frac{\sqrt{3}}{4}]$ cm^2	**1**

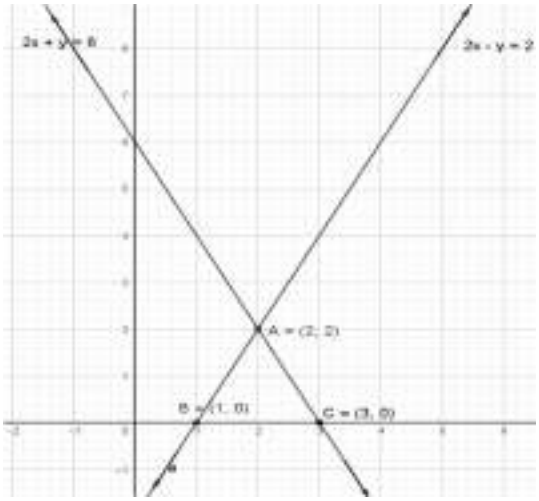
	For Visually Impaired candidates: (D) 9πcm^2 area of circle=$\pi(3^2)$ $=9\,\pi$ cm^2	
8.	(B) $\frac{31}{36}$ Probability of getting sum 8 is $\frac{5}{36}$ Probability of not getting sum 8 is $\frac{31}{36}$	**1**
9.	(B) $12°$ $\sin 5x = \frac{\sqrt{3}}{2}$ So, $5x = 60°$ And hence $x = 12°$	**1**
10.	(C) 4 Since HCF=81, the numbers can be $81x$ and $81y$ $81x + 81y = 1215$ $x + y = 15$ which gives four pairs as (1,14), (2,13), (4,11), (7,8)	**1**
11.	(D) 5cm $\pi r^2 = 51$ $V=\frac{1}{3} \times \pi r^2 \times h$ $85 = \frac{1}{3} \times 51 \times h$ $h= \frac{85}{17} = 5cm$	**1**
12.	(D) As for equal roots to the corresponding equation, $b^2 = 4ac$ Hence $ac = \frac{b^2}{4}$ And hence $ac > 0 \Rightarrow$ c and a must have same signs	**1**
13.	(C) 231 Area of sector $= \frac{1}{2} \times l \times r$ $= \frac{1}{2} \times 22 \times 21 = 231$cm^2	**1**

14.	(C) 18cm $\Delta ABC \sim \Delta DEF$ $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} = \frac{Perimeter\ of\ \Delta ABC}{Perimeter\ of\ \Delta DEF}$ $\frac{6}{9} = \frac{Perimeter\ of\ \Delta ABC}{27}$ Perimeter of Δ ABC= 18cm	**1**
15.	(B) $\frac{9}{4}$ Probability of getting vowels in the word Mathematics is $\frac{4}{11}$, So, $\frac{2}{2x+1} = \frac{4}{11}$ $\Rightarrow x = \frac{9}{4}$	**1**
16.	(C) Parallelogram By visualising the figure by plotting points in co-ordinate plane it can be concluded it is a Parallelogram.	**1**
17.	(A) median is increased by 2	**1**
18.	(A) 40cm  Since, tangent is perpendicular to the radius at the point of contact In ΔOPT, right angled at T $OP^2=OT^2+TP^2$ $41^2=9^2+TP^2$ TP^2= 1681-81=1600 TP=40cm	**1**
19.	(A) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)	**1**
20.	(A) $\cos A+\cos^2 A=1$ ---------(i) gives $\cos A= \sin^2 A$------(ii) (using $\sin^2 A+ \cos^2 A=1$) Substituting value of cos A from (ii) in (i) $\sin^2 A +\sin^4 A=1$ $\therefore$ Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)	**1**

	(Section – B)	
21. **(A)**	n =60, a =8 and d=2 t_{60}= 8 + 59(2) =126 t_{51}= 108 Hence t_{51} + t_{52}+……..+ t_{60}= $\frac{10}{2}$(108 +126) =1170	½ ½ 1
	OR	
(B)	230 = 6 + (n -1)7 gives n=33 ∴ Middle Term = t_{17}= 6 + (16)(7) = 118	1 1
22.	A+B = 90° and A – B= 30° A=60° and B =30°	1 1
23.	 △ABC~△DEF ⇒$\frac{AB}{DE}$ =$\frac{BC}{EF}$ $\frac{AB}{DE}$ =$\frac{2B}{2EQ}$ (AP and DQ are the medians) $\frac{AB}{DE}$ =$\frac{BP}{EQ}$ In △ABP and △DEQ $\frac{AB}{DE}$ =$\frac{BP}{EQ}$ ∠B=∠E (△ABC~△DEF) ⇒△ABP ~△DEQ Hence, $\frac{AB}{DE}$ = $\frac{AP}{DQ}$	½ ½ ½ ½
24.(A)	area of grass field that can be grazed by them =$\frac{\theta_1}{360°} \times \pi r^2 + \frac{\theta_2}{360°} \times \pi r^2 + \frac{\theta_3}{360°} x \pi r^2$ =$\frac{\pi r^2}{360°}$ (θ_1 + θ_2 + θ_3) =$\frac{\pi r^2}{360°} \times 180°$ = $\frac{22}{7} \times \frac{14 X 14}{2}$ =308 m^2	1 1

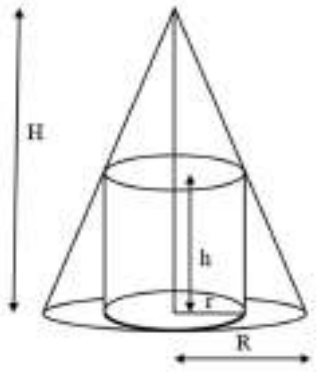
	OR	
(B)	Area of minor segment= Area of sector − area of triangle $=\frac{90°}{360°}\pi\ r^2 - \frac{1}{2}\times r^2$ $=(\frac{25}{4}\pi - \frac{25}{2})$ cm^2 Area of major segment = Area of circle – Area of minor segment $=\pi\ 5^2 - (\frac{25}{4}\pi - \frac{25}{2})$ $= 25\pi - \frac{25}{4}\pi + \frac{25}{2}$ $= (\frac{75}{4}\pi + \frac{25}{2})$ cm^2	**1** **1**
25.	 Let r be the radius of the inscribed circle BD=BE=10cm CD=CF=8cm Let AF=AE= x ar(△ABC) =ar(△AOC) + ar(△BOC) + ar(△AOB) $=\frac{1}{2}\times$ r x AC + $\frac{1}{2}\times$ r $\times$ BC +$\frac{1}{2}\times$ r $\times$ AB 90 = $\frac{1}{2}\times 4\ (x + 8 + 18 + x + 10)$ x = 4.5cm ∴ AB=4.5+10=14.5cm AC=4.5+8=12.5cm **For Visually Impaired candidates:** AC^2=AB^2+BC^2= 24^2+7^2=625 AC=25cm Area of ∆ABC=$\frac{1}{2}\times 7\times 24$=84cm^2 -----(i) Let r=radius of circle Also, Area of ∆ABC=$\frac{1}{2}$ (24r+25r+7r) $=\frac{1}{2}\times 56$ r -------(ii) From (i) and (ii), we get r=3cm	½ ½ ½ ½ ½ ½ ½

	(Section – C)	
26.	 In ∆APO and ∆ACO AP=AC (Tangents from External Point) AO=AO (common) OP=OC (radii) ∆APO ≅ ∆ACO ∠POQ=180˚ (PQ is the diameter) ∠POA+∠COA+∠QOB+∠COB=180˚ 2∠COA+2∠COB=180˚ ∠ AOB = 90° **For Visually Impaired candidates:**  PA=PB (Tangents from external point to a circle) ∠PAB=∠PBA= x (angles opposite to equal sides) In ∆PAB, ∠PAB+∠PBA+∠APB=180° $x + x$ +∠APB=180° ∠APB=180°−2 x ------(i) Also, ∠PAB+∠OAB=90° (radius is perpendicular to the tangent at the point of contact) x +∠OAB=90° x =90°−∠OAB --------(ii) Substituting (ii) in (i), we get ∠APB=180°-2(90°− ∠OAB) ∠APB=2∠OAB	**1** **1** **1** **½** **1** **1** **½**
27.	HCF (36,60,84) =12 Required number of rooms= $\frac{36}{12}+\frac{60}{12}+\frac{84}{12}$ =3+5+7 =15	**1 ½** **1** **½**
28.	$2x^2-(1+2\sqrt{2})x+\sqrt{2}$ $= 2x^2-x-2\sqrt{2}x+\sqrt{2}$ $= (2x-1)(x-\sqrt{2})$ Hence the zeroes are $\frac{1}{2}$ and $\sqrt{2}$. Now $\frac{-b}{a} = \frac{2\sqrt{2}+1}{2} = \sqrt{2}+\frac{1}{2}$ and $\frac{c}{a} = \frac{\sqrt{2}}{2} = \frac{1}{2}\times\sqrt{2}$	 **1** **1** **1**

29.	$sin\theta + cos\theta = \sqrt{3}$ gives $(sin\theta + cos\theta)^2 = 3.$ Hence $1 + 2sin\theta cos\theta = 3$ So $2sin\theta cos\theta = 2$ $\Rightarrow sin\theta\ cos\theta = 1$ $\therefore tan\ \theta + cot\theta = \frac{1}{sin\theta cos\theta}$ =1 **OR** $\frac{cosA-sinA+}{cosA+sinA-} = \frac{(cosA-sinA+\ )(cosA+sinA+1)}{(cosA+sinA-1)(cosA+sinA+\ )}$ $= \frac{cos^2A+2cosA+1-sin^2A}{2sinAcosA}$ $= \frac{2cosA(1+cosA)}{2sinAcosA} = \frac{1+cosA}{sinA} = cosecA + cotA$	**1** **1** **1** **1** **1** **1**
30.	P(Vidhi drives the car) = $\frac{3}{8}$ as favourable outcomes are HHT,THH,HHH P(Unnati drives the car) = $\frac{4}{8}$ as favourable outcomes are THT,THH,HTH,TTH As $\frac{4}{8} > \frac{3}{8}$ Unnati has greater probability to drive the car	**1** **1** **1**
31.	Let the income of Aryan and Babban be $3x$ and $4x$ respectively And let their expenditure be $5y$ and $7y$ respectively. Since each saves ₹ 15,000, we get $3x - 5y = 15000$ $4x - 7y = 15000$ Hence $x = 30000$ Their income thus become ₹90,000 and ₹1,20,000 respectively. **OR**  	**1** **1** **1** **2 for correct Graph**

