तत् त्वं पूषन् अपावृणु
केन्द्रीय विद्यालय संगठन

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AHMEDABAD REGION

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SUBJECT: MATHEMATICS

COMPENDIUM

Of Diverse Questions For

CLASS - IX

आज़ादी का अमृत महोत्सव

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CLASS - IX

CHAPTER 01 :NUMBER SYSTEM

REAL NUMBERS

	COMPETENCY BASED QUESTIONS
Q1	Which of the following is a rational number? a) π b) 0 c) $1+\sqrt{3}$ d) $2\sqrt{3}$
Q2	If the HCF of 65 and 117 is expressible in 65m-117, thenthe value of m is? a) 4 b) 2 c) 1 d) 3
Q3	Every real number is a) Neither rational nor irrational b) Always rational c) Always irrational d) Either rational or irrational
Q4	Find the value of $\sqrt{6} \times \sqrt{27}$: a) $9\sqrt{2}$ b) $9\sqrt{3}$ c) $6\sqrt{3}$ d) $2\sqrt{3}$
Q 5	Find the value of $\sqrt[3]{216} - \sqrt[3]{125}$ a) 1 b) -1 c) 2 d) -2
Q 6	The decimal expansion of $\sqrt{2}$ is: a) 1.4121 b) Non-terminating recurring c) Finite decimal d) Non-terminating non-recurring

Q 7	A rational number lying between $\sqrt{2}$and $\sqrt{3}$ is: a) 1.6 b) 2.9 c) $\sqrt{6}$ d) $\sqrt{11}$
Q 8	Which of the following number is an irrational number? a) $\sqrt{16}-4$ b) $\sqrt{5}+3$ c) $-\sqrt{25}$ d) $-\sqrt{36}+\sqrt{64}$
Q 9	If $x=\frac{\sqrt{7}}{5}$and$\frac{5}{X}=\sqrt{7}$, then the value of p is a) $\frac{25}{7}$ b) $\frac{7}{25}$ c) $\frac{\sqrt{7}}{\sqrt{5}}$ d) $\frac{\sqrt{7}}{5}$
Q10	When $15\sqrt{15}$is divided by $3\sqrt{3}$,find the quotient. a) $5\sqrt{3}$ b) $3\sqrt{5}$ c) $5\sqrt{5}$ d) $3\sqrt{3}$
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q 1	 Srikanth has made a project on real numbers, where he finely explained the applicability of exponential laws and divisibility conditions on real numbers. He also included some assessment questions at the end of his project as listed below. Answer them.

(i)	**For what value of n, 4^n ends in 0?** a) 10 b) When n is even c) When n is odd d) No value of n
(ii)	**If a is a positive rational number and n is a positive integer greater than 1, then for what value of n, an is a rational number?** (a) when n is any even integer (b) when n is any odd integer (c) for all n > 1 (d) only when n=0
(iii)	**If x and y are two odd positive integers, then which of the following is true?** (a) x^2+y^2 is even (b) x^2+y^2 is not divisible by 4 (c) x^2+y^2 is odd (d) both (a) and (b)
(iv)	**The statement 'One of every three consecutive positive integers is divisible by 3' is** (a) always true (b) always false (c) sometimes true (d) None of these
(v)	**If n is any odd integer, then n^2-1 is divisible by** (a) 22 (b) 55 (c) 88 (d) 8
Q 2	 Rohan started learning cooking in the lockdown. One day he tried to make cake by reading a recipe. Recipe include 1.2 bowl of flour, 2 cup of sugar, 1.73 cup milk and 4 eggs.

(i)	Is 1.73 a whole number a) Yes b) No
(ii)	Is 1.2 a rational number a) Yes b) No
(iii)	Is 4 is irrational number a) Yes b) No
(iv)	Is 2 a whole number a) Yes b) No
(v)	Is 1.73 a rational number a) Yes b) No
Q 3	 Laxman plays in the cricket team of his school. Laxman aspires to play in Indian cricket team in future and his bowling numbers are impressive. In the last games 5 games Laxman bowled with an average of 3.142678,2.333……,1.2727……,1.2353535…… , 1.875respectively .
(i)	How can you write 3.142678 as a rational number a) $\frac{3142678}{100000}$ b) $\frac{3142678}{1000000}$ c) $\frac{3142678}{10000}$ d) $\frac{3142678}{100000000}$
(ii)	How can you write 1.2727…… as a rational number a) $\frac{14}{11}$ b) $\frac{14}{13}$ c) $\frac{14}{9}$ d) $\frac{14}{15}$

(iii)	The number 1.23535……give us a (a) Terminating decimal expansion (b) Non-terminating recurring decimal expansion
(iv)	The number 1.875 give us a (a) Terminating decimal expansion (b) Non-terminating recurring decimal expansion
(v)	Where in number line does number 2.33…… lies a) Between 1 and 2 b) Between 2.3 and 3 c) Between 1 and 1.5 d) Between 0.5 and 1
Q 4	 Rahul and his family is going to Shimla by car. In the journey they made a few stops.The speed of car at different interval was 70.66 km/h , 60.53 km/h , 80.133 km/h ,65.311 km/h and 74.331 km/h .
(i)	The speed 70.66 km/h lies where on number line? (a) Between 70.4 and 70.6 (b) Between 70.2 and 70.3 (c) Between 70.6 and 70.7 (d) Between 70.3 and 70.4
(ii)	The speed 60.53 km/h lies where on number line? (a) Between 60.5 and 60.6 (b) Between 60.6 and 60.7 (c) Between 60.7 and 60.8 (d) Between 60.8 and 60.9
(iii)	The speed 80.133 km/h lies where on number line? (a) Between 80.11 and 80.12 (b) Between 80.13 and 80.14

	(c) Between 80.15 and 80.16 (d) Between 80.16 and 80.17
(iv)	The speed 65.311 km/h lies where on number line? (a) Between 65.309 and 65.310 (b) Between 65.34 and 65.35 (c) Between 65.31 and 65.32 (d) Between 65.36 and 65.37
(v)	The speed 74.331 km/h lies where on number line? (a) Between 74.37 and 74.38 (b) Between 74.35 and 74.36 (c) Between 74.34 and 74.35 (d) Between 74.33 and 74.34
Q 5	 Rohan was given a task by his sport teacher to complete 5 rounds of the school ground. The distance of one round is $2\sqrt{5}+5\sqrt{3}$km. He takes 10 minutes to complete one round.
(i)	Is $2\sqrt{5}+5\sqrt{3}$a rational number? a) Yes b) No
(ii)	Total distance Rohan has to cover is ___ a) $4\times(2\sqrt{5}+5\sqrt{3})$ b) $5\times(2\sqrt{5}+5\sqrt{3})$ c) $3\times(2\sqrt{5}+5\sqrt{3})$ d) $5\times(2\sqrt{5}+5\sqrt{2})$
(iii)	Total time taken to complete the rounds (a) 20 minutes (b) 40 minutes (c) 50 minutes (d) 60 minutes

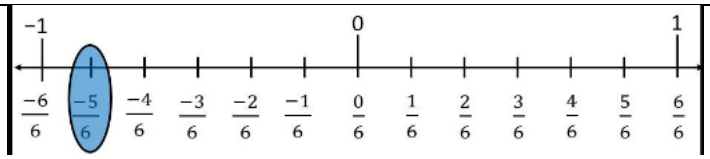
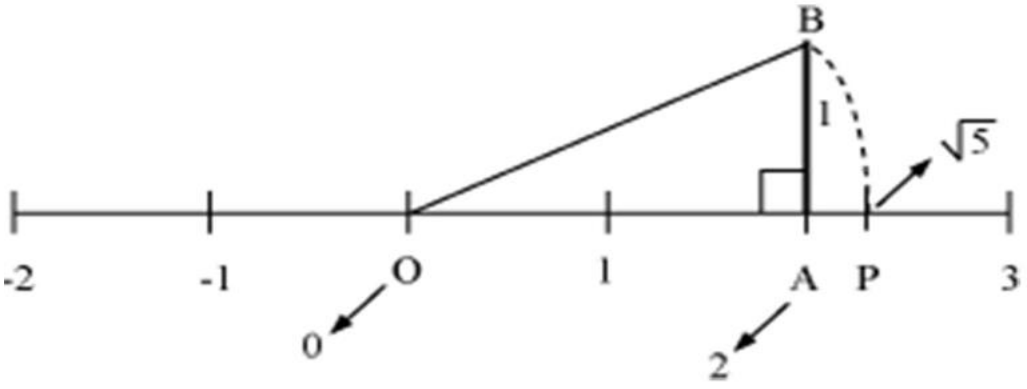
<table>
<tr><td>(iv)</td><td>The value of total distance covered by Rohan is a rational number.
(a) TRUE (b) FALSE</td></tr>
<tr><td>(v)</td><td>Can we map the$2\sqrt{5}+5\sqrt{3}$on a number line?
a) Yes
b) No</td></tr>
<tr><td></td><td>OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)</td></tr>
<tr><td>Q 1</td><td>Between any two rational number there are infinitely many rational numbers (True/False)</td></tr>
<tr><td>Q 2</td><td>Zero is an irrational number. (True/False)</td></tr>
<tr><td>Q 3</td><td>The decimal expansion of 36/100 is _____.</td></tr>
<tr><td>Q 4</td><td>Match the Following
<table>
<tr><th>A</th><th>B</th></tr>
<tr><td>a.10/3</td><td>1.Terminating</td></tr>
<tr><td>b.3.142678</td><td>2.Non-Terminating Recurring</td></tr>
<tr><td>c.5.32156901……</td><td>3.Non-Terminating Non-Recurring</td></tr>
</table></td></tr>
<tr><td>Q 5</td><td>If $x = 6-\sqrt{35}$then the value of$\frac{1}{x}$ = _____?</td></tr>
<tr><td>Q 6</td><td>$\sqrt{2}$is a rational number (True/False)?</td></tr>
<tr><td>Q 7</td><td>π is an _____(Rational/Irrational) number.</td></tr>
<tr><td>Q 8</td><td>$(64)^{-1/2}$is equal to _____.</td></tr>
<tr><td>Q 9</td><td>Decimal Representation of rational number cannot be non-terminating non-recurring. (True/False)</td></tr>
<tr><td>Q 10</td><td>The $\frac{p}{q}$form of 0.777777…… where p and q are integers and q$\neq 0$, is $\frac{77}{90}$(True/False)</td></tr>
<tr><td></td><td>SHORT ANSWER TYPE QUESTIONS</td></tr>
<tr><td>Q 1</td><td>Let ‘a’ be a non-zero rational number and ‘b’ be an irrational number. Is ‘ab’ necessarily an irrational? Justify your answer with example.</td></tr>
<tr><td>Q 2</td><td>Simplify: $(\sqrt{5}+\sqrt{2})^2$</td></tr>
<tr><td>Q 3</td><td>Express 1.8181… in the form $\frac{p}{q}$ where p and q are integers and q ≠ 0.</td></tr>
<tr><td>Q 4</td><td>If $x = \frac{1}{\sqrt{5}-2}$, find the value of $x^3 - 3^2 - 5x + 3$.</td></tr>
</table>

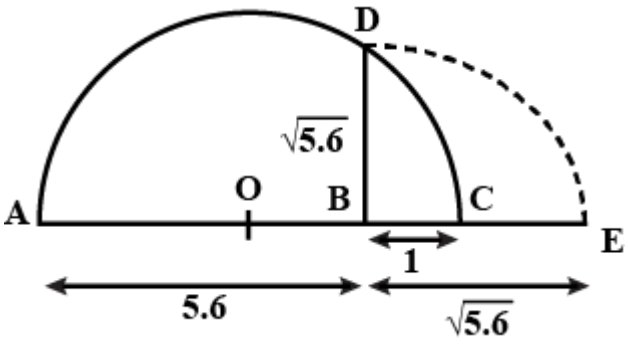
Q 5	Find 'x', if $2^{x-7} \times 5^{x-4} = 1250$.
Q 6	Represent -5/6 on the number line.
Q 7	Multiply $3\sqrt{2}$by $5\sqrt{3}$.
Q 8	Represent $\sqrt{5}$on number line
Q 9	Express $0.\overline{6}$ in the form p/q, where p and q are integers and q ≠ 0.
Q 10	Express $0.\overline{001}$in the form p/q, where p and q are integers and q ≠ 0.
	LONG ANSWER TYPE QUESTIONS
Q 1	Represent $\sqrt{5.6}$geometrically on the number line
Q 2	Find: (i)$(64)^{1/2}$ (ii)$(32)^{1/5}$ (iii) $(125)^{1/3}$
Q 3	Are there two irrational numbers whose sum and product both are rationals? Justify.
Q 4	Simplify : $(3\sqrt{5} - 5\sqrt{2})(4\sqrt{5} + 3\sqrt{2})$
Q 5	If $a = 5 + 2\sqrt{6}$ and b = 1/a, then what will be the value of $a^2 + b^2$?
Q 6	If $\sqrt{3} = 1.732$, $\sqrt{2} = 1.414$, then the value of $4 / (3\sqrt{3} - 2\sqrt{2}) + 3 / (3\sqrt{3} + 2\sqrt{2})$ is?
Q 7	Two friends Aayush and Shubham were planting trees along the boundary of their society. While doing this, Aayush said that they could only plant the number of trees which would be a natural number or a positive integer. Shubham agreed with his thought. (i) Are both of them correct? (ii) Define natural number, integers, rational and irrational number. (iii) What values are depicted from their activity?
Q 8	Two friends Pankaj and Siddharth went to an antique store to purchase 3^4 old coins of single type. They finally short-listed coins of two types A and B and decided to choose the one having lowest price. On being asked the price, the shopkeeper told them coin 'A' is priced at Rs.2^7 each and coin B is priced at Rs.3^5 each. Pankaj helped Siddharth to select the type of coin on the basis of price. They further decided to distribute coins among their 3^2 friends. (i) Which type do you think they finally bought based on lowest price? What is the total price they paid to the shopkeeper? (ii) Find the number of coins each of which their friends received.

