DELHI PUBLIC SCHOOL MATHURAROAD

ASSIGNMENT BOOKLET

Session: 2023-24

Mathematics

Class: X

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TERMWISE SYLLABUS

Periodic Test - 1
Syllabus
Chapter – 2 and 3

Periodic Test - 2
Syllabus
Chapter – 4 and 6

Term – 1 Exam
Syllabus
Chapter – 1, 2, 3, 4, 5, 6, 8,11 and 14

Periodic Test - 3
Syllabus
Chapter – 9 and 14

Pre-Board Exams
Syllabus
Chapter – 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,11,12,13 and14

COURSE STRUCTURE CLASS -X

Units	Unit Name	Marks
I	NUMBER SYSTEMS	06
II	ALGEBRA	20
III	COORDINATE GEOMETRY	06
IV	GEOMETRY	15
V	TRIGONOMETRY	12
VI	MENSURATION	10
VII	STATISTICS & PROBABILTY	11
	Total	80

INTERNAL ASSESMENT	**20 MARKS**
Pen and paper and Multiple Assessment (5 + 5)	10 Marks
Portfolio	5 Marks
Lab Practical (Lab activities to be done from the prescribed books)	5 Marks

CHAPTER 1

REAL NUMBERS

1. **The largest number that divides 70 and 125, which leaves the remainders 5 and 8, is:**

(a) 65 (b) 15 (c) 13 (d) 25

2. 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

3. **The least number that is divisible by all the numbers from 1 to 5 is:**

(a) 70 (b) 60 (c) 80 (d) 90

4. L.C.M. of 23 × 32 and 22 × 33 is :

(a) 23 (b) 33 (c) 23 × 33 (d) 22 × 32

5. The HCF and LCM of two numbers are 33 and 264 respectively. When the first number is completely divided by 2 the quotient is 33. The other number is:

(a) 66 (b) 130 (c) 132 (d) 196

6. What will be the least possible number of the planks, if three pieces of timber 42 m, 49 m and 63 m long have to be divided into planks of the same length?

(a) 5 (b) 6 (c) 7 (d) none of these

7. What is the greatest possible speed at which a man can walk 52 km and 91 km in an exact number of minutes?

(a) 17 m/min (b) 7 m/min (c) 13 m/min (d) 26 m/min

8. If A = 2n + 13, B = n + 7, where n is a natural number then HCF of A and B is:

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

9. Pairs of natural numbers whose least common multiple is 78 and the greatest common divisor is 13 are:

(a) 58 and 13 or 16 and 29 (b) 68 and 23 or 36 and 49

(c) 18 and 73 or 56 and 93 (d) 78 and 13 or 26 and 39

10. Two natural numbers whose sum is 85 and the least common multiple is 102 are:

(a) 30 and 55 (b) 17 and 68 (c) 35 and 55 (d) 51 and 34

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

11. **Assertion:** 2 is an example of a rational number.
Reason: The square roots of all positive integers are irrational numbers.

12. Assertion: $\mathbf{12^n}$ ends with the digit zero, where n is any natural number.
Reason: Any number ends with digit zero, if its prime factor is of the form 2^m x 5^n, where m and n are natural numbers.

Subjective Questions:

1. Find the largest number which divides 70 and 125, leaving remainders 5 and 8 Respectively.
2. Find the sum of the exponents of the prime factors in the prime factorisation of 196.
3. Find the HCF of 1848, 3058 and 1331.
4. Express 140 as a product of its prime factors
5. Find LCM and HCF of 867 and 255 and verify that LCM × HCF = product of the two numbers.
6. Find the HCF of 240 and 6552
7. Find the largest number which divides 615 and 963 leaving remainder 6 in each case.
8. Find whether the pair of numbers 847, 2160 are co-primes or not?
9. Find the number nearest to 110000 but greater than 100000 which is exactly divisible by 8, 15 and 21.
10. Find the least number that is divisible by all numbers between 1 and 10 (both inclusive).

11. The numbers 525 and 3000 are both divisible only by 3, 5, 15, 25 and 75. What is HCF (525, 3000)? Justify your answer.
12. The LCM of 2 numbers is 14 times their HCF. The sum of LCM and HCF is 600. If one number is 280, then find the other number.
13. Prove that $\frac{3\sqrt{2}}{5}$ is irrational.
14. The length, breadth and height of a room are 8.25 m, 6.75 m and 4.50 m Respectively. Determine the longest rod which can measure the three dimensions of the room exactly.
15. A circular field has a circumference of 360 km. Three cyclists start together and can cycle 60km, 48km and 72km a day, around the field. After how many days will they meet again at the starting point.
16. Find the greatest number of 6 digits exactly divisible by 24, 15 and 36.
17. Let a and b be positive integers. Show that $\sqrt{2}$ always lies between $\frac{a}{b}$ and $\frac{a-2b}{a+b}$
18. Prove that ($\sqrt{n-1} + \sqrt{n+1}$) is irrational, for every $n \in N$
19. **Given that HCF (306, 657) = 9, find LCM (306, 657).**
20. **Prove that 3 + 2$\sqrt{5}$ is irrational.**
21. **Check whether 6^n can end with the digit 0 for any natural number n.**
22. What is the HCF of the smallest prime number and the smallest composite number?
23. Prove that $\sqrt{3} - \sqrt{2}$ and $\sqrt{3} + \sqrt{5}$ are irrational.
24. Explain why 3 x 5 x 7 + 7 is a composite number.
25. Prove that $\sqrt{p} + \sqrt{q}$ is irrational, where p,q are primes.

Answers:

Part : 1

1. c	2. b	3. b	4.	5. c
6. c	7. d	8. c	9.b	10. d
11. c	12. d			

Part : 2

1. 13	2. 4	3. 11	4. 2^2 .5.7	5. 4335 , 51

6. 24 7. 87 8. Yes 9. 109200 10. 2520

11.75 12. 80 14. 75 cm 15. 30 days 16. 9997201

19. 22338 22. 2

CASE STUDY 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

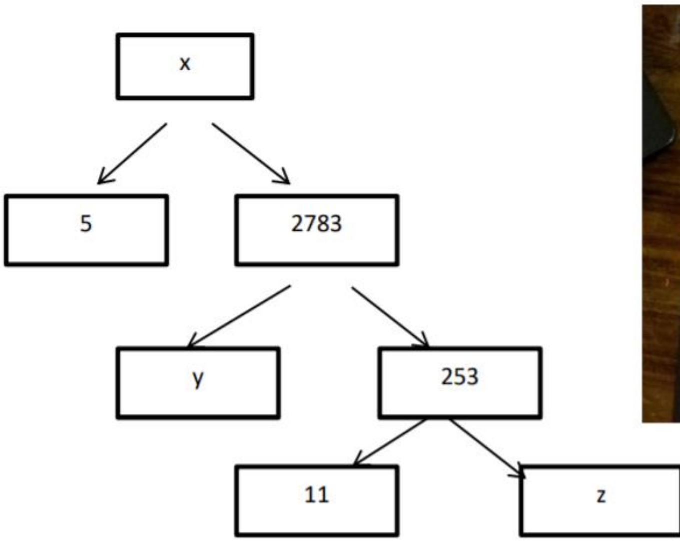
1. What is the minimum number of books you will acquire for the class library, so that they can be distributed equally among students of Section A or Section B?
2. If the product of two positive integers is equal to the product of their HCF and LCM is true then find the HCF (32, 36).
3. Express 36 as a product of its primes.
4. If p and q are positive integers such that $p = ab^2$ and $q=a^2b$, where a, b are prime numbers, then the LCM (p, q) is

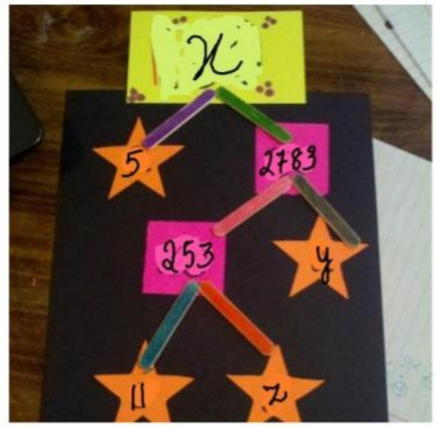
Answers :

1.288 2. 4 3. $2^2 \times 3^2$ 4. a^2b^2

Case Study 2

A Mathematics Exhibition is being conducted in your School and one of your friends is making a model of a factor tree. He has some difficulty and asks for your help in completing a quiz for the audience. Observe the following factor tree and answer the following:





1. What will be the value of x?

2. What will be the value of y?

3. What will be the value of z?

4. The prime factorisation of 13915 is

Answers

1. 13915 2. 11 3. 23 4. a) 5. $5 \times 11^2 \times 13^2$

Reference links:

http://ndl.iitkgp.ac.in/document/bDdWWVBLZEVEQ1RkRVB1R05USmsxaDh2L2xaM3RJeW4xMFZjcnVpWWs0TT0

http://ndl.iitkgp.ac.in/document/cDBBWUJKc3pUZlJUZGJnWVhDdjNQeEpScG96QnJRYVlmdjczT2h0OXVxaz0

EXTENDED LEARNING

Choose the correct answer from the given four options in the following questions:

1. The decimal expansion of the rational number $\frac{33}{2^2.5}$will terminate after

   (A) one decimal place
   (B) two decimal places
   (C) three decimal places
   (D) more than 3 decimal places

2. n^2– 1 is divisible by 8, if n is
   (A) an integer (C) a natural number
   (B) an odd integer (D) an even integer

3. $119^2 - 111^2$ is:
   (A) a prime number
   (B) a composite number
   (C) an odd composite number
   (D) an even composite number

4. If the HCF of 65 and 117 is expressible in the form 65m – 117, then the value of m is
   (A) 4 (B) 2 (C) 1 (D) 3
5. The largest number which divides 70 and 125, leaving remainders 5 and 8, respectively, is
   (A) 13 (B) 65 (C) 875 (D) 1750
6. If two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$; $x, y$are prime numbers, then HCF (a, b) is
   (A) xy (B) xy^2 (C) x^3y^3 (D) x^2y^2
7. If two positive integers p and q can be expressed as $p = ab^2$ and $q = a^3b$;a, b being prime numbers, then LCM (p, q) is
   (A) ab (B) a^2b^2 (C) a^3b^2 (D) a^3b^3
8. The product of a non-zero rational and an irrational number is
   (A) always irrational (C) always rational
   (B) rational or irrational (D) one
9. If HCF of $(x-5)(x^2-x-a)$ and $(x-4)(x^2-2x-b)$ is $(x-4)(x-5)$, the values of a and b are respectively
   (A) 15, 18 (B) 10, 7 (C) $-8, 10$ (D) 12, 15
10. Prime factorization of $'n' = 2^9 \times 5^8 \times 17$. The number of zeroes it contains,
    (A) 1 (B) 9 (C) 8 (D) 18
11. If n is a natural number, then $9^{2n} - 4^{2n}$is always divisible by
    (A) 5 (B) 13 (C) both 5 and 13 (D) none of these
12. The smallest rational number by which $\frac{1}{3}$ should be multiplied so that its decimal expansion terminates after one place of decimal is
    (A) $\frac{3}{10}$ (B) $\frac{1}{10}$ (C) 3 (D) $\frac{3}{100}$
13. The decimal expansion of $\frac{23457}{2^3 \times 5^4}$will terminate after how many places of decimals ?
    (A) 2 (B) 3 (C) 4 (D) 5
14. Given that LCM(91, 26) = 182, then HCF(91, 26) is :
    (A) 13 (B) 26 (C) 7 (D) 9

15. The decimal expansion of the rational number $\frac{14587}{1250}$ will terminate after:

(A) one decimal place (C) two decimal places

(B) three decimal places (D) four decimal places

Extended Learning

1) B	2) B	3) D	4) B	5) A	6) B
7) C	8) A	9) B	10) C	11) C	12) A
13) C	14) A	15) D			

CHAPTER 2 - POLYNOMIALS

ASSIGNMENT

Choose the correct answer from the given four options

1. If the sum of the zeroes of the quadratic polynomial $3x^2 - kx + 6$ is 3, the value of k is

(A) 3 (B) 1 (C) 9 (D) -9

2. If the zeroes of a quadratic polynomial are 5 and -6, then the coefficient of x is

(A) -1 (B) 1 (C) 5 (D) -6

3. If the zeroes of the quadratic polynomial $ax^2 + bx + c$ are equal in magnitude but opposite in sign then the coefficient of x is

(A) $\frac{c}{a}$ (B) 0 (C) $-\frac{c}{a}$ (D) 1

4. The value of p for which the polynomial $x^3 + 4x^2 - px + 8$ is exactly divisible by $(x - 2)$ is

(A) 0 (B) 3 (C) 5 (D) 16

5. For what value of k, is 3 a zero of the polynomial $2x^2 + x + k$?

(A) 21 (B) –21 (C) 22 (D) –22

6. If one of the zeroes of the quadratic polynomial $(k-1)x^2 + kx + 1$ is (-3), then k equals to

(A) $\frac{4}{3}$ (B) $-\frac{4}{3}$ (C) $\frac{2}{3}$ (D) $-\frac{2}{3}$

7. The quadratic polynomial, sum and product of whose zeroes are $\frac{1}{2}$ and –12 respectively is:

(A) $x^2 - x - 12$ (B) $x^2 + x - 12$ (C) $2x^2 - x + 24$ (D) $2x^2 - x - 24$

8. If one zero of polynomial $f(y) = (k^2 + 4)y^2 + 13y + 4k$ is the reciprocal of the other, then value of k is

(A) 1 (B) –1 (C) 2 (D) –2

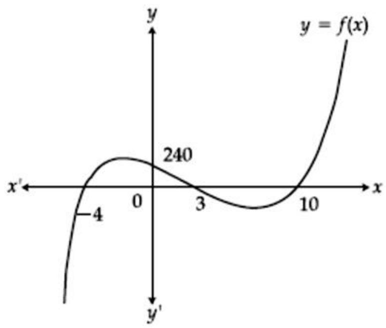
9. The sum and product of the zeroes of the polynomial $9x^2 - 5$ respectively are :

(A) $0, -\frac{9}{5}$ (B) $0, \frac{9}{5}$ (C) $0, \frac{5}{9}$ (D) $0, -\frac{5}{9}$

10. The number to be added to the polynomial $x^2 - 5x + 4$, so that 3 is the zero of the polynomial is :

(A) 2 (B) -2 (C) 0 (D) 3

11. In the figure, the number of zeroes of $f(x)$ are :



(A) 1 (B) 2 (C) 3 (D) 4

12. The graph of a polynomial $p(x)$ passes through the points $(-5, 0), (0, -40), (8, 0)$ and $(5, -30)$. Which among the following is a factor of $p(x)$?

(A) $(x - 5)$ (B) $(x - 8)$ (C) $(x + 30)$ (D) $(x + 40)$

DIRECTION: In the question number 13 and 14, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option

13. Statement A (Assertion): If $2 - \sqrt{3}$ is one of the zeroes of a quadratic polynomial, then the other zero will be $2 + \sqrt{3}$.

Statement R(Reason) : In a quadratic polynomial with rational coefficients, irrational zeroes occur in conjugate pairs.

(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.

14. Statement A (Assertion): The polynomial $p(x) = x^2 - 2x + 2$ has two real zeroes.

Statement R (Reason) : A quadratic polynomial can have at most two real zeroes.

(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.

VERY SHORT ANSWER TYPE QUESTIONS

15. If α and β are the zeroes of $x^2 + 7x + 12$, then find the sum of their reciprocals.

16. What will be number of zeroes of the polynomials whose graphs are either touching or intersecting the axes only at the points: (–3, 0), (0, 2) & (3, 0)?

17. If one zero of the polynomial $4x^2 - 2x + (k - 4)$ is reciprocal of the other, find the value of k.

18. The sum and the product of the zeroes of the polynomial $f(x) = 4x^2 - 27x + 3k^2$ are equal. Find the value(s) of k.

SHORT ANSWER TYPE QUESTIONS

19. Form a quadratic polynomial whose zeroes are $\frac{3-\sqrt{3}}{5}$ and $\frac{3+\sqrt{3}}{5}$.

20. If one zero of $p(x) = 4x^2 - (8k^2 - 40k)\,x - 9$ is negative of the other, find values of k.

21. Form a quadratic polynomial whose one zero is $3 - \sqrt{5}$ and product of the zeroes is 4.

22. If α and β are zeroes of the quadratic polynomial $x^2 - 6x + a$; find the value of a if $3\alpha + 2\beta = 20$.

23. If α and β are the two zeroes of the polynomial $3x^2 + 5x - 2$, find a quadratic polynomial whose zeroes are 3α and 3β.

24. If α and β are the two zeroes of the polynomial $6y^2 - 7y + 2$, find a quadratic polynomial whose zeroes are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

25. If one zero of the polynomial $3x^2 - 8x - 2k - 1$ is seven times the other, find the zeroes and the value of k.

26. If $\frac{2}{3}$ and – 3 are the zeroes of the polynomial $ax^2 + 7x + b$, then find the values of a and b.

27. If one zero of the polynomial $x^2 - kx + 16$ is cube of the other, find the value of k and hence find the zeroes.

28. If the sum of squares of zeroes of the polynomial $x^2 - 8x + k$ is 40, find the value of k.

29. If α and β are the zeroes of the polynomial $x^2 - x - 4$, evaluate:

(i) $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$ (ii) $\alpha - \beta$ (iii) $\frac{1}{\alpha^3} + \frac{1}{\beta^3}$ (iv) $\alpha^4 + \beta^4$

30. Find the zeroes of the following quadratic polynomials and verify the relation between the zeroes and coefficients of the polynomials:

(i) $4\sqrt{3}x^2 + 5x - 2\sqrt{3}$

(ii) $4x^2 + 5\sqrt{2}\,x - 3$

LONG ANSWER TYPE QUESTIONS

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

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

CASE STUDY BASED

33. Case Study -1

The figure given alongside 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?

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

(iii) The zeroes of the polynomial $r(t) = -12t^2 + (k-3)t + 48$ are negative of each other. Then find the value of k.

34. Case Study – 2

Applications of Parabolas-Highway Overpasses/Underpasses

A highway underpass is parabolic in shape. A parabola is the graph that results from $p(x) = ax^2 + bx + c$.

(i) If the highway overpass is represented by $-x^2 + 2x + 8$, then find its zeroes.

(ii) Find a quadratic polynomial which represents Highway Underpass whose one zero is 6 and sum of the zeroes is 0.

(iii) Find the number of zeroes that polynomial $f(x) = (x - 2)^2 + 4$ can have.

ANSWER KEY

1. C
2. B
3. B
4. D
5. B
6. A
7. D
8. C
9. D
10. A
11. C
12. B
13. A
14. D
15. $-\frac{7}{12}$
16. 2

17. $k = 8$
18. $k = \pm 3$
19. $x^2 - \frac{6}{5}x + \frac{6}{25}$
20. $k = 0, 5$
21. $x^2 - 6x + 4$
22. $a = -16$
23. $x^2 + 5x - 6$
24. $2x^2 - 7x + 6$
25. $\frac{1}{3}, \frac{7}{3}$; $k = -\frac{5}{3}$

26. $a = 3, b = -6$

27. $k = \pm 10$, zeroes are 2, 8 or $-2, -8$

28. $k = 12$

29. (i) $\frac{9}{16}$ (ii) $\pm\sqrt{17}$ (iii) $\frac{13}{64}$ (iv) 49

30. (i) $-\frac{2}{\sqrt{3}}, \frac{\sqrt{3}}{4}$ (ii) $-\frac{3}{\sqrt{2}}, \frac{1}{2\sqrt{2}}$

31. $k\left(x^2 - \frac{2}{3}x + \frac{1}{3}\right)$

32. $p = -5, q = -6$

33. (i) 48 (ii) 2 seconds (iii) 3

34. (i) 4, -2, (ii) $k(x^2 - 36)$ (iii) 0

EXTENDED LEARNING

Choose the correct option in each of the following:

1. If α , β are roots of polynomial $3x^2 + 6x + K$ such that $\alpha^2+\beta^2+\alpha\beta=\frac{8}{3}$, then the value of K is:

(A) –8 (B) 8 (C) – 4 (D) 4

2. If the zeroes of a quadratic polynomial are equal in magnitude but opposite in sign then :

(A) sum of its zeroes is 0 (B) product of its zero is 0

(C) one of the zeroes is 0 (D) there are no zeroes of the polynomial

3. If the product of zeroes of $ax^3-6x^2+11x-6$ is 4, then the value of a is

(A) $\frac{3}{2}$ (B) $-\frac{3}{2}$ (C) $\frac{2}{3}$ (D) $-\frac{2}{3}$

4. The zeroes of the polynomial $5x^2-7x+k$ are sin A and cos A. The value of k is :

(A) $\frac{12}{7}$ (B) $\frac{7}{12}$ (C) $\frac{12}{5}$ (D) $\frac{5}{12}$

5. If one zero of $2x^2-3x+k$ is reciprocal to the other, then the value of k is :

(A) 2 (B) $-\frac{2}{3}$ (C) $-\frac{3}{2}$ (D) -3

6. The quadratic polynomial $p(y)$ with -15 and -7 as sum and one of the zeroes respectively is :

(A) $y^2-15y-56$ (B) $x^2+15x+56$

(C) $y^2+15y+96$ (D) $y^2+15y-56$

7. If α and β are the zeroes of $5x^2-7x+2$, then the sum of their reciprocals is :

(A) $\frac{7}{2}$ (B) $\frac{7}{5}$ (C) $\frac{2}{5}$ (D) $\frac{14}{25}$

8. If zeroes of $x^2- kx + 6$ are in the ratio 3 : 2, then the value of k is

(A) 5 (B) -5 (C) ±5 (D) 6

9. If α,β,γ are the zeroes of $f(x)=ax^3+bx^2+cx+d$ then $\alpha^2+\beta^2+\gamma^2$ is equal to:

(A) $\frac{b^2-ac}{a^2}$ (B) $\frac{b^2-2ac}{a}$ (C) $\frac{b^2+2ac}{b^2}$ (D) $\frac{b^2-2ac}{a^2}$

10. The graph of a polynomial $p(x)$ is either touching or intersecting the axes only at the points $(-5,0),(0,0),(5,0)$. The number of zeroes of $p(x)$ is :

(A) 1 (B) 2 (C) 3 (D) 4

11. The quadratic polynomial p(x) with -81 and 3 as product and one of the zeroes respectively is :

(A) $x^2 + 24x - 81$ (B) $x^2 - 24x - 81$

(C) $x^2 - 24x + 81$ (D) $x^2 + 24x + 81$

12. Given that two of the zeroes of the cubic polynomial $ax^3 + bx^2 + cx + d$ are 0, the third zero is :

(A) $-\frac{b}{a}$ (B) $\frac{b}{a}$ (C) $\frac{c}{a}$ (D) $-\frac{d}{a}$

13. Given that one of the zeroes of the cubic polynomial $ax^3 + bx^2 + cx + d$ is zero, the product of the other two zeroes is :

(A) $-\frac{c}{a}$ (B) $\frac{c}{a}$ (C) 0 (D) $-\frac{b}{a}$

14. If the zeroes of the quadratic polynomial $ax^2 + bx + c, c \neq 0$ are equal, then

(A) c and a have opposite signs (B) c and b have opposite signs

(C) c and a have the same sign (D) c and b have the same sign

15. If α and β are zeroes of polynomial $f(x) = x^2 + px + q$ then polynomial having $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ as its zeroes is :

(A) $x^2 + qx + p$ (B) $x^2 - px + q$

(C) $qx^2 + px + 1$ (D) $px^2 + qx + 1$

ANSWER KEY

1.	D	**2.**	A	**3.**	A	**4.**	C	**5.**	A
6.	B	**7.**	A	**8.**	C	**9.**	D	**10.**	C
11.	A	**12.**	A	**13.**	B	**14.**	C	**15**.	C

CHAPTER 3

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

For the following given questions choose the correct option

1. Customers are asked to stand in the lines. If one customer is extra in a line, then there would be two less lines. If one customer is less in line, there would be three more lines. Find the number of customers.

   (a) 40 (b) 50 (c) 60 (d) 70

2. The value of k for which the system of equations $x + 2y = 3 and\ 5x + ky + 7 = 0$ has no solution is

   (a) 12 (b) 10 (c) 24 (d) 5

3. The sum of two digits and the number formed by interchanging its digit is 110. If ten is subtracted from the first number, the new number is 4 more than 5 times of the sum of the digits in the first number. Find the first number.

   (a) 46 (b) 48 (c) 64 (d) 84

4. A fraction becomes $\frac{1}{3}$ when 1 is subtracted from the numerator and it becomes $\frac{1}{4}$ when 8 is added to its denominator. Find the fraction.

   (a) 4/12 (b) 3/13 (c) 5/12 (d) 11/7

5. Five years ago, A was thrice as old as B and ten years later, A shall be twice as old as B. What is the present age of A.

   (a) 20 (b) 50 (c) 60 (d) 40

6. What will be the solution of these equations $ax + by = a - b, bx - ay = a + b$

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

7. If $x = a, y = b$ is the solution of the pair of equation $x - y = 2\ and\ x + y = 4$ then what will be value of a and b

   (a) 2,1 (b) 3,1 (c) 4,6 (d) 1,2

8. 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) 36 (b) 45 (c) 18 (d) 90

9. Which of the following is not a linear equation?

(a) $ax + by + c = 0$ (b) $0x + 0y + c = 0$
(c) $0x + by + c = 0$ (d) $ax + 0y + c = 0$

10. The condition that the equation $ax + by + c = 0$ represent a linear equation in two variables is
(a) $a \neq 0, b = 0$ (b) $b \neq 0, a = 0$
(c) $a = 0, b = 0$ (d) $a \neq 0, b \neq 0$

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

11. **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 pairs has no solution and is called inconsistent pair of equations.

12. **Assertion:** A pair of linear equations has no solution (s) 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.

Subjective questions:

1 Ten years ago, a father was twelve times as old as his son and ten years hence, he will be twice as old as his son will be then. Find their present ages.

2. Find the area of triangle formed by the lines $x = 3 , y = 4 \; and \; x = y$

3. In ΔABC, ∟C = 3∟B = 2(∟A+∟B), find the three angles.

4. Write the values of k for which the system of equations $x + ky = 0$,$2x - y = 0$ has a unique solution.

5. Sum of two numbers is 35 and their difference is 13. Find the numbers.

6. Draw the graphs of the equations: $x + 3y = 6$; $2x - 3y = 12$ and hence find the value of a if $3x + 2y = 3 + a$.

7. Draw the graphs of following pair of equations: $2x + y = 2$; $2x + y - 6 = 0$. On the same graph paper. Find the area of trapezium formed by these lines along with both the axes.

8. Determine, graphically, the vertices of the triangle formed by the lines $y = x$, $3y = x$, $x + . y = 8$.

9. Solve the following system of linear equations graphically

   $2x - y = 4$; $x + y + 1 = 0$

10. For which values of p and q, will the following pair of linear equations have infinitely many solutions? $4x + 5y = 2$; $(2p + 7q)x + (p + 8q)y = 2q - p + 1$.

11. For what value of a and b the pair of linear equations has coincident lines on the graphical representation: $2x - y = 5$; $(a - 2b)x - (a + b)y = 15$

12. The sum of digits of a two digit number is 15. The number obtained by reversing the order of digits of the given number exceeds the given number by 9. Find the given number.

13. A man sold a chair and a table together for Rs 1520 thereby making a profit of 25% on the chair and 10% on the table. By selling them together for Rs 1535, he would have made a profit of 10% on the chair and 25% on the table. Find the cost price of each.

14. I am three times as old as my son. Five years later, I shall be two and a half times as old as my son. How old am I and how did is my son?

15. The sum of a two digit number and the number formed by interchanging its digits is 110. If 20 is subtracted from the original number, the new number is 4 more than 4 times the sum of the digits in the original number. Find the original number.

16. The population of the village is 5000. If in a year, the number of males were to increase by 5% and that of a female by 3% annually, the population would grow to 5202 at the end of the year. Find the number of males and females in the village.

17. Father's age is three times the sum of ages of his two children. After 5 years his age will be twice the sum of ages of two children. Find the age of father.

18. The largest angle of a triangle is equal to the sum of the other two angles. The smallest angle is one-fourth of the largest angle. Find the angles of the triangle.

19. A railway half- ticket costs half the full fare but the reservation charges are the same of a half ticket as on a full ticket. One reserved full ticket from station A to station B costs Rs 216. Also,

one full reserved and one reserved half ticket from station A to station B cost Rs 327. Find the full fare from station A to station B and also the reservation charges for a ticket.

20. A bird flying in the same direction as that of the wind, covers a distance of 45 km in 2 hours 30 minutes. But it takes 4 hours 30 minutes to cover the same distance when it flies against the direction of the wind. Ignoring conditions other than the wind conditions, find (i) the speed of the bird in still air (ii) the speed of the wind.

21. In a School Assembly students are made to stand in rows. If one student is extra in a row there would be 2 rows less. If one student is less in a row there would be 3 rows more. Find the number of students in the class.

22. Amit and Sumit have certain number of oranges. Amit says to Sumit, "If you give me 10 of your oranges, I will have twice the number of oranges left with you." Sumit replies, "if you give me 10 of your oranges, I will have the same number of oranges as left with you." Find the number of oranges with Amit and Sumit separately.

23. A chemist has one solution which is 50% acid and a second which is 25% acid. How much of each should be mixed to make 10 litres of 40% acid solution?

24. A and B are two points 150 km apart on a highway. Two cars start with different speeds, from A and B at the same time. If they move in the same direction, they meet in 15 hours but if they move in the opposite directions they meet in one hour. Find their speeds.

25. At a certain time in a deer park, the number of heads and the number of legs of deer and human visitors were counted and it was found there were 39 heads & 132 legs. Find the number of deer and human visitors in the park.

ANSWERS

1. c 2.b 3.c 4.c 5.b 6.d 7.b 8.a 9.b 10.d 11. d 12. D

Part : 2

1. 34, 12 2. ½ sq unit 3. $20^0, 40^0, 120^0$ 4. +1/2 , - 1/2

5. 24 and 11 6. 15 7.8 sq units 8. (0,0) (6,2) (4,4)

9.(1,2) 10. 15,1 11. 4,-1 12. 78

13. 600,700 14. 60 , 20 15. 64 16. 2600,2400

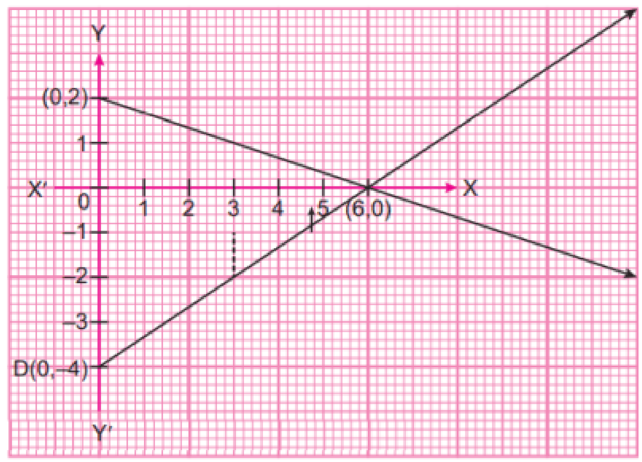
17. 45 years 18. 90° , 67.5° , 22.5° 19. Rs 210 and Rs 6

20. 14km/hr, 4 km/hr 21. 60 22. 70,50

23. 6 , 4 24. 80 km /hr, 70 km/ hr 25. 27,12

CASE STUDY I

The scissors which is so common in our daily life use, its blades represent the graph of linear equations.



Let the blades of a scissor are represented by the system of linear equations:

$$x + 3y = 6 \text{ and } 2x - 3y = 12$$

(i) The pivot point (point of intersection) of the blades represented by the linear equation x + 3y = 6 and 2x – 3y = 12 of the scissor is

(ii) The points at which linear equations x + 3y = 6 and 2x – 3y = 12 intersect y – axis respectively are

(iii) If (1, 2) is the solution of linear equations $ax + y = 3$ and $2x + by = 12$, then values of a and b are respectively

(a) (b) 2, 3(c) –1, 5 (d) 3, 5

(iv) If a pair of linear equations in two variables is consistent, then the lines represented by two equations are

Case Study -1 Answers:

1 (6, 0) 2 (0, 2) and (0, –4) 3 (1, 5) 4 intersecting or coincident

Case –Study 2

It is common that Governments revise travel fares from time to time based on various factors such as inflation (a general increase in prices and fall in the purchasing value of money) on different types of vehicles like auto, Rickshaws, taxis, Radio cab etc. The auto charges in a city comprise of a fixed charge together with the charge for the distance covered. Study the following situations:

Name of the city	Distance travelled (Km)	Amount paid (Rs.)
City A	10	75
	15	110
City B	8	91
	14	145

Situation 1: In city A, for a journey of 10 km, the charge paid is Rs 75 and for a journey of 15 km, the charge paid is Rs 110.

Situation 2: In a city B, for a journey of 8km, the charge paid is Rs91 and for a journey of 14km, the charge paid is Rs 145.

Refer situation 1

1. If the fixed charges of auto rickshaw be Rs x and the running charges be Rs y km/hr, the pair of linear equations representing the situation is

2. A person travels a distance of 50km.What will be the amount paid by him.

Refer situation 2

3. What will a person have to pay for travelling a distance of 30km?

4. The graph of lines representing the conditions are: (situation 2)

<u>Case Study -2 Answers:</u>

1 $x + 10y = 75, x + 15y = 110$ 2 Rs 355 3 Rs289 4 Parallel

Reference Links:

EXTENDED LEARNING

1. The equation of the line whose graph passes through the origin, is :
   (a) $2x + 3y = 1$ (b) $2x + 3y = 0$
   (c) $2x + 3y = 6$ (d) none of these

2. The graphical representation of the pair of equations $x + 2y - 4 = 0$ and $2x + 4y - 12 = 0$ represents :
   (a) intersecting lines (b) parallel lines (c) coincident lines (d) all of these

3. The condition so that the pair of linear equations $kx + 3y + 1 = 0, 2x + y + 3 = 0$ has exactly one solution is :
   (a) $k = 6$ (b) $k \neq 6$ (c) $k = 3$ (d) $k \neq 3$

4. The lines representing the linear equations $2x - y = 3$ and $4x - y = 5$:
   (a) intersect at a point (b) are parallel
   (c) are coincident (d) intersect at exactly two points

5. The pair of equations $y = 0$ and $y = -7$ has :
   (a) one solution (b) two solutions
   (c) infinitely many solutions (d) no solution

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) $\frac{15}{4}$ (d) $\frac{3}{2}$

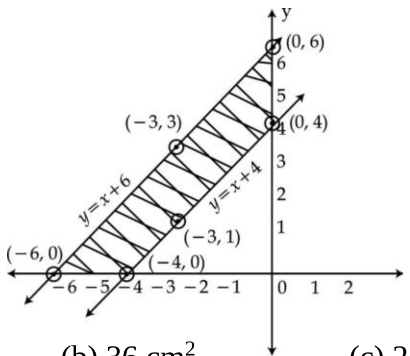
7. The pair of linear equations $8x - 5y = 7$ and $5x - 8y = -7$ have :
   (a) one solution (b) two solutions (c) no solution (d) many solutions

8. One equation of a pair of dependent linear equations is $-5x + 7y = 2$, the second equation can be :
   (a) $10x + 14y + 4 = 0$ (b) $-10x = 14y + 4 - 0$
   (c) $-10x + 14y + 4 = 0$ (d) $10x - 14y = -4$

9. The value of k for which the pair of equations : $kx - y = 2$ and $6x - 2y = 3$ has a unique solution is
   (a) $k = 3$ (b) $k \neq 3$ (c) $k \neq 0$ (d) $k = 0$

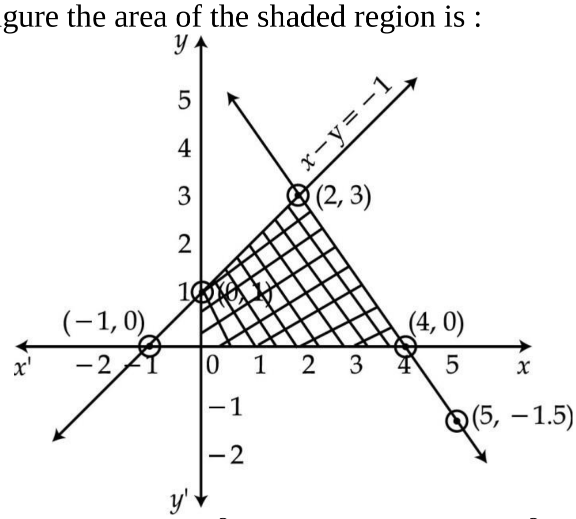
10. The value of k for which the pair of linear equations $4x + 6y - 1 = 0$ and $2x + ky - 7 = 0$ represents parallel lines is :
    (a) $k = 3$ (b) $k = 2$ (c) $k = 4$ (d) $k = -2$

11. In the given figure, the area of the shaded region is :



(a) 16 cm^2 (b) 36 cm^2 (c) 24 cm^2 (d) 10 cm^2

12. In the given figure the area of the shaded region is :



(a) 6 cm^2 (b) 7 cm^2 (c) 7.5 cm^2 (d) 5 cm^2

13. If $x = a$, $y = b$ is the solution of the equations $x – y = 2$ and $x + y = 4$, then the values of a and b respectively are
(a) 3 and 5 (b) 5 and 3 (c) 3 and 1 (d) –1 and –3

14. The pair of equations $x =4$ and $y =3$ graphically represents lines which are :
(a) parallel (b) intersecting at (3, 4)
(c) coincident (d) intersecting at (4, 3)

15. The point of intersection of the lines $y =3x$ and $x = 3y$ is :
(a) (3, 0) (b) (0, 3) (c) (3, 3) (d) (0, 0)

ANSWERS

1) b 2) b 3) b 4) a 5) d 6) c 7) a 8) c 9) d 10) a

11) d 12) b 13) c 14) c 15) d

CHAPTER 4

QUADRATIC EQUATIONS

MULTIPLE CHOICE QUESTIONS

1) 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

2) If the equation $x^2 - kx + 9 = 0$ does not possess real roots, then

(a) $-6 < k < 6$ (b) $k > 6$ (c) $k < -6$ (d) $k = \pm 6$

3) If $\frac{1}{2}$ is a root of the equation $x^2 + kx - \frac{5}{4} = 0$, then the value of k is

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

4) Root of the equation $x^2 - 0.09 = 0$ is

(a) 0.3 (b) 0.03 (c)$\pm$ 0.3 (d) no root

5) The two consecutive odd positive integers, sum of whose squares is 290 are

(a) 13, 15 (b) 11,13 (c) 7,9 (d) 5,7

6) Value(s) of k for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots is

(a) 0 (b) 4 (c) 8 (d) 0 and 8

7) Which of the following equations has the sum of its roots as 3?

(a) $2x^2 - 3x + 6 = 0$ (b) $-x^2 + 3x - 3 = 0$ (c) $\sqrt{2}x^2 - \frac{3}{\sqrt{2}}x + 1 = 0$

(d) $2x^2 - 3x + 6 = 0$

8) $(x^2 + 1)^2 - x^2 = 0$ has

(a) four equal roots (b) two equal roots (c) no equal roots (d) one equal roots

9) Which of the following is not a quadratic equation?

(a) $2(x-1)^2 = 4x^2 - 2x + 1$ (b) $2x - x^2 = x^2 + 5$
(c) $(\sqrt{2}x + \sqrt{3})^2 + x^2 = 3x^2 - 5x$ (d) $(x^2 + 2x)^2 = x^4 + 3 + 4x^3$

10) If $ax^2 + bx + c = 0$ has equal roots, then the value of k is

(a) $\pm\sqrt{ac}$ (b) $\pm 2\sqrt{ac}$ (c) $\sqrt{ac}$ (d) none of these

ASSERTION AND REASONING

Q11

Statement A (Assertion): The equation $8x^2 + 3kx + 2 = 0$ has equal roots then the value of $k = \pm\frac{8}{3}$

Statement R (Reason): The equation $ax^2 + bx + c = 0$ has equal roots if 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 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.

Q12

Statement A (Assertion): The equation $(2x-1)^2 - 4x^2 + 5 = 0$ is a quadratic equation.

Statement R (Reason): The equation $ax^2 + bx + c = 0, a \neq 0$ is called a quadratic equation

(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.

Q13

Statement A (Assertion): The roots of the quadratic equation $x^2 + 2x + 2 = 0$ are imaginary.

Statement R (Reason): If discriminant $D = b^2 - 4ac < 0$ then the roots of the equation $ax^2 + bx + c = 0, a \neq 0$ are imaginary.

(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.

Q14

Statement A (Assertion): The quadratic equation $4x^2 - 12x + 9 = 0$ has repeated roots.

Statement R (Reason): The quadratic equation $ax^2 + bx + c = 0$ has equal roots if 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 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.

Q15

Statement A (Assertion): The quadratic equation $9x^2 + 3kx + 4 = 0$ has equal roots for $k = \pm 4$

Statement R (Reason): If the discriminant of a quadratic equation is equal to zero, then the roots of the equation are real and equal.

(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.

VERY SHORT ANSWER QUESTIONS

16) Find the value of k for which the quadratic equation $kx(x-2)+6=0$ has two equal roots.

17) Write the discriminant of the quadratic equation:$(x+5)^2 = 2(5x-3)$.

18) If $a\ and\ b$ are the roots of the quadratic equation $x^2 + ax - b = 0$, then find$a\ and\ b$.

19) Find the value of k for which the equation $x^2 + 2kx + (k^2 - k + 2) = 0$ has real and equal roots.

20) Show that $x = -2$ is a solution of $3x^2 + 13x + 14 = 0$.

SHORT ANSWER QUESTIONS

1. Solve the following quadratic equations for x:

(i) $x^2 - 2ax + (a^2 - b^2) = 0$ (CBSE 2022)

(ii) $ax^2 + a = a^2x + x$

(iii) $x^2 + 5x - (a^2 + a - 6) = 0$

(iv) $4x^2 - 4px + (p^2 - q^2) = 0$

(v) $4x^2 - 4(a^2 - b^2)x + (a^2 - b^2)^2 = 0$

(vi) $9x^2 - 6a^2x + (a^4 - b^4) = 0$

(vii) $abx^2 + (b^2 - ac)x - bc = 0$

(viii) $x^2 - 2ax - (4b^2 - a^2) = 0$ (CBSE 2022)

(ix) $x^2 + x - (a+1)(a+2) = 0$

(x) $\frac{1}{(x-1)(x-2)} + \frac{1}{(x-2)(x-3)} = \frac{2}{3}, x \neq 1,2,3$

2. Find the roots of the following quadratic equations, if they exist, using the quadratic formula:

(i) $3x^2 - 5x + 2 = 0$ (ii) $x^2 + 4x + 5 = 0$ (iii) $2x^2 - 2\sqrt{2}x + 1 = 0$

3. Find the roots of the following equations:

(i) $x + \frac{1}{x} = 3, x \neq 0$ (ii) $\frac{1}{x} - \frac{1}{x-2} = 3, x \neq 0, 2$

4. Find the value of m for which the quadratic equation $(m-1)x^2 + 2(m-1)x + 1 = 0$ has two real and equal roots. **(CBSE 2022)**

5. Solve the following quadratic equation for x: **(CBSE 2022)**

(a) $\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$ (b) $x^2 + 2\sqrt{2}x - 6 = 0$

6. If $\frac{2}{3}$ and -3 are the roots of the quadratic equation $ax^2 + 7x + b = 0$, find the values of a and b. **[CBSE, 2016]**

7. For what value of k the equation $kx^2 - 2\,(k-1)x + (k+2) = 0$ has real and equal roots? **(CBSE 2022)**

8. Find the values of p for which the quadratic equation $(p-12)x^2 + 2\,(p-12)x + 2 = 0$ has equal roots .

9. Find the positive value(s) of k for which $x^2 + kx + 64 = 0$ and$x^2 - 8x + k = 0$ both will have real roots. **[CBSE 2016]**

10. For what value(s) of k will the quadratic equation $(k+4)x^2 + (k+1)x + 1 = 0$ have real and equal roots?

11. Find the non - zero value of value of k, for which the quadratic equation $kx^2 + 1 - 2(k-1)x + x^2 = 0$ has equal roots. Hence find the roots of the equation. [CBSE 2015]

12. If -4 is a root of the quadratic equation $x^2 + px - 4 = 0$ and the quadratic equation $2x^2 + px + k = 0$ has equal roots, find the value of k.

13. If roots of a quadratic equation $(b-c)x^2 + (c-a)x + (a-b) = 0$ are real and equal, prove that $2b = a + c$.

14. If the roots of the equation $(a^2 + b^2)x^2 - 2(ac + bd)x + (c^2 + d^2) = 0$ are equal, prove that $ad = bc$.

15. If the equation $(1 + m^2)x^2 + 2mcx + (c^2 - a^2) = 0$ has equal roots, prove that $c^2 = a^2(1 + m^2)$. **(CBSE 2022)**

16. There are three consecutive positive integers such that the sum of the square of the first and the product of the other two is 154. Find the integers.

17. The difference of two numbers is 5 and the difference of their reciprocals is $\frac{1}{10}$. Find the numbers.

18. The numerator of a fraction is one less than its denominator. If three is added to each of its numerator and denominator, the fraction is increased by $\frac{3}{28}$. Find the fraction.

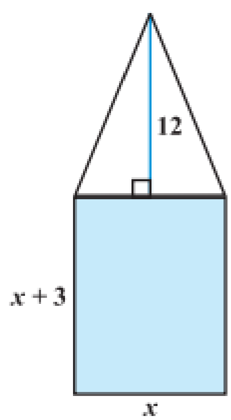
19. The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction.

20. Find two consecutive odd positive integers, sum of whose squares is 290.

21. A motor boat whose speed is 18 km/h 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.

22. An aeroplane left 40 minutes late due to heavy rains and in order to reach its destination, 1600km away in time, it had to increase its speed by 400 km/hr from its original speed. Find the original speed of the plane.

23. A rectangular park is to be designed whose breadth is 3 m less than its length. Its area is to be 4 square metres more than the area of a park that has already been made in the shape of an isosceles triangle with its base as the breadth of the rectangular park and of altitude 12 m. Find its length and breadth.



24. The sum of the reciprocals of Rehman's ages, (in years) 3 years ago and 5 years from now is $\frac{1}{3}$ Find his present age.

25. In a class test, the sum of Shefali's marks in Mathematics and English is 30. Had she got 2 marks more in Mathematics and 3 marks less in English, the product of their marks would have been 210. Find her marks in the two subjects.

26. The diagonal of a rectangular field is 60 metres more than the shorter side. If the longer side is 30 metres more than the shorter side, find the sides of the field. **(CBSE 2022)**

27. The difference of squares of two numbers is 180. The square of the smaller number is 8 times the larger number. Find the two numbers. **(CBSE 2022)**

28. A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.

29. The speed of a boat in still water is 11 km/hr. It can go 12 km upstream and return downstream to the original point in 2 hours 45 minutes. Find the speed of the stream.

30. Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

31. An express train takes 1 hour less than a passenger train to travel 132 km between Mysore and Bangalore (without taking into consideration the time they stop at intermediate stations). If the average speed of the express train is 11km/h more than that of the passenger train, find the average speed of the two trains.

32. Sum of the areas of two squares is 468 m^2 . If the difference of their perimeters is 24 m, find the sides of the two squares.

33. To fill a swimming pool two pipes are used. If the pipe of larger diameter used for 4 hours and the pipe of smaller diameter for 9 hours, only half of the pool can be filled. Find, how long it would take for each pipe to fill the pool separately, if the pipe of smaller diameter takes 10 hours more than the pipe of larger diameter to fill the pool?
(CBSE SAMPLE PAPER 2022 – 23)

34. In a flight of 600km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr from its usual speed and the time of the flight increased by 30 min. Find the scheduled duration of the flight.
(CBSE SAMPLE PAPER 2022 – 23)

35. The product of the digits of a two digit positive number is 24. If 18 is added to the number then the digits of the number are interchanged. Find the number. **(CBSE 2022)**

36. A two digit number is four times the sum of its digits. It is also equal to three times the product of its digits. Find the number.

37. A vehicle travels at a certain average speed for a distance of 63 km and then travels a

distance of 72 km at an average speed of 6 km/h more than its original speed. If it takes 3 hours to complete the total journey, what is its original average speed?

38. A farmer wishes to grow a 100 sq m rectangular vegetable garden. Since he has with him only 30 m barbed wire, he fences three sides of the rectangular garden letting compound wall of his house act as the fourth side fence. Find the dimensions of his garden.

39. At t minutes past 2 p.m. the time needed by the minute hand of a clock to show 3 p.m. was found to be 3 minutes less than $\frac{t^2}{4}$ minutes. Find t.

40. The sum of two numbers is 34. If 3 is subtracted from one number and 2 is added to another, the product of these two numbers becomes 260. Find the numbers. **(CBSE 2022)**

41. The hypotenuse (in cm) of a right angled triangle is 6cm more than twice the length of the shortest side. If the length of the third side is 6 cm less than thrice the length of the shortest side, then find the dimensions of the triangle. **(CBSE 2022)**

OBJECTIVE ANSWERS

Q1 c	Q2 a	Q3 a	Q4 c	Q5 b
Q6 d	Q7 b	Q8 c	Q9 c	Q10 c
Q11 a	Q12 d	Q13 a	Q14 c	Q15 a
Q16 k = 6	Q17 D = -124	Q18 a= -1, b = 2	Q19 k = 2	

ANSWERS

1) i) $x = a + b, x = a - b$

ii) $x = \frac{1}{a}, x = a$

iii) $x = (a - 2), x = -(a + 3)$

iv) $x = \frac{p+q}{2}, x = \frac{p-q}{2}$

v) $x = \frac{a^2 - b^2}{2}, x = \frac{a^2 - b^2}{2}$

vi) $x = \frac{a^2 + b^2}{3}, x = \frac{a^2 - b^2}{3}$

vii) $x = \frac{b}{a}, x = \frac{-c}{b}$

viii) $x = a + 2b, x = a - 2b$

ix) $x = (a + 1), x = -(a + 2)$

x) $x = 0, x = 4$

2) (i) $x = \frac{2}{3}, x = 1$ (ii) No real root exist (iii) $x = \frac{1}{\sqrt{2}}, x = \frac{1}{\sqrt{2}}$

3) (i) $x = \frac{3+\sqrt{5}}{2}, x = \frac{3-\sqrt{5}}{2}$ (ii) $x = \frac{3+\sqrt{3}}{3}, x = \frac{3-\sqrt{3}}{3}$

4) $m = 2$

5) (i) $x = -\sqrt{3}, x = \frac{-7}{\sqrt{3}}$ (ii) $x = -3\sqrt{2}, \sqrt{2}$

6) $a = -10\,.5\,, b = 31.5$

7) $k = \frac{1}{4}$

8) $p = 16$

9) $k = 16$

10) $k = 3$

11) $k = 3, x = \frac{1}{2}, x = \frac{1}{2}$

12) $k = \frac{9}{8}$, p = 3

16) (16,17,18) or (19,20,21)

17) $x = 10, y = 5$

18) $x = \frac{3}{4}$

19) Fraction = $\frac{3}{7}$

20) 11 and 13

21) 6 km\hr

22) 800km/hr

23) $l = 7m \; and \; b = 4m$

24) 7 years

25) $(12, 18) \; or \; (13, 17)$

26) Shorter side = 90 m , longer side = 120 m

27) $(12, 18) \; or \; (-12, 18)$

28) 40 km\hr

29) Speed of stream = 5km/hr

30) Smaller tap = 25 hrs larger tap = 15 hrs

31) Passenger train = 33 km\hr Express train = 44 km/hr

32) 12 m and 18 m

33) Larger pipe = 20 hrs Smaller pipe = 30 hrs

34) Time = 1 hour

35) Number = 46

36) Number = 24

37) Original speed = 42km/hr

38) Square of 10m, rectangle of 5m by 10m

39) $t = 14\ minutes$

40) (16, 18) or (23, 11)

41) (10, 24, 26)

CASE STUDY 1

In an auditorium, seats are arranged in rows and columns. The number of rows were equal to the number of seats in each row. When the number of rows were doubled and the number of seats in each row was reduced by 10, the total number of seats increased by 300.

(i) If x is taken as number of row in original arrangement. How many number of rows are there in the original arrangement?

(ii) How many number of seats are there in the auditorium after re-arrangement?

CASE STUDY 2 (CBSE 2022)

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.

(i) Based on the information given above, form a quadratic equation in terms of x.

(ii) Find the width of the sidewalk around the pool.

Reference Link's

Introduction

http://ndl.iitkgp.ac.in/document/Uk8wZnhNcm53bVNMOUdTTmRmdk5rZFJENUc5VXIvb1QzUUNHb3Vhc1RzRTBPYkN4SXozSXZQaFpTdzd5L1p2Qw

Quadratic Formula

http://ndl.iitkgp.ac.in/document/Uk8wZnhNcm53bVNMOUdTTmRmdk5rYVduRHBzczhwS3FaM3JPSjlDUnNsQnhYL3ZRVy9qemg3dllyTHFuL3IrdQ

EXTENDED LEARNING

Choose the correct answer from the given four options:

1. If $x^2 + 2kx + 4 = 0$ has a root $x = 2$, then the value of k is ?

(A) -1 (B) -2 (C) 2 (D) -4

2. For what value of k will $\frac{7}{3}$ be a root of $3x^2 - 13x - k = 0$?

(A) 1 4 (B) $\frac{3}{7}$ (C) $\frac{-7}{2}$ (D) -14

3. The positive root of $\sqrt{3x^2 + 6}$ = 9 is :

(A) 3 (B) 4 (C) 5 (D) 7

4. If the equation x^2 + 4x + k = 0 has real and distinct roots then

(A) k< 4(B) k > 4 (C) k ≤4 (D) k ≥ 4

5. Which of the following is not a quadratic equation :

(A) $(x-2)^2 + 1 = 2x - 3$ (B) $x(x+1) + 8 = (x+2)(x-2)$

(C) $x(2x+3) = x^2 + 1$ (D) $(x+2)^3 = x^3 - 4$

6. Which of the following is a solution of the quadratic equation:

$x^2 - b^2 = a(2x - a)$?

(A) $a + b$ (B) $2b - a$ (C) ab (D) $\frac{a}{b}$

7. The roots of the equation $ax^2 + x + b = 0$ are equal if :

(A) $b^2 = 4a$ (B) $b^2 < 4a$

(C) $b^2 > 4a$ (D)$ab = \frac{1}{4}$

8. If the discriminant of $3x^2 + 2x + a = 0$ is double the discriminant of $x^2 - 4x + 2 = 0$, then the value of a is :

(A) 2 (B) -2 (C) 1 (D) -1

9. Which constant should be added and subtracted to solve the quadratic equation $4x^2 + \sqrt{3}x + 5 = 0$ by the method of completing the square?

(A) $\frac{9}{16}$ (B) $\frac{3}{16}$ (C) $\frac{3}{4}$ (D) $\frac{\sqrt{3}}{4}$

10. Which constant must be added and subtracted to solve the quadratic equation $9x^2 + \frac{3}{4}x - \sqrt{2} = 0$ by the method of completing the square?

(A) $\frac{1}{8}$ (B) $\frac{1}{64}$ (C) $\frac{1}{4}$ (D) $\frac{9}{64}$

ANSWERS

1) B	2) A	3) C	4) C	5) B	6) A
7) A	8) D	9) B	10) B		

CHAPTER 5–ARITHMETIC PROGRESSIONS

ASSIGNMENT

Choose the correct answer from the given four options

1. If $p-1,\ p+3$ and $3p-1$ are three consecutive terms of in A.P, then p is equal to

(A) 4 (B) -4 (C) 2 (D) -2

2. Which term of the A.P : 5, 2, -1,… is -49?

(A) 19th (B) 15th (C) 16th (D) 20th

3. Which term of the A.P. $45, 41, 37, 33$,…… is the first negative term?

(A) 17th (B) 13th (C) 14th (D) 12th

4. Which term of the A.P. -120, -116, -112, ….. is its first positive term?

(A) 33rd (B) 32nd (C) 34th (D) 35th

5. Sum of first n terms of the series $\sqrt{2}+\sqrt{8}+\sqrt{18}\cdots$. is :

(A) $\frac{n(n+1)}{2}$ (B) $\sqrt{2}\,n$ (C) $\frac{n(n+1)}{\sqrt{2}}$ (D) 1

6. The tenth term from the end of the A.P. 4, 9, 14, ..., 254 is :

(A) 214 (B) 209 (C) 208 (D) 204

7. If $18, a, b, -3$ are in A.P then $a+b=$

(A) 19 (B) 7 (C) 11 (D) 15

8. The common difference of an A.P. whose nth term is $a_n = 3n + 7$ is

(A) 7 (B) 3 (C) 4 (D) -3

9. Which term of the A.P. : 92, 88, 84, 80, ... is 0?

(A) 23rd (B) 32nd (C) 22nd (D) 24th

10. The next term of the AP $\sqrt{7}, \sqrt{28}, \sqrt{63}$ ... ...is

(A) $\sqrt{70}$ (B) $\sqrt{84}$ (C) $\sqrt{97}$ (D) $\sqrt{112}$

DIRECTION: In the question number 11 and 12, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option

11. Statement A (Assertion): 10th term from the end for the AP : 4, 9, 14, …, 254, is 209.

Statement R(Reason) : In an AP where first term, common difference and last term are denoted by a, d and l respectively, the n^{th} term from end is given by

$l - (n-1)d$.

(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.

12. Statement A (Assertion): **Sum of first 15 terms of 2+5+8+… is 345.**

Statement R (Reason) : Sum of fist n terms in an A.P. is given by the formula,

$S_n = 2n \times [2a + (n-1)d]$.

(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.

<u>VERY SHORT ANSWER TYPE QUESTIONS</u>

13. Is 144 a term of the sequence 3, 7, 11 …… ?

14. Three numbers are in AP and their sum is 24. Find the middle term.

15. If the mean of first n natural numbers is 15, then find n.

16. Find the number of odd integers between 2 and 100 divisible by 3.

17. Find the common difference of the Arithmetic Progression (A.P.)

$$\frac{1}{a}, \frac{3-a}{3a}, \frac{3-2a}{3a}, \ldots (a \neq 0)$$

<u>SHORT ANSWER TYPE QUESTIONS</u>

18. The 8^{th} term of an A.P is zero. Prove that its 38^{th} term is three times its 18^{th} term.

19. The 8^{th} term of an A.P. is 20 and the 15^{th} term is 12 more than the 11^{th} term. Find the A.P.

20. Find the middle term of the A.P.: $-11, -7, -3$, ……. , 45.

21. Find the middle term(s) in the AP : 20, 16, 12, ………….., (-176).

22. Sum of n terms of an A.P. is $5n^2 - 3n$. Find the A.P. and the 10^{th} term.

23. The sum of first 6 terms of an A.P. is 42. The ratio of its 10th term to its 30th term is 1:3. Find the first term and the thirteenth term of the A.P.

24. Find the sum of all two-digit numbers which leave the remainder 2 when divided by 5.

25. In November 2009, the number of visitors to a zoo increased daily by 20. If a total of 12300 people visited the zoo in that month, find the number of visitors on 1st Nov. 2009.

26. Find the value of x, when in the A.P. given below

$2 + 6 + 10 + \ldots + x = 1800.$

27. Split 69 into three parts such that they are in AP and the product of two smaller parts is 483.

28. The sum of the first three numbers in an A.P. is 18. If the product of the first and the third term is 5 times the common difference, find the three numbers.

LONG ANSWER TYPE QUESTIONS

29. How many terms of the A.P.: 20, $19\frac{1}{3}$, $18\frac{2}{3}$………… should be taken so that their sum is 300? Explain the double answer.

30. Find the number of terms of the A.P. : 54, 51, 48,… so that their sum is 513. Explain the double answer.

31. Find the sum of the following series :

$$5 + (-41) + 9 + (-39) + 13 + (-37) + 17 + \ldots + (-5) + 81 + (-3)$$

32. The sum of first 20 terms of an A.P. is one third of the sum of next 20 terms. If first term is 1, find the sum of first 30 terms of this A.P.

33. An A.P. has 21 terms. The sum of the three middlemost terms is 129 and the sum of the last 3 terms is 237. Find the A.P.

34. In an AP, if $S_5 + S_7$ = 167 and S_{10} = 235, then find the AP, where S_n denotes the sum of its first n terms. (CBSE 2015)

35. Find the 60^{th} term of the AP 8, 10, 12, ..., if it has a total of 60 terms and hence find the sum of its last 10 terms. (CBSE 2015)

36. In an A.P. of 50 terms, the sum of the first 10 terms is 210 and the sum of its last 15 terms is 2565. Find the A.P.

37. Divide 56 in four parts in A.P. such that the ratio of the product of their extremes (1st and 4th) to the product of means (2nd and 3rd) is 5: 6. (CBSE 2016)

38. Find four numbers in AP whose sum is 20 and the sum of whose squares is 120.

39. If the sum of the first p terms of an A.P. is same as the sum of the first q terms, show that the sum of its $(p+q)$ terms is zero.

40. If the sum of the first p terms of an A.P. is q and the sum of the first q terms is p; then show that the sum of the first $(p + q)$ terms is $\{-(p + q)\}$.

41. In an A.P., the n^{th} term is $\frac{1}{m}$ and the m^{th} term is $\frac{1}{n}$. Find

(i) $(mn)^{th}$ term, (ii) sum of first (mn) terms.

42. If m times the m^{th} term of an A. P. is equal to n times its n^{th} term and $m \neq n$, show that the $(m+n)^{th}$ term of the A.P. is zero.

CASE STUDY BASED

43. Ravi wants to buy a car and plans to take loan from a bank for his car. He repays his total loan of Rs 1,18,000 by paying every month starting with the first instalment of Rs 1000. If he increases the instalment by Rs 100 every month , answer the following:

(i) Find the amount paid by him in 30th installment.

(ii) Find the amount paid by him in 30 installments.

(iii) What amount does he still have to pay after 30th installment?

(iv) If total installments are 40 then find the amount paid in the last installment?

(v) Find the ratio of the 1st installment to the last installment.

Answers: (i) 3900 (ii) 73500 (iii) 44500 (iv) 4900 (v) 10 : 49

44. Push-ups are a fast and effective exercise for building strength. These are helpful in almost all sports including athletics. While the push-up primarily targets the muscles of the chest, arms, and shoulders, support required from other muscles helps in toning up the whole body.

Nitesh wants to participate in the push-up challenge. He can currently make 3000 push-ups in one hour. But he wants to achieve a target of 3900 push-ups in 1 hour for which he practices regularly. With each day of practice, he is able to make 5 more push-ups in one hour as compared to the previous day. If on first day of practice he makes 3000 push-ups and continues to practice regularly till his target is achieved.

Keeping the above situation in mind answer the following questions:

(i) Form an A.P representing the number of push-ups per day

(ii) Find the minimum number of days he needs to practice before the day his goal is accomplished.

(iii) Find the total number of push-ups performed by Nitesh up to the day his goal is achieved.

Answers: (i) 3000, 3005, 3010, …, 3900 (ii) 180 (iii) 624450

45. The school auditorium was to be constructed to accommodate at least 1500 people. The chairs are to be placed in concentric circular arrangement in such a way that each succeeding circular row has 10 seats more than the previous one.

(i) If the first circular row has 30 seats, how many seats will be there in the 10th row?

(ii) For 1500 seats in the auditorium, how many rows need to be there?

(iii) If 1500 seats are to be arranged in the auditorium, how many seats are still left to be put after 10th row?

(iv) If there were 17 rows in the auditorium, how many seats will be there in the middle row?

Answers: (i) 120 (ii) 15 (iii) 750 (iv) 110

ANSWER KEY

1. A	**4.** B	**7.** B	**10.** D
2. A	**5.** C	**8.** B	**11.** A
3. B	**6.** B	**9.** D	**12.** C
13. No	**14.** 8	**15.** 29	**16.** 17
17. 1/3	**18.** –	**19.** $-1, 2, 5, \ldots$	**20.** 17

21. $-76, -80$

22. 2, 12, 22, …; $a_{10} = 92$

23. $a = 2; a_{13} = 26$

24. 981

25. 120

26. 118

27. 21, 23, 25

28. 15, 6, −3 or 2, 6, 10

29. 25 or 36

30. 18 or 19

31. 420

32. 900

33. 3, 7, 11, …

34. 1, 6, 11, …

35. 1170

36. 3, 7, 11, …

37. 8, 12, 16, 20

38. 2, 4, 6, 8

EXTENDED LEARNING

Choose the correct answer from the given four options

1. What is the sum of all 3-digit numbers that leave a remainder of 2 when divided by 3?

(A) 164,850 (B) 164,749 (C) 149,700 (D)156,720

2. How many three-digit positive integers exist which when divided by 7 leave a remainder of 5?

(A)142 (B) 143 (C) 141 (D) 129

3. The sum of the 4^{th} and 12^{th} terms of an A.P.is 20. The sum of the first 15 terms of the A.P.is

(A) 300 (B) 120 (C) 150 (D) 170

4. If the sum of first n even natural number is equal to k times the sum of first n odd natural numbers, then k equals

(A) $\frac{1}{n}$ (B) $\frac{n-1}{n}$ (C) $\frac{n+1}{2n}$ (D) $\frac{n+1}{n}$

5. The first and the last term of an AP are 1 and 11. If the sum of its term is 36, then the number of terms is

(A) 5 (B) 6 (C) 7 (D) 8

6. If $\frac{1}{x+2}$, $\frac{1}{x+3}$, $\frac{1}{x+5}$ are in A.P., then x is

(A) 5 (B) 3 (C) 1 (D) 2

7. Which term of the A.P. 113, 108, 103, ... is the first negative term ?

(A) 22nd term (B) 24th term (C) 26th term (D) 28th term

8. The first positive term of the A.P. –11, –8, –5, …, is

(A) 2 (B) 1 (C) 4 (D) 3

9. If for an A.P. $a_5 = a_{10} = 51$, then a_{15} is

(A) 71 (B) 72 (C) 76 (D) 51

10. What is the common difference of an AP in which $a_{18} - a_{14} = 32$?

(A) 8 (B) – 8 (C) – 4 (D) 4

11. 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 4th terms is

(A)–1 (B) – 8 (C) 7 (D) –9

12. If 7 times the 7th term of an AP is equal to 11 times its 11th term, then its 18th term is :

(A) 7 (B) 11 (C) 18 (D) 0

13. The 4th term from the end of the AP: –11, –8, –5, ..., 49 is

(A) 37 (B) 40 (C) 43 (D) 58

14. A theatre has 40 rows with 30 seats in the first row, 33 in the second row, and 36 in the third row and so on. How many seats are there in the theatre?