	Hence, the solution is $x = 2, y = 2$ Area= 2 sq. units **For Visually Impaired candidates** Let the present age of father be x and son be y So, $(x + 5) = 3(y + 5) \Rightarrow x - 3y = 10$ $x - 5 = 7(y - 5) \Rightarrow x - 7y = -30$ So, $x = 40, y = 10$. Hence the present ages of father and son are 40 years and 10 years Respectively	½ ½ **1** **1** **1**
	Section D	
32.	Let the original speed of train be x km/hr Distance =63km, time(t_1) =$\frac{63}{x}$ hrs Faster speed = (x +6) km/hr time (t_2)=$\frac{72}{x+6}$ hrs Now $t_1 + t_2 = 3$ hrs So $\frac{63}{x} + \frac{72}{x+6} = 3$ $63(x + 6) + 72x = 3(x + 6)x$ $135x + 378 = 3x^2 + 18x$ $3x^2 - 117x - 378 = 0$ $x^2 - 39x - 126 = 0$ $x^2 - 42x + 3x - 126 = 0$ gives $(x + 3)(x - 42) = 0$ As x can't be negative, so $x = 42$ km/hr The original speed of train=42 km/hr	**1** **1** **1** **1** **1**
33.	Correct given, figure and construction Correct Proof since LM is parallel to QR Let PM= x $\frac{PL}{PQ} = \frac{PM}{PR}$ $\frac{5.7}{15.2} = \frac{x}{x+5.5}$ x =PM=3.3cm	**2** **2** ½ ½

34. (A)



Slant height of the cone $L = \sqrt{R^2 + H^2} = \sqrt{12^2 + 6^2}$
$= 3\sqrt{20}\ cm$ **½**

Curved Surface area of cone$= \pi RL = \pi \times 12 \times 3\sqrt{20}$
$= (36\sqrt{20})\ \pi\ cm^2$ **1**

Area of base circle of cone (= area of outer circle – area of inner circle + top circular area of cylinder)
$= \pi R^2 = \pi \times (12)^2$
$= 144\pi\ cm^2$ **1**

Curved Surface area of cylinder$= 2\pi rh = 2\pi \times 4 \times 3$
$= 24\ \pi\ cm^2$ **1**

Surface area of the remaining solid= Curved surface of cone
+ area of base circle of cone
+ curved surface area of cylinder **1**

$= \left(36\sqrt{20}\right)\pi + 144\pi + 24\pi$
$= \left(168 + 36\sqrt{20}\right)\pi\ cm^2$ **½**

OR

(B) Volume of cone=$\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 3 \times 3 \times 12 = 36\pi cm^3$

Volume of ice-cream in the cone=$\frac{5}{6} \times 36\pi cm^3 = 30\pi\ cm^3$ **2**

Volume of ice-cream in the hemispherical part= $\frac{2}{3}\pi r^3 = \frac{2}{3}\pi \times 3 \times 3 \times 3 = 18\pi\ cm^3$ **1+½**

Total volume of the ice-cream = $(30\pi + 18\pi) = 48\ \pi = 150.86 cm^3$ (approx.) **1+½**

35. (A) Mode of the frequency distribution = 55

Modal class is 45-60. Lower limit is 45 Class Interval (h) =15 **½**

Now, Mode = $l + \left(\frac{f_1 - f_0}{2f_0 - f_1 - f_2}\right) \times h$

$55 = 45 + \frac{15 - x}{30 - x -} \times 5$ **1**

So, $x = 5$ **1**

CI	f_i	x_i	$f_i x_i$
0-15	10	7.5	75
15-30	7	22.5	157.5
30-45	5	37.5	187.5
45-60	15	52.5	787.5
60-75	10	67.5	675
75-90	12	82.5	990
	59		2872.5

1 ½

Mean= $\bar{x} = \frac{2872.5}{59} = 48.68$ **1**

OR

(B)

Height (in cm)	Number of girls	Class Interval	frequency
less than 140	04	135-140	4
less than 145	11	140-145	7
less than 150	29	145-150	18
less than 155	40	150-155	11
less than 160	46	155-160	6
less than 165	51	160-165	5

1

Median = l +($\frac{\frac{N}{2}-Cf}{f}$) x h **1**

=145 + ($\frac{\frac{51}{2}-11}{18}$)×5 **1**

=149.03

Median height = 149.03cm **1**

3×Median= Mode +2× Mean **1**

3×149.03=148.05+2× Mean

Mean=149.52

Section E

36.

(i) Common difference of first progression= 3

Common difference of first progression= -3

Sum of common difference=0. **1**

(ii) t_{34} = 187 +(34-1) (-3)

So, t_{34} =88 **1**

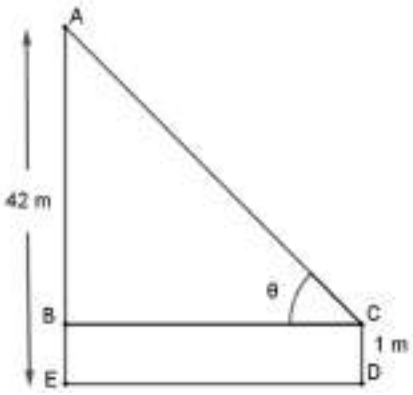
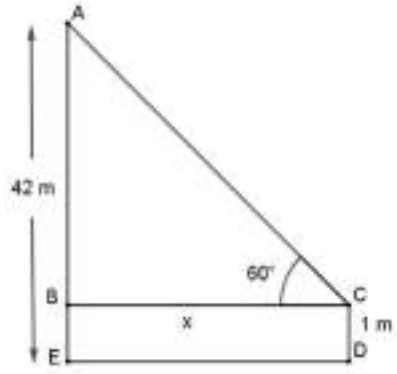
(iii) (A) Sum $= \frac{10}{2}[2(-5) + (10-1)(3)]$ **1**

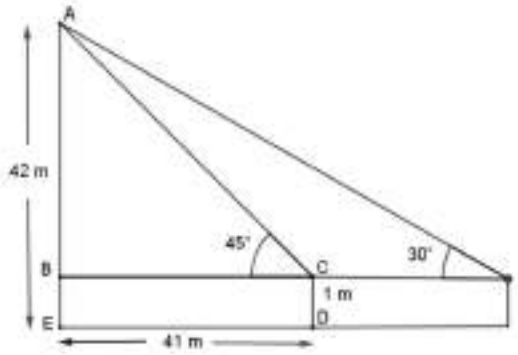
$= 85$ **1**

OR

(B) -5 +(n-1)3 = 187 +(n-1) (-3) **1**

n = 33 **1**

37.	(i) PR= $\sqrt{(8-2)^2+(3-5)^2}$ = $2\sqrt{10}$	**1**
	(ii) Co-ordinates of Q (4,4). The mid-point of PR is (5,4) ∴Q is not the mid-point of PR	½ ½
	(iii) (A) Let the point be $(x,0)$ So, $\sqrt{(2-x)^2+25}$ = $\sqrt{(4-x)^2+16}$ Hence $x = \frac{3}{4}$.Therefore the point is $(\frac{3}{4},0)$. **OR** (B) The coordinates of S will be $\left(\frac{2\times4+3\times2}{2+3},\frac{2\times4+3\times5}{2+3}\right)$ $= \left(\frac{14}{5},\frac{23}{5}\right)$	**1** **1** **1** **1**
38.	 (i) Distance from India gate = 41m, Height of monument = 42m, Shreya's height =1m So, $\tan\theta$=$\frac{41}{41}$ =1 Angle of elevation $= \theta = 45^o$.	½ ½
	 (ii) Angle of elevation =60° Perpendicular = 41m Let the distance from the India Gate be x m Hence tan 60°= $\frac{41}{x}$ $\Rightarrow x = \frac{41}{\sqrt{3}}$ ∴ Shreya is standing at a distance of $\frac{41\sqrt{3}}{3}$ m	½ ½



(iii) (A)

Distance from the India Gate = 41 m

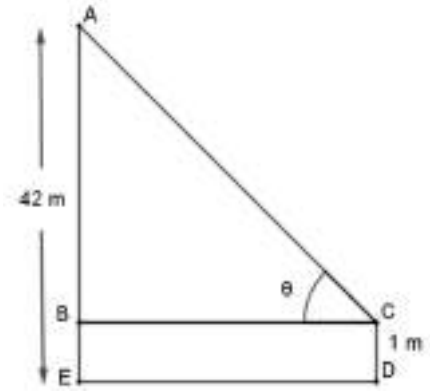
Let the distance moved back be x m

Then, $\tan 30^\circ = \frac{41}{41+x}$ **1**

$x = (41\sqrt{3} - 41)$ m $= 41(\sqrt{3}\text{-}1)$ m **1**

∴ The distance moved back = $41(\sqrt{3}\text{-}1)$ m

OR



(B) Let the angle of elevation of be θ

Now, $\tan\theta = \frac{41}{\frac{41}{\sqrt{3}}} = \sqrt{3}$ **1**

This gives $\theta = 60^\circ$ **1**

CLASS X – MATHEMATICS
SAMPLE PAPER ANALYSIS

Unit No.	Unit	Chapter	Section A		Section B	Section C	Section D	Section E	Total
			MCQ	AR					
I	Number System	Real Numbers	2(2)	1(1)		1(3)			**4(6)**
II	Algebra	Polynomials	1(1)			1(3)			**2(4)**
		Pair of Linear Equations in Two Variables	1(1)			1*(3)			**2(4)**
		Quadratic Equations	1(1)				1(5)		**2(6)**
		Arithmetic Progression			1* (2)			1(4)	**2(6)**
III	Coordinate Geometry	Coordinate Geometry	2(2)					1(4)	**3(6)**
IV	Geometry	Triangles	1(1)		1(2)		1(5)		**3(8)**
		Circles	2(2)		1(2)	1(3)			**4(7)**
V	Trigonometry	Introduction to Trigonometry	2(2)	1(1)	1(2)	1* (3)			**5(8)**
		Some Applications of Trigonometry						1(4)	**1(4)**
VI	Mensuration	Areas Related to Circles	2(2)		1*(2)				**3(4)**
		Surface Areas and Volumes	1(1)				1*(5)		**2(6)**
VII	Statistics and Probability	Statistics	1(1)				1*(5)		**2(6)**
		Probability	2(2)			1(3)			**3(5)**
Total			**18(18)**	**2(2)**	**5(10)**	**6(18)**	**4(20)**	**3(12)**	**38(80)**