	(iii) What values did Pankaj depict when he helped Siddharth?
Q 9	State whether the following statement is true: There is a number x such that x^2 is irrational but x^4 is rational. Justify your answer by an example.
Q 10	Find the value of a in the following : $\frac{6}{3\sqrt{2}-2\sqrt{3}} = 3\sqrt{2} - a\sqrt{3}$
	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	(b) 0
Ans 2	(b) 2
Ans 3	(d) either rational or irrational
Ans 4	(a) $9\sqrt{2}$
Ans 5	(a) 1
Ans6	(d) Non-terminating non-recurring
Ans7	(a) 1.6
Ans8	(b) $\sqrt{5}+3$
Ans9	(a) $\frac{25}{7}$
Ans10	(c)$5\sqrt{5}$

	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
1	(i) (d) no value of n (ii) (c) for all n > 1 (iii) (d) both (a) and (b) (iv) (a) always true (v) (d) 8
2	(i) NO (ii) YES (iii) NO (iv) YES (v) NO
3.	(i) b (ii) a (iii) b (iv) a (v) b
4.	(i) c (ii) a (iii) b (iv) c (v) d
5.	(i) b (ii) b (iii) c (iv) b (v) a

	SOLUTIONS TO OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
1	True
2	False
3	0.36
4	a -2, b -1, c -3
5	$6+\sqrt{35}$
6	False
7	Irrational
8	$\frac{1}{8}$
9	True
10	False
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
1.	Yes, 'ab' is necessarily an irrational. For example, let a = 2 (a rational number) and b = $\sqrt{2}$ (an irrational number) If possible let ab = $2\sqrt{2}$ is a rational number. Now, $\frac{ab}{a}=\frac{2\sqrt{2}}{2}=\sqrt{2}$ is a rational number. [$\because$ The quotient of two non-zero rational number is a rational] But this contradicts the fact that $\sqrt{2}$ is an irrational number. Thus, our supposition is wrong. Hence, ab is an irrational number.
2	Here, $(\sqrt{5}+\sqrt{2})^2=(\sqrt{5})^2+2\sqrt{5}\sqrt{2}+(\sqrt{2})^2$ $=5+2\sqrt{10}+2=7+\sqrt{10}$
3	Let $x=1.8181\ldots$ ...(i) $100x=181.8181\ldots$ ...(ii) [multiplying eqn. (i) by 100] $99x=180$ [subtracting (i) from (ii)] $x=\frac{180}{99}$ Hence, $1.8181\ldots=\frac{180}{99}=\frac{20}{11}$
4	$x=\frac{1}{\sqrt{5}-2}$

	$=\frac{1}{\sqrt{5}-2}\times\frac{\sqrt{5}+2}{\sqrt{5}+2}$ $=\frac{\sqrt{5}+2}{5-4}=\sqrt{5}+2$ $\therefore x-2=\sqrt{5}$ Squaring both sides, we have $x^2-4x+4=5$ $x^2-4x-1=0$ ...(i) Now, $x^3-3^2-5x+3=(x^2-4x-1)(x+1)+4$ $=0(x+1)+4=4$ [using (i)]
5	We have $2^{x-7}\times5^{x-4}=1250$ $\Rightarrow 2^{x-7}\times5^{x-4}=2\times5\times5\times5\times5$ $\Rightarrow 2^{x-7}\times5^{x-4}=2^1\times5^4$ Equating the powers of 2 and 5 from both sides, we have $\Rightarrow x-7=1$ and $x-4=4$ $\Rightarrow x=8$ and $x=8$ Hence, $x=8$ is the required value.
6	
7	$3\sqrt{2}\times5\sqrt{3}=3\times5\times\sqrt{2}\times\sqrt{3}=15\sqrt{6}$
8	
9	Assume that $x = 0.666\ldots$ Then, $10x = 6.666\ldots$ $10x = 6 + x$ $9x = 6$ $x = 2/3$

10	Assume that x = 0.001001… Then, 1000x = 1.001001… 1000x = 1 + x 999x = 1 x = 1/999
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
1	Presentation of $\sqrt{5.6}$ on number line: Mark the distance **5.6 units** from a fixed points **A** on a given line to obtain a point **B** such that **AB=5.6 units**. From **B**, mark a distance of **1 unit** and mark the new points as **C**. Find the mid-point of **AC** and mark the points as **O**. Draw a semicircle with centre **O** and radius **OC**. Draw a line perpendicular to **AC** passing through **B** and intersecting the semicircle at **D**. Then **BD**=$\sqrt{5.6}$. Now, draw an arc with centre **B** and radius **BD**, which intersects the number line in **E**. Thus, **E** represent $\sqrt{5.6}$ 
2	(i)$64^{1/2} = (8\times8)^{1/2}$ $= (8^2)^{½}$ $= 8^1$ [$\because 2\times1/2 = 2/2 = 1$] $= 8$ (ii)$32^{1/5} = (2^5)^{1/5}$ $= (2^5)^{⅕}$

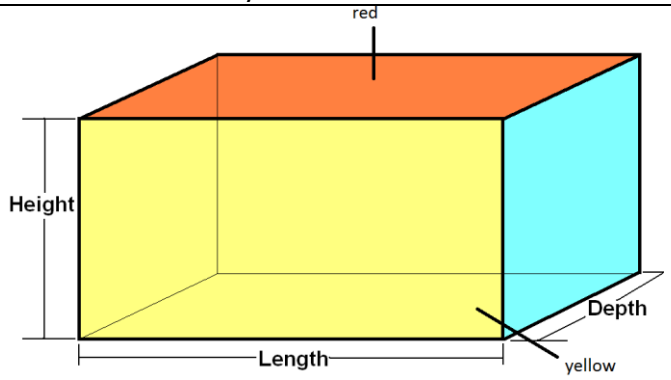
	$= 2^1$ [$\because 5 \times 1/5 = 1$] $= 2$ (iii) $(125)^{1/3} = (5 \times 5 \times 5)^{1/3}$ $= (5^3)^{⅓}$ $= 5^1$ ($3 \times 1/3 = 3/3 = 1$) $= 5$
3	Yes. (3 + √2) and(3 - √2) are two irrational numbers. (3 + √2) (3 -√2) = 6, a rational number. (3+ √2)(3 - √2) = 7, a rational number. So, we have two irrational numbers whose sum and product both are rationals.
4	$(3\sqrt{5} - 5\sqrt{2})(4\sqrt{5} + 3\sqrt{2}) = 3\sqrt{5}(4\sqrt{5}) + 3\sqrt{5}(3\sqrt{2}) - 5\sqrt{2}(4\sqrt{5}) - 5\sqrt{2}(3\sqrt{2})$ $= 12(5) + 9\sqrt{5}(\sqrt{2}) - 20\sqrt{5}(\sqrt{2}) - 15(2)$ $= 60 + 9\sqrt{10} - 20\sqrt{10} - 30$ $= 60 - 30 + 9\sqrt{10} - 20\sqrt{10}$ $= 30 - 11\sqrt{10}$ Therefore, $(3\sqrt{5} - 5\sqrt{2})(4\sqrt{5} + 3\sqrt{2}) = 30 - 11\sqrt{10}$
5	Given, a = 5 + 2√6 Also, b = 1/a We have to find the value of a^2+b^2. Now, b = 1/(5+2√6) b = 1/(5+2√6) × (5-2√6)/(5-2√6) We know (a - b)(a + b) = $a^2 - b^2$ $(5+2\sqrt{6})(5-2\sqrt{6}) = (5)^2 - (2\sqrt{6})^2$ = 25 - 4(6) = 25 - 24 = 1

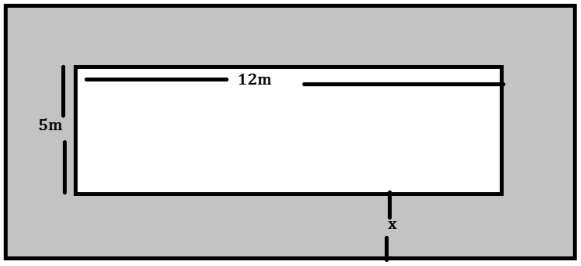
	So, $1/(5+2\sqrt{6}) \times (5-2\sqrt{6})/(5-2\sqrt{6}) = (5-2\sqrt{6})/(1)$ $b = (5-2\sqrt{6})$ $a^2+b^2 = (5+2\sqrt{6})^2 + (5-2\sqrt{6})^2$ By using algebraic identity, $(a + b)^2 = a^2 + 2ab + b^2$ $(5+2\sqrt{6})^2 = (5)^2 + 2(5)(2\sqrt{6}) + (2\sqrt{6})^2$ $= 25 + 20\sqrt{6} + 4(6)$ $= 25 + 24 + 20\sqrt{6}$ $= 49 + 20\sqrt{6}$ By using algebraic identity, $(a - b)^2 = a^2 + 2ab + b^2$ $(5-2\sqrt{6})^2 = (5)^2 - 2(5)(2\sqrt{6}) + (2\sqrt{6})^2$ $= 25 - 20\sqrt{6} + 4(6)$ $= 25 + 24 - 20\sqrt{6}$ $= 49 - 20\sqrt{6}$ Now, $a^2+b^2 = 49 + 20\sqrt{6} + 49 - 20\sqrt{6}$ $= 49 + 49$ $= 98$ Therefore, $a^2+b^2 = 98$
6	$4/(3\sqrt{3} -2\sqrt{2}) + 3/(3\sqrt{3} + 2\sqrt{2})$ $=\{4(3\sqrt{3} + 2\sqrt{2}) +3(3\sqrt{3}-2\sqrt{2})\}/(3\sqrt{3}-2\sqrt{2})(3\sqrt{3}+2\sqrt{2})$ use $(a - b)(a + b) = a^2 -b^2$ in denominator now, $=\{12\sqrt{3}+8\sqrt{2}+9\sqrt{3}-6\sqrt{2}\}/(27 -8)$ $=(21\sqrt{3} +2\sqrt{2})/(19)$ now , put $\sqrt{3} = 1.732$ and $\sqrt{2} = 1.414$ $=(21\times1.732 + 2\times1.414)/19$ $=(36.372+ 2.828)/19$ $=39.2/19$ $=2.06$
7	(i) Yes, both are correct as natural number is the set of whole positive integers.

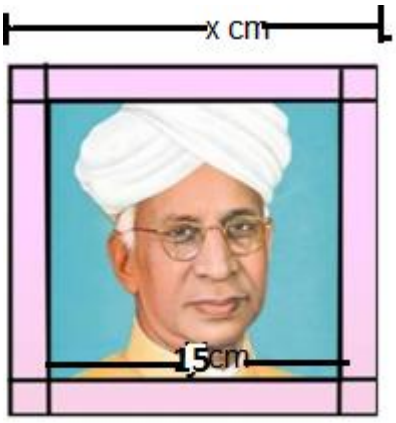
	(ii) **Natural number:** A natural number is the number that is used for counting, i.e. starting from 1 onwards. They are the whole positive integers. **Integers:** It is the whole number that can be positive, negative or zero. Z = {.....–4, –3, –2, –1, 0 , 1, 2, 3, ...} **Rational number:** Any number that can be written in the form is called rational number, where p and q are integers and $q \neq 0$. **Irrational number:** A number that cannot be written in the form , where p and q are integers and $q \neq 0$. (iii) Values depicted are: • Environment friendly • Cooperation
8	(i) Total number of coins = 3^4 Price of coin A =Rs.2^7 each Total price of coin A = Rs.$3^4 \times 2^7$ Price of coin B = Rs.3^5 each Total price of coin B = Rs.$3^5 \times 3^4$ Since $2^7 < 3^5$, Price of coin A < Price of coin B Hence, finally they bought the coin A and total price paid to shopkeeper is = Rs.$3^4 \times 2^7$ = Rs.81 × 128 = Rs.10,368 (ii) Number of coins each friend received = = $3^{4-2} = 3^2 = 9$ (iii) Values depicted are: • Proper use of mathematical knowledge. • Honesty, friendship.
9	True. Let us take $x = \sqrt[4]{2}$ Now, $x^2 = (\sqrt[4]{2})^2 = \sqrt{2}$, an irrational number. $x^4 = (\sqrt[4]{2})^4 = 2$, a rational number. So, we have a number x such that x^2 is irrational but x^4 is rational.
10	$\frac{6}{3\sqrt{2}-2\sqrt{3}} = \frac{6}{3\sqrt{2}-2\sqrt{3}} \times \frac{3\sqrt{2}+2\sqrt{3}}{3\sqrt{2}+2\sqrt{3}}$ $= \frac{6\,X\,(3\sqrt{2}+2\sqrt{3})}{18-12}$ $= \frac{6\,X\,(3\sqrt{2}+2\sqrt{3})}{6}$ $= (3\sqrt{2} + 2\sqrt{3})$