(A) 3540 (B) 3450 (C) 2940 (D) 4680

15. The sum of n terms of an A.P. is $3n^2 + 5n$. Its 15th term will be

(A) 96 (B) 92 (C) 204 (D) 200

ANSWER KEY

1. A	**2.** D	**3.** C	**4.** D	**5.** B
6. C	**7.** B	**8.** B	**9.** D	**10.** A

11. C
12. D
13. B
14. A
15. B

CHAPTER 6
TRIANGLES

MULTIPLE CHOICE QUESTIONS

1) $\Delta\ ABC\ and\ \Delta DEF$ are two similar triangles such that $\angle A = 36^0\ and\ \angle E = 74^0$, then $\angle\ C\ is$

(a) 45° (b) 30° (c) 60° (d) 70°

2) If the three sides of a triangle are $a, \sqrt{3}a, and\ \sqrt{2}\ a$ then the measure of the angle opposite to longest side is

(a) 45° (b) 30° (c) 60° (d) 90°

3) In$\Delta\ ABC$, AB = 2 cm, BC = 3 cm and AC = 2.5 cm. If $\Delta DEF \sim \Delta ABC$ and EF = 6 cm, then perimeter of $\Delta\ ABC$ is

(a) 15 cm (b) 13 cm (c) 7.5 cm (d) 10 cm

4) A vertical stick 1.2 m long casts a shadow 40 cm long on the ground. At the same time a pole 6 m casts a shadow $x\ cm$ long on the ground, then $x\ equals$

(a) 80 cm (b) 200 cm (c) 240 cm (d) 40 cm

5) If $\Delta ABC \sim \Delta EDF\ and\ \Delta ABC$ is not similar to ΔDEF, then which of the following is not true?

(a) BC . EF = AC . FD (b) AB . EF = AC . DE (c) BC . DE = AB . EF

(d) BC . DE = AB . FD

6) 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) similar but not congruent (c) neither congruent nor similar (d) congruent as well as similar

7) If in triangles ABC and DEF, $\frac{AB}{EF} = \frac{AC}{DE}$, then they will be similar when

(a) $\angle A = \angle D$ (b) $\angle A = \angle E$ (c) $\angle B = \angle E$ (d) $\angle C = \angle F$

8) If in two triangles ABC and PQR, $\frac{AB}{QR} = \frac{BC}{PR} = \frac{CA}{PQ}$, then

a) $\Delta PQR \sim \Delta CAB$ b) $\Delta PQR \sim \Delta ABC$ c) $\Delta PQR \sim \Delta CBA$ d) $\Delta PQR \sim \Delta BCA$

9) $\Delta\ ABC\ and\ \Delta DEF$ are two similar triangles such that $\angle A = 30^0\ , \angle C = 50^0$, AB = 5 cm, AC = 8 cm and DF = 7.5 cm, then which of the following is true

(a) DE = 12 cm, $\angle F = 50^0$ (b) DE = 12 cm, $\angle F = 100^0$

(c) EF = 12 cm, $\angle D = 100^0$ (d) EF = 12 cm, $\angle D = 30^0$

10) In triangle ABC, if AB = $6\sqrt{3}$ cm, AC = 12 cm and BC = 6 cm, then $\angle B$ is

(a) 120° (b) 60° (c) 90° (d) 45°

ASSERTION AND REASONING

Q11

Statement A (Assertion): D and E are points on the side AB and AC respectively of ΔABC such that DE is parallel to BC, then the value of $x = 4$ when $AD = x\ cm,$

$DB = (x - 2)\ cm, AE = (x + 2)\ cm, EC = (x - 1)\ cm$

Statement R (Reason): If a line is parallel to one side, then it divides the other two sides in the same ratio.

(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.

Q12

Statement A (Assertion): D and E are points on the side AB and AC respectively of ΔABC such that AD = 4 cm, DB = 6 cm, AE = 9 cm and EC = 15 cm, then DE is parallel to BC

Statement R (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 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.

Q12

Statement A (Assertion): D and E are points on the side AB and AC respectively of ΔABC such that AB = 10.8 cm, AD = 6.3 cm, AC = 9.6 cm and EC = 4 cm, then DE is parallel to BC

Statement R (Reason): If a line is parallel to one side, then it divides the other two sides in the same ratio.

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

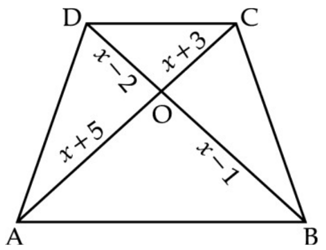
(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)

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

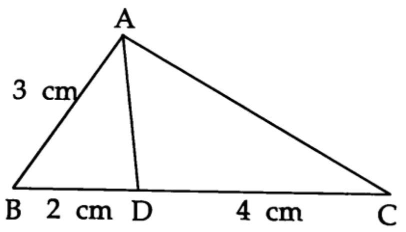
(d) Assertion (A) is false but reason (R) is true.

SHORT ANSWER QUESTIONS

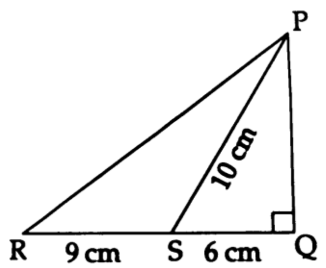
1. A and B are respectively the points on the sides PQ and PR of a ΔPQR such that PQ = 12.5 cm, PA = 5 cm and PB = 4 cm. IS AB ∥ QR? Give reasons.
2. If one diagonal of a trapezium divides the other diagonal in the ratio 1: 3. Prove that one of the parallel sides is three times the other.
3. In the given figure, if AB || DC, find the value of x.



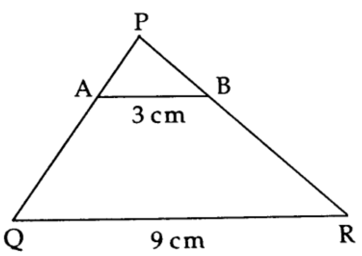
4. PQR is a right triangle right angled at Q and $QS \perp PR$. If PQ = 6cm and PS = 4cm, find QS, RS, and QR
5. In ΔABC, D and E are the points on the side AB and AC respectively such that DE || BC. If AD = 6x −7, DB = 4x − 3, AE = 3x−3 and EC = 2x − 1, then find the value of x.
6. A boy of height 120 cm is walking away from the base of a lamp-post at a speed of 87 m/min.If the lamp-post is 36m above the ground, find the length of his shadow after 3 minutes.
7. In the given figure, AD is the bisector of $\angle A$. Find AC



8. In the given figure, find the length of PR if PS = 10 cm, SQ = 6 cm, RS = 9 cm and $\angle Q = 90^0$

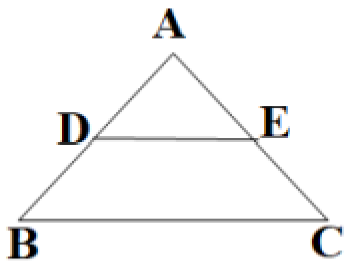


9. In the given figure, PR = 6cm and AB || QR. Find BP



10. In the given figure, DE ∥ BC, $AE = a\ units, EC = b\ units, DE = x\ units\ and$

$BC = y\ units$. Find the value for x **(CBSE SAMPLE PAPER 2022)**

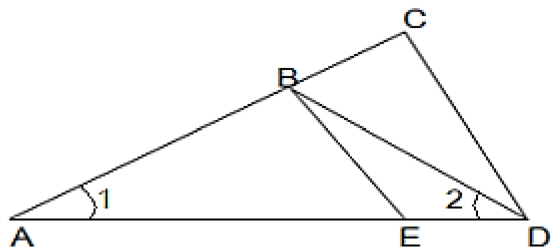


11. ABCD is a trapezium with AD ∥ BC and AD = 4cm. If the diagonals AC and BD intersect each other at O such that $AO/OC = DO/OB = 1/2$, then find BC.

(CBSE SAMPLE PAPER 2022)

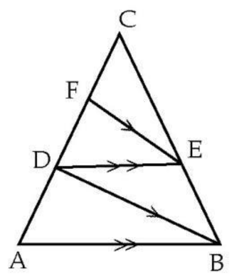
12. In the given figure below, $\frac{AD}{AE} = \frac{AC}{BD}$ and $\angle 1 = \angle 2$. Show that $\Delta BAE \sim \Delta CAD$

(CBSE SAMPLE PAPER 2022)

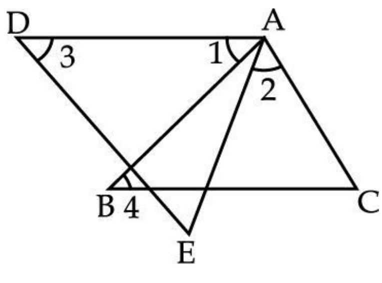


13. X and Y are points on the sides PQ and PR respectively of a ΔPQR. If the lengths of PX, QX, PY and YR (in cm) are 4, 4.5, 8 and 9 respectively. Then show XY | |QR.

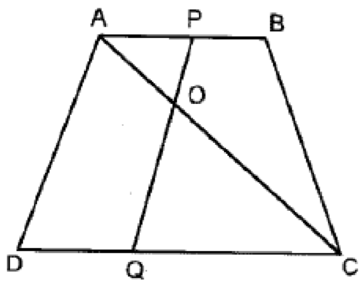
14. In given figure AB | | DE and BD | | EF. Prove that $DC^2 = CF \times AC$.



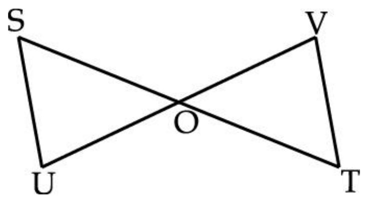
15. In the given figure, $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$. Show that $AE.BC = AC.DE$.



16. If $AB \parallel DC$ and AC, PQ intersect each other at the point O, prove that $OA . CQ = OC . AP$

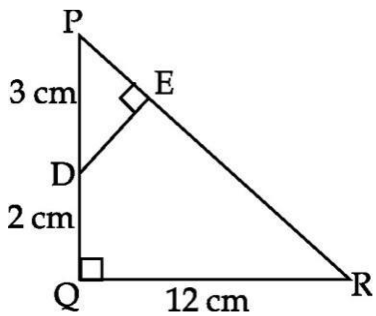


17. In the given figure ST and UV are intersecting at O such that the lengths of OS, OT, OU and OV (in cm) are 4.2, 6.3, 1.2 and 1.8. Prove SU || VT.

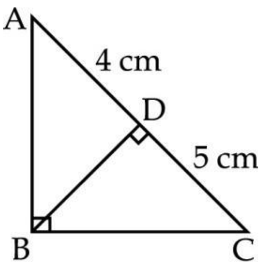


LONG ANSWER QUESTIONS

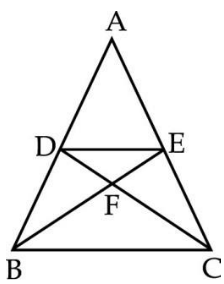
18. In the given figure, ΔPQR is right angled triangle right angled at Q. DE ⊥ PR. Prove ΔPQR ~ΔPED and find the lengths of PE and DE if PD = 3 cm, QD = 2 cm and QR = 12 cm.



19. In the given figure, ABC is a triangle, right angled at B and BD⊥AC. If AD = 4 cm and CD = 5 cm, find BD and AB.

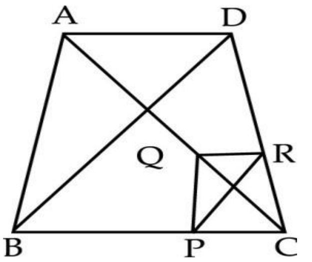


20. In the given figure, $\Delta\, ABE \cong \Delta ACD$, prove that $\Delta ADE \sim \Delta ABC$

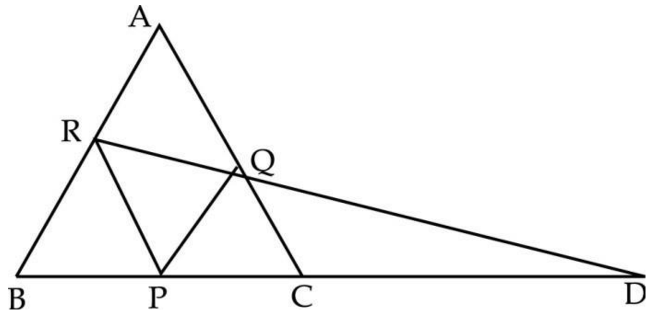


21. In the given figure, two triangles ABC and DBC lie on same side of BC such that PQ|| BA and

PR||BD. Prove that QR||AD.



22. In the given figure PQ || BA ; PR ||CA. If PD = 12 cm. Find BD×CD.



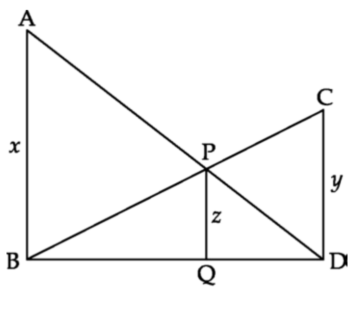
23. In ΔABC, P divides the side AB such that AP : PB = 1 : 2. Q is a point on AC such that PQ | | BC. Find the ratio of the areas of ΔAPQand trapezium BPQC.

24. Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD produced in E. Prove that EL = 2 BL.

25. Two poles of height p and q metres are standing vertically on a level ground, $'a'$ metres apart. Prove that the height of the point of intersection of the lines joining the top of each pole to the foot of the opposite pole is given by $\frac{pq}{p+q}$ metres.

OR

In figure, AB || PQ || CD, AB = x units, CD = y units and PQ = z units, prove that $\frac{1}{x}+\frac{1}{y}=\frac{1}{z}$.



OBJECTIVE ANSWERS

Q1 d	Q2 d	Q3 a	Q4 b	Q5 c
Q6 b	Q7 b	Q8 a	Q9 b	Q10 c
Q11 a	Q12 d	Q13 b		

CASE STUDY 1

Peter, who is 1.6 m tall, is standing near a lamp post one day. He observes his shadow and the shadow of the lamp post on the ground. He finds the length of his shadow CE to be 2 m, while the length of the shadow of the lamp post AE was 6 m.

On the basis of the above information answer the following questions:

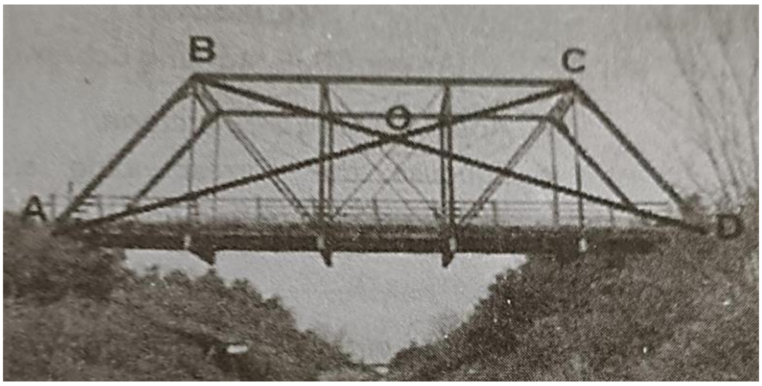
(i) Show that $\Delta\, ABE \sim \Delta CDE$

(ii) Find the length of the lamp post AB.

(iii) Find the ratio of the sides DE and BD.

<u>CASE STUDY 2</u>

While driving through the hills, Sneha observed a bridge in the shape of a trapezium with the diagonals AC and BD intersecting each other at O.



On the basis of the above information answer the following questions:

(i) Find the length of OD.

(ii) If P and Q are points on AB and CD respectively such that PQ \\ BC. If PB = 18 cm, DQ = 35 cm and CQ = 15 cm. Find the length of the side AB.

Reference links:

Defining Similarity (Introduction)

http://ndl.iitkgp.ac.in/document/aTZSamtNclFvQnZ0ekhwV0M3RG0rbmtPdEorVkx4YXorekhaNUtyMmNnZz0

http://ndl.iitkgp.ac.in/document/S1FSa1BwQlErclc2ZHF3REVCeWx5Q2dMN0NRZE5HL1h5bS9YTFlwWjVoWT0

Angle-Angle Similarity

http://ndl.iitkgp.ac.in/document/NTl2a2xJdzVubU1Od2ZnNTdGUzQ1eW93cVpnNVUyZEFUZzhDTG9SVW9IUT0

THALES Theorem Activity

http://ndl.iitkgp.ac.in/document/cVJTMTBoQWgwdzlBUk1xU1hQRnNrZUZtV3ZhZjhCWFBoWlhYQk5kNHVGYz0

EXTENDED LEARNING

1. If Δ ABC ~ Δ EDF and ΔABC is not similar to ΔDEF, then which of the following is not true?

   (A) BC . EF = A C. FD

   (B) AB . EF = AC . DE

   (C) BC . DE = AB . EF

   (D) BC . DE = AB . FD

2. If in two triangles ABC and PQR, $\frac{AB}{QR} = \frac{BC}{PR} = \frac{CA}{PQ}$, then

   (A) Δ PQR ~ Δ CAB

   (B) Δ PQR ~ Δ ABC

   (C) Δ CBA ~ Δ PQR

   (D) Δ BCA ~ Δ PQR

3. It is given that Δ ABC ~ Δ PQR, with $\frac{BC}{QR} = \frac{1}{3}$= . Then, $\frac{ar(\Delta PRQ\ )}{ar(\Delta BCA)}$ is equal to

   (A) 9 (B) 3 (C) $\frac{1}{3}$ (D) $\frac{1}{9}$

4. If Δ ABC ~ Δ QRP, $\frac{ar(\Delta ABC)}{ar(\Delta PQR)} = \frac{9}{4}$= , AB = 18 cm and BC = 15 cm, then PR is equal to

   (A) 10 cm (B) 12 cm (C) $\frac{20}{3}cm$ (D) 8 cm

5. PQ is drawn parallel to the base BC of a ΔABC cutting AB at P and AC at Q. If AB = 4BP and CQ = 2 cm, then AQ is equal to :

   (A) 2 cm (B) 4 cm (C) 6 cm (D) 8 cm

6. A vertical stick 30 m long casts a shadow 15 m long on the ground. At the same time, a tower casts a shadow 75 m long on the ground. The height of the tower is :

   (A) 150 m (B) 100 m (C) 25 m (D) 200 m

7. It is given that Δ ABC ~ Δ DFE, $\angle$A =30°, $\angle$C = 50°, AB = 5 cm, AC = 8 cm and DF= 7.5 cm. Then, the following is true:

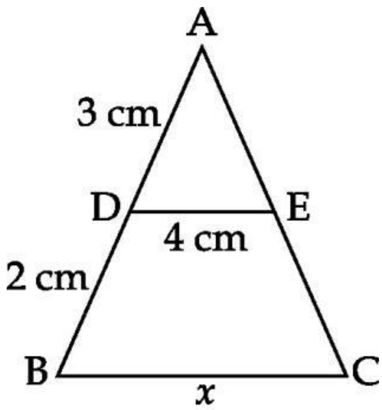
   (A) DE = 12 cm, $\angle$F = 50°

   (B) DE = 12 cm, $\angle$F = 100°

   (C) EF = 12 cm, $\angle$D = 100°

   (D) EF = 12 cm, $\angle$D = 30°

8. In the figure given below, if DE || BC, then x equals :



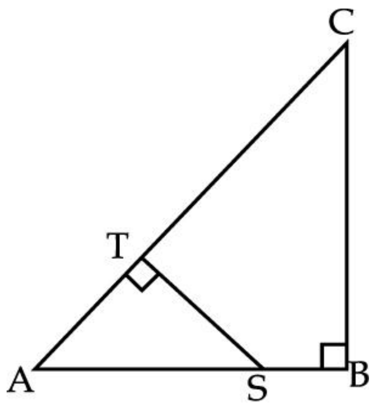
(A) 3 cm (B) 2 cm (C) 4 cm (D) 6.7 cm

9. The sides of four triangles are given below. Which one is right triangle ?

(A) 3 cm, 6 cm, 8 cm (B) 4 cm, 6 cm, 8 cm

(C) 8 cm, 24 cm, 25 cm (D) 7 cm, 24 cm, 25 cm

10. In the given figure, $\angle T$ and $\angle B$ are right angles. If the lengths of AT, BC and AS (in centimetres) are 15, 16 and 17 respectively, then the length of TC (in centimetres) is :



(A) 18 (B) 16 (C) 19 (D) 12

11. If in ΔABC and ΔDEF, $\frac{AB}{DE} = \frac{BC}{FD}$, then they will be similar if :

(A) $\angle B = \angle E$ (B) $\angle A = \angle D$ (C) $\angle B = \angle D$ (D) $\angle A = \angle F$

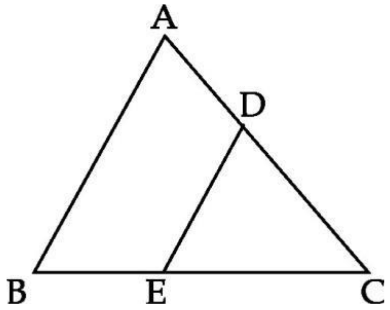
12. ΔABC is such that AB = 3 cm, BC = 2 cm and CA = 2.5 cm. If $\Delta DEF \sim \Delta ABC$ and EF = 4 cm, then perimeter of ΔDEF is :

(A) 15 cm (B) 22.5 cm (C) 7.5 cm (D) 30 cm

13. Sides of two similar triangles are in the ratio 4 : 9. Areas of these triangles are in the ratio

(A) 2 : 3 (B) 4 : 9 (C) 81 : 16 (D) 16 : 81

14. In the given figure $\Delta ABC \sim \Delta EDC$. If lengths of AB, ED, CE and CD (in centimeters) are 5, 2, 2.4 and 2.2 respectively, then the lengths of CA and CB respectively are (in centimeters) :



(A) 6, 5.5 (B) 6.5, 5.5 (C) 5.5, 6.5 (D) 6, 5

15. If in ΔABC, AB = 6 cm and DE||BC such that AE = $\frac{1}{4}$AC, then the length of AD is :

(A) 2 cm (B) 1.2 cm (C) 1.5 cm (D) 4 cm

ANSWERS

1 C	2 A	3 D	4 A	5 C	6 C	7 B	8 D
9 D	10 C	11 C	12 A	13 D	14 A	15 C	

Chapter - 7

Coordinate Geometry

MCQ (Q1-Q10)

1. The coordinates of the point equidistant from the points A(1, 2), B (3, –4) and C(5, –6) are

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

2. Two of the vertices of a ΔABC are given by A(6, 4) and B(–2, 2) and its centroid is G(3, 4). The coordinates of the third vertex C of the ΔABC are

(a) (2, 3) (b) (4, 6) (c) (4, 3) (d) (5, 6)

3. The value of P for which the point (–1, 3), (2, p) and (5, –1) are collinear is

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

4. The distance of the point (–6, 8) from the origin.

(a) 8 (b) 11 (c) 10 (d) 9

5. In what ratio of line $x - y - 2 = 0$ divides the line segment joining (3, –1) and (8, 9)?

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

6. The points on x-axis at a distance of 10 units from (11, –8) are

(a)(5, 2) (17, 0) (b)(5, 0) (17, 0) (c)(6, 0) (17, 0) (d)(5, 0) (16, 0)

7. The point on the x-axis which is equidistant from (2, –5) and (–2, 9) is

(a)(7, 0) (b)(-7, 0) (c)(2, 0) (d)(-2, 0)

8. A point on the y – axis which is equidistant from the point A (6, 5) and B (-4, 3) is

(a)(0, 10) (b)(0, 9) (c)(0, -7) (d)(0, 6)

9. The distance between the points (a cos 25^0 , 0) and (0, a cos 65^0) is

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

10. The distance between the points (a cos A + b sin A ,0)

and (0 , a sin A – b cos A) is

(a) a^2+b^2 (b) a + b (c) a^2- b^2 (d) $\sqrt{a^2+\ b^2}$

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

11. **Assertion (A):** The point (–1, 6) divides the line segment joining the points (–3, 10) and (6, –8) in the ratio 2 : 7 internally.

Reason (R): Given three points, i.e. A, B, C form an equilateral triangle,

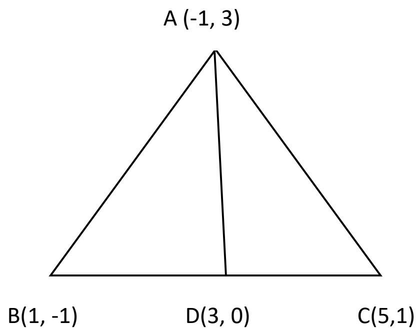
then AB = BC = AC.

12. **Assertion (A):** Mid-point of a line segment divides line in the ratio 1 : 1.

Reason (R): The ratio in which the point (–3, k) divides the line segment joining the points (–5, 4) and (–2, 3) is 1 : 2.

Subjective Questions:

1. Find the value of a, so that the point (3, a) lie on the line $2x - 3y = 5$
2. Find the distance between points (0,5) and (-5,0)
3. If the points A (1,2), B (0,0) and C (a,b) are collinear, then what is the relation between a and b?
4. The coordinates of the points P and Q are respectively (4, -3) and (-1, 7). Find the abscissa of a point R on the line segment PQ such that $\frac{PR}{PQ} = \frac{3}{5}$.
5. In the given figure, if A (-1, 3) , B (1, -1) and C (5, 1) are the vertices of a triangle ABC, what is the length of the median through vertex A?



6. Find the ratio in which y-axis divides the line segment joining the points A(5, -6) and B (-1, -4). Also find the coordinates of the point of division.

7. Let P and Q be the points of trisection of the line segment joining the point A(2, -2) and B (-7, 4) such that P is nearer to A. Find the coordinates of P and Q
8. Find the ratio in which the point (-3, k) divides the line-segment joining the points (-5, -4) and (-2, 3). Also find the value of k.
9. 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 coordinates of P
10. If the point A (0, 2) is the equidistant from the points B(3, p) and C(p, 5), find p. also find the length of AB.
11. If the points A (-2, 1), B (a, b) and C (4, -1) are collinear and a – b =1, find the values of a and b.

12. If the point P (k-1, 2) is equidistant from the points A (3, k) and B (k, 5), find the value of k.
13. Find the ratio in which the line segment joining the points A (3, -3) and b (-2, 7) is divided by x-axis. Also find the coordinates of the point of division.
14. Find the values of k if the points A(k + 1, 2k), B(3k, 2k + 3) and C(5k – 1 , 5k) are collinear.

15. If the point P(x, y) is equidistant from the points A(a +b, b – a) and B(a – b , a + b) ,Prove $that \quad bx = ay$
16. If the point C (-1, 2) divides internally the line segment joining the points A(2, 5) and B(x, y) in the ratio of 3 : 4, find the value of $x^2 + y^2$
17. Find the ratio in which the point P (x, 2) divides the line segment joining the points A (12, 5) and B (4, -3). Also find the value of x.
18. If A (4, 2), B (7, 6) and C (1, 4) are the vertices of a △ABC and AD is its median, prove that the median AD divides △ABC into to triangles of equal areas.
19. If the point A (2, -4) is equidistant from P (3, 8) and Q (-10, y), find the values of y. also find distance PQ.
20. The base BC of an equilateral triangle ABC lies on y-axis. The coordinates of point C are (0, -3). The origin is the mid-point of the base. Find the coordinates of the points A and B. also find the coordinates of another point D such that BACD is a rhombus.
21. If the mid-point of the line segment joining the points A (3, 4) and B (a, 4) is P (x, y) and $x + y - 20 = 0$,then find the value of a
22. **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.

23. If the coordinates of the mid-points of the sides of a triangle are (1, 1), (2, -3)and (3,4). Find the centroid
24. Show that △ABC with vertices A (-2, 0), B (2, 0) and C (0, 2) is similar to △DEF with vertices D (-4, 0), E (4, 0) and F(0, 4)
25. If A(-2, 1), B(a, 0), C(4, b) and D(1, 2) are the vertices of a parallelogram ABCD, find the values of a and b. Hence, find the lengths of its sides.

ANSWERS

OBJECTIVE QUESTIONS

1. (b) 2.(d) 3. (d) 4. (c) 5. (c) 6. (b) 7. (b) 8. (b) 9. (a) 10. (d)

11.b 12. c

SUBJECTIVE QUESTIONS

1. $a = \frac{1}{3}$ 2. $5\sqrt{2}\ units$ 3. 2a = b 4. 1 5. 5 units

6. $P\left(0, \frac{-13}{3}\right)$ 7. -4, 2 8. k = $\frac{2}{3}$ 9. (16, 8)

10. $\sqrt{10}$ units 11. a = 1 and b = 0 12. k = 1 or k = 5

13. k = $\frac{3}{7}$ 14. k = 2, $\frac{1}{2}$ 16. 9

17. x = 9, The ratio in which p divides the line segment is $\frac{3}{5}$i.e., 3: 5

18. $\frac{9}{2}$sq. Units 19. PQ = $\sqrt{290}$ and $\sqrt{338}$

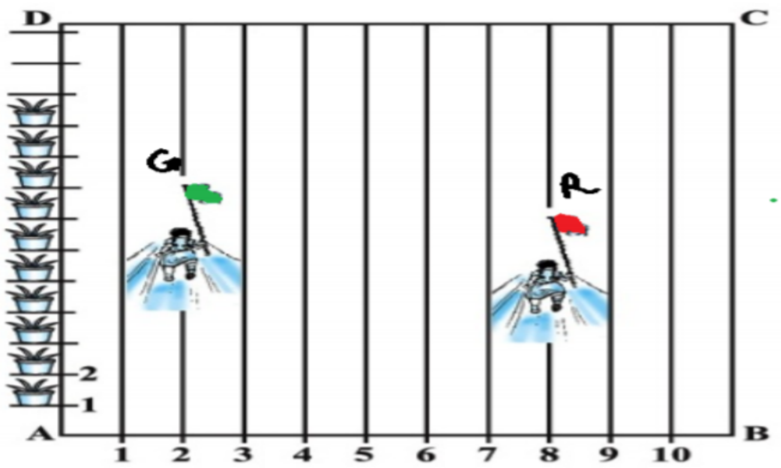
20. Coordinates of point B are (0, 3), coordinates of point A = ($\pm 3\sqrt{3}$, 0),

Coordinates of point D =($\mp 3\sqrt{3}$, 0)

21. 45 22. (-5,-2) 23. $\left(2, \frac{2}{3}\right)$ 25. $\left(2, \frac{2}{3}\right)$, $5\sqrt{2}\ units$

<u>Case Study -1</u>

In order to conduct Sports Day activities in your School, lines have been drawn with chalk powder at a distance of 1 m each, in a rectangular shaped ground ABCD, 100 flowerpots have been placed at a distance of 1 m from each other along AD, as shown in given figure below. Niharika runs 1/4 th the distance AD on the 2nd line and posts a green flag. Preet runs 1/5 th distance AD on the eighth line and posts a red flag.



1. Find the position of green flag

2. Find the position of red flag

3. What is the distance between both the flags?

4. If Rashmi has to post a blue flag exactly halfway between the line segment joining the two flags, where should she post her flag?

5. If Joy has to post a flag at one-fourth distance from green flag, in the line segment joining the green and red flags, then where should he post his flag?

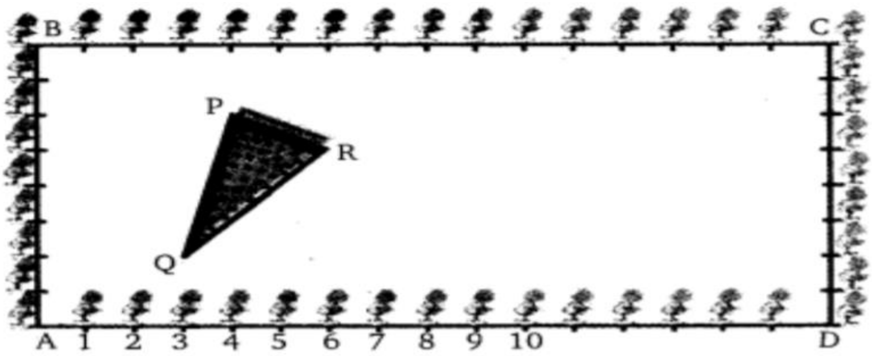
ANSWERS:

1. a) (2,25)　　2. c) (8,20)　　3. c) $\sqrt{61}$　　4. a) (5, 22.5)

5. a) (3.5,24)

Case Study 2

The class X students school in Krishnagar have been allotted a rectangular plot of land for their gardening activity. Saplings of Gulmohar are planted on the boundary at a distance of 1 m from each other. There is triangular grassy lawn in the plot as shown in the figure. The students are to sow seeds of flowering plants on the remaining area of the plot.



1. Taking A as origin, find the coordinates of P

2. What will be the coordinates of R, if C is the origin?

3. What will be the coordinates of Q, if C is the origin?

ANSWERS:

1. a) (4,6)   2. c) (10,3)   3. d) (13,6)

Reference Links:

DISTANCE FORMULA
http://ndl.iitkgp.ac.in/document/NThHSnRlalBZZ3NaWC9rZlJIYXBWbk95bGxyankzS2NyQkpYOWQxaWJTOD0
SECTION FORMULA
http://ndl.iitkgp.ac.in/document/R1JtNk5rUjZuZ1pmdklDeFo1RE1MUzhxVm9pcHIwUlk0Z1I2ZnhCbGJyaz0

CHAPTER 8

INTRODUCTION TO TRIGONOMETRY

MULTIPLE CHOICE QUESTION

1. If sin A = $\frac{1}{2}$, then the value of cot A is

(A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$ (C) $\frac{\sqrt{3}}{2}$ (D) 1

2.If $\sin\theta = \frac{a}{b}$,then $\cos\theta$ is

(A) $\frac{b}{\sqrt{bb}-aa}$ (B) $\frac{b}{a}$ (C) $\frac{\sqrt{bb}-aa}{b}$ (D) $\frac{a}{\sqrt{bb}-aa}$

3.If 4 tan θ =3 ,then the value of $\frac{4sin\theta-\cos\theta}{4\sin\theta+\cos\theta}$ is

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{3}{4}$

4.The value of $\frac{\tan 30°}{\cot 60°}$ is

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{1}{\sqrt{3}}$ (C) $\sqrt{3}$ (D) 1

5.The value of (sin 45°+ cos 45°) is

(A) $\frac{1}{\sqrt{2}}$ (B)$\sqrt{2}$ (C) $\frac{\sqrt{3}}{2}$ (D)1

6.The value of (sin30° + cos 30°) – (sin 60° + cos 60°) is

$(A) - 1$ (B) 0 (C) 1 (D) 2

7.If $\sin\alpha = \frac{1}{2}$ and $\cos\beta = \frac{1}{2}$, then the value of ($\alpha + \beta$) is

(A)0° (B) 30° (C) 60° (D) 90°

8.If ΔABC is a right angled at C ,then the value of cos (A+ B) is

(A)0 (B) 1 (C) $\frac{1}{2}$ (D) $\frac{\sqrt{3}}{2}$

9.If sec A .sin A = 0 ,then the value of cos A is

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{1}{\sqrt{3}}$ (C) $\sqrt{3}$ (D) 1

10. sin A cos A = sin A is true when A =

(A)0° (B) 30° (C) 60° (D) 90°

ASSERATION AND REASONING

Directions: 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.

Q11. Assertion: The value of $\sin 60^0 \cos 30^0 + \sin 30^0 \cos 60^0$ is 1

Reason: $\sin 90^0=1$ and $\cos 90^0=0$

Q12. Assertion: sin (A+B) = sin A + sin B

Reason: For any value of θ, $1+\tan^2\theta = \sec^2\theta$

SUBJECTIVE QUESTIONS

1. If $cot\theta = \frac{20}{21}$, find the value of $\sqrt{(1+\sin\theta)}$ √(1- sin θ
2. If $3tan\theta = 2$, prove that $\frac{4sin\theta - cos\theta}{2sin\theta + cso\theta} = \frac{5}{7}$
3. Find the area and perimeter of a right-angled triangle whose hypotenuse is 25 cm and base angle is 60°.
4. If $7\sin^2\theta + 3\cos^2\theta = 4$, find tanθ.
5. A rhombus of side 20 cm has two angles of 60° each. Find the length of each diagonal.
6. If $sin\ (A-B) = sin\ A\ cos\ B - \ cosA\ sin\ B$ and

   $cos\ (A-B) = cos\ A\ cos\ B\ +\ sin\ A\ sin\ B$

   then find the values of sin 15° and cos15°.
7. If $sin\ (A+B) = sin\ A\ cos\ B +\ cosA\ sin\ B$ and

   $cos\ (A+B) = cos\ A\ cos\ B - sin\ A\ sin\ B$

   then find the values of sin 75° and cos75°.
8. If $\theta = 30°$, verify that

   (i) $\sin 3\theta = 3\sin\theta - 4\,sin^3\theta$

   (ii) $\cos 3\theta = 4\,cos^3\theta - 3\cos\theta$
9. If A and B are acute angles such that tan A= $\frac{1}{2}$ and tan B= $\frac{1}{3}$ and

   $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A.tanB}$, find $A+B$.
10. If $\sin 5\theta = \cos 4\theta$, where 5θ and 4θ are acute angles, find the value of θ.
11. If $tan2\theta = \cot(\theta + 6°)$, where 2θ and $(\theta + 6°)$ are acute angles, find the value of θ.
12. If $\sin(A-B) = \frac{1}{2}$ and $\cos(A+B) = \frac{1}{2}$, $0° < A+B \leq 90°, A > B$, find A and B.
13. If $\sin(A+B) = \cos(A-B) = \frac{\sqrt{3}}{2}$, A and B are acute angles($A > B$), find A and B.
14. Given a right angled Δ ABC, right angled at B in which tan A = $\frac{15}{8}$ and tan C = $\frac{8}{15}$, then find the value of $\sin(A+C)$.
15. Prove the following identities:

a) $\sqrt{\frac{1+cos\theta}{1-cos\theta}} = cosec\theta + cot\theta$

b) $\sqrt{\frac{1+sin\theta}{1-sin\theta}} + \sqrt{\frac{1-sin\theta}{1+sin\theta}} = 2sec\theta$

c) $\frac{sec\,\theta+tan\theta}{sec\,\theta-tan\theta} = \left(\frac{1+\sin\theta}{\cos\theta}\right)^2$

d) $cos^4A - cos^2A = sin^4A - \ sin^2A$

e) $\sqrt{sec^2\theta + cosec^2\theta}\ = tan\,\theta + cot\,\theta$

f) $sin^4A + cos^4A = 1 - 2sin^2A\,cos^2A$

g) $sin^6A + cos^6A = 1 - 3sin^2A\,cos^2A$

h) $sin^8A + cos^8A = (sin^2A - cos^2A)(1 - 2sin^2A\,cos^2A)$

i) $sin^4A - cos^4A = sin^2A - cos^2A = 2sin^2A - 1 = 1 - 2cos^2A$

j) $\frac{2}{cos^2\theta} - \frac{1}{cos^4\theta} - \frac{2}{sin^2\theta} + \frac{1}{sin^4\theta} = cot^4\theta - tan^4\theta$

k) $\frac{cot\theta+cosec\theta-1}{cot\theta-cosec\theta+1} = \frac{1+cos\theta}{sin\theta} = cosec\theta + cot\theta$

l) $\frac{sin\theta}{cot\theta+cosec\theta} = 2 + \frac{sin\theta}{cot\theta-cosec\theta}$

16. If $\tan A = \sqrt{2} - 1$, show that $\sin A \cos A = \frac{\sqrt{2}}{4}$

17. If $sec\theta - \tan\theta\ =\ x$, then show that $sec\theta\ + \tan\theta\ = \frac{1}{x}$. Hence find the value of $\cos\theta$and$\sin\theta$.

18. If $x = a\ sin\theta$ and $y = b\tan\theta$, prove that $\frac{a^2}{x^2} - \frac{b^2}{y^2} = 1$

19. If $tan\theta + sin\theta = m$ and $tan\theta - sin\theta = n$, show that $m^2 - n^2 = 4\sqrt{mn}$

20. If $x = r\ sinA\ \ cosC,\ \ y = r\ sin\ A\ sin\ C, z = r\ cos\ A$, prove that $r^2 = x^2 + y^2 + z^2$.

<u>HOTS QUESTIONS</u>

21. Solve for θ:

(i) $\frac{cos^2\theta}{cot^2\theta - cos^2\theta} = 3$

(ii) $sec^2\theta +\ tan^2\theta = 3$

22. If $\cot\theta = \frac{2x}{\sqrt{9-4x^2}}$, then evaluate: $\mathrm{cosec}\,\theta - \tan\theta$.

23. If $\sin\theta\ +\ \cos\theta\ =\ p$ and $\sec\theta\ +\ \mathrm{cosec}\theta\ =\ q$, then prove that $q\ (p^2 - 1)\ =\ 2p$.

24. If $sec\theta\ + \tan\theta\ =\ p$, then prove that $sin\theta\ =\ \frac{p^2-1}{p^2+1}$.

25. If $x = a\sec\theta + b\tan\theta$ and $y = a\ tan\theta + b\ sec\theta$, prove that $x^2 - y^2 = a^2 - b^2$.

26. If $a\sin A + b\cos A = c$, then prove that $a\cos A - b\sin A = \sqrt{a^2 + b^2 - c^2}$

27. If $\cos\theta - \ \sin\theta\ =\ \sqrt{2}\sin\theta$, prove that $\cos\theta + \sin\theta =\ \sqrt{2}\cos\theta$.

28. If $15tan^2\theta + 4sec^2\theta = 23$, then find the value of $(\sec\theta + cosec\theta)^2 - sin^2\theta$.

29. If $cosec\theta = x + \frac{1}{4x}$, prove that $cosec\theta + \cot\theta = 2x \; or \; \frac{1}{2x}$.

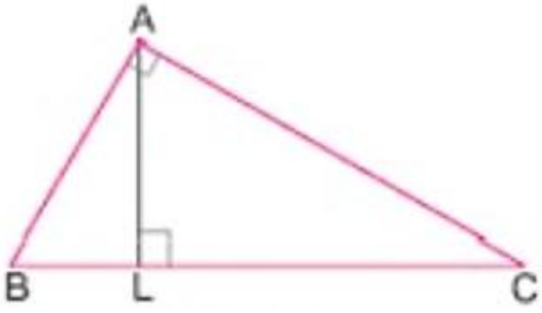
ANSWERS

OBJECTIVE

1. A
2. C
3. C
4. D
5. B
6. B
7. D
8. A
9. D
10. A
11. b
12. d

CASE STUDY QUESTIONS 1.

A right triangular signboard ABC is used by students of DPS to display " **SAVE WATER** If AC = 1m and AB =$\sqrt{3}m$ and $\angle A = 90°$. Answer the following questions



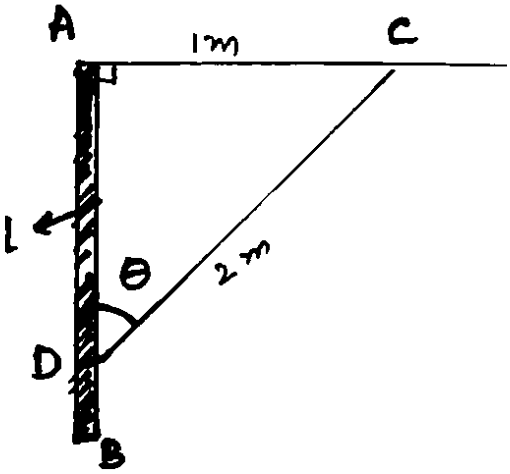
Q1 Find the value of ∠B

Q2. Find the value of sin B

Q3. Find the value of sin B + cos C + tan$\frac{A}{2}$

CASE STUDY QUESTIONS 2.

The rod AC of a TV disc antenna is fixed at right angle to the wall AB and a rod CD is supporting the disc as shown in the figure .If AC = 1m and CD = 2m .Answer the following



Q1.Find the value of θ.

Q2.Find the value of tan θ.

Q3. Find the value of 6 $\tan^2\theta$ - 6 $\sec^2\theta$

CASE STUYDY 1	30^0	$^1/_2$	2
CASE STUDY II	30^0	$\sqrt{3}$	-6

LINK FOR E- RESOURCES

https://www.youtube.com/watch?v=nbuyle1CsSM&t=2s&ab_channel=EDUMANTRAEDUMANTRAVerified

https://www.youtube.com/watch?v=T9lt6MZKLck&ab_channel=Don%27tMemorise

EXTENDED LEARNING

Choose the correct answer from the given four options:

1. $If\ \sin\theta + \cos\theta = \sqrt{3}\ , then$ cosec θ + sin θ equal to

(A) $2\cos\theta$ (B) $2\sin\theta$ (C) 0 (D) 1

2. If θ is an acute angle such that $\sec\theta = \text{cosec } 60°$ then the value of $2cos^2\theta - 1$

(A) 2 (B) 11 (C) -2 (D) 0

3. The value of $[(secA + tanA)\ (1 - sinA)]$ is equal to

(A) tan^2A (B) sin^2A (C) $cosA$ (D) $sinA$

4. If A is an acute angle in a right ΔABC, right angled at B, then the value of $sinA + cosA$ is :

(A) equal to one (B) greater than one

(C) less than one (D) equal to two

5. If $cosec\theta - sin\theta = \sqrt{5}$, the value of ($cosec\theta$+sin θ) is :

(A) 1 (B) 2 (C) 3 (D) 4

6. ΔABC is a right angled at B, If BC =5cm and AC -AB =1cm then value of $\frac{1+\sin C}{\cos C}$ is

(A) 5 (B) 1

(C) -1 (D) None of the above

7. If cosec$\theta = 2x$ and cot$\theta = \frac{2}{x}$ then 2 ($x2 - \frac{1}{x2}$) is equal to

(A) $\frac{1}{2}$ (B) 0 (C) -1 (D) $1 + \sqrt{3}$

8. If $tan\ x = \frac{1}{\sqrt{5}}$, then$\frac{\text{cosec } 2x - \sec 2x}{\text{cosec } 2x + \sec 2x}$ equals

(A) $\frac{1}{7}$ (B) $\frac{3}{7}$ (C) $\frac{2}{3}$ (D) 0

9. If tan (20° − 3α) = cot (5 α --20°)then the value of α is :

(A) 45° (B) 15° (C) 60° (D) 0

10. $tan\ (45° - \theta) - cot\ (45° + \theta)$ is equal to

(A) $2cos\theta$ (B) 0 (C) $2sin\theta$ (D) 1

ANSWERS

1. D
2. B
3. C 4. B 5. C

6. A 7. B 8. D 9. D 10.D

CHAPTER 9

SOME APPLICATIONS OF TRIGONOMETRY

Choose the correct answer from the given four options

1. 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 the top of the tower is found to be 60°. The height of the tower is

(A) 15 m (B) $15\sqrt{3}$ m (C) 30 m (D) $5\sqrt{3}$ m

2. An observer 1.5 metre tall is 20.5 metre away from a tower 22 metres high. The angle of elevation of the top of the tower from the eye of the observer is

(A) 60° (B) 45° (C) 30° (D) 90°

3. A kite is flying at a height of $50\sqrt{3}$ m from the horizontal. It is attached with a string and makes an angle 60° with the horizontal. The length of the string is

(A) 150 m (B) $50\sqrt{3}$ m (C) 25 m (D) 100 m

4. The angle of elevation of the sun, when the shadow of a pole h meters high is $\sqrt{3}\,h$ is

(A) 60° (B) 45° (C) 30° (D) 90°

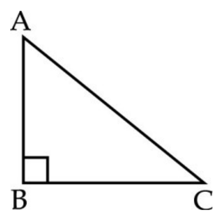
5. As observed from the top of a 75m high light house from the sea-level, the angle of depression is 60°. The distance of the ship from the base of light house is

(A) 25 m (B) 75 m (C) 50 m (D) $25\sqrt{3}$ m

6. A pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then the Sun's elevation is

(A) 60° (B) 45° (C) 30° (D) 90°

7. In given figure, if AB = 4 m and AC = 8 m, then angle of elevation of A as observed from C is :



(A) 60° (B) 30° (C) 45° (D) 90°

8. A ladder 10 m in length touches a wall at height of 5 m. The angle made by the ladder with the horizontal is :

(A) 30° (B) 90° (C) 60° (D) 45°

9. The ratio of the length of a tree and its shadow is $1:\frac{1}{\sqrt{3}}$. The angle of a sun's elevation is

(A) 30° (B) 90° (C) 60° (D) 45°

10. The angle of elevation of the top of a tower from a point P on the ground is α. After walking a distance d towards the foot of the tower, angle of elevation is found to be β. Then,

(A) $\alpha < \beta$ (B) $\alpha > \beta$ (C) $\alpha = \beta$ (D) $\alpha + \beta = 90°$

DIRECTION: In the question number 11 and 12, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option

11. Statement A (Assertion): If the angle of elevation of the top of a tower from a point on the ground, which is 30 m away from the foot of the tower, is 30°, then the height of the tower is $10\sqrt{3}$ m.

Statement R(Reason) : The angle of elevation of a point on the object being viewed is the angle formed by the line of sight with the horizontal when the point is below the horizontal level.

(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.

12. Statement A (Assertion): The length of shadow of a tower decreases as the sun's altitude changes from 45° to 60°.

Statement R (Reason) : As sun's altitude (θ) increases, $\tan\theta$ decreases.

(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.

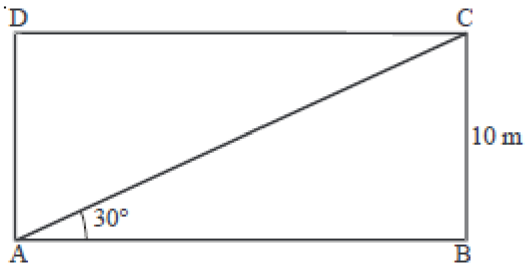
<u>Short Answer Questions</u>

13. The tops of the poles of height 16 m and 10 m are connected by a wire of length l metres. If the wire makes an angle of 30° with the horizontal, find l.

14. 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 find the ratio $h_1 : h_2$.

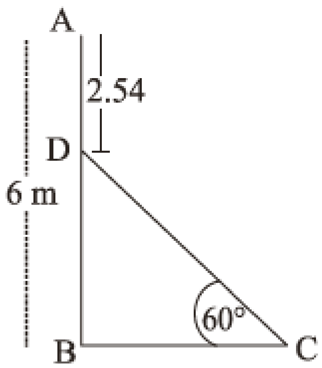
15. An observer, 1.7 m tall, is $20\sqrt{3}$ m away from a tower. The angle of elevation from the eye of observer to the top of tower is 30°. Find the height of tower. (CBSE 2016)

16. In the given figure find the perimeter of rectangle ABCD.



17. A peacock is sitting on the top of a tree. It observes a snake on the ground at an angle of depression of 30°. The peacock with a speed of 300 m/min catches the snake in 12 seconds. What is the height of the tree?

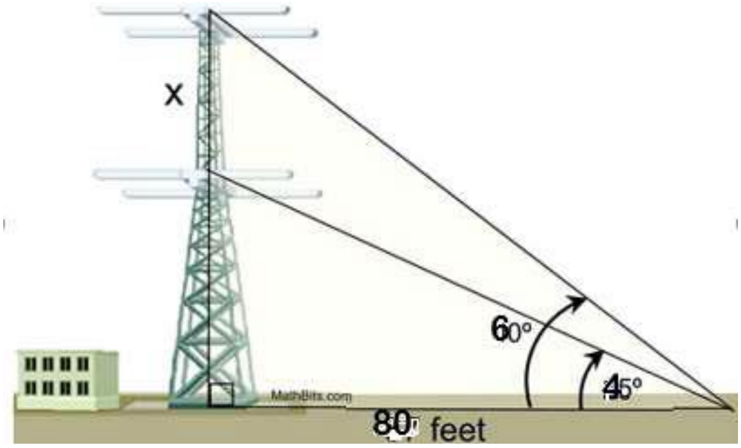
18. In Figure, AB is a 6 m high pole and CD is a ladder inclined at an angle of 60° to the horizontal and reaches up to a point D of pole. If AD = 2.54 m, find the length of the ladder. (use $\sqrt{3}$ =1.73)(CBSE 2016)



19. A tree 12 m high, is broken by the wind in such a way that its top touches the ground and makes an angle of 60° with the ground. At what height form the ground, is the tree broken by the wind?

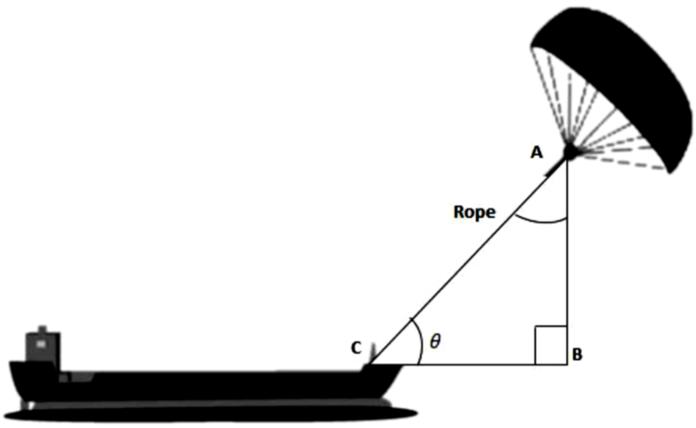
20. Trigonometry is used in architecture to ensure that buildings are built safely. For example, architects have to calculate lengths of support cables for poles, suspension bridges, etc. to ensure stability and safety. Based on the following figure , answer the questions:

A radio station tower is to be built in two sections. From a point 80 feet from the base of the tower, the angle of elevation of the top of the first section is 45°, and the angle of elevation of the top of the second section is 60°. What should be the lengths of the two supporting cables? (Use $\sqrt{2}$ =1.4)



21. ‘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:



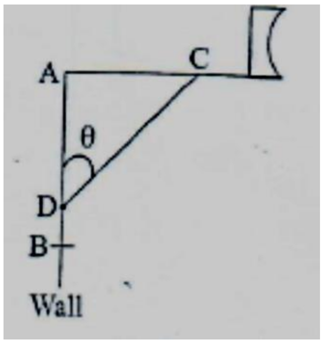
(i) In the given figure, if $\sin\theta = cos\,(3\theta - 30°)$, where θ and $3\,\theta - 30°$ are acute angles, then find the value of θ.

(ii)What should be the length of the rope of the kite sail in order to pull the ship at the angle θ (calculated above) and be at a vertical height of 200 m?

22. The rod AC of a TV disc antenna is fixed at right angles to the wall AB and a rod CD is supporting the disc as shown in figure. If AC = 1.5 m long and CD = 3 m, find

(i) $\tan\theta$

(ii) $\sec\theta + cosec\ \theta$.



Long Answer Questions

23. From the top of tower 60 m high, the angles of depression of the top and bottom of a building whose base is in the same straight line with the base of the tower are observed to be 30° and 60° respectively. Find the height of the building.

24. 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.

25. From the top of a tower the angle of depression of an object on the horizontal ground is found to be 60°. On descending 20 m vertically downwards from the top of the tower, the angle of depression of the object is found to be 30°. Find the height of the tower.

26. The angle of elevation of the top of a rock from the top and foot of a 100 m high tower are respectively 30° and 45°. Find the height of the rock.

27. An aeroplane when flying at a height of 3000 m above the ground passes vertically above another aeroplane at an instant when the angles of elevation of the two planes from the same point on the ground are 60° and 45° respectively. Find the vertical distance between the aero planes at that instant. (Use $\sqrt{3}$ =1.732)

28. The angle of elevation of a jet plane 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 plane is flying at a constant height of $1500\sqrt{3}$ m, find the speed of the jet plane.

29. Determine the height of a mountain if the elevation of its top at an unknown distance from the base is 45° and at a distance 10 km further off from the mountain, along the same line, the angle of elevation is 30°. (Use $\sqrt{3}$ =1.732).

30. An aeroplane flying horizontally at a height of 1 km above the ground is observed at a certain point on earth to subtend and angle of 60°. After 10 seconds, its angle of elevation at the same point is observed to be 30°. Calculate the speed of the aeroplane in km/hr. (Use $\sqrt{3}$ =1.732)

31. The shadow of a tower standing on a level plane is found to be 50 m longer when Sun's elevation is 30° than when it is 60°. Find the height of the tower.

32. The angle of elevation of a jet aircraft from a point P on the ground is 60°. After a flight of 30 seconds, the angle of elevation becomes half of the previous angle. If the jet is flying at a speed of 864 km/hr, find the constant height at which the jet is flying.($\sqrt{3}$ = 1.73)

33. The angle of elevation of the top of a vertical tower from a point on the ground is 60°. From another point 10 m vertically above the first, its angle of elevation is 45°. Find the height of the tower. (Use $\sqrt{3}$ =1.732)

34. From the top of a 50 m high tower, the angles of depression of the top and bottom of a pole are observed to be 45° and 60° respectively. Find the height of the pole. (CBSE 2016) (Use $\sqrt{3}$ =1.732)

35. 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.

36. A man sitting at a height of 20 m on a tall tree on a small island in the middle of a river observes two poles directly opposite to each other on the two banks of the river and in line with the foot of tree. If the angles of depression of the feet of the poles from a point at which the man is sitting on the tree on either side of the river are 60° and 30° respectively. Find the width of the river.

37. The angle of elevation of the top of a tower 30 m high from the foot of another tower in the same plane is 60° and the angle of elevation of the top of the second tower from the foot of the first tower is 30°. Find the distance between the two towers and the height of the other tower.

38. The angle of elevation of the top of a tower from certain point is 30°. If the observer moves 20 metres towards the tower, the angle of elevation of the top increases by 30°. Find the height of the tower. (Use $\sqrt{3}$ =1.732)

39. The angle of elevation of a cloud from a point 60 m above a lake is 30° and the angle of depression of the reflection of cloud in the lake is 60°. Find the height of the cloud.

40. Two boats approach a light house in mid sea from opposite directions. The angles of elevation of the top of the light house from two boats are 30° and 45° respectively. If the distance between two boats is 100 m, find the height of the light house. (CBSE 2014)

41. Two ships are sailing in the sea on the either side of the light-house, the angles of depression of two ships as observed from the top of the light-house are 60° and 45° respectively. If the distance between the ships is $200\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)$ m, find the height of the light-house.

42. A boy is standing on the ground and flying a kite with 120m of string at an elevation of 30°. Another boy is standing on the roof of a 14m high building and is flying his kite at an elevation of 45°. Both the boys are on opposite sides of both the kites. Find the length of the string that the second boy must have so that the kites meet.

43. 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 a 20 m high building, finds the elevation of the same bird to be 45°. The boy and the girl are on the opposite sides of the bird. Find the distance of the bird from the girl. (Given $\sqrt{2}$ = 1·414)

44. The shadow of a flagstaff at a certain time is three times as long as its shadow when the sun's altitude is 60°. Find the angle between the sun's altitude at the time of the longer shadow.

45. A man standing at the top of the tower observes a car at an angle of depression of 30°, which is approaching the foot of the tower with a uniform speed. 12 minutes later, the angle of depression of the car is found to be 45°. How soon after this, will the car reach the foot of the tower? (Use $\sqrt{3}$ =1.73)

46. A window of a house is 15 metres above the ground. From the window, the angles of elevation and depression of the top and the bottom of another house situated on the opposite side of the lane are found to be 30° and 45°, respectively. Find the height of the other house.

47. A moving boat is 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 in m/min. (Use $\sqrt{3}$ =1.732)

48. The angle of elevation of the top B of a vertical tower AB from a point X on the ground is 60°. At a point Y, 40 m vertically above X, the angle of elevation is 45°. Find the height of the tower AB and the distance XB.

<u>CASE STUDY BASED</u>

49. Trigonometry in the form of triangulation forms the basis of navigation, whether it is by land, sea or air. GPS a radio navigation system helps to locate our position on earth with the help of satellites. A guard, stationed at the top of a 240 m tower, observed an unidentified boat coming towards it. A clinometer or inclinometer is an instrument used for measuring angles or slopes(tilt). The guard used the clinometer to measure the angle of depression of the boat coming towards the lighthouse and found it to be 30°.

(i) Make a labelled figure on the basis of the given information and calculate the distance of the boat from the foot of the observation tower. $(240\sqrt{3}\,m)$

(ii) After 10 minutes, the guard observed that the boat was approaching the tower and its distance from tower is reduced by 240(√3 - 1) m. He immediately raised the alarm. What was the new angle of depression of the boat from the top of the observation tower? (45°)

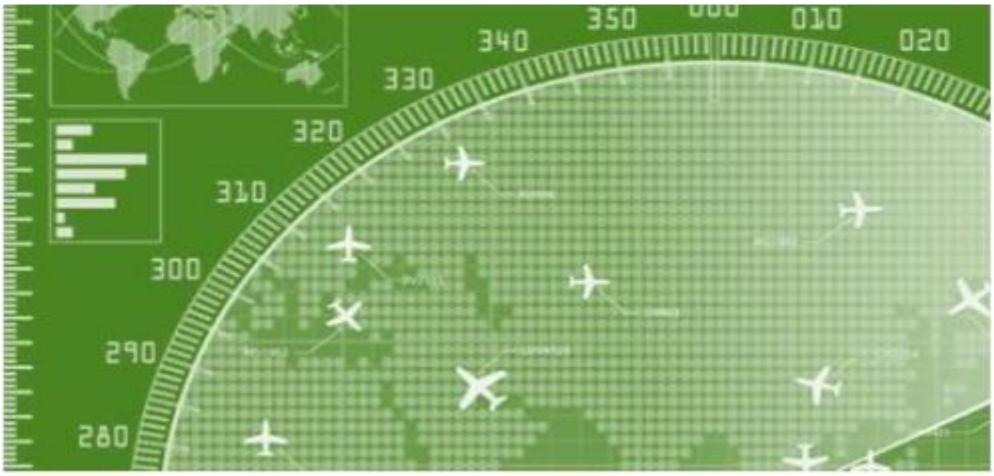
50. Gadisar Lake is located in the Jaisalmer district of Rajasthan. It was built by the King of Jaisalmer and rebuilt by Gadsi Singh in 14th century. The lake has many Chhatris. One of them is shown below :

Observe the picture. From a point A, h m above from water level, the angle of elevation of top of Chhatri (point B) is 45° and angle of depression of its reflection in water (point C) is 60° . If the height of Chhatri above water level is (approximately) 10 m, then

(i) draw a well-labelled figure based on the above information;

(ii) find the height (h) of the point A above water level. (Use $\sqrt{3}$ = 1·73) (Ans : 2.67 m)

51. We all have seen the airplanes flying in the sky but might have not thought of how they actually reach the correct destination. Air Traffic Control (ATC) is a service provided by ground-based air traffic controllers who direct aircraft on the ground and through a given section of controlled airspace, and can provide advisory services to aircraft in non-controlled airspace. Actually, all this air traffic is managed and regulated by using various concepts based on coordinate geometry and trigonometry.



At a given instance, ATC finds that the angle of elevation of an airplane from a point on the ground is 60°. After a flight of 30 seconds, it is observed that the angle of elevation changes to 30°. The height of the plane remains constantly as $3000\sqrt{3}$ m. Use the above information to answer the questions that follow-

(i) Draw a neat labelled figure to show the above situation diagrammatically.

(ii) What is the distance travelled by the plane in 30 seconds?

(iii) Keeping the height constant, during the above flight, it was observed that after $15(\sqrt{3} - 1)$ seconds, the angle of elevation changed to 45°. How much is the distance travelled in that duration.

(iv) What is the speed of the plane in km/hr?

Answers: (ii) 6000 m (iii) $3000(\sqrt{3} - 1)$m (iv) 720 km/h

ANSWER KEY

1. B
2. B
3. D
4. C
5. D
6. A
7. B
8. A
9. C
10. A
11. B
12. C
13. 12 m
14. 3:1
15. 21.7 m
16. $20+20\sqrt{3}$ m
17. 30 m
18. 4 m
19. $24\sqrt{3} - 36$ m
20. 112 ft, 160 ft
21. 30°, 400 m
22. (i) $1/\sqrt{3}$ (ii) $\frac{2}{3}(3 + \sqrt{3})$
23. 40 m
24. $50(3 + \sqrt{3})$ m
25. 30 m
26. $50(3 + \sqrt{3})$ m
27. 1268 m
28. 720 km/h
29. 13.66 km
30. 415.68 km/h
31. $25\sqrt{3}$ m
32. 6228 m
33. 23.66 m
34. 21.13 m
35. 8 m
36. $\frac{80}{3}\sqrt{3}$ m
37. $10\sqrt{3}$ m; 10 m

38. 15 m

39. 120 m

40. $50(\sqrt{3}-1)$ m

41. 200 m

42. $46\sqrt{2}$ m

43. 42.42 m

44. 30°

45. 16 min 23 sec

46. 23.66 m

47. 31.7 m/min

48. $20(3+\sqrt{3})m$; $40(\sqrt{3}+1)$ m

EXTENDED LEARNING

1. 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) 15° (B) 30° (C) 45° (D) 60°

2. The angle of elevation of the top of a tree of height 18 m is 30° when measured from a point P in the plane of its base. The distance of the base of the tree from P is:

(A) 6m (B) $6\sqrt{3}$ m (C) 18 m (D) $18\sqrt{3}$ m

3. The angle of depression of a car parked on the road from the top of a 150 m high tower is 60°. 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

4. The length of shadow of a tower on the plane ground is $\sqrt{3}$ times of the height of the tower. The angle of elevation of sun is

(A) 45° (B) 30° (C) 60° (D) 90°

5. From the top of a cliff 25 m high the angle of elevation of a tower is found to be equal to the angle of depression of the foot of the tower. The height of the tower is

(A) $25m$ (B) $50m$ (C) $75m$ (D) $100m$

6. From the top of hill 200 m high, the angle of depression of the top and the bottom of a tower are observed to be 30° and 60°.The height of the tower is:

(A) 133.33m (B) 135.33m (C) 137.33m (D) 132.5 m

7. An observer 1.5 metres tall is 28.5 metres away from a tower 30 metres high. The angle of elevation of the top of the tower from the eye of the observer is :

(A) 30° (B) 60° (C) 45° (D) 90°

8. A man observes the elevation of a tower to be 30°. After advancing 11m towards it, he finds that the elevation is 45°. The height of the tower to be nearest metre is:

(A) 10 (B) 15 (C) 20 (D) 22

9. From the top of a pillar of height 20 m, the angles of elevation and depression of the top and bottom of another pillar are 30° and 45°,respectively.The height of the second pillar (in metres) is:

(A) $\frac{20}{\sqrt{3}}$ ($\sqrt{3}$ - 1) (B) 10 (C) $10\sqrt{3}$ (D) $\frac{20}{\sqrt{3}}$ ($\sqrt{3}$ + 1)

10. The angles of depression of two ships from the top of a light house are 45° and 30° towards east. If the ships are 100 m apart, the height of the light house is

(A) $\frac{50}{\sqrt{3}+1}$ (B) $\frac{50}{\sqrt{3}-1}$ (C) $50(\sqrt{3}-1)$ (D) $50(\sqrt{3}+1)$

11. The length of the shadow of a tower standing on level plane is found to be $2x$ metres longer when the sun's altitude is $30°$ than when it was $45°$. The height of tower is

(A) $x(\sqrt{3}+1)$ m (B) $x(\sqrt{3}-1)$ m (C) $x\sqrt{3}$ m (D) $x\sqrt{3}+1$ m

12. 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 $30^\circ$and 60°, then the height of the tower is

(A) $\sqrt{a+b}$ (B) $\sqrt{ab}$ (C) $\sqrt{a-b}$ (D) $\sqrt{\frac{a}{b}}$

13. It is found that on walking x meters towards a chimney in a horizontal line through its base, the elevation of its top changes from 30° to 60°. The height of the chimney is

(A) $3\sqrt{2}x$ (B) $2\sqrt{3}x$ (C) $\frac{\sqrt{3}}{2}x$ (D) $\frac{2}{\sqrt{3}}x$

14. From the top of a light house, the angles of depression of two ships on the opposite sides of it are observed to be 30° and 60°. If the height of the light house is h metres and the line joining the ships passes through the foot of the light house, the distance between the ships is

(A) $\frac{\sqrt{3}}{2}h$ (B) $\frac{4}{\sqrt{3}}h$ (C) $4\sqrt{3}h$ (D) $\frac{\sqrt{3}}{4}h$

15. If the shadow of a tower is 30 m long, when the sun's elevation is 30°. What is the length of the shadow, when sun's elevation is 60°?