Note: (i) Numeric outside the bracket indicates the number of questions (ii) Numeric inside the bracket indicates the marks

*** Indicates that question has an internal choice**

CLASS X – MATHEMATICS

PRACTICE PAPER I

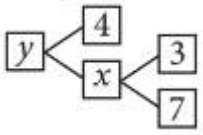
Time Allowed: 3 Hrs. **Maximum Marks: 80**

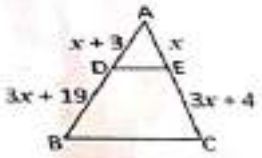
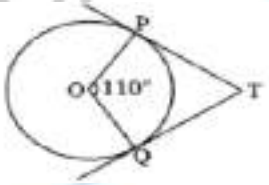
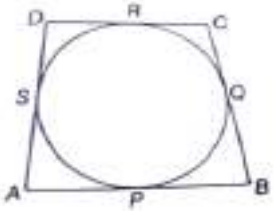
General Instructions:

1. This Question Paper has 5 Sections A - E.
2. **Section A** has 20 MCQs carrying 1 mark each
3. **Section B** has 5 questions carrying 02 marks each.
4. **Section C** has 6 questions carrying 03 marks each.
5. **Section D** has 4 questions carrying 05 marks each.
6. **Section E** has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

SECTION A

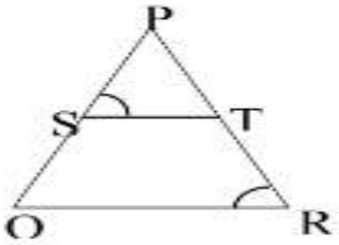
Section A consists of 20 questions of 1 mark each.

S.No		Marks
1	The values of x and y in the given figure are: (a) x = 10; y = 14 (b) x = 21; y = 84 (c) x = 21; y = 25 (d) x = 10; y = 40 	1
2	The value of k such that $3x^2 + 2kx - k - 5$ has the sum of the zeroes as half of their product is (a) $\frac{2}{3}$ (b) $\frac{8}{3}$ (c) $\frac{5}{3}$ (d) $\frac{7}{3}$	1
3	If the lines given by 3x + 2ky = 2 and 2x + 5y + 1 = 0 are parallel, then the value of k is (a) $\frac{-5}{4}$ (b) $\frac{2}{5}$ (c) $\frac{15}{4}$ (d) $\frac{3}{2}$	1
4	The value of k for which the equation $2x^2 + 8kx + 8 = 0$ has equal roots is (a) 3 (b) -3 (c) ±3 (d) ±1	1

5	The value of x for which 2x, (x + 10) and (3x + 2) are the three consecutive terms of an A.P., is (a) 6 (b) –6 (c) 18 (d) –18	1
6	The value of x for which DE || BC in the given figure is (a) 4 (b) 1 (c) 3 (d) 2 	1
7	The relation between x and y such that the point P(x, y) is equidistant from the points A(1, 4) and B(−1, 2) is (a) x − y + 3 = 0 (b) x = y (c) x = 2y (d) None of these.	1
8	A line intersects the y-axis and x-axis at the points P and Q respectively. If (2, -5) is the mid-point of PQ, then the coordinates of P and Q are (a) (0, - 5) & (2, 0) (b) (0, 10) & (-4, 0) (c) (0, 4) & (-10, 0) (d) (0, -10) & (4, 0)	1
9	If sinB = $\frac{1}{2}$, then value of $3\cos B - 4\cos^3 B$ is (a) 1 (b) 2 (c) 3 (d) 0	1
10	If $a\cos\theta + b\sin\theta = m$ and $a\sin\theta - b\cos\theta = n$, then $a^2 + b^2$ is (a) $m^2 + n^2$ (b) $m^2 - n^2$ (c) 2mn (d) 4mn	1
11	The angle of elevation of the top of a 30 m high tower at a point 30 m away from the base of the tower is : (a) 30^o (b) 45^o (c) 60^o (d) 90^o	1
12	In the figure, PT and TQ are two tangents to the circle with centre O. If $\angle POQ = 110^o$, then $\angle PTQ$ is (a)70^o (b) 75^o (c) 80^o (d) 85^o 	1
13	In the given figure , quadrilateral ABCD is circumscribed touching the circle at P, Q, R and S. If AP = 6cm , BP= 5 cm , CQ= 3 cm and DR= 4 cm, then perimeter of quadrilateral ABCD is (a) 18 cm (b) 27 cm (c) 36 cm (d) 22 cm 	1

14	In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. The length of the arc is (a) 22cm (b) 21cm (c) 20cm (d) 25cm	1
15	A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to its radius. What will be the volume of the solid in terms of π? (a) π cm^3 (b) 2 π cm^3 (c) 3 π cm^3 (d) 4 π cm^3	1
16	If the difference of Mode and Median of a data is 24, then the difference of median and mean is (a) 8 (b) 12 (c) 24 (d) 36	1
17	In a family of 3 children, the probability of having at least one boy is (a) $\frac{7}{8}$ (b) $\frac{1}{8}$ (c) $\frac{5}{8}$ (d) $\frac{3}{4}$	1
18	The probability of selecting a boy randomly from a class is 0.6 and there are 45 students in the class. Then the number of girls is (a) 9 (b) 12 (c)36 (d)18	1
DIRECTION: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A) (c) Assertion (A) is true but reason (R) is false. (d) Assertion (A) is false but reason (R) is true.		
19	Assertion (A): The 11th term of an AP is 7, 9, 11, 13, ... is 27. Reason (R): If S_n is the sum of first n terms of an AP, then its nth term an is given by $a_n = S_n + S_{n-1}$.	1
20	Assertion (A): The surface area of largest sphere that can be inscribed in a hollow	1

	cube of side 'a' is $\pi a^2 cm^2$. Reason (R): The surface area of a sphere of radius r is $\frac{4}{3}\pi r^3$.	
SECTION B **Section B consists of 5 questions of 2 marks each.**		
21	Prove that $\sqrt{3}$ is an irrational number.	2
22	D is a point on side BC of a triangle ABC such that $\angle ADC = \angle BAC$. Prove that $\frac{CA}{CD} = \frac{CB}{CA}$.	2
23	If $4\cot^2 45 - \sec^2 60 + \sin^2 60 + p = \frac{3}{4}$, find the value of p. (Or) If $\sec A + \tan A = p$, then prove that $\frac{p^2-1}{p^2+1} = \sin A$.	2
24	Find the length of tangent drawn to a circle with radius 7 cm from a point 25 cm away from the centre.	2
25	Find the area of the corresponding minor sector of a circle of radius 35 cm and central angle 90°. (Or) A chord of a circle of radius 14cm makes a right angle at the centre. Find the area of the minor segment of the circle.	2
SECTION C **Section C consists of 6 questions of 3 marks each.**		
26	Find the largest possible positive integer that divides 125, 162 and 259 leaving remainder 5, 6 and 7 respectively.	3
27	If α and β are the zeroes of the polynomial $p(x) = 3x^2 - 15x + 21$. Form a quadratic polynomial whose zeroes are α^{-2} and β^{-2}.	3
28	The sum of the digits of two-digit number is 9. Also 9 times this number is twice the number obtained by reversing the order of the digits. Find the number. (Or) Determine graphically the vertices of the triangle, the equations of whose sides are given below: 2y – x = 8; 5y – x = 14; y – 2x = 1	3

<table>
<tr><td>29</td><td>If $\sin^2\theta - 3\sin\theta\cos\theta + 1 = 0$, then prove that $\tan\theta = 1$ or $\frac{1}{2}$.</td><td>3</td></tr>
<tr><td>30</td><td>Prove that the length of tangents drawn from external point to a circle are equal.
(Or)
Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the lines segment joining the points of contact at the centre.</td><td>3</td></tr>
<tr><td>31</td><td>The mode of the following series is 36. Find the missing frequency in it.
<table>
<tr><td>Class Interval</td><td>0 - 10</td><td>10 - 20</td><td>20 - 30</td><td>30 – 40</td><td>40 – 50</td><td>50 - 60</td><td>60 - 70</td></tr>
<tr><td>Frequency</td><td>8</td><td>10</td><td>f</td><td>16</td><td>12</td><td>6</td><td>7</td></tr>
</table></td><td>3</td></tr>
<tr><td colspan="3">SECTION D
Section D consists of 4 questions of 5 marks each.</td></tr>
<tr><td>32</td><td>Solve for x: $3\left(\frac{3x-1}{2x+3}\right) - 2\left(\frac{2x+3}{3x-1}\right) = 5; x \neq \frac{1}{3}, -\frac{3}{2}$.
(Or)
A truck covers a distance of 150 km at a certain average speed and then covers another 200 km at an average speed which is 20 km per hour more than the first speed. If the truck covers the total distance in 5 hours, find the first speed of the truck.</td><td>5</td></tr>
<tr><td>33</td><td>Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio.
In figure, $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle PST = \angle PRQ$. Prove that PQR is an isosceles triangle.
 