CHAPTER 02 : POLYNOMIALS

	COMPETENCY BASED QUESTIONS
Q1	Factors of $\sqrt{2}x^2 - x - 10\sqrt{2}$ are (a) $(\sqrt{2}x - 5)\left(x + 2\sqrt{2}\right)$ (b) $(\sqrt{2}x + 5)\left(x + 2\sqrt{2}\right)$ (c) $(\sqrt{2}x + 5)\left(x - 2\sqrt{2}\right)$ (d) $(\sqrt{2}x - 5)\left(x - 2\sqrt{2}\right)$
Q2	The value of $(5)^3 + (7)^3 + (-12)^3$ is (a)1260 (b) -1260 (c) 420 (d)0
Q3	When $p(x) = 5x^4 - 4x^3 + 16x - 83$ is divided by $(x - 2)$, the remainder is (a) 0 (b) 3 (c) -6 (d) -3
Q4	If $a + b = 7, ab = 6$ then the value of $a^3 + b^3$ will be (a)117 (b) 217 (c) 469 (d) 61
Q 5	Factors of $343a^3 - 125b^3$ are (a) $(7a + 5b)(49a^2 + 35ab + 25b^2)$ (b) $(7a - 5b)(49a^2 - 35ab - 25b^2)$ (c) $(7a - 5b)(7a^2 + 35ab + 5b^2)$ (d) $(7a - 5b)(49a^2 + 35ab + 25b^2)$
Q 6	Out of the following, the quadratic polynomial is (a) $5x^2 - x^3 + 14$ (b) $3x - 2$ (c) $3x^2 - 2x + 1$ (d) $x^2 + \frac{1}{x^2} + 2$
Q 7	The expansion of $(4x - 3y - 5z)^2$ (a) $16x^2 + 9y^2 + 25z^2 - 24xy + 30yz - 40xz$ (b) $16x^2 + 9y^2 + 25z^2$ (c) $16x^2 - 9y^2 - 25z^2 - 24xy + 30yz - 40xz$ (d) all correct
Q 8	If $x + \frac{1}{x} = 12$ then find $x^2 + \frac{1}{x^2}$ (a)144 (b)24 (c) 36 (d) 142
Q 9	Identify the expression which is not a polynomial (a) $\sqrt{5}x + 9$ (b) $\sqrt{2}x^2 + \sqrt{5}x + \sqrt{3}$ (c) $2\sqrt{x} + 7x^2$ (d) $\sqrt{3}x^3 + 10x^2$
Q10	Product of $(2a + 7)(2a - 7)$ is (a)$2a^2 - 7$ (b) $2a^2 - 49$ (c) $2a^2 + 49$ (d) $4a^2 - 49$

	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
(i)	 For the box to satisfy certain requirements, its depth must be three meter greater than the width, and its length must be three meter less than twice width. 1. If width is taken as x, which of the following polynomial represent volume of box ? (a) $2x^2 + 3x - 9$ (b) $2x^2 - 3x - 9$ (c) $2x^3 + 3x^2 - 9x$ (d) $2x^3 + 3x^2 + 9$ 2. Which of the following polynomial represent What the area of yellow surface of the box? $(a)2x^2 + 3x - 9$ $(b)2x^2 - 3x + 9$ $(c)2x^2 + 3x$ $(d)x^3 + 3x$ 3. What kind of polynomial does the area of red surface represent? (a) Linear (b) Quadratic (c) Cubic (d)monomial 4. What is the degree of polynomial representing volume of the box? (a) zero (b) one (c) two (d)three 5. If the width is 40cm ,the length and the depth will be a) 70cm, 80 cm (b) 77cm, 43 cm (c) 43cm , 77cm (d) 80cm, 43cm

(ii)	**The frame will have a solid base and will be cut out of a piece of steel The diagram of frame is shown below.**  **In order to input the right values in the AutoCAD software, the engineer needs to calculate some basic things. On the basis of the above information, answer any four of the following questions:** 1.What are the dimensions of the outer frame? (a) $(12+2x)(5+x)$ (b)$(12+x)(5+x)$ (c)$(12+2x)(5-2x)$ (d)$(12+2x)(5+2x)$ 2. A metal sheet of aluminum is used to make the frame. What should be the maximum area of sheet before cutting? (a) $4x^2+34x-60$ (b) $4x^2-34x-60$ (c) $4x^2+34x+60$ (d) $4x^2-34x+60$ 3. What is the exact area of frame? (a) $4x^2-34x+60$ (b) $4x^2-34x$ (c) $4x^2+34x-50$ (d) $4x^2-34x+43$ 4. Find the area of frame if the value of $x=50$ cm. (a) 11760 m^2 (b) 68.75 m^2 (c) 78 m^2 (d) 3410 m^2 5. What is the degree of polynomial representing area of frame? (a) zero (b) one (c) two (d)three
(iii)	Since 1962, India has been celebrating Teachers' Day on 5th September the birth anniversary of Dr. Radhakrishnan to honor the contribution made by teachers to society. Every student celebrates this day to acknowledge and support the contribution of his or her teacher. This day is also celebrated to honor Dr.Sarvepalli Radhakrishnan, the great teacher, academic philosopher and India's Second President Is he was born on the same day in 1888. Dr. Radhakrishnan was a strong

	supporter of education. All 60 students of class IX celebrated the day with full zeal and enthusiasm. It was a day of delight for the teachers to see the talents of their students who had taken part and had put in their heart and soul to put up a wonderful programme for their teachers. They gifted a photo of Dr. Sarvepalli Radhakrishnan, with the beautiful wooden frame given in the following picture. The frame is in the shape of square with sides of frame is x cm and sides of photo is 15 cm. All the four corners have four small squares. See the picture and give the following answers.  1.What is the area of whole photo frame in terms of x (a) x (b) $4x$ (c) $2x$ (d) x^2 2. Find the area of only frame. (a) $x^2 - (15)^2$ (b) $x^2 + 15^2$ (c) $(x - 15)^2$ (d) $(x - 15)$ 3. Find the area of any one of the corner square. (a) $x^2 - (15)^2$ (b) $\frac{x^2+15^2}{2}$ (c) $\frac{(x-15)^2}{4}$ (d) $\frac{(x-15)^2}{2}$ 4. If $x = 20\ cm$, what will be the area of whole photo frame? (a) 150cm^2 (b) 225cm^2 (c) 400cm^2 (d) 25cm^2 5. What kind of polynomial does the area of frame represent? (a) Linear (b) Quadratic (c) Cubic (d)monomial
(iv)	Raga Ram and Ravi were writing the test on polynomials. Following replies were given by them for the questions given below: Could you help them to decide the correct answer. 1.What is the degree of polynomial $x^2 + 6x - 2$ (a) Raga's reply: Degree of given polynomial is 2 as highest exponent of x is 2 (b) Ram's reply: Degree of given polynomial is 1 as coefficient of x is 1 (c)Ravi's reply: Degree of given polynomial is 3 as there are three terms in a polynomial.

	2. Identify the type of polynomial (a) Raga- Linear polynomial (b) Ram - Quadratic polynomial (c) Ravi - Cubic polynomial 3.Name the polynomial has degree zero (a) Raga- Zero polynomial (b) Ram - Linear polynomial (c) Ravi - Constant polynomial 4.Identify the type of polynomial which is a binomial and having degree7 $x^7 + 7x - 2$, $x^7 - 2$, $x^7 + x^8$, $7x + 2$ (a) Raga: $x^7 + x^8$ (b) Ram: $7x + 2$ (c) Ravi: $x^7 + 2x - 2$ (d) None 5.The Degree of polynomial $p(x) = 0$ is (a) Raga- 0 (b) Ram - 1 (c) Ravi – does not exist
(v)	Rakesh, Raj and Ashka are completing their math homework given by the teacher. Following questions are given to the. Do help them to verify their answers 1) Give example of quadratic polynomial. Raj wrote $p(x) = (x - 4)(x - 2)$. Rakesh wrote $p(x) = (x^2 - 4)$ and Ashka has written $8x^2$ (a) only Rakesh is correct (b) Both Raj and Rakesh are correct (c) Only Ashka is correct (d) All are correct 2) Write an example of a polynomial having one variable of degree 3 having 3 terms Rakesh's answer: $2x^3 - x + 7$ Raj's answer: $2x^3 - y^3 + 6$ Ashka's answer: $\sqrt{3}x^3 + 5$ (a) only Rakesh is correct (b) Both Raj and Rakesh are correct (c) Only Ashka is correct (d) All are correct

	3) Write an example of a polynomial having one variable of degree 31 Rakesh's answer: a^{31} Raj's answer: $x^{31} + 6$ Ashka's answer: $31x^3 - 31\,x$ (a) only Rakesh is correct (b) Both Raj and Rakesh are correct (c) Only Ashka is correct (d) All are correct 4) Factorise: $x^3 - 64$ Rakesh's answer: $(x-2)(\,x^2 + 4x + 16)$ Raj's answer: $(x-4)^3$ Ashka's answer: $(x-4)(\,x^2 + 4x + 16)$ (a) only Rakesh is correct (b) Both Raj and Rakesh are correct (c) Only Ashka is correct (d) All are correct 5) Expand: $(2x+3)^3$ Rakesh's answer: $8x^3 + 27$ Raj's answer: $4x^3 + `18x + 9$ Ashka's answer: $8x^3 + 36x^2 + 54x + 27$ (a) only Rakesh is correct (b) Both Raj and Rakesh are correct (c) Only Ashka is correct (d) All are correct	
(iv)	**OBJECTIVE TYPE**	
1	Degree of polynomial $p(x) = \sqrt{5}$ is _____	
2	What is the degree of polynomial $(x) = 0$?	
3	Factorisation of $x^3 - 216y^3 + 18x^2y + 108xy^2$ is $x - 6y^3$. True/False	
4	Match the columns:	

	General form of Polynomial	Degree of Polynomial	
	Cubic Polynomial	1	
	Quadratic Polynomial	3	
	Linear Polynomial	no	
	Constant Polynomial	0	
	Zero Polynomial	4	
		2	

5	Correct the statement if it is false: Degree of zero polynomial is zero.	3
6	Polynomial $p(x) = 5x - 6$ has infinite zeroes. True/False	2
7	Justify the statement if false: A binomial can have at least two terms.	1
8	Classify the following polynomials as polynomials in one variable, two variables etc. (i) $x^2 + x + 1$ (ii) $y^3 - 5y$ (iii) $xy + yz + zx$ (iv) $x^2 - 2xy + y^2 + 1$	0
9	Write the coefficient of x^2 in the given expression: $(x-1)(3x-4)$	NO
10	0 and 2 are the zeroes of $t^2 - 2t$. true/False	
	SHORT ANSWER TYPE QUESTIONS	
Q 1	If $a + b = 15$, $ab = 14$ then find $a^2 + b^2$	
Q 2	Expand $(a - 2b + 3c)^2$	
Q 3	Expand $(3a - 4c)^3$	
Q 4	Find the product of $(x^2 + 3y + 7)(x - 2)$	
Q 5	Factorise using identities: $x^2 + \frac{1}{x^2})\,(x^2 - \frac{1}{x^2})$	
Q 6	Find the value of $p(-2\sqrt{3})$ if $p(y) = \sqrt{3}y^2 - 3y + 5\sqrt{3}$	
Q 7	By Remainder Theorem find the remainder, $p(x) = 4x^3 - 12x^2 + 14x - 3$, $g(x) = 2x - 1$	
Q 8	For what value of m is $x^3 - 2mx^2 + 16$ divisible by $x + 2$?	
Q 9	If $a + b + c = 9$ and $ab + bc + ca = 26$, find $a^2 + b^2 + c^2$.	
Q 10	Give possible expressions for the length and breadth of the rectangle whose area is given by $4a^2 + 4a - 3$.	
	LONG ANSWER TYPE QUESTIONS	
Q 1	Factorise: $x^3 - 216y^3 + 18x^2y + 108xy^2$	
Q 2	Without actually calculating the cube, find the value of $(5)^3 + (7)^3 + (-12)^3$	
Q 3	Without actual division, Factorise $p(x) = x^3 - x^2 - 17x - 15$	

Q 4	Find k if $x^3 + 6x^2 + 11x + 6 = k\,(x + 1)$
Q 5	Without finding the cubes, factorise $(x - y)^3 + (y - z)^3 + (z - x)^3$
Q 6	If $p(x) = x^2 - 4x + 3$, evaluate : $p(2) - p(-1) + p\left(\frac{-1}{2}\right)$
Q 7	If $x + y = 12$ and $xy = 27$, find the value of $x^3 + y^3$
Q 8	If $(x - 2)$ is a factor of polynomial $p(x) = x^4 - 2x^3 + 3x^2 - ax + 3a - 7$ then find the value of a.
Q 9	Simplify: $(2x - 5y)^3 - (2x + 5y)^3$
Q 10	Multiply: $x^2 + 4y^2 + z^2 + 2xy + xz - 2yz$ by $(-z + x - 2y)$