(A) 10 m (B) 15 m (C) 20 m (D) 22 m

ANSWER KEY

1. C	**2.** D	**3.** A	**4.** B	**5.** B
6. A	**7.** C	**8.** A	**9.** D	**10.** D
11. A				
12. B				
13. C				
14. B				
15. A				

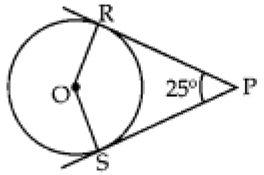
CHAPTER 10

CIRCLES

1. The distance between two parallel tangents of a circle of radius 4 cm is

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

2. In the given figure, if ∟RPS = 25°, the value of ∟ROS is



(a) 135° (b) 145° (c) 165° (d) 155°

3. A tangent is drawn from a point at a distance of 17 cm of circle C(0, r) of radius 8 cm. The length of its tangent is

(a) 5 cm (b) 9 cm (c) 15 cm (d) 23 cm

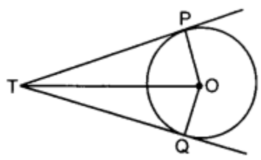
4. The length of tangents drawn from an external point to the circle:

(a) are equal (b) are not equal
(c) sometimes are equal (d) are not defined

5. Number of tangents drawn at a point of the , circle is/are

(a) one (b) two
(c) none (d) infinite

6. In the given figure, TP and TQ are two tangents to a circle with centre O, such that ∠POQ



= 110°. Then ∠PTQ is equal to

(a) 55° (b) 70°
(c) 110° (d) 90°

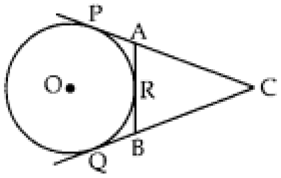
7. Tangents from an external point to a circle are

(a) equal (b) not equal
(c) parallel (d) perpendicular.

8. The length of a tangent drawn from a point at a distance of 10 cm of circle is 8 cm. The radius of the circle is

(a) 4 cm (b) 5 cm
(c) 6 cm (d) 7 cm

9. In given 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 = 6 cm then the length of BR is



(a) 6 cm (b) 5 cm
(c) 4 cm (d) 3 cm

10. From a point P which is at a distance of 13 cm from the centre O of a circle of radius 5 cm, the pair of tangents PQ and PR to the circle are drawn. Then the area of the quadrilateral PQOR is

(a) 60 cm^2 (b) 65 cm^2
(c) 30 cm^2 (d) 32.5 cm^2

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

11. Assertion: AB and CD are two parallel chords of a circle whose diameter is AC. Then AB ≠ CD.

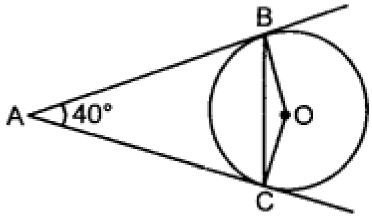
Reason : Perpendicular from the centre of a circle does not bisects the chord.

12. Assertion: If length of a tangent from an external point to a circle is 8 cm, then length of the other tangent from the same point is 8 cm.

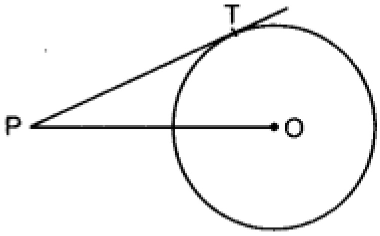
Reason: length of the tangents drawn from an external point to a circle are equal.

Solve the following :

1. In the given figure, AB and AC are tangents to the circle with centre O such that ∠BAC = 40°, then find ∠BOC



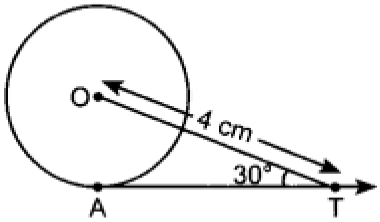
2. In the given figure, point P is 26 cm away from the centre O of a circle and the length PT of the tangent drawn from P to the circle is 24 cm. Then find the radius of the circle .



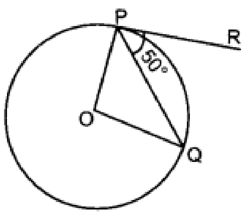
3. Two parallel lines touch the circle at points A and B respectively. If area of the circle is 25 cm^2, then find the length AB .

4. From a point P which is at a distance of 13 cm from the centre O of a circle of radius 5 cm, the pair of tangents PQ and PR to the circle are drawn. Then find the area of the quadrilateral PQOR

5. In figure AT is a tangent to the circle with centre O such that OT = 4 cm and ∠OTA = 30°. Then find AT

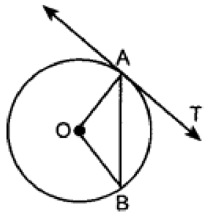


6. In figure if O is centre of a circle, PQ is a chord and the tangent PR at P makes an angle



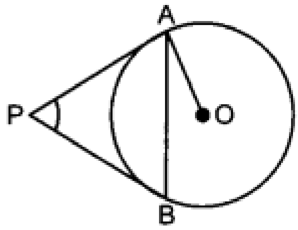
of 50° with PQ, then find the measure of ∠ POQ

7. In figure, O is the centre of a circle, AB is a chord and AT is the tangent at A. If ∠AOB =



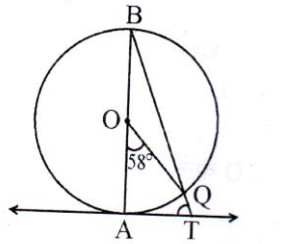
100°, then find the measure of ∠BAT

8. In the figure PA and PB are tangents to the circle with centre O. If ∠APB = 60°, then find ∠OAB



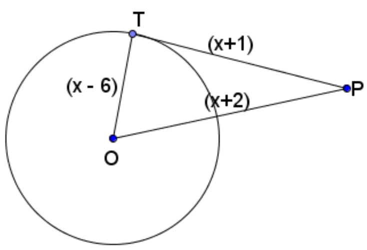
9. In figure, AB is a diameter of a circle with centre O and AT is a tangent.

If $\angle AOQ = 58°$, find $\angle ATQ$.



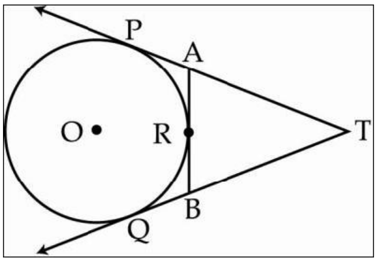
10. Tangents AC and AB are drawn to a circle from a point A such that ∠BAC = 30°. A chord BD is drawn parallel to the tangent AC. Find ∠DBC.

11. PA and PB are two tangents drawn from a point P to a circle with centre O touching it at A and B. If $\angle OAB = 20°$, find $\angle APB$.
12. A circle touches all the four sides of a quadrilateral ABCD whose sides AB, BC and CD have length (in cm) 6, 7 and 4 respectively, find the length of AD.
13. Find the length of side OP of the ΔOTP.

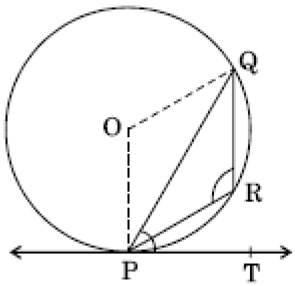


14. In two concentric circles, prove that all chords of the outer circle which touch the inner circle are of equal length.
15. TA and TB are two tangents drawn from a point T to a circle of radius 6 cm with centre O, touching it at A and B. If the length of the chord AB=6 cm, find $\angle ATB$.

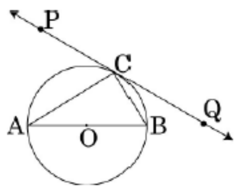
16. In the given figure, TP and TQ are tangents from T to the circle with centre O and R is any point on the circle. If AB is a tangent to the circle at R, prove that : TA +AR = TB +BR



18. In Figure, PQ is a chord of a circle with centre O and PT is a tangent. If ∠QPT = 60°, find ∠PRQ.



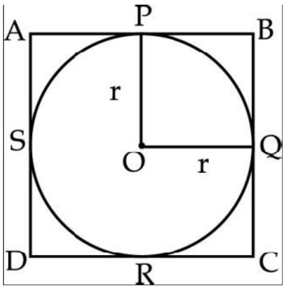
19. In figure, PQ is a tangent at a point C to a circle with centre O. If AB is a diameter and ∠CAB = 30°, find ∠PCA.



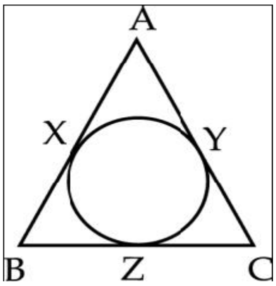
21. If PA and PB are two tangents drawn from a point P to a circle with centre O touching it at A and B, prove that OP is the perpendicular bisector of AB.
22. PA and PB are two tangents drawn from a point P to a circle with centre O touching it at A and B such that $\angle APB = 60°$. If AP = 5 cm, find the length of chord AB and also the radius of the circle.
23. 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. Find the radius of the circle. Also prove that OA and PQ are perpendicular bisectors of each other.
24. Two concentric circles are of radii $(3x + 5)$ and $(2x - 4)$cm where $(3x + 5) > (2x - 4)$. Length of the chord of the outer circle which touches the inner circle is 48 cm. Find the radii of the two circles.
25. PA and PB are two tangents drawn to a circle with centre O and radius r. If OP =

2r, show that ΔAPB is equilateral.

26. In the figure a circle is inscribed in a quadrilateral ABCD in which ∠B = 90°. If AD = 23 cm, AB= 29 cm and DS = 5 cm find the radius of the in-circle.



27. ABC is an isosceles triangle in which AB = AC which is circumscribed about a circle as shown in the figure. Show that BC is bisected at the point of contact.



ANSWER KEY

1. d 2. d 3. c 4. a 5. a 6. b 7. a 8. c 9. b 10. a 11. c

Part 2

1. 2. 10cm 3. 10 cm 4. 60 cm^2 5. $2\sqrt{3}$ cm^2

6. 100° 7. 50° 8. 30° 9. 61° 10. 75°

11. 40° 12. 3 cm 13. 13 cm 15. 120° 17. 120°

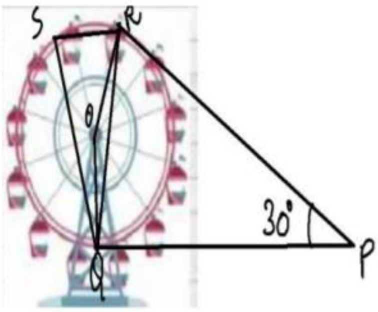
18. 60° 20. 5 cm, $\frac{5}{\sqrt{3}}$cm 21. 5 cm 22. 26 cm , 10 cm

24. 11 cm

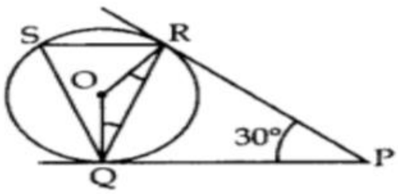
Case Study -1

A Ferris wheel (or a big wheel in the United Kingdom) is an amusement ride consisting of a rotating upright wheel with multiple passenger-carrying components (commonly referred to as passenger cars, cabins, tubs, capsules, gondolas, or pods) attached to the rim in such a way that as the wheel turns, they are kept upright, usually by gravity.

After taking a ride in Ferris wheel, Aarti came out from the crowd and was observing her friends who were enjoying the ride.She was curious about the different angles and measures that the wheel will form. She forms the figure as given below.



∟



1. In the given figure find ∟ROQ

2. Find ∟RQP

3. Find ∟RSQ

4. Find ∟ORP

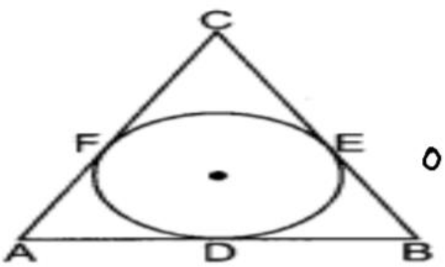
5. RQ represents

ANSWERS:

1. c) 150   2. a) 75   3. b) 75   4. a) 90   5. Chord

Case Study 2

Varun has been selected by his School to design logo for Sports Day T-shirts for students and staff . The logo design is as given in the figure and he is working on the fonts and different colours according to the theme. In given figure, a circle with centre O is inscribed in a ΔABC, such that it touches the sides AB, BC and CA at points D, E and F respectively. The lengths of sides AB, BC and CA are 12 cm, 8 cm and 10 cm respectively



1. Find the length of AD

2. Find the Length of BE

3. Find the length of CF

4. If radius of the circle is 4cm, Find the area of ΔOAB

5. Find area of ΔABC

ANSWERS:

1. a) 7 2. b) 5 3. d) 3 4. c) 24 5. b) 60

Reference Links:
http://ndl.iitkgp.ac.in/document/MjdNaThFWmViUEpmK2tZOFB4NW9ZaHBCTmg1b0tWZ0JjVzNsa1UxQlJSdz0
http://ndl.iitkgp.ac.in/document/VjlSR0F1TXBpVEV6MDQvYTBlN0xPTGpiQUtUZGRrQjBRa2NUSnh2eHorND0

EXTENDED LEARNING

1. The angle between two tangents drawn from an external point to a circle is 110°. The angle subtended at the centre by the segments joining the points of contact to the centre of circle is:

   (A) 70° (B) 90° (C) 55° (D) 110°

2. If tangents PA and PB from a point P to a circle with centre O are inclined to each other an angle of 70°, then find ∠POA.

   (A) 60° (B) 65° (C) 55° (D) 50°

3. What is the distance between two parallel tangents of a circle of the radius 4 cm?

   (A) 8cm (B) 4cm (C) 2cm (D) 6cm

4. The tangents drawn at the ends of a diameter of a circle are:

   (A) intersecting at a point inside the circle
   (B) perpendicular
   (C) intersecting at the centre of the circle
   (D) parallel

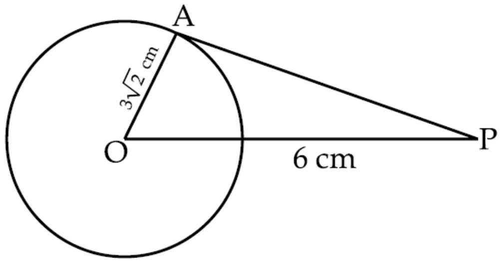
5. A circle touches all the four sides of quadrilateral ABCD whose sides are AB = 12 cm,BC = 15 cm, CD = 16 cm. The length of side AD is

   (A) 15 cm (B) 17 cm (C) 16.5 cm (D) 13 cm

6. The length of tangent drawn from a point 8 cm away from the centre of a circle of radius 6 cm is

   (A) $\sqrt{5}$ cm (B) 2 $\sqrt{5}$ cm (C) 5 cm (D) 2 $\sqrt{7}$ cm

7. A tangent PA is drawn from an external point P to a circle of radius $3\sqrt{2}$ cm such that the distance of the point P from O is 6 cm as shown in figure. The value of ∠APO is:



(A) 30° (B) 45° (C) 60° (D) 75°

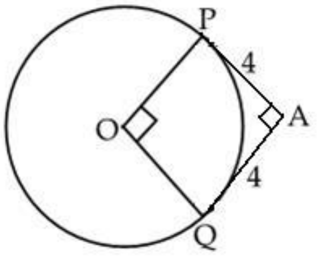
8. PQ is a tangent drawn from a point P to a circle with centre O and QOR is a diameter of the circle such that ∠POR=120°, then ∠OPQ is

(A) 60° (B) 30° (C) 90° (D) 45°

9. Two concentric circles of radii a and b (a > b) are given. The chord AB of larger circle touches the smaller circle at C. The length of AB is:

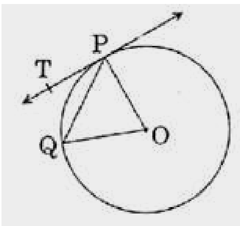
(A) $2\sqrt{a^2 - b^2}$ (B) $\sqrt{a^2 + b^2}$ (C) $\sqrt{a^2 - b^2}$ (D) $2\sqrt{a^2 + b^2}$

10. 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 4 cm, then the radius of the circle is



(A) 10 cm (B) 4 cm (C) 7.5 cm (D) 2.5 cm

11. If figure, O is the centre of a circle, PQ is a chord and PT is the tangent at P. If ∠POQ = 70°, then ∠TPQ is equal to

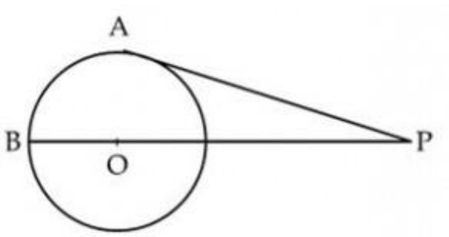


(A) 45° (B) 5° (C) 35° (D) 70°

12. If two tangents inclined at an angle of 60° are drawn to circle of radius 3 cm, the length of each tangent is equal to

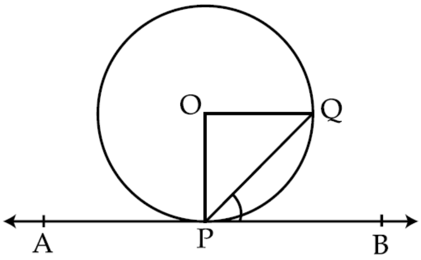
(A) $\frac{3\sqrt{3}}{2}$ cm (B) 6 cm (C) 3 cm (D) $3\sqrt{3}$ cm

13. In fig., PA is a tangent to a circle of radius 6 cm and PA = 8 cm, then length of PB is



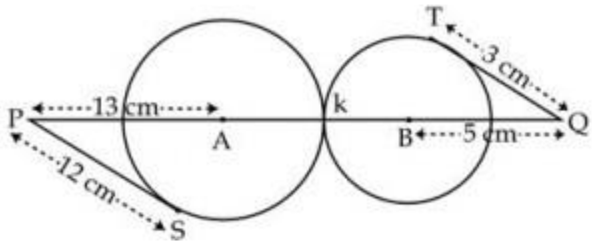
(A) 10cm (B) 16cm (C) 18cm (D) 12cm

14. In Fig., APB is a tangent to a circle with centre O, at point P. If $\angle QPB = 50°$, then the measure of $\angle POQ$ is :



(A) 120° (B) 100° (C) 140° (D) 150°

15. In fig., two circles with centres A and B touch each other externally at K. The length of PQ (in cm) is



(A) 24cm (B) 20cm (C) 27cm (D) 18cm

ANSWER KEY

1.	A	2.	C	3.	A	4.	D	5.	D
6.	D	7.	B	8.	B	9.	A	10.	B
11.	C	12.	D	13.	B	14.	B	15.	C

CHAPTER 11

AREA RELATED TO CIRCLES

MULTIPLE CHOICE QUESTIONS

Q1. If the area of a circle is 154 cm^2, then its circumference is

(A) 11 cm (B) 22 cm (C) 44 cm (D) 55 cm

Q2. Area of the largest triangle that can be inscribed in a semi-circle of radius r units is

(A) r^2 sq. units (B) ½ r^2 sq. units (C) 2 r^2 sq. units (D) 2 r^2 sq. units

Q3. A pendulum swings through an angle of 30° and describes an arc 8.8 cm in length. .

The length of the pendulum is

(A) 16.8 cm (B) 18.6 cm (C) 44.5 cm (D) 15.6 cm

Q4. The area of the square that can be inscribed in a circle of radius 8 cm is

(A) 256 cm^2 (B) 128 cm^2 (C) 64 $\sqrt{2}$ cm^2 (D) 64 cm^2

Q5. The area of a sector of circle of radius 21 cm and central angle 120°is

(A) 462 cm^2 (B) 128 cm^2 (C) 644$\sqrt{2}$ cm^2 (D) 64 cm^2

Q6. The ratio of the circumference to its diameter is defined as _____________.

It is a / an _______number.

(A) π ,Rational (B) π , Irrational (C) $\frac{22}{7}$, Rational (D) $\frac{22}{7}$, Irrational

Q7.The angle through which the minute hand of the clock moves 8 to 8:35

(A) 210° (B) 90° (C) 60° (D) 45°

Q8.The area of circle that can be inscribed in a square of side 6 cm is

(A) 36π cm^2 (B) 18 π cm^2 (C) 12 π cm^2 (D) 9 π cm^2

Q9.An arc of the circle is of length 5 π and the sector it bounds has an area of 20 π m^2

The radius of the circle is

(A) 1 m (B) 5 m (C) 8 m (D) 10 m

Q10.A chord 10 cm long is drawn in a circle whose radius is $5\sqrt{2}$ cm.Find the area of minor segment .

(A) 16 cm^2 (B) 14.29 cm^2 (C) 14.25 cm^2 (D) 16.25 cm^2

ASSERTION AND REASONING QUESTIONS

Directions: 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.

Q11. Assertion (A): The length of the minute hand of a clock is 7 cm ,then the area swept by the minute hand in 5 minute is $\frac{77}{6}cm^2$.

Reason (R): The length of an arc of a sector of angle q and radius r is given by

$$l = \frac{\theta}{360^\circ} \times 2\pi r$$

Q12. Assertion (A): If the circumference of a circle is 176 cm, then its radius is 28 cm.

Reason (R): Circumference = 2π × radius.

Q13. Assertion (A): If a wire of length 22 cm is bent in the shape of a circle, then area of the circle so formed is $40cm^2$.

Reason (R): Circumference of the circle = length of the wire.

Q14. Assertion (A): In a circle of radius 6 cm, the angle of a sector is 60°. Then the area of the sector is $\frac{132}{7}cm^2$.

Reason (R): Area of the circle with radius r is πr^2.

SHORT ANSWER TYPE QUESTIONS

Q15.The perimeter of a sector of a circle with radius 6.5 cm is 31cm ,then find the area of the sector .

Q16. The perimeter of a semi circular protactor is 72 cm.Find the measure of its diameter.

(Use $\pi = 3.14$)

Q17. The area of a sector of a circle of radius 36 cm is 54 π cm^2 . Find the length of the corresponding arc of the sector.(EXPRESS IN TERMS OF π) .

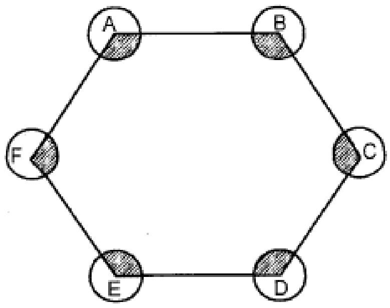
Q18. The minute hand of a clock is 3.5 cm long . What is the angle described by the minute hand in 20 minutes.

Q19. The perimeter of a sector of a circle of radius 5.2cm is 16.4 cm. Find the area of the sector.

Q20. A cow is tied with a rope of length 14 m at the corner of a rectangular field of dimensions 20m × 16m. Find the area of the field in which the cow can graze. (Use $= \frac{22}{7}$)

Q21. Find the area of the sector of a circle of radius 5 cm, if the corresponding arc length is 3.3 cm.

Q22. ABCDEF is a regular hexagon with verticals A, B, C, D, E, F as the centres, circles of same radius r are drawn. Find the area of the shaded portion. (Give answer in π only)

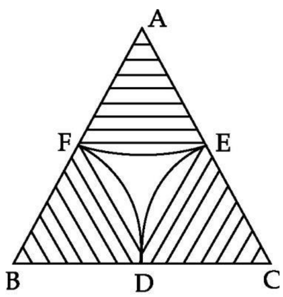


Q23. A piece of wire 20 cm long is bent into the form of an arc of a circle subtending an angle of 60° at its center. Find the radius of the circle.

Q24.Area of a sector of central angle 200° of a circle is 770 cm^2 . Find the length of the corresponding arc of this sector.

<u>LONG ANSWER QUESTIONS</u>

Q25. In given figure, arcs are drawn by taking vertices A, B and C of an equilateral triangle of side 10 cm. to intersect the sides BC, CA and AB at their respective mid-points D, E and F. Find the area of the shaded region (Use π = 3.14).



Q26. A sector is cut from a circle of radius 21 cm .The angle of the sector is 150°.

Find the length of its arc and the area?

Q27. The minute hand of a clock is 10 cm long. Find the distance covered by the tip of the minute hand between 9am and 9:35am?

Q28. Find the area of the minor segment of a circle of radius 14cm, when the central angle is 60^0.

Also find the area of the corresponding major segment.

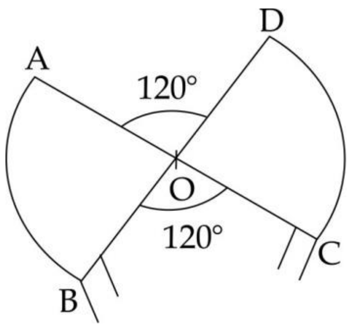
Q29. Find the distance covered by the tip of the minute hand, 14cm long in a day.

Q30. Find the area of a quadrant of a circle whose circumference is 44 cm.

Q31. A chord of a circle of radius 20 cm subtends an angle of 90° at the center.

Find the area of the corresponding major segment of the circle. (Use $\pi = 3.14$).

Q32. A table in a restaurant has a top of the shape as shown in the figure, where $\angle AOD = 120°$ and $OA = OB = OC = OD = 60$ cm. Find the perimeter of the top of the table. (Take $\pi = 3.14$).



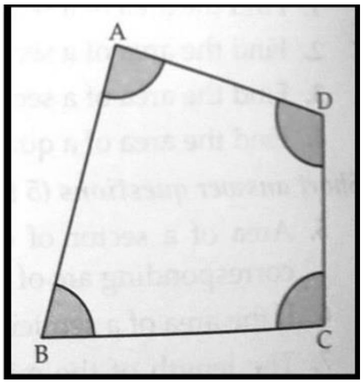
Q33. What is the ratio of the radii of two circles at the centre of which two arcs of the same length subtend angles of 60° and 75°?

Q34. The length of the minute hand of a clock is 5 cm. Find the area swept by the minute hand during the time period 6 : 05 a m and 6 : 40 a m. **(CBSE SAMPLE PAPER 2022-23)**

Q35. Sides of a triangular field are 15 m, 16 m and 17 m. With the three corners of the field a cow, a buffalo and a horse are tied separately with ropes of length 7 m each to graze in the field. Find the area of the field which cannot be grazed by the three animals.

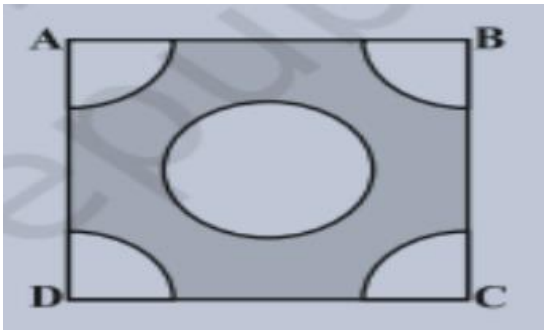
Q36. In the given figure, arcs have been drawn of radius 7cm each with vertices A, B, C and D of quadrilateral ABCD as centres. Find the area of the shaded region.

(CBSE SAMPLE PAPER 2022-23)



CASE STUDY 1

Sangeeta made a design on the red carpet. In each corner of a square carpet of side 4m , a quadrant of a circle of radius 1m is colored black and a circle of diameter 2m is colored yellow as shown in figure.



Answer the following questions : $Use\ \pi = 3.14$

(i) Find the area of square ABCD.

(ii) Find the area of each quadrant with radius 1m.

(iii) Find the angle subtended by a quadrant.

(iv) Find the area of the remaining portion of the square.

CASE STUDY 2

Pendulum Clock: It is a clock that uses a pendulum, a swinging weight, as its time keeping element. 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 7cm and 6 cm long respectively.

(i) Find the area swept by the minute hand in 10 minutes.

(ii) Find the angle described by hour hand in 10 minutes.

(iii) Find the distance covered by the tip of hour hand in 3.5 hours.

(iv)If the tip of pendulum covers a distance of 66 cm in complete oscillation, then find the angle described by pendulum at the centre.

CASE STUDY 3

Sprinkler: An irrigation sprinkler (also known as a water sprinkler or simply a sprinkler) is a device used to irrigate agricultural crops, lawns, landscapes, golf courses, and other areas. A water sprinkler is set to shoot a stream of water a distance of 21 m and rotate through an angle of 80 degrees.

(i) What is the area of the lawn it waters?

(ii) For r = 28 m, what angle is required to water equal to previous area?

(iii) If the area of the garden to be sprinkled is 308 sq. m and it can shoot upto 21m then find the angle through which it must rotate?

ANSWERS

Multiple choice Question

1. C , 44cm	2. A , r^2 sq. units	3. A , 16.8 cm	4. B , 128 cm^2	5. A , 462 cm^2
6. B , π , Irrational	7. A , 210°	8. D , $9\pi\ cm^2$	9. C , 8 m	10. B , 14.29 cm^2

Assertion And Reasoning Questions

11. B	12. A	13. B	14. B

Short Answer Type Questions

15. 58.5 cm^2	16. 28 cm	17. 3π	18. 120°	19. 15.6 cm^2
20. 154 m^2	21. 8.75cm^2	22. $2\pi r^2$.	23. $60/\pi$	24. 770cm^2

Long Answer Questions

25. 39.2cm^2	26. 55 cm, 577.5 cm^2	27. 183.3cm^2	28. 598.11cm^2	29. 88 cm	30. 154.06 cm^2
31. 1142cm^2	32. 252.56cm	33. 5 : 4	34. $45\frac{5}{6}\ cm^2$	35. $(24\sqrt{21}-77)m^2$	36. 154cm^2

Case study 1 :

1. 16m^2	2. 0.785m^2	3 . 90	4 . 9.72 m^2

Case study 2

1. 25.6 cm^2	2. 60°	3 . 2.2 cm	4 . 84°

Case study 3

1. 154cm^2	2. 22.5°	3. 160°

Reference link:

Solving problems involving circles

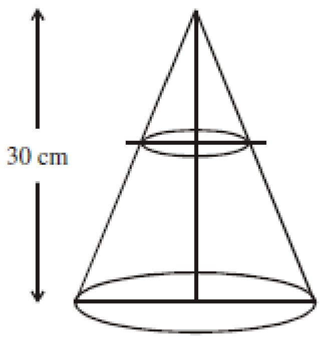
http://ndl.iitkgp.ac.in/document/V2JlWG5ES2wyYnlEZ0lCSlRGSG9QcDhmYnRSREI3WkZnQlkrbUttNzNIZz0

Area of composite shapes involving area of the sector

http://ndl.iitkgp.ac.in/document/Vis5bTFZMC9CQ09qTFVkd0RKSEtPOUh1YllqOWlYQXUxQmYrQ1BDS1FJQT0

CHAPTER 12
SURFACE AREAS AND VOLUMES

1. How many balls, each of radius 1 cm, can be made from a solid sphere of lead of radius 8 cm?
2. If the area of three adjacent faces of a cuboid are X, Y and Z respectively, then find the volume of the cuboid.
3. Find the ratio of the volume of a cube to that of the sphere which fits inside the cube.
4. A cubical block of side 10 cm is surmounted by a hemisphere. What is the largest diameter of the hemisphere? Find the cost of painting the TSA of the solid so formed at the rate Rs 5 per 100 sq. cm. (use $\pi = 3.14$)
5. Two cones with same base radius 8 cm and height 15 cm are joined together along their bases. Find the surface area of the shape so formed.
6. A solid is in the form of a right circular cylinder with hemispherical ends. The total height of the solid is 58 cm and the diameter of the cylinder is 28 cm. Find the total surface area of the solid.
7. A barrel of a fountain pen, cylindrical in shape is 7 cm long and 5 mm in diameter. A full barrel of ink pen is used up on writing 3300 words on an average. How many words can be written in a bottle of ink containing one fifth of a litre.
8. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimension of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm. Find the volume of the wood in the entire stand.
9. A toy is in the form of a cone mounted on a hemisphere of radius 3.5 cm.The total height of the toy is 15.5 cm. Find its surface area.
10. A shuttle cock used for playing badminton has a shape of frustum of a cone mounted on a hemisphere. The external diameters of the frustum are 5 cm and 2 cm and the height of the entire shuttle cock is 7 cm. Find its external surface area.
11. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder. If the height of the cylinder is 12 cm and its base is of radius 4.2 cm.Find the total surface area of the article. Also, find the volume of wood left in the article.
12. In figure, is shown a cone of height 30 cm. A small cone is cut off from the top by a plane parallel to its base. If the volume of the small cone is $\frac{1}{27}$ of the volume of the given cone, find at what height above the baes is the section made?

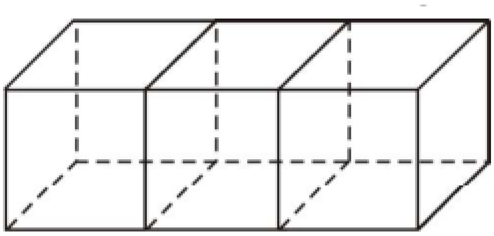


13. A building is in the form of a cylinder surrounded by a hemispherical dome and contains $14\frac{19}{21}$ m^3 of air. If the internal diameter of the building is equal to its total height above the floor. Find the height of the building.
14. An ice-cream cone consists of a right circular cone of height 14 cm and diameter of the circular top is 5 cm. It has hemisphere on the top with the same diameter as of circular top. Find the volume of ice-cream in the cone.
15. A spherical glass vessel has a cylindrical neck 7 cm and 4 cm in diameter. The diameter of the spherical part is 21 cm. Find the quantity of water in litres it can hold.
16. A factory manufactures 1,20,000 pencils daily. The pencils are cylindrical in shape, each of length 25 cm and circumference of the base as 1.5 cm. Find the cost of colouring the CSA of the pencils manufactured in one day at Rs 0.05 per dm^2.
17. Water is flowing at the rate of 15 km/h through a pipe of diameter 14 cm into a rectangular tank which is 50 m long and 44 m wide. Find the time in which the level of water in the tank will rise by 21 cm?
18. Water in a canal, 6 m wide and 1.5 m deep, is flowing at a speed of 4 km/hr. How much area will it irrigate in 10 minutes if 8 cm of standing water is required?
19. A plate of metal 1 cm thick ,9 cm broad and 81 cm long is melted into a cube. Find the difference in the surface area of the two solids.
20. A solid iron pole having cylindrical portion 220 cm high and of base diameter 24 cm is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pole, given that mass of 1 cm^3 of iron is 8 kg. (Use $\pi = 3.14$).
21. There are two identical solid cubical boxes of side 7cm. From the top face of the first cube a hemisphere of diameter equal to the side of the cube is scooped out. This hemisphere is inverted and placed on the top of the second cube's surface to form a dome. Find

    (i) the ratio of the total surface area of the two new solids formed

    (ii) volume of each new solid formed. **(CBSE SAMPLE PAPER 2022)**

22. A lampshade is made by cutting the top of a hollow cone by a plane parallel to its base. The radii of the top and the base of the shade are 4 cm and 12 cm and the height of the shade is 6 cm. Find the area of the curved surface of the lampshade.
23. Due to heavy floods in a state, thousands were rendered homeless. 50 schools collectively decided to provide place and the canvas for 1500 tents and share the whole expenditure equally. The lower part of each tent is cylindrical with base radius 2.8 m and height 3.5 m and the upper part is conical with the same base radius, but of height 2.1 m. If the canvas used to make the tents costs ₹120 per m sq, find the amount shared by each school to set up the tents. **(CBSE SAMPLE PAPER 2022)**
24. Three cubes of side 6 cm each, are joined .Find the total surface area of the resulting cuboid.



(**CBSE PAPER 2022)**

25. From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid.
(**CBSE PAPER 2022)**
26. **ASSERATION AND REASONING**

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) & Reason (R) are true, and Reason (R) is the correct explanation of Assertion(A).

(b) Both Assertion (A) & 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.

27. **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 = $\sqrt{h^2 + r^2}$

28. **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 = $(2\pi rh + 2\pi r^2)$.

29. **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.

30. **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 = Volume of one ball / Volume of lead

31. **Assertion:** If a ball is in the shape of a sphere has a surface area of 221.76 cm2, then its diameter is 8.4 cm.
Reason: If the radius of the sphere be r, then surface area, $S = 4\pi r^2, i.e.,$
$r = \sqrt{(S/4\pi)}$

ANSWERS

1. 512 **2.** $\sqrt{XYZ}$ **3.** **6 : π** **4.** Rs 33.90 **5.** 854.08 cm^2
6.5104cm^2 **7.** 480000 **8.** 523.532cm^2 **9**. 214.5cm^2 **10.** 74.5cm^2
11. 538.56cm^2, 354.816cm^3 **12.** 20 cm **13.** 4 m **14.** 124.4 cm^3
15. 3.73 litres (approx.) **16.** Rs 2250 **17.** 2 hours **18.** 750000 m^2
19. 1152cm^2 **20.** 892.26 kg **21**. (i) 1:1 (ii) $\frac{1519}{6}cm^3, \frac{2597}{6}cm^3$
22. 502.85cm^2 **23.** Rs332, 640 **24.** 504 cm sq. **25.** 2024 cm sq.

ASSERATION AND REASONING ANSWERS

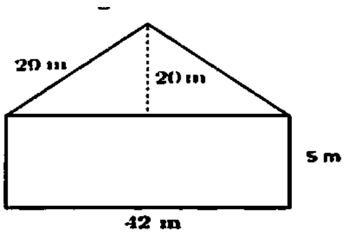
27.d **28.a** **29.d** **30.c** **31.a**

CASE STUDY 1	Q1 1914 sq. m	Q2 660 sq. m	Q3 231
CASE STUDY II	Q1 5 m	Q2 264 cu. m	Q3 66 m^2

CASE STUDY QUESTION 1

Kumbh Mela is a major pilgrimage and festival of Hinduism .It is celebrated in a cycle of approximately 12 years. The festival is marked by a ritual dip in the holy waters. The government of UP planned to procure tent for the pilgrims during Kumbh Mela .The specification of the tent is given below.

Top conical part has a thick fabric whose cost is Rs. 60 per square meter .Lower cylindrical part has PVC coated fabric whose cost is Rs.70 per square meter. The front view section of tent is given below with dimensions :



Q1.How much thick fabric is required ?

Q2. How much PVC coated fabric is required?

Q3. If space requirement of a pilgrims is 6 sq. m , how many pilgrims can be accommodate in a tent ?

CASE STUDY QUESTION 2

A village contractor was given a work of digging a well of diameter 4m and 21 m deep . He was asked to spread evenly the earth taken out around the well to form an embankment in the shape of a circular ring of width 3m. Answer the following questions

Q1. Find the radius of the outer ring ?

Q2.Find the volume of earth taken out from the well?

Q3. Find the area of the ring?Top of Form

EXTENDED LEARNING

1. The number of solid spheres, each of diameter 6 cm that can be made by melting a solid metal cylinder of height 45 cm and diameter 4 cm is:

   (A) 2 (B) 5 (C) 4 (D) 6

2. Volumes of two spheres are in the ratio 64:27. The ratio of their surface areas is:

   (A) 3 : 4 (B) 4 : 3 (C) 9 : 16 (D) 16 : 9

3. A cylindrical pencil sharpened at one edge is the combination of

   (A) a cone and a cylinder (B) frustum of a cone and a cylinder

   (C) a hemisphere and a cylinder (D) two cylinders.

4. The height of a conical tent of the centre is 5cm. The distance of any point on its circular base from the top of the tent is 13m. The area of the slant surface is:

   (A) 144 π sq m (B) 130 π sq m (C) 156 π sq m (D) 169 π sq

5. A hemispherical bowl of internal diameter 36 cm is full of some liquid. This liquid is to be filled in cylindrical bottles of radius 3 cm and height 6 cm., Then no of bottles needed to empty the bowl.

   (A) 36 (B) 72 (C) 18 (D) 144

6. A spherical iron ball is dropped into a cylindrical vessel of base diameter 14 cm, containing water. The level is increased by $9\frac{1}{3}$ cm. What is the radius of the ball?

   (A) 3.5 cm (B) 7 cm (C) 9 cm (D) 12 cm

7. If a rectangular sheet of paper 44 cm × 22 cm is rolled along its length of form a cylinder, then the volume of cylinder in cm^3 is

   (A) 1694 (B) 3080 (C) 3388 (D) none of these

8. A water tank is hemispherical at the bottom and cylindrical on the top of it.The radius is 12 cm.If the total capacity is 3312 πm^3, then the capacities of the two portions are in ratio:

   (A) 8 : 9 (B) 8 : 11 (C) 8 : 13 (D) 8 : 15

9. The height of a solid cylinder is 15 cm and the diameter of its base is 7 cm. The two equal conical holes each of radius 3 cm and height 4 cm are cut off. Find the volume of the remaining solid.

   (A) 438.8 cm^3 (B) 550.4 cm^3 (C) 502.1 cm^3 (D) 471.4 cm^3

10. 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 upto its brim. How many children will get the ice cream cones?

(A) 163 (B) 263 (C) 363 (D) 463

11. 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

12. A mason constructs a wall of dimensions 270cm× 300cm × 350cm with the bricks each of size 22.5cm × 11.25cm × 8.75cm and it is assumed that $\frac{1}{8}$ space is covered by the mortar. Then the number of bricks used to construct the wall is:

(A) 11100 (B) 11200 (C) 11000 (D) 11300

13. A medicine-capsule is in the shape of a cylinder of diameter 0.5 cm with two hemispheres stuck to each of its ends. The length of entire capsule is 12 cm. The capacity of the capsule is

(A) 0.36 cm^3 (B) 0.35 cm^3 (C) 0.34 cm^3 (D) 0.33 cm^3

14. The diameters of the two circular ends of the bucket are 44 cm and 24 cm. The height of the bucket is 35 cm. The capacity of the bucket is

(A) 32.7 litres (B) 33.7 litres (C) 34.7 litres (D) 31.7 litres

15. The radii of the top and bottom of a bucket of slant height 45 cm are 28 cm and7 cm, respectively. The curved surface area of the bucket is

(A) 4950 cm^2 (B) 4951 cm^2 (C) 4952 cm^2 (D) 4953 cm^2

EXTENDED LEARNING

1. B	**2.** D	**3.** A	**4.** C	**5.**B
6.B	**7.** C	**8.** A	**9.**C	**10.**C
11.D	**12.**B	**13.** A	**14.** A	**15.**A

LINK FOR E – RESOURCES

Surface Area And Volume (Introduction)
http://ndl.iitkgp.ac.in/document/eHVJQ0YyM05ZNFl5bjhyd3V2U3AvelVTT09WTno2c09odlgvTUJqZUExUT0

Surface Area of Cube and Cuboid
http://ndl.iitkgp.ac.in/document/UU9xUURTQ0dyTnozKytGUVIwOXBTaG5HbzQ4cmYwYmpIeU1qalgybjNacz0

Surface Area of Right Circular Cylinder
http://ndl.iitkgp.ac.in/document/OFhzdlhVeWQrMTFXOHVlVlRaNy9sNzk4RDdrdTVrRGRwdVhNWERHbGV3az0

http://www.mathopenref.com/cylinderarea.html

Surface Area of Right Circular Cone
http://ndl.iitkgp.ac.in/document/WlRJVk05TS9INmpWYi84eWVqSzBJOUE2aGhGdTNTNUdmL1RRU05haStMST0

Surface Area of a Sphere And Hemisphere
http://ndl.iitkgp.ac.in/document/U293UTVRczNYR0UrMzVieEpuRmRSaVhTaUhpQkF2Ny9YS29GSldXa3ZoTT0

Volume of Cube and Cuboid
http://ndl.iitkgp.ac.in/document/MVF0cyt1Ukd3MWtLdTQvb01uZk1RczJncHROYzNDamFHRDZBMEJkeDV2RT0

Volume of Right Circular Cylinder
http://ndl.iitkgp.ac.in/document/LzFaK09UMzdQZkx2NWhsZkNKNGZJWFM4aEZOSktsdCtaaWgyMGNPd3R3MD0

http://www.mathopenref.com/cylindervolume.html

Volume of a Cone
http://ndl.iitkgp.ac.in/document/Q0pnd29qYzA1TmIxSFFZYjc3N2Fpbi9FYS92RS8vSGNldExyZ1FiY0JhVT0

Volume of a Sphere
http://ndl.iitkgp.ac.in/document/V21ndS96SG45Sk5nY2RGZit1NktiT0JSK0FKMEFla2sxSERPemVGenp2dz0

CHAPTER 14

STATISTICS

OBJECTIVE QUESTIONS

MCQ (Q1-Q10)

1. Mean of 100 items is 49. It was discovered that three items which should have been 60, 70, 80 were wrongly read as 40, 20, 50 respectively. The correct mean is

(a) 48 (b) 49 (c) 50 (d) 60

2. For the following distribution

Cl	0-5	5-10	10-15	15-20	20-25
f	10	15	12	20	9

the difference of the upper limit of the median class and the lower limit of the modal class is

(a) 0 (b) 5 (c) 10 (d) -5

3. What should be the modal class

Cl	0-10	10-20	20-30	30-40	40-50
f	6	5	20	28	19

(a) 10-20 (b) 30-40 (c) 20-30 (d) 40-50

4. If 35 is removed from the data, 30, 34, 35, 36, 37, 38, 39, 40 then the median increases by:

(a) 2 (b) 1.5 (c) 1 (d) 0.5

5. If the sum of all the frequencies is 24, then the value of z is:

$Variable\ (x)$	1	2	3	4	5
$Frequency$	z	5	6	1	2

(a) 4 (b). 6 (c) 8 (d) 10

6. The average weight of a group of 25 men was calculated to be 78.4 kg. It was discovered later that one weight was wrongly entered as 69 kg instead of 96 kg. What is the correct average?

(a) 75.76 (b) 77.56 (c) 79.48 (d) 80.30

7. The mode of the following data is:

x_i	10	14	18	21	25
f_i	10	15	7	9	9

(a) 16 (b) 14 (c) 12 (d) 10

8. Which of the following is not a measure of central tendency?

(a) Mode (b) Range (c) Median (d) Mean

9. The mean of 20 observations was 60. It was detected on rechecking that the value of 125 was wrongly copied as 25 for computation of mean. Find the correct mean

(a) 67 (b) 66 (c) 65 (d) 60

10. For the following distribution

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	3	9	13	10	5

the number of students who got marks less than 30 is

(a) 13 (b) 25 (c) 10 (d) 12

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

11. Assertion: If the value of mode and mean is 60 and 66 respectively, then the value of median is 64.

Reason: Median = (mode + 2 mean)/2

12. Assertion: If the median of the given data 26, 29, 42, 53, x, x + 2, 70, 75, 82, 93, is 65 then the value of x is 64.

Reason : When the number of observations(n) is odd the median is the value of the $\frac{n+1}{2}$ th observation.

Solve the following :

1. Calculate the mean of the scores of 20 students in a Mathematics Test:

Marks:	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of students:	2	4	7	6	1

2. Calculate the arithmetic mean of the following frequency distribution:

Class:	0 – 100	100 – 200	200 – 300	300 – 400	400 – 500
Frequency:	12	20	45	38	35

3. Find the mean marks of the following data:

Marks:	Below 20	Below 40	Below 60	Below 80	Below 100
Number of students:	15	31	55	70	80

4. Calculate the arithmetic average for the following data by Step-deviation Method:

Marks:	70	60	50	40	30	20
Number of students:	7	18	40	40	63	65

5. Determine the mean of the following distribution:

Marks:	< 10	<20	<30	<40	<50	<60	<70	<80	<90	<100
Number of students:	5	9	17	29	45	60	70	78	83	85

6. In the following distribution, the frequency of the class interval (40 – 50) is missing. It is known that the mean of the distribution is 52.Find the missing frequency.

Wages(in Rs)	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No: of workers:	5	3	4	x	2	6	13

7. If the mean of the following frequency distribution is 188,find the missing frequencies.

Classes	0 – 80	80 – 160	160 – 240	240 – 320	320 – 400	Total
Frequency	20	25	f_1	f_2	10	100

8. Calculate the median from:

Marks:	0 – 10	10 – 30	30 – 60	60 – 80	80 – 100
Number of students:	5	15	30	8	2

9. Find the median of the following frequency distribution:

Classes:	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency:	3	4	2	5	6

10. Find the median wage of a worker from the following distribution table:

Wages(in Rs)	More than 150	More than 140	More than 130	More than 120	More than 110	More than 100	More than 90	More than 80
No. of workers :	0	10	29	60	104	134	151	160

11. If the median of the following frequency distribution is 28.5,find the values of $x \text{ and } y$ **:**

Class Interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	Total
Frequency	5	x	*20*	*15*	Y	5	60

12. Find the missing frequencies f_1 *and* f_2 in the following distribution. It is given that median of the distribution is 41 and the total number of observations is 82.

Class Interval	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	Total
Frequency	10	f_1	*15*	*20*	f_2	11	82

13. Find the mode of the following data:

Class Interval	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Frequency:	6	8	12	10	6

14. The weight of coffee in 70 packets are shown in the following data. Find the mode.

Weight(in grams):	200-201	201-202	202-203	203-204	204-205	205-206
No.of packets:	12	26	20	9	2	1

15. 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
No. of students :	7	21	34	46	66	77	92	100

16. Find the missing frequency of the following data if the mode is 48.6 :

Class Interval:	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85
Frequency :	6	20	44	y	3

17. Determine the missing frequencies f_1 *and* f_2 from the following data, when mode is 67 and the total number of frequencies is 47.

Classes:	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
Frequency:	5	f_1	15	f_2	7

18. The Median and Mode of the following wage distribution are known to be Rs 33.5 and Rs 34 respectively. Three frequencies values from the table are however, missing. Find out the missing frequencies.

Wages:	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	Total
No: of persons:	4	16	x	Y	z	6	4	230

19. Find the mean, median and mode of the following distribution:

Classes:	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Frequency:	4	5	7	10	12	8	4

20. Find A and B

$Classinterval$	$Classmark$
$0-5$	A
$5-10$	B
$10-15$	12.5
$15-20$	17.5

21. Find the mean.

Class interval	5-15	15-25	25-35	35-45	45-55	55-65
Frequency	6	11	21	23	14	4

22. Write the following distribution as 'less than type' cumulative frequency distribution:

Class Interval:	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
Frequency:	5	3	4	3	3	4	7	8

23. Write the following distribution as 'more than type' cumulative frequency distribution :

Class Interval:	50 – 55	55 – 60	60 – 65	65 – 70	70 – 75	75 – 80
Frequency:	2	6	8	14	15	5

24. Find the mean of 32 numbers given mean of ten of them is 12 and the mean of other 20 is 9 and mean of last 2 numbers is 10.

25. The following observations are arranged in ascending order :
20, 23, 42, 53, x, x + 2, 70, 75, 82, 96.If the median is 63, find the value of *x*.

ANSWERS

OBJECTIVE QUESTIONS

1. (c) 2.(a) 3. (b) 4. (d) 5. (d) 6. (c) 7. (b) 8. (b) 9. (c) 10. (b)

11. (c) 12. (a)

ANSWER KEY

1.35 **2**. 292.67 **3.** 47.25 **4.** 50.85 **5.** 48.41

6. 7 **7.** $f_{1} = 15$, $f_{2} = 30$ **8.** 40. **9.** 32 **10.** Rs 115.45

11. $x = 8, y = 7$ **12.** $f_{1} = 14$, $f_{2} = 12$. **13.** 53.33 **14.** 201.7 kg **15.**44.7

16. 26 **17.** $f_{1} = 8$, $f_{2} = 12$. **18.** $= 950$, $y = 100$ **,** z = 40

19. Mean= 37.2, Median= 39, Mode= 43.33 **20.** 2.5 ,7.5

21. 35.375 24. 10 25. 62

Case Study 1

COVID-19 Pandemic The COVID-19 pandemic, also known as coronavirus pandemic, is an ongoing pandemic of coronavirus disease caused by the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) among humans.

The following tables shows the age distribution of case admitted during a day in two different hospitals

Table 1

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
No. of cases	6	11	21	23	14	5

Table 2

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
No. of cases	8	16	10	42	24	12

Refer to table 1

1. The average age for which maximum cases occurred is

2. The upper limit of modal class is

3. The mean of the given data is

Refer to table 2

4. The mode of the given data is

5. The median of the given data is

ANSWERS

1. c) 36.82   2. d) 45   3. d) 35.4   4. a) 41.4   5. b) 40.2

<u>CASE STUDY 2:</u>

Electricity energy consumption is the form of energy consumption that uses electric energy. Global electricity consumption continues to increase faster than world population, leading to an increase in the average amount of electricity consumed per person (per capita electricity consumption).

Tariff	: LT - Residential	Bill Number	: 384756
Type of Supply	: Single Phase	Connected Load	: 3 kW
Meter Reading Date	: 31-11-13	Meter Reading	: 65789
Previous Reading Date	: 31-10-13	Previous Meter Reading	: 65500
		Units Consumed	: 289

A survey is conducted for 56 families of a Colony A. The following tables gives the weekly consumption of electricity of these families.

Weekly consumption (in units)	0-10	10-20	20-30	30-40	40-50	50-60
No. of families	16	12	18	6	4	0

The similar survey is conducted for 80 families of Colony B and the data is recorded as below:

Weekly consumption (in units)	0-10	10-20	20-30	30-40	40-50	50-60
No. of families	0	5	10	20	40	5

<u>Refer to data received from Colony A</u>

1. The median weekly consumption is

2. The mean weekly consumption is

3. The modal class of the above data is I

Refer to data received from Colony B

4. The modal weekly consumption is

5. The mean weekly consumption is

ANSWERS

1. c) 20 units 2. a) 19.64 units 3. c) 20-30 units 4. b) 43.6 units 5. c) 38.75 units

Reference Links:

Introduction:

http://ndl.iitkgp.ac.in/document/NkNtUk9CWmtpenRtTDRSaGczOHIzT3Noa3FEUlJjMmYvZm82MXNNUzNJUT0

Mean:

http://ndl.iitkgp.ac.in/document/RnlYNXdmQWcxSlplUTRQRUd4bEMxa2VqeGZiQmU3dW0rd1hyT1d1eTFYVT0

CHAPTER 14- PROBABILITY

ASSIGNMENT

Choose the correct answer from the given four options

1. An event is very unlikely to happen, its probability is closest to

(A) 0.0001 (B) 0.001 (C) 0.01 (D) 0.1

2. If an event occurs surely, then its probability is

(A) 0 (B) 1 (C) ½ (D) ¾

3. The probability of getting a perfect square number from the numbers 1 to 10 is :

(A) 3/10 (B) ½ (C) 2/5 (D) 1/5

4. Two dice are thrown simultaneously, the probability of getting a doublet is

(A) 5/36 (B) 1/12 (C) 1/9 (D) 1/6

5. The probability of getting a bad egg in a lot of 400 eggs is 0.035. The number of bad eggs in the lot is

(A) 7 (B) 14 (C) 21 (D) 28

6. In tossing a die, the probability of getting an odd number or a number less than 4 is :

(A) 1 (B) ½ (C) 2/3 (D) ¾

7. Which of the following can be the probability of an event ?

(A) -0.05 (B) 1.005 (C) 0.375 (D) 9/7

8. A girl calculates the probability of her winning the game in a match is 0.08. What is the probability of her losing the game,

(A) 91% (B) 8% (C) 92% (D) 80%

9. The probability of getting exactly two tails, when three coins are tossed simultaneously is :

(A) 1/8 (B) ½ (C) 3/8 (D) 5/8

10. A box contains cards bearing numbers from 6 to 70. If one card is drawn at random from the box, the probability that it bears a one digit number is

(A) 1/16 (B) 4/65 (C) 1/13 (D) 1/14

DIRECTION: In the question number 11 and 12, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option

11. Statement A (Assertion): If you toss a coin 6 times and it comes down heads on each occasion, then the probability of getting a head is 1.

Statement R(Reason) : The sum of the probabilities of all the elementary events of an experiment is 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 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.

12. Statement A (Assertion): When a die is rolled, the probability of getting a number which is a multiple of 3 and 5 both is zero.

Statement R (Reason): The probability of an impossible event is zero.

(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.

VERY SHORT ANSWER TYPE QUESTIONS

13. Chances of winning a game are 60%. If Anil has played the game 20 times, find the number of times he can expect to lose.

14. A jar contains 27 marbles. Some of them are green and other are blue. If a marble is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. Find the number of blue marbles in the jar.

15. The probability of winning a game is $\frac{x}{12}$. The probability of losing it is $\frac{1}{3}$. Find the value of x.

16. A bag contains 4 red, 5 green and 3 yellow balls. A ball is drawn at random from the bag. What is the probability that the drawn ball is not green?

17. A bundle of cards numbered from 5 to 20 are put in a box. One card is drawn at random from the box. What is the probability that the number on the card is a multiple of both 2 and 5?

Short Answer Questions

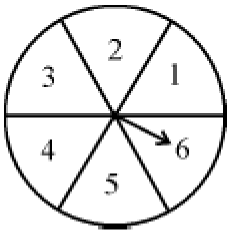
18. The probability of selecting a blue marble at random from a jar that contains only blue, black and green marbles is $\frac{1}{5}$. The probability of selecting a black marble at random from the same jar is $\frac{1}{4}$. If the jar contains 11 green marbles, find the total number of marbles in the jar.

19. A number x is chosen at random from the numbers $-3, -2, -1, 0, 1, 2$. What is the probability that $x^2 \leq 4$?

20. A number x is chosen at random from the numbers $-5, -4, -3, -2, -1, 0, 1, 2, 3$. What is the probability that $|x| < 3$?

21. A number x is selected at random from the numbers 1, 2, 3 and 4. Another number y is selected at random from the numbers 1, 4, 9 and 16. Find the probability that product of x and y is less than 16. (CBSE 2016)

22. In figure, is shown a disc on which a player spins an arrow twice. The fraction $\frac{a}{b}$ is formed, where 'a' is the number of sector on which arrow stops on the first spin and 'b' is the number of the sector in which the arrow stops on second spin. On each spin, each sector has equal chance of selection by the arrow. Find the probability that the fraction $\frac{a}{b} > 1$. (CBSE 2016)



23. In a game, Raju asks his friend Karan to write down a two-digit number secretly. What is the probability that Karan will write a doublet? What is the probability that Karan's number is divisible by 2, 3 and 5?

24. The army purchased 1250 guns from a dealer. If in every lot of 50 guns, there are only 47 good guns, find the probability that from a lot of 50 guns, we get a defective gun. How many defective guns do you expect in the purchase of 1250 guns?

25. A two digit number is chosen at random such that the sum of its digits is 11.

a) Write the sample space.

b) Find the probability that the number is even.

c) Find the probability that the number is greater than 50.

d) Find the probability that the number is divisible by 11.

26. Two unbiased coins are tossed simultaneously. What is the probability of getting

a) all heads?

b) at least one head?

c) at most one tail?

27. Anjali draws a card from a well shuffled deck of 52 cards. What is the probability that she draws :

a) a spade

b) a card other than an ace.

c) spade or an ace

d) Red and Queen

e) the seven of club

f) neither an ace nor a king.

28. All the face cards are removed from a pack of 52 cards and are then shuffled well. One card is selected from the remaining cards. What is the probability of

a) getting an ace?

c) getting 10 of spade?

b) getting a red card?

d) getting a number less than 5?

29. A cartoon consists of 100 shirts of which 88 are good, 8 have minor defects and 4 have major defects. Jimmy, a trader, will only accept the shirts which are good, but Sujata, another trader, will only reject the shirts which have major defects. One shirt is drawn at random from the carton. What is the probability that

a) it is acceptable to Jimmy ?

b) it is acceptable to Sujata?

30. A bag contains 18 balls out of which x balls are red.

a) If one ball is drawn at random from the bag, what is the probability that it is red ?

b) If 2 more red balls are put in the bag, the probability of drawing a red ball will be $\frac{9}{8}$ times the probability of drawing a red ball in the first case. Find the value of x.

31. Three different coins are tossed together. Write the sample space. Find the probability of getting

a) exactly two heads

d) at most two heads

b) at least two heads

e) head and tail appear alternatively

c) at least two tails

f) at most three heads

32. In a single throw of a pair of different dice, what is the probability of getting

a) Same number on both the dice.

b) Different numbers on both dice?

c) Sum at least 10

d) multiple of 2 on one dice and a multiple of 3 on the other.

e) the product of numbers on the top of dice as 12

f) prime number on each dice? (CBSE 2016)

33. Find the probability that a non-leap year chosen at random has

a) 52 Sundays

b) 53 Sundays

34. What is the probability that a leap year chosen at random has

a) 53 Sundays

b) 53 Sundays and 53 Mondays

c) 53 Sundays or 53 Saturdays.

35. What is the probability that in a leap year chosen at random, the month of February has

a) 5 Mondays

b) 4 Mondays

36. Find the probability that in a year chosen at random, the month of November has

a) 5 Sundays

b) 4 Sundays

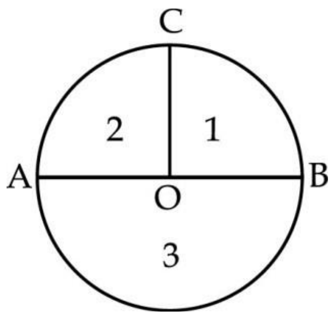
37. There are 500 sealed envelopes in a box, 10 of them contain a cash prize of Rs. 100 each, 50 of them contains a cash prize of Rs. 50 each and 100 of them contain a cash prize of Rs. 10 each, and the rest do not contain any cash prize. If they are well shuffled and then an envelope is picked up, what is the probability that it contains

a) no cash prize?

b) a cash prize of Rs. 100?

c) at least a prize?

38. A game of chance consists of an arrow which comes to rest, pointing at one of the regions 1, 2, or 3. O is the centre of the circle, OC $\perp$AB. Find the probability that



(1) arrow is resting on 3

(2) arrow is resting on 1

(3) arrow is not resting on 2

39. A box contains cards bearing numbers from 6 to 70. If one card is drawn at random from the box, find the probability that it bears

a) a number divisible by 5.

b) an odd number less than 30.

c) a composite number between 50 and 70. (CBSE 2015)

40. A die has its six faces marked 0,1,1,1, 6, 6. Two such dice are thrown together and the total score is recorded.

a) How many different scores are possible ?

b) What is the probability of getting a total of 7 ?

41. At a fete, cards bearing numbers 1 to 1000, one number on one card, are put in a box. Each player selects one card at random and that card is not replaced. If the selected card has a perfect square greater than 500, the player wins a prize. What is the probability that

(a) the first player wins a prize?

(b) the second player wins a prize, if the first has won?

CASE STUDY BASED

42. Dengue is one of the most prevalent public health issues in India. Over the decades, dengue has flourished dramatically.

In a hospital there are 200 beds for patients. Of these 120 are occupied by males and remaining by females. 20% of the males and 40% of the females are suffering from malaria and rest of them from Dengue. If a patient is selected at random, find the probability that he/she is :

(i) Female patient.

(ii) Male patient suffering from malaria.

(iii) Female patient suffering from dengue.

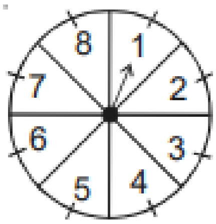
Answers (i) 2/5 (ii) 3/25 (iii) 6/25

43. A circular dartboard has sections numbered from 1 to 8 as shown below. Players have to make a prediction and throw a dart. They win if their dart lands on the section that matches their prediction.

Arya says, "My dart will land on a composite number."

Bashir says, "My dart will land on an even number."

Cathy says, "My dart will land on a number greater than 2."



Calculate the probability of each of their predictions occurring and determine who has the highest chances of winning.