</td><td>5</td></tr>
<tr><td>34</td><td>A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of cone is 4cm and diameter of the base is 8cm. Determine the volume</td><td>5</td></tr>
</table>

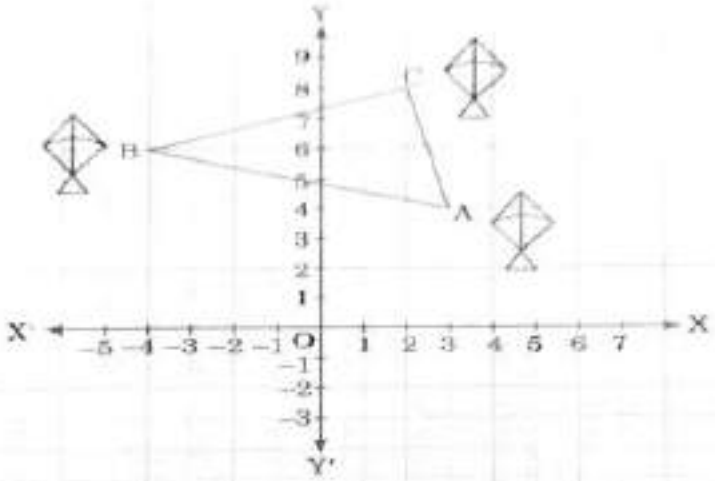
	of the toy. If a cube circumscribes the toy then find the difference of the volumes of cube and the toy. Also, find the total surface area of the toy. (Or) A circus tent is in the shape of cylinder surmounted by a conical top of same diameter. If the common diameter is 56m, the height of cylindrical part is 6m and the total height of tent above the ground is 27m, find the area of the canvas required to making the tent. Also, find the volume of the tent.	
35	Find the missing frequency and the median for the following distribution table if the mean is 18.	5

Class Interval	11 – 13	13 - 15	15 - 17	17 - 19	19 - 21	21 – 23	23 - 25
Frequency	3	6	9	13	x	5	4

SECTION E

Case study-based questions are compulsory.

36	Pankaj wants to participate in the push-up challenge. He can currently make 3000 push-ups in one hour. But he wanted to achieve a target of 3900 push-ups in one-hour. With each day of practice, he is able to make 5 more push-ups in one hour as compared to the previous day. On first day of practice, he do 3000 push-ups and continues to practice regularly till his target is achieved. Based on the above information, answer the following questions: (i) Form an AP representing the number of push-ups per day. (ii) Find the total number of push-ups performed by Pankaj in starting first week. (iii) Find the minimum number of days Pankaj needs to practice before his goal is achieved. (Or) On which day, Pankaj performed 3500 push-ups?	4
37	A boy standing at O, observed three kites at a points A, B and C.	4



(i) What is the distance between the kites A and B?

(ii) What is the ratio by which y-axis divide the line segment AB?

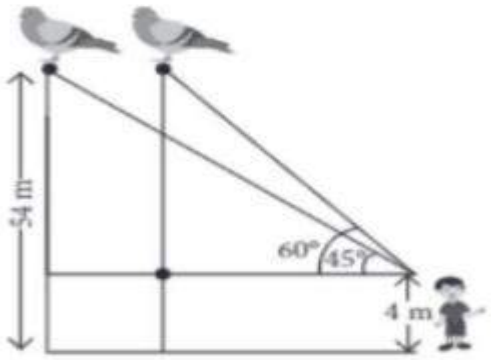
(iii) What are the coordinates of point on the y-axis equidistant from B and C?

(Or)

What is the length of median of triangle through B?

38

A boy 4 m tall spots a pigeon sitting on the top of a pole of height 54m from the ground. The angle of elevation of the pigeon from the eyes of boy at any instant is 60^{o}. The pigeon flies away horizontally in such a way that it remained at a constant height from the ground. After 8 seconds, the angle of elevation of the pigeon from the same point is 45^{o}.



Based on the above information answer the following questions (Take $\sqrt{3} = 1.73$):

4

	(i) Find the distance between the boy and the pole. (ii) If the distance between the positions of pigeon increases, then what will be the effect on the angle of elevation? (iii) Find the distance of first position of the pigeon from the eyes of the boy. (Or) How much distance the pigeon covers in 8 seconds?	

CLASS X - MATHEMATICS
PRACTICE PAPER II

Time Allowed: 3 Hrs. **Maximum Marks: 80**

General Instructions:

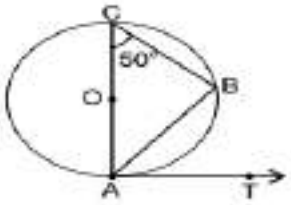
1. This Question Paper has 5 Sections A - E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

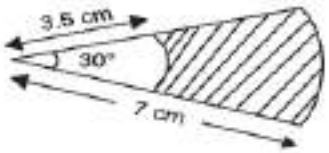
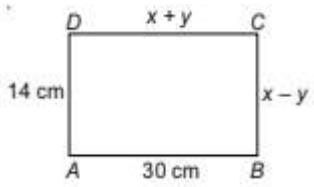
SECTION A

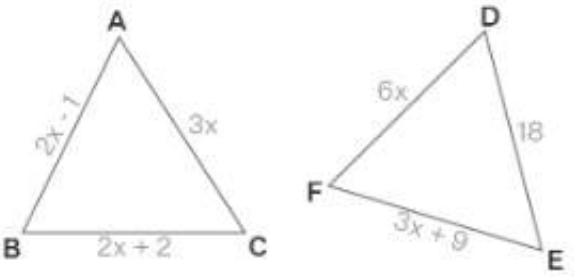
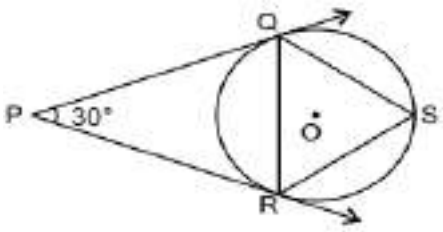
Section A consists of 20 questions of 1 mark each.

S.No		Marks
1	If p and q are the zeroes of the quadratic polynomial $f(x) = 2x^2 - 7x + 3$, the value of $p + q - pq$ is (a) 1 (b) 2 (c) 3 (d) None of these	1
2	D and E are respectively the points on the sides AB and AC of a triangle ABC such that AD = 2 cm, BD = 3 cm, BC = 7.5 cm and DE || BC. Then, length of DE (in cm) is- (a) 2.5 (b) 3 (c) 5 (d) 6	1
3	If the sum of the ages of a father and his son in years is 65 and twice the difference of their ages in years is 50, then the age of father is (a) 40 years (b) 45 years (c) 55 years (d) 65 years	1
4	If the perimeter of a square is equal to the perimeter of a circle, then the ratio of their areas is (a) 11:14 (b) 22: 13 (c) 14:11 (d) 13:22	1

5	If one root of the equation $4x^2 - 2x + (\alpha - 4) = 0$ be the reciprocal of the other, then α = (a) 8 (b) – 8 (c) 4 (d) -4	1
6	The LCM of two numbers is 14 times their HCF. The sum of LCM and HCF is 600. If one number is 280, then the other number is (a) 20 (b) 28 (c) 60 (d) 80	1
7	If in two triangles ABC and DEF, $\frac{AB}{DE} = \frac{BC}{FE} = \frac{CA}{FD}$ then (a) $\Delta FDE \sim \Delta CAB$ (b) $\Delta FDE \sim \Delta ABC$ (c) $\Delta CBA \sim \Delta FDE$ (d) $\triangle BCA \sim \Delta FDE$	1
8	The surface area of a cube is $216cm^2$, its volume is (a) $144cm^3$ (b) $196cm^3$ (c) $212cm^3$ (d) $216cm^3$	1
9	The line segment joining the points P(-3, 2) and Q(5, 7) is divided by the y-axis in the ratio is (a) 3:1 (b) 3:4 (c) 3:2 (d) 3:5	1
10	$(1 + \tan^2\theta)(1 - \sin\theta)(1 + \sin\theta) =$ (a) 0 (b) –1 (c) 1 (d) 2	1
11	It is given that $\Delta ABC \sim \Delta DFE$, $\angle A = 30°$, $\angle C = 50°$, AB = 5 cm, AC = 8 cm and DF = 7.5 cm. Then, which of the following is true? (a) DE = 12 cm, $\angle F = 50°$ (b) DE = 12 cm, $\angle F = 100°$ (c) EF = 12 cm, $\angle D = 100°$ (d) EF = 12 cm, $\angle D = 30°$	1
12	The radius of a circle whose circumference is equal to the sum of the circumference of the two circles of diameters 36cm and 20cm is (a) 56cm (b) 42cm (c) 28cm (d) 16cm	1
13	The arithmetic mean of x, x + 3, x + 6, x + 9 and x + 12 (a) x + 6 (b) x + 5 (c) x + 7 (d) x + 8	1

14	If $\sin\theta + \cos\theta = 1$, then the value of $\sin\theta.\cos\theta$ = (a) 1 (b) 0 (c) –1 (d) 2	1
15	A bag contains 5 red balls and n green balls. If the probability of drawing a green ball is three times that of a red ball, then the value of n is (a) 18 (b) 15 (c) 10 (d) 20	1
16	In the figure, AB is a chord of circle and AOC is its diameter such that $\angle ACB = 50°$. If AT is the tangent to the circle at the point A, then $\angle BAT$ is: (a) 65° (b) 60° (c) 50° (d) 40° 	1
17	In $\triangle ABC$, right angled at B, $\sin A = \frac{7}{23}$, then the value of $\cos C$ is (a) $\frac{7}{25}$ (b) $\frac{24}{25}$ (c) $\frac{7}{24}$ (d) $\frac{24}{7}$	1
18	If for a data, Mean:Median = 9:8, then Median:Mode = (a) 8:9 (b) 4:3 (c) 7:6 (d) 5:4	1
DIRECTION: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option		
19	Assertion: If the point P(x, y) is equidistant from L(5, 1) and M(-1, 5) then, the relation between x and y is x = y. Reason: The coordinates of the point P(x, y) which is the mid - point of the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ are $(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2})$. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A) (c) Assertion (A) is true but reason (R) is false (d) Assertion (A) is false but reason (R) is true	1

20	Assertion: The HCF of two numbers is 9 and their LCM is 2016. If the one number is 54, then the other number is 336. Reason: Relation between numbers and their HCF and LCM is product of two numbers a, b = HCF (a, b) × LCM (a, b). (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A) (c) Assertion (A) is true but reason (R) is false (d) Assertion (A) is false but reason (R) is true	1
	SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	In the given figure, sectors of two concentric circles of radii 7 cm and 3.5 cm are given. Find the area of the shaded region.  (Or) A horse is placed for grazing inside a rectangular field 70 m by 52 m and is tethered to one corner by a rope 21 m long. On how much area can it graze?	2
22	Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segment joining the points of contact at the centre.	2
23	In figure, ABCD is a rectangle. Find the values of x and y.  	2