	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	(a) $(\sqrt{2}x - 5)\left(x + 2\sqrt{2}\right)$
Ans2	(b) -1260
Ans3	(d) -3
Ans4	(b) 217
Ans5	(d) $(7a - 5b)(\ 49a^2 + 35ab + 25b^2)$
Ans6	(c) $3x^2 - 2x + 1$
Ans7	(a) $16x^2 + \ 9y^2 + 25z^2 - 24xy + 30yz - 40xz$
Ans8	(d) 142
Ans9	(c) $2\sqrt{x} + \ 7x^2$
Ans10	(d) $4a^2 - \ 49$
	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
1	1. (c) $2x^3 + \ 3x^2 - 9x$ 2. $(a)2x^2 + \ 3x - 9$ 3. (b) Quadratic 4. (d) Cubic 5. (b) 77cm, 43 cm
2	1. (d)$(12 + 2x)(5 + 2x)$ 2. (c) $4x^2 \ + 34x + 60$ 3.(c) $4x^2 - \ 34x$ 4. (c) 78 m^2 5. (c) two
3	1.(d) x^2 2.(a) $x^2 - \ (15)^2$ 3. $\frac{(x-\ 15)^2}{4}$ 4.(c) 400cm^2 5.(b) Quadratic
4	1. (a) Raga's reply: Degree of given polynomial is 2 as highest exponent of x is 2 2. (b) Ram - Quadratic polynomial 3. (c) Ravi - Constant polynomial 4. (d) None 5. (c) Ravi – does not exist
5	1. (d) All are correct 2. (a) only Rakesh is correct 3. (b) Both Raj and Rakesh are correct 4. (c) Only Ashka is correct 5. (c) Only Ashka is correct
	Objective Type
1	Degree of polynomial $p(x) = \sqrt{5}$ is Zero
2	Does not exist
3	False
4	Match the columns:

		General form of Polynomial	answers	
		Cubic Polynomial	3	
		Quadratic Polynomial	2	
		Linear Polynomial	1	
		Constant Polynomial	0	
		Zero Polynomial	NO	

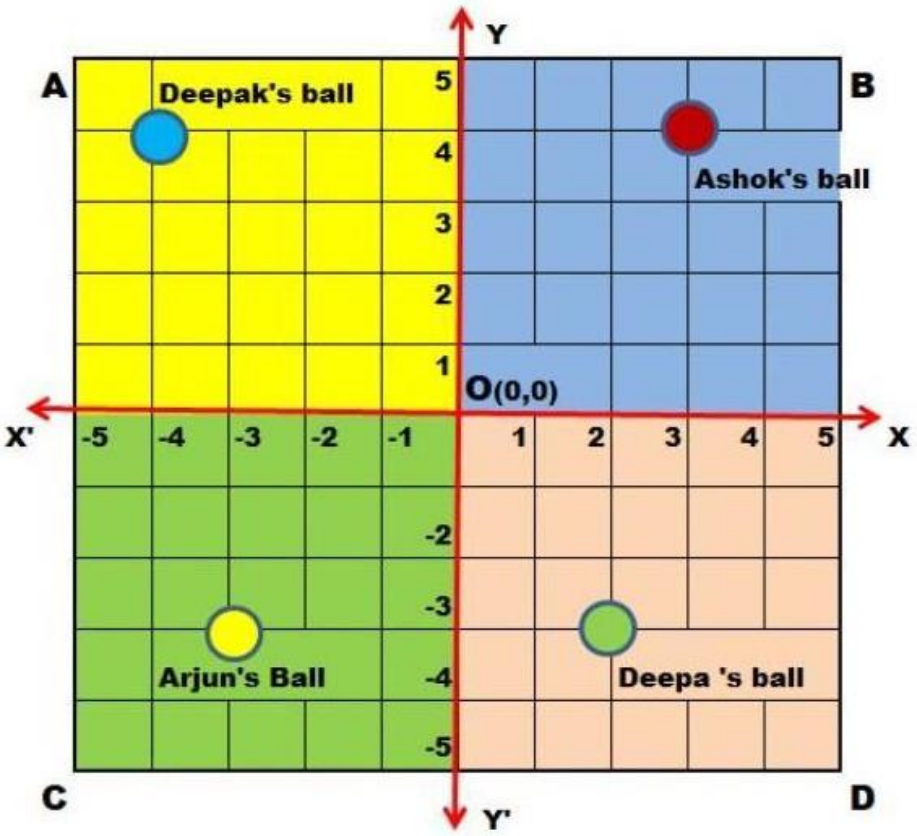
5	false: Degree of zero polynomial does not exist.
6	False. it has only one zero.
7	false: A binomial can have ~~at least~~ exactly two terms.
8	Classify the following polynomials as polynomials in one variable, two variables etc. (i) & (ii)one variable (iii) & (iv)two variables
9	3
10	yes
	SHORT ANSWER TYPE QUESTIONS
1	$a^2 + b^2 = 197$
2	$(a - 2b + 3c)^2 = a^2 + 4b^2 + 9c^2 - 4ab - 12bc + 6ac$
3	$(3a - 4c)^3 = 27a^3 - 108a^2c + 144ac^2 - 64c^3$
4	the product of $(x^2 + 3y + 7)(x - 2) = x^3 - 2x^2 + 3xy - 6y + 7x - 14$
5	$(x^2 + \frac{1}{x^2})(x^2 - \frac{1}{x^2}) = x^4 - \frac{1}{x^4}$
6	$23\sqrt{3}$
7	½
8	For what value of m is $x^3 - 2mx^2 + 16$ divisible by $x + 2$? $m = 1$
9	If $a + b + c = 9$ and $ab + bc + ca = 26$, find $a^2 + b^2 + c^2$. $a^2 + b^2 + c^2 = 624$
10	Give possible expressions for the length and breadth of the rectangle whose area is given by $4a^2 + 4a - 3$. $4a^2 + 4a - 3 = (2a - 1)(2a + 3)$ so length n breath can be either of $(2a - 1)$ or $(2a + 3)$

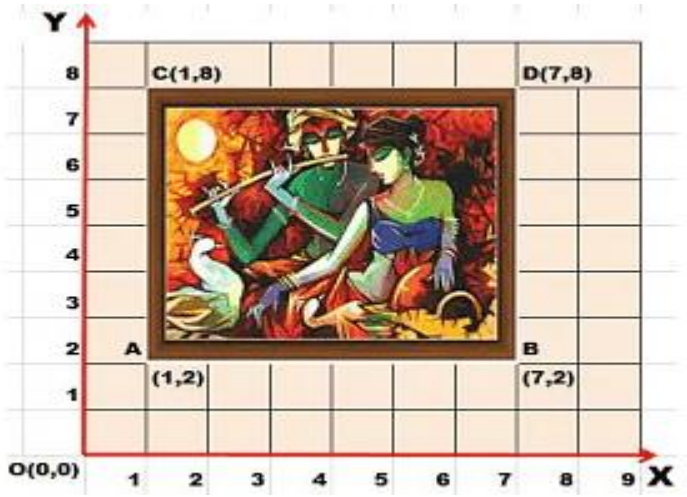
	LONG ANSWER TYPE QUESTIONS
1	Factorise: $x^3 - 216y^3 + 18x^2y + 108xy^2$ $= (x - 2y)^3$
2	Without actually calculating the cube, find the value of $(5)^3 + (7)^3 + (-12)^3$ = -1260
3	$(x + 1)(x + 3)(x - 5)$
4	$k = x^2 + 5x + 6$
5	Without finding the cubes, factorise $(x - y)^3 + (y - z)^3 + (z - x)^3$ As $x - y + y - z + z - x = 0$ hence $(x - y)^3 + (y - z)^3 + (z - x)^3 = 3(x - y)(y - z)(z - x)$
6	If $p(x) = x^2 - 4x + 3$, evaluate : $p(2) - p(-1) + p\left(\frac{-1}{2}\right)$ $p(2) = -1$, $p(-1) = 8$, $p\left(\frac{-1}{2}\right) = \frac{21}{4}$ $p(2) - p(-1) + p\left(\frac{-1}{2}\right) = \frac{49}{4}$
7	If $x + y = 12$ and $xy = 27$, find the value of $x^3 + y^3 = 432$
8	If $(x - 2)$ is a factor of polynomial $p(x) = x^4 - 2x^3 + 3x^2 - ax + 3a - 7$ then find the value of a. $a = -5$
9	$(2x - 5y)^3 - (2x + 5y)^3 = -120x^3y - 250y^3$
10	$(-z + x - 2y)(x^2 + 4y^2 + z^2 + 2xy + xz - 2yz)$ $= (x - 2y - z)(x^2 + 4y^2 + z^2 + 2xy + xz - 2yz)$ $= x^3 - 8y^3 - z^3 + 6xyz$

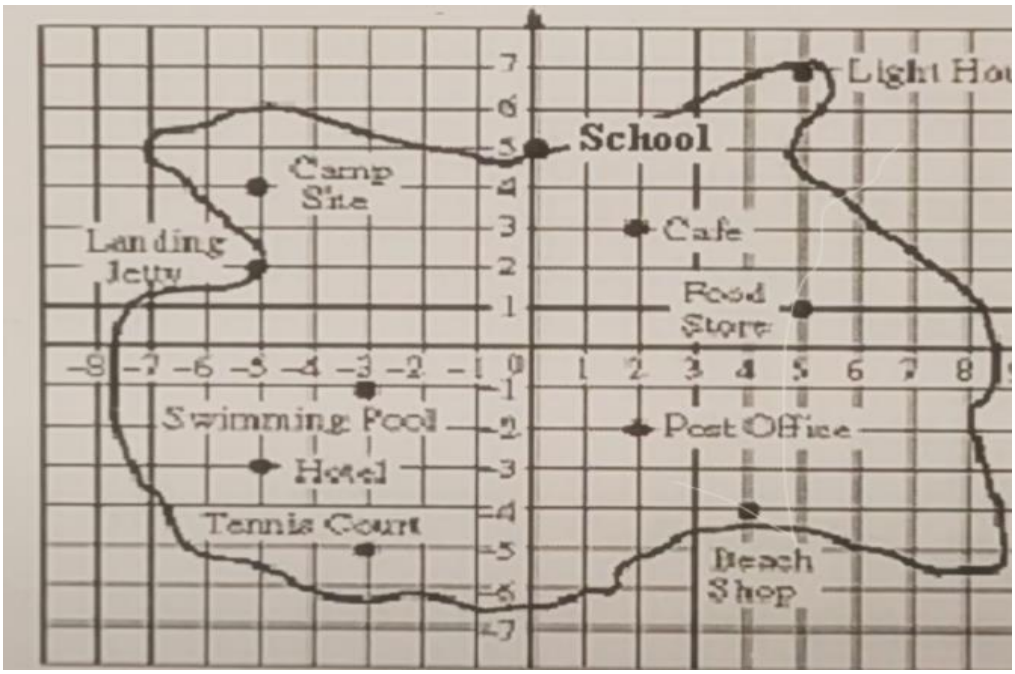
	COMPETENCY BASED QUESTIONS
Q1	Absicssa of a point is positive in : a) I and II quadrants b) I and IV quadrants c) I quadrant only d) II quadrant only
Q2	Mirror image of the point (9,-8) in Y-axis is: a) (-9,-8) b) (9,8) c) (-9,8) d) (-8,9)
Q3	Point (0,4) lies : a) In I quadrant b) On x-axis c) On y-axis d) In IV quadrant
Q4	Which graph is parallel to x-axis? a) Y=x+1 b) Y=2 c) X=3 d) X=2y
Q 5	The point of intersection of horizontal and vertical lines determining the position of a point in a Cartesian plane is called: a) Origin b) X-axis c) Y-axis d) Quadrants
Q 6	The perpendicular distance of a point P(5,8) from the y-axis is: a) 5 b) 8 c) 3 d) 13
Q 7	If (x+2,4) = (5,y-2),then coordinates (x,y) are: a) (7,12) b) (6,3) c) (3,6) d) (2,1)

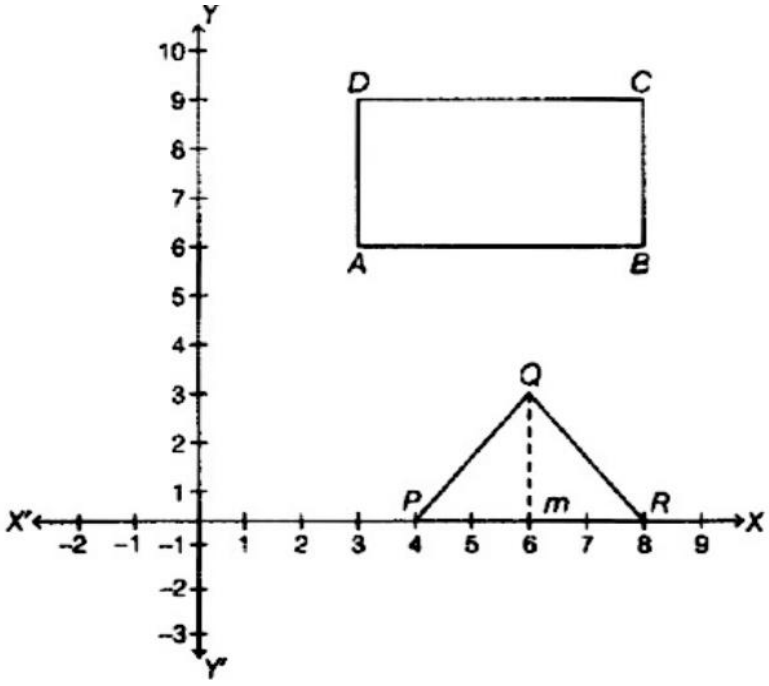
Q 8	The number of parts the coordinates axes divides the plane is: a) Two parts b) Four parts c) Six parts d) Eight parts
Q 9	Ordinate of all the points in the x-axis is: a) 0 b) 1 c) -1 d) Any natural number
Q10	The equation of y-axis is: a) X=0 b) Y=0 c) X=y=0 d) X=constant
Q 11	Which of the following statements is incorrect? a) A line segment has definite length. b) Three lines are concurrent if and only if they have a common point. c) Two lines drawn in a plane always intersect at a point. d) One and only one line can be drawn passing through a given point and parallel to a given line.
Q 12	Two planes intersect each other to form a: a) Plane b) Point c) Straight line d) Angle
Q 13	The number of line segments determined by three collinear points is: a) Two b) Three c) Only one d) Four
Q 14	The number of interwoven isosceles triangles in Sriyantra (in the Atharvaveda) is: a) 7 b) 8 c) 9 d) 10
Q 15	The total number of propositions in Euclid's famous treatise "The Elements" are: a) 13 b) 55 c) 460 d) 465