Answers: $\frac{3}{8}, \frac{1}{2}, \frac{3}{4}$ Cathy has the highest chances of winning

ANSWER KEY

1. A

2. B

3. A

4. D

5. B

6. C

7. C

8. C

9. C

10. B

11. D

12. A

13. 8

14. 9

15. 8

16. 7/12

17. 1/8

18. 20

19. 5/6

20. 5/9

21. 7/16 **22.** 5/12 **23.** 1/10; 1/30 **24.** 3/50; 75

25. (a) $S = \{29, 92, 65, 56, 74, 47, 83, 38\}$ (b) ½ (c) 5/8 (d) 0

26. (a) 1/4 (b) 3/4 (c) 3/4

27. (a) ¼ (b) 12/13 (c) 4/13 (d) 1/26 (e) 1/52 (f) 11/13

28. (a) 1/10 (b) ½ (c) 1/40 (d) 3/10

29. (a) 0.88 (b) 0.96 **30.** (a) $\frac{x}{18}$ (b) 8

31. $S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$

(a) 3/8 (b) ½ (c) ½ (d) 7/8 (e) ¼ (f) 1

32. (a) 1/6 (b) 5/6 (c) 1/6 (d) 11/36 (e) 1/9 (f) ¼

33. (a) 6/7 (b) 1/7 **34.** (a) 2/7 (b) 1/7 (c) 3/7

35. (a) 1/7 (b) 6/7 **36.** (a) 2/7 (b) 5/7

37. (a) 17/25, (b) 1/50, (c) 8/25 **38.** (a) ½ (b) ¼ (c) ¾

39. (a) 1/5 (b) 12/65 (c) 3/13

40. (a) 6; $S = \{0,1,2,6,7,12\}$, (b) 1/3

41. (i) 0.009 (ii) 8/999

EXTENDED LEARNING

1. A fair die is rolled. The probability of getting a number x such that $1 \leq x \leq 6$, is

(A) 0 (B) $P(x) > 1$ (C) $0 < P(x) < 1$ (D) 1

2. 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

3. A card is drawn from a well shuffled pack of 52 playing cards. The probability that the card is a red or a queen is

(A) $\frac{1}{3}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) $\frac{7}{13}$

4. The probability of getting a number between 1 and 25 which is prime is

(A) $\frac{2}{23}$ (B) $\frac{9}{23}$ (C) $\frac{5}{23}$ (D) $\frac{4}{23}$

5. Which of the following cannot be the probability of an event?

(A) $\frac{1}{3}$ (B) 0.1 (C) 3 % (D) $\frac{17}{16}$

6. In tossing a die, the probability of getting an odd number or a number less than 4 is :

(A) 1 (B) $\frac{1}{2}$ (C) $\frac{2}{3}$ (D) $\frac{3}{4}$

7. If a die is thrown once, the probability of getting a number less than 3 and greater than 2 is

(A) 0 (B) 1 (C) $\frac{1}{3}$ (D) $\frac{2}{3}$

8. Two friends were born in the year 2000. The probability that they have the same birth date is :

(A) $\frac{1}{2000}$ (B) $\frac{2}{365}$ (C) $\frac{1}{365}$ (D) $\frac{1}{366}$

9. The probability of guessing the correct answer to certain question is $\frac{p}{12}$. If the probability of not guessing the correct answer to same question is $\frac{3}{4}$, the value of p is:

(A) 3 (B) 4 (C) 2 (D) 1

10. If probability of success is 0.5% then probability of failure is

(A) 0.95 (B) 0.095 (C) 99.5 (D) 0.995

11. If three coins are tossed simultaneously, then the probability of getting no head, is

(A) 1 (B) 3/8 (C) 1/8 (D) ¼

12. A bag contains some balls of which x are white, $2x$ are black and $3x$ are red. A ball is selected at random. The probability that it is not red is

(A) ½ (B) 1/3 (C) ¼ (D) 1/6

13. A pair of dice is thrown once. The probability of getting even number on each dice is

(A) 1/6 (B) 1/12 (C) ¼ (D) ½

14. Cards marked with numbers 5 to 50 are placed in a box and mixed thoroughly. One card is drawn at random from the box. The probability that the number on the card taken out is a perfect square is

(A) 1/11 (B) 5/46 (C) 1/9 (D) 7/50

15. The king, queen and jack of clubs are removed from a pack of 52 cards and then the remaining pack is well shuffled. A card is selected from the remaining cards. The probability of getting a card of heart is

(A) 13/48 (B) 13/49 (C) 10/49 (D) ¼

ANSWER KEY

1. D
2. C
3. D
4. B
5. D
6. C
7. A
8. D
9. A
10. D
11. C
12. A
13. C
14. B
15. B

Class- X Session- 2022-23

Subject- Mathematics (Standard)

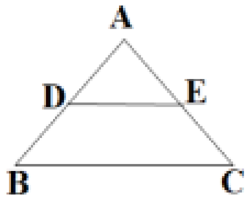
Sample Question Paper

Time Allowed: 3 Hrs. **Maximum Marks : 80**

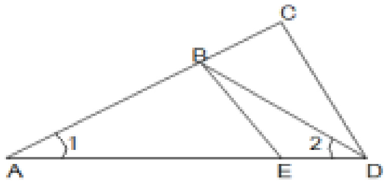
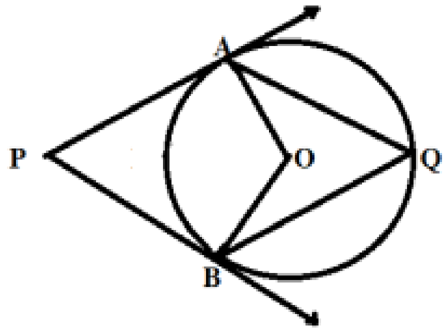
General Instructions:

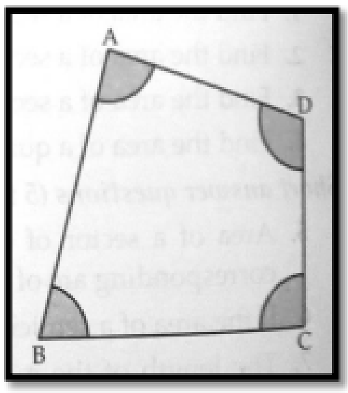
1. This Question Paper has 5 Sections A-E.
2. Section **A** has 20 MCQs carrying 1 mark each
3. Section **B** has 5 questions carrying 02 marks each.
4. Section **C** has 6 questions carrying 03 marks each.
5. Section **D** has 4 questions carrying 05 marks each.
6. Section **E** has 3 case based integrated units of assessment (04 marks each) with sub-parts 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 π =22/7 wherever required if not stated.

	SECTION A	
	Section A consists of 20 questions of 1 mark each.	
S.NO.		**MARKS**
1	Let a and b be two positive integers such that $a = p^3q^4$ and $b = p^2q^3$, where p and q are prime numbers. If HCF(a,b) = p^mq^n and LCM(a,b) = p^rq^s, then (m+n)(r+s)= (a) 15 (b) 30 (c) 35 (d) 72	**1**
2	Let p be a prime number. The quadratic equation having its roots as factors of p is (a) $x^2 - px + p = 0$ (b) $x^2 - (p+1)x + p = 0$ (c) $x^2 + (p+1)x + p = 0$ (d) $x^2 - px + p + 1 = 0$	**1**
3	If α and β are the zeros of a polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta = \alpha\beta$, then p is (a)-2/3 (b) 2/3 (c) 1/3 (d) -1/3	**1**
4	If the system of equations 3x+y =1 and (2k-1)x +(k-1)y =2k+1 is inconsistent, then k = (a) -1 (b) 0 (c) 1 (d) 2	**1**
5	If the vertices of a parallelogram PQRS taken in order are P(3,4), Q(-2,3) and R(-3,-2), then the coordinates of its fourth vertex S are (a) (-2,-1) (b) (-2,-3) (c) (2,-1) (d) (1,2)	**1**
6	$\Delta ABC \sim \Delta PQR$. If AM and PN are altitudes of ΔABC and ΔPQR respectively and $AB^2 : PQ^2 = 4 : 9$, then AM: PN = (a) 3:2 (b) 16:81 (c) 4:9 (d) 2:3	**1**

<table>
<tr><td>7</td><td>If x tan 60° cos 60° = sin60° cot 60°, then x =
(a) cos30° (b) tan30° (c) sin30° (d) cot30°</td><td>1</td></tr>
<tr><td>8</td><td>If sinθ + cosθ = $\sqrt{2}$, then tanθ + cot θ =
(a) 1 (b) 2 (c) 3 (d) 4</td><td>1</td></tr>
<tr><td>9</td><td>In the given figure, DE ∥ BC, AE = a units, EC =b units, DE =x units and BC = y units. Which of the following is true?

(a) x= $\frac{a+b}{ay}$ (b) y= $\frac{ax}{a+b}$ (c) x= $\frac{ay}{a+b}$ (d) $\frac{x}{y} = \frac{a}{b}$</td><td>1</td></tr>
<tr><td>10</td><td>ABCD is a trapezium with AD ∥ BC and AD = 4cm. If the diagonals AC and BD intersect each other at O such that AO/OC = DO/OB =1/2, then BC =
(a) 6cm (b) 7cm (c) 8cm (d) 9cm</td><td>1</td></tr>
<tr><td>11</td><td>If two tangents inclined at an angle of 60° are drawn to a circle of radius 3cm, then the length of each tangent is equal to
(a) $\frac{3\sqrt{3}}{2}$ cm (b) 3cm (c) 6cm (d) 3√3cm</td><td>1</td></tr>
<tr><td>12</td><td>The area of the circle that can be inscribed in a square of 6cm is
(a) 36π cm^2 (b) 18π cm^2 (c) 12 π cm^2 (d) 9π cm^2</td><td>1</td></tr>
<tr><td>13</td><td>The sum of the length, breadth and height of a cuboid is 6√3cm and the length of its diagonal is 2√3cm. The total surface area of the cuboid is
(a) 48 cm^2 (b) 72 cm^2 (c) 96 cm^2 (d) 108 cm^2</td><td>1</td></tr>
<tr><td>14</td><td>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</td><td>1</td></tr>
<tr><td>15</td><td>The number of revolutions made by a circular wheel of radius 0.25m in rolling a distance of 11km is
(a) 2800 (b) 4000 (c) 5500 (d) 7000</td><td>1</td></tr>
<tr><td>16</td><td>For the following distribution,
<table><tr><td>Class</td><td>0-5</td><td>5-10</td><td>10-15</td><td>15-20</td><td>20-25</td></tr><tr><td>Frequency</td><td>10</td><td>15</td><td>12</td><td>20</td><td>9</td></tr></table>the sum of the lower limits of the median and modal class is
(a) 15 (b) 25 (c) 30 (d) 35</td><td>1</td></tr>
</table>

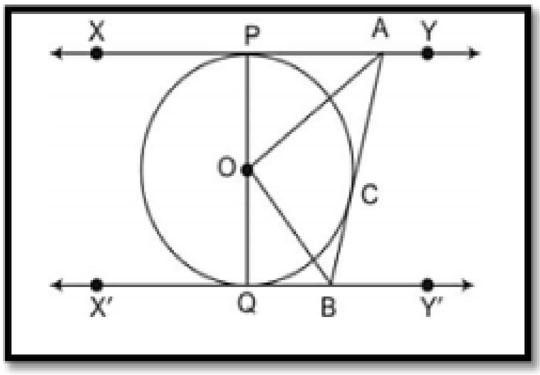
17	Two dice are rolled simultaneously. What is the probability that 6 will come up at least once? (a)1/6 (b) 7/36 (c) 11/36 (d) 13/36	**1**
18	If 5 tanβ =4, then $\frac{5\,sin\beta-2\cos\beta}{5\sin\beta+2\cos\beta}=$ (a) 1/3 (b) 2/5 (c) 3/5 (d) 6	**1**
19	**DIRECTION:** In the question number 19 and 20, a statement of **assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option ***Statement A (Assertion):*** If product of two numbers is 5780 and their HCF is 17, then their LCM is 340 ***Statement R(Reason)* :** HCF is always a factor of LCM (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	***Statement A (Assertion):*** If the co-ordinates of the mid-points of the sides AB and AC of ΔABC are D(3,5) and E(-3,-3) respectively, then BC = 20 units ***Statement R(Reason)* :** The line joining the mid points of two sides of a triangle is parallel to the third side and equal to half of it. (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**

<table>
<tr><td></td><td>SECTION B</td><td></td></tr>
<tr><td></td><td>Section B consists of 5 questions of 2 marks each.</td><td></td></tr>
<tr><td>S.No.</td><td></td><td>Marks</td></tr>
<tr><td>21</td><td>If 49x+51y= 499, 51 x+49 y= 501, then find the value of x and y</td><td>2</td></tr>
<tr><td>22</td><td>In the given figure below, $\frac{AD}{AE} = \frac{AC}{BD}$ and $\angle 1 = \angle 2$. Show that Δ BAE~ ΔCAD .

</td><td>2</td></tr>
<tr><td>23</td><td>In the given figure, O is the centre of circle. Find $\angle$AQB, given that PA and PB are tangents to the circle and $\angle$APB= 75°.

</td><td>2</td></tr>
<tr><td>24</td><td>The length of the minute hand of a clock is 6cm. Find the area swept by it when it moves from 7:05 p.m. to 7:40 p.m.

OR
In the given figure, arcs have been drawn of radius 7cm each with vertices A, B, C and D of quadrilateral ABCD as centres. Find the area of the shaded region.

</td><td>2</td></tr>
</table>

25	If $\sin(A+B) = 1$ and $\cos(A-B) = \sqrt{3}/2$, $0° < A+B \leq 90°$ and $A > B$, then find the measures of angles A and B. **OR** Find an acute angle θ when $\frac{\cos\theta - \sin\theta}{\cos\theta + \sin\theta} = \frac{1-\sqrt{3}}{1+\sqrt{3}}$	2

	SECTION C	
	Section C consists of 6 questions of 3 marks each.	
S.No		**Marks**
26	Given that $\sqrt{3}$ is irrational, prove that $5 + 2\sqrt{3}$ is irrational.	**3**
27	If the zeroes of the polynomial $x^2 + px + q$ are double in value to the zeroes of the polynomial $2x^2 - 5x - 3$, then find the values of p and q.	**3**
28	A train covered a certain distance at a uniform speed. If the train would have been 6 km/h faster, it would have taken 4 hours less than the scheduled time. And, if the train were slower by 6 km/hr ; it would have taken 6 hours more than the scheduled time. Find the length of the journey. **OR** Anuj had some chocolates, and he divided them into two lots A and B. He sold the first lot at the rate of ₹2 for 3 chocolates and the second lot at the rate of ₹1 per chocolate, and got a total of ₹400. If he had sold the first lot at the rate of ₹1 per chocolate, and the second lot at the rate of ₹4 for 5 chocolates, his total collection would have been ₹460. Find the total number of chocolates he had.	**3**
29	Prove the following that- $\frac{\tan^3\theta}{1+\tan^2\theta} + \frac{\cot^3\theta}{1+\cot^2\theta} = \sec\theta \operatorname{cosec}\theta - 2\sin\theta\cos\theta$	**3**
30	Prove that a parallelogram circumscribing a circle is a rhombus **OR**	**3**

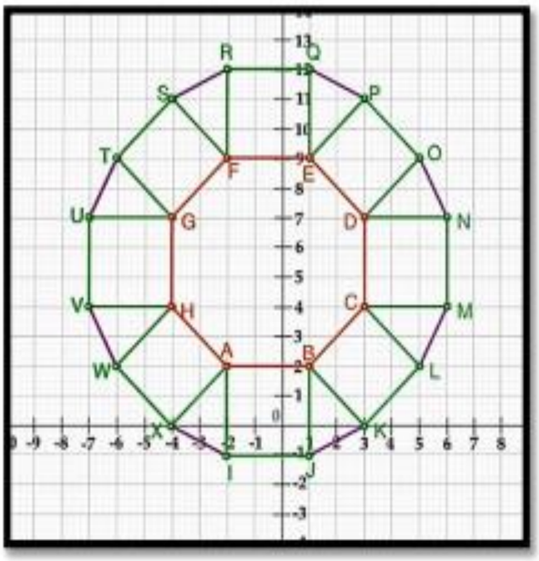
	In the figure XY and X'Y' are two parallel tangents to a circle with centre O and another tangent AB with point of contact C interesting XY at A and X'Y' at B, what is the measure of ∠AOB. 	
31	Two coins are tossed simultaneously. What is the probability of getting (i) At least one head? (ii) At most one tail? (iii) A head and a tail?	**3**
	SECTION D	
	Section D consists of 4 questions of 5 marks each.	
S.No		**Marks**
32	To fill a swimming pool two pipes are used. If the pipe of larger diameter used for 4 hours and the pipe of smaller diameter for 9 hours, only half of the pool can be filled. Find, how long it would take for each pipe to fill the pool separately, if the pipe of smaller diameter takes 10 hours more than the pipe of larger diameter to fill the pool? **OR** In a flight of 600km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr from its usual speed and the time of the flight increased by 30 min. Find the scheduled duration of the flight.	**5**
33	Prove that if a line is drawn parallel to one side of a triangle intersecting the other two sides in distinct points, then the other two sides are divided in the same ratio. Using the above theorem prove that a line through the point of intersection of the diagonals and parallel to the base of the trapezium divides the non parallel sides in the same ratio.	**5**

34	Due to heavy floods in a state, thousands were rendered homeless. 50 schools collectively decided to provide place and the canvas for 1500 tents and share the whole expenditure equally. The lower part of each tent is cylindrical with base radius 2.8 m and height 3.5 m and the upper part is conical with the same base radius, but of height 2.1 m. If the canvas used to make the tents costs ₹120 per m^2, find the amount shared by each school to set up the tents. **OR** There are two identical solid cubical boxes of side 7cm. From the top face of the first cube a hemisphere of diameter equal to the side of the cube is scooped out. This hemisphere is inverted and placed on the top of the second cube's surface to form a dome. Find (i) the ratio of the total surface area of the two new solids formed (ii) volume of each new solid formed.	5
35	The median of the following data is 525. Find the values of x and y, if the total frequency is 100	5

Class interval	Frequency
0–100	2
100–200	5
200–300	x
300–400	12
400–500	17
500–600	20
600–700	y
700–800	9
800–900	7
900–1000	4

	SECTION E	
	Case study based questions are compulsory.	
36	A tiling or tessellation of a flat surface is the covering of a plane using one or more geometric shapes, called tiles, with no overlaps and no gaps. Historically, tessellations were used in ancient Rome and in Islamic art. You may find tessellation patterns on floors, walls, paintings etc. Shown below is a tiled floor in the archaeological Museum of Seville, made using squares, triangles and hexagons.	

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? **1**

(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? **1**

(iii) What are the coordinates of the point on y axis equidistant from A and G? **2**

OR

What is the area of Trapezium AFGH?

37 The school auditorium was to be constructed to accommodate at least 1500 people. The chairs are to be placed in concentric circular arrangement in such a way that each succeeding circular row has 10 seats more than the previous one.

(i) If the first circular row has 30 seats, how many seats will be there in the 10th row? **1**

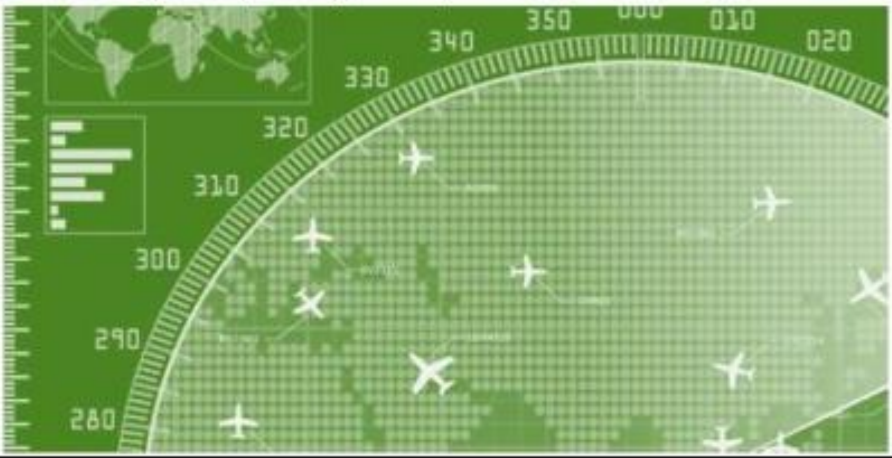
(ii) For 1500 seats in the auditorium, how many rows need to be there? **2**

OR

If 1500 seats are to be arranged in the auditorium, how many seats are still left to be put after 10^{th} row?

(iii) If there were 17 rows in the auditorium, how many seats will be there in the middle row? **1**

38 We all have seen the airplanes flying in the sky but might have not thought of how they actually reach the correct destination. Air Traffic Control (ATC) is a service provided by ground-based air traffic controllers who direct aircraft on the ground and through a given section of controlled airspace, and can provide advisory services to aircraft in non-controlled airspace. Actually, all this air traffic is managed and regulated by using various concepts based on coordinate geometry and trigonometry.



	At a given instance, ATC finds that the angle of elevation of an airplane from a point on the ground is 60°. After a flight of 30 seconds, it is observed that the angle of elevation changes to 30°. The height of the plane remains constantly as $3000\sqrt{3}$ m. Use the above information to answer the questions that follow- (i) Draw a neat labelled figure to show the above situation diagrammatically. (ii) What is the distance travelled by the plane in 30 seconds? **OR** Keeping the height constant, during the above flight, it was observed that after $15(\sqrt{3}-1)$ seconds, the angle of elevation changed to 45°. How much is the distance travelled in that duration. (iii) What is the speed of the plane in km/hr.	**1** **2** **1**

SAMPLE QUESTION PAPER
MARKING SCHEME
SUBJECT: MATHEMATICS- STANDARD
CLASS X

SECTION - A

1	(c) 35	1
2	(b) $x^2-(p+1)x+p=0$	1
3	(b) 2/3	1
4	(d) 2	1
5	(c) (2,-1)	1
6	(d) 2:3	1
7	(b) tan 30°	1
8	(b) 2	1
9	(c) $x=\frac{ay}{a+b}$	1
10	(c) 8cm	1
11	(d) $3\sqrt{3}$cm	1
12	(d) 9π cm^2	1
13	(c) 96 cm^2	1
14	(b) 12	1
15	(d) 7000	1
16	(b) 25	1
17	(c) 11/36	1
18	(a) 1/3	1
19	(b) Both assertion (A) and reason (R) are true and reason (R) is not 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

21 Adding the two equations and dividing by 10, we get : $x+y = 10$ ½

Subtracting the two equations and dividing by -2, we get : $x-y = 1$ ½

Solving these two new equations, we get, $\mathbf{x = 11/2}$ ½

$\mathbf{y = 9/2}$ ½

22 In ΔABC,
$\angle 1 = \angle 2$
$\therefore AB = BD$ ………………………**(i)** ½
Given,
$AD/AE = AC/BD$
Using equation **(i)**, we get ½
$AD/AE = AC/AB$ ……………….**(ii)**
In ΔBAE and ΔCAD, by equation (ii),
$AC/AB = AD/AE$ ½
$\angle A = \angle A$ (common)
$\therefore \Delta BAE \sim \Delta CAD$ [By SAS similarity criterion] ½

23 $\angle PAO = \angle PBO = 90°$ (angle b/w radius and tangent) ½

$\angle AOB = 105°$ (By angle sum property of a triangle) ½

$\angle AQB = ½ \times 105° = 52.5°$ (Angle at the remaining part of the circle is half the angle subtended by the arc at the centre) 1

24

We know that, in 60 minutes, the tip of minute hand moves 360°

In 1 minute, it will move $= 360°/60 = 6°$ ½

$\therefore$ From 7 : 05 pm to 7: 40 pm i.e. 35 min, it will move through $= 35 \times 6° = 210°$ ½

$\therefore$ Area of swept by the minute hand in 35 min = Area of sector with sectorial angle θ of 210° and radius of 6 cm

$= \frac{210}{360} \times \pi \times 6^2$ ½

$= \frac{7}{12} \times \frac{22}{7} \times 6 \times 6$

$= 66 cm^2$ ½

OR

Let the measure of $\angle A$, $\angle B$, $\angle C$ and $\angle D$ be θ_1, θ_2, θ_3 and θ_4 respectively
Required area = Area of sector with centre A + Area of sector with centre B + Area of sector with centre C + Area of sector with centre D ½

$= \frac{\theta_1}{360} \times \pi \times 7^2 + \frac{\theta_2}{360} \times \pi \times 7^2 + \frac{\theta_3}{360} \times \pi \times 7^2 + \frac{\theta_4}{360} \times \pi \times 7^2$ ½

$= \frac{(\theta_1 + \theta_2 + \theta_3 + \theta_4)}{360} \times \pi \times 7^2$

$= \frac{(360)}{360} \times \frac{22}{7} \times 7 \times 7$ (By angle sum property of a triangle) ½

$= 154\ cm^2$ ½

25 sin(A+B) =1 = sin 90, so A+B = 90……………….(i) ½

cos(A-B)= √3/2 = cos 30, so A-B= 30…………..(ii) ½

From (i) & (ii) ∠A = 60° ½

And ∠B = 30° ½

OR

$\frac{\cos\theta - \sin\theta}{\cos\theta + \sin\theta} = \frac{1-\sqrt{3}}{1+\sqrt{3}}$

Dividing the numerator and denominator of LHS by cosθ, we get ½

$\frac{1 - \tan\theta}{1+\tan\theta} = \frac{1-\sqrt{3}}{1+\sqrt{3}}$ ½

Which on simplification (or comparison) gives tanθ = √3 ½

Or θ= 60° ½

SECTION - C

26 Let us assume 5 + 2√3 is rational, then it must be in the form of p/q where p and q are co-prime integers and q ≠ 0 1

i.e 5 + 2√3 = p/q ½

So $\sqrt{3} = \frac{p-5q}{2q}$……………………(i) ½

Since p, q, 5 and 2 are integers and q ≠ 0, HS of equation (i) is rational. But LHS of (i) is √3 which is irrational. This is not possible. ½

This contradiction has arisen due to our wrong assumption that 5 + 2√3 is rational. So, 5 + 2√3 is irrational. ½

27 Let α and β be the zeros of the polynomial $2x^2 -5x -3$

Then α + β = 5/2 ½

And αβ = -3/2. ½

Let 2α and 2β be the zeros $x^2 + px + q$

Then 2α + 2β = -p ½

2(α + β) = -p

2 x 5/2 =-p

So p = -5 ½

And 2α x 2β = q ½

4 αβ = q

So q = 4 x-3/2

= -6 ½

28	Let the actual speed of the train be x km/hr and let the actual time taken be y hours.	½
	Distance covered is xy km	
	If the speed is increased by 6 km/hr, then time of journey is reduced by 4 hours i.e.,	
	when speed is (x+6)km/hr, time of journey is (y−4) hours.	
	$\therefore$ Distance covered =(x+6)(y−4)	
	$\Rightarrow xy=(x+6)(y-4)$	
	$\Rightarrow -4x+6y-24=0$	½
	$\Rightarrow -2x+3y-12=0$ ....(i)	
	Similarly $xy=(x-6)(y+6)$	
	$\Rightarrow 6x-6y-36=0$	
	$\Rightarrow x-y-6=0$ ....(ii)	½
	Solving (i) and (ii) we get x=30 and y=24	1
	Putting the values of x and y in equation (i), we obtain	
	Distance =(30×24)km =720km.	½
	Hence, the length of the journey is 720km.	
	OR	
	Let the number of chocolates in lot A be x	½
	And let the number of chocolates in lot B be y	
	$\therefore$ total number of chocolates =x+y	
	Price of 1 chocolate = ₹ 2/3 , so for x chocolates $=\frac{2}{3}x$	
	and price of y chocolates at the rate of ₹ 1 per chocolate =y.	
	$\therefore$ by the given condition $\frac{2}{3}x+y=400$	½
	$\Rightarrow 2x+3y=1200$ ....(i)	
	Similarly $x+\frac{4}{5}y=460$	½
	$\Rightarrow 5x+4y=2300$ .... (ii)	
	Solving (i) and (ii) we get	
	x=300 and y=200	
	$\therefore x+y=300+200=500$	1
	So, Anuj had 500 chocolates.	½
29	LHS : $\dfrac{\sin^3\theta/\cos^3\theta}{1+\sin^2\theta/\cos^2\theta}+\dfrac{\cos^3\theta/\sin^3\theta}{1+\cos^2\theta/\sin^2\theta}$	½

$$= \frac{\sin^3\theta/\cos^3\theta}{(\cos^2\theta + \sin^2\theta)/\cos^2\theta} + \frac{\cos^3\theta/\sin^3\theta}{(\sin^2\theta + \cos^2\theta)/\sin^2\theta}$$

$$= \frac{\sin^3\theta}{\cos\theta} + \frac{\cos^3\theta}{\sin\theta}$$ ½

$$= \frac{\sin^4\theta + \cos^4\theta}{\cos\theta\sin\theta}$$ ½

$$= \frac{(\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta}{\cos\theta\sin\theta}$$ ½

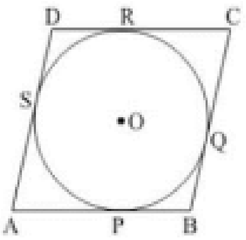
$$= \frac{1 - 2\sin^2\theta\cos^2\theta}{\cos\theta\sin\theta}$$ ½

$$= \frac{1}{\cos\theta\sin\theta} - \frac{2\sin^2\theta\cos^2\theta}{\cos\theta\sin\theta}$$

$= \sec\theta\operatorname{cosec}\theta - 2\sin\theta\cos\theta$ ½

= RHS

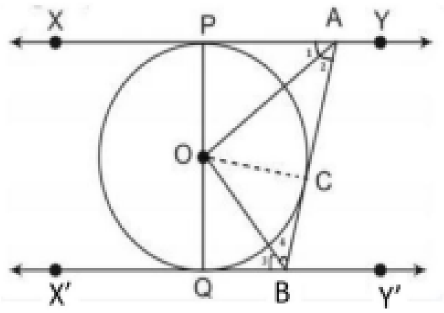
30



Let ABCD be the rhombus circumscribing the circle with centre O, such that AB, BC, CD and DA touch the circle at points P, Q, R and S respectively.
We know that the tangents drawn to a circle from an exterior point are equal in length.

∴ AP = AS…………(1)
BP = BQ……………(2)
CR = CQ …………...(3) 1
DR = DS……………(4).
Adding (1), (2), (3) and (4) we get
AP+BP+CR+DR = AS+BQ+CQ+DS
(AP+BP) + (CR+DR) = (AS+DS) + (BQ+CQ)
∴ AB+CD=AD+BC-----------(5) 1
Since AB=DC and AD=BC (opposite sides of parallelogram ABCD) ½
putting in (5) we get, 2AB=2AD
or AB = AD.
∴ AB=BC=DC=AD
Since a parallelogram with equal adjacent sides is a rhombus, so ABCD is a rhombus ½

OR



Join OC

In Δ OPA and Δ OCA

OP = OC (radii of same circle)

PA = CA (length of two tangents from an external point) 1

AO = AO (Common)

Therefore, Δ OPA ≅ Δ OCA (By SSS congruency criterion) ½

Hence, ∠ 1 = ∠ 2 (CPCT) ½

Similarly ∠ 3 = ∠ 4

∠PAB + ∠QBA =180°(co interior angles are supplementary as XY∥X'Y') ½

2∠2 + 2∠4 = 180°

∠2 + ∠4 = 90°-------------------------(1) ½

∠2 + ∠4 +∠AOB = 180° (Angle sum property)

Using (1), we get, ∠AOB = 90°

31 (i) P (At least one head) = $\frac{3}{4}$ 1

(ii) P(At most one tail) = $\frac{3}{4}$ 1

(iii) P(A head and a tail) = $\frac{2}{4} = \frac{1}{2}$ 1

SECTION D

32 Let the time taken by larger pipe alone to fill the tank= x hours ½
Therefore, the time taken by the smaller pipe = x+10 hours

Water filled by larger pipe running for 4 hours = $\frac{4}{x}$ litres

Water filled by smaller pipe running for 9 hours = $\frac{9}{x+10}$ litres

We know that

$\frac{4}{x} + \frac{9}{x+10} = \frac{1}{2}$ 1

Which on simplification gives: 1

$x^2 - 16x - 80 = 0$

$x^2 - 20x + 4x - 80 = 0$

$x(x-20) + 4(x-20) = 0$

$(x+4)(x-20) = 0$

$x = -4, 20$ 1

x cannot be negative. ½

Thus, $x = 20$ ½

$x + 10 = 30$

Larger pipe would alone fill the tank in 20 hours and smaller pipe would fill the tank alone in 30 hours. ½

OR

Let the usual speed of plane be x km/hr ½

and the reduced speed of the plane be (x-200) km/hr

Distance =600 km [Given]

According to the question,

(time taken at reduced speed) - (Schedule time) = 30 minutes = 0.5 hours.

1

$\frac{600}{x-200} - \frac{600}{x} = \frac{1}{2}$

Which on simplification gives: 1

$x^2 - 200x - 240000 = 0$

$x^2 - 600x + 400x - 240000 = 0$

$x(x-600) + 400(x-600) = 0$

$(x-600)(x+400) = 0$ 1

$x = 600$ or $x = -400$ ½

But speed cannot be negative. ½

∴ The usual speed is 600 km/hr and ½

the scheduled duration of the flight is $\frac{600}{600} = 1$ hour

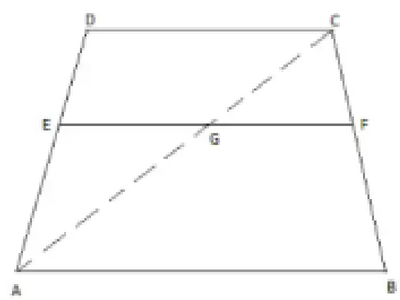
33 For the Theorem :

Given, To prove, Construction and figure 1½

Proof

1½

½



Let ABCD be a trapezium DC∥AB and EF is a line parallel to AB and hence to DC.

To prove : $\frac{DE}{EA} = \frac{CF}{FB}$

Construction : Join AC, meeting EF in G.

Proof :

In △ABC, we have

GF∥AB

CG/GA=CF/FB [By BPT] ......(1) ½

In △ADC, we have

EG∥DC (EF ∥AB & AB ∥DC)

DE/EA= CG/GA [By BPT] .....(2) ½

From (1) & (2), we get,

$\frac{DE}{EA} = \frac{CF}{FB}$ ½

34. Radius of the base of cylinder (r) = 2.8 m = Radius of the base of the cone (r)

Height of the cylinder (h)=3.5 m

Height of the cone (H)=2.1 m.

Slant height of conical part (l)=$\sqrt{r^2+H^2}$

$= \sqrt{(2.8)^2+(2.1)^2}$

$= \sqrt{7.84+4.41}$ 1

$= \sqrt{12.25} = 3.5$ m 1

Area of canvas used to make tent = CSA of cylinder + CSA of cone 1

$= 2\times\pi\times2.8\times3.5 + \pi\times2.8\times3.5$

$= 61.6+30.8$

$= 92.4\text{m}^2$ 1

1

Cost of 1500 tents at ₹120 per sq.m

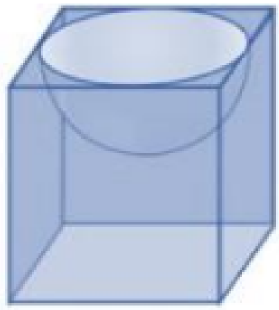
$= 1500\times120\times92.4$

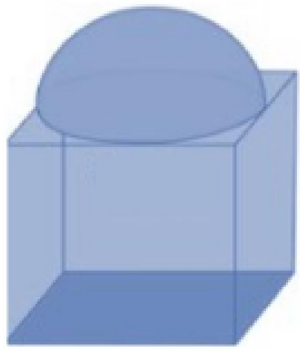
$= 16{,}632{,}000$

Share of each school to set up the tents = 16632000/50 = ₹332,640

OR

First Solid Second Solid





(i) SA for first new solid (S_1):

$6\times7\times7 + 2\pi\times3.5^2 - \pi\times3.5^2$ 1

$= 294 + 77 - 38.5$

$= 332.5 cm^2$

SA for second new solid (S_2):

$6\times7\times7 + 2\pi\times3.5^2 - \pi\times3.5^2$ 1

$= 294 + 77 - 38.5$ 1

$= 332.5\ cm^2$

So $S_1 : S_2 = 1:1$

(ii) Volume for first new solid (V_1)= $7\times7\times7 - \frac{2}{3}\pi\times3.5^3$

$= 343 - \frac{539}{6} = \frac{1519}{6}\ cm^3$ 1

Volume for second new solid (V_2)= $7\times7\times7 + \frac{2}{3}\pi\times3.5^3$

$= 343 + \frac{539}{6} = \frac{2597}{6}\ cm^3$ 1

35 Median = 525, so Median Class = 500 – 600 ½

Class interval	Frequency	Cumulative Frequency
0–100	2	2
100–200	5	7
200–300	x	7+x
300–400	12	19+x
400–500	17	36+x
500–600	20	56+x
600–700	y	56+x+y
700–800	9	65+x +y
800–900	7	72+x+y
900–1000	4	76+x+y

1½

$76+x+y=100 \Rightarrow x+y=24$ ....(i) 1

Median $= l + \frac{\frac{n}{2}-cf}{f} \times h$ ½

Since, l=500, h=100, f=20, cf=36+x and n=100

Therefore, putting the value in the Median formula, we get;

$525 = 500 + \frac{50-(36+x)}{20} \times 100$ ½

so x = 9

y = 24 – x (from eq.i)

y = 24 – 9 = 15

Therefore, the value of x = 9 ½

and y = 15. ½

36 (i) B(1,2), F(-2,9)

$BF^2 = (-2-1)^2 + (9-2)^2$

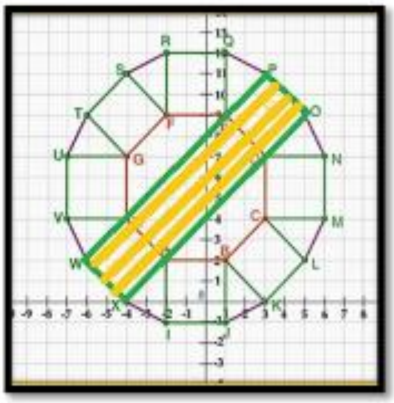
$= (-3)^2 + (7)^2$

$= 9 + 49$

$= 58$

So, BF = $\sqrt{58}$ units 1

(ii)



W(-6,2), X(-4,0), O(5,9), P(3,11) ½

Clearly WXOP is a rectangle

Point of intersection of diagonals of a rectangle is the mid point of the diagonals. So the required point is mid point of WO or XP

$= \left(\frac{-6+5}{2}, \frac{2+9}{2}\right)$ ½

$= \left(\frac{-1}{2}, \frac{11}{2}\right)$

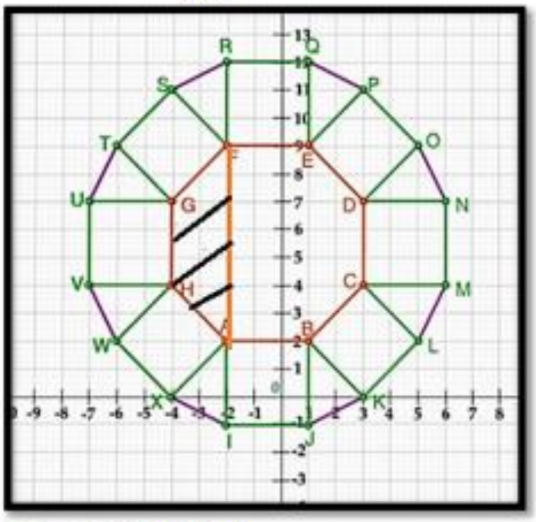
(iii) A(-2,2), G(-4,7)

Let the point on y-axis be Z(0,y) ½

$AZ^2 = GZ^2$ ½

$(0+2)^2 + (y-2)^2 = (0+4)^2 + (y-7)^2$
$(2)^2 + y^2 + 4 - 4y = (4)^2 + y^2 + 49 - 14y$
$8 - 4y = 65 - 14y$
$10y = 57$
So, y= 5.7 ½
i.e. the required point is (0, 5.7) ½

OR



A(-2,2), F(-2,9), G(-4,7), H(-4,4)
Clearly GH = 7-4=3units ½
AF = 9-2=7 units ½
So, height of the trapezium AFGH = 2 units
So, area of AFGH = $\frac{1}{2}$(AF + GH) x height
$= \frac{1}{2}(7+3) \times 2$ ½
= 10 sq. units ½

37. (i) Since each row is increasing by 10 seats, so it is an AP with first term a= 30, and common difference d=10. ½
So number of seats in 10^{th} row = a_{10} = a+ 9d
$= 30 + 9\times10 = 120$ ½

(ii) $S_n = \frac{n}{2}(2a + (n-1)d)$
$1500 = \frac{n}{2}(2 \times 30 + (n-1)10)$ ½
$3000 = 50n + 10n^2$
$n^2 + 5n - 300 = 0$ ½
$n^2 + 20n - 15n - 300 = 0$
$(n+20)(n-15) = 0$ ½
Rejecting the negative value, n= 15 ½

OR

No. of seats already put up to the 10^{th} row = S_{10} ½
$S_{10} = \frac{10}{2}\{2 \times 30 + (10-1)10)\}$ ½

$= 5(60 + 90) = 750$ ½

So, the number of seats still required to be put are 1500 -750 = 750 ½

(iii) If no. of rows =17

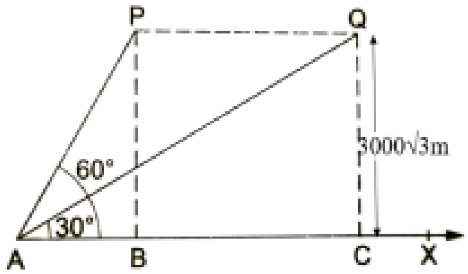
then the middle row is the 9th row ½

a_8 = a+ 8d

= 30 + 80

= 110 seats ½

38 (i)



1

P and Q are the two positions of the plane flying at a height of 3000√3m.
A is the point of observation.

(ii) In △ PAB, tan60° =PB/AB

Or √3 = 3000√3/ AB

So AB=3000m 1

tan30°= QC/AC

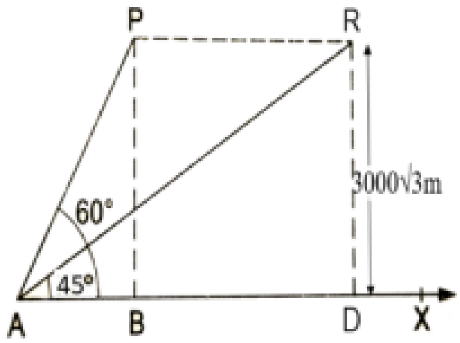
1/√3= 3000√3 / AC

AC = 9000m ½

distance covered = 9000- 3000

= 6000 m. ½

OR



½

In △ PAB, tan60° =PB/AB

Or √3 = 3000√3/ AB

So AB=3000m ½

tan45° = RD/AD

1= 3000√3 / AD ½

AD = $3000\sqrt{3}$ m

distance covered = $3000\sqrt{3} - 3000$ ½

= $3000(\sqrt{3} - 1)$m.

(iii) speed = 6000/ 30 ½

= 200 m/s

= 200 x 3600/1000 ½

= 720km/hr

Alternatively: speed = $\frac{3000(\sqrt{3}-1)}{15(\sqrt{3}-1)}$ ½

= 200 m/s

= 200 x 3600/1000 ½

= 720km/hr

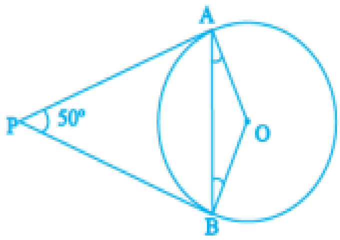
Class - X Session 2022-23
Subject - Mathematics (Basic)
Sample Question Paper

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 Short Answer-I (SA-I) type questions carrying 2 marks each.
4. Section C has 6 Short Answer-II (SA-II) type questions carrying 3 marks each.
5. Section D has 4 Long Answer (LA) type questions carrying 5 marks each.
6. Section E has 3 Case Based integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 2 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

	Section A	
	Section A consists of 20 questions of 1 mark each.	
SN		**Marks**
1	If two positive integers p and q can be expressed as $p = ab^2$ and $q = a^3b$; a, b being prime numbers, then LCM (p, q) is (a) ab (b) a^2b^2 (c) a^3b^2 (d) a^3b^3	1
2	What is the greatest possible speed at which a man can walk 52 km and 91 km in an exact number of hours? (a) 17 km/hours (b) 7 km/hours (c) 13 km/hours (d) 26 km/hours	1
3	If one zero of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is (a) 10 (b) -10 (c) 5 (d) –5	1
4	Graphically, the pair of equations given by $6x – 3y + 10 = 0$ $2x – y + 9 = 0$ represents two lines which are (a) intersecting at exactly one point. (b) parallel. (c) coincident. (d) intersecting at exactly two points.	1

5	If the quadratic equation $x^2 + 4x + k = 0$ has real and equal roots, then (a) $k < 4$ (b) $k > 4$ (c) $k = 4$ (d) $k \geq 4$	1
6	The perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0) is (a) 5 units (b) 12 units (c) 11 units (d) $(7 + \sqrt{5})$ units	1
7	If in triangles ABC and DEF, $\frac{AB}{DE} = \frac{BC}{FD}$, then they will be similar, when (a) $\angle B = \angle E$ (b) $\angle A = \angle D$ (c) $\angle B = \angle D$ (d) $\angle A = \angle F$	1
8	In which ratio the y-axis divides the line segment joining the points (5, – 6) and (–1, – 4)?. (a) 1 : 5 (b) 5 : 1 (c) 1 : 1 (d) 1 : 2	1
9	In the figure, if PA and PB are tangents to the circle with centre O such that $\angle APB = 50°$, then $\angle OAB$ is equal to  (a) 25° (b) 30° (c) 40° (d) 50°	1
10	If $\sin A = \frac{1}{2}$, then the value of sec A is : (a) $\frac{2}{\sqrt{3}}$ (b) $\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) 1	1
11	$\sqrt{3} \cos^2 A + \sqrt{3} \sin^2 A$ is equal to (a) 1 (b) $\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) 0	1
12	The value of $\cos 1° . \cos 2° . \cos 3° . \cos 4° \ldots\ldots\ldots\ldots \cos 90°$ is (a) 1 (b) 0 (c) – 1 (d) 2	1
13	If the perimeter of a circle is equal to that of a square, then the ratio of their areas is (a) 22 : 7 (b) 14 : 11 (c) 7 : 22 (d) 11: 14	1
14	If the radii of two circles are in the ratio of 4 : 3, then their areas are in the ratio of : (a) 4 : 3 (b) 8 : 3 (c) 16 : 9 (d) 9 : 16	1
15	The total surface area of a solid hemisphere of radius 7 cm is : (a) 447π cm^2 (b) 239π cm^2 (c) 174π cm^2 (d) 147π cm^2	1

16 For the following distribution : 1

Class	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25
Frequency	10	15	12	20	9

the upper limit of the modal class is

(a) 10 (b) 15 (c) 20 (d) 25

17 If the mean of the following distribution is 2.6, then the value of y is 1

Variable (x)	1	2	3	4	5
Frequency	4	5	y	1	2

(a) 3 (b) 8 (c) 13 (d) 24

18 A card is selected at random from a well shuffled deck of 52 cards. The probability of its being a red face card is 1

(a) $\frac{3}{26}$ (b) $\frac{3}{13}$ (c) $\frac{2}{13}$ (d) $\frac{1}{2}$

Direction for questions 19 & 20: In question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.

19 **Assertion:** If HCF of 510 and 92 is 2, then the LCM of 510 & 92 is 32460 1

Reason: as HCF(a,b) x LCM(a,b) = a x 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.

20 **Assertion (A):** The ratio in which the line segment joining (2, -3) and (5, 6) internally divided by x axis is 1:2. 1

Reason (R): as formula for the internal division is $\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$

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

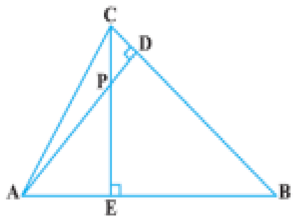
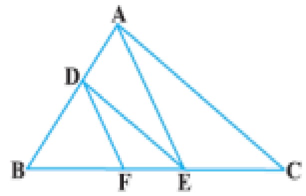
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

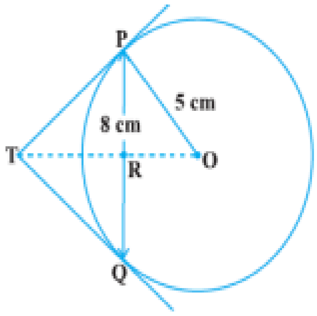
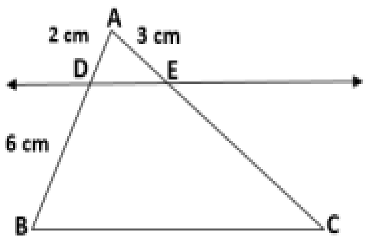
(c) Assertion (A) is true but Reason (R) is false.

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

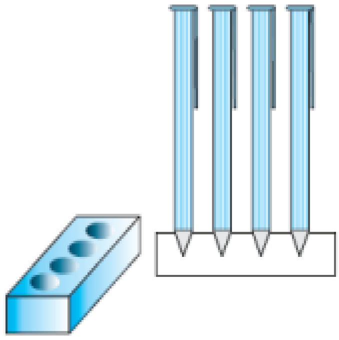
Section B

Section B consists of 5 questions of 2 marks each.

21	For what values of k will the following pair of linear equations have infinitely many solutions? kx + 3y – (k – 3) = 0 12x + ky – k = 0	2
22	In the figure, altitudes AD and CE of Δ ABC intersect each other at the point P. Show that: (i) ΔABD ~ ΔCBE (ii) ΔPDC ~ ΔBEC  **[OR]** In the figure, DE || AC and DF || AE. Prove that $\frac{BF}{FE} = \frac{BE}{EC}$ 	2
23	Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.	2
24	If $\cot\theta = \frac{7}{8}$, evaluate $\frac{(1+\sin\theta)\ (1-\sin\theta)}{(1+\cos\theta)\ (1-\cos\theta)}$	2
25	Find the perimeter of a quadrant of a circle of radius 14 cm. **[OR]** Find the diameter of a circle whose area is equal to the sum of the areas of the two circles of radii 24 cm and 7 cm.	2
	Section C	
	Section C consists of 6 questions of 3 marks each.	
26	Prove that $\sqrt{5}$ is an irrational number.	3
27	Find the zeroes of the quadratic polynomial $6x^2 - 3 - 7x$ and verify the relationship between the zeroes and the coefficients.	3
28	A shopkeeper gives books on rent for reading. She takes a fixed charge for the first two days, and an additional charge for each day thereafter. Latika paid Rs 22 for a book kept for six days, while Anand paid Rs 16 for the book kept for four days. Find the fixed charges and the charge for each extra day. **[OR]** Places A and B are 100 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 5	3

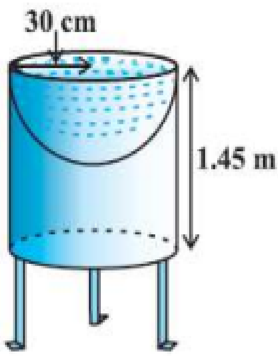
	hours. If they travel towards each other, they meet in 1 hour. What are the speeds of the two cars?	
29	In the figure, PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q intersect at a point T. Find the length TP. 	3
30	Prove that $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\sec\theta\,\mathrm{cosec}\,\theta$ **[OR]** If $\sin\theta+\cos\theta=\sqrt{3}$, then prove that $\tan\theta+\cot\theta=1$	3
31	Two dice are thrown at the same time. What is the probability that the sum of the two numbers appearing on the top of the dice is (i) 8? (ii) 13? (iii) less than or equal to 12?	3
	Section D	
	Section D consists of 4 questions of 5 marks each.	
32	An express train takes 1 hour less than a passenger train to travel 132 km between Mysore and Bangalore (without taking into consideration the time they stop at intermediate stations). If the average speed of the express train is 11km/h more than that of the passenger train, find the average speed of the two trains. **[OR]** A motor boat whose speed is 18 km/h 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.	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 same ratio. In the figure, find EC if $\frac{AD}{DB}=\frac{AE}{EC}$ Using the above theorem. 	5

34 A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand. 5



[OR]

Ramesh made a bird-bath for his garden in the shape of a cylinder with a hemispherical depression at one end. The height of the cylinder is 1.45 m and its radius is 30 cm. Find the total surface area of the bird-bath.



35 A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are given only to persons having age 18 years onwards but less than 60 years. 5

Age (in years)	Number of policy holders
Below 20	2
20-25	4
25-30	18
30-35	21
35-40	33
40-45	11
45-50	3
50-55	6
55-60	2

Section E

Case study based questions are compulsory.

36 **Case Study – 1**

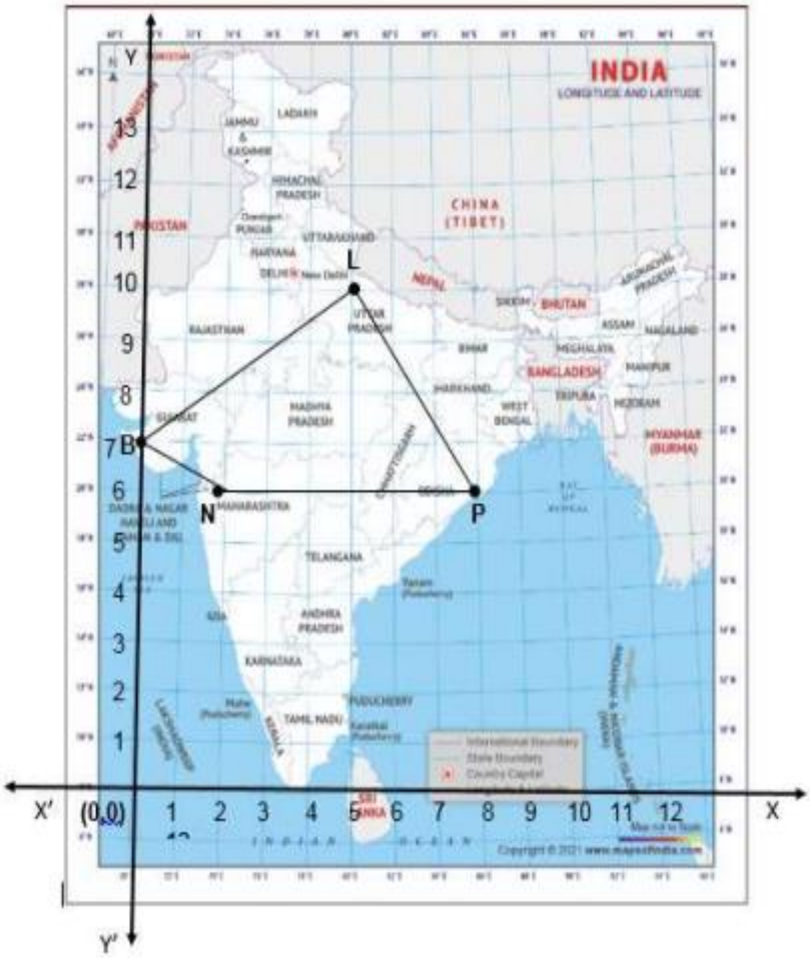
In the month of April to June 2022, the exports of passenger cars from India increased by 26% in the corresponding quarter of 2021–22, as per a report. A car manufacturing company planned to produce 1800 cars in 4^{th} year and 2600 cars in 8th year. Assuming that the production increases uniformly by a fixed number every year.

Based on the above information answer the following questions.

I.	Find the production in the 1st year.	1
II.	Find the production in the 12th year.	1
III.	Find the total production in first 10 years. **[OR]** In how many years will the total production reach 31200 cars?	2

37 **Case Study – 2**

In a GPS, The lines that run east-west are known as lines of latitude, and the lines running north-south are known as lines of longitude. The latitude and the longitude of a place are its coordinates and the distance formula is used to find the distance between two places. The distance between two parallel lines is approximately 150 km. A family from Uttar Pradesh planned a round trip from Lucknow (L) to Puri (P) via Bhuj (B) and Nashik (N) as shown in the given figure below.



Based on the above information answer the following questions using the coordinate geometry.

I.	Find the distance between Lucknow (L) to Bhuj(B).	1
II.	If Kota (K), internally divide the line segment joining Lucknow (L) to Bhuj (B) into 3 : 2 then find the coordinate of Kota (K).	1
III.	Name the type of triangle formed by the places Lucknow (L), Nashik (N) and Puri (P) **[OR]** Find a place (point) on the longitude (y-axis) which is equidistant from the points Lucknow (L) and Puri (P).	2

38 **Case Study – 3**

Lakshaman Jhula is located 5 kilometers north-east of the city of Rishikesh in the Indian state of Uttarakhand. The bridge connects the villages of Tapovan to Jonk. Tapovan is in Tehri Garhwal district, on the west bank of the river, while Jonk is in Pauri Garhwal district, on the east bank. Lakshman Jhula is a pedestrian bridge also used by motorbikes. It is a landmark of Rishikesh.

A group of Class X students visited Rishikesh in Uttarakhand on a trip. They observed from a point (P) on a river bridge that the angles of depression of opposite banks of the river are 60° and 30° respectively. The height of the bridge is about 18 meters from the river.

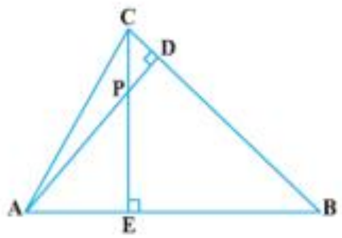
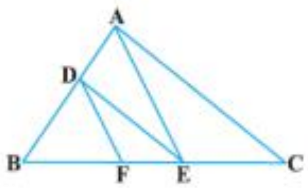
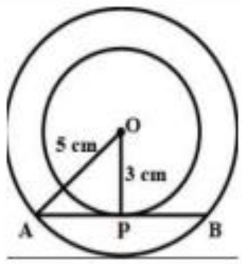
Based on the above information answer the following questions.