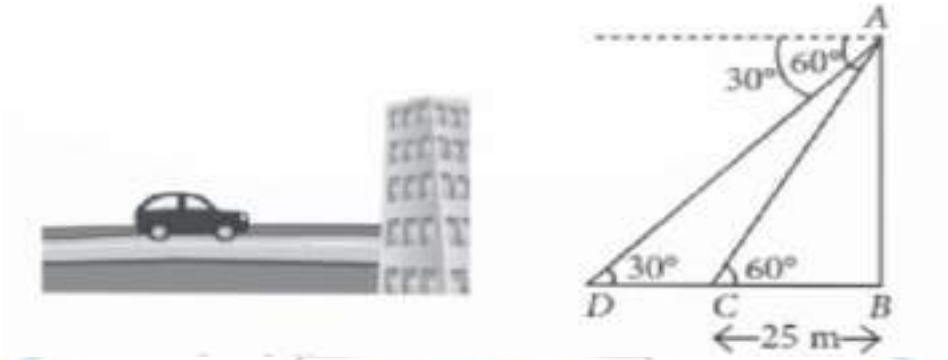
24	In the given figure, $\triangle ABC \sim \triangle DEF$. Find the length of the sides of the each triangle.  	2
25	Show that $\frac{\tan 60° - \tan 30°}{1 + \tan 60° \cdot \tan 30°} = \tan 30°$ (Or) In ΔPQR, right angled at Q, PQ = 3 cm and PR = 6 cm. Determine $\angle QPR$ and $\angle PRQ$.	2
	SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	Check graphically whether the pair of linear equations 4x – y – 8 = 0 and 2x – 3y + 6 = 0 is consistent. Also, find the vertices of the triangle formed by these lines with the x-axis. (Or) Ten years ago, father was 12 times as old as his son and ten years hence, he will be twice as old as his son will be, find the present ages.	3
27	If $\sec\theta = x + \frac{1}{4x}$, prove that $\sec\theta + \tan\theta = 2x$ or $\frac{1}{2x}$.	3
28	Given that $\sqrt{5}$ is irrational, prove that $2 + 3\sqrt{5}$ is irrational.	3
29	In the figure, tangents PQ and PR are drawn to a circle such that $\angle RPQ = 30°$. A chord RS is drawn parallel to the tangent PQ. Find $\angle RQS$.  	3

	(Or) Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.	
30	Two dice are thrown simultaneously. What is the probability that (i) 5 will not come up on either of them? (ii) 5 will come up on at least one? (iii) 5 will come up at both dice?	3
31	Find the value of k such that the polynomial $x^2 - (k + 6)x + 2(2k - 1)$ has sum of its zeros equal to half of their product.	3
	SECTION D **Section D consists of 4 questions of 5 marks each.**	
32	The mean of the following frequency table is 50. But the frequencies x and y in class 20 – 40 and 60 – 80 are missing, find the missing frequencies.	5

Class	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100	Total
Frequency	17	x	32	y	19	120

33	If AD and PM are medians of triangles ABC and PQR respectively where $\triangle ABC \sim \triangle PQR$, prove that $\frac{AB}{PQ} = \frac{AD}{PM}$.	5
34	A building is in the form of a cylinder surmounted by a hemispherical dome. The base diameter of the dome is equal to $\frac{2}{3}$ of the total height of the building. Find the height of the building if it contains $67\frac{1}{21}\,m^3$ of air. (Or) Due to heavy floods in a state, thousands were rendered homeless. 50 schools collectively offered to the state government to provide place and the canvas for 1500 tents to be fixed by the government and decided to share the whole expenditure equally. The lower part of each tent is cylindrical of base radius	5

	2.8 m and height 3.5 m, with conical upper part of same base radius but height 2.1 m. If the canvas used to make the tent costs ₹ 120 per sq. m, find the amount shared by each school to set up the tents.	
35	A person on tour has ₹.360 for his expenses. If he extends his tour for 4 days, he has to cut down his daily expenses by ₹.3. Find the original duration of the tour. (Or) A plane left 30 minutes later than the schedule time and in order to reach its destination 1500km away in time it has to increase its speed by 250 km/hr from its usual speed. Find its usual speed.	5
SECTION E **Case study-based questions are compulsory.**		
36	In a cinema hall, peoples are seated at a distance of 1m from each other, to maintain the social distance due to CORONA virus pandemic. Let three peoples sit at the points P, Q and R whose coordinates are (6, −2), (9, 4) and (10, 6) respectively. Based on the above information, answer the following i) Find the distance between P and R. ii) Find the midpoint of the line segment joining P and R. iii) If a point A lie on the straight-line joining Q and R such that it divides the distance between them in the ration of 1: 2. Then find the coordinates of A. (Or) Find the ratio in which Q divides the line segment joining P and R.	4
37	Rohit is standing at the top of the building observes a car at an angle of 30^o, which is approaching the foot of the building with a uniform speed, 6 seconds later, angle of depression of car formed to be 60^o, whose distance at that	4

	instant from the building is 25m.  Based on the above information, answer the following questions: i) Find the height of the building. ii) Determine the distance between two positions of the car. (Or) Evaluate the time taken by the car to reach the foot of the building from the starting point. iii) Find the distance of the observer from the car when it makes an angle of 60^{o}.	
38	India is competitive manufacturing location due to the low cost of man power and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6^{th} year and 22600 in 9^{th} year. Based on the above information, answer the following questions. i) Find the production in the first year. ii) In which year, production will be 29200? iii) Find the difference of the production during 7^{th} year and 4^{th} year. (Or) Find the difference between 12^{th} year and first year.	4

CLASS X - MATHEMATICS
PRACTICE PAPER III

Time Allowed: 3 Hrs. **Maximum Marks: 80**

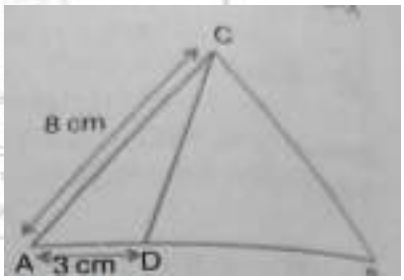
General Instructions:

1. This Question Paper has 5 Sections A - E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

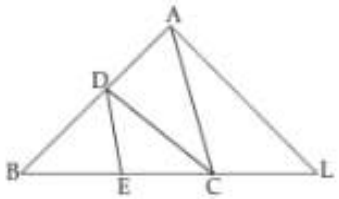
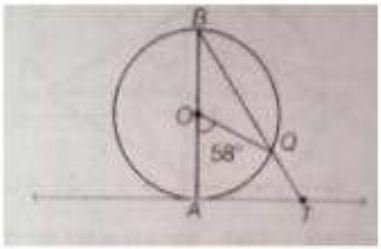
SECTION A

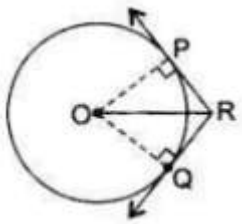
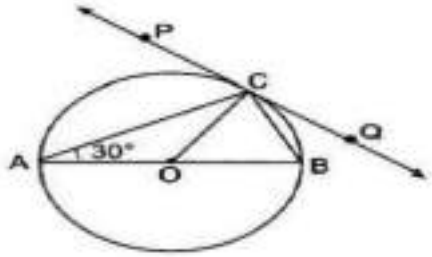
Section A consists of 20 questions of 1 mark each.

S.No		Marks
1	If the product of the zeroes of the quadratic polynomial $3x^2 + 5k + k$ is $\frac{-2}{3}$, then value of k is (a) -3 (b) -2 (c) 2 (d) 3	1
2	The distance between the points (a cosα + b sinα, 0) and (0, a sinα – b cosα) is (a) $a^2 + b^2$ (b) a + b (c) $a^2 – b^2$ (d) $\sqrt{a^2 + b^2}$	1
3	In ΔABC and ΔPQR, we have AB = 4.5cm, BC = 5cm, CA = $6\sqrt{2}$cm, PQ = 10cm, QR = 9cm, PR = $12\sqrt{2}$cm. If ∠A = 75^o and ∠B = 55^o, then ∠P = (a) 75^o (b) 55^o (c) 50^o (d) 130^o	1
4	If the area of the sector of a circle is $\frac{5}{18}$ of the area of the circle, then sector angle is (a) 60^o (b) 90^o (c) 100^o (d) 120^o	1

5	If the sum of 15 observations of a data is (434 + x) and the mean of the observation is x, then x = (a) 25 (b) 27 (c) 31 (d) 33	1
6	The value of k, for which the system of equations $kx + y = k^2$ and $x + ky = 1$ has infinitely many solutions is (a) 1 (b) 2 (c) 3 (d) 4	1
7	The value of $2(\sin^2 45° + \cot^2 30°) - 6(\cos^2 45° - \tan^2 30°)$ is (a) 6 (b) 3 (c) 2 (d) 4	1
8	In figure, ∠ACB = ∠CDA, AC = 8cm, AD = 3cm, then BD = (a) $\frac{22}{3}$ (b) $\frac{26}{3}$ (c) $\frac{55}{3}$ (d) $\frac{64}{3}$ 	1
9	If $x^2 + (4x + k - 1) + 2 = 0$ has equal roots, then k = (a) $\frac{-2}{3}$, 1 (b) $\frac{2}{3}$, -1 (c) $\frac{3}{2}$, $\frac{1}{3}$ (d) (c) $\frac{3}{2}$, $\frac{-1}{3}$	1
10	AB and CD are two common tangents to circles which touch each other at C. If D lies on AB such that CD = 4cm, then AB = (a) 4cm (b) 6cm (c) 8cm (d) 12cm	1
11	If the perimeter of a sector of a circle of radius 6.5cm is 29cm, then its area is (a) $58cm^2$ (b) $52cm^2$ (c) $25cm^2$ (d) $56cm^2$	1
12	The value of (sec A + tan A) (1 – sin A) is (a) sec A (b) sin A (c) cosec A (d) cos A	1
13	The mean and median of the data a, b and c are 50 and 35 respectively, where a < b < c. If c – a = 55, then b – a is (a) 8 (b) 7 (c) 3 (d) 5	1