Q 16	Proved statements based on deductive reasoning, by using postulates and axioms are known as: a) A statement only b) A proposition only c) A theorem only d) Both proposition and theorem
Q 17	**Which of these statements do not satisfy Euclid's axiom?** a) Things which are equal to the same thing are equal to one another. b) If equals are added to equals, the wholes are equal. c) If equals are subtracted from equals, the remainders are equal. d) The whole is lesser than the part.
Q 18	The first known proof that 'the circle is bisected by its diameter' was given by: a) Pythagoras b) Thales c) Euclid d) Hypatia
Q 19	For every line 'l' and a point P not lying on it, the number of lines that passes through P and parallel to 'l' are: a) 1 b) 2 c) 3 d) No line
Q 20	Which of the following is an axiom? a) Theorems b) Definitions c) The universal truth in all branches of Mathematics. d) Universal truth specific to geometry.
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q 11	There is a square park ABCD in the middle of Saket colony in Delhi. Four children Deepak, Ashok,Arjun and Deepa went to play with their balls. The colour of the ball of Ashok,Deepak,Arjun and Deepa are red, blue,yellow and green respectively. All four children roll their ball from the centre point O in the direction of XOY, X'OY, X'OY' and XOY'. Their balls stopped as shown in the figure.

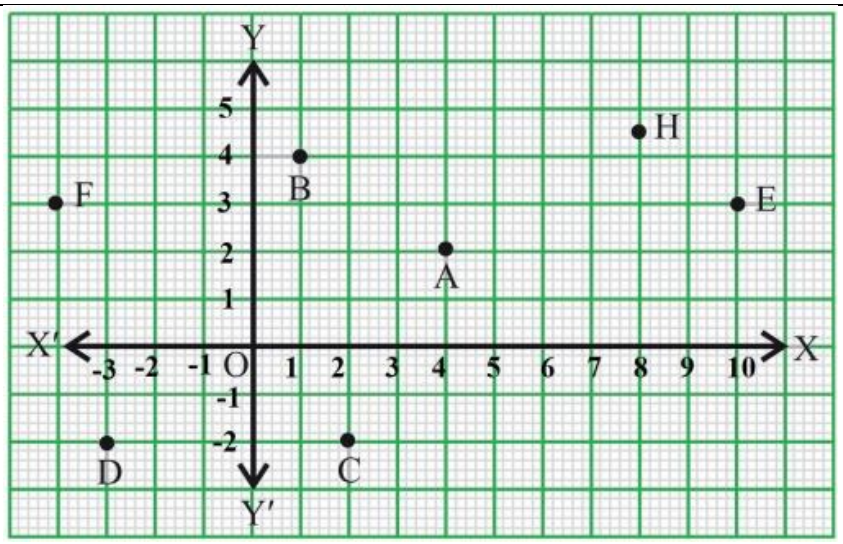
	 Answer the following questions:
(i)	What are the coordinates of the ball of Ashok? a) (4,3) b) (3,4) c) (4,4) d) (3,3)
(ii)	What are the coordinates of the ball of Deepa? a) (2,-3) b) (3,2) c) (2,3) d) (2,2)
(iii)	What the lie XOX’ is called? a) Y-axis b) Ordinate c) X-axis d) origin
(iv)	What the point O is called? a) Y-axis b) Ordinate c) X-axis d) origin

(v)	What is the ordinate of the ball of Arjun? a) -3 b) 3 c) 4 d) 2
Q 12	Rohit was putting up one of his paintings in his living room. Before this Rohit had put a grid on the wall where each unit measured equal to a foot. The upper left corner of the frame is at point C(1,8) and the upper right corner at D(7,8). The bottom left corner is at A(1,2) and the bottom right corner at B(7,2). 
(i)	What is the width of the painting plus frame? a) 6 feet b) 9 feet c) 8 feet d) 5 feet
(ii)	What is the length of the painting plus frame? a) 6 feet b) 9 feet c) 8 feet d) 5 feet
(iii)	Which sides of the painting are parallel to x-axis? a) Diagonals AD and BC b) AB and CD c) AC and BD d) No one
(iv)	Which sides of the painting is parallel to y-axis? a) Diagonals AD and BC b) AB and CD c) AC and BD d) No one

(v)	Point A,B,C and D lie in which quadrant? a) II b) III c) IV d) I
Q 13	Map is used to describe spatial relationships of specific features that the map aims to represent. Maps are drawn to a scale. Directions are taken at right angles, with North-South (y-axis) perpendicular to East-West (x-axis). South and west directions are taken as negative. So,the map gets divide into Cartesian plane. Sumit drew ampa in Cartesian plane. Observe the given graph and answer the following questions: 
(i)	What is the coordinate of Café? a) (3,2) b) (-2,-3) c) (2,3) d) (2,-3)
(ii)	What is the distance of Camp site from y-axis? a) 4 units b) 5 units c) 9 units d) 1 unit
(iii)	Which of the following place(s) is (are) in the third quadrant? a) Swimming pool b) Hotel c) Tennis court d) All of the above

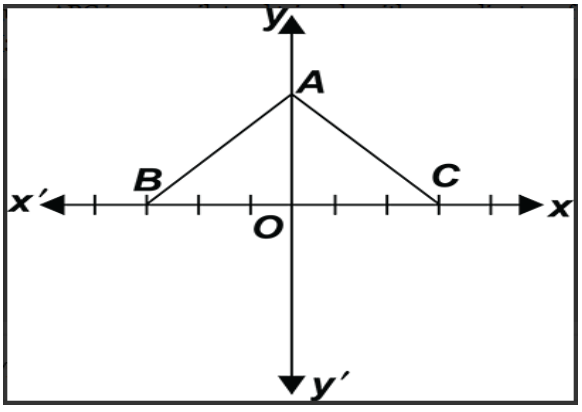
(iv)	What are the coordinates of School? a) (5,0) b) (-5,0) c) (0,5) d) (0,-5)
(v)	What is the distance of Beach shop from x-axis? a) 5 units b) 4 units c) 2 units d) 6 units
Q 14	DPS school provides free education to girl students from weaker sections. The local body of a town want to open a DPS school in the town for which a rectangular plot ABCD as shown in the figure is very suitable. But this plot belongs to SohanLal. He agrees toexchange it with triangular plot PQR as shown below. 
(i)	Write the coordinates of point C? a) (9,8) b) (8,9) c) (7,8) d) (8,7)
(i)	Write the coordinates of point A? a) (6,3) b) (3,6) c) (5,3) d) (3,5)

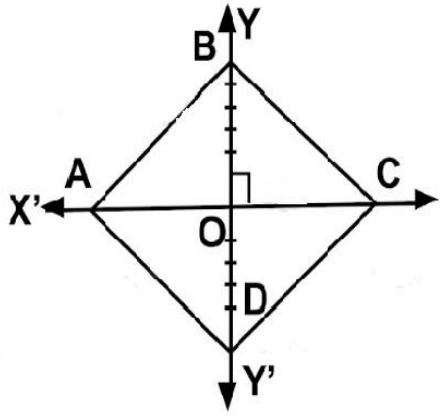
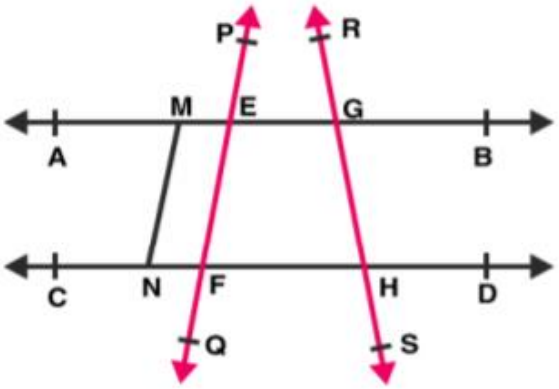
(ii)	Write the coordinates of point Q? a) (4,5) b) (3,6) c) (6,4) d) (4,6)
(iii)	Find the area(in sq units) of rectangle ABCD. a) 15 b) 10 c) 8 d) 12
(iv)	Find the area(in sq units) of triangle PQR. a) 4 b) 8 c) 6 d) 10
Q 15	Students of class IX are on visit of SansadBhawan. Teacher assign them the activity to observe and take some pictures to analyses the seating arrangement between various MP and Speaker based on coordinate geometry. The staff tour guide explained various facts related to Math's of SansadBhawan to the students, students were surprised when teacher asked them you need to apply coordinate geometry on the seating arrangement of MP's and Speaker. 

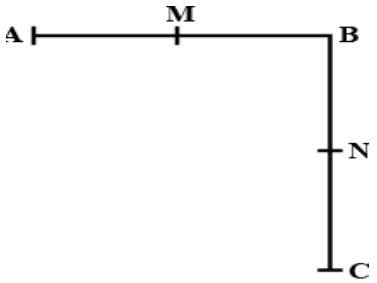
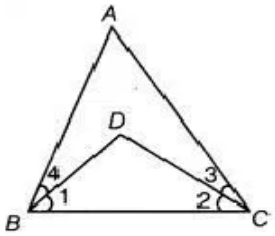
	
(i)	What are the coordinates of position F? a) (3,4) b) (4,3) c) (-3,4) d) (-4,3)
(ii)	What are the coordinates of position D? a) (3,2) b) (-3,-2) c) (-3,2) d) (3,-2)
(iii)	Which point i will get after taking 4 steps in the positive x-axis and later 2 steps in positive y-axis. a) B b) E c) A d) C
(iv)	In which quadrant, the point C lie? a) IV b) II c) III d) I
(v)	Find the perpendicular distance of the point E from the x-axis. a) 13 units b) 10 units c) 3 units d) 11 units
Q 16	A school organized an educational trip to a museum. Almost all the students of class IX went to the trip with their mathematics teacher. They saw many pictures of the Mathematicians and read about their

	contributions in the field of mathematics. After visiting the museum, teacher asked them the following questions:
(i)	It is known that if x+y=10 then x+y+z=10+z. Euclid's axiom that illustrates this statement is: a) First axiom b) Second axiom c) Third axiom d) Fourth axiom
(ii)	In how many chapters the book written by Euclid is divided? a) 10 b) 20 c) 13 d) 23
(iii)	Euclid stated that all right angles are equal to each other in the form of: a) An axiom b) A definition c) A postulate d) A proof
(iv)	Which of the following needs a proof: a) Theorem b) Axiom c) Definition d) Postulate
(v)	What is the name of book, which was written by Euclid? a) Book b) Elements c) Plane d) Sulbasutras
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q 27	x-coordinate is positive in I and III quadrant.(True/False)
Q 28	The ordinate of the point Q(2,3) is 2.(True/False)
Q 29	The point (0,6) lies on ------ axis.
Q 30	X – coordinate of a point is also known as -----.
Q 31	The figure obtained by plotting the points (2,3), (-2,3), (-2,-3), (2,-3) is a -----.
Q 32	What is the vertical number line in the coordinate plane called?

Q 33	What are the coordinates of the Origin?
Q 34	The axes intersect at a point called -----.
Q 35	If a point (x,y) lies above horizontal axis, then y is always -----.
Q 36	The point (-3,-4) lies in ------ quadrant.
Q 37	A solid has ---- dimensions.
Q 38	The line drawn from the centre of the circle to any point on its circumference is called -----.
Q 39	There are ----- number of Euclid's Postulates.
Q 40	The things which are double of the same thing are -----.
Q 41	A point has ---- dimension.
Q 42	Euclidean geometry is only valid for curved surfaces.(True/False)
Q 43	Only one line can pass through a given point.(True/False)
Q 44	Two distinct intersecting lines cannot be parallel to the same line.(True/False)
Q 45	The length of the circle means ------ of the circle.
Q 46	In how many chapters Euclid divided his famous treaties "The Elements"?
	SHORT ANSWER TYPE QUESTIONS
Q 47	Which of the following points lie on y-axis? A(1,1), B(1,0), C(0,1), D(0,0), E(0,-1), F(-1,0), G(0,5), H(-7,0), I(3,3).
Q 48	Without plotting the points indicate the quadrant in which they lie, if: i) Ordinate is -5 and abscissa is 3. ii) abscissa is -5 and ordinate is -3. iii) abscissa is -5 and ordinate is 3. iv) Ordinate is 5 and abscissa is 3.
Q 49	What will be reflections of D(-2, -3) in x-axis and y-axis?
Q 50	In which quadrant or axis each of the following points lie? a) (-3,5) b) (4,-1) c) (2,0) d) (2,2) e) (-3,-6).