I.	Find the distance PA.	1
II.	Find the distance PB	1
III.	Find the width AB of the river. **[OR]** Find the height BQ if the angle of the elevation from P to Q be 30°.	2

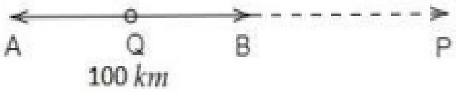
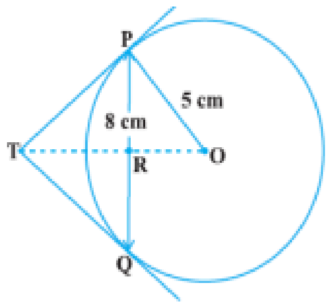
Class- X
Mathematics Basic (241)
Marking Scheme SQP-2022-23

Time Allowed: 3 Hours **Maximum Marks: 80**

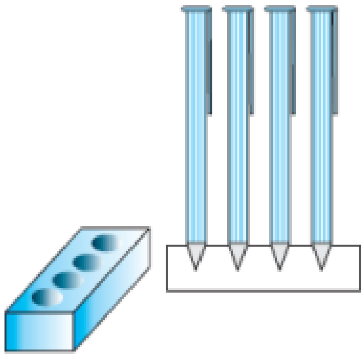
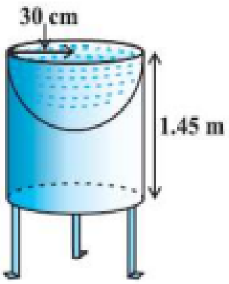
	Section A	
1	(c) a^3b^2	1
2	(c) 13 km/hours	1
3	(b) -10	1
4	(b) Parallel.	1
5	(c) k = 4	1
6	(b) 12	1
7	(c) $\angle B = \angle D$	1
8	(b) 5 : 1	1
9	(a) 25°	1
10	(a) $\frac{2}{\sqrt{3}}$	1
11	(c) $\sqrt{3}$	1
12	(b) 0	1
13	(b) 14 : 11	1
14	(c) 16 : 9	1
15	(d) 147π cm^2	1
16	(c) 20	1
17	(b) 8	1
18	(a) $\frac{3}{26}$	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	
21	For a pair of linear equations to have infinitely many solutions : $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \frac{k}{12} = \frac{3}{k} = \frac{k-3}{k}$ $\frac{k}{12} = \frac{3}{k} \Rightarrow k^2 = 36 \Rightarrow k = \pm 6$ Also, $\frac{3}{k} = \frac{k-3}{k} \Rightarrow k^2 - 6k = 0 \Rightarrow k = 0, 6.$ Therefore, the value of k, that satisfies both the conditions, is $k = 6$.	½ ½ ½ ½
22	 (i) In ΔABD and ΔCBE $\angle ADB = \angle CEB = 90^\circ$ $\angle ABD = \angle CBE$ (Common angle) $\Rightarrow \Delta ABD \sim \Delta CBE$ (AA criterion) (ii) In ΔPDC and ΔBEC $\angle PDC = \angle BEC = 90^\circ$ $\angle PCD = \angle BCE$ (Common angle) $\Rightarrow \Delta PDC \sim \Delta BEC$ (AA criterion) [OR]  In ΔABC, DE || AC BD/AD = BE/EC ....(i) (Using BPT) In ΔABE, DF || AE BD/AD = BF/FE ....(ii) (Using BPT) From (i) and (ii) BD/AD = BE/EC = BF/FE Thus, $\frac{BF}{FE} = \frac{BE}{EC}$	½ ½ ½ ½ ½ ½ ½ ½
23	 Let O be the centre of the concentric circle of radii 5 cm and 3 cm respectively. Let AB be a chord of the larger circle touching the smaller circle at P Then AP = PB and OP⊥AB Applying Pythagoras theorem in ΔOPA, we have $OA^2 = OP^2 + AP^2 \Rightarrow 25 = 9 + AP^2$ $\Rightarrow AP^2 = 16 \Rightarrow AP = 4$ cm $\therefore AB = 2AP = 8$ cm	½ ½ ½ ½
24	Now, $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)} = \frac{(1-\sin^2\theta)}{(1-\cos^2\theta)}$ $= \frac{\cos^2\theta}{\sin^2\theta} = \left(\frac{\cos\theta}{\sin\theta}\right)^2$ $= \cot^2\theta$ $= \left(\frac{7}{8}\right)^2 = \frac{49}{64}$	½ ½ ½ ½

25	Perimeter of quadrant = $2r + \frac{1}{4} \times 2\pi r$ $\Rightarrow$ Perimeter = $2 \times 14 + \frac{1}{2} \times \frac{22}{7} \times 14$ $\Rightarrow$ Perimeter = 28 + 22 =28+22 = 50 cm [OR] Area of the circle = Area of first circle + Area of second circle $\Rightarrow \pi R^2 = \pi (r_1)^2 + \pi (r_1)^2$ $\Rightarrow \pi R^2 = \pi (24)^2 + \pi (7)^2 \Rightarrow \pi R^2 = 576\pi + 49\pi$ $\Rightarrow \pi R^2 = 625\pi \Rightarrow R^2 = 625 \Rightarrow R = 25$ Thus, diameter of the circle = 2R = 50 cm.	½ ½ 1 ½ ½ 1
	Section C	
26	Let us assume to the contrary, that $\sqrt{5}$ is rational. Then we can find a and b ($\neq 0$) such that $\sqrt{5} = \frac{a}{b}$ (assuming that a and b are co-primes). So, a = $\sqrt{5}$ b $\Rightarrow a^2 = 5b^2$ Here 5 is a prime number that divides a^2 then 5 divides a also (Using the theorem, if a is a prime number and if a divides p^2, then a divides p, where a is a positive integer) Thus 5 is a factor of a Since 5 is a factor of a, we can write a = 5c (where c is a constant). Substituting a = 5c We get $(5c)^2 = 5b^2 \Rightarrow 5c^2 = b^2$ This means 5 divides b^2 so 5 divides b also (Using the theorem, if a is a prime number and if a divides p^2, then a divides p, where a is a positive integer). Hence a and b have at least 5 as a common factor. But this contradicts the fact that a and b are coprime. This is the contradiction to our assumption that p and q are co-primes. So, √5 is not a rational number. Therefore, the √5 is irrational.	1 ½ ½ ½ ½
27	$6x^2 - 7x - 3 = 0 \Rightarrow 6x^2 - 9x + 2x - 3 = 0$ $\Rightarrow 3x(2x - 3) + 1(2x - 3) = 0 \Rightarrow (2x - 3)(3x + 1) = 0$ $\Rightarrow 2x - 3 = 0$ & $3x + 1 = 0$ x = 3/2 & x = -1/3 Hence, the zeros of the quadratic polynomials are 3/2 and -1/3. For verification Sum of zeros = $\frac{-\text{coefficient of } x}{\text{coefficient of } x^2}$ $\Rightarrow$ 3/2 + (-1/3) = – (-7) / 6 $\Rightarrow$ 7/6 = 7/6 Product of roots = $\frac{\text{constant}}{\text{coefficient of } x^2}$ $\Rightarrow$ 3/2 x (-1/3) = (-3) / 6 $\Rightarrow$ -1/2 = -1/2 Therefore, the relationship between zeros and their coefficients is verified.	½ ½ 1 1
28	Let the fixed charge by Rs x and additional charge by Rs y per day Number of days for Latika = 6 = 2 + 4 Hence, Charge x + 4y = 22 x = 22 – 4y ....(1) Number of days for Anand = 4 = 2 + 2 Hence, Charge x + 2y = 16 x = 16 – 2y .... (2) On comparing equation (1) and (2), we get,	½ ½

	22 – 4y = 16 – 2y ⇒ 2y = 6 ⇒ y = 3 Substituting y = 3 in equation (1), we get, x = 22 – 4 (3) ⇒ x = 22 – 12 ⇒ x = 10 Therefore, fixed charge = Rs 10 and additional charge = Rs 3 per day [OR]  AB = 100 km. We know that, Distance = Speed × Time. AP – BP = 100 ⇒ 5x − 5y = 100 ⇒ x−y=20.....(i) AQ + BQ = 100 ⇒ x + y = 100....(ii) Adding equations (i) and (ii), we get, x − y + x + y = 20 +100 ⇒ 2x = 120 ⇒ x = 60 Substituting x = 60 in equation (ii), we get, 60 + y = 100 ⇒ y = 40 Therefore, the speed of the first car is 60 km/hr and the speed of the second car is 40 km/hr.	1 1 ½ ½ 1 1
29	 Since OT is perpendicular bisector of PQ. Therefore, PR=RQ=4 cm Now, OR = $\sqrt{\mathbf{OP^2 - PR^2}}$ = $\sqrt{\mathbf{5^2 - 4^2}}$ =3cm Now, ∠TPR + ∠RPO = 90° (∵TPO=90°) & ∠TPR + ∠PTR = 90° (∵TRP=90∘) So, ∠RPO = ∠PTR So, $\Delta TRP \sim \Delta PRO$ [By A-A Rule of similar triangles] So, $\frac{TP}{PO} = \frac{RP}{RG}$ $\Rightarrow \frac{TP}{5} = \frac{4}{3} \Rightarrow$ TP = $\frac{20}{3}$ cm	½ ½ ½ ½ ½ ½
30	$\text{LHS} = \frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = \frac{\tan\theta}{1-\frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1-\tan\theta}$ $= \frac{\tan^2\theta}{\tan\theta-1} + \frac{1}{\tan\theta\,(1-\tan\theta)}$ $= \frac{\tan^3\theta-1}{\tan\theta\,(\tan\theta-1)}$ $= \frac{(\tan\theta-1)\,(\tan^3\theta+\tan\theta+1)}{\tan\theta\,(\tan\theta-1)}$ $= \frac{(\tan^3\theta+\tan\theta+1)}{\tan\theta}$ $= \tan\theta + 1 + \sec$ = 1 + $\tan\theta + \sec\theta$ $= 1 + \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$ $= 1 + \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\,\cos\theta}$	½ ½ ½ ½ ½

	$= 1 + \frac{1}{\sin\theta\ \cos\theta} = 1 + \sec\theta \operatorname{cosec}\theta$ [OR] sin θ + cos θ = $\sqrt{3} \Rightarrow (\sin\theta + \cos\theta)^2 = 3$ $\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$ $\Rightarrow 1 + 2\sin\theta\cos\theta = 3 \Rightarrow 1 \sin\theta\cos\theta = 1$ Now tanθ + cotθ = $\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\text{isn}\,\theta}$ $= \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$ $= \frac{1}{\sin\theta\cos\theta} = \frac{1}{1} = 1$	½ ½ ½ ½ ½ ½ ½
31	(i) P(8) = $\frac{5}{36}$ (ii) P(13) = $\frac{0}{36} = 0$ (iii) P(less than or equal to 12) = 1	1 1 1
	Section D	
32	Let the average speed of passenger train = x km/h. and the average speed of express train = (x + 11) km/h As per given data, time taken by the express train to cover 132 km is 1 hour less than the passenger train to cover the same distance. Therefore, $\frac{132}{x} - \frac{132}{x+11} = 1$ $\Rightarrow \frac{132\,(x+11-x)}{x\,(x+11)} = 1 \Rightarrow \frac{132\ x\ 11}{x\,(x+11)} = 1$ $\Rightarrow 132 \times 11 = x(x + 11) \Rightarrow x^2 + 11x - 1452 = 0$ $\Rightarrow x^2 + 44x - 33x - 1452 = 0$ $\Rightarrow x\,(x + 44) - 33(x + 44) = 0 \Rightarrow (x + 44)(x - 33) = 0$ $\Rightarrow x = -44, 33$ As the speed cannot be negative, the speed of the passenger train will be 33 km/h and the speed of the express train will be 33 + 11 = 44 km/h. [OR] Let the speed of the stream be x km/hr So, the speed of the boat in upstream = (18 - x) km/hr & the speed of the boat in downstream = (18 + x) km/hr ATQ, $\frac{\text{distance}}{\text{upstream speed}} - \frac{\text{distance}}{\text{downstream speed}} = 1$ $\Rightarrow \frac{24}{18-x} - \frac{24}{18+x} = 1$	½ 1 ½ 1 1 ½ ½ ½ ½ 1

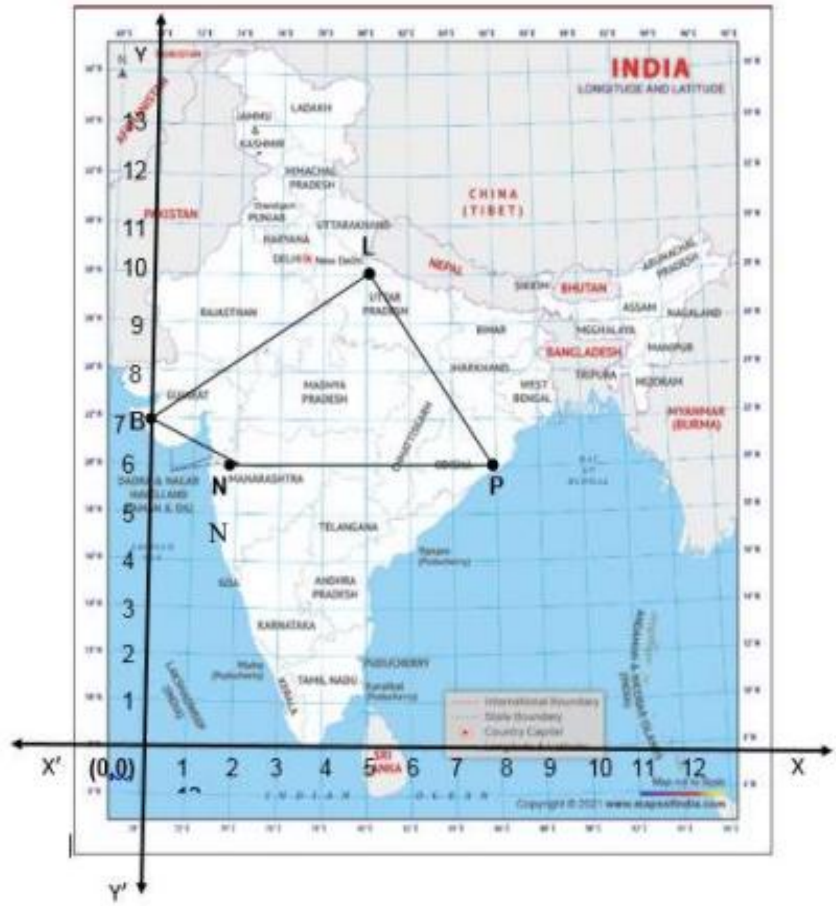
Q	Solution	Marks
	$\Rightarrow 24\left[\frac{1}{18-x}-\frac{1}{18+x}\right]=1 \Rightarrow 24\left[\frac{18+x-(18-x)}{(18-x).(18+x)}\right]=1$	1
	$\Rightarrow 24\left[\frac{2x}{(18-x).(18+x)}\right]=1 \Rightarrow 24\left[\frac{2x}{(18-x).(18+x)}\right]=1$	
	$\Rightarrow 48x = 324 - x^2 \Rightarrow x^2 + 48x - 324 = 0$	1
	$\Rightarrow (x + 54)(x - 6) = 0 \Rightarrow x = -54$ or 6	½
	As speed to stream can never be negative, the speed of the stream is 6 km/hr.	½
33	Figure	½
	Given, To prove, constructions	1½
	Proof	2
	Application ----	1
34		
	Volume of one conical depression = $\frac{1}{3} \times \pi r^2 h$	½
	$= \frac{1}{3} \times \frac{22}{7} \times 0.5^2 \times 1.4$ cm^3 = 0.366 cm^3	1½
	Volume of 4 conical depression = 4 x 0.366 cm^3	
	= 1.464 cm^3	½
	Volume of cuboidal box = L x B x H	½
	= 15 x 10 x 3.5 cm^3 = 525 cm^3	1½
	Remaining volume of box = Volume of cuboidal box – Volume of 4 conical depressions	½
	= 525 cm^3 – 1.464 cm^3 = 523.5 cm^3	1
	[OR]	
		
	Let h be height of the cylinder, and r the common radius of the cylinder and hemisphere.	
	Then, the total surface area = CSA of cylinder + CSA of hemisphere	½
	$= 2\pi rh + 2\pi r^2 = 2\pi r (h + r)$	2
	$= 2 \times \frac{22}{7} \times 30 (145 + 30)$ cm^2	1
	$= 2 \times \frac{22}{7} \times 30 \times 175$ cm^2	½
	= 33000 cm^2 = 3.3 m^2	1

35

Class Interval	Number of policy holders (f)	Cumulative Frequency (cf)
Below 20	2	2
20-25	4	6
25-30	18	24
30-35	21	45
35-40	33	78
40-45	11	89
45-50	3	92
50-55	6	98
55-60	2	100

1

		$n = 100 \Rightarrow n/2 = 50$, Therefore, median class = 35 – 40, Class size, h = 5, Lower limit of median class, l = 35, frequency f = 33, cumulative frequency cf = 45 $\Rightarrow$Median = $l + \left[\frac{\frac{n}{2} - cf}{f}\right] \times h$ $\Rightarrow$Median = $35 + \left[\frac{50-45}{33}\right] \times 5$ $= 35 + \frac{25}{33} = 35 + 0.76$ = 35.76 Therefore, median age is 35.76 years	½ 1½ 1 1
		Section E	
36	1	Since the production increases uniformly by a fixed number every year, the number of Cars manufactured in 1st, 2nd, 3rd, . . .,years will form an AP. So, a + 3d = 1800 & a + 7d = 2600 So d = 200 & a = 1200	½ ½
	2	$t_{12} = a + 11d \Rightarrow t_{30} = 1200 + 11 \times 200$ $\Rightarrow t_{12} = 3400$	½ ½
	3	$S_n = \frac{n}{2}[2a + (n-1)d] \Rightarrow S_{10} = \frac{10}{2}[2 \times 1200 + (10-1)\, 200]$ $\Rightarrow S_{10} = \frac{13}{2}[2 \times 1200 + 9 \times 200]$ $\Rightarrow S_{10} = 5 \times [2400 + 1800]$ $\Rightarrow S_{10} = 5 \times 4200 = 21000$ [OR] Let in n years the production will reach to 31200 $S_n = \frac{n}{2}[2a + (n-1)d] = 31200 \Rightarrow \frac{n}{2}[2 \times 1200 + (n-1)200] = 31200$ $\Rightarrow \frac{n}{2}[2 \times 1200 + (n-1)200] = 31200 \Rightarrow n\ [12 + (n-1)] = 312$ $\Rightarrow n^2 + 11n - 312 = 0$ $\Rightarrow n^2 + 24n - 13n - 312 = 0$ $\Rightarrow (n+24)(n-13) = 0$ $\Rightarrow n = 13$ or – 24. As n can't be negative. So n = 13	½ ½ ½ ½ ½ ½ ½ ½
37	**Case Study – 2**		



1	LB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \Rightarrow$ LB = $\sqrt{(0 - 5)^2 + (7 - 10)^2}$ LB = $\sqrt{(5)^2 + (3)^2} \Rightarrow$ LB = $\sqrt{25 + 9}$ LB = $\sqrt{34}$ Hence the distance is 150 $\sqrt{34}$ km	½ ½
2	Coordinate of Kota (K) is $\left(\frac{3 \times 5 + 2 \times 0}{3+2}, \frac{3 \times 7 + 2 \times 10}{3+2}\right)$ $= \left(\frac{15+0}{5}, \frac{21+20}{5}\right) = \left(3, \frac{41}{5}\right)$	½ ½
3	L(5, 10), N(2,6), P(8,6) LN = $\sqrt{(2 - 5)^2 + (6 - 10)^2} = \sqrt{(3)^2 + (4)^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ NP = $\sqrt{(8 - 2)^2 + (6 - 6)^2} = \sqrt{(4)^2 + (0)^2} = 4$ PL = $\sqrt{(8 - 5)^2 + (6 - 10)^2} = \sqrt{(3)^2 + (4)^2} \Rightarrow$ LB = $\sqrt{9 + 16} = \sqrt{25} = 5$ as LN = PL ≠ NP, so Δ LNP is an isosceles triangle. **[OR]**	½ ½ ½ ½

	Let A (0, b) be a point on the y – axis then AL = AP $\Rightarrow \sqrt{(5-0)^2+(10-b)^2} = \sqrt{(8-0)^2+(6-b)^2}$ $\Rightarrow (5)^2 + (10-b)^2 = (8)^2 + (6-b)^2$ $\Rightarrow 25 + 100 - 20b + b^2 = 64 + 36 - 12b + b^2 \Rightarrow 8b = 25 \Rightarrow b = \frac{25}{8}$ So, the coordinate on y axis is $\left(0, \frac{25}{8}\right)$	 ½ ½ ½ ½
38	**Case Study – 3** 	

1	$\sin 60° = \frac{PC}{PA}$ $\Rightarrow \frac{\sqrt{3}}{2} = \frac{18}{PA} \Rightarrow PA = 12\sqrt{3}$ m	½ ½
2	$\sin 30° = \frac{PC}{PB}$ $\Rightarrow \frac{1}{2} = \frac{18}{PB} \Rightarrow PB = 36$ m	½ ½
3	$\tan 60° = \frac{PC}{AC} \Rightarrow \sqrt{3} = \frac{18}{AC} \Rightarrow AC = 6\sqrt{3}$ m $\tan 30° = \frac{PC}{CB} \Rightarrow \frac{1}{\sqrt{3}} = \frac{18}{CB} \Rightarrow CB = 18\sqrt{3}$ m Width AB = AC + CB = $6\sqrt{3} + 18\sqrt{3} = 24\sqrt{3}$ m [OR] RB = PC =18 m & PR = CB = $18\sqrt{3}$ m $\tan 30° = \frac{QR}{PR} \Rightarrow \frac{1}{\sqrt{3}} = \frac{QR}{18\sqrt{3}} \Rightarrow QR = 18$ m QB = QR + RB = 18 + 18 = 36m. Hence height BQ is 36m	1 ½ ½ ½ 1 ½

Number of printed pages: 4

Class-X

Periodic Assessment – 1 (2022-23)Subject- Mathematics

Set A2

Time Allowed: 1.5 Hours **Maximum Marks: 40** **General Instructions**:

1. This question paper contains two parts A and B.
2. Both Part A and Part B have internal choices.

Part – A:

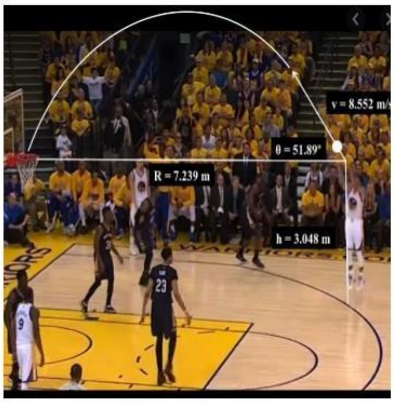
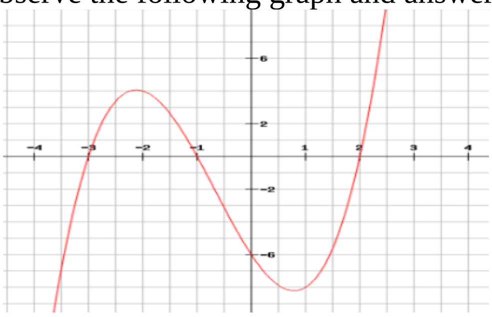
1. It consists of two sections- I and II.
2. Section I has 4 questions of 1 mark each (Question 1, 2 very short answer typeand Question 3, 4 MCQs). Internal choice is provided in 1 question.
3. Section II has 2 questions (Question 5, 6) on case study. Each case study has 4 case-based sub-parts. (2 subparts are MCQs and 2 subparts are very short answertype) .

Part – B:

1. It consists of three sections- III, IV and V.
2. Section III has 3 questions (Q .No 7,8,9) very short answer type questions of 2 mark each.
3. Section IV has 4 questions (Q . No 10,11,12,13) short answer type questions of 3 marks each
4. Section V has 2 questions (Q .No 14,15) long answer type questions of 5 marks each.
5. Internal choice is provided in 1 question of 2 marks, 1 questions of 3 marks and 1 question of 5 marks.

Q. No.	Part-A	Marks allocated
	Section I	
1	Calculate the area bounded by the line x + y = 10 and both the coordinate axis. OR Solve the given pair of linear equations by elimination method. $3x - y - 7 = 0$ $2x + 5y + 1 = 0$	1 1
2	Find the value of “p” from the polynomial $x^2 + 3x + p$, if one of the zeroes of the polynomial is 2.	1

3	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	1

4	The pair of equations y = 0 and y = 5 has (a) no solution (b) unique/one solution (c) two solutions (d) infinitely many solutions	1
	Section II	
	Case Study 1	
5	Basketball and soccer are played with a spherical ball. Even though an athlete dribbles the ball in both sports, a basketball player uses his handsand a soccer player uses his feet. Usually, soccer is played outdoors ona large field and basketball is played indoor on a court made out of wood.The projectile (path traced) of soccer ball and basketball are in the form of parabola representing quadratic polynomial. 	
(A)	The shape of the path traced shown is a) Spiral b) Ellipse c) Linear d) Parabola	1
(B)	The graph of parabola opens upwards, if _____________ a) $a = 0$ b) $a < 0$ c) $a > 0$ d) $a \neq 0$	1
(C)	Observe the following graph and answer  In the above graph, how many zeroes are there for the polynomial?	1
(D)	If the graph of given polynomial does not intersect x- axis then howmany zeroes will the polynomial have?	1
	Case Study -2	
6	It is common that Governments revise travel fares from time to time basedon various factors such as inflation (a general increase in prices and fall	

in the purchasing value of money) on different types of vehicles like auto, Rickshaws, taxis, Radio cab etc. The auto charges in a city comprise of afixed charge together with the charge for the distance covered. Study thefollowing situations.

Name of the city	Distance travelled (Km)	Amount paid (Rs.)
City A	10	75
	15	110
City B	8	91
	14	145

Situation 1: In city A, for a journey of 10 km, the charge paid is Rs 75and for a journey of 15 km, the charge paid is Rs 110.

Situation 2: In a city B, for a journey of 8km, the charge paid is Rs91 andfor a journey of 14km, the charge paid is Rs 145.

(A)	Refer situation 1 If the fixed charges of auto rickshaw be Rs x and the running charges beRs y km/hr, the pair of linear equations representing the situation is $a)\ x + 10y = 110, x + 15y = 75$ $b)\ x + 10y = 75, x + 15y = 110$ $c)\ 10x + y = 110, 15x + y = 75$ $d)\ 10x + y = 75, 15\,x + y = 110$	1
(B)	A person travels a distance of 50km. The amount he has to pay isa) Rs.155 b) Rs.255 c) Rs.355 d) Rs.455	1
(C)	Refer situation 2 What will a person have to pay for travelling a distance of 30km?	1
(D)	If the pair of lines are intersecting then how many solutions arepossible?	1
	Part – B	
	Section III	

7	The Sum of a two digit number and the number obtained by reversing theorder of its digits is 121. If units and ten's digit of the number are x and y respectively, then write the linear equation representing the above statement. **Or**	2

	A number is 27 more than the number obtained by reversing its digits. If its unit's and ten's digit are x and y respectively, write the linear equationrepresenting the statement.	2
8	Write two solutions for the following equation: $3x + 4y = 7$	2
9	Find the quadratic polynomial if its zeroes are 0, √5.	2
	Section IV	
10	For which values of a and b does the following pair of linear equationshave an infinite number of solutions? $2x + 3y = 7$ $(a - b)x + (a + b)y = 3a + b - 2$ OR For which value of k will the following pair of linear equations have no solution? $3x + y = 1$ $(2k - 1)x + (k - 1)y = 2k + 1$	3 3
11	Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$.	3
12	If α and β are the zeroes of the polynomial $ax^2 + bx + c$, find the value of $\alpha^2 + \beta^2$.	3
13	If one of the zeros of the quadratic polynomial $f(x) = 4x^2 - 8kx - 9$ is equal in magnitude but opposite in sign of the other, find the value of k.	3
	Section V	
14	Compute the zeroes of the polynomial $4x^2 - 4x - 8$. Also, establish a relationship between the zeroes and coefficients. OR Compute the zeroes of the polynomial $4u^2 + 8u$. Also, establish arelationship between the zeroes and coefficients.	5 5
15	Draw the graph $of\ 2x + y = 6\ and\ 2x - y + 2 = 0$. Shade the region boundedby these lines and y-axis. Find the area of the shaded region.	5

Number of printed pages 9

Class-X

Periodic Assessment – 1 (2022-23)
Subject- Mathematics

Solution & Marking Key
Set A1 & A2

Time Allowed: 1.5 Hours **Maximum Marks: 40**

General Instructions:

1. This question paper contains two parts A and B.

2. Both Part A and Part B have internal choices.

Part – A:

1. It consists of two sections- I and II.

2. Section I has 4 questions of 1 mark each (Question 1,2 very short answer type andQuestion 3,4 MCQs). Internal choice is provided in 1 question.

3. Section II has 2 questions (Question 5, 6) on case study. Each case study has 4 case-basedsub-parts.(2 subparts are MCQs and 2 subparts are very short answer type) .

Part – B:

1. It consists of three sections- III, IV and V.

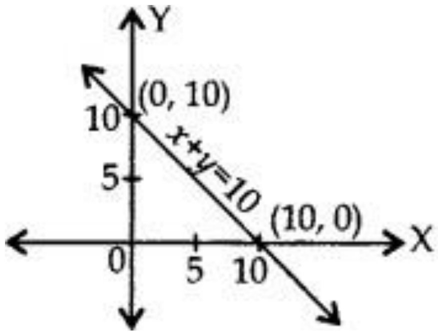
2. Section III has 3 questions (Q .No 7, 8, 9) very short answer type questions of 2 mark each.

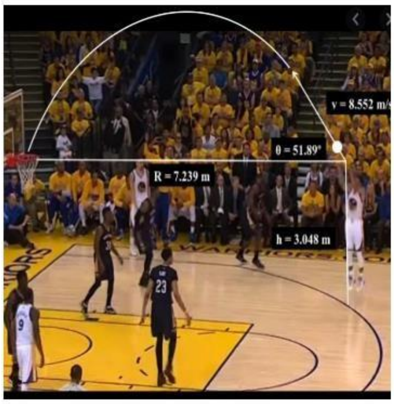
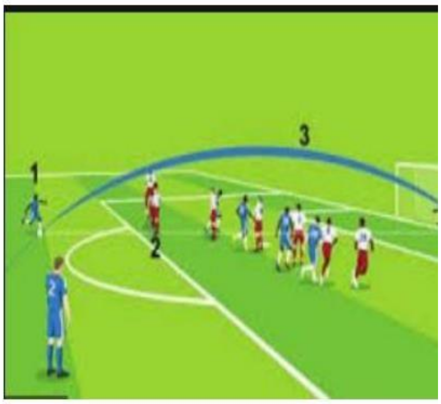
3. Section IV has 4 questions (Q . No 10,11,12,13) short answer type questions of 3 markseach

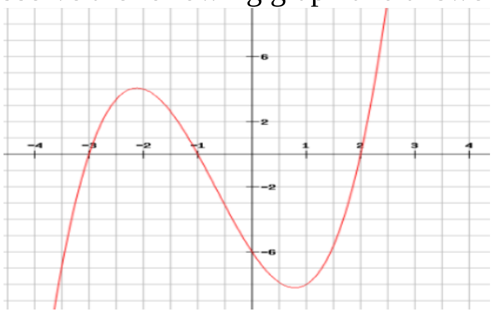
4. Section V has 2 questions (Q .No 14,15) long answer type questions of 5 marks each.

5. Internal choice is provided in 1 question of 2 marks, 1 questions of 3 marks and 1 questionof 5 marks.

Q. No.	Q. No.	Part-A	Marks allocated
A1	A2	**Section-I**	

1	2	Find the value of “p” from the polynomial $x^2 + 3x + p$, if one of thezeroes of the polynomial is 2. **Solution:** As 2 is the zero of the polynomial. We know that if α is a zero of the polynomial p(x), then p(α) = 0 Substituting x = 2 in $x^2 + 3x + p$, $\Rightarrow 2^2 + 3(2) + p = 0$ $\Rightarrow 4 + 6 + p = 0$ $\Rightarrow 10 + p = 0$ $\Rightarrow p = -10$	1
2	1	Calculate the area bounded by the line x + y = 10 and both the co-ordinate axes. Solution:  $x + y = 10$ $\begin{array}{\|c\|c\|c\|} \hline x & 10 & 10 \\ \hline y & 10 & 0 \\ \hline \end{array}$ Area of triangle = 1/2 × base × corresponding altitude = 1/2 × 10 × 10 = 50 cm^2 OR Solve the given pair of linear equations by elimination method. 3x – y – 7 = 0 2x + 5y + 1 = 0 Solution: 3 x – y = 7 …(i)2x + 5y = -1 -00 Multiplying equation (i) by 5 & (ii) by 1, $\begin{array}{rcrcr} 15x & - & 5y & = & 35 \\ 2x & + & 5y & = & -1 \\ \hline 17x & & & = & 34 \end{array}$ **...[by adding** $\Rightarrow x = 2$ Putting the value of x in (i), we have 3(2)-y = 7 ⇒ 6 – 7 = y ∴ y = -1 ∴ x = 2, y = -1	1

3	4	The pair of equations x = 0 and x = 5 has (a) no solution (b) unique/one solution (c) two solutions (d) infinitely many solutions Solution : (c)	1
4	3	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 Solution : (a)	1
		Section II	
		Case Study 1	
5		Basketball and soccer are played with a spherical ball. Even though an athlete dribbles the ball in both sports, a basketball player uses his hands and a soccer player uses his feet. Usually, soccer is played outdoors on a large field and basketball is played indoor on a court made out of wood. The projectile (path traced) of soccer ball and basketball are in the form of parabola representing quadratic polynomial.  	

(A)	(A)	The shape of the path traced shown is a) Spiral b) Ellipse c) Linear d) Parabola Sol: (d)	1
(B)	(B)	The graph of parabola opens upwards, if ________ a) a = 0 b) a < 0 c) a > 0 d) a 0 Sol : (c)	1
(C)	(C)	Observe the following graph and answer  In the above graph, how many zeroes are there for the polynomial? Sol : 3	1
(D)	(D)	If the graph of given polynomial does not intersect x- axis then how many zeroes will the polynomial have ? Sol : No zeroes	1
		Case Study -2	
6	6	It is common that Governments revise travel fares from time to time based on various factors such as inflation (a general increase in prices and fall in the purchasing value of money) on different types of vehicles like auto, Rickshaws, taxis, Radio cab etc. The auto charges in a city comprise of a fixed charge together with the charge for the distance covered. Study the following situations:	

Name of the city	Distance travelled (Km)	Amount paid (Rs.)
City A	10	75
	15	110
City B	8	91
	14	145

		Situation 1: In city A, for a journey of 10 km, the charge paid is Rs75and for a journey of 15 km, the charge paid is Rs 110. Situation 2: In a city B, for a journey of 8km, the charge paid is Rs91 and for a journey of 14km, the charge paid is Rs 145.	
(A)	(A)	Refer situation 1 If the fixed charges of auto rickshaw be Rs x and the running charges be Rs y km/hr, the pair of linear equations representing the situation is a) $x + 10y = 110$, $x + 15y = 75$ b) $x + 10y = 75$, $x + 15y = 110$ c) $10x + y = 110$, $15x + y = 75$ d) $10x + y = 75$, $15x + y = 110$ Sol : (b)	1
(B)	(B)	A person travels a distance of 50km. The amount he has to pay is a) Rs.155 b) Rs.255 c) Rs.355 d) Rs.455 Sol : (c)	1
(C)	(C)	Refer situation 2 What will a person have to pay for travelling a distance of 30km? Sol: Rs 289	1
(D)	(D)	If the pair of lines are intersecting then how many solutions are possible ? Sol : One	1
		Part – B	
		Section III	
7	9	Find the quadratic polynomial if its zeroes are 0, $\sqrt{5}$. Solution: A quadratic polynomial can be written using the sum and product of its zeroes as: $x^2 – (\alpha + \beta)x + \alpha\beta$ Where α and β are the roots of the polynomial. Here, $\alpha = 0$ and $\beta = \sqrt{5}$ So, the polynomial will be: $x^2 – (0 + \sqrt{5})x + 0(\sqrt{5})$ $= x^2 – \sqrt{5}x$	1 1
8	8	Write two solutions for the following equation: $3x + 4y = 7$	

		Sol : $3x + 4y = 7$ ….(1) Step 1: Isolate above equation in y. Subtract 3x from both the sides, $3x + 4y – 3x = 7 – 3x$ $4y = 7 – 3x$ Divide each side by 4 $y = 1/4 \times (7 – 3x)$ ….(2) Step 2: Find Solutions Substituting $x = 1$ in (2) $y = 1/4 \times (7 – 3) = 1/4 \times 4 = 1$ Thus $x = 1$ and $y = 1$ is the solution of $3x + 4y = 7$ Again, Substituting $x = 2$ in (2) $y = 1/4 \times (7 – 3 \times 2) = 1/4 \times 1 = 1/4$ Thus $x = 2$ and $y = 1/4$ is the solution of $3x + 4y = 7$ Therefore, (1, 1) and (2, 1/4) are two solution of $3x + 4y = 7$.	1 1
9	7	The Sum of a two digit number and the number obtained by reversing the order of its digits is 121. If units and ten's digit of the number are x and y respectively, then write the linear equation representing the above statement. Solution: As per the statement given, the number is $10y + x$. On reversing the digits of the number, we get, $10x + y$ Sum of the two numbers is 121. (Given) $10y + x + 10x + y = 121$ $11x + 11y = 121$ $x + y = 11$ Which represents the required linear equation. **Or** A number is 27 more than the number obtained by reversing its digits. lf its unit's and ten's digit are x and y respectively, write the linear equation representing the statement. Solution: Given: The original number is 27 more than the number obtained by reversing its digits The given number is in the form of $10y + x$. Number produced by reversing the digits of the number is $10x + y$. As per statement: $10y + x = 10x + y + 27$ $10y – y + x – 10x = 27$ $9y – 9x = 27$ $9 (y – x) = 27$ $y – x = 3$ $x – y + 3 = 0$ Above equation represents the required linear equation.	1 1 1 1
		Section IV	
10	13	If one of the zeros of the quadratic polynomial $f(x) = 4x^2 – 8kx – 9$ is equal in magnitude but opposite in sign of the other, find the value of k. Answer: Let one root of the given polynomial be α.	1

		Then the other root = -α Sum of the roots = (-α) + α = 0 ⇒ −b/a = 0 or −8k/4 = 0 or k = 0	1 1
11	12	If α and β are the zeroes of the polynomial $ax^2 + bx + c$, find the value of $\alpha^2 + \beta^2$. Solution: $\alpha + \beta = \frac{-b}{a}$, $\alpha\beta = \frac{c}{a}$ $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$ $\alpha^2 + \beta^2 = \left(\frac{-b}{a}\right)^2 - 2\left(\frac{c}{a}\right)$ $\alpha^2 + \beta^2 = \frac{b^2}{a^2} - \frac{2c}{a}$ $\therefore \quad \alpha^2 + \beta^2 = \frac{b^2 - 2ca}{a^2}$	1 1 1
12	11	Solve 2x + 3y = 11 and 2x – 4y = – 24 and hence find the value of 'm' for which y = mx + 3. **Solution:** 2x + 3y = 11… .... (i) 2x – 4y = -24… .... (ii) From equation (i), we get; x = (11 – 3y)/2 ....(iii) Putting the value of x in equation (ii), we get 2[(11 – 3y)/2] – 4y = −24 11 – 3y – 4y = -24 -7y = -35 y = 5… ....(iv) Putting the value of y in equation (iii), we get; x = (11 – 15)/2 = -4/2 = −2 Hence, x = -2, y = 5 Also, y = mx + 3 5 = -2m +3 -2m = 2 m = -1 Therefore, the value of m is -1.	1 1 1
13	10	For which values of a and b does the following pair of linear equations have an infinite number of solutions? 2x + 3y = 7 (a – b)x + (a + b)y = 3a + b – 2 Solution: We have, 2x + 3y = 7…..(i) (a – b) x + (a + b) y = 3a + b – 2 … (ii) Here, a1 = 2, b1 = 3, c1 = 7 and a2 = a – b, b2 = a + b, c2 = 3a + b – 2	1

		For infinite number of solutions, we have $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \frac{2}{a-b} = \frac{3}{a+b} = \frac{7}{3a+b-2}$ Now, $\frac{2}{a-b} = \frac{3}{a+b}$ $\Rightarrow 2a + 2b = 3a - 3b \Rightarrow 2a - 3a = -3b - 2b$ $\Rightarrow -a = -5b$ ...(iii) $\therefore a = 5b$ Again, we have $\frac{3}{a+b} = \frac{7}{3a+b-2} \Rightarrow 9a + 3b - 6 = 7a + 7b$ 9a – 7a + 3b – 75 -6 = 0 ⇒ 2a – 45 – 6 = 0 => 2a – 4b = 6 ⇒ a – 2b = 3 …(iv) Putting a = 5b in equation (iv), we get 56 – 2b = 3 or 3b = 3 i.e., b = 33 =1 Putting the value of b in equation (ii), we get a = 5(1) = 5 Hence, the given system of equations will have an infinite number of solutions for a = 5 and b = 1. OR For which value of k will the following pair of linear equations have no solution? 3x + y = 1 (2k – 1)x + (k – 1)y = 2k + 1 Solution : We have, 3x + y = 1, 3x + y − 1 = 0 …(i) (2k – 1) x + (k – 1) y = 2k + 1 ⇒ (2k – 1) x + (k – 1) y – (2k + 1) = 0 ……(ii) Here, a1 = 3, b1 = 1, C1 = -1 a2 = 2k – 1, b2 = k – 1, C2 = -(2k + 1) For no solution, we must have $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{3}{2k-1} = \frac{1}{k-1} \neq \frac{1}{2k+1}$ Now, $\frac{3}{2k-1} = \frac{1}{k-1} \Rightarrow 3k - 3 = 2k - 1$ ⇒ 3k – 2k = 3 – 1 ⇒ k = 2 Hence, the given system of equations will have no solutions for k = 2.	1 1 1 1 1
		Section V	
14	15	Draw the graph of 2x + y = 6 and 2x – y + 2 = 0. Shade the region bounded by these lines and x-axis. Find the area of the shaded region. Solution: We have, 2x + y = 6, ⇒ y = 6 – 2x	

When x = 0, we have y = 6 – 2 × 0 = 6
When x = 3, we have y = 6 – 2 × 3 = 0
When x = 2, we have y = 6 – 2 × 2 = 2
Thus, we get the following table: 1

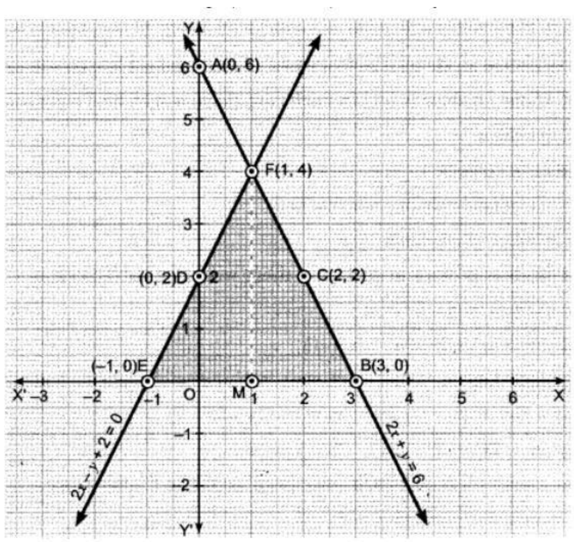
x	0	3	2
y	6	0	2

Now, we plot the points A(0,6), B(3,0) and C(2, 2) on the graph paper. We join A, B and C and extend it on both sides to obtain the graph of the equation 2x + y = 6. 1

We have, 2x – y + 2 = 1 = y = 2x + 2
When x = 0, we have y = 2 × 0 + 2 = 2
When x = -1, we have y = 2 × (-1) + 2 = 0
When x = 1, we have y = 2 × 1 + 2 = 4
Thus, we have the following table:

1

x	0	–1	1
y	2	0	4



1

1

$\Rightarrow$ Area of the shaded region $= \frac{1}{2}(\text{Base} \times \text{Height}) = \frac{1}{2}(BE \times FM)$

$= \left(\frac{1}{2} \times 4 \times 4\right)$ sq. units = 8 sq. units. 1

For set A 2 Area is 4 sq.units.

15 | 14 | Compute the zeroes of the polynomial $4x^2 – 4x – 8$. Also, establish a relationship between the zeroes and coefficients.

Solution:

Let the given polynomial be $p(x) = 4x^2 – 4x – 8$

		To find the zeroes, take p(x) = 0 Now, factorise the equation $4x^2 - 4x - 8 = 0$ $4x^2 - 4x - 8 = 0$ $4(x^2 - x - 2) = 0$ $x^2 - x - 2 = 0$ $x^2 - 2x + x - 2 = 0$ $x(x - 2) + 1(x - 2) = 0$ $(x - 2)(x + 1) = 0$ $x = 2, x = -1$ So, the roots of $4x^2 - 4x - 8$ are -1 and 2. Relation between the sum of zeroes and coefficients: $-1 + 2 = 1 = -(-4)/4$ i.e. (- coefficient of x/ coefficient of x^2) Relation between the product of zeroes and coefficients: $(-1) \times 2 = -2 = -8/4$ i.e (constant/coefficient of x^2) OR **Compute the zeroes of the polynomial** $4u^2 + 8u$ **. Also, establish a relationship between the zeroes and coefficients.** Solution : We have, $p(u) = 4u^2 + 8u = p(u) = 4u (u + 2)$ The zeros of polynomial p(u) is given by $p(u) = 0 \Rightarrow 4u (u + 2) = 0$. $\therefore u = 0, -2$ Thus, the zeros of $4u^2 + 8u$ are $\alpha = 0$ and $\beta = -2$ Now, sum of the zeros = $\alpha + \beta = 0 - 2 = -2$ and $\frac{-(\text{Coefficient of } u)}{\text{Coefficient of } u^2} = \frac{-8}{4} = -2$ Therefore, sum of the zeros = $\frac{-(\text{Coefficient of } u)}{\text{Coefficient of } u^2}$ Again, product of the zeros = $\alpha\beta = 0 \times (-2) = 0$ and $\frac{\text{Constant term}}{\text{Coefficient of } u^2} = \frac{0}{4} = 0$ Therefore, product of zeros = $\frac{\text{Constant term}}{\text{Coefficient of } u^2}$	 1 1 1 1 1 1 1 1 1 1

No. of printed pages : 8

Class- X
Mid Term Examination 2022-23
Mathematics
SET C1

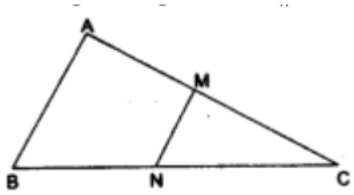
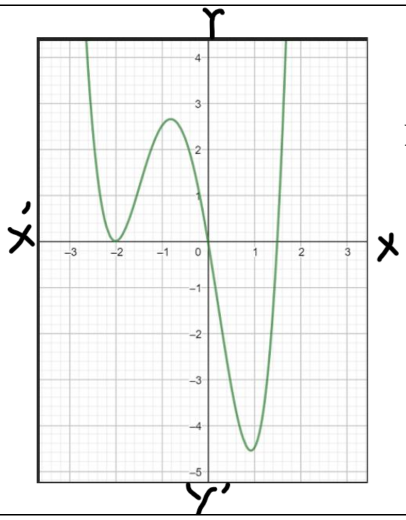
Max. Marks: 80 **Duration:3 hours**

General Instructions:
1. This question paper contains two parts A and B.
2. Both Part A and Part B have internal choices.

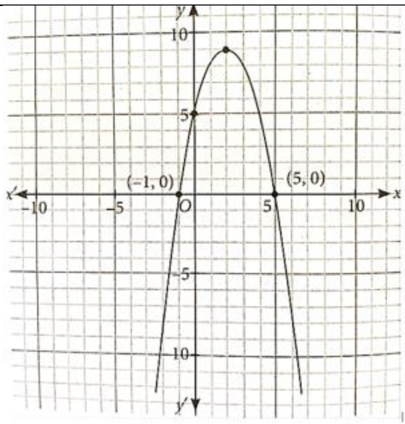
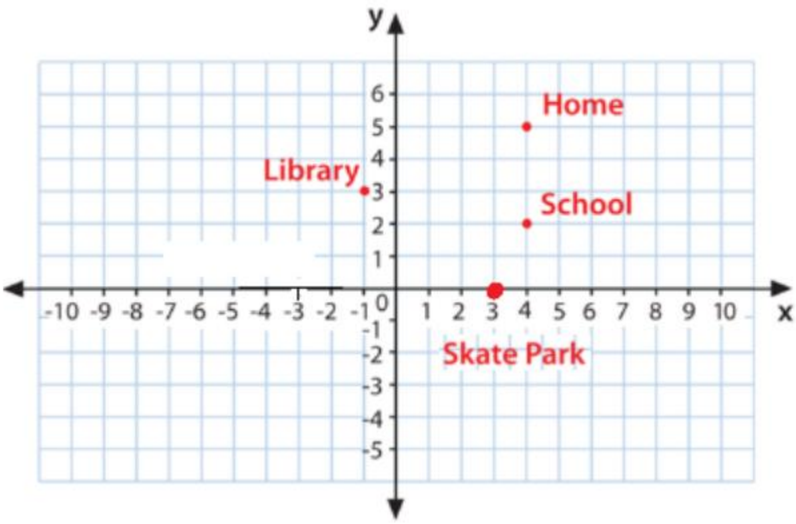
Part – A:
1. It consists of two sections- I and II
2. Section I has 16 questions.
Q1-Q4 are multiple choice question of 1 mark each
Q5-Q16 are question of 1 mark each .Internal choice is provided in 5 questions.
3. Section II has four case study-based questions. Each case study has 5 case-based sub-parts. An examinee is to attempt any 4 out of 5 sub-parts.

Part – B:
1. Question No 21 to 26 are Very short answer Type questions of 2 mark each,
2. Question No 27 to 33 are Short Answer Type questions of 3 marks each
3. Question No 34 to 36 are Long Answer Type questions of 5 marks each.
4. Internal choice is provided in 2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.

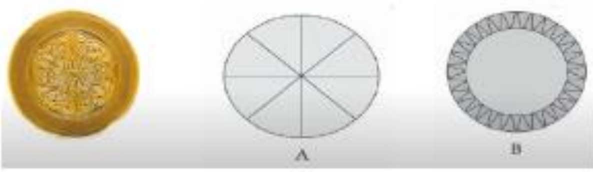
Q.NO.	**Part A**	Marks
	Section – I	
1	Check whether the given equations $3x - y = 3$; $9x - 3y = 9$ is a. consistent and has unique solution b. consistent and has no solution c. inconsistent and has no solution d. consistent and has infinitely many solutions	1
2	In Δ PQR, right-angled at Q , PQ = 3 cm and PR = 6 cm. Determine ∠ PRQ.	1

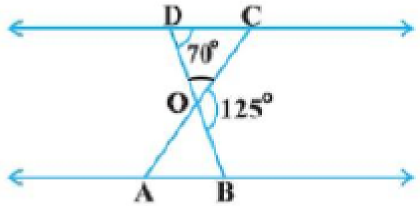
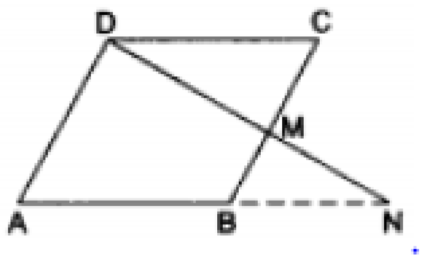
	a. 30° b. 60° c. 45° d. 90°	
3	In the given figure, MN∥AB, BC = 7.5 cm, AM = 4 cm and MC = 2 cm. Find the length of BN.  a. 5 cm b. 7.5cm c. 2.5cm d. 10 cm	1
4	An army contingent of 1000 members is to march behind an army band of 56 members in a parade. The two groups are to march in the same number of columns. The maximum number of columns in which they can march is a. 9 b. 8 c. 7000 d. 8000	1
5	 The graphs of y = p(x) is given, for a polynomial p(x). Find the number of zeroes of p(x) .	1
6	If α and β are the zeroes of the quadratic polynomial $p(x) = 4x^2 - 5x - 1$, find the value of $\alpha^2\beta + \alpha\beta^2$. OR If $x = -2$ is one of the zero of the polynomial $f(x) = x^2 - 5x + k$ find the value of k.	1
7	Is it possible to have two numbers whose HCF is 18 and LCM is 760? Give reason	1
8	Find a quadratic polynomial whose sum and product of the zeroes are $-2\sqrt{3}, -9$ respectively.	1
9	Express 7429 as a product of its prime factors.	1
10	The ordinate of a point A on the y-axis is 5 and B has coordinates (- 3,1). Find the length of AB.	1

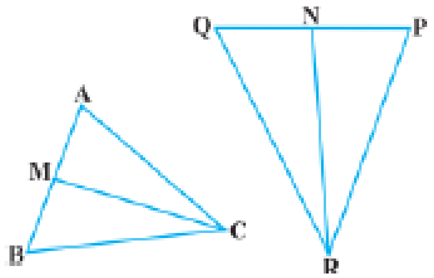
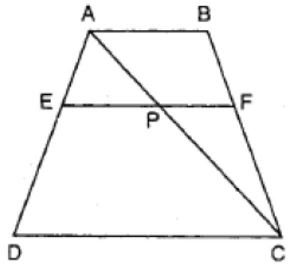
	OR Find the value of k, if the point P (0, 2) is equidistant from (3, k) and (k, 5).	
11	Evaluate : $3\cos^2 60° - 2\sin^2 45°$.	1
12	If a and b are any two positive numbers ,HCF (a,b) = 15 , LCM (a,b) = 90 and a = 54 then find the value of b. OR Two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$: x, y are prime numbers. Find LCM (a, b).	1
13	The area of the sector of a circle of radius 12 cm is 24π cm^2. Find the central angle of the sector. OR Find the area of a quadrant of a circle whose circumference is 88 cm.	1
14	If the area of a circle is 154 cm^2, find the perimeter of the circle. OR Find the radius of a circle whose perimeter and area are numerically equal.	1
15	In ΔPQR , E and F are points on the sides PQ and PR respectively , state whether $EF \parallel QR$ for the given values as stated . $PE = 3.9\ cm, EQ = 3\ cm, PF = 3.6\ cm$ and $FR = 2.4\ cm$	1
16	The minute hand of a clock is 3.5 cm long .What is the distance covered by the tip of the minute hand in 15 minutes ?	
	Section-II **Case study-based questions are compulsory. Attempt any 4 sub parts from each question. Each Sub part of the question carries 1 mark**	
17	**CASE STUDY 1** ABC construction company got the contract of making speed humps on roads. Speed humps are parabolic in shape and prevents over speeding, minimise accidents and gives a chance for pedestrians to cross the road. The mathematical representation of a speed hump is shown in the given graph.	

	 	
i)	The polynomial represented by the graph can be __________ polynomial. a. Linear b. Quadratic c. Cubic d. Zero	1
ii)	The zeroes of the polynomial represented by the graph are a. $1, 5$ b. $1, -5$ c. $-1, 5$ d. $-1, -5$	1
iii)	The sum of zeroes of the polynomial represented by the graph are a. 4 b. 5 c. 6 d. 7	1
iv)	If α and β are the zeroes of the polynomial represented by the graph such that β > α, then 8α+ β = a. -1 b. -2 c. 3 d. -3	1
v)	The expression of the polynomial represented by the graph is a. $-x^2 - 4x - 5$ b. $x^2 + 4x + 5$ c. $x^2 + 4x - 5$ d. $-x^2 + 4x + 5$	1
18	**CASE STUDY 2** Two brothers Ramesh and Pulkit were at home and have to reach School. Ramesh went to Library first to return a book and then reaches School directly whereas Pulkit went to Skate Park first to meet his friend and then reaches School directly. 	

i)	How far is School from their Home? $a.$ $5\,m$ $b.$ $3\,m$ $c.$ $2\,m$ $d.$ $4\,m$	1
ii)	The location of the library is: $a. (-1, 3)$ $b. (1, 3)$ $c. (3, 1)$ $d. (3, -1)$	1
iii)	How far is library from the Skate park? $a.$ $5m$ $b.$ $\sqrt{6}\,m$ $c.$ $\sqrt{24}\,m$ $d.$ $4m$	1
iv)	P(3,4) is the point on the line segment joining library and home which divides it in ratio k : 1 , the value of k is a. 3 b. 4 c. 5 d. 8	1
v)	In the middle of the Library and Skate park , there is a bus stand .The coordinate of the bus stand is $a. (1.5\,, 1)$ $b. (1, 1.5)$ $c. (2, 5)$ $d. (1.5, 1.5)$	1
19	**CASE STUDY 3** Moin tells his daughter, "Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be. Taking the present age of father as x years and daughter as y years , answer the given questions 	
i)	Q 1. What is the first equation according to the first condition? a. $x - 7y = 42$ b. $x - 7y = -42$ c. $x + 7y = 42$ d. $x - 5y = 42$	1
ii)	What is the second equation according to the second condition? a. $x + 3y = 6$ b. $x - 3y = 6$ c. $x + 3y = -6$ d. $x + 3y = 12$	1
iii)	What is the present age of Moin? a. 42 b. 48 c. 84 d. 52	1
iv)	What is the present age of Moin's daughter? a. 10 b. 14 c. 12 d. 16	1
v)	Geometric representation of the two equations on graph is a. Parallel lines b. Coincident lines	1

	c. Intersecting lines d. None of the above	
20	**CASE STUDY 4** A brooch is a small piece of jewellery that has a pin at the back so that it can be fastened to a dress. A few designs of thebrooch are given, observe them carefully:  **Design A:** Brooch A is made with silver wire in the form of a circle with a diameter 28 mm. The wire is used for making4 diameters which divides the circle into 8 equal sectors. **Design B:** Brooch B is made in two colours- Gold and Silver. The outer part is made of gold. The circumference of the silver part is 44 mm and the gold part is 3 mm wide everywhere.	
i)	**Refer to design A:** The total length of the silver wire required is: a. 180 mm b. 200 mm c. 250 mm d. 280 mm	1
ii)	The area of each sector of the brooch is: a. 44 mm^2 b. 52 mm^2 c. 77 mm^2 d. 68 mm^2	1
iii)	**Refer to design B:** The radius of the outer part (golden) is: a. 7 mm b. 9 mm c. 7.5 mm d. 10 mm	1
iv)	The difference in the area of the golden and silver part is: a. 18 π b. 44 π c. 51 π d. 64 π	1
v)	If the outer circumference of the golden part is to be decorated with a golden thread, how much thread will be required ? a. $62.86\ mm$ b. $61.86\ mm$ c. $52.86\ mm$ d. $68.86\ mm$	1
	Part –B **All questions are compulsory. In case of internal choices, attempt anyone.**	
21	If the distance between the points (2 , -2) and (-1 , x) is 5 , find the possible value(s) of x .	2
22	The sum of two numbers is 8. If their sum is four times their difference, find the numbers. OR Reena has pens and pencils which together are 40 in number. If she has 5 more pencils and 5 less pens, then number of pencils would become 4 times the number of pens. Find the original number of pens and pencils.	2

23	In the given figure, $\Delta ODC \cong \Delta OBA$, $\angle BOC = 125°$ and $\angle CDO = 70°$. Find $\angle DOC$, $\angle DCO$ and $\angle OAB$. 	2
24	In what ratio does the point P(2, 5) divide the join of A(8, 2) and B(-6, 9)?	2
25	If 3 cot θ= 4, find the value of $\frac{4Cos\theta - Sin\theta}{2Cos\ \theta + Sin\ \theta}$	2
26	In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the length of the corresponding arc . OR 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 the area of that part of the field in which the horse can graze. 	2
	<u>Part –B</u> **<u>All questions are compulsory. In case of internal choices, attempt anyone.</u>**	
27	Prove that √5 is irrational.	3
28	Find the zeroes of quadratic polynomial $6x^2 - 3 - 7x$ and also verify the relationship between the zeroes and the coefficients.	3
29	M is a point on the side BC of a parallelogram ABCD. DM when produced meets AB at N. Prove that. i. $\frac{DM}{MN} = \frac{DC}{BN}$ ii. $\frac{DN}{DM} = \frac{AN}{DC}$  OR	3

	In fig. CM and RN are respectively the medians of △ABC and △PQR. If △ABC ~ △PQR, prove that: i. △AMC ~ △PNR ii. $\frac{CM}{RN} = \frac{AB}{PQ}$ iii. △CMB ~ △RNQ  	
30	Point A is on x-axis, point B is on y-axis and the point P lies on line segment AB, such that P (4, - 5) and AP : PB = 5 :3. Find the coordinates of point A and B.	3
31	In $\Delta\ PQR$, right-angled at $Q, PR + QR = 25\ cm$ and $PQ = 5\ cm$. Determine the values of $in\ P\ and\ cos\ P$. OR If tan θ = $\frac{12}{13}$, evaluate $\frac{2\ Sin\theta Cos\theta}{Cos^2\theta - Sin^2\theta}$.	3
32	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 ?	3
33	There is a circular path around a sports field. Sonia takes 96 minutes to walk one round of the field, while Ravi takes 80 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?	3
	<u>Part –B</u> **<u>All questions are compulsory. In case of internal choices, attempt anyone.</u>**	
34	A two-digit number is 4 more than 6 times the sum of its digits. If 18 is subtracted from the number, the digits are reversed. Find the number. OR Determine graphically whether the following pair of linear equations is consistent . If consistent obtain the solution graphically , $3x - y = 7\ \ and\ \ 2x + 5y + 1 = 0$	5
35	In Fig. if EF‖DC‖AB. prove that $\frac{AE}{ED} = \frac{BF}{FC}$  	5
36	Prove the following identities, where the angles involved are acute angles for which the expressions are defined. $$\frac{cosA}{1 + sin\ A} + \frac{1 + sin\ A}{cosA} = 2\ sec\ A$$	5

No. of printed pages:20

Class- X
Mathematics
Mid Term Examination 2022-23
Marking key and Solution set C1/C2

Max. Marks: 80 **Duration:3 hours**

General Instructions:

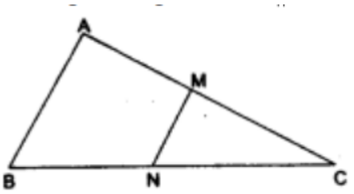
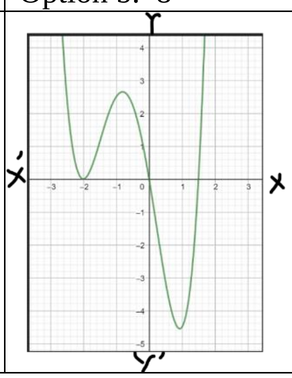
1. This question paper contains two parts A and B.
2. Both Part A and Part B have internal choices.

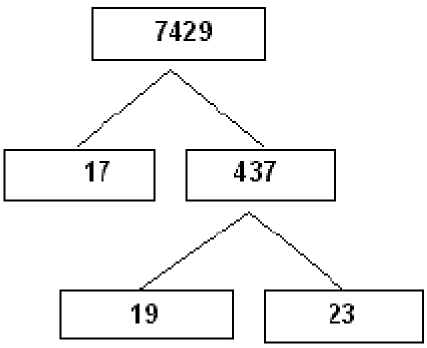
Part – A:

1. It consists of two sections- I and II
2. Section I has 16 questions. Q1-Q4 are multiple choice questions .Internal choice is provided in 5 questions.
3. Section II has four case study-based questions. Each case study has 5 case-based sub-parts. An examinee is to attempt any 4 out of 5 sub-parts.

Part – B:

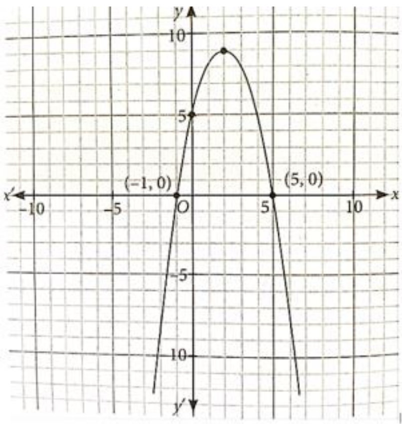
1. Question No 21 to 26 are Very short answer Type questions of 2 mark each,
2. Question No 27 to 33 are Short Answer Type questions of 3 marks each
3. Question No 34 to 36 are Long Answer Type questions of 5 marks each.
4. Internal choice is provided in 2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.

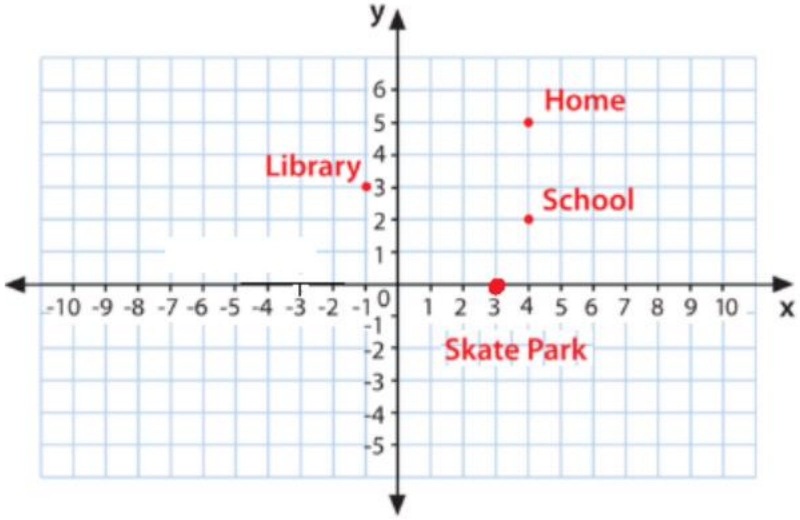
C1	**C**	**Section – I**	
1 Ans1.	2	OR Check whether the given equations $3x - y = 3$; $9x - 3y = 9$ is e. consistent and has unique solution f. consistent and has no solution g. inconsistent and has no solution h. consistent and has infinitely many solutions option d	1
2 Ans 2.	1	In Δ PQR, right-angled at Q , PQ = 3 cm and PR = 6 cm. Determine ∠ PRQ. a. 30° b. 60° c. 45° d. 90° a. 30°	1
3 Ans 3.	4	In the given figure, MN∥AB, BC = 7.5 cm, AM = 4 cm and MC = 2 cm. Find the length of BN.  b. 5 cm b. 7.5cm c. 2.5cm d. 10 cm Option a. 5 cm	1
4 Ans 4.	3	An army contingent of 1000 members is to march behind an army band of 56 members in a parade. The two groups are to march in the same number of columns. The maximum number of columns in which they can march is a. 9 b. 8 c. 7000 d. 8000 Option b. 8	1
5 Ans 5.		 The graphs of y = p(x) is given, for a polynomial p(x). Find the number of zeroes of p(x) . Number of zeroes of p(x) = 3	1

6 Ans 6. Q6 Ans 6.	11	If α and β are the zeros of the quadratic polynomial $p(x) = 4x^2 - 5x - 1$, find the value of $\alpha^2\beta + \alpha\beta^2$. α and β are zeroes of the polynomial: $p(x)=4x^2-5x-1$ a=4, b = -5,c = -1 So, Sum of the zeroes = α + β = $-\frac{b}{a} = \frac{5}{4}$ Product of the zeroes = αβ = $\frac{c}{a} = -\frac{1}{4}$ Now, $\alpha^2\beta + \alpha\beta^2 = \alpha\beta(\alpha + \beta)$ $= \frac{5}{4} \times -\frac{1}{4}$ $= -\frac{5}{16}$ OR If $x = -2$ is one of the zero of the polynomial $f(x) = x^2 - 5x + k$ find the value of k. Compare $f(x) = x^2 - 5x + k$ with x= -2 as one of the zero ,we get ⇒ $(-2)^2 -5(-2) + (k) = 0$ ⇒ 4 +10 + k = 0 ⇒ k = - 14	1
7 Ans 7	10	Is it possible to have two numbers whose HCF is 18 and LCM is 760? Give reason As we know that the LCM has to be a multiple of the HCF. It is not possible because 760 is not a multiple of 18.	1
8 Ans 8.	9	Find a quadratic polynomial whose sum and product of the zeroes are $-2\sqrt{3}, -9$ respectively. Here, α + β = $-2\sqrt{3}$ and $\alpha\beta = -9$ $f(x) = x^2 - (\alpha + \beta)x + \alpha\beta$ [Formula] $= x^2 - (-2\sqrt{3})x + (-9)$ $\Rightarrow f(x) = x^2 + 2\sqrt{3}x - 9$	1
9 Ans 9.	8	Express 7429 as a product of its prime factors.  So, 7429 = 17 × 19 × 23.	1
10	7	The ordinate of a point A on the y-axis is 5 and B has coordinates (- 3,1). Find the length of AB.	1

Ans 10. Ans 10.		Here, A(0,5) and B(-3, 1) AB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-3-0)^2 + (1-5)^2}$ $= \sqrt{9+16}$ $= \sqrt{25}$ = 5 units OR Find the value of k, if the point P (0, 2) is equidistant from (3, k) and (k, 5). Let the point P(0, 2) is equidistant from A(3, k) and B(k, 5) PA = PB $PA^2 = PB^2$ $(3 - 0)^2 + (k - 2)^2 = (k - 0)^2 + (5 - 2)^2$ $\Rightarrow 9 + k^2 + 4 - 4k = k^2 + 9$ $\Rightarrow 9 + k^2 + 4 - 4k - k^2 - 9 = 0$ $\Rightarrow 4 - 4k = 0$ $\Rightarrow -4k = -4$ $\Rightarrow k = 1$	
11. Ans 11.	6	Evaluate $3\cos^2 60° - 2\sin^2 45°$ $3\cos^2 60° - 2\sin^2 45°$ $= 3 \times \frac{1}{4} - 2 \times \frac{1}{2} = \frac{3}{4} - 1 = -\frac{1}{4}$	1
12 Ans 12. 12 Ans12	16	If a and b are any two positive numbers , HCF (a,b) = 15, LCM (a,b) = 90 and a = 54 then find the value of b. HCF (a,b) = 15, LCM (a,b) = 90 and a = 54 b = $\frac{HCF \times LCM}{a} = \frac{90 \times 15}{54} = 25$ OR Two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$: x,y are prime numbers. Find LCM (a, b). Here: $a = x^3y^2$, and $b = xy^3$ LCM = Product of highest powers of x and y so, LCM = x^3y^3	1
13 Ans 13. Q13	15	The area of the sector of a circle of radius 12 cm is 24π cm^2. Find the central angle of the sector. It is given that area of the sector = 24π cm^2 and Radius = 12 cm $24\pi = \frac{\theta}{360} \times \pi \times 12 \times 12$ Therefore, Central angle of the sector = 60° OR	1

Ans 13.		Find the area of a quadrant of a circle whose circumference is 88 cm. We know that circumference of the circle = $2\pi r$ $\Rightarrow 88 = 2 \times \frac{22}{7} \times r$ $\Rightarrow 88 \times \frac{7}{44} = r$ $\Rightarrow$ 2 × 7 × r $\Rightarrow$ r = 14cm Now, Area of quadrant = $\frac{1}{4}\pi r^2 = \frac{1}{4} \times \frac{22}{7} \times 14 \times 14 = 154 cm^2$	
14 Ans 14. Ans 14.	14	If the area of a circle is 154 cm^2 , find the perimeter of the circle. area of a circle = 154 cm^2 Let radius = r units According to the question, $154 = \pi r^2 \Rightarrow$ r = 7 $\Rightarrow$r = 7 cm Perimeter = $2\pi r = 2 \times \frac{22}{7} \times 7 = 44\ cm$ OR Find the radius of a circle whose perimeter and area are numerically equal. Assume radius of a circle = r Then, area of a circle = πr^2 and Perimeter of a circle = $2\pi r$ According to question we have, Perimeter of a circle = area of a circle $\Rightarrow \pi r^2 = 2\pi r$ $\Rightarrow$ r = 2 units	1
15 Ans 15.	13	In ΔPQR ,E and F are points on the sides PQ and PR respectively , state whether $EF \mid\mid QR$ for the given values as stated . $PE = 3.9\ cm, EQ = 3\ cm, PF = 3.6\ cm$ and $FR = 2.4\ cm$ In $\Delta PQR, E$ and F are two points on side PQ and PR respectively. (i) $PE = 3.9\ cm, EQ = 3\ cm$ (Given) $PF = 3.6\ cm, FR = 2{,}4\ cm$ (Given) $\therefore \frac{PE}{EQ} = \frac{3.9}{3} = \frac{39}{30} = \frac{13}{10} = 1.3$ [By using Basic proportionality theorem] And, $\frac{PF}{FR} = \frac{3.6}{2.4} = \frac{36}{24} = \frac{3}{2} = 1.5$ So, $\frac{PE}{EQ} \neq \frac{PF}{FR}$ Hence, EF is not parallel to QR.	1
16	12	The minute hand of a clock is 3.5 cm long.What is the distance covered by tip of the minute hand in 15 minutes ?(Taking ,$\pi = 22/7$) Angle made by the clock in 15 minutes is 90 degrees	1

Ans 16.		Distance covered is $\frac{\theta}{360} \times 2\pi r$ $= \frac{1}{4} \times 2 \times \frac{22}{7} \times 3.5 = 5.5\ cm$	
		Section-II **Case study-based questions are compulsory. Attempt any 4 sub parts from each question. Each Sub part of the question carries 1 mark**	
17		ABC construction company got the contract of making speed humps on roads. Speed humps are parabolic in shape and prevents over speeding, minimise accidents and gives a chance for pedestrians to cross the road. The mathematical representation of a speed hump is shown in the given graph.  	
i) Ans		The polynomial represented by the graph can be __________ polynomial. a. Linear b. Quadratic c. Cubic d. Zero (b) Quadratic	1
ii) Ans.		The zeroes of the polynomial represented by the graph are a. $1, 5$ b. $1, -5$ c. $-1, 5$ d. $-1, -5$ (c) $-1, 5$	1
iii) Ans.		The sum of zeroes of the polynomial represented by the graph are a. 4 b.5 c. 6 d. 7 (a) Sum of zeroes = -1 + 5 = 4	1
iv) Ans.		If α and β are the zeroes of the polynomial represented by the graph such that β > α, then 8α+ β = a. -1 b. -2 c. 3 d. -3 (d) -3	1
v) Ans		The expression of the polynomial represented by the graph is a. $-x^2 - 4x - 5$ b. $x^2 + 4x + 5$ c. $x^2 + 4x - 5$ d. $-x^2 + 4x + 5$ (d) $-x^2 + 4x + 5$	1
18		**CASE STUDY 2**	

<table>
<tr><td>Ans
18.</td><td></td><td>Two brothers Ramesh and Pulkit were at home and have to reach School. Ramesh went to Library first to return a book and then reaches School directly whereas Pulkit went to Skate Park first to meet his friend and then reaches School directly.


Let Home represented by point H(4, 5), Library by point L(-1, 3), Skate Park by point P(3, 0) and School by S(4, 2).</td><td></td></tr>
<tr><td>i)

Ans.</td><td></td><td>How far is School from their Home?
a. 5 m b. 3 m c. 2 m d. 4 m

(b) 3m</td><td>1</td></tr>
<tr><td>ii)

Ans.</td><td></td><td>The location of the library is:
a. (-1, 3) b. (1, 3) c. (3, 1) d. (3, -1)

(a) (-1, 3)</td><td>1</td></tr>
<tr><td>iii)

Ans.</td><td></td><td>How far is library from the Skate park?