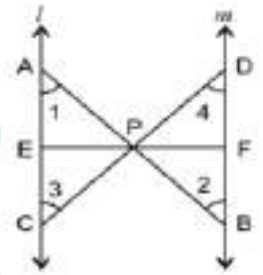
14	The probability of guessing the correct answer to certain question is $\frac{m}{n}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then (a) n = 4m (b) n = 3m (c) n = 2m (d) m = n	1
15	The sum of HCF and LCM of 12, 21, 15 is (a) 423 (b) 420 (c) 417 (d) 140	1
16	In ΔABC, right-angled at B, AB = 5 cm and ∠ACB = 30° then the length of the side AC is (a) $5\sqrt{3}$ cm (b) $2\sqrt{3}$cm (c) 10cm (d) None of these	1
17	A solid is hemispherical at the bottom and conical above. If the surface areas of the two parts are equal, then the ratio of its radius and height of its conical part is (a) 1: $\sqrt{2}$ (b) $\sqrt{2}$:1 (c) 1: $\sqrt{3}$ (d) $\sqrt{3}$:1	1
18	If in two similar triangles DEF and PQR, ∠D = ∠Q and ∠R = ∠E, then which of the following is not true? (a) $\frac{EF}{PR}=\frac{DF}{PQ}$ (b) $\frac{DE}{PQ}=\frac{EF}{RP}$ (c) $\frac{DE}{QR}=\frac{DF}{PQ}$ (d) $\frac{EF}{RP}=\frac{DE}{QR}$	1
DIRECTION: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A) (c) Assertion (A) is true but reason (R) is false (d) Assertion (A) is false but reason (R) is true		
19	Assertion: If product of two numbers is 5780 and their HCF is 17, then their LCM is 340. Reason: HCF is always a factor of LCM.	1

20	Assertion: If the centroid of the triangle having its vertices at A(1, a), B(2, b) and C(c^2, -3) lies on x-axis, then a + b = 3. Reason: On y-axis, x-coordinate of every point is zero.	1
	SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	If the perimeter of a semi-circular protractor is 66 cm, find the diameter of the protractor. (Or) The minute hand of a clock is 20 cm long. Find the area on the face of the clock described by the minute hand between 8 am and 8:45 am.	2
22	In the adjoining figure, DE || AC and DC || AP. Prove that $\frac{BE}{EC} = \frac{BC}{CP}$.  	2
23	Prove that $\frac{\cot A - \cos A}{\cot A + \cos A} = \frac{\operatorname{cosec} A - 1}{\operatorname{cosec} A + 1}$. (Or) Evaluate the following : $\frac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \cos^2 30°}$	2
24	Solve the following linear equations: $\frac{x}{3} + \frac{y}{4} = 11$, $\frac{5x}{6} - \frac{y}{3} = -7$.	2
25	In the given fig. AB is diameter of the circle with centre O and AT is tangent. If ∠AOQ=58°, find ∠ATQ.  	2
	SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	If one zero of the polynomial $ax^2 + bx + c$ is double the other, prove that $2b^2 = 9ac$.	3

27	Two tangents RQ and RP are drawn from an external point R to the circle with centre O. If ∠PRQ = 120°, then prove that OR = PR + QR.  (Or) If PQ is a tangent at a point C to a circle with centre O. If AB is a diameter and ∠CAB = 30°, find ∠PCA.  	3
28	Prove that: $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1 = 0$.	3
29	All the black face cards are removed from a pack of 52 playing cards. The remaining cards are well shuffled and then a card is drawn at random. Find the probability of getting a: (i) face card (ii) red card (iii) black card	3
30	Find the largest number that will divide 398, 436 and 542, leaving remainders 7, 11 and 15 respectively.	3
31	The sum of a two-digit number and the number formed by interchanging its digit is 110. If 10 is subtracted from the first number, the new number is 4 more than 5 times the sum of the digits, find the first number. (Or) The area of a rectangle gets reduced by 80 sq. units if its length is reduced by 5 units and breadth is increased by 2 units. If we increase the length by 10 units and decrease the breadth by 5 units, the area is increased by 50 sq. units. Find the length and breadth of the rectangle.	3

SECTION D

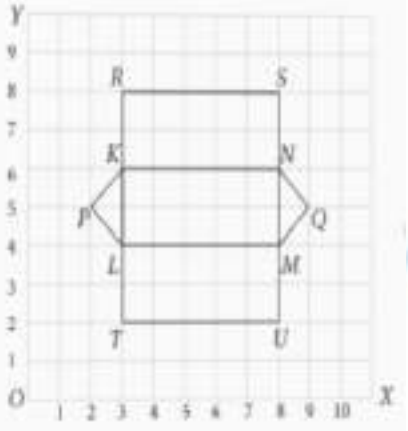
Section D consists of 4 questions of 5 marks each.

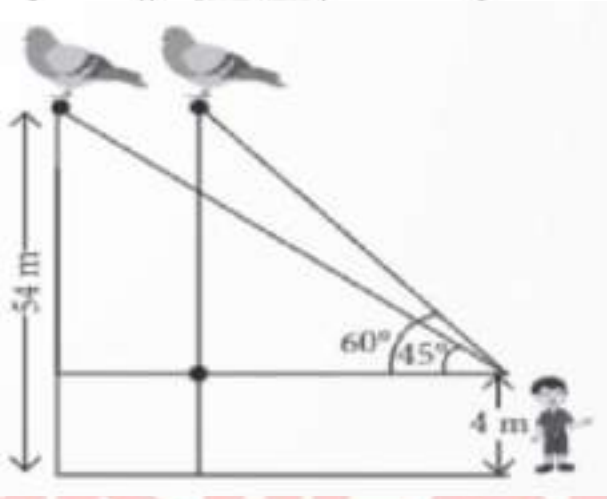
32	In the figure, l || m and line segments AB, CD and EF are concurrent at point P. Prove that $\frac{AE}{BF} = \frac{AC}{BD} = \frac{CE}{DF}$. 	5
33	Two trains leave a railway station at the same time. The first train travels due west and the second train due north. The first train travels 5 km/hr faster than the second train. If after two hours, they are 50 km apart, find the average speed of each train.	5
34	If the median of the following data is 32.5, find the values of x and y. Class Interval: 0 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | 60 - 70 | Total Frequency: x | 5 | 9 | 12 | y | 3 | 2 | 40	5
35	A solid wooden toy is in the form of a hemisphere surmounted by a cone of same radius. The radius of hemisphere is 3.5 cm and the total wood used in the making of toy is $166\frac{5}{6}$ cm^3. Find the height of the toy. Also find the cost of painting the hemisphere part of the toy at the rate of ₹10 per cm^2. (Or) A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm, and the diameter of the base is 4 cm. Determine the volume of the toy. If a right circular cylinder circumscribes the toy, find the difference between the volumes of the cylinder and the toy. (Take $\pi = 3.14$)	5

SECTION E

Case study-based questions are compulsory.

36	Swathi gets pocket money from her father every-day. Out of the pocket	4

	money, she saves ₹.2.75 on the first day, ₹.3 on second day, ₹3.25 on the third and so on. On the basis of above information, answer the following questions: i) What is the amount saved by Swathi on 14^{th} day? (Or) What is the amount saved by Swathi on 30^{th} day? ii) What is the total amount saved by her in the month of June, if he starts saving from 1^{st} June? iii) On which day, she saves ten times as much she saved on day I?	
37	The camping alpine tent is usually made using high quality canvas and it is waterproof. These alpine tents are mostly used in hilly areas as the snow will not settle on the tent and make it damp. It is easy to lay out and one need not use a manual to set it up. One alpine tent is shown in the figure given below which has two triangular faces and three rectangular faces. Also, the images of canvas on graph paper is shown in the adjacent figure.   Based on the above information, answer the following questions: (i) Find the distance of point Q from y-axis. (Or)	4

	What are the coordinates of U? ii) Find the distance between points P and Q. iii) If a point A(x, y) is equidistant from R and T, write the relation between x and y.	
38	A boy 4m tall spots a pigeon sitting on the top of a pole of height 54m from the ground. The angle of elevation of the pigeon from the eyes of boy at any instant is 60^o. The pigeon flies away horizontally in such a way that it remained at a constant height from the ground. After 8 seconds, the angle of elevation of the pigeon from the same point is 45^o.  Based on the above information, answer the following questions: i) Find the distance of first position of the pigeon from the eyes of the boy. ii) Evaluate the distance between the boy and the pole? iii) How much distance the pigeon covers in 8 second? (Or) Find the speed of the pigeon.	4

CLASS X - MATHEMATICS
PRACTICE PAPER IV

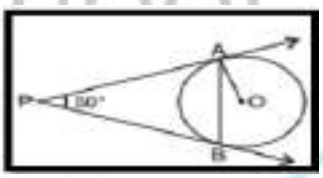
Time Allowed: 3 Hrs. **Maximum Marks: 80**

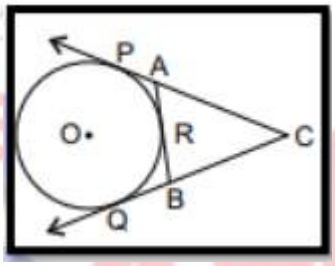
General Instructions:

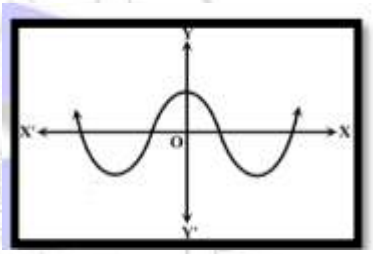
1. This Question Paper has 5 Sections A - E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

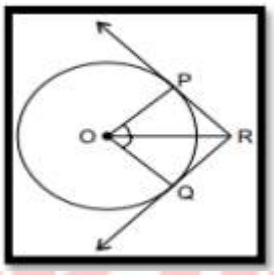
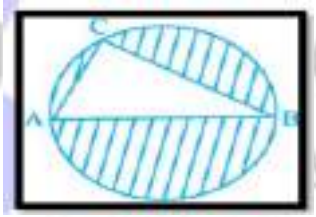
SECTION A

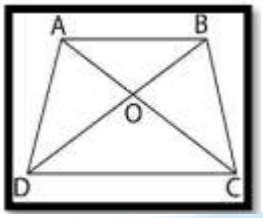
Section A consists of 20 questions of 1 mark each.