Q 51	Take a rectangle ABCD with A(-6,4), B(-5,2), C(-3,3), D(-,4). Find its mirror image with respect to x-axis.
Q 52	Take a quadrilateral ABCD with A(-5,-4), B(-6,2), C(-2,2), D(-3,4). Find its mirror image with respect to Y-axis.
Q 53	Find the coordinates of the point i) Which lies on x and y axes both. ii) Whose ordinate is -4 and lies on y-axis. iii) Whose abscissa is 5 and lies on x-axis.
Q 54	A point lies on x-axis at a distance of 9 units from y-axis. What are its coordinates? What will be the coordinates of a point, if it lies on y-axis at a distance of -9 units from x-axis?
Q 55	If a point R lies between two points P and Q such that PR = QR, then prove that PR = ½ PQ.
Q 56	Two salesmen make equal sales during the month of June. In July, each salesman doubles his sale of the month of June. Compare their sales in July. State which axiom you use here. Also, give two more axioms other than the axiom used in the above situation.
Q 57	If lines AB, AC, AD and AE are parallel to a line l, then show that the points A, B, C, D and E are collinear.
Q 58	If P and Q are the centres of two intersecting circles, then prove that PQ = QR = PR.
	LONG ANSWER TYPE QUESTIONS
Q 59	In rectangle OPQR point O is the origin, OP = 9 units along positive x-axis and PQ = 5 units. Find the coordinates P, Q and R. Also, find the area of the rectangle.
Q 60	In the given figure, ABC is an equilateral triangle. The coordinates of vertices B and C are (3,0) and (-3,0), respectively. Find the coordinates of its vertex A. Also, find its area. 

Q 61	If the coordinates of a point M are (-2, 9) which can also be expressed as $(1 + x, y^2)$ and $y > 0$, then find in which quadrant do the following points lie : P(y, x), Q(2, x), R(x^2, y − 1), S(2x, -3y).
Q 62	Write the coordinates of the vertices of a rectangle, whose length and breadth are 6 units and 3 units respectively, one vertex at the origin, the longer side lies on the y-axis and one of the vertices lies in the II quadrant. Also find the area of the rectangle.
Q 63	In the given figure, ABCD is a rhombus with diagonals AC = 16 cm and BD = 8 cm. Find the coordinates of A, B, C and D. 
Q 64	In the given figure, name the following:  i) Six points ii) Five line segments iii) Four collinear points iv) Four lines
Q 65	If a line falling on two straight lines makes the interior angles on the same side of it, whose sum is 120^0, then the two straight lines, if produced indefinitely, meet on the side on which the sum of angles is less than 120^0. Is it true or false? Explain it.

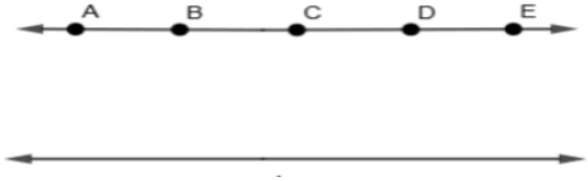
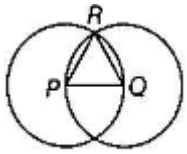
Q 66	In the figure given below:  i) If AB = BC, then M is the mid-point of AB and N is the mid-point of BC. Show that AM = NC. ii) If BM = BN, then M is the mid-point of AB and N is the mid-point of BC. Show that AB = BC.
Q 67	In given figure, we have ∠ABC = ∠ACB and ∠3 =∠4. Show that BD = DC. 
Q 68	Rehman and Prakash contributed equal amount towards Prime Minister Relief Fund. Prakash and Rahul also contributed equal amount towards Prime Minister Relief Fund. If Rahul contributed Rs. 500, then how much Rehman contributed? Which Euclid axiom helped in reaching the correct answer?

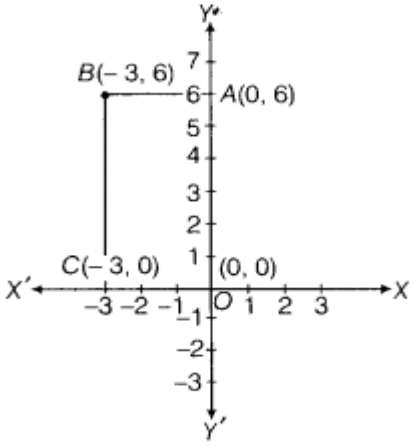
	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	(b) I and IV quadrants
Ans 2	(a)(-9,-8)
Ans 3	(c) on y-axis
Ans 4	(b) y=2
Ans 5	(a)origin
	(a)5
	(c) (3,6)
	(b) four parts
	(a)0
Ans10	(a)x=0
Ans 11	c) two lines drawn in a plane always intersect at a point.
Ans 12	c) straight line
Ans 13	b) three
Ans 14	c) 9
Ans 15	d)465
Ans 16	d)both proposition and theorem
Ans 17	d)The whole is lesser than the part
Ans 18	b) Thales
Ans 19	a)1
Ans 20	c) The universal truth in all branches of Mathematics.

	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Ans 21	i) b) (3,4) ii) a) (2,-3) iii) c) x-axis iv) d) origin v) -3
Ans 22	i) a) 6 feet ii) a) 6 feet iii) b) AB and CD iv) c) AC and BD v) d) I
Ans 23	i) c)(2,3) ii) b) 5 units iii) d) all of the above iv) c)(0,5) v) b) 4 units
Ans 24	i) b) (8,9) ii) b) (3,6) iii) c) (6,4) iv) a) 15 sq units v) b) 8 units
Ans 25	i) d) (-4,3) ii) b) (-3,-2) iii) c) A iv) a) IV v) c) 3 units
Ans 26	i) b) second axiom ii) c) 13 iii) c) A postulates iv) a) Theorem v) b) Elements
	SOLUTIONS TO OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Ans 27	False
Ans 28	False
Ans 29	y-axis
Ans 30	Abscissa

Ans 31	Rectangle
Ans 32	y-axis
Ans 33	O(0,0)
Ans 34	Origin
Ans 35	positive
Ans 36	Third
Ans 37	3
Ans 38	Radius
Ans 39	Five
Ans 40	Equal
Ans 41	Zero
Ans 42	False
Ans 43	False
Ans 44	True
Ans 45	Circumference
Ans 46	13 chapters

	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
Ans 47	C(0,1), D(0,0), E(0,-1), G(0,5)
Ans 48	i) IV ii) III iii) II iv) I
Ans 49	On x-axis (-2,3) On y-axis (2,-3)
Ans50	a) II b) IV c) X – axis d) I e) III
Ans51	A(-6,-4), B(-6,-2), C(-2,-2), D(-2,-4)
Ans52	A(5,-4), B(6,2), C(2,2), D(3,4).
Ans53	i) (0,0) ii) (0,-4) iii) (5,0)
Ans54	When the point lies on x axis at a distance of 9 units from y axis then the coordinate of this point is (9,0). When the point lies on y axis at a distance of -9 units from x axis then the coordinate of this point is (0,-9).
Ans 55	R is the mid-point of PQ PR=RQ PR+PR = RQ+PR 2PR = RQ (2PR)/2 =PQ/2(dividing by2 on both sides) PR = ½ PQ
Ans 56	Let the sale of both the salesmen in June be "x". In July, each salesman doubles his sales of June. Hence, In July, Sales of first salesmen = 2x And, sales of second salesman = 2x. According to Euclid's axiom 6, things that are double of the same things are equal to one another. Therefore, in July their sales are again equal. Other axioms are:

	Axiom 5: The whole is greater than the part. Axiom 7: Things which are halves of the same things are equal to one another.
Ans 57	In the given question, we have been given that the lines AB, AC, AD, and AE are parallel to line l. As we know that if two or more lines are parallel to a given line then all the lines are parallel to each other. AB, AC, AD, and AE are also parallel to each other having point A as common to each line. Now, we also know that there is only one line that can be drawn parallel to the given line from a point not on the line. All the points A, B, C, D, and E will lie on one line as shown below.  Hence, the points A, B, C, D, and E are collinear points.
Ans 58	In the given figure, PR = PQ (radii of the same circle) ……..(i) And QP = QR (radii of the same circle) ……..(ii) From Eqs (i) and (ii), PR = QR (by axiom 1)…….(iii) From Eqs (i), (ii) and (iii), PQ = QR = PR 
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
Ans 59	In rectangle OPQR, point O is the origin and OP = 9 units. Therefore, we get O(0,0) and P(9,0) Also, given that PQ = 5 units. Therefore, we get Q(9,5) and R(0,5) Area of rectangle = 9 x 5 = 45 sq units.
Ans 60	BC = 3+3 = 6 units Length of altitude OA = $\sqrt{3}/2$ x BC = $\sqrt{3}/2$ x 6 =$3\sqrt{3}$ Therefore, coordinate of A are $(0,3\sqrt{3})$

	Area of ΔABC = ½ x BC x AO = ½ x 6 x 3√3 =9√3sq units
Ans 61	Given, (-2,9) = (1 + x, y^2) and y > 0 On comparing both coordinates, we get 1+x = -2 and y^2 = 9 x = -3 and y = 3 now, P(y,x) = P(3,-3) IV quadrant Q(2, x) = Q(2,-3)IV quadrant R(x^2, y − 1) = R(9,2) I quadrant S(2x, -3y) = S(-6,-9) III quadrant
Ans 62	 Rectangle OABC whose vertices are O(0, 0), A(0, 6), B(-3, 6)andC(-3, 0) ∴ Area of rectangle = Length x Breadth ∴ Area of rectangle OABC = 6x3= 18 sq units
Ans 63	AC perpendicularly bisect BC So, BO = DO = ½ BD = 4 cm Also, AO = CO = ½ AC = 8 cm O is origin. Both B and D lies on y-axis so, x- coordinate = 0 Therefore, B(0,4) and D(0,-4) Both A and C lies on x-axis so, y- coordinate = 0 Therefore, A(-8,0) and C(8,0)
Ans 64	i) Six points : A,B,C,D,E,F. ii) Five line segments : EG, FH, EF, GH, MN. iii) Four collinear points : M, E, G, B. iv) Four lines : AB, CD, PQ, RS.

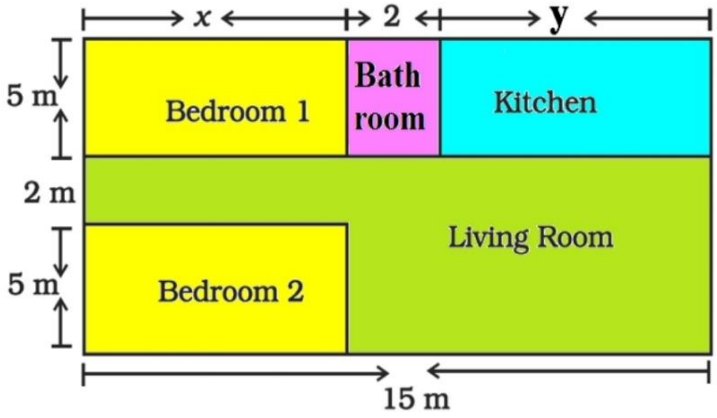
Ans 65	True, according to Euclid's fifth postulate : If a straight line falling on two straight lines makes the interior angles on the same side of it taken together less than two right angles, then the two straight lines, if produced indefinitely, meet on that side on which the sum of angles is less than two right angles
Ans 66	Given : AB = BC …….(i) i) M is mid-point of AB. AM = MB = ½ AB Also, N is mid-point of BC. BN = NC = ½ BC Multiplying both sides by ½ in eq (i), ½ AB = ½ BC (Euclid's axiom 7) AM = NC Given : BM = BN …….(i) ii) M is mid-point of AB. AM = BM = ½ AB 2AM = 2BM = AB Also, N is mid-point of BC. BN = NC = ½ BC 2BN = 2NC = BC Multiplying both sides by 2 in eq (i), 2BM = 2BN (Euclid's axiom 6) AB = BC
Ans 67	Given, ∠ABC = ∠ACB …(i) and ∠4 = ∠3 …(ii) According to Eulid's axiom, if equals are subtracted from equals, then remainders are also equal. On subtracting Eq. (ii) from Eq. (i), we get ∠ABC −∠4 = ∠ACB −∠3 ∠1 = ∠2 Now, in ABDC, ∠1=∠2 DC =BD [sides opposite to equal angles are equal] BD = DC.
Ans 68	Given, Rehman and Prakash contributed equal amount. Also, Prakash and Rahul contributed equal amount. It is given that Rahul contributes Rs.500 Therefore, Rehman also contributed Rs.500 (By axiom 1)

CHAPTER : 04 LINEAR EQUATIONS IN TWO VARIABLES

	COMPETENCY BASED QUESTIONS
Q1	The linear equation has2x- 5y=7 has (a) a unique solution (b) two solutions (c) no solution (d) infinitely many solutions
Q2	Age of a father is 7 years more than 3 times the present age of his son. The above statement can be expressed in a linear equation as (a) x -3y -7= 0 (b) x+3 y + 7 =0 (c) x + 3 y- 7=0 (d) x-3 y + 7=0
Q3	The geometric representation of x =- 2 meets the x -axis at (a) (2, 0) (b) (-2 ,0) (c) (0, 2) (d) (0,-2)
Q4	A solution of the equation 2 x +5 y - 3 = 0 is (a) (5, - 2) (b) (- 5 ,2) (c) (- 1 ,1) (d) (1,- 1)
Q 5	The value of k , if x=2 and y = - 1 , is a solution of the equation 2x + 3y = k is (a) 6 (b) 7 (c) 5 (d) 1