$a.\ 5m$ $b.\ \sqrt{6}\,m$ $c.\ \sqrt{24}\,m$ $d. 4m$

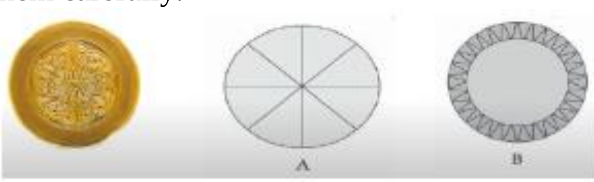
(a) 5m</td><td>1</td></tr>
<tr><td>iv)

Ans.</td><td></td><td>P(3,4) is the point on the line segment joining library and home which divides it in ratio k : 1 , the value of k is

a. 3 b. 4 c. 5 d. 8

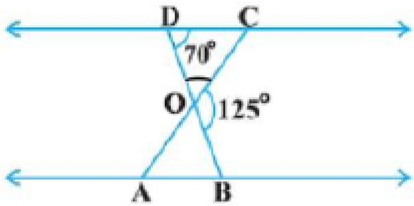
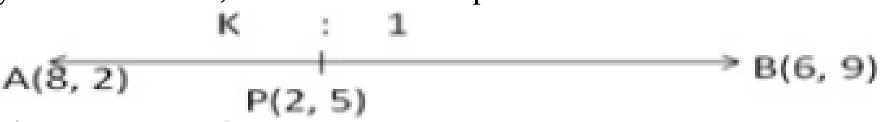
(b) 4</td><td>1</td></tr>
<tr><td>v)

Ans.</td><td></td><td>In the middle of the Library and Skate park , there is a bus stand .The coordinate of the bus stand is
$a. (1.5\ ,1)$ $b. (1, 1.5)$ $c. (2, 5)$ $d. (1.5, 1.5)$
$b. (1\ , 1.5)$</td><td>1</td></tr>
<tr><td>19</td><td></td><td><u>CASE STUDY 3</u></td><td></td></tr>
</table>

		Moin tells his daughter, “Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be. Taking the present age of father as x years and daughter as y years , answer the given questions 	
i) Ans		Q 1. What is the first equation according to the first condition? a. $x - 7y = 42$ b. $x - 7y = -42$ c. $x + 7y = 42$ d. $x - 5y = 42$ option b	1
ii) Ans		What is the second equation according to the second condition? a. $x + 3y = 6$ b. $x - 3y = 6$ c. $x + 3y = -6$ d. $x + 3y = 12$ option b	1
iii) Ans		What is the present age of Moin? 42 b. 48 c. 84 d. 52 Option a	1
iv) Ans		What is the present age of Moin’s daughter? 10 b. 14 c. 12 d. 16 Option c	1
v) Ans		Geometric representation of the two equations on graph is a. Parallel lines b. Coincident lines c. Intersecting lines d. None of the above option c	1
20		**<u>CASE STUDY 4</u>** A brooch is a small piece of jewellery that has a pin at the back so that it can be fastened to a dress. A few designs of thebrooch are given, observe them carefully:  **Design A:** Brooch A is made with silver wire in the form of a circle with a diameter 28 mm. The wire is used for making4 diameters which divides the circle into 8 equal sectors.	

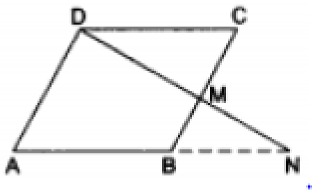
		Design B: Brooch B is made in two colours- Gold and Silver. The outer part is made of gold. The circumference of the silver part is 44 mm and the gold part is 3 mm wide everywhere. **Refer to design A:**	
i) Ans.		The total length of the silver wire required is: a. 180 mm b. 200 mm c. 250 mm d. 280 mm (b) 200 mm	1
ii) Ans.		The area of each sector of the brooch is: a. 44 mm^2 b. 52 mm^2 c. 77 mm^2 d. 68 mm^2 c. 77 mm^2	1
iii) Ans.		**Refer to design B:** The radius of the outer part (golden) is: a. 7 mm b. 9 mm c. 7.5 mm d. 10 mm d. 10 mm	1
iv) Ans.		The difference in the area of the golden and silver part is: a. 18 π b. 44 π c. 51 π d. 64 π c. 51 π	1
v) Ans.		If the outer circumference of the golden part is to be decorated with a golden thread ,how much thread will be required ? a. $62.86mm$ b. $61.86mm$ c. $52.86mm$ d. $68.86mm$ a. $62.86mm$	1
		Part –B **All questions are compulsory. In case of internal choices, attempt anyone.**	
21 Ans 21.	26	If the distance between the points (2 , -2) and (-1 , x) is 5 , find the possible value(s) of x . Given Distance between (2, −2) and (−1, x) = 5 $\sqrt{(-1\ -2)^2+(x-(-2))^2} = 5$ $\sqrt{(-3)^2+(x+2)^2} = 5$ $\sqrt{9+x^2+2^2+4x} = 5$ $\sqrt{9+x^2+4+4x} = 5$ $\sqrt{x^2+4x+13} = 5$ *Squaring both sides*	2

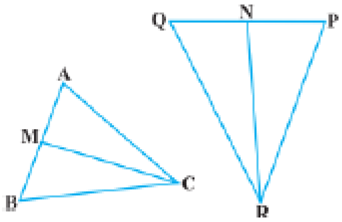
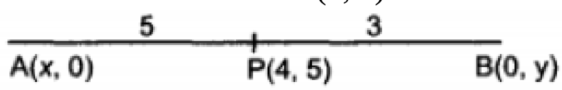
		$\left(\sqrt{x^2+4x+13}\right)^2 = 5^2$ $x^2 + 4x + 13 = 25$ $x^2 + 4x + 13 - 25 = 0$ $x^2 + 4x - 12 = 0$ *Solving by splitting the middle term* $x^2 + 6x - 2x - 12 = 0$ $x(x+6) - 2(x+6) = 0$ $(x-2)(x+6) = 0$ $\therefore$ **x = 2, −6**	
22 Ans 22. Ans 22.	25	The sum of two numbers is 8. If their sum is four times their difference, find the numbers. Let the numbers be ‘a’ and ‘b’. Given that, sum of two numbers is 8. $\Rightarrow$ a + b = 8 ...(1) Also, their sum is four times their difference $\Rightarrow$ a + b = 4(a – b) $\Rightarrow$ a + b = 4a – 4b $\Rightarrow$ 3a -5b = 0 ...(2) Substituting value of 'a' from equation (2) in equation (1) $\Rightarrow \frac{5}{3}b + b = 8$ $\Rightarrow \frac{5b+3b}{3} = 8$ $\Rightarrow$ 8b = 24 $\Rightarrow$ b = 3 Using this value of 'b' in (1), gives a = 8 − 3 = 5 Thus, a = 5 and b = 3. OR Reena has pens and pencils which together are 40 in number. If she has 5 more pencils and 5 less pens, then number of pencils would become 4 times the number of pens. Find the original number of pens and pencils. Let the number of pens be x and that of pencil be y, As per given condition Reena has total 40 pens and pencils. So, x + y =40 ....(i) And if she has 5 more pencils and 5 less pens, then number of pencils would become 4 times the number of pens. So, y + 5 = 4(x- 5) y + 5 = 4x - 20 4x - y = 25 .... (ii)	2

		Adding equation (i) and equation (ii), we get x + 4x = 40 + 25 5x = 65 $x = \frac{65}{5} = 13$ Putting x = 13 in equation (i), we get 13 + y = 40 y = 40 - 13 = 27 Hence, Reena has 13 pens and 27 pencils.	
23 Ans 23.	24	In the given figure, ΔODC ≅ΔOBA, ∠BOC = 125° and ∠CDO = 70°. Find ∠DOC, ∠DCO and ∠OAB.  From the given figure, ∠DOC + 125° = 180° [linear pair] ∠DOC = 55° Now, in ΔDOC, $\angle DCO + \angle ODC + \angle DOC = 180^\circ$ [angle sum property of a triangle] $\angle DCO + 70^\circ + 55^\circ = 180^\circ$ $\angle DCO = 55^\circ$ Now, $\triangle ODC \cong \triangle OBA$ [given] $\therefore \angle OAB = \angle OCD = 55^\circ$	2
24 Ans 24.	23	In what ratio does the point P(2, 5) divide the join of A(8, 2) and B(-6, 9)? Let P divided the join of A(8, 2), B(-6, 9) in the ratio k:1 By section formula, the coordinates of p are  $\left(\frac{-6k+8}{k+1}, \frac{9k+2}{k+1}\right)$ $\therefore \frac{-6k+8}{k+1} = 2$ and $\frac{9k+2}{k+1} = 5$ ⟹-6k + 8 = 2k + 2 and 9k + 2 =5k + 5 -8k = -6 and 4k = 3 $k = \frac{-6}{-8} = \frac{3}{4}$ $and\ k = \frac{3}{4}$	2

		$\Rightarrow k = \frac{3}{4}$ in each case Hence, the required ratio of which is $(\frac{3}{4}:1)$ which is (3 : 4)	
25 Ans 25.	22	If 3 cot θ= 4, find the value of $\frac{4Cos\theta - Sin\theta}{2Cos\,\theta + Sin\,\theta}$ Here, $3\cot\theta = 4 \Rightarrow \cot\theta = \frac{4}{3}$ Now, $\frac{4\cos\theta - \sin\theta}{2\cos\theta + \sin\theta} = \frac{4\frac{\cos\theta}{\sin\theta} - \frac{\sin\theta}{\sin\theta}}{2\frac{\cos\theta}{\sin\theta} + \frac{\sin\theta}{\sin\theta}}$ ..(Dividing throughout by $\sin\theta$) $= \frac{4\cot\theta - 1}{2\cot\theta + 1}$ $= \frac{4\times\frac{4}{3} - 1}{2\times\frac{4}{3} + 1} = \frac{\frac{16}{3} - 1}{\frac{8}{3} + 1}$ $= \frac{\frac{13}{3}}{\frac{11}{3}} = \frac{13}{3} \times \frac{3}{11}$ $= \frac{13}{11}$	2
26 Ans 26. Ans 26.	21	In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the length of the corresponding arc . Radius of the circle $= 21\ cm$ Length of the arc AB $= \frac{\theta}{360^\circ} \times 2\pi r$ $= \frac{60^\circ}{360}{}^\circ \times 2 \times \frac{22}{7} \times 21$ $= \frac{1}{6} \times 2 \times \frac{22}{7} \times 21 = 22$ The length of the arc is $22\ cm$. OR 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 the area of that part of the field in which the horse can graze.  Side of square field $= 15\ m$ Length of rope is the radius of the circle, $r = 5\ m$ Since, the horse is tied at one end of square field, it will graze only quarter of the field with radius $5\ m$. Area of circle $= \pi r^2 = 22/7 \times 5^2 = 78.57\ m^2$	2

		Area in which the horse can graze $= \frac{1}{4}$ of area of the circle $= \frac{78.57}{4} =$ $19.642\ m^2$	
		Part –B **All questions are compulsory. In case of internal choices, attempt anyone.**	
27 Ans 27.	33	Prove that $\sqrt{5}$ is irrational. Let us prove $\sqrt{5}$ irrational by contradiction. Let us suppose that $\sqrt{5}$ is rational. It means that we have co-prime integers a and b ($b \neq 0$) Such that $\sqrt{5} = \frac{a}{b}$ $\Longrightarrow b\sqrt{5} = a$ Squaring both sides, we get $\Longrightarrow 5b^2 = a^2$…..(1) It means that 5 is factor of a^2 Hence, 5 is also factor of a by Theorem. ... (2) If, 5 is factor of a, it means that we can write a = 5c for some integer c. Substituting value of a in (1) , $5b^2 = 25c^2$ $\Rightarrow b^2 = 5c^2$ It means that 5 is factor of b^2. Hence, 5 is also factor of b by Theorem. ... (3) From (2) and (3) , we can say that 5 is factor of both a and b . But, a and b are co-prime . Therefore, our assumption was wrong. $\sqrt{5}$ cannot be rational. Hence, it is irrational.	3
28 Ans 28.	32	Find the zeroes of quadratic polynomial given as: $6x^2 - 3 - 7x$ and also verify the relationship between the zeroes and the coefficients. We have been given the quadratic equation as: $6x^2 - 3 - 7x$ First of all we will write it into standard form as: $6x^2 - 7x - 3$ (Now we will factorize 7 such that the product of the factors is equal to - 18 and the sum is equal to - 7) It can be written as $= 6x^2 + 2x - 9x - 3$ $= 2x(3x + 1) - 3(3x + 1)$ $= (3x + 1)(2x - 3)$ The value of $6x^2 - 3 - 7x$ is zero when $3x + 1 = 0$ or $2x - 3 = 0$, i.e. $X = -\frac{1}{3}\ or\ \frac{3}{2}$ Therefore, the zeroes of $6x^2 - 3 - 7x$ are $-\frac{1}{3}\ and\ \frac{3}{2}$	3

		Sum of zeroes = $\frac{-1}{3}+\frac{3}{2}=\frac{7}{6}=\frac{-(-7)}{6}=\frac{-(\text{coefficient of } x)}{\text{coefficient of } x^2}$ Product of zeroes =$\frac{-1}{3}\times\frac{3}{2}=\frac{-1}{2}=\frac{-3}{6}=\frac{\text{constant term}}{\text{coefficient of } x^2}$ Hence verified	
29 Ans 29.	31	M is a point on the side BC of a parallelogram ABCD. DM when produced meets AB at N. Prove that. i. $\frac{DM}{MN}=\frac{DC}{BN}$ ii. $\frac{DN}{DM}=\frac{AN}{DC}$  Given: ABCD is a parallelogram To Prove: i. $\frac{DM}{MN}=\frac{DC}{BN}$ ii. $\frac{DN}{DM}=\frac{AN}{DC}$ Proof: In ΔDMC and ΔNMB , we have ∠DMC = ∠NMB (Vertically opposite angle) ∠DCM = ∠NBM (Alternate angles) By AA - Similarity criteria, we have $\triangle DMC \sim \triangle NMB$ $\therefore \frac{DM}{MN}=\frac{DC}{BN}$ which completes the proof of part (i). Now, $\frac{MN}{DM}=\frac{BN}{DC}$ Adding 1 to both sides, we obtain $\frac{MN}{DM}+1=\frac{BN}{DC}+1$ $\Longrightarrow \frac{MN+DM}{DM}=\frac{BN+DC}{DC}$ $\Longrightarrow \frac{MN+DM}{DM}=\frac{BN+AB}{DC}$ [∵ ABCD is a parallelogram] $\Rightarrow \frac{DN}{DM}=\frac{AN}{DC}$ OR In Fig. CM and RN are respectively the medians of △ABC and △PQR. If △ABC ~ △PQR, prove that: i. △AMC ~ △PNR ii. $\frac{CM}{RN}=\frac{AB}{PQ}$	3

Ans 29.		iii. $\triangle CMB \sim \triangle RNQ$  i. $\Delta ABC \sim \Delta PQR$ (Given) So, $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$...(1) (corresponding sides of similar triangles are proportional) and $\angle A = \angle P$, $\angle B = \angle Q$ and $\angle C = \angle R$ ...(2) But AB = 2 AM and PQ = 2 PN (As CM and RN are medians) So, from (1), i.e., $\frac{AM}{PM} = \frac{CA}{RP}$ ...(3) Also, $\angle MAC = \angle NPR$ [From (2)] ...(4) So, from (3) and (4), $\Delta AMC \sim \Delta PNR$ (SAS similarity criterion) ...(5) ii. From (5), $\frac{CM}{RN} = \frac{CA}{RP}$....(6) (corresponding sides of similar triangles are proportional) But $\frac{CA}{RP} = \frac{AB}{PQ}$.[From (1)] ...(7) Therefore, $\frac{CM}{RN} = \frac{AB}{PQ}$ [From (6) and (7)] ...(8) iii. Again, $\frac{AB}{PQ} = \frac{BC}{QR}$[From (1)] Therefore $\frac{CM}{RN} = \frac{BC}{QR}$ [From (8)] ...(9) Also, $\frac{CM}{RN} = \frac{AB}{PQ} = \frac{2BM}{2QN}$ i.e., $\frac{CM}{RN} = \frac{BM}{QN}$ ...(10) i.e., $\frac{CM}{RN} = \frac{BC}{QR} = \frac{BM}{QN}$ [From (9) and (10)] Therefore, $\Delta CMB \sim \Delta RNQ$ (SSS similarity criterion)	
30 Ans 30.	30	Point A is on x-axis, point B is on y-axis and the point P lies on line segment AB, such that P (4, - 5) and AP : PB = 5 :3. Find the coordinates of point A and B. Let coordinates of A are (x, 0) and coordinates of B are (0, y)  	3

		Using section formula, we get $4 = \frac{5 \times 0+3\times x}{5+3}$ 32 = 3x x = $\frac{32}{3}$ Similarly, -5 = $\frac{5 \times y+3\times 0}{5+3}$ 40 = -5y y =- 8 Coordinate of A are $\left(\frac{32}{3}, 0\right)$ and coordinates of B are (0, -8).	
31 Ans 31. Ans 31.	29	In $\Delta\ PQR$, right-angled at $Q, PR + QR = 25\ cm$ and $PQ = 5\ cm$. Determine the values of $sin\ P\ and\ cos\ P$. Given that, $PR + QR = 25 , PQ = 5$ Let PR be x. $\therefore\ QR = 25 - x$ By Pythagoras theorem , $PR^2 = PQ^2 + QR^2$ $x^2 = (5)2 + (25 - x)^2$ $x^2 = 25 + 625 + x^2 - 50x$ $50x = 650$ $x = 13$ $\therefore\ PR = 13\ cm$ $QR = (25 - 13)\ cm = 12\ cm$ $sin\ P = \frac{QR}{PR} = \frac{12}{13}$ $cos\ P = \frac{PQ}{PR} = \frac{5}{13}$ $tan\ P = \frac{QR}{PQ} = \frac{12}{5}$ OR If tan $\theta = \frac{12}{13}$, evaluate $\frac{2\ Sin\theta Cos\theta}{Cos^2\theta - Sin^2\theta}$ We have, $tan\theta = \frac{12}{13}$ Now, $\frac{2\sin\theta\cos\theta}{\cos^2\theta - \sin^2\theta} = \frac{\frac{2\sin\theta\cos\theta}{\cos^2\theta}}{\frac{\cos^2\theta-\sin^2\theta}{\cos^2\theta}}$ [dividing numerator and denominator by c $= \frac{2\tan\theta}{1-\tan^2\theta} = \frac{2\times\frac{12}{13}}{1-\left(\frac{12}{13}\right)^2} = \frac{\frac{24}{13}}{1-\frac{144}{169}} = \frac{\frac{24}{13}}{\frac{25}{169}} = \frac{24}{13} \times \frac{169}{25} = \frac{312}{25}$ Hence, $\frac{2\sin\theta\cos\theta}{\cos^2\theta-\sin^2\theta} = \frac{312}{25}$	3

32 Ans 32.	28	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 ? Diameter of the wheels of a car = $80\ cm$ Circumference of wheels = $2\pi r = 2r \times \pi = 80\,\pi\ cm$ Distance travelled by car in 10 minutes = $\frac{66 \times 1000 \times 100 \times 10}{60} = 1100000\ cm/s$ No. of revolutions = Distance travelled by car/Circumference of wheels $= \frac{1100000}{80}\pi = \frac{1100000 \times 7}{80 \times 22} = 4375$ Therefore, each wheel of the car will make 4375 revolutions.	3
33 Ans 33.	27	There is a circular path around a sports field. Sonia takes 96 minutes to walk one round of the field, while Ravi takes 80 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? They will be meet again after LCM of both values at the starting point. $96 = 2^5 \times 3\ ,\ 80 = 2^4 \times 5$ $LCM = 2^5 \times 3 \times 5 = 480\ minutes$ Therefore, they will meet together at the starting point after 480 minutes.	3
		Part –B **All questions are compulsory. In case of internal choices, attempt anyone.**	

34 Ans 34.	36	A two-digit number is 4 more than 6 times the sum of its digits. If 18 is subtracted from the number, the digits are reversed. Find the number. Suppose the digits at units and tens place of the given number be x and y respectively. ∴ the number is $10y+x$ The number is 4 more than 6 times the sum of the two digits. ∴ $10y + x = 6(x + y)+ 4$ $\Rightarrow 10y + x = 6x + 6y + 4$ $\Rightarrow 6x + 6y - 10y - x = -4$ $\Rightarrow 5x - 4y = -4$ ....(i) After interchanging the digits, the number becomes $10x+y$ If 18 is subtracted from the number, the digits are reversed. Thus, we have $(10y + x) - 18 = 10x + y$ $\Rightarrow 10x + y - 10y - x = -18$ $\Rightarrow 9x - 9y = -18$ $\Rightarrow 9(x - y) = -18$ $\Rightarrow x - y = \frac{-18}{9}$ $\Rightarrow x - y = -2$ …..(ii) So, we have the systems of equations $5x - 4y = -4$, $x - y = -2$ Here x and y are unknowns. We have to solve the above systems of equations for x and y. Multiplying the second equation by 5 and then subtracting from the first, we have $(5x - 4y) - (5x - 5y) = -4 - (-2 \times 5)$ $\Rightarrow 5x - 4y - 5x + 5y = -4 + 10$ $\Rightarrow y = 6$ Substituting the value of y in the second equation, we have $x - 6 = -2$ $x = 6 - 2$ $x = 4$ Hence, the number is $10 \times 6 + 4 = 64$ OR Determine graphically whether the following pair of linear equations: $3x - y = 7$ $2x + 5y + 1 = 0$ has: i. a unique solution ii. infinitely many solutions or iii. no solution. It is given that $3x - y = 7$ ....(1) $2x + 5y+1 = 0$ ....(2)	5

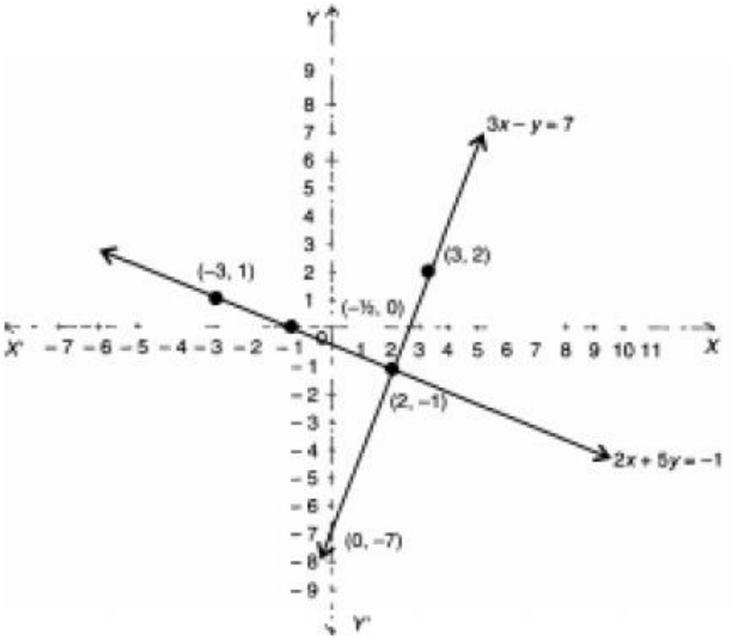
Hence, given pair of linear equations has a unique solution.
From (i) y = 3x - 7

x	0	2	3
y	-7	-1	2

and from (ii) 2x + 5y + 1 = 0
or, 5y = -1 - 2x
or, $y = \frac{-1-2x}{5}$

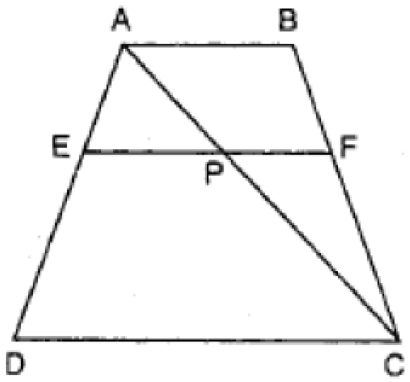
x	2	-3
y	-1	1

Plotting these points we get the following graph



Clearly two lines intersect at point(2, -1)
Hence x = 2 and y = - 1

35	35	In Fig. if EF|| DC|| AB. prove that $\frac{AE}{ED} = \frac{BF}{FC}$	5

Ans 35.		 Given: According to the question,We have, EF‖ DC‖ AB in the given figure. To prove: $\frac{AE}{ED} = \frac{BF}{FC}$ Proof: In ΔADC, we have AB‖EF $\therefore \frac{AE}{ED} = \frac{AP}{PC}$ **[By Basic proportionality theorm]** In ΔCAB, we have, EF‖DC $\therefore \frac{CP}{PA} = \frac{CF}{FB}$ [By Basic Proportionality Theorem] ...(2) $\frac{AP}{PC} = \frac{BF}{CF}$ Therefore, equation (i) and equation (ii), we get $\frac{AE}{ED} = \frac{AP}{PC} = \frac{BF}{CF}$ $\frac{AE}{ED} = \frac{BF}{CF}$.	
36 Ans 36.	34	cos A/(1+sin A) + (1+sin A)/cos A = 2 sec A L.H.S. $= \frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A}$ $= \frac{[\cos^2 A + (1+\sin A)^2]}{(1+\sin A)\cos^2 A}$ $= \frac{\cos^2 A + \sin^2 A + 1 + 2\sin A}{(1+\sin A)\cos A}$ $= \frac{1 + 1 + 2\sin A}{(1+\sin A)\cos A}$	5

		$= \frac{2+\ 2sin\ A}{1+sin\ A \cos A}$ $= \frac{2(1+sin\ A)}{1+sin\ A \cos A}$ $= \frac{2}{\cos A}\ =\ 2\ sec\ A$ = R.H.S.	

No. of Printed Pages: 5

Class- X
Periodic Assessment 3, 2022-23
Subject- Mathematics
Set : B1

Time Allowed: 1 ½ Hrs. **Max. Marks: 40**

General Instructions:

1. This Question Paper has 5 Sections A-E and contains **19** questions.
2. Section **A** has 10 MCQs carrying 1 mark each
3. Section **B** has 3 questions carrying 02 marks each.
4. Section **C** has 2 questions carrying 03 marks each.
5. Section **D** has 2 questions carrying 05 marks each.
6. Section **E** has 2 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 1 question of 3 marks and 1 question of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.

	SECTION A **Section A consists of 10 questions of 1 mark each.**	**Marks**
1	Which of the following equations has no real roots? (a) $x^2 - 4x + 3\sqrt{2} = 0$ (b) $x^2 + 4x - 3\sqrt{2} = 0$ (c) $x^2 - 4x - 3\sqrt{2} = 0$ (d) $3x^2 - 4x - 3\sqrt{2} = 0$	1
2	The point which divides the line segment joining the points (7, –6) and (3, 4) in ratio 1 : 2 internally lies in the (a) I quadrant (b) II quadrant (c) III quadrant (d) IV quadrant	1
3	The 12th term from the last term of the AP: 9, 6, 3, …, −63 is (a) -36 (b) -24 (c) -30 (d) -27	1
4	Which of the following is a quadratic equation? (a) $(x+3)(x-1) = x^2 - 4x + 9$ (b) $(x-3)(2x+1) = x(x+5)$ (c) $x^2 + 3x + 1 = (x-2)^2$ (d) $(x+1)^2 - x(x-3) = 0$	1
5	Which term of the AP: 5, 2, −1, … is −22? (a) 9tb (b) 10th (c) 11th (d) 12th	1
6	If $p, p+4, 3p-2$ are in AP, then p is equal to	1

	(a) 4 (b) -4 (c) 5 (d) -5	
7	If one root of the quadratic equation $6x^2 - x - k = 0$ is $\frac{2}{3}$, then the value of k is (a) -2 (b) 2 (c) $\frac{10}{3}$ (d) 3	1
8	In an AP if $a = 1, a_n = 20$ and $S_n = 399$, then n is (a) 19 (b) 21 (c) 38 (d) 42	1
9	If the distance between the points (4, k) and (1, 0) is 5, then the possible value(s) of k is (are): (a) 4 (b) -16 (c) 16 (d) ± 4	1
10	**DIRECTION:** In this question, a statement of **assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option ***Statement A (Assertion):*** A triangle with vertices at $(4, 0)$, $(-1, -1)$, and $(3, 5)$ is an isosceles right angled triangle. ***Statement R(Reason)*** **:** An Isosceles triangle is always right angled. (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 3 questions of 2 marks each.**	
11	The sum of first n terms of an A.P. is $(3n^2 + 5n)$. Determine the A.P.	2
12	If the vertices of a parallelogram PQRS taken in order are $P(3, 4), Q(-2, 3)$ and $R(-3, -2)$, then find the coordinates of its fourth vertex S. **OR** Find the ratio in which the y-axis divides the line segment joining the points (6, –4) and (–2, –7). Also find the point of intersection.	2

13	Find the point on the x-axis, which is equidistant from the points (6, 3) and (3, 0).	2
	SECTION C **Section C consists of 2 questions of 3 marks each.**	
14	Find the value of m for which the quadratic equation $(m-1)\,x^2 + 2(m-1)x + 1 = 0$ has equal roots. **OR** Find the whether the following equations have real roots. If real roots exist, find them. $\frac{1}{2x-3}+\frac{1}{x-5}=1, x\neq\frac{3}{2}, 5$	3
15	Show that the points $(0, -2)$, (3, 1), (0, 4) and (– 3, 1) are the vertices of a square.	3
	SECTION D **Section D consists of 2 questions of 5 marks each.**	
16	Due to bad weather, a plane got delayed by half an hour. To reach the destination 1500 km away in time, so that the passengers could catch the connecting flight, the speed of the plane was increased by 250 km/hour than the usual speed. Find the usual speed of the plane.	5
17	Solve the equation : $1 + 4 + 7 + 10 + \ldots + x = 287$	5
	SECTION E **Case study based questions are compulsory.**	
18	In figure -1, 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 outer edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.	

Figure – 1

In figure -2, another square swimming pool is installed by a family in their backyard. There is a concrete sidewalk around the pool of width y m. The outer edge of the sidewalk measures 9 m. The area of the pool is 25 sq. m.

Figure -2

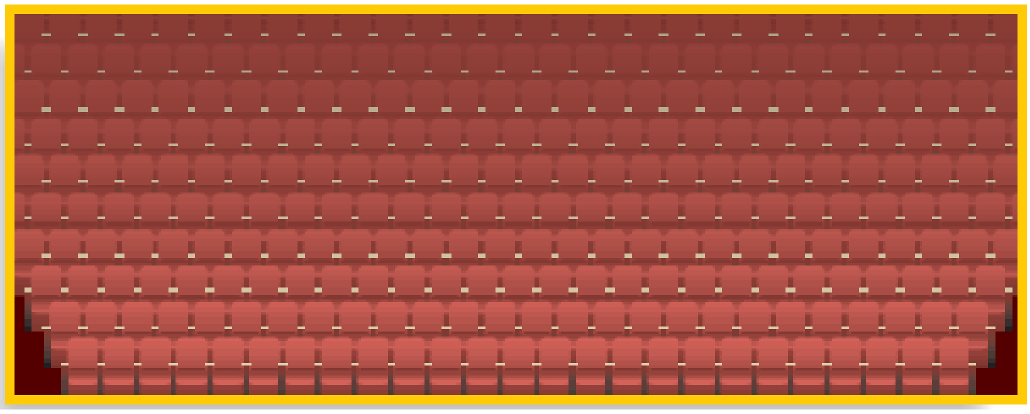
(a) Based on the information given above, what are the dimensions of the inner edges of the sidewalk in figure - 1?

(b) Based on the information given above, what are the dimensions of the inner edges of the sidewalk in figure - 2?

(c) Form a quadratic equation in terms of x for figure -1 and find the width of the sidewalk. 1

OR

Form a quadratic equation in terms of y for figure - 2 and find the width of the sidewalk. 1

		2
19	 The first row of a concert hall has 25 seats, and each row after the first has one more seat than the row before it. There are 32 rows of seats. a) Thirty-five students from a class want to sit in the same row. How close to the front can they sit? b) What is the total number of seats in the concert hall? c) Suppose 12 more rows of seats are built. How many additional seats will the concert hall have? **OR** Suppose each seat in rows 1 through 11 of the concert hall costs Rs 240. How much money does the concert hall take in for these sold-out rows?	1 1 2

No. of Printed Pages: 8

Class- X
Periodic Assessment 3, 2022-23
Subject- Mathematics
Set : B1 / B2 Solutions

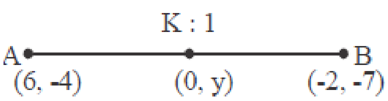
Time Allowed: 1 ½ Hrs. **Max. Marks: 40**

General Instructions:

1. This Question Paper has 5 Sections A-E and contains **19** questions.
2. Section **A** has 10 MCQs carrying 1 mark each
3. Section **B** has 3 questions carrying 02 marks each.
4. Section **C** has 2 questions carrying 03 marks each.
5. Section **D** has 2 questions carrying 05 marks each.
6. Section **E** has 2 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 1 question of 3 marks and 1 question of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.

B1	**B2**	**Expected Answers**	**Marks**
		SECTION A **Section A consists of 10 questions of 1 mark each.**	
1	**5**	Which of the following equations has no real roots? (a) $x^2 - 4x + 3\sqrt{2} = 0$ (b) $x^2 + 4x - 3\sqrt{2} = 0$ (c) $x^2 - 4x - 3\sqrt{2} = 0$ (d) $3x^2 - 4x - 3\sqrt{2} = 0$ Sol (a)	1
2	**1**	The point which divides the line segment joining the points (7, –6) and (3, 4) in ratio 1 : 2 internally lies in the (a) I quadrant (b) II quadrant (c) III quadrant (d) IV quadrant Sol (d)	1
3	**2**	The 12th term from the last term of the AP: 9, 6, 3, …, −63 is (a) −36 (b) −24 (c) −30 (d) −27 Sol (c)	1
4	**3**	Which of the following is a quadratic equation? (a) $(x+3)(x-1) = x^2 - 4x + 9$ (b) $(x-3)(2x+1) = x(x+5)$	1

		(c) $x^2 + 3x + 1 = (x - 2)^2$ (d) $(x + 1)^2 - x\,(x - 3) = 0$ Sol (b)	
5	**4**	Which term of the AP: 5, 2, -1, … is -22? (a) 9tb (b) 10th (c) 11th (d) 12th Sol (b)	1
6	**9**	If $p, p + 4, 3p - 2$ are in AP, then p is equal to (a) 4 (b) -4 (c) 5 (d) -5 Sol (c)	1
7	**6**	If one root of the quadratic equation $6x^2 - x - k = 0$ is $\frac{2}{3}$, then the value of k is (a) -2 (b) 2 (c) $\frac{10}{3}$ (d) 3 Sol (b)	1
8	**7**	In an AP if $a = 1$, $a_n = 20$ and $S_n = 399$, then n is (a) 19 (b) 21 (c) 38 (d) 42 Sol (c)	1
9	**8**	If the distance between the points (4, k) and (1, 0) is 5, then the possible value(s) of k is (are): (a) 4 (b) -16 (c) 16 (d) ± 4 Sol (d)	1
10	**10**	**DIRECTION:** In this question, a statement of **assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option ***Statement A (Assertion):*** A triangle with vertices at $(4, 0)$, $(-1, -1)$, and $(3, 5)$ is an isosceles right angled triangle. ***Statement R(Reason)* :** An Isosceles triangle is always right angled. (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. Sol (c)	1

		SECTION B **Section B consists of 3 questions of 2 marks each.**	
11	**12**	The sum of first n terms of an A.P. is $(3n^2 + 5n)$. Determine the A.P. Sol. $S_n = 3n^2 + 5n$ $S_1 = 3(1) + 5(1) = 8 = a$ $S_2 = 3(2)^2 + 5(2)$ $= 3(4) + 10$ $= 12 + 10 = 22$ $\therefore \quad a + a_2 = 22$ $8 + a_2 = 22$ $a_2 = 22 - 8$ $= 14$ $\therefore \quad d = 14 - 8 = 6$ The AP is 8, 14, 20, …	½ ½ ½ 1/2
12	**13**	If the vertices of a parallelogram PQRS taken in order are $P(3, 4), Q(-2, 3)$ and $R(-3, -2)$, then find the coordinates of its fourth vertex S. Sol. Let point S be (x, y) Midpoint of PR = Midpoint of QS $\left(\frac{3-3}{2}, \frac{4-2}{2}\right) = \left(\frac{-2+x}{2}, \frac{3+y}{2}\right)$ So, $x = 2, y = -1$ Coord. of S = (2, −1) **OR** Find the ratio in which the y-axis divides the line segment joining the points (6, –4) and (–2, –7). Also find the point of intersection.  Let the point P(0, y) on y-axis divides the line segment AB in K : 1 $\therefore \quad 0 = \frac{-2K+6}{K+1} \Rightarrow K = 3 \quad \therefore$ Ratio is 3 : 1 Also, $y = \frac{3(-7)+1(-4)}{3+1} = \frac{-25}{4}$ $\therefore$ Point of intersection is $\left(0, \frac{-25}{4}\right)$	1 1 1 1
13	**11**	Find the point on the *x*-axis, which is equidistant from the points (6, 3) and (3, 0).	

		Sol. Let the point on x-axis be $P(x, 0)$ which is equidistant from point $A(6, 3)$ and $B(3, 0)$. $\therefore$ PA = PB $\Rightarrow$ $PA^2 = PB^2$ $\Rightarrow (6-x)^2 + (3-0)^2 = (3-x)^2 + (0-0)^2$ $\Rightarrow$ $36 + x^2 - 12x + 9 = x^2 + 9 - 6x$ $\Rightarrow 36 = 6x$ $\Rightarrow x = 6$ The required point is (6, 0)	1 1
		SECTION C **Section C consists of 2 questions of 3 marks each.**	
14	**15**	Find the value of m for which the quadratic equation $(m-1)\,x^2 + 2(m-1)x + 1 = 0$ has equal roots. Solution: D = 0 $4\,(m-1)^2 - 4(m-1) = 0$ $4\,(m-1)\,[m-1-1] = 0$ $(m-1)\,(m-2) = 0$ $m = 1 \; or \; 2$ Since coefficient of x^2 cannot be zero, so $m = 1$ is rejected. Hence $m = 2$. **OR** Find the whether the following equations have real roots. If real roots exist, find them. $\frac{1}{2x-3} + \frac{1}{x-5} = 1, x \neq \frac{3}{2}, 5$ Sol. $\frac{x-5+2x-3}{(2x-3)(x-5)} = 1$ $\Rightarrow 2x^2 - 10x - 3x + 15 = x - 5 + 2x - 3$ $\Rightarrow 2x^2 - 13x + 15 = 3x - 8$ $\Rightarrow 2x^2 - 16x + 23 = 0$ Now, $D = b^2 - 4ac = (-16)^2 - 4(2)\,(23)$ $D = 256 - 184 = 72 > 0$	1 1 1 1 1/2 1/2

16		Two distinct real roots exist. $x = \frac{-(-16) \pm \sqrt{72}}{2(2)} = \frac{16 \pm 6\sqrt{2}}{4} = \frac{8 \pm 3\sqrt{2}}{2}$	1
15	**14**	Show that the points (0, −2), (3, 1), (0, 4) and (– 3, 1) are the vertices of a square. Sol. Let A(0, −2), B(3, 1), C(0, 4) and D(– 3, 1) be the given points. $AB = \sqrt{(0-3)^2 + (-2-1)^2} = \sqrt{9+9} = 3\sqrt{2}$ $BC = \sqrt{(3-0)^2 + (1-4)^2} = \sqrt{9+9} = 3\sqrt{2}$ $CD = \sqrt{(0+3)^2 + (4-1)^2} = \sqrt{9+9} = 3\sqrt{2}$ $DA = \sqrt{(0+3)^2 + (-2-1)^2} = \sqrt{9+9} = 3\sqrt{2}$ $AC = \sqrt{(0+0)^2 + (-2-4)^2} = \sqrt{36} = 6$ $BD = \sqrt{(3+3)^2 + (1-1)^2} = \sqrt{36} = 6$ Since, AB = BC = CD = DA and AC = BD, all the four sides of the quadrilateral ABCD are equal and its diagonals AC and BD are also equal. Therefore, ABCD is a square.	½ each
		SECTION D **Section D consists of 2 questions of 5 marks each.**	
16	**17**	Due to bad weather, a plane got delayed by half an hour. To reach the destination 1500 km away in time, so that the passengers could catch the connecting flight, the speed of the plane was increased by 250 km/hour than the usual speed. Find the usual speed of the plane. Sol. Let the usual speed of plane be x km/h. Time taken at original speed = $\frac{1500}{x}$ hours Time taken at increased speed = $\frac{1500}{x+250}$ hours $\Rightarrow \frac{1500}{x} - \frac{1500}{x+250} = \frac{1}{2}$ $\Rightarrow x^2 + 250x - 750000 = 0$ $\Rightarrow (x + 1000)(x - 750) = 0$ $\Rightarrow x = 750$ or -1000 As speed cannot be negative, speed of plane = 750 km/h.	1 1 1 1 1

17	**16**	Solve the equation : $$1 + 4 + 7 + 10 + \ldots + x = 287$$ Sol. Here, 1, 4, 7, 10, ..., *x* form an AP with $a = 1, d = 3, a_n = x$ $$a_n = a + (n - 1)d$$ So, $x = 1 + (n - 1) \times 3 = 3n - 2$ $S_n = \frac{n}{2}[a + x]$ $287 = \frac{n}{2}(1 + 3n - 2)$ $574 = n(3n - 1)$ $or, 3n^2 - n - 574 = 0$ $3n^2 - 42n + 41n - 574 = 0$ $3n(n - 14) + 41(n - 14) = 0$ $(n - 14)(3n + 41) = 0$ $n = 14 \; or -\frac{41}{3}$ As *n* cannot be negative, so *n* = 14 Therefore, *x* = 3*n* – 2 = 3 × 14 – 2 = 40.	½ 1 1/2 1 1 1
		SECTION E **Case study based questions are compulsory.**	
18	**18**	In figure -1, 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 outer edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m. 	

Figure -1

In figure -2, another square swimming pool installed by a family in their backyard. There is a concrete sidewalk around the pool of width y m. The outer edge of the sidewalk measures 9 m. The area of the pool is 25 sq. m.

Figure -2

(d) Based on the information given above, what are the dimensions of the inner edges of the sidewalk in figure - 1? 1

(e) Based on the information given above, what are the dimensions of the inner edges of the sidewalk in figure - 2? 1

(f) Form a quadratic equation in terms of x for figure -1 and find the width of the sidewalk. 2

OR

Form a quadratic equation in terms of y for figure - 2 and find the width of the sidewalk.

Sol. (a) For figure -1 , the dimensions of inner edges are (7-2x) m and (12-2x) m respectively

(b) For figure -2 , the dimension of each inner edge is (9-2x) m

(c) For figure -1 ,

$(7-2x)(12-2x)=36$

$4x^2-38x+48=0$

$2x^2-19x+24=0$

$(x-8)(2x-3)=0$

$x=8\ or\ x=\frac{3}{2}$

Rejecting $x = 8$, the width of sidewalk is 3/2 m.

OR

For figure -2,

$(9 - 2y)^2 = 25$

$4y^2 - 36y + 81 - 25 = 0$

$4y^2 - 36y + 56 = 0$

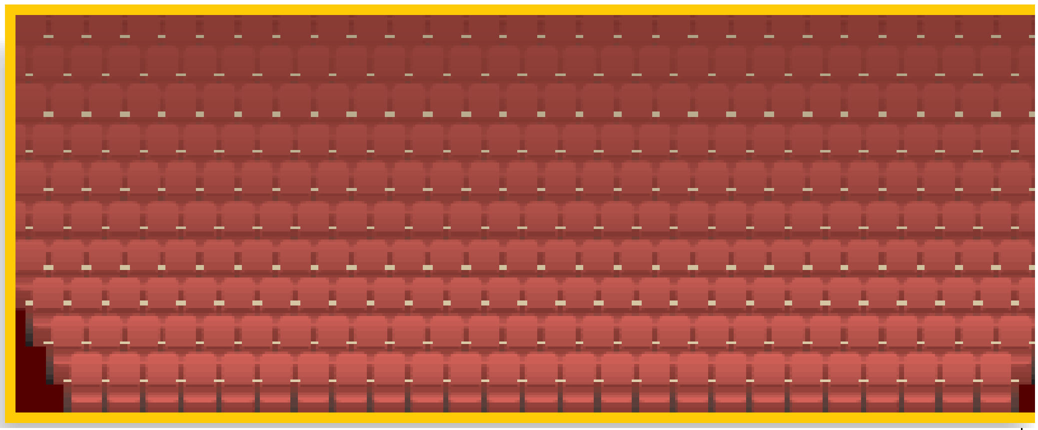
Or $y^2 - 9y + 14 = 0$

$(y - 2)(y - 7) = 0$

So, $y = 2 \text{ or } 7$

Rejecting $y = 7$, the width of sidewalk is 2 m.

19 **19**



The first row of a concert hall has 25 seats, and each row after the first has one more seat than the row before it. There are 32 rows of seats.

d) Thirty-five students from a class want to sit in the same row. How close to the front can they sit? 1

e) What is the total number of seats in the concert hall? 1

f) Suppose 12 more rows of seats are built. How many additional seats will the concert hall have? 2

OR

Suppose each seat in rows 1 through 11 of the concert hall costs Rs 240. How much money does the concert hall take in for these sold-out rows?

Sol (a) Use $a = 25$ and $d = 1$

$35 = 25 + (n - 1)$

$11 = n$

The class can sit in the 11th row.

(b) Use $a = 25$ and $a_{32} = 25 + (32 - 1) = 56.$

$S_{32} = \frac{32}{2}[25 + 56] = 16 \times 81 = 1296$

		There are 1296 seats in the concert hall. **(c)** The expanded concert hall has 32+12= 44 rows of seats. Now $a_{44} = 25 + (44 - 1)(1) = 68$, The *total* number of seats in the expanded hall is: $S_{44} = \frac{44}{2}[25 + 68] = 22 \times 93 = 2046$ The number of *additional* seats is = 2046 − 1296 = 750. **OR** The *total* number of seats in rows 1 to 11 are $S_{11} = \frac{11}{2}[25 + 35] = \frac{11}{2} \times 60 = 330$ Money earned from rows 1 to 11 = 330 (240)= Rs 79200	

No. of printed pages: 6

Class - X

PRE-BOARD EXAMINATION (2022-23)

Subject: Mathematics

Set - A2

Time Allowed: 3 Hours **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 sub-parts 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 Qs 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 π =22/7 wherever required if not stated.

Q. No. A1	**SECTION A** Section A has 20 MCQ questions of 1 mark each.
1	If x tan 45° sin 30° = cos 30° tan 30°, then x is equal to (a) $\sqrt{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) 1
2	Value(s) of k for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots is (a) 0 only (b) 4 (c) 8 only (d) 0, 8
3	The angles of cyclic quadrilaterals ABCD are: A = (6x+10), B = (5x)°, C = (x+y) ° and D = (3y-10) °. The value of x and y is: (a) x=20° and y = 10° (b) x=20° and y = 30° (c) x=44° and y=15° (d) x=15° and y=15°
4	The prime factorisation of 96 is (a) $2^5 \times 3$ (b) 2^6 (c) $2^4 \times 3$ (d) $2^4 \times 32$
5	If ABC and DEF are two triangles and $\frac{AB}{DE} = \frac{BC}{FD}$, then the two triangles are similar if (a) ∠A=∠F (b) ∠B=∠D (c) ∠A=∠D (d) ∠B=∠E
6	If P(A) denotes the probability of an event A, then (a) P(A) < 0 (b) P(A) > 1 (c) $0 \leq P(A) \leq 1$ (d) $-1 \leq P(A) \leq 1$
7	If Δ ABC and Δ DEF are similar such that 2AB = DE and BC = 8 cm, then Find EF. (a) 16 cm (b) 12 cm (c) 8 cm (d) 4 cm
8	The perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0) is (a)5 (b)12 (c)11 (d)7+$\sqrt{5}$
9	sin2B = 2 sin B is true then what is the value of B ? (a) 0 (b) 1 (c) not defined (d) 2
10	If the zeroes of the quadratic polynomial $x^2 + (a+1)x + b$ are 2 and -3, then (a) a = -7, b = -1 (b) a = 5, b = -1 (c) a = 2, b = -6 (d) a = 0, b = -6
11	For the following distribution

C.I.	0-10	10-20	20-30	30-40	40-50
f	20	30	24	40	18

The sum of lower limits of the modal class and the median class is
(a) 20 (b) 30 (c) 40 (d) 50

12 $5 \tan^2 A - 5 \sec^2 A + 1$ is equal to
(a) 6 (b) -5 (c) 1 (d) -4

13 The mode and mean is given by 7 and 8, respectively. Then the median is:
(a) $\frac{1}{13}$ (b) $\frac{13}{3}$ (c) $\frac{23}{3}$ (d) 33

14 If radii of two concentric circles are 4 cm and 5 cm, then 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

15 If the area of a circle is 154 cm^2, then its perimeter is
(a) 11 cm (b) 22 cm (c) 44 cm (d) 55 cm

16 If two solid hemispheres of same base radius r are joined together along their bases, then curved surface area of this new solid is
(a) $4\pi r^2$ (b) $6\pi r^2$ (c) $3\pi r^2$ (d) $8\pi r^2$

17 Area of the largest triangle that can be inscribed in a semi-circle of radius r units is
(a) r^2 sq units (b) $1/2\ r^2$ sq units
(c) $2r^2$ sq units (d) $\sqrt{2}\ r^2$ sq units

18 If $\Delta ABC \sim \Delta DFE$, $\angle A = 30°$, $\angle C = 50°$, 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, $\angle D = 30°$

19 Assertion: $\mathbf{12^n}$ ends with the digit zero, where n is any natural number.
Reason: Any number ends with digit zero, if its prime factor is of the form $2^m \times 5^n$, where m and n are natural numbers.
(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

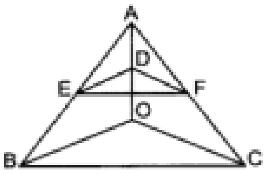
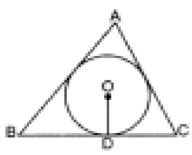
20 Assertion (A): Mid-point of a line segment divides line in the ratio 1 : 1.
Reason (R): The ratio in which the point (–3, k) divides the line segment joining the points (–5, 4) and (–2, 3) is 1 : 2.
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (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

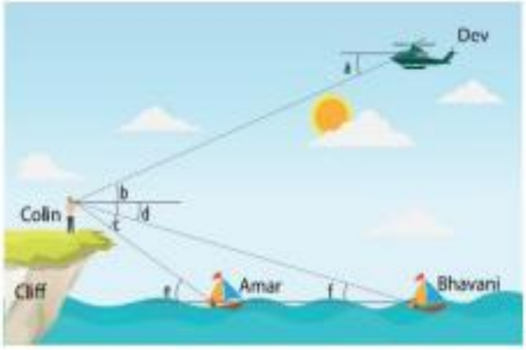
Section B has 5 questions carrying 02 marks each

21 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 area of ploughing the field (Take $\pi = 22/7$).

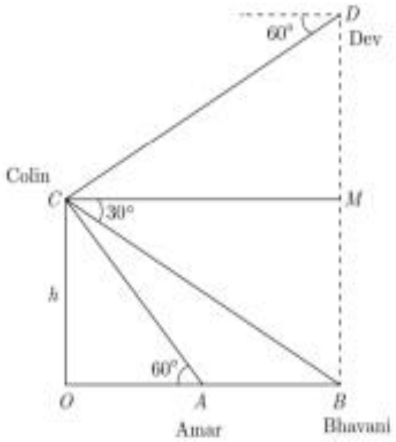
OR

	The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.
22	A fraction becomes $\frac{1}{3}$ when 1 is subtracted from the numerator and it becomes $\frac{1}{4}$ when 8 is added to its denominator. Find the fraction.
23	In the figure, if DE || OB and EF || BC, then prove that DF || OC. 
24	If $\theta = 45°$, then what is the value of $2\sec^2\theta + 3\operatorname{cosec}^2\theta$? **OR** In Δ PQR, right-angled at Q, PR + QR = 25 cm and PQ = 5 cm. Determine the values of sin P, cos P
25	A chord of a circle of radius 10 cm subtends a right angle at its centre. Calculate the length of the chord (in cm).
	SECTION C Section C has 6 questions carrying 03 marks each.
26	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) red card. (ii) black card. (iii) king.
27	Prove that $\sqrt{7}$ is an irrational number.
28	If the zeroes of the polynomial $x^2 + px + q$ are double in value to the zeroes of $2x^2 - 5x - 3$, find the value of p and q.
29	Graphically find the solution of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$. OR Solve the following pair of linear equations for x and y: $141x + 93y = 189$; $93x + 141y = 45$
30	Prove that : $\frac{\tan\theta+\sec\theta-1}{\tan\theta-\sec\theta+1} = \frac{1+\sin\theta}{\cos\theta}$
31	Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$. **OR** In the figure, a triangle ABC is drawn to circumscribe a circle of radius 4 cm, such that the segments BD and DC are of lengths 8 cm and 6 cm respectively. Find the sides AB and AC. 
	SECTION D

32	If the median of the distribution given below is 28.5, find the values of x and y. <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>Total</td></tr><tr><td>**Frequency**</td><td>5</td><td>x</td><td>20</td><td>15</td><td>y</td><td>5</td><td>60</td></tr></table>
33	Speed of a boat in still water is 15 km/h. It goes 30 km upstream and returns back at the same point in 4 hours 30 minutes. Find the speed of the stream. OR If twice the area of a smaller square is subtracted from the area of a larger square; the result is 14 cm^2. However, if twice the area of the larger square is added to three times the area of the smaller square, the result is 203 cm^2. Determine the sides of the two squares.
34	Prove Basic Proportionality Theorem , Using this theorem prove that in a trapezium ABCD in which AB || DC and if its diagonals intersect each other at the point O then $\frac{AO}{BO} = \frac{CO}{DO}$
35	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. OR 150 spherical marbles, each of diameter 1.4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, which are completely immersed in water. Find the rise in the level of water in the vessel.
	Case-Study based Questions **SECTION E** Section E has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
36	India is competitive manufacturing location due to the low cost of manpower 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 6th year and 22600 in 9th year. Based on the information given , answer the following questions (i) In which year, the production is 29,200 sets . (ii) Find the production during first year. (iii) Find the difference of the production during 7th year and 4th year. OR Find the production during first 3 years.
37	Mr. Colin is a Navy officer who is tasked with planning a coup on the enemy at a certain date. Currently he is inspecting the area standing on top of the cliff. Agent Dev is on a chopper in the sky. When Mr. Colin looks down below the cliff towards the sea, he has Bhawani and Amar in boats positioned to get a good vantage point. Bhawani boat is behind the Amar boat.



Following angle have been measured :
From Colin to Bhawani : 30°
From Dev to Colin : 60°
From Amar to Colin : 60°



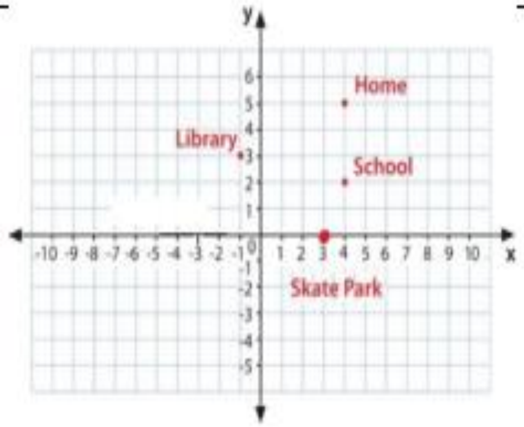
Based on the above information answer the following questions :

(i) Write a pair of angle of elevation.
(ii) Write a pair of angle of depression.
(iii) If the angle of elevation of Amar to Colin is 60°, what is the distance of Amar from the base of the hill?

OR

If angle of depression of Dev to Colin is 60°, what is the height of Dev's chopper from the base of the hill?

38 Two brothers Ramesh and Pulkit were at home and have to reach School. Ramesh went to Library first to return a book and then reaches School directly whereas Pulkit went to Skate Park first to meet his friend and then reaches School directly.



(i) How far is School from their home?

(ii) Write the coordinates of the location of the library.

(iii) Find the distance between the school and Skate Park.

OR

(iii) Find the co-ordinates of the mid-point between the co-ordinates of home and library.

No. of printed pages:14

Class - X

PRE-BOARD EXAMINATION 2022-23

Subject: Mathematics

Set A1 and A 2

Solution & Marking Key

Time Allowed: 3 Hours **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 sub-parts 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 Qs 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 π =22/7 wherever required if not stated.

Q. No. A1	Q. No. A2	**SECTION A** Section A has 20 MCQ questions of 1 mark each.	Marks allocated
1	2	Value(s) of k for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots is (a) 0 only(b) 4(c) 8 only(d) 0, 8 Sol: (d) 0, 8	1
2	3	The angles of cyclic quadrilaterals ABCD are: A = (6x+10), B=(5x)°, C = (x+y) ° and D=(3y-10) °. The value of x and y is: (a) x=20° and y = 10°(b) x=20° and y = 30° (c) x=44° and y=15°(d) x=15° and y=15° Answer: (b) x=20° and y = 30°	1
3	4	The prime factorisation of 96 is (a) $2^5 \times 3$(b) 2^6(c) $2^4 \times 3$(d) $2^4 \times 32$ Answer: (a) $2^5 \times 3$	1
4	5	If ABC and DEF are two triangles and $\frac{AB}{DE} = \frac{BC}{FD}$, then the two triangles are similar if (a) ∠A=∠F(b) ∠B=∠D(c) ∠A=∠D(d) ∠B=∠E Answer: (b) ∠B=∠D	1
5	6	If P(A) denotes the probability of an event A, then (a) $P(A) < 0$ (b) $P(A) > 1$ (c) $0 \le P(A) \le 1$ (d) $-1 \le P(A) \le 1$ Answer: (c) $0 \le P(A) \le 1$	1
6	7	If Δ ABC and Δ DEF are similar such that 2AB = DE and BC = 8 cm, then Find EF. (a) 16 cm(b) 12 cm(c) 8 cm(d) 4 cm Answer: (a) 16 cm	

<table>
<tr><td>7</td><td>8</td><td>The perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0) is
(a)5 (b)12 (c)11 (d)$7+\sqrt{5}$

Sol : (b) 12</td><td>1</td></tr>
<tr><td>8</td><td>9</td><td>sin2B = 2 sin B is true then what is the value of B?
(a) 0 (b) 1 (c) not defined (d) 2
Sol: (a)0</td><td>1</td></tr>
<tr><td>9</td><td>10</td><td>If the zeroes of the quadratic polynomial $x^2 + (a+1)x + b$ are 2 and -3, then
(a) a = -7, b = -1 (b) a = 5, b = -1 (c) a = 2, b = -6 (d) a = 0, b = -6
Sol: (d) a = 0 , b = -6</td><td>1
1</td></tr>
<tr><td>10</td><td>11</td><td>For the following distribution
<table><tr><td>C.I.</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td></tr><tr><td>f</td><td>20</td><td>30</td><td>24</td><td>40</td><td>18</td></tr></table>The sum of lower limits of the modal class and the median class is
(a) 20(b) 30(c) 40(d) 50
Sol : (d) 50</td><td>1</td></tr>
<tr><td>11</td><td>12</td><td>5 tan² A – 5 sec² A + 1 is equal to
(a) 6(b) -5(c) 1(d) -4

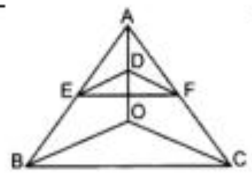
Sol : (d) -4</td><td>1</td></tr>
<tr><td>12</td><td>13</td><td>The mode and mean is given by 7 and 8, respectively. Then the median is:
(a) $\frac{1}{13}$(b) $\frac{13}{3}$(c) $\frac{23}{3}$(d) 33
Answer: (c) $\frac{23}{3}$</td><td>1</td></tr>
<tr><td>13</td><td>14</td><td>If radii of two concentric circles are 4 cm and 5 cm, then 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
Sol : (b)</td><td>1</td></tr>
<tr><td>14</td><td>15</td><td>If the area of a circle is 154 cm^2, then its perimeter is
(a) 11 cm (b) 22 cm (c) 44 cm(d) 55 cm
Answer: (c) 44 cm</td><td>1</td></tr>
<tr><td>15</td><td>16</td><td>If two solid hemispheres of same base radius r are joined together along their bases, then curved surface area of this new solid is
(a) $4\pi r^2$ (b) $6\pi r^2$ (c) $3\pi r^2$ (d) $8\pi r^2$

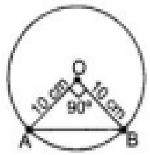
Sol :(a) $4\pi r^2$</td><td></td></tr>
<tr><td>16</td><td>17</td><td>Area of the largest triangle that can be inscribed in a semi-circle of radius r units is
(a) r^2 squnits (b) 1/2 r^2 sq units
(c) $2r^2$ sq units (d) $\sqrt{2}\ r^2$ sq units
Sol : (a)r^2 squnits</td><td></td></tr>
<tr><td>17</td><td>18</td><td>If ΔABC ~ΔDFE, ∠A = 30°, ∠C = 50°, AB = 5 cm, AC = 8 cm and DF = 7.5 cm. Then, which of the following is true?
(a) DE =12 cm, ∠F =50° (b) DE = 12 cm, ∠F =100°
(c) EF = 12 cm, ∠D = 100° (d) EF = 12 cm,∠D =30°

Sol : (b)DE = 12 cm, ∠F =100</td><td></td></tr>
<tr><td>18</td><td>1</td><td>If x tan 45° sin 30° = cos 30° tan 30°, then x is equal to
(a) $\sqrt{3}$(b) $\frac{1}{2}$(c) $\frac{1}{3}$(d) 1

Sol : (d) 1</td><td></td></tr>
</table>

19	19	Assertion: 12^n ends with the digit zero, where n is any natural number. Reason: Any number ends with digit zero, if its prime factor is of theform $2^m \times 5^n$, where m and n are natural numbers. (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 Sol : (d)	
20	20	Assertion (A): Mid-point of a line segment divides line in the ratio 1 : 1. Reason (R): The ratio in which the point (–3, k) divides the line segment joining the points (–5, 4) and (–2, 3) is 1 : 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. Sol : (c)	
		SECTION B Section B has 5 questions carrying 02 marks each	
21	22	A fraction becomes $\frac{1}{3}$ when 1 is subtracted from the numerator and it becomes $\frac{1}{4}$ when 8 is added to its denominator. Find the fraction. Solution: Let the numerator be x and denominator be y. $\therefore \quad \text{Fraction} = \frac{x}{y}$ Now, according to question, $\frac{x-1}{y} = \frac{1}{3} \Rightarrow 3x - 3 = y$ $3x - y = 3 \quad \ldots(i)$ and $\frac{x}{y+8} = \frac{1}{4} \Rightarrow 4x = y + 8$ $4x - y = 8 \quad \ldots(ii)$ Now, subtracting equation (ii) from (i), we have $3x - y = 3$ $-4x \mp y = -8$ $-x = -5$ $\therefore \quad x = 5$ Putting the value of x in equation (i), we have $3 \times 5 - y = 3 \Rightarrow 5 - y = 3 \Rightarrow 15 - 3 = y$ $\therefore y = 12$ Hence, the required fraction is 5/12	1 1
22	23	In the figure, if DE || OB and EF || BC, then prove that DF || OC.	

		 Solution : Since DE ∥ OB , $\frac{AE}{EB} = \frac{AD}{DO}$ ....(i) (Thales theorem) $\frac{AE}{EB} = \frac{AF}{FC}$ ....(ii) (Thales theorem) $\frac{AF}{FC} = \frac{AD}{DO}$ Hence by converse of B.P.T DF ∥ OC	1 1
23	24	If $\theta = 45°$, then what is the value of $2\sec^2\theta + 3\operatorname{cosec}^2\theta$? Solution: $2\sec^2\theta + 3\operatorname{cosec}^2\theta = 2\sec^2 45° + 3\operatorname{cosec}^2 45°$ $= 2(2\text{–}\sqrt{})^2 + 3\,(2\text{–}\sqrt{})^2 = 4 + 6 = 10$ OR In Δ PQR, right-angled at Q, PR + QR = 25 cm and PQ = 5 cm. Determine the values of sin P, cos P Solution: In a given triangle PQR, right angled at Q, the following measures are PQ = 5 cm PR + QR = 25 cm Now let us assume, QR = x PR = 25-QR PR = 25- x According to the Pythagorean Theorem, $PR^2 = PQ^2 + QR^2$ Substitute the value of PR as x $(25- x)^2 = 5^2 + x^2$ $25^2 + x^2 - 50x = 25 + x^2$ $625 + x^2 - 50x - 25 - x^2 = 0$ -50x = -600 x= -600/-50 x = 12 = QR Now, find the value of PR PR = 25- QR Substitute the value of QR PR = 25-12 PR = 13 Now, substitute the value to the given problem (1) sin P = Opposite Side/Hypotenuse = QR/PR = 12/13 (2) Cos P = Adjacent Side/Hypotenuse = PQ/PR = 5/13	1 1 1 1
24	25	A chord of a circle of radius 10 cm subtends a right angle at its centre. Calculate the length of the chord (in cm). Solution:	

		$AB^2 = OA^2 + OB^2$ …[Pythagoras' theorem  $AB^2 = 10^2 + 10^2$ $AB^2 = 2(10)^2$ $AB = 10\sqrt{2}$ CM	1 1
25	21	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 area of ploughing the field (Take $\pi = 22/7$). Solution: Length of the fence (in metres) = Total cost/Rate = 5280/24 = 220 So, the circumference of the field = 220 m If r metres is the radius of the field, then $2\pi r = 220$ $2 \times (22/7) \times r = 220$ $r = (220 \times 7)/ (2 \times 22)$ $r = 35$ Hence, the radius of the field = 35 m Area of the field = πr^2 $= (22/7) \times 35 \times 35$ $= 22 \times 5 \times 35\ m^2$ = 3850 sq. m. **OR** The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes. Solution: Here $\theta = \frac{360°}{60\ m} \times 5\ m = 30°$ ..[$\because$ **1 hour = 60 minutes** r(radius) = 14 cm $\therefore$ **Required area** $= \frac{\theta}{360}\pi r^2$ $= \frac{30}{360} \times \frac{22}{7} \times 14 \times 14$ $= \frac{154}{3}\ cm^2$ or $51.\bar{3}\ cm^2$	1 1 1 1
		SECTION C Section C has 6 questions carrying 03 marks each.	
26	27	Prove that $\sqrt{7}$ is an irrational number. Solution: Let us assume, to the contrary, that $\sqrt{7}$ is a rational number. Then, there exist co-prime positive integers and such that $\sqrt{7} = a/b$, $b \neq 0$ So, $a = \sqrt{7}\, b$ Squaring both sides, we have $a^2 = 7b^2$ …… (i) $\Rightarrow$ 7 divides $a^2 \Rightarrow$ 7 divides a So, we can write a = 7c (where c is an integer)	1 1

Putting the value of a = 7c in (i), we have

$49c^2 = 7b^2$

$7c^2 = b^2$

It means 7 divides b^2 and so 7 divides b.