S.No		Marks
1	If A (1, 3), B (-1, 3), C (2, 5) and D (x, 5) are the vertices of a parallelogram ABCD, then the value of x is : (a) 3 (b) 4 (c) 5 (d) 5.5	1
2	In the figure, PA and PB are tangents to the circle with centre O such that ∠APB = 50°, then the measure of ∠OAB = (a) 37° (b) 36° (c) 50° (d) 25° 	1
3	If $\sec\theta + \tan\theta = p$, then $\frac{p^2-1}{p^2+1} =$ (a) tanθ (b) cosθ (c) sinθ (d) cosecθ	1
4	If the perimeter of a circle is equal to that of a square, then the ratio of their areas is: (a) π : 2 (b) 4 : π (c) 1 : 2 (d) 2 : π	1

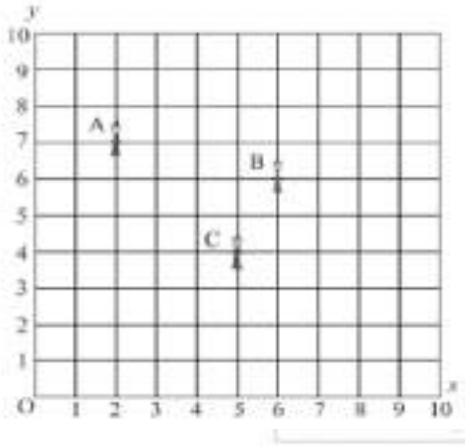
5	If in triangles ABC and DEF, ∠B = ∠E, ∠F = ∠C and AB = 3DE, then the two triangles are: (a) congruent but not similar (b) similar but not congruent (c) neither congruent nor similar (d) congruent as well as similar	1
6	Two positive integers m and n are expressible in the form of $m = pq^3$ and $n = p^3q^2$, where p and q are prime numbers, then HCF(m, n) = (a) pq (b) pq^2 (c) p^3q^3 (d) p^2q^3	1
7	What is the angle of elevation of the sun when the length of the shadow of a vertical pole is equal to its height? (a) 30° (b) 60° (c) 45° (d) None of these	1
8	In the figure, CP and CQ are tangents to a circle with centre O. ARB is another tangent touching the circle at R. If CP = 11 cm and BC = 7 cm, then the length of BR is : (a) 3.5 cm (b) 4 cm (c) 3 cm (d) 11 cm 	1
9	The roots of the equation $x^2 + x - p(p + 1) = 0$, where p is a constant are (a) p, p + 1 (b) −p, p + 1 (c) p, −(p + 1) (d) −p, −(p + 1)	1
10	The area of a quadrant of a circle, where the circumference of circle is 44 cm is (a) 32.5 cm^2 (b) 35.5 cm^2 (c) 36.5 cm^2 (d) 38.5 cm^2	1
11	The probability that a non-leap year selected at random will contain 53 Sundays is: (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{7}$ (d) $\frac{5}{7}$	1
12	If 7 times the 7^{th} term of an AP is equal to 11 times its 11^{th} term, then its 18^{th} term will be: (a) 7 (b) 11 (c) 18 (d) 0	1

<table>
<tr><td>13</td><td>Consider the following frequency distribution of the heights of 60 students of a class:
<table><tr><td>Height (in cm)</td><td>150 - 155</td><td>155 - 160</td><td>160 - 165</td><td>165 - 170</td><td>170 - 175</td></tr><tr><td>No of Students</td><td>15</td><td>10</td><td>8</td><td>9</td><td>5</td></tr></table>
The upper limit of the median class in the given data is
(a) 165 (b) 155 (c) 160 (d) 170</td><td>1</td></tr>
<tr><td>14</td><td>Which of the following can be the probability of an event?
(a) –0.04 (b) 1.004 (c) $\frac{18}{23}$ (d) $\frac{8}{7}$</td><td>1</td></tr>
<tr><td>15</td><td>The graph of y = p(x), where p(x) is a polynomial in variable x. The number of zeroes of p(x) is:
(a) 2 (b) 3
(c) 4 (d) 0
  </td><td>1</td></tr>
<tr><td>16</td><td>If the centroid of the triangle formed by (7, x), (y, -6) and (9, 10) is (6, 3), then the value of x and y respectively are :
(a) 5, 3 (b) 5, 2 (c) −3, 2 (d) 6, 5</td><td>1</td></tr>
<tr><td>17</td><td>$\frac{\sin^3\theta+\cos^3\theta}{\sin\theta+\cos\theta} + \sin\theta \cdot \cos\theta =$
(a) 0 (b) 1 (c) -1 (d) $\frac{1}{2}$</td><td>1</td></tr>
<tr><td>18</td><td>The pair of equations x = a and y = b graphically represents lines which are:
(a) Parallel (b) intersecting at (b, a)
(c) coincident (d) intersecting at (a, b)</td><td>1</td></tr>
<tr><td colspan="3">DIRECTION: In the question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason (R) is false
(d) Assertion (A) is false but reason (R) is true</td></tr>
</table>

19	Assertion(A): Volume of a cube having length of diagonal $5\sqrt{3}$cm is 125cm^3. Reason(R): For a cube having length of diagonal = $\sqrt{3}$ side and volume = $(\text{side})^3$.	1
20	Assertion (A): 5, 10, 15 are three consecutive terms of an AP. Reason (R): if a, b, c are three consecutive terms of an AP, then 2b = a + c	1
	SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	Find an acute angle θ, when $\frac{\text{cosec}\theta+\sec\theta}{\text{cosec}\theta+\sec\theta} = \frac{\sqrt{3}+1}{\sqrt{3}-1}$ (Or) If $\tan\theta + \sec\theta = m$, then prove that $\sec\theta = \frac{m^2+1}{2m}$	2
22	In the given figure, two tangents RQ and RP are drawn from an external point R to the circle with centre O. If ∠PRQ = 120°, then prove that OR = PR + RQ. 	2
23	In the given figure AB is a diameter of the circle, AC = 6cm and BC = 8 cm. Find the area of the shaded region (Use π = 3.14). 	2
24	Show that 9^n can never end with digit 0 for any natural number n. (Or) On morning walk, three persons step off together and their steps measure 40 cm, 42 cm and 45 cm respectively. What is the minimum distance each should walk so that each can cover the same distance in complete steps?	2

25	In the given figure, $\frac{AO}{OC} = \frac{BO}{OD} = \frac{1}{2}$ and AB = 8cm. Find the value of DC.  	2
SECTION C **Section C consists of 6 questions of 3 marks each.**		
26	If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 - 5x + 6$, find the value of: (i) $\alpha^2 + \beta^2$ (ii) $\alpha^3\beta^2 + \alpha^2\beta^3$.	3
27	A circle is touching the side BC of ΔABC at P and touching AB and AC produced at Q and R respectively. Prove that AQ = $\frac{1}{2}$ (Perimeter of $\triangle ABC$).	3
28	The mode of the following series is 36. Find the missing frequency in it. Class Interval: 0 - 10 | 10 - 20 | 20 - 30 | 30 – 40 | 40 – 50 | 50 - 60 | 60 - 70 Frequency: 8 | 10 | f | 16 | 12 | 6 | 7	3
29	Prove that $3 + 2\sqrt{5}$ is irrational.	3
30	Solve: 99x + 101y = 499; 101x + 99y = 501. (Or) If x + 1 is a factor of $2x^3 + ax^2 + 2bx + 1$, then find the values of a and b given that 2a - 3b = 4.	3
31	Prove that: $\frac{1}{\text{cosec}A - \cot A} - \frac{1}{\sin A} = \frac{1}{\sin A} - \frac{1}{\text{cosec}A + \cot A}$. (Or) Prove that: $\frac{1+\sec\theta-\tan\theta}{1+\sec\theta+\tan\theta} = \frac{1-\sin\theta}{\cos\theta}$.	3
SECTION D **Section D consists of 4 questions of 5 marks each.**		
32	From a solid right circular cylinder with height 12 cm and radius of the base 5 cm, a right circular cone of the same height and the same base radius is removed. Find the volume and total surface area of the remaining solid. [Use π=3.14.]	5

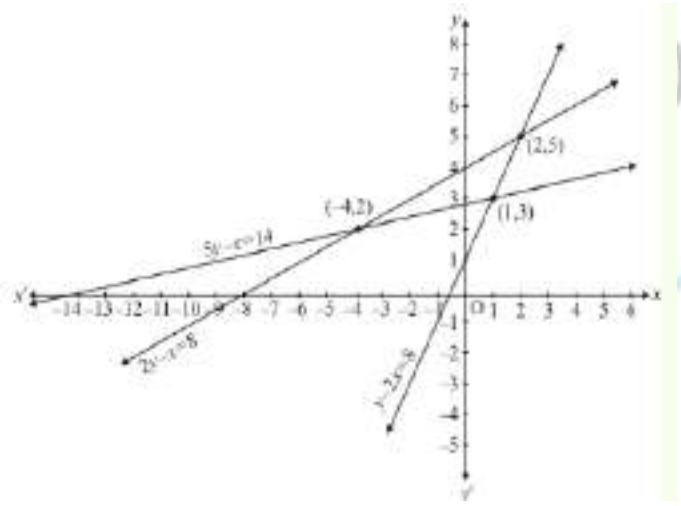
	(Or) A toy is in the form of a cylinder with hemispherical ends. If the whole length of the toy is 90 cm and its diameter is 42 cm, find the cost of painting the toy at the rate of 70 paise per cm^2.	
33	An aeroplane left 30 minutes later than its scheduled time and in order to reach its destination 1500 km away in time, it had to increase its speed by 250 km/h from its usual speed. Determine its usual speed. (Or) The difference of two natural numbers is 5 and the difference of their reciprocals is 110. Find the numbers.	5
34	Find the missing frequencies f_1 and f_2, if mean of 50 observations given below is 38.2. Class: 0 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | 60 - 70 Frequency: 4 | 4 | f_1 | 10 | f_2 | 8 | 5	5
35	If two poles 5 m and 15 m high are 100 m apart, then find the height of the point of intersection of the line joining the top of each pole to the foot of the opposite pole.	5
SECTION E **Case study-based questions are compulsory.**		
36	There are two temples on each bank of a river. One temple is 50 m high. A man, who is standing on the top of a 50m high temple, observed from the top that the angle of depression of the top and foot of other temple are 30° and 60° respectively. (i) Draw a neat, labelled figure to show the above situation diagrammatically. (ii) Find measure of angle ADF (Or) Find measure of angle ACB.	4

	(iii) Find the height of the other temple.	
37	Resident Welfare Association (RWA) of a Gulmohar Society in Delhi have installed three electric poles A, B and C in a society's common park. Despite these three poles, some parts of the park are still in dark. So, RWA decides to have one more electric pole D in the park. The park can be modelled as a coordinate system given below.   (i) What is the distance of the pole B from the corner O of the park? (ii) What are the coordinates of the mid-point of the line joining the points A and C? (Or) Find the coordinates of the point which dividing the line segment BC in the ratio 1:2. (iii) Find the position of the fourth pole D so that four points A, B, C and D form a parallelogram.	4
38	Amit was playing a number card game. In the game, some number cards (having both +ve or-ve numbers) are arranged in a row such that they are following an arithmetic progression. On his first turn, Amit picks up 6th and 14th card and finds their sum to be -76. On the second turn he picks up 8th and 16th card and	4

	finds their sum to be -96. Based on the above information, answer the following questions. (i) What is the difference between the numbers on any two consecutive cards? (ii) Find the number on first card. (iii) What is the number on the 19th card? (Or) What is the number on the 23rd card?	