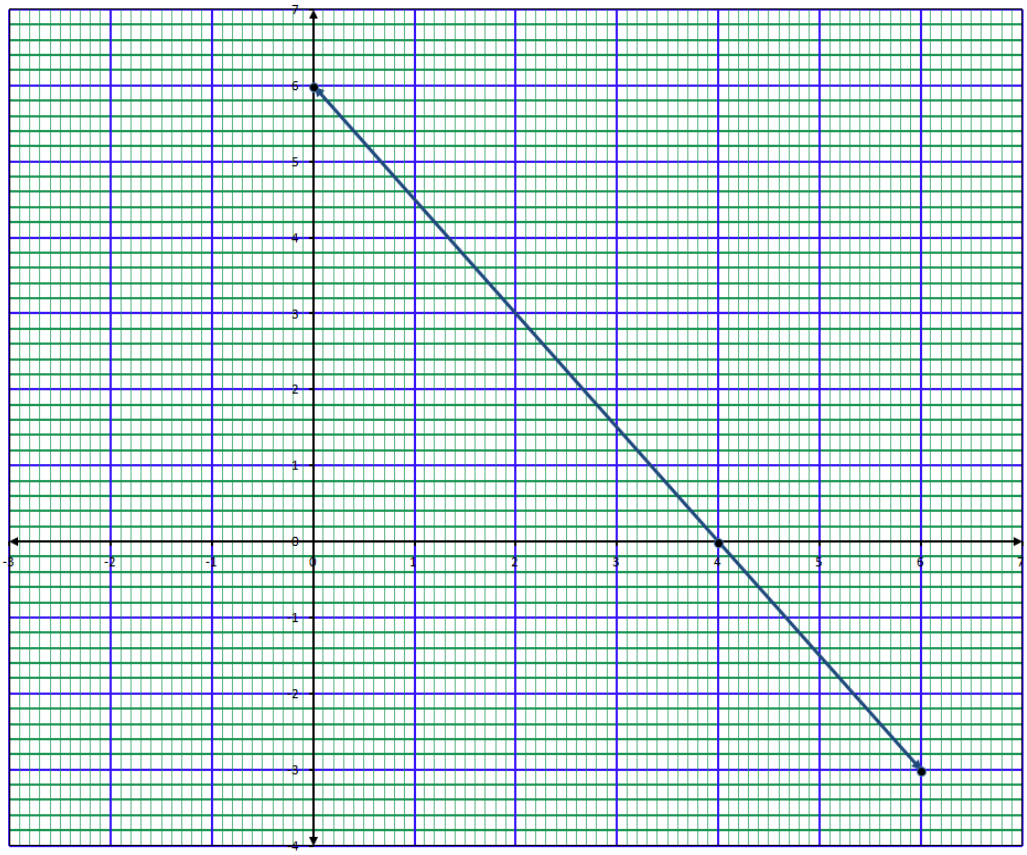
Q 6	The linear equation 3x = 2 y when expressed in the form ax+ by+ c = 0, then a, b, c , , are respectively (a) 3, 2, 0 (b) 3, 2, 1 (c) 3, -2, 0 (d) 3, -2, 1
Q 7	If the point (3, 4) lies on the graph of the equation 3 y= ax +7 , the value of a is (a) 5/3 (b) 3/5 (c) 1 (d) 2/ 5
Q 8	The graph of line x + y =7 intersect the X-axis at (a) (7 , 0) (b) (0 , 7) (c) (-7 , 0) (d) (0 , -7)
Q 9	The graph of y + 2 = 0 is a line (a) making an intercept –2 on the x-axis (b) making an intercept –2 on the y-axis (c) parallel to the x-axis at a distance of 2 units below the x-axis (d) parallel to the y-axis at a distance of 2 units to the left of y-axis
Q10	Which of the following is not a linear equation in two variables? (a) ax + by = c (b) ax^2 + by = c (c) 2x + 3y = 5 (d) 3x + 2y = 6
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q 1	On his birthday, Manoj planned that this time he celebrates his birthday in a small orphanage centre. He bought apples to give to children and adults working there. Manoj donated 2 apples to each children and 3 apples to each adult working there along with Birthday cake. He distributed 60 apples

	
(i)	Write a linear equation in two variables for the above situation in standard form (a) 2x -3y = 60 (b) 2x + 3y =60 (c) 3x + 2y =60 (d) 3x - 2y =60
(ii)	How many solutions are there for the linear equation representing the above situation? (a) One (b) Two (c) Infinitely many (d) Four
(iii)	How many children are there in the orphanage if there are 10 working adults? (a) 15 (b) 10 (c)30 (d) 20
(iv)	How many adults are working there in the orphanage if there are 12 children? (a) 36 (b) 15 (c) 30 (d) 12

(v)	A solution of the above equation in two variables is (a) (10,15) (b) (12,12) (c) (12,0) (d) (15,12)
Q 2	In the below given layout, the design and measurements has been made such that area of two bedrooms and Kitchen together is **75 sq. m.** 
(i)	The area of kitchen and two bedrooms are respectively equal to: (a) 5x, 5y (b) 5y, 10x (c) 5x, 10y (d) 10x, 5y
(ii)	The area of the rectangular layout is: (a) 75 sq. m (b) 180 sq.m (c) 150 sq. m (d) 54 sq. m
(iii)	The pair of linear equation in two variables formed from the information given in layout are: (a) x + y = 13, x + y = 9 (b) 2x + y = 13, x + y = 9

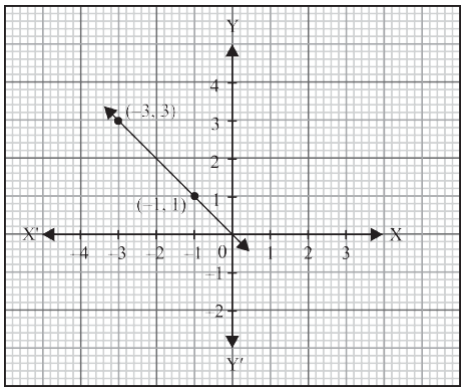
	(c) x + y = 13, 2x + y = 15 (d) None of the above
(iv)	Find the length of the outer boundary of the layout (a) 27m (b) 15m (c) 50m (d) 54 m
(v)	The mathematical concept applied in solving the above problem is: (a) Statistics (b) Coordinates geometry (c) Linear equations (d) Probability
Q 3	Sanjay bought 5 notebooks and 2 pens for Rs. 120. He told to guess the cost of each notebook and pen to his friends Mohan and Anil. Sanjay has given the clue that both the costs are integers and divisible by 5 such that the cost of a notebook is greater than that of a pen.   Now, Mohan and Anil tried to guess. Mohan said that price of each notebook could be Rs. 18. Then five notebooks would cost Rs.90, the two pens would cost Rs.30 and each pen could be for Rs. 15. Anil felt that Rs. 18 for one notebook was too little. It should be at least Rs. 20. Then the price of each pen would also be Rs.10. **Based on the above situation, answer the following questions:**

(i)	Write a linear equation in two variables for this situation
(ii)	A solution of the above equation in two variables is (a) 10,50 (b)20,10 (c)30,20 (d)20,25
(iii)	Check whether the answers of Mohan and Anil are correct.
(iv)	Find the cost of a notebook and a pen
(v)	If Sanjay purchased 8 notebooks and 4 pens, how much money he has to pay to the shopkeeper? (a) Rs. 150 (b) Rs. 200 (c) Rs. 250 (d) Rs. 300
Q 4	Aditya purchased two types of chocolates A and B at the rate of Rs. x and Rs. y respectively. The total amount spent is Rs. 12. After reaching home, he forms a linear equation in two variables for two types of chocolates. He prepares a table and a graph of the linear equation as given below: **Based on the above situation and graph, answer the following questions:**

	
(i)	Which of the following linear equation in two variables is correct? (a) 2x + y = 12 (b) 3x + 2y = 12 (c) x + 2y = 12 (d) 2x + 3y = 12
(ii)	How many Chocolates of types A and B purchased (a) A=3 ,B=2 (b) A=2, B=3 (c) A=2,B=2 (d) A=3,B=3
(iii)	If Aditya purchased 4 chocolates of type A and 5 Chocolates of type B, then find the total amount. (a)22 (b) 23 (c) 25 (d) 28

(iv)	How many Chocolates A and B can be purchased from an amount of Rs. 36 (a) 9,6 (b) 6,9 (c) 4,9 (d) 9,4
(v)	How many solutions are there for the linear equation representing the above situation? (a) One (b) Two (c) Infinitely many (d) Four
Q 5	In Hyderabad, a small colony of five Blocks Apartments is there and in each Block, 40 flats are there. The colony has a Resident Welfare Association consisting of executive members from each block. They decided to develop flower beds in the park of the colony and then plant different flower plants in the beds. The difference of three times the money spent on one flower bed and two times the money spent on one flower plants was Rs. 10000. The total number of flower beds develops is 10 and the number of flower plants planted is 100.  **Based on the above situation, answer the following questions**
(i)	Write a linear equation in two variables for the above situation (a) 3x -2y =10000 (b) 3x+2y =10000 (c) 2x+ 3y =10000 (d) 2x -3y =10000

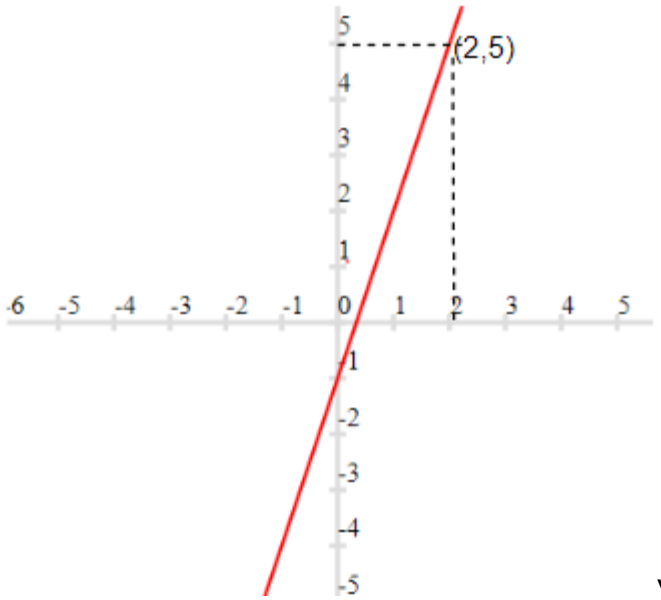
(ii)	A solution of the above equation is (a) (5000,4000) (b) (4000 ,1000) (c) (2000 ,2000) (d) (4000 ,2000)
(iii)	How muchmoney spent by the Resident Welfare Association? (a) 120000 (b)140000 (c) 150000 (d) 160000
(iv)	How much money has to be spent if total number of flower beds develops are 15 and the number of flower plants planted is 150?
(v)	What value is indicated in this situation ?
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q 1	The equation of a line passing through origin is of the form -------
Q 2	The graph of every linear equation in two variables is a ------
Q 3	The graph of the linear equation x+2y=7 passes through the point (0,7) (Write True/ False)
Q 4	For the graph of the linear equation ax +by+c=0 to pass through the origin which of the three a,b and c necessarily zero ?
Q 5	Find one solution of 2x-3y-12=0
Q 6	Give the equations of two lines passing through (2,14)How many more such lines are there ?
Q 7	Total number of legs in a herd of goats and hens is 40 .Represent this situation in the form of a linear equation in two variables .
Q 8	Express 5x=-8y in the form of ax+by+c=0
Q 9	Find the point on x axis from where graph of linear equation x - 5y = 3 will pass