So, 7 is a common factor of both a and b which is a contradiction.

So, our assumption that $\sqrt{7}$ is rational is wrong. 1

Hence, we conclude that $\sqrt{7}$ is an irrational number.

27 28 If the zeroes of the polynomial $x^2 + px + q$ are double in value to the zeroes of $2x^2 - 5x - 3$, find the value of p and q.

Solution:

We have, $2x^2 - 5x - 3 = 0$ 1

$= 2x^2 - 6x + x - 3$

$= 2x(x - 3) + 1(x - 3)$

$= (x - 3)(2x + 1)$

Zeroes are:

$x - 3 = 0$ or $2x + 1 = 0$ 1

$\Rightarrow x = 3$ or $x = -12$

Since the zeroes of required polynomial is double of given polynomial.

Zeroes of the required polynomial are:

3×2, (-12×2), i.e., 6, -1

Sum of zeroes, $S = 6 + (-1) = 5$

Product of zeroes, $P = 6 \times (-1) = -6$

Quadratic polynomial is $x^2 - Sx + P$ 1

$\Rightarrow x^2 - 5x - 6$ …(i)

28 29 Graphically find the solution of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$.

Solution:

We have,' $x - y + 1 = 0$ and $3x + 2y - 12 = 0$

Thus, $x - y = -1 \Rightarrow x = y - 1$ …(i)

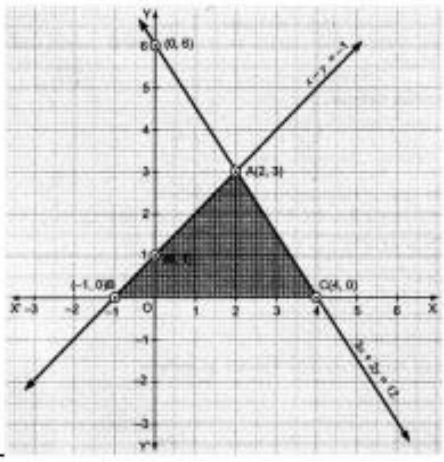
$3x + 2y = 12$ … (ii) 1

From equation (i), we have

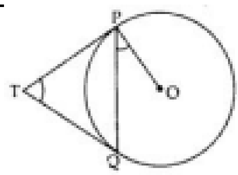
x	−1	0	2
y	0	1	3

From equation (ii), we have 1

x	0	4	2
y	6	0	3



		Solution of the equation is (2 , 3) OR Solve the following pair of linear equations for x and y: $141x + 93y = 189$; $93x + 141y = 45$ Solution: $\begin{array}{r} 141x + 93y = 189 \\ 93x + 141y = 45 \\ \hline 234x + 234y = 234 \end{array}$ ...[By adding $\Rightarrow x + y = 1$ ...(i) (÷ by 234) Again $\begin{array}{r} 141x + 93y = 189 \\ \underset{-}{}93x \underset{-}{+} 141y = \underset{-}{}45 \\ \hline 48x - 48y = 144 \end{array}$ ...[By subtracting $\Rightarrow x - y = 3$ ...(ii) (÷ by 48) By adding (i) and (ii), we get $x + y = 1$ ...(i) $x - y = 3$ ...(ii) $2x = 4 \quad \Rightarrow \quad x = 2$ Putting the value of x in (i), we get $2 + y = 1$ $y = 1 - 2 = -1 \quad \therefore \quad x = 2, y = -1$	1 1 1 1
29	30	Prove that : $\frac{\tan\theta+\sec\theta-1}{\tan\theta-\sec\theta+1} = \frac{1+\sin\theta}{\cos\theta}$ Solution: L.H.S. $= \frac{\tan\theta + \sec\theta - 1}{\tan\theta - \sec\theta + 1}$ $= \frac{\tan\theta + \sec\theta - (\sec^2\theta - \tan^2\theta)}{\tan\theta - \sec\theta + 1}$ ...[$\because \sec^2\theta - \tan^2\theta = 1$ $= \frac{\tan\theta + \sec\theta - [(\sec\theta + \tan\theta)(\sec\theta - \tan\theta)]}{(\tan\theta - \sec\theta + 1)}$ $= \frac{(\tan\theta + \sec\theta)[1 - (\sec\theta - \tan\theta)]}{(\tan\theta - \sec\theta + 1)}$ $= \frac{(\tan\theta + \sec\theta)(1 - \sec\theta + \tan\theta)}{1 - \sec\theta + \tan\theta}$ $= \sec\theta + \tan\theta = \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}$ $= \frac{1 + \sin\theta}{\cos\theta}$ = R.H.S.	 1 1 1
30	31	Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that ∠PTQ = 2∠OPQ Solution: . We are given a circle with centre O, an external point T and two tangents TP and TQ to the circle, where P, Q are the points of contact (see Figure).	



We need to prove that:
∠PTQ = 2∠OPQ
Let ∠PTQ = θ
Now, TP = TQ ....[∵ Lengths of tangents drawn from an external pt. to a circle are equal 1
So, TPQ is an isosceles triangle.

$\therefore \quad \angle TPQ = \angle TQP = \frac{1}{2}(180^\circ - \theta) = 90^\circ - \frac{1}{2}\theta$ ...(*i*) 1

Also, ∠OPT = 90°

...[∵ **Tangent at any point of a circle is ⊥ to the radius through the pt. of contact**

So, $\angle OPQ = \angle OPT - \angle TPQ = 90^\circ - \left(90^\circ - \frac{1}{2}\theta\right)$ 1

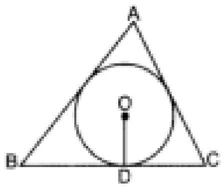
...[From (*i*)

$\angle OPQ = \frac{1}{2}\theta \quad \Rightarrow \quad \angle OPQ = \frac{1}{2}\angle PTQ$

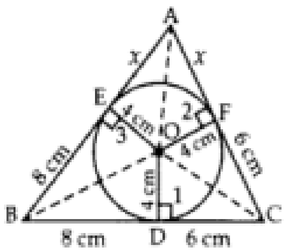
$\therefore$ **∠PTQ = 2∠OPQ** **...(Proved)**

OR

In the figure, a triangle ABC is drawn to circumscribe a circle of radius 4 cm, such that the segments BD and DC are of lengths 8 cm and 6 cm respectively. Find the sides AB and AC.



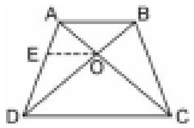
Solution:



Let AE = x ∴ AF = x
BC = 8 + 6 = 14 cm
AB = (x + 8) cm
AC = (x + 6) cm
∠1 = ∠2 = 23 = 90° ...[Tangent is ⊥ to the radius B [through the point of contact 1

		$s = \frac{14 + x + 8 + x + 6}{2}$ $= \frac{2x + 28}{2} = \frac{2x}{2} + \frac{28}{2} = (x + 14)$ ar(ΔABC) $= \sqrt{s(s-a)(s-b)(s-c)}$ $= \sqrt{x + 14(x + 14 - 14)[(x + 14 - (x + 8)][x + 14 - (x + 6)]}$ $= \sqrt{x + 14(x.6.8)} = \sqrt{48.x(x + 14)}$ $= \sqrt{16.3x(x + 14)} = 4\sqrt{3x(x + 14)}$ ar(ΔABC) = ar(ΔBOC) + ar(ΔBOA) + ar(ΔAOC) $4\sqrt{3x(x + 14)} = \frac{BC \times 4}{2} + \frac{AB \times 4}{2} + \frac{AC \times 4}{2}$ **...[ar of Δ = $\frac{1}{2}$ × base × corr. altitude** $4\sqrt{3x(x + 14)} = 2(BC + AB + AC)$ $4\sqrt{3x(x + 14)} = 2(14 + x + 8 + x + 6)$ $3x(x + 14) = (x + 14)^2$ … [Squaring both sides $3x(x + 14) - (x + 14)^2 = 0$ $(x + 14) [3x - (x + 14)] = 0$ $(x + 14) (2x - 14) = 0$ x = -14 or x = 7 ∴ x = 7 …As side of Δ cannot be -ve ∴ AB = x + 8 = 15 cm and AC = x + 6 = 13 cm	1 1
31	26	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) red card. (ii) black card. (iii) king. Solution:	1 1

		Red Card No. of favourable outcomes : 26 (13–13 cards of heart and diamond suits) Probability $(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$ $= \frac{26}{46} = \frac{13}{23}$ Black Card No. of favourable outcomes : 20 (10–10 cards of club and spade suits) Probability $(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$ $= \frac{20}{46} = \frac{10}{23}$ King No. of favourable outcomes : 2 (king of heart and diamond suits) Probability $(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{2}{46} = \frac{1}{23}$	1
		SECTION D Section D has 4 questions carrying 05 marks each	
32	33	Speed of a boat in still water is 15 km/h. It goes 30 km upstream and returns back at the same point in 4 hours 30 minutes. Find the speed of the stream. Solution: Let the speed of stream be x km/h. ∴ Speed of boat upstream = (15 – x) km/h. Speed of boat downstream = (15 + x) km/h. According to question, $\frac{30}{15-x} + \frac{30}{15+x} = 4\frac{1}{2} = \frac{9}{2}$ $\Rightarrow \frac{30(15+x+15-x)}{(15-x)(15+x)} = \frac{9}{2}$ $\Rightarrow 30 \times 2 \times 30 = 9(225 - x^2)$ $\Rightarrow 100 \times 2 = 225 - x^2$ $\Rightarrow 200 = 225 - x^2$ $\Rightarrow x^2 = 25$ $\Rightarrow x = \pm 5$ $\Rightarrow x = 5$ (Rejecting – 5) ∴ Speed of stream = 5 km/h OR If twice the area of a smaller square is subtracted from the area of a larger square; the result is 14 cm^2. However, if twice the area of the larger square is added to three times the area of the smaller square, the result is 203 cm^2. Determine the sides of the two squares. Solution: Let the sides of the larger and smaller squares be x and y respectively. Then $x^2 - 2y^2 = 14$ …..(i) and $2x^2 + 3y^2 = 203$ ……(ii) Operating (ii) -2 × (i), we get $\Rightarrow 2x^2 + 3y^2 - (2x^2 - 4y^2) = 203 - 2 \times 14$ $\Rightarrow 2x^2 + 3y^2 - 2x^2 + 4y^2 = 203 - 28$ $\Rightarrow 7y^2 = 175$ $\Rightarrow y^2 = 25$ $\Rightarrow y \pm 15$	1 1 1 1 1 1 1 1

		$\Rightarrow y = 5$ [∵ Side cannot be negative] By putting the value of y in equation (i), we get $x^2 - 2 \times 5 = 14$ $\Rightarrow x^2 - 50 = 14$ or $x^2 = 64$ $\therefore x = 8$ or $x = 8$ ∴ Sides of the two squares are 8 cm and 5 cm.	1 1
33	34	Prove Basic Proportionality Theorem , Using this theorem prove that in a trapezium ABCD in which AB ∥ DC and if its diagonals intersect each other at the point O then $\frac{AO}{BO} = \frac{CO}{DO}$ **Solution:** Given , To Prove , Construction , Fig , Proof accordingly Given, ABCD is a trapezium where AB ∥ DC and diagonals AC and BD intersect each other at O.  We have to prove, AO/BO = CO/DO From the point O, draw a line EO touching AD at E, in such a way that, EO ∥ DC ∥ AB In ΔADC, we have OE ∥ DC Therefore, By using Basic Proportionality Theorem AE/ED = AO/CO ……………..**(i)** Now, In ΔABD, OE ∥ AB Therefore, By using Basic Proportionality Theorem DE/EA = DO/BO…………….**(ii)** From equation **(i)** and **(ii)**, we get, AO/CO = BO/DO ⇒AO/BO = CO/DO Hence, proved.	3 1 1
34	35	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. Solution: Volume of sphere = $\frac{4}{3}\pi(6)^3$ cm^3 Volume of water rise in cylinder = $\pi r^2\left(\frac{32}{9}\right)$ cm^3 $\therefore \quad \pi r^2 \frac{32}{9} = \frac{4}{3}\pi(6)^3 \quad \Rightarrow r^2 = \frac{4 \times 2 \times 36 \times 9}{32} = 81$ r=9 Hence diameter is 18 cm OR 150 spherical marbles, each of diameter 1.4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, which are completely immersed in water. Find the rise in the level of water in the vessel. Solution: Diameter of spherical balls = 1.4 cm Radius of spherical balls, r = 0.7 cm	2 2 1

		Diameter of cylinder = 7 cm Radius of cylinder = 3.5 cm No. of spherical balls = 150 Let the rise in water be h cm. Now, 150 × volume of a spherical ball = Volume of cylinder with height h. *i.e.,* $150 \times \left[\frac{4}{3}\pi r^3\right] = \pi R^2 h$ $150 \times \frac{4}{3} \times \pi \times 0.7 \times 0.7 \times 0.7 = \pi \times 3.5 \times 3.5 \times h$ $h = 150 \times \frac{4}{3} \times \frac{0.7\times0.7\times0.7}{3.5\times3.5} = \frac{28}{5} = 5.6$ cm	2 2 1
35	32	If the median of the distribution given below is 28.5, find the values of x and y.	

Class interval	0–10	10–20	20–30	30–40	40–50	50–60	Total
Frequency	5	x	20	15	y	5	60

Solution:
Here, median = 28.5 and n = 60
Now, we have

Class interval	Frequency (f_i)	Cumulative frequency (cf)
0–10	5	5
10–20	x	$5 + x$
20–30	20	$25 + x$
30–40	15	$40 + x$
40–50	y	$40 + x + y$
50–60	5	$45 + x + y$
Total	$\Sigma f_i = 60$	

Since the median is given to be 28.5, thus the median class is 20 – 30.

$\therefore \quad \frac{n}{2} = 30, l = 20, h = 10, cf = 5 + x$ and $f = 20$

$\therefore \quad \text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h \quad \Rightarrow 28.5 = 20 + \left[\frac{30-(5+x)}{20}\right] \times 10$

$\Rightarrow \quad 28.5 = 20 + \frac{25-x}{20} \times 10$ 1

$\Rightarrow \quad 28.5 = 20 + \frac{25-x}{2} \quad \Rightarrow \quad 57 = 40 + 25 - x$

$\Rightarrow \quad 57 = 65 - x \quad \Rightarrow \quad x = 65 - 57 = 8$

Also, $n = \Sigma f_i = 60$

$\Rightarrow \quad 45 + x + y = 60$ 1

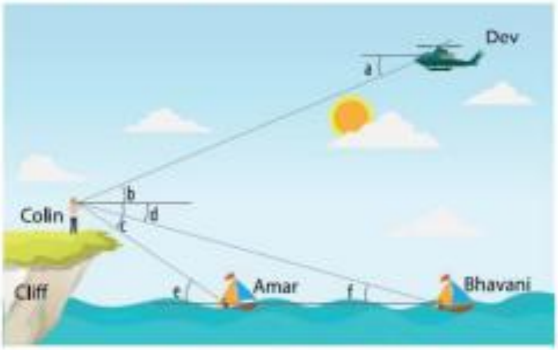
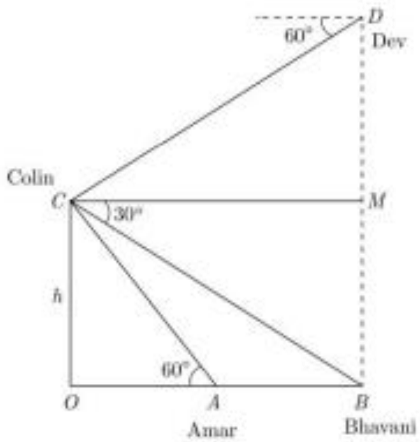
$\Rightarrow \quad 45 + 8 + y = 60 \quad [\because x = 8]$

$\therefore \quad y = 60 - 53 \quad \Rightarrow \quad y = 7$ 2

Hence, $x = 8$ and $y = 7$.

1

		Case-Study based Questions **SECTION E** Section E has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.	
36	36	India is competitive manufacturing location due to the low cost of manpower 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 6th year and 22600 in 9th year. Based on the information given , answer the following questions (i) In which year, the production is 29,200. Ans: N=12 (ii) Find the production during first year. Ans: Rs 5000 (iii) Find the difference of the production during 7th year and 4th year. Ans: Difference= 18200-11600=6600 OR Find the production during first 3 years. Ans: Production during first 3 year= 5000 + 7200 + 9400 = 21600	 1 1 2 2
37	37	Mr. Colin is a Navy officer who is tasked with planning a coup on the enemy at a certain date. Currently he is inspecting the area standing on top of the cliff. Agent Dev is on a chopper in the sky. When Mr. Colin looks down below the cliff towards the sea, he has Bhawani and Amar in boats positioned to get a good vantage point. Bhawani boat is behind the Amar boat.  Following angle have been measured : From Colin to Bhawani : 30° From Dev to Colin : 60° From Amar to Colin : 60°  Based on the above information answer the following questions :	

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(i) Write a pair of angle of elevation.
(ii) Write a pair of angle of depression.
(iii) If the angle of elevation of Amar to Colin is 60°, what is the distance of Amar from the base of the hill?
OR
If angle of depression of Dev to Colin is 60°, what is the height of Dev's chopper from the base of the hill?

Solution:
(i) $(\angle b°, \angle e°)$
(ii) $(\angle c°, \angle d°)$
(iii) $\frac{h}{\sqrt{3}}$ OR 4h
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<td>38</td>
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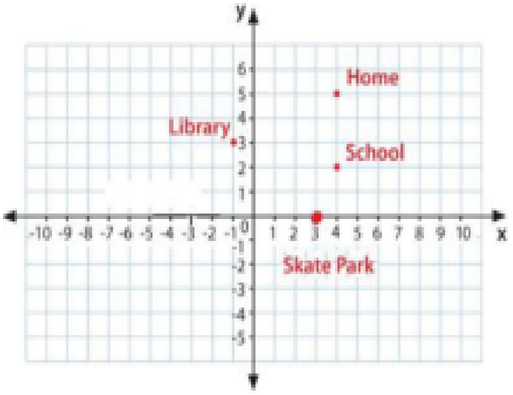
<td>
Two brothers Ramesh and Pulkit were at home and have to reach School. Ramesh went to Library first to return a book and then reaches School directly whereas Pulkit went to Skate Park first to meet his friend and then reaches School directly.



(i) How far is School from their home?
(ii) Write the coordinates of the location of the library.
(iii) Find the distance between the school and Skate Park.

OR
(iii) Find the co-ordinates of the mid-point between the co-ordinates of homeandlibrary.

Solution:
(i) 3 m
(ii) (-1,3)
(iii) $\sqrt{5}$ $\boldsymbol{units\ OR}$ $(1.5, 4)$
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No. of Printed Pages: 9

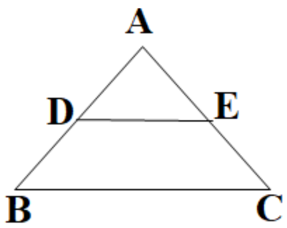
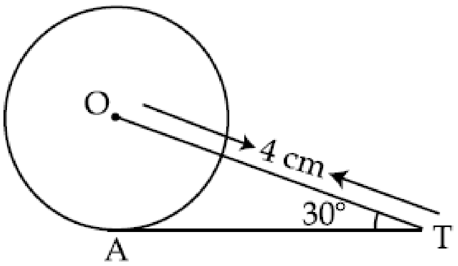
Class- X
Practice Test 3, 2022-23
Subject- Mathematics
Set : B1

Time Allowed: 3 Hours **Maximum Marks: 80**

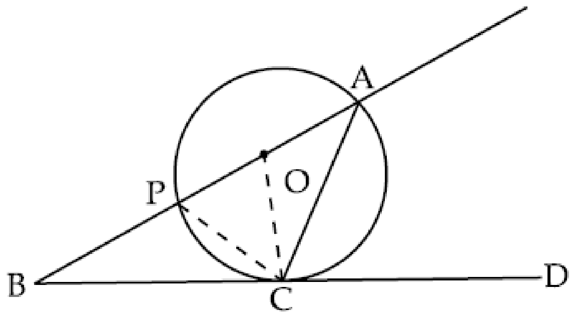
General Instructions:

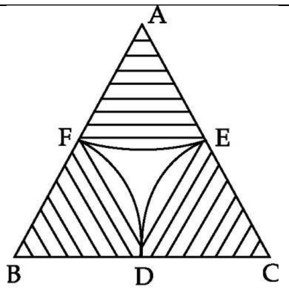
1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 questions carrying 2 marks each.
4. Section C has 6 questions carrying 3 marks each.
5. Section D has 4 questions carrying 5 marks each.
6. Section E has 3 Case Based integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 2 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

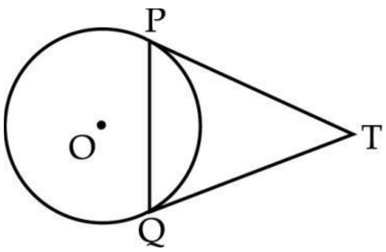
	SECTION A **Section A consists of 20 questions of 1 mark each.**	**Marks**
1	The LCM of the least composite and the least prime numbers is (a) 1 (b) 2 (c) 4 (d) 8	1
2	If the quadratic equation $kx^2 + 4x + 1 = 0$ has real roots, then (a) $k \leq 4$ (b) $k > 4$ (c) $k = 4$ (d) $k \geq 4$	1
3	The zeroes of the polynomial $p(x) = -12x^2 + (k-3)x + 48$ are negative of each other. Then the value of k is (a) 3 (b) 0 (c) -1.5 (d) -3	1
4	The value of k for which the lines $5x + 7y = 3$ and $15x + 21y = k$ coincide is (a) 18 (b) 5 (c) 7 (d) 9	1
5	If P ($\frac{a}{3}$, 4) 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	1

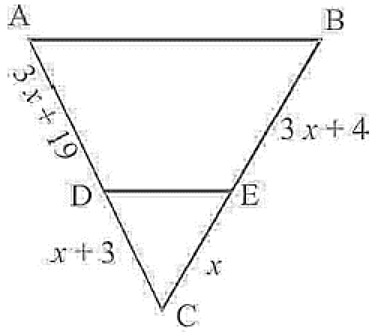
6	Given that ΔABC~ΔPQR. If AM and PN are medians of ΔABC and ΔPQR respectively and AB : PQ = 4 : 9, then AM : PN = (a) 16:81 (b) 2:3 (c) 3:2 (d) 4:9	1
7	If $4\ tan\theta\ =\ 3$, then $\frac{4\sin\theta-\cos\theta}{4\sin\theta+\cos\theta}$ is equal to (a) $\frac{2}{3}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$	1
8	If $2sin^2\beta - cos^2\beta\ =\ 2$, then β is (a) 0° (b) 90° (c) 45° (d) 30°	1
9	In the figure, if DE∥ BC, AD = 3cm, BD = 4cm and BC= 14 cm, then DE equals  (a) 7cm (b) 3cm (c) 4cm (d) 6cm	1
10	A 15 metres high tower casts a shadow 24 metres long at a certain time and at the same time, a telephone pole casts a shadow 16 metres long. The height of the telephone pole is (a) 10 m (b) 12 m (c) 22.5 m (d) 25.6 m	1
11	In the given figure, AT is a tangent to the circle with centre O such that OT = 4 cm and ∠OTA = 30°. Then AT is equal to  (a) 4 cm (b) 2 cm (c) $2\sqrt{3}$ cm (d) $4\sqrt{3}$ cm	1
12	If the diameter of a semi-circular protractor is 14 cm, then its perimeter is (a) 27 cm (b) 36 cm (c) 18 cm (d) 9 cm	1
13	A solid ball is exactly fitted inside the cubical box of edge $'a'$. The volume of the ball is	1

	(a) $\frac{4}{3}\pi a^3$ (b) $\frac{2}{3}\pi a^3$ (c) $\frac{1}{6}\pi a^3$ (d) $\frac{1}{12}\pi a^3$	
14	Using the empirical relationship between measures of central tendency, the mode is equal to (a) 2 Median − 3 Mean (b) 3 Median − 2 Mean (c) 3 Median + 2 Mean (d) 2 Median + 3 Mean	1
15	In a circle of diameter 42 cm, if an arc subtends an angle of 60° at the centre, then length of arc is (a) 11 cm (b) $\frac{22}{7}$ cm (c) 22 cm (d) 44 cm	1
16	The mode of the given data is Class Interval: 0 - 20 / 20 - 40 / 40 - 60 / 60 - 80 Frequency: 15 / 6 / 18 / 10 (a) 18 (b) 50 (c) 58 (d) 52	1
17	A card is drawn from a well shuffled deck of cards. What is the probability that the card drawn is neither a king nor a queen? (a) $\frac{11}{13}$ (b) $\frac{12}{13}$ (c) $\frac{11}{26}$ (d) $\frac{11}{52}$	1
18	$\sqrt{(1-\ cos^2\ \theta)\ sec^2\ \theta} =$ (a) $\sin\theta$ (b) $\cos\theta$ (c) $\tan\theta$ (d) $\cot\theta$	1
	Direction for questions 19 & 20: In question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.	
19	**Statement A (Assertion): If two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$; x, y are prime numbers, then HCF $(a, b) = x^3y^3$.** **Statement R(Reason) : HCF is the product of the smallest power of each common prime factor in the numbers.** (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.	1

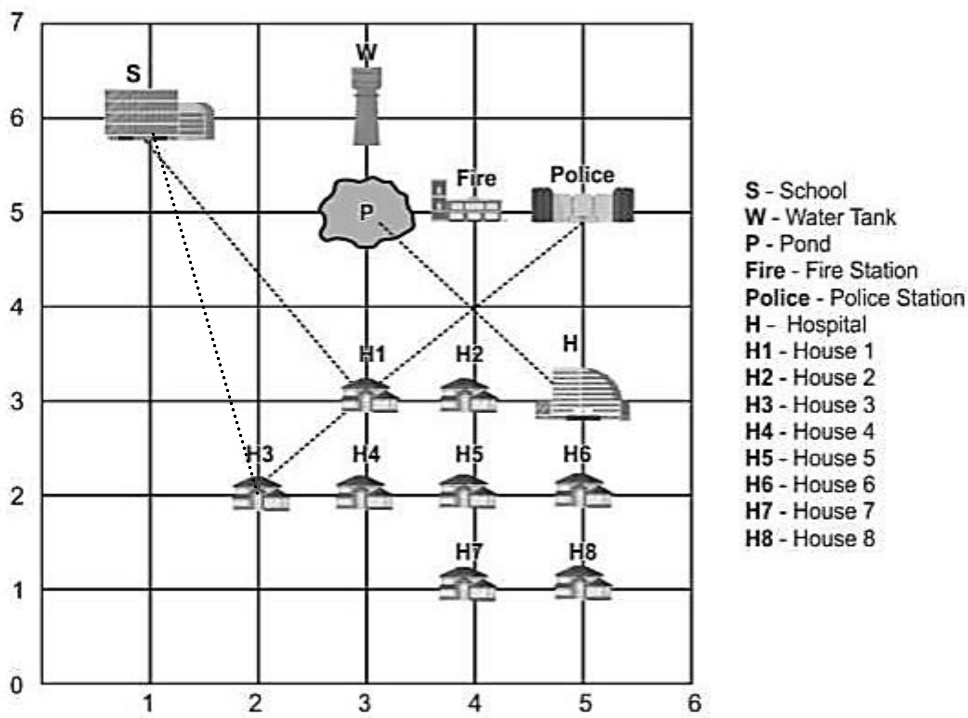
	(d) Assertion (A) is false but reason (R) is true.	
20	**Statement A (Assertion): The points A (2,1), B (4, 2) and C(8, 4) are collinear.** ***Statement R(Reason) :*** **If AB + BC = AC, then A, B and C are collinear points.** (a) Both assertion (A) and reason (R) are true and reason (R) is the correct 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	Solve the following pair of linear equations: $21x + 47y = 110$ $47x + 21y = 162$	2
22	D is a point on the side BC of a triangle ABC such that ∠ ADC = ∠ BAC. Show that $CA^2 = CB.CD$.	2
23	The tangent at a point C of a circle and a diameter AP when extended intersect at B. If ∠ BCA =110º , find ∠CPA.  	2
24	In figure, arcs are drawn by taking vertices A, B and C of an equilateral triangle of side 10 cm, to intersect the sides BC, CA and AB at their respective mid-points D, E and F. Find the area of the shaded region (Use π =3.14)	2

	 **[OR]** A chord of a circle of radius 14 cm subtends an angle of 60° at the centre. Find the area of the corresponding minor segment. (Use $\pi = \frac{22}{7}$ and $\sqrt{3} = 1.73$)	
25	In triangle ABC, right-angled at B, if tan A = $\frac{1}{\sqrt{3}}$, find the value of sin A cos C + cos A sin C. **[OR]** If $sin\ (A - B) = cos\ (A + B) = \frac{1}{2}$, where A and B are acute angles**,** find A and B.	2
	SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	Prove that $3 + 2\sqrt{5}$ is irrational, given that $\sqrt{5}$ is irrational.	3
27	If α and β are the zeros of the polynomial $6y^2 - 7y + 2$, find a quadratic polynomial whose zeros are 2α and 2β.	3
28	The area of a rectangle gets reduced by 9 square units, if its length is reduced by 5 units and breadth is increased by 3 units. If we increase the length by 3 units and the breadth by 2 units, the area increases by 67 square units. Find the dimensions of the rectangle. **[OR]** There are some students in the two examination halls A and B. To make the number of students equal in each hall, 10 students are sent from A to B. But if 20 students are sent from B to A, the number of students in A becomes double the number of students in B. Find the number of students in the two halls.	3

29	Prove the following identity: $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\sec\theta\,\mathrm{cosec}\,\theta$	3
30	Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle. **[OR]** 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 TP. 	3
31	Cards with numbers 2 to 101 are placed in a box. A card is selected at random. What is the probability that the card has (i) an even number? (ii) a square number? (iii) a number divisible by 7?	3
	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 63 km and then travels a distance of 72 km at an average speed of 6 km/h more than its original speed. If it takes 3 hours to complete the total journey, what is its original average speed? **[OR]** Sum of the areas of two squares is 468 m^2. If the difference of their perimeters is 24 m, find the sides of the two squares.	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 same ratio. Using the above theorem, find the value of *x* for which DE || AB.	5

		
34	A building is in the form a cylinder surmounted by a hemispherical vaulted dome and contains $41\frac{19}{21}\, m^3$ of air. If the internal diameter of dome is equal to its total height above the floor, find the height of the building. **OR** A rocket is in the form of a right circular cylinder closed at the lower end and surmounted by a cone with the same radius as that of the cylinder. The diameter and height of the cylinder are 6 cm and 12 cm, respectively. If the slant height of the conical portion is 5 cm, find the total surface area and volume of the rocket [Use π = 3.14].	5
35	The median of the distribution given below is 35. Find the values of x and y, if sum of all frequencies is 170.	5

Class Interval	**Frequency**
0 – 10	10
10 – 20	20
20 – 30	x
30 – 40	40
40 – 50	y
50 – 60	25
60 - 70	15

	SECTION E **Case study based questions are compulsory.**	
36	**Case Study 1** Coordinate Geometry and Property Surveying helps in Urban Planning to establish boundaries, helps in location and construction of layout surveys for highways, railways, and other works, providing ground control points for mapping. Shown below is a town plan on a coordinate grid, where 1 unit = 1 km. Consider the co-ordinates of each building to be the point of intersection of the respective grid lines. Consider the horizontal axis as the x-axis and the vertical axis as the y-axis.  Study the given information and answer the questions that follow: (i) What is the distance between the School and House 3 along the path shown? (ii) A library is to be constructed at a point on y- axis, which is equidistant from the School and the Hospital. What are the coordinates of the library? **[OR]** Name the type of triangle formed by the buildings School (S), House1 (H1) and Police Station.	1 2 1

	(iii) What is the ratio in which House 1 divides the path joining House 3 and the Police station?	
37	**Case Study 2** Trigonometry in the form of triangulation forms the basis of navigation, whether it is by land, sea or air. GPS a radio navigation system helps to locate our position on earth with the help of satellites. A guard, stationed at the top of a 75 m tower, observed an unidentified boat coming towards it. The guard observes the angle of depression of the boat coming towards the lighthouse and found it to be 30°. After 10 minutes, the guard observed that the boat was approaching the tower and the angle of depression of boat changed to 60°.  (i) Make a labelled figure based on the given information. (ii) Find the initial distance of the boat from the foot of the lighthouse. (iii) Find the distance travelled by the boat in 10 minutes. Hence, find the speed of the boat in m/min. **[OR]** At some instant of time, the guard observed that the boat was approaching the tower and its distance from tower is reduced by $75(\sqrt{3}-1)$ m. He immediately raised the alarm. What was the new angle of depression of the boat from the top of the observation tower?	1 1 2
38	**Case Study 3** The flags of different Houses and Clubs are to be placed on the straight passage of the school for Sports Day. There are 15 flags to be placed at intervals of every 2 m. The flags are stored at the gate which is 3m from the position of the first flag. Ruchi is given the	

	responsibility of placing the flags. Ruchi keeps her books where the flags were stored. She could carry only one flag at a time.  Study the given information and answer the questions that follow: (i) Write the distances travelled in carrying each flag and returning back. Is it an arithmetic progression? (ii) What is the maximum distance she would travel carrying a flag? (iii) How much distance would she cover in completing this job and returning back to collect her books? **[OR]** However, Ruchi took break after placing the middle most flag and returned back to collect her books. How much distance did she cover in completing this job and returning back to collect her books?	1 1 2

No. of Printed Pages: 20

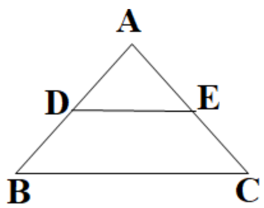
Class- X
Practice Test 3, 2022-23
Subject- Mathematics
Set : B1/ B2 Solutions

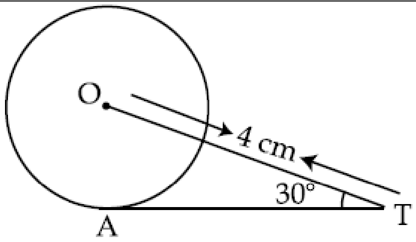
Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

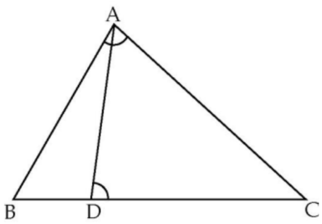
1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 questions carrying 2 marks each.
4. Section C has 6 questions carrying 3 marks each.
5. Section D has 4 questions carrying 5 marks each.
6. Section E has 3 Case Based integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 2 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

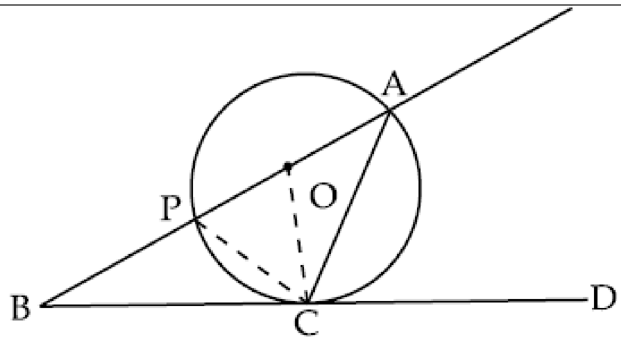
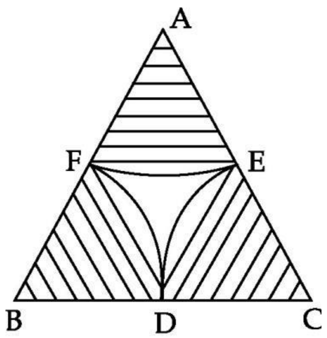
B1	B2	Expected Answers	Marks
		SECTION A **Section A consists of 20 questions of 1 mark each.**	
1	**6**	The LCM of the least composite and the least prime numbers is (a) 1 (b) 2 (c) 4 (d) 8 Correct Answer: **Option (c)**	1
2	**1**	If the quadratic equation $kx^2 + 4x + 1 = 0$ has real roots, then (a) $k \leq 4$ (b) $k > 4$ (c) $k = 4$ (d) $k \geq 4$ Correct Answer: **Option (a)**	1
3	**2**	The zeroes of the polynomial $p(x) = -12x^2 + (k-3)x + 48$ are negative of each other. Then the value of k is (a) 3 (b) 0 (c) -1.5 (d) -3 Correct Answer: **Option (a)**	1
4	**3**	The value of k for which the lines $5x + 7y = 3$ and $15x + 21y = k$ coincide is (a) 18 (b) 5 (c) 7 (d) 9	1

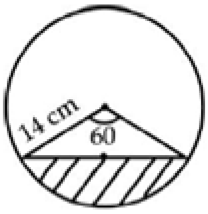
		Correct Answer: **Option (d)**	
5	**4**	If P ($\frac{a}{3}$, 4) is the mid-point of the line segment joining the points Q (– 6, 5) and R (– 2, 3), then the value of a is (a) – 4 (b) – 12 (c) 12 (d) – 6 Correct Answer: **Option (b)**	1
6	**5**	Given that ΔABC~ΔPQR. If AM and PN are medians of ΔABC and ΔPQR respectively and AB : PQ = 4 : 9, then AM : PN = (a) 16:81 (b) 2:3 (c) 3:2 (d) 4:9 Correct Answer: **Option (d)**	1
7	**10**	If 4 $tan\theta = 3$, then $\frac{4\sin\theta-\cos\theta}{4\sin\theta+\cos\theta}$ is equal to (a) $\frac{2}{3}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$ Correct Answer: **Option (c)**	1
8	**7**	If $2sin^2\beta - cos^2\beta = 2$, then β is (a) 0^o (b) 90^o (c) 45^o (d) 30^o Correct Answer: **Option (b)**	1
9	**8**	In the figure, if DE‖ BC, AD = 3cm, BD = 4cm and BC= 14 cm, then DE equals  (a) 7cm (b) 3cm (c) 4cm (d) 6cm Correct Answer: **Option (d)**	1
10	**9**	A 15 metres high tower casts a shadow 24 metres long at a certain time and at the same time, a telephone pole casts a shadow 16 metres long. The height of the telephone pole is (a) 10 m (b) 12 m (c) 22.5 m (d) 25.6 m Correct Answer: **Option (a)**	1
11	**18**	In the given figure, AT is a tangent to the circle with centre O such that OT = 4 cm and ∠OTA = 30°. Then AT is equal to	1

		 (a) 4 cm (b) 2 cm (c) $2\sqrt{3}$ cm (d) $4\sqrt{3}$ cm Correct Answer: **Option (c)**	
12	**11**	If the diameter of a semicircular protractor is 14 cm, then its perimeter is (a) 27 cm (b) 36 cm (c) 18 cm (d) 9 cm Correct Answer: **Option (b)**	1
13	**12**	A solid ball is exactly fitted inside the cubical box of edge a. The volume of the ball is (a) $\frac{4}{3}\pi a^3$ (b) $\frac{2}{3}\pi a^3$ (c) $\frac{1}{6}\pi a^3$ (d) $\frac{1}{12}\pi a^3$ Correct Answer: **Option (c)**	1
14	**13**	Using the empirical relationship between measures of central tendency, the mode is equal to (a) 2 Median − 3 Mean (b) 3 Median − 2 Mean (c) 3 Median + 2 Mean (d) 2 Median + 3 Mean Correct Answer: **Option (b)**	1
15	**14**	In a circle of diameter 42 cm, if an arc subtends an angle of 60° at the centre, then length of arc is (a) 11 cm (b) $\frac{22}{7}$ cm (c) 22 cm (d) 44 cm Correct Answer: **Option (c)**	1
16	**15**	The mode of the given data is Class Interval: 0 - 20 | 20 - 40 | 40 - 60 | 60 - 80 Frequency: 15 | 6 | 18 | 10 (a) 18 (b) 50 (c) 58 (d) 52 Correct Answer: **Option (d)**	1
17	**16**	A card is drawn from a well shuffled deck of cards. What is the probability that the card drawn is neither a king nor a queen? (a) $\frac{11}{13}$ (b) $\frac{12}{13}$ (c) $\frac{11}{26}$ (d) $\frac{11}{52}$	1

		Correct Answer: **Option (a)**	
18	**17**	$\sqrt{(1-\ cos^2\ \theta)\ sec^2\ \theta} =$ (a) $\sin\theta$ (b) $\cos\theta$ (c) $\tan\theta$ (d) $\cot\theta$ Correct Answer: **Option (c)**	1
		Direction for questions 19 & 20: In question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.	
19	**20**	**Statement A (Assertion): If two positive integers a and b are written as $a\ =\ x^3y^2$ and $b\ =\ xy^3$; x, y are prime numbers, then HCF (a, b) = x^3y^3.** **Statement R(Reason) : HCF is the product of the smallest power of each common prime factor in the numbers.** (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. Correct Answer: **Option (d)**	1
20	**19**	**Statement A (Assertion): The points A (2,1), B (4, 2) and C(8, 4) are collinear.** ***Statement R(Reason) :*** **If AB + BC = AC, then A, B and C are collinear points.** (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. Correct Answer: **Option (a)**	1
		SECTION B **Section B consists of 5 questions of 2 marks each.**	
21	**25**	Solve the following pair of linear equations: $21x\ +\ 47y\ =\ 110$	

		$47x + 21y = 162$ Sol. $21x + 47y = 110$ (1) $47x + 21y = 162$ (2) Adding Equations (1) and (2), we have $68x + 68y = 272$ $or\ x + y = 4$ (3) Subtracting Equation (1) from Equation (2), we have $26x - 26y = 52$ $or\ x - y = 2$ (4) On adding and subtracting Equations (3) and (4), we get $x = 3, y = 1$	½ ½ 1
22	**21**	D is a point on the side BC of a triangle ABC such that ∠ ADC = ∠ BAC. Show that $CA^2 = CB.CD$. Sol.  In ΔADC and ΔABC ∠C is common ∠ADC = ∠ BAC (Given) By AA similarity ΔADC~ΔBAC $\frac{CA}{CB} = \frac{CD}{CA}$ or $CA^2 = CB.CD$	½ 1 ½
23	**22**	The tangent at a point C of a circle and a diameter AP when extended intersect at B. If ∠BCA =110º , find ∠CPA.	

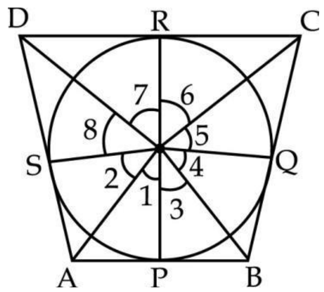
			½
		Sol. Here, $\angle BCO = 90^\circ$	
		So, $\angle OCA = 110^\circ - 90^\circ = 20^\circ$	½
		Now, triangle OCA is isosceles,	
		So, $\angle OAC = 20^\circ$	½
		Also, $\angle ACP = 90^\circ$ [Angle in semicircle]	½
		Thus, $\angle CPA = 180^\circ - [90^\circ + 20^\circ] = 70^\circ$	
24	**23**	In figure, arcs are drawn by taking vertices A, B and C of an equilateral triangle of side 10 cm, to intersect the sides BC, CA and AB at their respective mid-points D, E and F. Find the area of the shaded region (Use $\pi = 3.14$)	
			
		Sol. Area of each sector	
		$= \frac{\theta}{360^\circ} \times \pi r^2 \text{ cm}^2$	
		$= \left(\frac{60}{360} \times \pi (5)^2\right) \text{ cm}^2$	
		$= \frac{25}{6} \pi \text{ cm}^2$	
		$\therefore$ Total area of shaded region $= 3\left(\frac{25}{6}\pi\right) \text{cm}^2$	
		$= \frac{25 \times 3.14}{2}$	1
		$= 39.25 \text{ cm}^2$.	

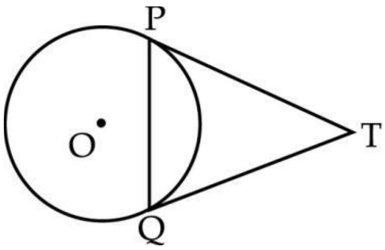
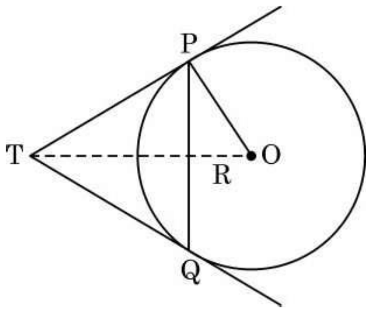
		OR A chord of a circle of radius 14 cm subtends an angle of 60° at the centre. Find the area of the corresponding minor segment. (Use $\pi = \frac{22}{7}$ and $\sqrt{3} = 1.73$) Sol. Clearly triangle formed between radii and chord is equilateral.  Area of segment = $\frac{\theta}{360}\pi r^2 - \frac{\sqrt{3}}{4}r^2$ $= \frac{22}{7} \times \cancel{14}^{2} \times \cancel{14}^{7} \times \frac{1}{\cancel{6}_{3}} - \frac{1}{\cancel{2}} \times \cancel{14}^{7} \times \cancel{14}^{7} \times \frac{\sqrt{3}}{\cancel{2}}$ $= \frac{308}{3} - 49\,(1.73)$ $= 102.67 - 84.77 = 17.90\ \text{cm}^2$	1 1 1
25	**24**	In triangle ABC, right-angled at B, if tan A = $\frac{1}{\sqrt{3}}$, find the value of sin A cos C + cos A sin C. Sol. tan A = $\frac{1}{\sqrt{3}}$ So, A = 30° and C = 60° sin A cos C + cos A sin C = $\frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2}$ = 1 **OR** If $in\ (A - B) = cos\ (A + B) = \frac{1}{2}, 0° < A + B \leq 90°, A > B$, find A and B. Sol. Here A – B = 30°, $A + B = 60°$ Solving, A = 45° and B = 15°	½ 1 ½ 1 1

		SECTION C **Section C consists of 6 questions of 3 marks each.**	
26	**31**	**B1 -** Prove that $3 + 2\sqrt{5}$ is irrational, given that $\sqrt{5}$ is irrational. Sol. Let us assume, to the contrary, that $3 + 2\sqrt{5}$ is rational. So, $3 + 2\sqrt{5} = \frac{a}{b}$, where a and b are coprime $(b \neq 0)$ Rearranging, we get $\sqrt{5} = \frac{a-3b}{2b}$ Since 3, 2, *a* and *b* are integers, $\frac{a-3b}{2b}$ is rational, and so $\sqrt{5}$ is rational. But this contradicts the fact that $\sqrt{5}$ is irrational. This contradiction has arisen due to our wrong assumption that 3+ 2√5 is rational. So, $3 + 2\sqrt{5}$ is irrational. **B2 -** Prove that $5 + 2\sqrt{3}$ is irrational, given that $\sqrt{3}$ is irrational. Sol. Let us assume, to the contrary, that $5 + 2\sqrt{3}$ is rational. So, $5 + 2\sqrt{3} = \frac{a}{b}$, where a and b are coprime $(b \neq 0)$ Rearranging, we get $\sqrt{3} = \frac{a-5b}{2b}$ Since 5, 2, *a* and *b* are integers, $\frac{a-5b}{2b}$ is rational, and so $\sqrt{3}$ is rational. But this contradicts the fact that $\sqrt{3}$ is irrational. This contradiction has arisen due to our wrong assumption that $5 + 2\sqrt{3}$ is rational. So, $5 + 2\sqrt{3}$ is irrational.	½ ½ ½ ½ ½ 1/2
27	**26**	**B1 -** If α and β are the zeros of the polynomial $6y^2 - 7y + 2$, find a quadratic polynomial whose zeros are 2α and 2β. Sol. $\alpha + \beta = \frac{7}{6}, \alpha\beta = \frac{2}{6}$ Sum of new zeroes = $2(\alpha + \beta) = \frac{7}{3}$ Product of new zeroes = $4\alpha\beta = \frac{4}{3}$ So, required polynomial $p(x) = x^2 - \frac{7}{3}x + \frac{4}{3}$ or $3x^2 - 7x + 4$	1 ½ ½ 1

		B2 - If α and β are the zeros of the polynomial $6y^2 + 7y + 2$, find a quadratic polynomial whose zeros are 2α and 2β. Sol. $\alpha + \beta = \frac{-7}{6}, \alpha\beta = \frac{2}{6}$ Sum of new zeroes $= 2(\alpha + \beta) = -\frac{7}{3}$ Product of new zeroes = $4\alpha\beta = 4\left(\frac{2}{6}\right) = \frac{4}{3}$ So, required polynomial $p(x) = x^2 + \frac{7}{3}x + \frac{4}{3}$ or $3x^2 + 7x + 4$	
28	**27**	The area of a rectangle gets reduced by 9 square units, if its length is reduced by 5 units and breadth is increased by 3 units. If we increase the length by 3 units and the breadth by 2 units, the area increases by 67 square units. Find the dimensions of the rectangle. Sol. Let length and breadth be x and y respectively. So, Area = xy **Ist Condition:** $(x-5)(y+3) = xy - 9 \quad \Rightarrow xy + 3x - 5y - 15 = xy - 9$ $\Rightarrow \quad 3x - 5y - 15 = -9$ $\Rightarrow \quad 3x - 5y = 6$ **2nd Condition:** $(x+3)(y+2) = xy + 67 \quad \Rightarrow xy + 2x + 3y + 6 = xy + 67$ $\Rightarrow \quad 2x + 3y + 6 = 67$ $\Rightarrow \quad 2x + 3y = 61$ Solving (1) and (2) $x = 17, y = 9$ So, length and breadth are 17 and 9 units respectively. **OR** There are some students in the two examination halls A and B. To make the number of students equal in each hall, 10 students are sent from A to B. But if 20	1 1 1

		students are sent from B to A, the number of students in A becomes double the number of students in B. Find the number of students in the two halls. Sol. Let the number of students initially in hall A be x. and the number of students initially in hall B be y. **Case I:** When number of students in both halls are equal. $\therefore x - 10 = y + 10$ $\Rightarrow x - y = 20$ ...(i) **Case II:** When students in hall A becomes twice of students in hall B. $\therefore x + 20 = 2(y - 20)$ $\Rightarrow x + 20 = 2y - 40$ $\Rightarrow x - 2y = -60$ ....(ii) Solving (i) and (ii), $x = 100, y = 80$ ∴ Number of students initially in hall A = 100 and number of students initially in hall B = 80	1 1 1
29	**28**	Prove the following identity: $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\,\text{cosec}\,\theta$ Sol. $\text{LHS} = \frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = \frac{\tan\theta}{1-\frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1-\tan\theta}$ $= \frac{\tan^2\theta}{\tan\theta-1} + \frac{1}{\tan\theta\,(1-\tan\theta)}$ $= \frac{\tan^3\theta-1}{\tan\theta\,(\tan\theta-1)}$ $= \frac{(\tan\theta - 1)(\tan^2\theta + \tan\theta + 1)}{\tan\theta(\tan\theta - 1)}$ $= \frac{\tan^2\theta + \tan\theta + 1}{\tan\theta}$ $= \tan\theta + \cot\theta + 1$	1 1

		$= 1 + \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$ $= 1 + \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\ \cos\theta}$ $= 1 + \frac{1}{\sin\theta\ \cos\theta} = 1 + \sec\theta\,\mathrm{cosec}\,\theta$	1
30	**29**	Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle. Sol.  Given that a quadrilateral ABCD circumscribes a circle with centre O at points P, Q, R, and S. To prove : ∠AOB+∠COD = 180° , ∠BOC+∠DOA = 180° Construction : Join OP, OQ, OR, OS Proof : In triangles OAP and OAS, AP = AS (Tangents from the same point A) OA = OA (Common side) OP = OS (Radii of the circle) So, by SSS congruency △OAP ≅ △OAS ∠1 = ∠2 Similarly, ∠4 = ∠3, ∠5 = ∠6, ∠7 = ∠8 Now by adding these angles we get, $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$ $2\angle 1 + 2\angle 3 + 2\angle 7 + 2\angle 6 = 360°$ Or $(\angle 1 + \angle 3) + (\angle 7 + \angle 6) = 180°$ Thus, ∠AOB+∠COD = 180° Similarly, it can be proved that ∠BOC+∠DOA = 180° **OR**	1 ½ 1 ½

		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 TP.  Sol. Join OT.  Let it intersect PQ at the point R. Then Δ TPQ is isosceles and TO is the angle bisector of ∠ PTQ. So, OT ⊥ PQ and therefore, OT bisects PQ which gives PR = RQ = 4 cm. Also, OR = $\sqrt{OP^2 - PR^2}$ = $\sqrt{5^2 - 4^2}$ = 3 cm . Now, $\angle O$ is common $\angle OPT = \angle ORP$ (Each 90°) Therefore, triangle OPT is similar to the triangle ORP by AA similarity. This gives $\frac{TP}{PR} = \frac{OP}{R0}$ So, $\frac{TP}{4} = \frac{5}{3}$ Thus TP = $\frac{20}{3}$ cm	1 ½ ½ ½ ½
31	**30**	**B1 -** Cards with numbers 2 to 101 are placed in a box. A card is selected at random. What is the probability that the card has (iv) an even number? (v) a square number? (vi) a number divisible by 7?	

Sol. Total number of outcomes with numbers 2 to 101 =100

(i) Total even numbers from 2 to 101 = {2, 4,6, …, 100}

Favourable cases = 50

Probability that card is with even number = $\frac{50}{100} = \frac{1}{2}$ 1

(ii) Square numbers from 2 to 101 = {4, 9, 16, 25, 36, 49, 64, 81, 100}

Favourable cases = 9

Probability that the card is with a square number = $\frac{9}{100}$ 1

(iii) Numbers divisible by 7 = {7, 14, 21, 28,35, 42, 49, 56, 63, 70, 77, 84, 91, 98}

Favourable cases = 14

Probability of getting number divisible by 7 = $\frac{14}{100} = \frac{7}{50}$ 1

B2 - Cards with numbers 2 to 101 are placed in a box. A card is selected at random. What is the probability that the card has

(i) an odd number?

(ii) a square number?

(iii) a number divisible by 6?

Sol. Total number of outcomes with numbers 2 to 101 =100

(i) Total odd numbers from 2 to 101 = {3, 5, 7, …, 101}

Favourable cases = 50

Probability that card is with odd number = $\frac{50}{100} = \frac{1}{2}$

(ii) Square numbers from 2 to 101 = {4, 9, 16, 25, 36, 49, 64, 81, 100}

Favourable cases = 9

Probability that the card is with a square number = $\frac{9}{100}$

(iii) Numbers divisible by 6 = {6, 12, 18, …, 96}

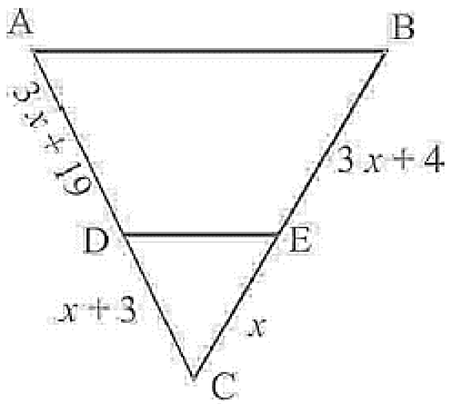
Favourable cases = 16

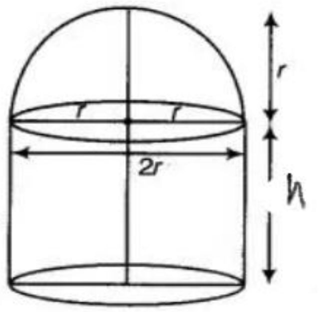
Probability of getting number divisible by 6 = $\frac{16}{100} = \frac{4}{25}$

SECTION D

Section D consists of 4 questions of 5 marks each.

32	**35**	A train travels at a certain average speed for a distance of 63 km and then travels a distance of 72 km at an average speed of 6 km/h more than its original speed. If it takes 3 hours to complete the total journey, what is its original average speed? Sol. Let its original average speed be x km/h. Then, $\frac{63}{x}+\frac{72}{x+6}=3$ $9\left(\frac{7}{x}+\frac{8}{x+6}\right)=3$ $3\left[\frac{7x+42+8x}{x(x+6)}\right]=1$ $21x + 126 + 24x = x^2 + 6x$ $x^2 - 39x - 126 = 0$ $x^2 - 42x + 3x - 126 = 0$ $(x + 3)(x - 42) = 0$ $x = - 3 \; or \; x = 42$ Since x is the average speed of the train, x cannot be negative. Therefore, x = 42. So, the original average speed of the train is 42 km/h. **[OR]** Sum of the areas of two squares is 468 m^2. If the difference of their perimeters is 24 m, find the sides of the two squares. Sol. Let the sides of the two squares be *x* m and *y* m Sum of Areas $x^2+y^2=468$ Difference of perimeters $4x-4y=24$ So, $x-y=6$ Or, $x=y+6$ Thus, $(y+6)^2+y^2=468$ $2y^2+12y+36-468=0$ $2y^2+12y-432=0$ Or, $y^2+6y-216=0$	1 1 1 1 1 1 1 1

		$y^2 + 18y - 12y - 216 = 0$ $(y-12)(y+18) = 0$ $y = 12, -18$ Since a side can't be negative , so $y = 12$. Sides of the two squares are 12 m and 18 m.	1 ½ ½
33	**32**	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. Using the above theorem, find the value of *x* for which DE || AB.  Sol. For the Theorem : Given, To prove, Construction and figure Proof If DE || AB $\therefore \frac{CD}{AD} = \frac{CE}{BE}$ [by BPT] $\frac{x+3}{3x+19} = \frac{x}{3x+4}$ $\Rightarrow (x + 3)(3x + 4) = x\,(3x + 19)$ $\Rightarrow 3x^2 + 4x + 9x + 12 = 3x^2 + 19x$ $\Rightarrow 19x - 13x = 12$ $\Rightarrow 6x = 12$ $\therefore x = 2$ Hence, the required value of x is 2.	 1 ½ 1 ½ ½ ½ 1

<table>
<tr>
<td>34</td>
<td>33</td>
<td>A building is in the form a cylinder surmounted by a hemispherical vaulted dome
and contains $41\frac{19}{21}m^3$ of air. If the internal diameter of dome is equal to its total
height above the floor, find the height of the building.
Sol.

Height of building = $2r$
Or, $h + r = 2r$
So, $h = r$
Volume of building = Volume of cylinder + volume of the hemisphere
$\frac{880}{21} = \pi r^2 h + \frac{2}{3}\pi r^3$
$\frac{880}{21} = \pi r^2 (r) + \frac{2}{3}\pi r^3$
$\frac{880}{21} = \frac{5}{3} \times \frac{22}{7} \times r^3$
$r^3 = 8$
$r = 2$ m
So, total height of building = $2r = 4$ m
OR
A rocket is in the form of a right circular cylinder closed at the lower end and surmounted by a cone with the same radius as that of the cylinder. The diameter
and height of the cylinder are 6 cm and 12 cm, respectively. If the slant height of the conical portion is 5 cm, find the total surface area and volume of the rocket</td>
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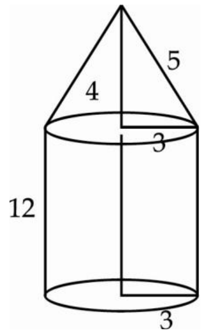
[Use π = 3.14].



Sol. Height of cone = $\sqrt{5^2 - 3^2}$ = 4 cm

$$SA = \pi r l + 2\pi r h + \pi r^2$$
$$= \pi r[l + 2h + r\ ]$$
$$= 3.14 \times 3 \times (5 + 24 + 3)$$
$$= 301.44\ sq\ cm$$

$$\text{Vol} = \pi r^2 h + \frac{1}{3}\pi r^2 h'$$
$$= \pi r^2\left[h + \frac{h'}{3}\right]$$
$$= 3.14\left[9\left(12 + \frac{4}{3}\right)\right]$$
$$= 3.14[120] = 376.8\ cm^3$$

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2 ½</td></tr>
<tr><td>35</td><td>34</td><td>

The median of the distribution given below is 35. Find the values of x and y, if sum of all frequencies is 170.

Class Interval	**Frequency**
0 – 10	10
10 – 20	20
20 – 30	x
30 – 40	40
40 – 50	y
50 – 60	25
60 - 70	15

Sol.

Class	f	cf
0 - 10	10	10
10 - 20	20	30
20 - 30	x	$30 + x$
30 - 40	40	$70 + x$
40 - 50	y	$70 + x + y$
50 - 60	25	$95 + x + y$
60 - 70	15	$110 + x + y$

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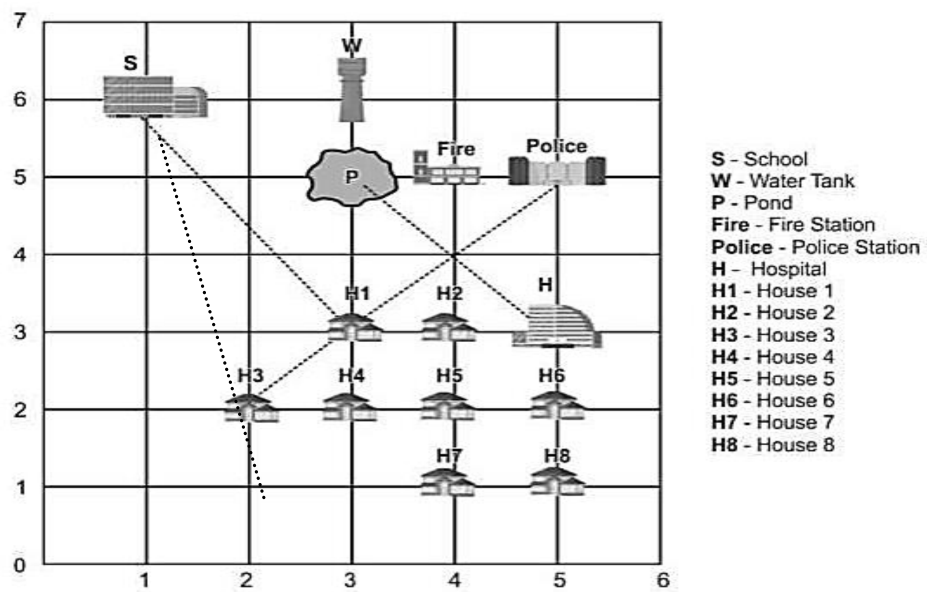
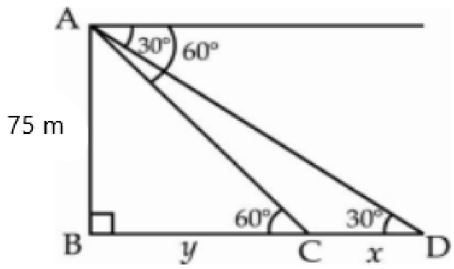
		Since median is 35, 30-40 is the median class. n = 170, $l = 30,\ f = 40,\ cf = 30 + x,\ h = 10$ Median = $l + \left(\frac{n/_2 - cf}{f}\right) \times h$ $35 = 30 + \frac{(85 - 30 - x)}{40} \times 10$ $5 \times 4 = 55 - x$ $x = 35$ Now, $110 + x + y = 170$ So, $y = 25$	½ 1 1 1
		SECTION E **Case study based questions are compulsory.**	
36	**36**	**Case Study 1** Coordinate Geometry and Property Surveying helps in Urban Planning to establish boundaries, helps in location and construction of layout surveys for highways, railways, and other works, providing ground control points for mapping. Shown below is a town plan on a coordinate grid, where 1 unit = 1 km. Consider the co-ordinates of each building to be the point of intersection of the respective grid lines. 	

		(Note: Consider the horizontal axis as the x-axis and the vertical axis as the y-axis.) Study the given information and answer the questions that follow: (i) What is the distance between the School and House 3 along the path shown? (ii) A library is to be constructed at a point on y- axis, which is equidistant from the School and the Hospital. What are the coordinates of the Library? **[OR]** Name the type of triangle formed by the buildings School (S), House1 (H1) and Police Station. (iii) What is the ratio in which House 1 divides the path joining House 3 and the Police station? **Sol.** (i) School (1, 6) and House 3 (2, 2) Distance = $\sqrt{(1-2)^2+(6-2)^2} = \sqrt{1+16} = \sqrt{17}$	1
		(ii) Let A (0, y) be a point on the y – axis then AS = AH So, $1^2+(y-6)^2 = 5^2+(y-3)^2$ $1+y^2+36-12y = 25+y^2+9-6y$ $6y = 3$ Or, $y = \frac{1}{2}$ So, the coordinates of Library = (0, $\frac{1}{2}$)	2
		OR S (1, 6), H1 (3,3) , L = Police (5,5)	
		SH1 = $\sqrt{(3-1)^2+(3-6)^2} = \sqrt{13}$	½
		SL = $\sqrt{(5-1)^2+(5-6)^2} = \sqrt{17}$	½
		LH1 = $\sqrt{(3-5)^2+(3-5)^2} = 2\sqrt{2}$	½
		The triangle is scalene.	½
		(iii) H3 (2, 2), H1 (3,3) , L = Police (5,5) Let the ratio be $k:1$ $3 = \frac{k(5)+1(2)}{k+1}$	

		$3k + 3 = 5k + 2$ $2k = 1$ $k = \frac{1}{2}$ So, the ratio is 1:2.	1
37	**37**	**Case Study 2** Trigonometry in the form of triangulation forms the basis of navigation, whether it is by land, sea or air. GPS a radio navigation system helps to locate our position on earth with the help of satellites. A guard, stationed at the top of a 75 m tower, observed an unidentified boat coming towards it. The guard observes the angle of depression of the boat coming towards the lighthouse and found it to be 30°. After 10 minutes, the guard observed that the boat was approaching the tower and the angle of depression of boat changed to 60°.  (iv) Make a labelled figure based on the given information. (v) Find the initial distance of the boat from the foot of the lighthouse. (vi) Find the distance travelled by the boat in 10 minutes. Hence, find the speed of the boat in m/min. **OR** At some instant of time, the guard observed that the boat was approaching the tower and its distance from tower is reduced by $75(\sqrt{3} - 1)$ m. He immediately raised the alarm. What was the new angle of depression of the boat from the top of the observation tower?	