CLASS X - MATHEMATICS
ANSWER KEY - PRACTICE PAPER I

SECTION A **Section A consists of 20 questions of 1 mark each.**		
S.No		**Marks**
1	(b) x = 21; y = 84	1
2	(c) $\frac{5}{3}$	1
3	(c) $\frac{15}{4}$	1
4	(d) ±1	1
5	(a) 6	1
6	(d) 2	1
7	(d) None of these	1
8	(d) (0, -10) & (4, 0)	1
9	(d) 0	1
10	(a) $m^2 + n^2$	1
11	(b) 45^o	1
12	(a)70^o	1
13	(c) 36 cm	1
14	(a) 22cm	1
15	(a) π cm^3	1
16	(b) 12	1
17	(a) $\frac{7}{8}$	1
18	(d)18	1
19	(c) Assertion (A) is true but reason (R) is false.	1
20	(c) Assertion (A) is true but reason (R) is false.	1

	SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	Proof	2
22	Proof	2
23	p = 0 (Or) Proof	
24	24cm	2
25	$3500cm^2$ (Or) $56cm^2$	2
	SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	12	3
27	$k(49x^2 - 11x + 1)$	3
28	18 (Or)  Hence the vertices of triangle are (−4,2) , (1,3), (2,5).	3

29	Proof	3
30	Proof	3
31	f =10	3
	SECTION D **Section D consists of 4 questions of 5 marks each.**	
32	x = 0 or -7 (Or) 60km/hr	5
33	Proof	5
34	Volume = $201.14cm^3$ and Surface Area = $172cm^2$ (Or) $4136m^2$	5
35	x = 8	5
	SECTION E **Case study-based questions are compulsory.**	
36	i) 3000, 3005, 3010, …., 3900 ii) 624450 iii) 180 (Or) 101	4
37	i) $\sqrt{53}$ ii) 3:4 iii) (0, 4)	4
38	i) $\frac{50}{\sqrt{3}}$m	4

	ii) Angle of elevation decreases iii) $\frac{100}{\sqrt{3}}$ m (Or) 21.09m	

CLASS X - MATHEMATICS
ANSWER KEY – PRACTICE PAPER II

SECTION A **Section A consists of 20 questions of 1 mark each.**		
S.No		**Marks**
1	(b) 2	1
2	(b) 3	1
3	(b) 45 years	1
4	(c) 14:11	1
5	(a) 8	1
6	(d) 80	1
7	(a) $\triangle$ FDE $\sim\triangle$ CAB	1
8	(d) $216cm^3$	1
9	(d) 3:5	1
10	(c) 1	1
11	(b) DE = 12 cm, $\angle F = 100°$	1
12	(a) 56cm	1
13	(a) x + 6	1
14	(b) 0	1
15	(b) 15	1
16	(c) 50°	1
17	(a) $\frac{7}{25}$	1
18	(b) 4:3	1
19	(d) Assertion (A) is false but reason (R) is true	1

20	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)	1
SECTION B **Section B consists of 5 questions of 2 marks each.**		
21	$9.625 cm^2$ (Or) $346.5 cm^2$	2
22	$\angle BOA + \angle APB = 180^\circ$	2
23	x = 22 & y = 8	
24	AB = 9 cm, BC = 12 cm, AC = 15 cm, DE = 18 cm, EF = 24 cm and DF = 30 cm.	2
25	$\frac{1}{\sqrt{3}}$ (On both sides) (Or) 30° & 60°	2
SECTION C **Section C consists of 6 questions of 3 marks each.**		
26	(-3, 0), (3, 4) and (2, 0) (Or) 34 years and 12 years	3
27	2x or $\frac{1}{2x}$	3
28	Irrational	3
29	$\angle RQS = 30^\circ$ (Or) Proof	3
30	(i) $\frac{25}{36}$ (ii) $\frac{11}{36}$ (iii) $\frac{1}{36}$	3
31	k = 7	3
SECTION D **Section D consists of 4 questions of 5 marks each.**		
32	x = 28 & y = 24	5

33	$\frac{AB}{PQ} = \frac{AD}{PM}$	5
34	6m (Or) ₹332640	5
35	20 days (Or) 750 km/hr	5
	SECTION E **Case study-based questions are compulsory.**	
36	i) $4\sqrt{5}$ units ii) (8, 2) iii) $(\frac{28}{3}, \frac{14}{3})$ (Or) 3:1	4
37	i) $25\sqrt{3}$ m ii) 50m (Or) 9 seconds iii) 50m	4
38	i) 5000 ii) 12^{th} year iii) 6600 (Or) 24200	4

CLASS X - MATHEMATICS
ANSWER KEY – PRACTICE PAPER III

SECTION A **Section A consists of 20 questions of 1 mark each.**		
S.No		**Marks**
1	(b) -2	1
2	(d) $\sqrt{a^2 + b^2}$	1
3	(c) 50^o	1
4	(c) 100^o	1
5	(c) 31	1
6	(a) 1	1
7	(a) 6	1
8	(c) $\frac{55}{3}$	1
9	(b) $\frac{2}{3}$, -1	1
10	(c) 8cm	1
11	(b) $52cm^2$	1
12	(d) cos A	1
13	(d) 5	1
14	(b) n = 3m	1
15	(a) 423	1
16	(c) 10cm	1
17	(d) $\sqrt{3}$:1	1
18	(b) $\frac{DE}{PQ} = \frac{EF}{RP}$	1
19	(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct	1

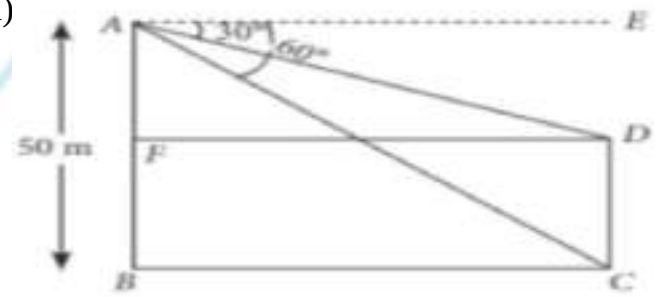
	explanation of assertion (A)	
20	(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)	1
	SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	25.67cm (Or) $\frac{6600}{7}$ cm^2	2
22	$\frac{BE}{EC} = \frac{BC}{CP}$	2
23	$\frac{67}{12}$	
24	x = 6 & y = 36	2
25	61^o	2
	SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	$2b^2 = 9ac$	3
27	OR = PR + QR (Or) 60°	3
28	0	3
29	(i) $\frac{3}{23}$ (ii) $\frac{13}{23}$ (iii) $\frac{10}{23}$	3
30	17	3
31	64 (Or) 40 units and 30 units	3
	SECTION D	

Section D consists of 4 questions of 5 marks each.		
32	$\frac{AE}{BF} = \frac{AC}{BD} = \frac{CE}{DF}$	5
33	15km/hr & 20km/hr	5
34	x = 3 & y = 6	5
35	h = 9.5cm and ₹770 (Or) $25.12cm^3$	5
SECTION E **Case study-based questions are compulsory.**		
36	i) ₹6 (Or) ₹10 ii) ₹191.25 iii) 100	4
37	i) 9 units (Or) (8, 2) ii) 7 units iii) y = 5	4
38	i) $\frac{100}{\sqrt{3}}$ m ii) $\frac{50}{\sqrt{3}}$ m iii) 21.09m (Or) 2.63m/sec	4

CLASS X - MATHEMATICS
ANSWER KEY - PRACTICE PAPER IV

SECTION A **Section A consists of 20 questions of 1 mark each.**		
S.No		**Marks**
1	(b) 4	1
2	(d) 25°	1
3	(c) $\sin\theta$	1
4	(b) $4 : \pi$	1
5	(b) similar but not congruent	1
6	(b) pq^2	1
7	(c) 45°	1
8	(b) 4 cm	1
9	(c) p, $-(p + 1)$	1
10	(c) 36.5 cm^2	1
11	(a) $\frac{1}{7}$	1
12	(d) 0	1
13	(c) 160	1
14	(c) $\frac{18}{23}$	1
15	(c) 4	1
16	(b) 5, 2	1
17	(b) 1	1
18	(d) intersecting at (a, b)	1
19	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)	1

20	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)	1
	SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	30° (Or) Proof	2
22	Proof	
23	$54.5cm^2$	
24	Proof (Or) 2520	2
25	10cm	2
	SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	(i) 13 (ii) 180	3
27	Proof	3
28	f = 10	3
29	Proof	3
30	x = 3, y = 2 (Or) a = 5, b = 2	3
31	Proof	3
	SECTION D **Section D consists of 4 questions of 5 marks each.**	
32	$628cm^3$ and $659.4cm^2$ (Or) ₹ 8316	5

33	750 km/h (Or) 10 and 15	5
34	7 and 12	5
35	3.75 m	5
SECTION E **Case study-based questions are compulsory.**		
36	(i)  (ii) 30° (Or) 60° (iii) 33.33m	4
37	(i) $6\sqrt{2}$ units (ii) $\left(\frac{7}{2}, \frac{11}{2}\right)$ (Or) $\left(\frac{17}{3}, \frac{16}{3}\right)$ (iii) (1, 5)	4
38	(i) -5 (ii) 7 (iii) -83 (Or) -103	4