		Sol. (i)  AB – light house, D - initial point , C – later point (ii) In right triangle ADB $\tan 30^0 = \frac{75}{BD}$ $BD = 75\sqrt{3}$m (iii) In right triangle ABC $\tan 60^0 = \frac{75}{BC}$ $BC = \frac{75}{\sqrt{3}} = 25\sqrt{3}$ m So, $CD = 75\sqrt{3} - 25\sqrt{3} = 50\sqrt{3}$ m Speed of boat = $\frac{50\sqrt{3}}{10} = 5\sqrt{3}$ m/min **OR** Distance of boat from tower = $75\sqrt{3} - 75(\sqrt{3} - 1) = 75\ m$ Let the angle of depression = θ $tan\theta = \frac{75}{75} = 1$ $\Rightarrow\ \theta = 45°$	1 1 1 1/2 ½ 1 1
38	**38**	**Case Study 3** The flags of different Houses and Clubs are to be placed on the straight passage of the school for Sports Day. There are 15 flags to be placed at intervals of every 2 m. The flags are stored at the gate which is 3m from the position of the first flag. Ruchi is given the responsibility of placing the flags. Ruchi keeps her books where the flags were stored. She could carry only one flag at a time.	

Study the given information and answer the questions that follow:

(iv) Write the distance travelled in carrying each flag and returning back. Is it an AP?

(v) What is the maximum distance she would travel carrying a flag?

(vi) How much distance would she cover in completing this job and returning back to collect her books?

OR

However, Ruchi took break after placing the middle most flag and returned back to collect her books. How much distance did she cover in completing this job and returning back to collect her books?

Sol. (i) The distance covered by Ruchi in fixing the first flag and returning back to her original position is $3 + 3 = 6m$

Similarly, for second flag $= 2(3 + 2) = 10m$

And for third flag $= 2(3 + 2 + 2) = 14m$ 1

This pattern can be given by $6, 10, 14, \ldots$ which is an AP 1

(ii) Maximum distance she would travel carrying a flag $= 3 + 2 \times 14 = 31\ m$

(iii) $a = 6, d = 4, n = 15$

Now distance covered by Ruchi 2

$$S_{15} = \frac{15}{2}[2(6) + (15 - 1)(4)] = 510 \text{ m}$$

OR

Middle most flag $= \frac{15+1}{2} = 8^{\text{th}}$

Now if she carries 8 flags, distance covered by Ruchi 2

$$S_8 = \frac{8}{2}[2(6) + (8 - 1)(4)] = 160m$$

SCHOLASTIC APTITUDE TEST (SAT - MATHEMATICS)

1. If $A = \{1,2,3,4\}, B = \{2,4,5,6\}, U = \{1,2,3,4,5,6,7\}$ then $A' \cap B'$ =______

(1) $\emptyset$ (2) $\{1,2,3,4,5,6\}$

(3) $\{7\}$ (4) $\{3,4,5,6\}$

2. An equivalent expression of $\frac{5}{7+4\sqrt{5}}$ after rationalizing the denominator is

(1) $\frac{20\sqrt{5}-35}{31}$ (2) $\frac{20\sqrt{5}-35}{129}$ (3) $\frac{35-20\sqrt{5}}{31}$ (4) $\frac{35-20\sqrt{5}}{121}$

3. If $x-2$ is factor of $3x^4 - 2x^3 + 7x^2 - 21x + k$ then the value of k is

(1) 2 (2) 9 (3) 18 (4) -18

4. Line $x + y = 2$ passes through the ________________quadrants.

(1) 1st and 3rd both

(2) 2nd and 3rd both

(3) 3rd and 4th both

(4) 1st, 2nd and 4th all

5. If the measure of the angle of ΔABC are in proportion 1 : 2: 3, then the measures of the smallest angle is

(1) 30° (2) 60° (3) 90° (4) 120°

6. ΔABC is an equilateral triangle, AB = 6, The points P, Q and R are midpoints of *AB*, *BC* and *CA* respectively. The perimeter of quadrilateral PBCR is __________

(1) 18 (2) 15 (3) 9 (4) 12

7. In $||gm$ ABCD, let *AM* be the altitude corresponding to the base *BC* and *CN* the altitude corresponding to the base *AB*. If AB = 10cm, AM = 6cm and CN =12cm then BC = _______cm.

(1) 20 (2) 10 (3) 12 (4) 5

8. A circle passes through the vertices of an equilateral ΔABC. The measure of an angle subtended by the side *AB* at the centre of the circle has measure

(1) 30° (2) 60° (3) 90° (4) 120°

9. If the lengths of the sides of a triangle are in proportion 3:4:5 then the area of triangle is _________sq. units, where perimeter of the triangle is 144.

(1) 64 (2) 364 (3) 564 (4) 864

10. The ratio of radii of two cones is 2:3 and the ratio of their slant heights is 9:4. Then the ratio of their curved surface area is

(1) 3 :2 (2) 1:2 (3) 1:3 (4) 2:3

11. The probability of getting both heads, when two balanced coins are tossed once is

(1) 1/2 (2) 1/3 (3) 1/4 (4) 1/5

12. The characteristic of the number log 0.003942 = _____

(1) 3 (2) 2 (3) -3 (4) -2

13. A number having digit 2 at unit place then its cube has digit _____ at its unit's place.

(1) 1 (2) 2 (3) 8 (4) 4

14. 3-years ago, the sum of ages of a father and his son was 40 years. After 2-year, the sum of ages of the father and his son will be__________

(1) 40 (2) 46 (3) 50 (4) 60

15. Correspondence ABC $\leftrightarrow$DEF of ΔABC and ΔDEF is similarity. If AB + BC + 10 and DE + EF + 12 and AC = 6 then DF = ______

(1) 6 (2) 5 (3) 7.2 (4) 16

16. In ΔABC, if $\frac{AB}{1} = \frac{AC}{2} = \frac{BC}{\sqrt{3}}$, then m$\angle$C = __________

(1) 90° (2) 30° (3) 60° (4) 45°

17. If 7θ and 2θ are measures of acute angles such than sin 7θ = cos2θ, then 2sin 3θ $-\sqrt{3}$ tan3θ = ______

(1) 1 (2) 0 (3) -1 (4) $1-\sqrt{3}$

18. If the angles of elevation of tower from two points a and b (a>b) meters from its foot and the same side of the tower, have measure 30° and 60°, then the height of the tower is

(1) $\sqrt{a+b}$ (2) $\sqrt{ab}$ (3) $\sqrt{a-b}$ (4) $\sqrt{a/b}$

19. A chord of a circle (O, 5) touches the circle (O, 3). Therefore, the length of the chord =

(1) 8 (2) 10 (3) 7 (4) 6

20. The median class of the frequency distribution given below is________

Class	0-10	10-20	20-30	30-40	40-50
Frequency	7	15	13	17	10

(1) 40-50 (2) 30-40 (3) 20-30 (4) 10-20

21. The simplified form of the expression given below is

$$\frac{\dfrac{y^4 - x^4}{x(x+y)} - \dfrac{y^3}{x}}{y^2 - xy + x^2}$$

(1) 1 (2) 0 (3) –1 (4) 2

22. If $a = \frac{4xy}{x+y}$, the value of $\frac{a+2x}{a-2x} + \frac{a+2y}{a-2y}$in most simplified form is

(1) 0 (2) 1 (3) –1 (4) 2

23. If $\frac{x^2-bx}{ax-c} = \frac{m-1}{m+1}$, has roots which are numerically equal but of opposite signs, the value of m must be

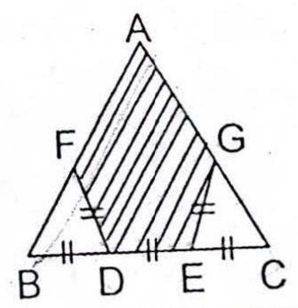
(1) $(a - b) / (a + b)$ (2) $(a + b) / (a - b)$

(3) c (4) $\frac{1}{c}$

24. In the set of equations $z^x = y^{2x}, 2^z = 2.4^x \,;\, x + y + z = 16$, the integral roots in the order x, y, z =

(1) 3, 4, 9 (2) 9, –5, 12 (3) 12, –5, 9 (4) 4, 3, 9

25. ΔABC is an equilateral triangle, we have BD = EG = DF = DE = EC, then the ratio of the area of the shaded portion to area of ΔABC is



(1) $\frac{4}{11}$ (2) $\frac{7}{9}$ (3) $\frac{5}{12}$ (4) $\frac{6}{7}$

26. If A + B = 90° then $\frac{\tan A \tan B + \tan A \cot B}{\sin A \sec B} - \frac{sin^2 B}{cos^2 A}$ is equal to

(1) $cot^2 A$ (2) $cot^2 B$ (3) $-tan^2 A$ (4) $-cot^2 A$

27. The value of the following expression is

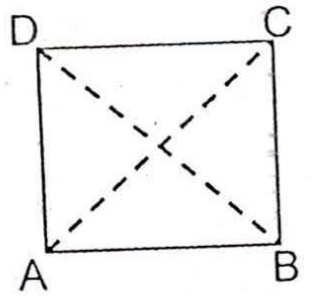
$$\left[\frac{1}{(2^2-1)}\right]+\left[\frac{1}{(4^2-1)}\right]+\left[\frac{1}{(6^2-1)}\right]+\cdots+\left[\frac{1}{(20^2-1)}\right]$$

(1) 10/21 (2) 13/27 (3) 15/22 (4) 8/33

28. If $2^{\sin x+\cos y}=1, 16^{\sin^2 x+\cos^2 y}=4$, then values of $\sin x$ and $\cos y$ respectively are

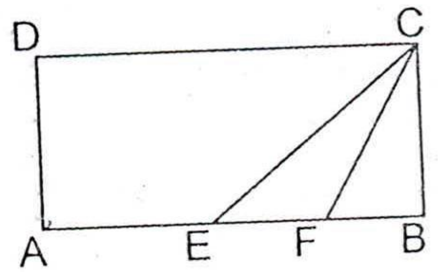
(1) $-\frac{1}{2},\frac{1}{2}$ (2) $\frac{1}{2},-\frac{1}{3}$ (3) 1, –1 (4) $\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}}$

29. ABCD is a square of area of 4 square units which is divided into 4 non-overlapping triangles as shown in figure, then sum of perimeters of the triangles so formed is



(1) $8(2+\sqrt{2})$ (2) $8(1+\sqrt{2})$ (3) $4(1+\sqrt{2})$ (4) $4(2+\sqrt{2})$

30. 150. In the diagram ABCD is a rectangle with AE = EF = FB, the ratio of the areas of triangle CEF and that of rectangle ABCD is



(1) 1 : 6 (2) 1 : 8 (3) 1 : 9 (4) 1 : 10

31. If we divide a two digit number by the sum of its digits we get 4 as quotient and 3 as remainder. Now if we divide that two digit number by the product of its digits, we get 3 as quotient and 5 as remainder. The two digit number is

(1) Even (2) Odd prime (3) Odd composite (4) Odd

32. The average weight (in kg) of all the students in a class equals the number of students in the class. The increase in the average weight when a teacher to 21 kg is included equals the decrease in average weight when a student of 19 kg is included. The

strength of the class is

(1) 15 (2) 10 (3) 20 (4) 17

33. Four positive integers sum to 125. If the first of these numbers is increased by 4, the second is decreased by 4. the third is multiplied by 4 and the fourth is divided by 4 we find four equal numbers then four original integers are

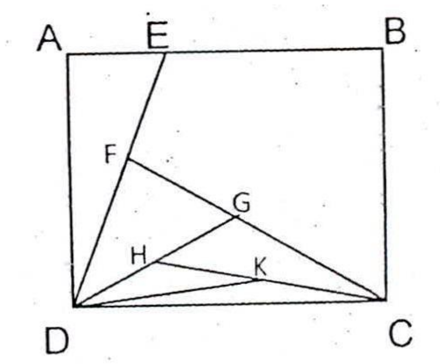
(1) 16, 24, 5, 80 (3) 7, 19, 46, 53

(2) 8, 22, 38, 57 (4) 12, 28, 40, 45

34. The total number of squares on a chessboard is

(1) 206 (2) 205 (3) 204 (4) 202

35. In the figure, the area of square ABCD is 4 cm^2 and E is midpoint of AB; F, G, H and K are the mid points of DE, CF, DG and CH respectively. The area of ΔKDC is:



(1) $\frac{1}{4}$cm^2 (2) $\frac{1}{8}$cm^2 (3) $\frac{1}{16}$cm^2 (4) $\frac{1}{32}$cm^2

36. If $x\%$ of y is equal to $1\%\ of\ z, y\%$ of z is equal to 1% of x and $z\%$ of x is equal to 1% of y, then the value of $xy + yz + zx$ is

(1) 1 (2) 2 (3) 3 (4) 4

37. The volume and whole surface area of a cylindrical solid of radius 'r' units are v and s respectively. If the height of cylinder is 1 unit then $\frac{v}{s}$ is equal to

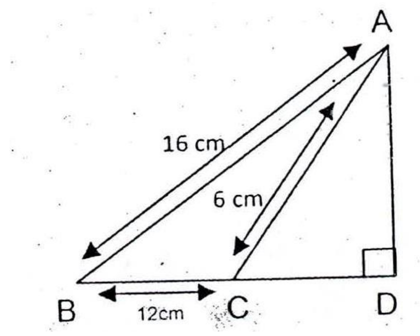
(1) $\frac{1}{2}\left(1 - \frac{1}{r+1}\right)$ (2) $\frac{1}{2}\left(1 + \frac{1}{r+1}\right)$ (3) $\frac{1}{2}\left(1 - \frac{1}{r}\right)$ (4) $\frac{1}{2}\left(1 + \frac{1}{r}\right)$

38. If the height of right circular cylinder is increased by 10% while the radius of base is decreased by 10% then curved surface area of cylinder

(1) Remains same (3) Increases by 1%

(2) Decreases by 1% (4) Increases by 0.1%

39. In the figure $\angle$D = 90°, AB = 16 cm, BC = 12 cm and CA = 6 cm, then CD is:



(1) $\frac{13}{6}$ cm (2) $\frac{17}{6}$ cm (3) $\frac{19}{6}$ cm (4) $\frac{18}{5}$ cm

40. If x, y, z are real numbers such that $\sqrt{x-1}+\sqrt{y-2}+\sqrt{z-3}=0$ then the values of x, y, z are respectively

(1) 1, 2, 3 (2) 0, 0, 0 (3) 2, 3, 1 (4) 2, 4, 1

41. If $(-1)^n + (-1)^{4n} = 0$, then n is

(1) any positive

(2) any negative

(3) any odd natural number

(4) any even natural number

42. If α and β be the zeroes of the polynomial $ax^2 + bx + c$, then the value of $\sqrt{\frac{\alpha}{\beta}}+\sqrt{\frac{\beta}{\alpha}}$ is

(1) b (2) $\frac{-b}{\sqrt{ac}}$ (3) $\frac{-b}{ac}$ (4) $\frac{1}{ac}$

43. If -4 is a root of the quadratic equation $x^2 + px - 4 = 0$ and the quadratic equation $x^2 + px + k = 0$ has equal roots, find the value of k,

(1) $\frac{3}{4}$ (2) $\frac{7}{4}$ (3) $\frac{2}{9}$ (4) $\frac{9}{4}$

44. The value of $\sqrt{6+\sqrt{6+\sqrt{6+\cdots}}}$ is

(1) 4 (2) 3 (3) -4 (4) 3.5

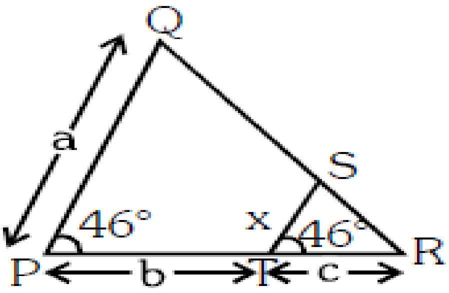
45. In an A.P., sum of first n terms is $\frac{3n^2}{2}+\frac{5n}{2}$. Find its 25th term.

(1) 100 (2) 25 (3) 75 (4) 76

46. ABC is a right angle triangle, right angled at c. If p is the length of the perpendicular from C to AB, AB = c and BC = a and AC = b, then

(1) $\frac{1}{a^2} = \frac{1}{b^2} - \frac{1}{p^2}$ (2) $\frac{1}{p^2} = \frac{1}{a^2} - \frac{1}{b^2}$ (3) $\frac{1}{b^2} = \frac{1}{p^2} - \frac{1}{a^2}$ (4) $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$

47. In the given figure, x in terms of a, b and c is



(1) $x = \frac{ac}{a+c}$

(3) $x = \frac{ac}{b+c}$

(2) $x = \frac{ab}{b+c}$

(4) $x = \frac{bc}{a+c}$

48. Two dice are thrown simultaneously. Find the probability of getting the sum prime number

(1) $\frac{12}{5}$ (2) $\frac{12}{15}$ (3) $\frac{5}{12}$ (4) 1

49. Two poles of height a meters and b meters are p meters apart. Height of the point intersection of the lines joining the top of each pole to the foot of the opposite pole is given by,

(1) $\frac{ab}{a+b}$ (2) $\frac{a+b}{ab}$ (3) $\frac{ab}{a-b}$ (4) $\frac{a-b}{ab}$

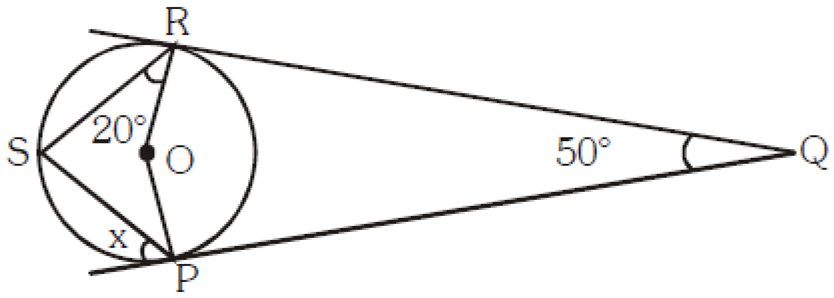
50. If $\tan\theta = \frac{x\sin\emptyset}{1-x\cos\emptyset}$ and $\tan\emptyset = \frac{y\sin\theta}{1-y\cos\theta}$, then find $\frac{x}{y}$.

(1) $\frac{\sin\emptyset}{\sin\theta}$ (2) $\frac{\sin\theta}{\sin\emptyset}$ (3) $\frac{\sin\theta}{1-\cos\theta}$ (4) $\frac{\sin\theta}{1-\cos\emptyset}$

51. If tangents PA and PB from a point P to a circle with centre O are inclined to each other at angle of 80°, then $\angle$POA is equal to,

(1) 50° (2) 60° (3) 70° (4) 80°

52. In the diagram, PQ and QR are tangents to the circle centre O, at P and R respectively. Find the value of x.



(1) 25 (2) 35 (3) 45 (4) 55

53. If h be the height and α the Semi-vertical angle of a right circular cone, then its volume is given by

(1) $\frac{1}{3}\pi h^3 tan^2\alpha$ (2) $\frac{1}{3}\pi h^2 tan^2\alpha$

(3) $\frac{1}{3}\pi h^2 tan^3\alpha$ (4) $\frac{1}{3}\pi h^3 tan^3\alpha$

54. If the mean of x and $\frac{1}{x}$ is M, the mean of x^3 and $\frac{1}{x^3}$ is

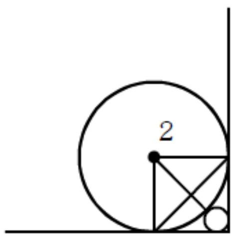
(1) $\frac{M^3-3}{2}$ (2) $M(4M^2-3)$

(3) M^3 (4) M^3+3

55. If $x = a\sec\theta + b\tan\theta$ and $y = a\tan\theta + b\sec\theta$ then the value of $x^2 - y^2$ will be

(1) a^2-b^2 (2) a^2+b^2 (3) a^2+1 (4) a^2-1

56. A circle with radius 2 unit is placed against a right angle. Another smaller circle is also placed as shown in figure. What is the radius of the smaller circle?



(1) $3-2\sqrt{2}$ (2) $4-2\sqrt{2}$ (3) $7-4\sqrt{2}$ (4) $6-4\sqrt{2}$

57. Sum of n terms of the series $\sqrt{2}+\sqrt{8}+\sqrt{18}+\sqrt{32}+\cdots$is

(1) $\frac{n(n+1)}{2}$ (2) $2n(n+1)$ (3) $\frac{n(n+1)}{\sqrt{2}}$ (4) 1

58. Sum of first n odd natural numbers is

(1) n^2 (2) $n + 1$ (3) $2n + 1$ (4) n

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

(1) 3 (2) 3.5 (3) 6 (4) -3

60. The value of k if the linear equations $x + 2y = 3$ and $5x + ky + 7 = 0$ has a unique solution is

(1) $k \neq 1$ (3) $k \neq 15$

(2) $k \neq 10$ (4) $k \neq 5$

61. In an A.P the sum of 'n' terms is $5n^2 - 5n$. Find the 10th term of the A.P.

(1) 80 (2) 90 (3) 100 (4) 110

62. If $\frac{a}{x+y} = \frac{b}{y+z} = \frac{c}{z-x}$, then which of the following equations is true?

(1) $a = b + c$ (2) $c = a + b$ (3) $b = x + c$ (4) $b = a + c$

63. The difference between the two roots of a quadratic equation is 2 and the difference between the cubes of the roots is 98, then which of the following is that quadratic equation?

(1) $x^2 - 8x + 15 = 0$

(2) $x^2 + 8x - 15 = 0$

(3) $x^2 + 5x + 15 = 0$

(4) $x^2 - 5x - 15 = 0$

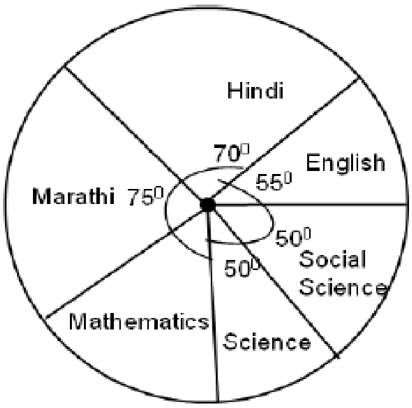
64. From a pack of 52 playing cards, face club cards are removed. The remaining cards are well shuffled and a card is drawn at random. Find the probability that the card drawn is a heart card.

(1) $\frac{1}{4}$ (2) $\frac{13}{49}$ (3) $\frac{3}{52}$ (4) $\frac{49}{52}$

65. A boat takes 7 hours to travel 30 km upstream and 28 km downstream. It takes 5 hours to travel 21 km upstream and to return. Find the speed of the boat in still water

(1) 10 km/hr (2) 20 km/hr (3) 14 km/hr (4) 6 km/hr

66. The marks scored by a student in an examination of 600 marks is shown in the following pie diagram. If he scored 60 marks in Mathematics, then find the percentage of marks that he secured in the examination.



(1) 60% (2) 50% (3) 75% (4) 5%

67. $\sqrt{m^4n^4} \times \sqrt[6]{m^2n^2} \times \sqrt[3]{m^2n^2} = (mn)^k$ then find the value of k.

(1) 6 (2) 3 (3) 2 (4) 1

68. The cost of 20 guavas and 5 apples is same as that of 12 guavas and 7 apples then how many times the cost of an apple is to that of a guava?

(1) Two times (2) half times

(3) four times (4) five times

69. In a group of students, 10% students scored marks less than 20, 20% students scored marks between 20 to 40, 35% students scored marks between 40 to 60 and 20% students scored marks between 60 to 80. Remaining 30 students scored marks between 80 to 100. Find the mode of marks.

(1) 30 (2) 50 (3) 60 (4) 70

70. One of the root of a quadratic equation is $3 - \sqrt{2},$ then which of the following is that equation?

(1) $x^2 - 6x - 7 = 0$ (2) $x^2 + 6x - 7 = 0$

(3) $x^2 + 6x + 7 = 0$ (4) $x^2 - 6x + 7 = 0$

71. In ΔABC, m $\angle$B = 90° , AB = $4\sqrt{5}$, BD$\perp$ AC, AD = 4, then area ΔABC =?

(1) 96 sq. units (2) 80 sq.units (3) 120 sq.units (4) 160 sq.units

72. Side of a cube is increased by 50%, then what percent increase will be in the vertical faces of the cube?

(1) 125% (2) 150% (3) 100% (4) 50%

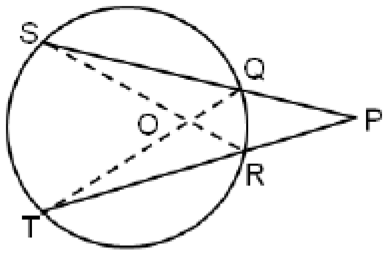
73. $sin\ x = \frac{6\ sin\ 30° - 8\ cos\ 60° + 2tan\ 45°}{2(\sin^2 30° + \cos^2 60°)}$, then x = ?

(1) $30°$ (2) $45°$ (3) $60°$ (4) $90°$

74. P $(1, -9)$, Q(2, 5) and R (6,7) are the co-ordinates of the vertices of ΔPQR , then find the co-ordinates of the centroid from the following alternatives given:

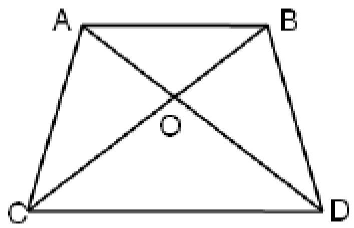
(1) $\left(\frac{10}{3}, -\frac{17}{3}\right)$ (2) (1, 3) (3) (3, 1) (4) $(-3, 1)$

75. In the following figure secants QS and TR intersect each other at point P, which is outside the circle. O is the point of intersection of chords SR and TQ. If OS = 5 cm, OT = 10 cm, TR = 12 cm, PR = 8 cm, then find PQ.



(1) 6 cm (2) 10 cm (3) 12 cm (4) 16 cm

76. In the following figure, AB || CD. Diagonals AC and BD intersect at point O. If AO : OC = 1 : 3, then $\frac{ar(AOB)}{ar(ABD)}$= ?



(1) $\frac{1}{4}$ (2) $\frac{1}{9}$ (3) 16 (4) 116

77. In ΔABC points P and Q trisect side AB. Points T and U trisect side AC and points R and S trisect side BC. Then perimeter of hexagon PQRSTU is how many times of the perimeter of ΔABC?

(1) $\frac{1}{3}$times (2) $\frac{2}{3}$times (3) $\frac{1}{6}$ times (4) $\frac{1}{2}$times

78. $\frac{sin^4\theta - cos^4\theta}{1 - sin^2\theta}$=

(1) $1 - cot^2\theta$ (2) $1 - tan^2\theta$

(3) $tan^2\theta - 1$ (4) $cot^2\theta - 1$

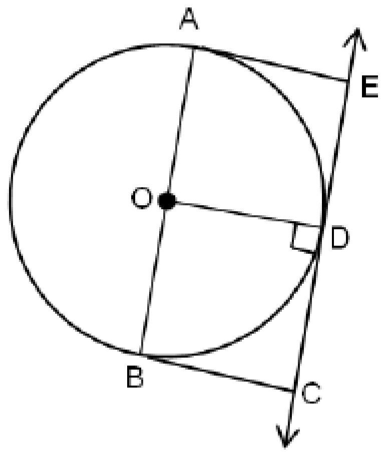
79. The radius of a cylindrical vessel is 7 cm and its height is 12 cm. $\frac{2}{3}$of the vessel is

filled with water. A sphere having radius 6 cm is dropped into the water. Find the volume of the water that will come out of the vessel.

(1) 196π cm^3 (2) $92\,\pi$ cm^3

(3) $288\,\pi$ cm^3 (4) $588\,\pi$ cm^3

80. Radius of circle with centre 'O' is $4\sqrt{5}$ cm. AB is the diameter of the circle. AE||BC, BC = 8 cm. Line EC is tangent at point D. Find the length of DE.



(1) $4\sqrt{5}$ cm (2) $6\sqrt{5}$ cm (3) 8cm (4) 10 cm

81. If $x + 3y - z = 4, 3x + 3y + z = 12,\ (x + 3y)^2 - z^2 = 36$, then the value of x =

(1) $\frac{3}{2}$ (2) $\frac{1}{3}$ (3) 3 (4) 5

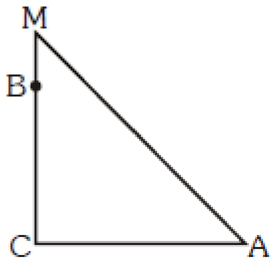
82. If the roots of quadratic equation $x^2 + px + q = 0$ are $\tan 30°$ and $\tan 15°$ respectively, then the value of $2 + q - p =$

(1) 3 (2) 4 (3) -1 (4) -2

83. If 30, 72 and x are three integers, such that the product of any two of them is divisible by the third, then the least value of x is

(1) 45 (2) 60 (3) 48 (4) 24

84. In the right triangle shown $MB + MA = BC + AC$. If BC = 8 and AC = 10, then the value of MB =



(1) $\frac{27}{5}$ (2) $\frac{15}{7}$ (3) $\frac{40}{13}$ (4) 6

85. Let a, b and c be real numbers, such that $a - 7b + 8c = 4$ and $8a + 4b - c = 7$ then the value of $a^2 - b^2 + c^2$ =

(1) -1 (2) 4 (3) -2 (4) 1

86. The roots of $x^3 + 3x^2 + 4x - 11 = 0$ are a, b and c and that the roots of $x^3 + rx^2 + sx + t = 0$ are $a + b$, $b + c$ and $c + a$, then the value of t is

(1) 18 (2) 23 (3) 15 (4) -17

87. If $a < b < c < d < e$ are consecutive positive integers, such that $b + c + d$ is a perfect square and $a + b + c + d + e$ is a perfect cube. What is the smallest possible value of ?

(1) 675 (2) 576 (3) 475 (4) 384

88. Product of two roots $x^4 - 11x^3 + kx^2 + 269x - 2001$ is -69, then the value of k is

(1) 5 (2) -7 (3) -10 (4) 8

89. In triangle ABC, AC = 3AB, let AD bisect angle A with D lying on BC and let E be the foot of the perpendicular from C to AD. Then $\frac{area\ of\ \Delta ABD}{area\ of\ \Delta CDE}$ =

(1)2 (2) $\frac{1}{3}$ (3) $\frac{1}{4}$ (4) $\frac{2}{3}$

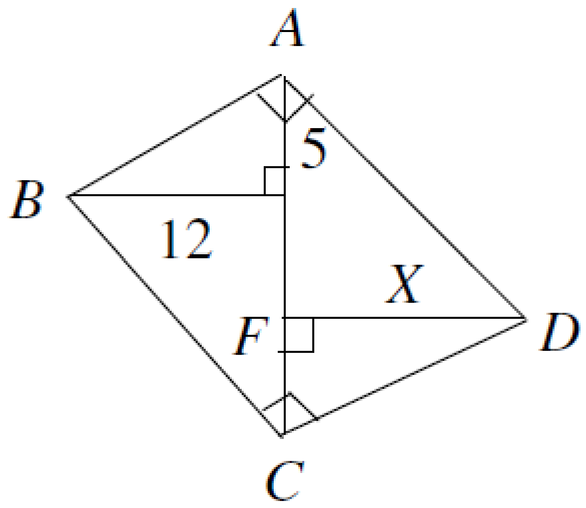
90. Three sides of triangle are consecutive integers and the largest angle is twice the smallest angle. The perimeter of triangle is

(1) 15 units (2) 10 units (3) 12 units (4) 16 units

91. In a triangle ABC, D is the midpoint of AB, E is the midpoint of DB and F is the midpoint of BC. If the area of ΔABC is 96, then the area of ΔAEF is

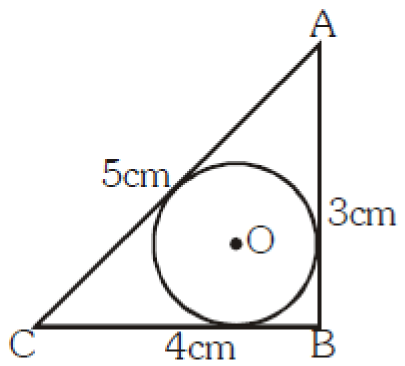
(1) 16 (2) 24 (3) 32 (4) 36

92. In the quadrilateral ABCD, $\angle A = \angle C = 90^\circ$, AE = 5 cm, BE = 12 cm and AC = 21 cm. If DF = x, then the value of x =



(1) $4\frac{3}{5}$ cm (2) $5\frac{1}{4}$ cm (3) $6\frac{2}{3}$cm (4) 7 cm

93. In the figure 'O' is the in centre of ΔABC where AB = 3 cm. BC = 4 cm and AC = 5 cm. Area of ΔABC = rs, where r is in-radius and s is the semiperimeter, then the value of OC =

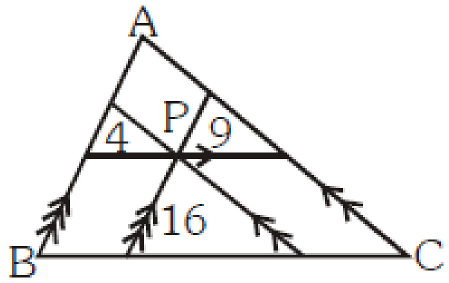


(1) $\sqrt{10}$ cm (2) 8 cm (3) $\sqrt{5}$ cm (4) $2\sqrt{2}$ cm

94. If $p(x) = x^4 + ax^3 + bx^2 + cx + d$ and $p(1) = p(2) = p(3) = 0$, then the value of $p(4) + p(0)$ =

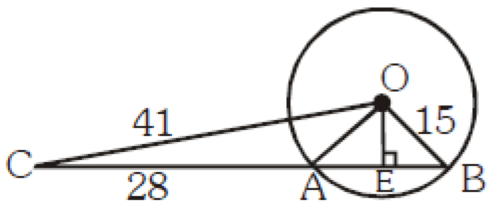
(1) 10 (2) 24 (3) 25 (4) 12

95. In the adjoining figure ABC is a triangle, P is any interior point in it. Three lines are drawn through the point P, parallel to three sides as shown in the figure. The triangle is divided into six parts. The areas as 3 smaller triangles are 4, 9 and 16 units, then the area of ΔABC is



(1) 64 (2) 81 (3) 42 (4) 65

96. In the figure O is the center of the circle, CAB is a secant, CO = 41 cm, CA = 28 cm and OB = 15 cm. OE $\perp$ AB, then AE =



(1) 8 cm (2) 10 cm (3) 12 cm (4) 15 cm

97. If sin α and cos α are the roots of $ax^2 + bx + c = 0$, then $a^2 + 2ac$ =

(1) c^2 (2) $-2ab$ (3) b^2 (4) 0

98. The area enclosed by the curve $|x| + |y| = 1$ is

$$|x| = \begin{matrix} x \; for \; x > 0 \\ -x \; for \; x < 0 \\ o \; for \; x = 0 \end{matrix}$$

(1) 1 sq unit (2) 2 sq units (3) 3 sq units (4) 4 sq units

99. $3^9 + 3^{12} + 3^{15} + 3^n$is a perfect cube, n ϵN, then the value of n =

(1) 18 (2) 17 (3) 14 (4) 16

100. A four digit number has the following properties

i) It is a perfect square

ii) Its first two digits are equal to each other

iii) Its last two digits are equal to each other

Then the four digit number is

(1) 5566 (2) 7744 (3) 2288 (4) 3399

ANSWER KEY

Q.N	Sol	Q.N	Sol	Q.N	Sol	Q.N	Sol	Q.N	Sol	Q.N	Sol	Q.N	Sol
1	3	11	3	21	3	31	2	41	3	51	1	61	2
2	1	12	3	22	4	32	3	42	2	52	3	62	4
3	4	13	3	23	1	33	1	43	4	53	1	63	1
4	4	14	3	24	4	34	3	44	2	54	2	64	2
5	1	15	3	25	2	35	2	45	4	55	1	65	1
6	2	16	2	26	2	36	3	46	3	56	4	66	1
7	1	17	2	27	1	37	1	47	3	57	3	67	2
8	4	18	2	28	1	38	2	48	3	58	1	68	3
9	4	19	1	29	2	39	3	49	1	59	1	69	2
10	1	20	3	30	1	40	1	50	2	60	2	70	4

Q.No.	Sol.	Q.No.	Sol.	Q.No.	Sol.	Q.No.	Sol.	Q.No.	Sol.	Q.No.	Sol.
71	2	76	1	81	1	86	2	91	4	96	3
72	1	77	2	82	1	87	1	92	3	97	3
73	4	78	3	83	2	88	3	93	1	98	2
74	3	79	2	84	3	89	2	94	2	99	3
75	2	80	4	85	4	90	1	95	2	100	2

SCHOLASTIC APTITUDE TEST (SAT - MATHEMATICS)

1. The average of 9 numbers is 18. If the average of first five numbers is 19 and the average of last 5 numbers is 17, find the 5^{th} number.

   (1) 16 (2) 20 (3) 18 (4) 22

2. In Δ PQR, PQ = PR , and X is the midpoint of PQ. XY is parallel to QR and meets PR at point Y. What kind of triangle is PXY?

   (1) Isosceles (2) Scalene (3) Equilateral (4) Right triangle

3. If α, β are roots of polynomial $3x^2 + 6x + K$ such that $\alpha^2 + \beta^2 + \alpha\beta = \frac{8}{3}$, then find the value of K.

   (1) –8 (2) 8 (3) –4 (4) 4

4. If $cosec\theta + sin\theta = 2,$ then the value of $cosec^{50}\theta + sin^{50}\theta$ is __________

   (1) 2 (2) 100 (3) 0 (4) 50

5. The sum of squares of two consecutive even numbers added by 4 is always divisible by

   (1) 24 (2) 16 (3) 8 (4) 32

6. If $cosec\ 4x = sec\ 5x$, then the value of $sin\ 3x + cos\ 6x$ is _______

   (1) 1 (2) 3 (3) 0 (4) –3

7. The ratio of radius of base to the height of the right circular cylinder is 1 : 2. If its volume is 2156 cm^3, then its total surface area is ______

   (1) 1024 cm^2 (2) 924 cm^2 (3) 874 cm^2 (4) 1204 cm^2

8. Find the centre of circle passing through the points (1, 4) (–2, 6) and (3, 7)

   (1) (1, 1) (2) (0, 0) (3) $\left(\frac{1}{2}, \frac{7}{2}\right)$ (4) $\left(\frac{1}{2}, \frac{13}{2}\right)$

9. The 7th term of an AP is 5 times the first term and its 9th term exceeds twice the 4th term by 1. The first term of the AP is _____

   (1) 151 (2) –39 (3) 3 (4) –124

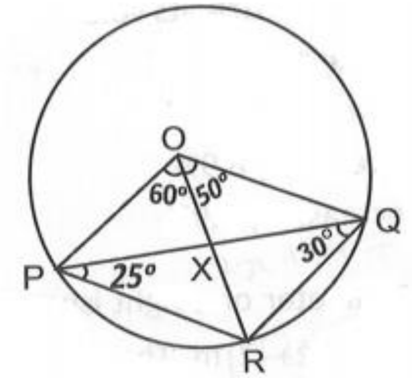
10. The length of shadow of a building, when the sun's altitude is 60°, is 20 m less than what it was when it was 45°. The height of the building is ______

    (1) 54.48m (2) 47.32m (3) 64.32m (4) 57.48m

11. If $\frac{6^6+6^6+6^6+6^6+6^6+6^6}{2^6+2^6} \times \frac{5^6+5^6+5^6+5^6+5^6}{3^6+3^6+3^6} = 5^n$, then the value of n is ________.

    (1) 6 (2) 0 (3) 12 (4) 7

12. In the given figures, the value of $\angle PXR$ is



(1) 85° (2) 100° (3) 95° (4) 120°

13. If radius of a right circular cylinder is increased by 10% and height is decreased by 10%, its volume will

(1) Increase by 9.8% (2) Decrease by 9.8%

(3) Increase by 8.9% (4) Decrease by 8.9%

14. The Perimeter of a right isosceles triangle is $(2+\sqrt{2})$m. The length of its hypotenuse is —

(1) 2m (2) 4m (3) $\sqrt{6}$ m (4) $\sqrt{2}$ m

15. A fraction becomes $\frac{5}{7}$ if 2 is added to both its numerator and denominator. If 4 is added to numerator and 3 is added to denominator, the fraction becomes $\frac{7}{8}$. Find the original fraction

(1) $\frac{8}{11}$ (2) $\frac{3}{5}$ (3) $\frac{5}{11}$ (4) $\frac{7}{9}$

16. If $x^m . y^n = 7889$, where x and y are prime numbers, the value of $x + y$is ______

(1) 30 (2) 60 (3) 100 (4) 300

17. If $217x + 131y = 913$ and $131x + 217y = 827$, then the value of $x + y$ is

(1) 8 (2) 5 (3) 7 (4) 6

18. If the co-ordinates of the midpoints of the sides of a triangle are (1, 1), (2, −3) and (3, 4), then the centroid of the triangle is ....

(1) $\left(3,\frac{1}{3}\right)$ (2)$\left(1,\frac{2}{3}\right)$ (3) (3, 1) (4) $\left(2,\frac{2}{3}\right)$

19. If $x^2 + xy + x = 12$ and$y^2 + xy + y = 18$, then the value of $x + y$ is ..

(1) 5 or −6 (2) 3 or 4 (3) 5 or 3 (4) 6 or −3

20. The greatest number of four digits which when divided by 3, 5, 7, 9 leaves the remainders 1, 3, 5, 7 respectively, is

(1) 9763 (2) 9673 (3) 9367 (4) 9969

21. If $\frac{2+5+8+\ldots\ldots \text{n.terms}}{7+11+15+\ldots\ldots \text{n.terms}} = \frac{23}{35}$, then value of n is

(1) 17 (2) 15 (3) 18 (4) 23

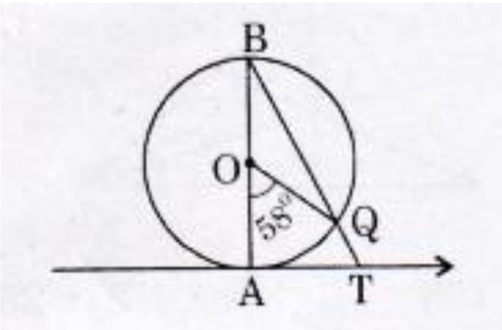
22. If $x = \frac{1}{2-\frac{1}{2-\frac{1}{2-x}}}$, $x \neq 2$, then the value of x is

(1) 1 (2) 3 (3) 2 (4) 5

23. If two vertices of an equilateral triangle be (0, 0) and (3, $\sqrt{3}$), then the third vertex is ...

(1) (1, 3 $\sqrt{3}$) (2) (0,2 $\sqrt{3}$) (3) (3, $\sqrt{3}$) (4) (1, $\sqrt{3}$)

24. In the given figure, AB is the diameter of a circle with O and AT is a tangent. If ∠AOQ = 58°, then the value of ∠ATQ is



(1) 52° (2) 61° (3) 46° (4) 75°

25. The radii of two cylinders are in the ratio 2 : 3 and their heights are in the ratio 5: 3, then the ratio of their volumes is

(1) 15:16 (2) 14:17 (3) 20:27 (4) 4:9

26. A bag contains 15 balls of which x are black and remaining are red. If the number of red balls are increased by 5, the probability of drawing the red balls doubles, then the probability of drawing red ball is

(1) $\frac{1}{5}$ (2) $\frac{4}{5}$ (3) $\frac{3}{5}$ (4) $\frac{2}{5}$

27. The mean of certain number of observations is 46. If four observation whose mean is 52 are removed, the mean becomes 44.5. The original number of observation is :

(1) 35 (2) 20 (3) 15 (4) 12

28. The area of a triangle with vertices $(p, 2 - 2p), (1-p, 2p)$ and $(-4-p, 6-2p)$ is 70 sq, units. Then, the numbers of possible integral values of p is :

(1) 0 (2) 1 (3) 2 (4) 3

29. If one zero of the quadratic polynomial $ax^2 + 15x + 6$ is reciprocal of the other, then the zeros of the polynomial are :

(1) 2 and $\frac{1}{2}$ (2) –2 and $-\frac{1}{2}$ (3) 3 and $\frac{1}{3}$ (4) –3 and $-\frac{1}{3}$

30. In a triangle ABC, points D is E are on sides AB and AC respectively such that BCED is trapezium. IF AE : EC = 3 : 2, then the ratio of area of ΔADE and trapezium BCED is :

(1) 9 : 16 (2) 9 : 4 (3) 9 : 25 (4) 16 : 25

31. Three spheres of radii 6 cm, x cm and y cm are melted to form a single sphere of radius 12 cm. If xy is equal to 80, then the value of x + y is :

(1) 21 (2) 18 (3) 24 (4) 42

32. The value of λ satisfying of the relation $y = \lambda x + 5$, where x and y are the solution of pair of equations $x + 2y = 10$ and $3x + 4y = 360$ is

(1) $\frac{1}{4}$ (2) $-\frac{1}{4}$ (3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

33. Angles A, B, C and D of a cyclic quadrilateral ABCD are in the ratio 3 : 3 : 2 : 2 respectively. If AB = 5 cm, BC = 3.5 cm and CD = 8 cm, then the length of AD is :

(1) 5 cm (2) 3.5 cm (3) 8 cm (4) 4 cm

34. The median of certain observations 17, 18, 23, 27, $x - 3, x + 5$, 45, 49, 74 and 85, arranged in an ascending order is 35. Later on, it was found that one observation 72 was misread as 27 by mistake. The correct median of the data is :

(1) 36 (2) 38 (3) 42 (4) 47

35. The sides of triangle are 61 cm, 54 cm and 35 cm respectively. The length of its longest altitude is :

(1) 10 $\sqrt{5}$ cm (2) 16 $\sqrt{5}$ cm (3) 24 $\sqrt{5}$ cm (4) 28 $\sqrt{5}$ cm

36. A bag contains two coins. One of them is a regular coin whereas the other has tails on both sides. From this bag, a coin is picked at random and tossed. Then, the probability of getting a head is :

(1) 0 (2) $\frac{1}{4}$ (3) $\frac{1}{2}$ (4) $\frac{3}{4}$

37. a and b are roots of a quadratic equation $x^2 + 5x + d = 0$, while a and c are the roots of the quadratic equation $x^2 + 6x + 2d = 0$. If there is only one common root in the two equations, then value of $d$is :

(1) –2 (2) –4 (3) 2 (4) 4

38. A regular polygon is drawn with 35 diagonals. Its interior angle will be

(1) 154° (2) 164° (3) 144° (4) 140°

39. What will be the ratio of volume of cube is to volume of sphere inscribed in the cube?

(1) 3 :π (2) 6 : π (3) 6 : 5 (4) 2 : π

40. If α, β are the roots of the equation $2x^2 - 5x + 16 = 0$ then the value of

$\left(\frac{\alpha^2}{\beta}\right)^{\frac{1}{3}} + \left(\frac{\beta^2}{\alpha}\right)^{\frac{1}{3}}$ is

(1) $\frac{1}{4}$ (2) $\frac{5}{4}$ (3) $\frac{1}{3}$ (4) $\frac{5}{12}$

41. If one root of quadratic equation $(K + 1)x^2 - 5x + 2K = 0$ is reciprocal of other then value of K is

(1) 2 (2) 0 (3) –1 (4) 1

42. If sum of LCM and HCF of two number is 50 and their LCM is 20 more than their HCF, then the product of two numbers will be

(1) 525 (2) 425 (3) 625 (4) 325

43. If 12 $cot^2\theta - 31\ cosec\theta + 32 = 0$ then value of sinθ is

(1) 3 $\frac{3}{5}$or 1 (2) $\frac{2}{3}$ or $-\frac{2}{3}$ (3) $\frac{4}{5}$ or $\frac{3}{4}$ (4) $\pm\frac{1}{2}$

44. A cone, a right circular cylinder and a hemisphere standing on equal base and have same height. The ratio of their volumes is

(1) 1 : 2 : 3 (2) 1 : 3 : 2 (3) 2 : 3 : 1 (4) 2 : 1 : 3

45. The edge of a cube is doubled then the percentage increase in the volume of cube is

(1) 100% (2) 500% (3) 300% (4) 700%

46. When 10 is subtracted from each of the given observation, the mean is reduced by 60%. If 5 is added to all the given observation, the mean will be

(1) 25 (2) 30 (3) 60 (4) 65

47. On increasing the radius of the base and height of a cone each by 20%, then the percentage increase in the volume will be

(1) 20% (2) 40.8% (3) 60% (4) 72.8%

48. The area of two concentric circles are 1386 cm^2 and 962.5 cm^2 . The width of the ring is

(1) 4.2 cm (2) 3.8 cm (3) 3.5 cm (4) 2.8 cm

49. The condition of points $(a, 0), (0, b)$ and (1,1) lie on straight line will be

(1) $ab = 1$ (2) $\frac{a+b}{ab} = 1$ (3) $a - b = 1$ (4) $\frac{ab}{a-b} =$
1

50. There are two taps to fill a tank. If both are opened, the tank fills in 1 hour. If the smaller

tap alone is opened, it takes 3 hours to fill the tank. How many hours will it take to fill the tank, if the larger tap alone is opened?

(1) 2 (2) $1\frac{1}{2}$ (3) $1\frac{1}{3}$ (4) $1\frac{1}{4}$

51. The 5th term of the arithmetic sequence is 5 and the sum of the first 5 terms is 55. What is its first term?

(1) 15 (2) 16 (3) 17 (4) 18

52. The sum of the first 11 terms and the sum of the first 17 terms of an arithmetic sequence are equal. What is the sum of the first 28 terms?

(1) 28 (2) 1 (3) -1 (4) 0

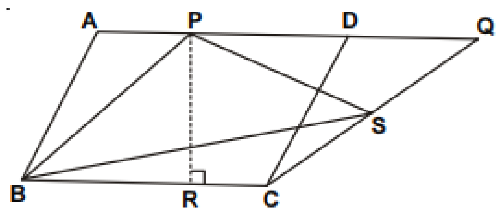
53. A square is drawn with vertices on a circle. The area of the square is 4 square centimeters. What is the area of the circle(in sq.cm.)?

(1) π (2) 2π (3) 2π (4) 4π

54. The sum of two numbers and the difference of their squares are both 10. What is the larger of these two numbers?

(1) 4 (2) $4\frac{1}{2}$ (3) 5 (4) $5\frac{1}{2}$

55. In the adjoining figure ABCD and PBCQ are parallelograms, BC = 12 cm , PR = 8 cm. Find ar (ΔPSB).



(1) 96 cm^2 (2) 72 cm^2 (3) 48 cm^2 (4) 36 cm^2

56. The diameter of the base of a cylindrical metal block is 6.6 cm and its height is 0.4m, How many discs of diameter 2.2 cm and height 0.2 cm can be cut from this metal block?

(1) 180 (2) 600 (3) 1200 (4) 1800

57. The number obtained by adding 12 to a natural number is 160 times of the multiplicative inverse of that natural number. Find the number.

(1) 20 (2) 16 (3) 12 (4) 8

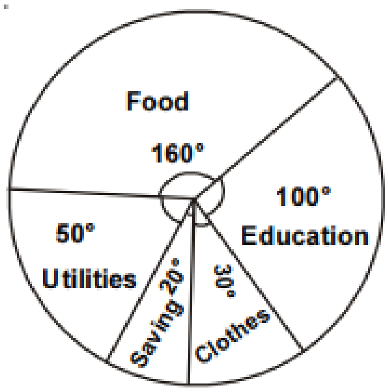
58. A train travels some distance at a constant speed. If the speed of the train would have increased by 15Km/hr, then it would have required 2 hours less. But if the speed of the train would have decreased by 5km/hr, then to cover the same distance it would have required 1 hour more. Find the distance covered by the train.

(1) 120 km (2) 240 km (3) 360 km (4) 400 km

59. How many numbers between 10 to 300, when divided by 4, leave remainder 3?

(1) 71 (2) 72 (3) 73 (4) 74

60. The expenditure incurred on different items in a family is shown in the adjacent pie diagram. If the amount of house rent is Rs 10,000 then find the amount incurred on education.



(1) Rs 20, 000 (2) Rs 32,000 (3) Rs 72,000 (4) Rs 30,000

61. ABCD is a cyclic quadrilateral such that AB is a diameter of the circle circumscribing it and $\angle ADC$ = 140° , then $\angle BAC$ is :

(1) 80° (2) 50° (3) 40° (4) 30°

62. 8 men and 12 boys can finish a work in 10 days while 6 men and 8 boys can finish it in 14 days. Then the number of days taken by one man alone is :

(1) 240 (2) 200 (3) 140 (4) 280

63. If the graph of the equation $4x + 3y = 12$ cuts the coordinate axes at A and B then the length of AB is :

(1) 4 units (2) 3 units (3) 5 units (4) 2 units

64. In ΔABC, if $2\angle A = 3\angle B = 6\angle C$ then the measures of ∠A, ∠ B and ∠C are respectively :

(1) 30°, 60°, 90° (2) 90°, 60°, 30°

(3) 30°, 90°, 60° (4) 45°, 45°, 90°

65. If the polynomial $f(x) = 2x^3 + mx^2 + nx - 14$ has $(x-1)$ and $(x+2)$ as its factors, find the value of $\frac{m}{n}$.

(1) 27 (2) $\frac{1}{3}$ (3) 3 (4) $\frac{1}{27}$

66. In how many years the ratio of the principal and its interest at 4% per annum will be 5 : 2 ? (1) 10 (2) 15 (3) 20 (4) 12

67. $(x+2), x$ and $(x-1)$ are the frequencies of the numbers 12, 15 and 20 respectively. If the mean of the distribution is 14.5, the value of x is

(1) 2 (2) 3 (3) 4 (4) 5

68. A businessman fixed the selling price of an article after increasing the cost price by 40%. Then he allowed his customer a discount of 20% and gained Rs. 48. The cost price of the article is

(1) Rs. 200 (2) Rs. 248 (3) Rs. 400 (4) Rs. 448

69. ABC is a right angled triangle and AD is perpendicular to the hypotenuse BC. If AC = 2 AB, then BC =

(1) 2 BD (2) BD (3) 5 BD (4) 4 BD

70. The compound interest for two years of the amount Rs. 75000 at the rate of 8% per annum would be

(1) Rs. 1,248 (2) Rs. 1,260 (3) Rs. 1,300 (4) Rs. 1,352

ANSWER KEY

1. 3
2. 1
3. 4
4. 1
5. 3
6. 1
7. 2
8. 4
9. 3
10. 2
11. 4
12. 3
13. 3
14. 4
15. 2
16. 1
17. 2
18. 4
19. 1
20. 1
21. 2
22. 1
23. 2
24. 2
25. 3
26. 1
27. 2
28. 2
29. 2
30. 1
31. 2
32. 4
33. 2
34. 3
35. 3
36. 2
37. 4
38. 3
39. 2
40. 2
41. 4
42. 1
43. 3
44. 2
45. 4
46. 2
47. 4
48. 3
49. 2
50. 2
51. 3
52. 4
53. 3
54. 4
55. 3
56. 4
57. 4
58. 3
59. 3
60. 1
61. 2
62. 3
63. 3
64. 2
65. 3
66. 1
67. 2
68. 3
69. 3

SCHOLASTIC APTITUDE TEST (SAT - MATHEMATICS)

1. If ΔABC is an equilateral triangle such that A(2, 2) and centroid of the triangle is (–2, 2) then find the length of its side.

(1) 4 units (2) 6 units (3) $4\sqrt{3}$ units (4) 9 units

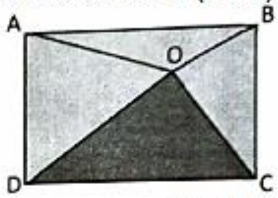
2. The sum of the n consecutive odd natural numbers starting from 5 is 60. Find the value of (n^2 – n).

(1) 20 (2) 30 (3) 42 (4) 56

3. The sum of the first ‘p’ odd natural numbers is 100 & the sum of the first ‘q’ even natural numbers is 90. Find the value of (p + q).

(1) 18 (2) 19 (3) 20 (4) 21

In the figure, ABCD is a rectangle such that Area of ΔAOB = a m^2, Area of ΔAOD = b m^2, Area of ΔCOD = c m^2. Then the area of ΔBOC (in m^2) = 4.



(1) a + b + c (2) a + b – c
(3) b + c – a (4) a + c – b

A ‘p’ m long wire is cut into two pieces one of which is bent into a circle and the other into a square enclosing the circle. What is the radius (in meter) of the circle? 5.

(1) $\frac{p}{\pi+4}$ (2) $\frac{2p}{\pi+4}$
(3) $\frac{p}{2\pi+8}$ (4) $\frac{2p\pi}{\pi+4}$

If the values of x in the roots of the equation $p(\sin^2 x) + q(\sin x) + r = 0$ are complementary, then 6.
(1) $p^2 = q(q + 2r)$ (2) $q^2 = p(p + 2r)$
(3) $r^2 = q(q + 2p)$ (4) $r^2 = p(q + 2p)$

The average age of all the 100 employees in an office is 29 years, where $\frac{2}{5}$ employees are ladies. The ratio of average age of men to women is 5 : 7. The average age of female employees is: 7.
(1) 18 years (2) 35 years
(3) 25 years (4) None of these

8.

If, $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P., then $\frac{b+a}{b-a} + \frac{b+c}{b-c}$ equals
(1) 1 (2) 2
(3) $\frac{b-c}{a-b}$ (4) $\frac{ab}{c}$

9. As a result of 40% hike in the price of rice per kg., a person is able to purchase 10 kg less rice for Rs.1400. What was the original price of rice per kg?

(1) Rs.50 (2) Rs.60 (3) Rs.40 (4) Rs.30

10. A man takes half time in rowing a certain distance downstream than upstream. What is the ratio of the speed of boat in still water to the speed of current?

(1) 1 : 2 (2) 2 : 1 (3) 1 : 3 (4) 3 : 1

11. One box contains four cards numbered 1, 3, 5 and 7 and another box contains four cards numbered as 2, 4, 6 and 8. One card is drawn from each box at random. The probability that the product of the numbers so drawn is more than 14 is:

(1) 1 /2 (2) 7/ 10 (3) 3 /8 (4) 5/ 8

12. A tower is observed from a point on the horizontal through the foot of the tower. The distance of this point from the foot of the tower is equal to the height of the tower. The angle of elevation on the top of the tower is:

1. 60^0 2. 45^0 3. $40\ ^0$ 4. 30^0

13. There are 1400 students in a school, 25% of those wear spectacles and 2/7 of those wearing spectacles are boys. How many girls in the school wear spectacles?

1. 300 2. 100 3. 200 4. 250

14. John cycling at a constant speed of 10 km/hr, reaches his school in time. If he cycles at a constant speed of 15 km/hr, he reaches his school in 12 minutes early. How many km he has to cycle for his school is?

1. 4 2. 6 3. 9 4. 12

15.

If $7\sin\alpha = 24 : \cos\alpha : 0 < \alpha < \pi/2$, then the value of $14\tan\alpha - 75\cos\alpha - 7\sec\alpha$ is equal to

1. 3 2. 4

3. 1 4. 2

16. If 20% of x = y, then y% of 20 is the same as:

1. 4% of x 2. 6% of y 3. 8% of x 4.10% of x

17. The sum of the first 12 terms of an AP. Whose nth term is given by $a_n = 3n + 4$ is:

1. 262 2. 272 3. 282 4. 292

18. Two goods trains each 500 m long, are running in opposite directions on parallel tracks. Their speeds are 45 km/hr and 30 km/hr respectively. Find the time taken by the slower train to pass the driver of the faster one:

1. 12 sec 2. 24 sec 3. 48 sec 4. 60 sec

19. The next term of the AP √18, √50, √98,.....is:

1. √146 2. √128 3. √162 4. √200

20. If a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The original duration of the flight is:

1. 1 hour 2. 2 hours 3. 3 hours 4. 4 hours

21. If $x^2 + 1/x^2 = 98$ ($x > 0$), then the value of $x^3 + 1/x^3$ is

1. a. 970 2. 1030 3. -970 4 -1030

22. A boy who was born on 29th February 1896, when did he celebrate his first birthday?

1. 29th February 1897 2. 29th February 1900 3. 29th February 1904 4. 29th February 1908

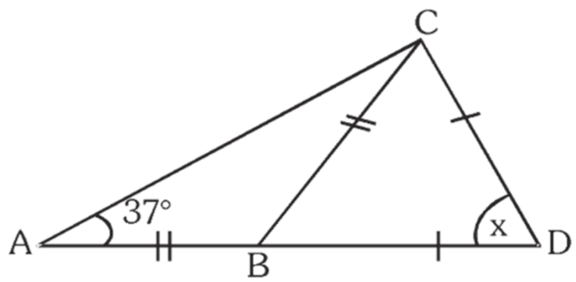
23. A and B start walking from a point in opposite directions. A covers 3 km and B covers 4 km, then A turns right and walks 4 km while B turns left and walks 3 km. How far is each from the starting point?

1. 4 km, 5 km 2. 5 km, 5 km 3. 10 km, 4 km 4.8 km, 4 km

24. How many numbers from 3 to 90 are there each of which is exactly divisible by 4 and also its one of the digit as 4?

1. 21 2.10 3. 20 4. 7

25. In the adjoining figure, AB = BC, BD = CD and ∠BAC = 37° then what will be the value of x?



1. 32° 2.74° 3.106° 4. 34°

26. Find the sum of all the integers from 1 to 100 that are divisible by 2 or 5.

1. 3000 2.3050 3.3600 4.3100

27. Find the value of xy if (1, 2), (4, y), (x, 6) and (3, 5) are vertices of rhombus taken in order.

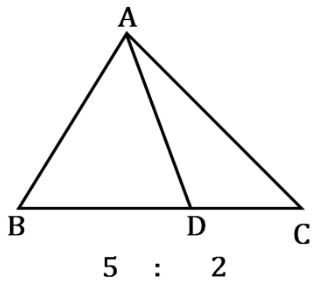
1. a. 6 2. 9 3. 18 4. 24

28. If $1960 = 2^a 5^b 7^c$ then, find the value of $2^{-a} 7^b 5^{-c}$

1. 175/8 2. 7/200 3. 7/2000 4.56/25

29. In ΔABC, D is a point on side BC such that 2BD = 5DC. If ar(ΔABC) = 49 cm^2 then ar(ΔABD) = ...

1. 28 cm^2 2.21 cm^2 3.14 cm^2 4. 35 cm^2



30. A natural number when increased by 6 equals 280 times of its reciprocal. Find the number.

1. 20 2. 14 3. -20 4. 6

31. In a two digit number, the digit at ten's place is three times the digit at unit place. The sum of the number and the digit at unit place is 32. Find the number.

1. a. 26 2. 31 3. 62 4. 23

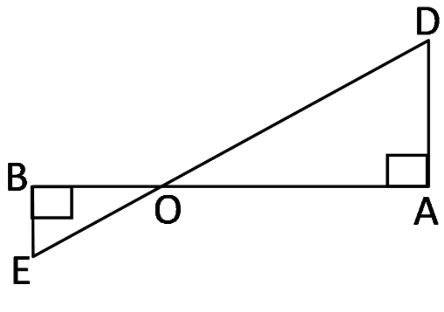
32. Mean of 8, 12, 6, 22, 10 and 4 is 12. If each observation is increased by 25% then the resulting mean is

1. 9 2. 15 3.12 4.16

33. Which of the following cannot be the probability of an event?

1. 5/7 2. 0.57 3.7% 4. 18/17

34. In given figure, EB and DA are perpendicular to AB if OE = 5 cm, OD = 7 cm, and ar (ΔBOE) = 150 cm^2 then ar(ΔAOD) =_________

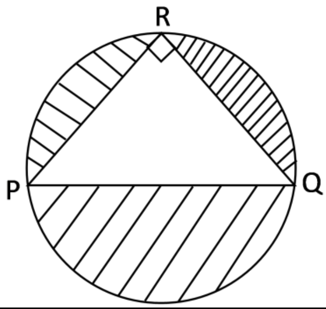


1. 294cm^2 2. 210 cm^2 3.150 cm^2 4. 324 cm^2

35. In the given figure PQ is the diameter of the circle. If PR = 5 cm and QR = 12 cm then find the area of the shaded region.

1. $(25\pi - 30)cm^2$ 2. $(26\pi - 30)cm^2$ 3. $(169\pi - 30)cm^2$ 4. $(169/4)\pi - 30)cm^2$

ANSWER KEY



1 – 3	2 – 2	3 – 2	4 – 4	5 – 3
6 – 2	7 – 2	8 – 2	9 – 3	10 - 4
11 – 1	12 – 2	13 – 4	14 – 2	15 – 4
16 – 1	17 – 3	18 – 2	19 – 3	20 – 1
21 – 1	22 – 3	23 – 2	24 – 4	25 – 1
26 – 2	27 – 3	28 – 2	29 – 4	30 – 2
31 – 2	32 – 2	33 – 4	34 – 1	35 – 4

USEFUL RESOURCES

i. http://www.sosmath.com/algebra/factor/fac01/fac01.html

(On this web page the process of long division of polynomials is explained step by step)

ii. http://www.purplemath.com/modules/factquad2.htm

(Splitting the middle term)

iii. http://www.purplemath.com/modules/quadform3.htm

(Quadratic Formula)

iv. http://plus.maths.org/content/os/issue29/features/quadratic/index

(101 uses of quadratic equation)

v. http://www.themathpage.com/alg/pythagorean-distance.htm

(how to get distance formula using Pythagoras theorem)

vi. http://www.mathopenref.com/consttangent.html

(Construction of tangent at a point on the circle)

vii. http://www.mathopenref.com/consttangents.html

(Constructing tangents through an external point)

USEFUL VIDEOS

i. http://www.youtube.com/watch?v=07IenNnS3Xs

(Splitting the middle term)

ii. http://www.youtube.com/watch?v=FsotIB0Usvw

(long division of polynomials)

iii. http://www.mathopenref.com/similartriangles.html

(Similar triangles)

iv. http://similartriangles3.pbworks.com/w/page/23053498/Applying-Similar-Trianglesto-the-Real-World

(Similar triangles)

v. http://www.youtube.com/watch?v=Ng2EpkKooo4

(Geometrical proof of Pythagoras theorem)

vi. http://www.cut-the-knot.com/pythagoras/

(Pythagoras theorem)

SUGGESTED URLs

www.ncert.nic.in

www.scert.nic.in

www.cbse.nic.in

www.edudel.nic.in

www.diksha.gov.in