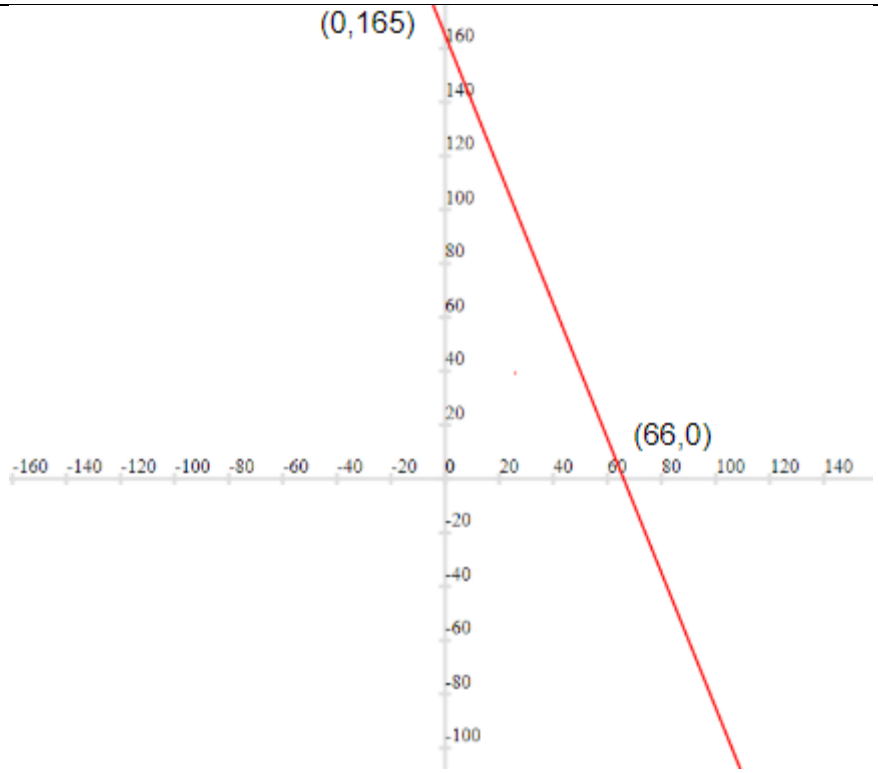
Q 10	 Thegraphgivenbelowrepresentsthelinearequation. Write the equation
	SHORT ANSWER TYPE QUESTIONS
Q 1	If the point (2,-7) lies on the line 4x+my=22 then what will be the value of m ?
Q 2	Draw the graph of the equation y = mx + c for m = 3 and c = -1 (a straight line in Cartesian plane). Read from the graph the value of y when x = 2.
Q 3	Find a if linear equation 3x-ay =6 has one solution as (4,3)
Q 4	In a one day international cricket match, Raina and Dhoni together scored 198 runs. Express the statement as a linear equation in two variables.
Q 5	Find the value of k for which x = 0, y = 8 is a solution of 3x – 6y = k.
Q 6	In some countries temperature is measured in Fahrenheit, whereas in countries like India it is measured in Celsius. Here is a linear equation that converts Fahrenheit to Celsius : F = (95)C + 32° If the temperature is – 40°C, then what is the temperature in Fahrenheit
Q 7	Write the equation of a line which is parallel to x-axis and is at a distance of 2 units from the origin
Q 8	Give equation of two lines on same plane which are intersecting at the point (2, 3)
Q 9	Find four different solutions 0f the equation x+2y =6
Q 10	If πx + 3y = 25, write y in terms of x and also, find the two solutions of this equation.
	LONG ANSWER TYPE QUESTIONS

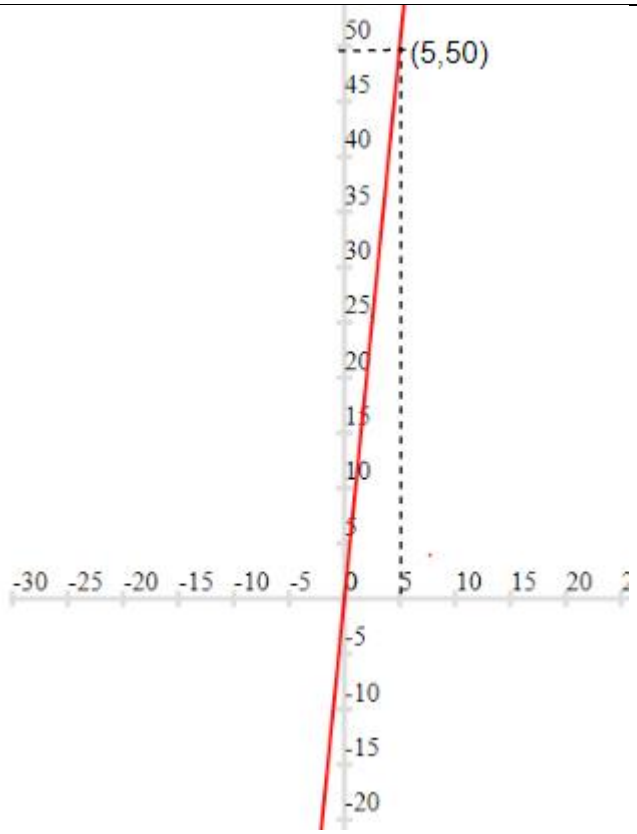
Q 1	A fraction becomes ¼ when 2 is subtracted from the numerator and 3 is added to the denominator .Represent this situation as a linear equation in two variables. Also find two solutions for this .
Q 2	Cost of 5 kg apples and 2 kg oranges is Rs. 330. Let the cost of 1 kg apples be Rs. x and that of 1 kg is Rs. y. Write the given data in the form of linear equation in two variables. Also , represent it graphically
Q 3	The parking charge for vehicles in super Delhi Metro is Rs 20 for first two hrs and Rs. 10 for subsequent hr. Assume total parking time to be x hrs. (where x>= 2) and total parking charge as y . Write the linear equation for above relation and draw graph. Find the parking Charges for 5 hrs from Graph
Q 4	The perimeter of a rectangle is 80 m. If the length of the field is decreased by 2 m and breadth increased by 2 m, the area is increased by 36 sq. km. find the length and breadth of rectangle
Q 5	Yamini and Fatima, two students of Class IX of a school, together contributed₹100 towards the Prime Minister's Relief Fund to help the earthquake victims. Write a linear equation which satisfies this data. (You may take their contributions as₹x and ₹y) . Draw the graph of the same.
Q 6	The taxi fare in a city is as follows: For the first kilometer, the fare is ₹8and for the subsequent distance it is ₹5per km. Taking the distance covered as x km and total fare as ₹y, write a linear equation for this information, and draw its graph.
Q 7	In countries like USA and Canada, temperature is measured in Fahrenheit, whereas in countries like India, it is measured in Celsius. Here is a linear equation that converts Fahrenheit to Celsius: F=(9 /5)C+32 (i) Draw the graph of the linear equation above using Celsius for x-axis and Fahrenheit for y-axis
Q 8	Draw the graph for the linear equation x-y =2
Q 9	A and B are friends. A is elder to B by 5 years. B's sister C is half the age of B while A's father D is 8 years older than twice the age of B. If the present age of D is 48 years, find the present ages of A, B and C.
Q 10	Find the value of k, if (1, -1) is a solution of the equation 3x – ky = 8. Also, find the coordinates of another point lying on its graph
Q 11	Give the geometric representations of y = 3 as an equation (i) in one variable (ii) in two variables

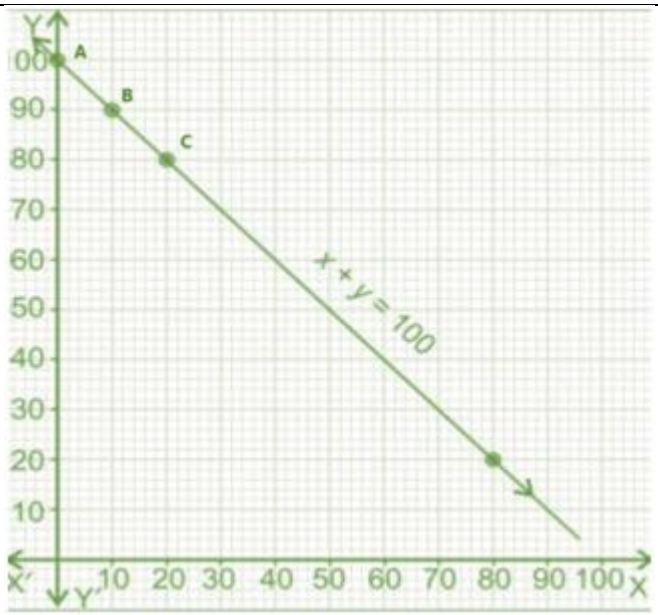
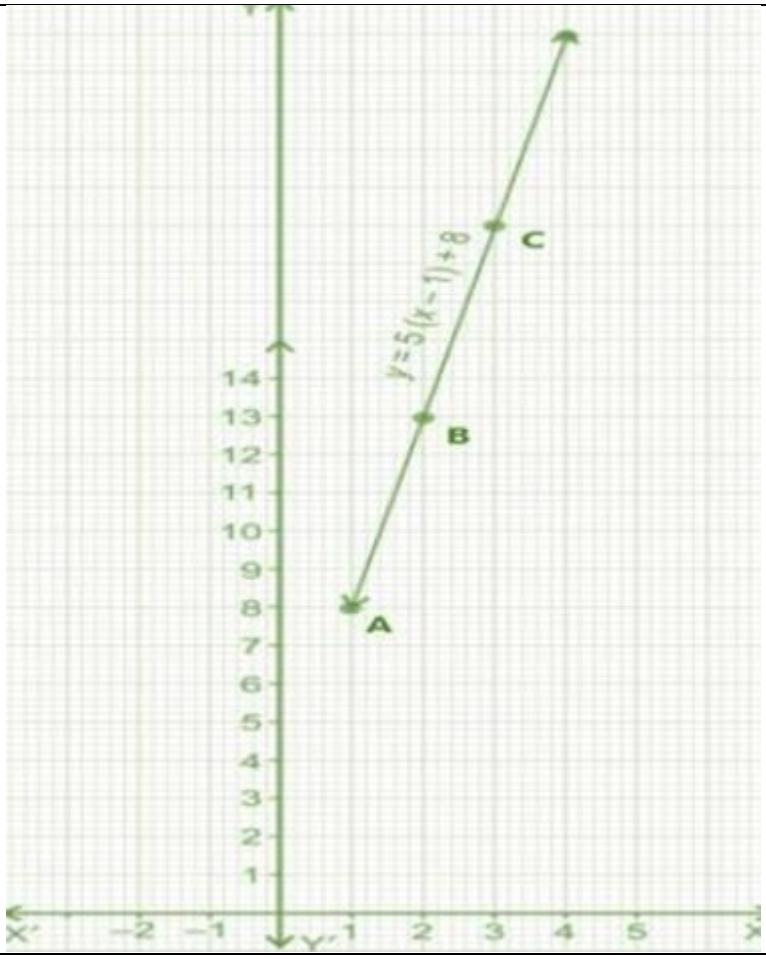
	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	(d)
Ans 2	(a)
Ans 3	(b)
Ans 4	(c)
Ans 5	(d)
Ans 6	(c)
Ans 7	(a)
Ans 8	(a)
Ans 9	(c)
Ans10	(b)

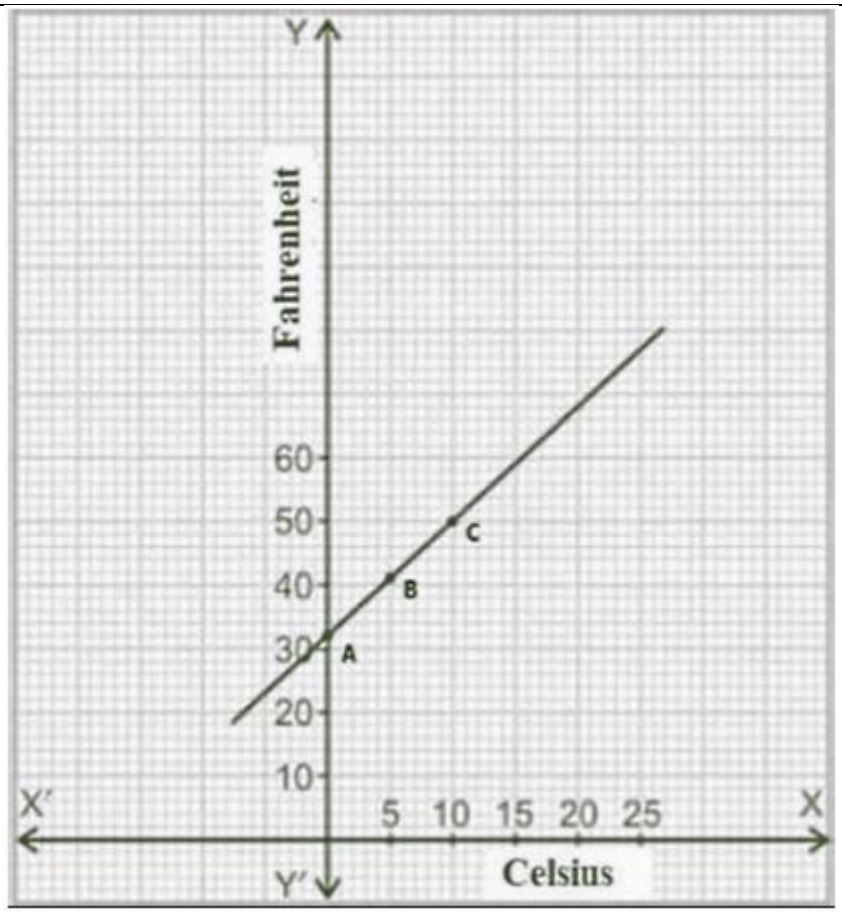
	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q1	(i)b (ii) c (iii) a (iv) d (v)b
Q2	(i)b (ii)b (iii)d (iv)d (v) c
Q3	(i)5x+2y=120 (ii) b (iii)Mohan is wrong, Anil is right (iv)cost of one note book= Rs20, cost of pen= Rs10 (v) b
Q4	(i)b (ii) b (iii) a (iv) a (v) c
Q5	(i)a (ii) b(iii) b (iv) Amount = Rs. 4000 x 15 + Rs. 1000 x 150 = Rs. 190000 (v) Awareness amongst citizens for protection of environment and making pollution free air
	SOLUTIONS TO OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q1	y=mx
Q2	Straight line
Q3	false
Q4	a (0) +b(0) +c=0 means c=0
Q5	3y=2x-12 , when y=0 ,x=6 therefore solution is (6,0)
Q6	x+y=16 , 7x-y=0
Q7	No .of legs of x goats =4x No of legs of y hens =2y Therefore 4x+2y =40 or 2x+y=20
Q8	5x+8y +c=0
Q9	x-5y=3 when y=0 , x- 5(0) =3 therefore point = (3,0)
Q10	Thegivenequationis$x+y=0$,*i.e.*,$y=-x$
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
Q1	4(2) +m(-7) =22 , -7m=14 therefore m= -2

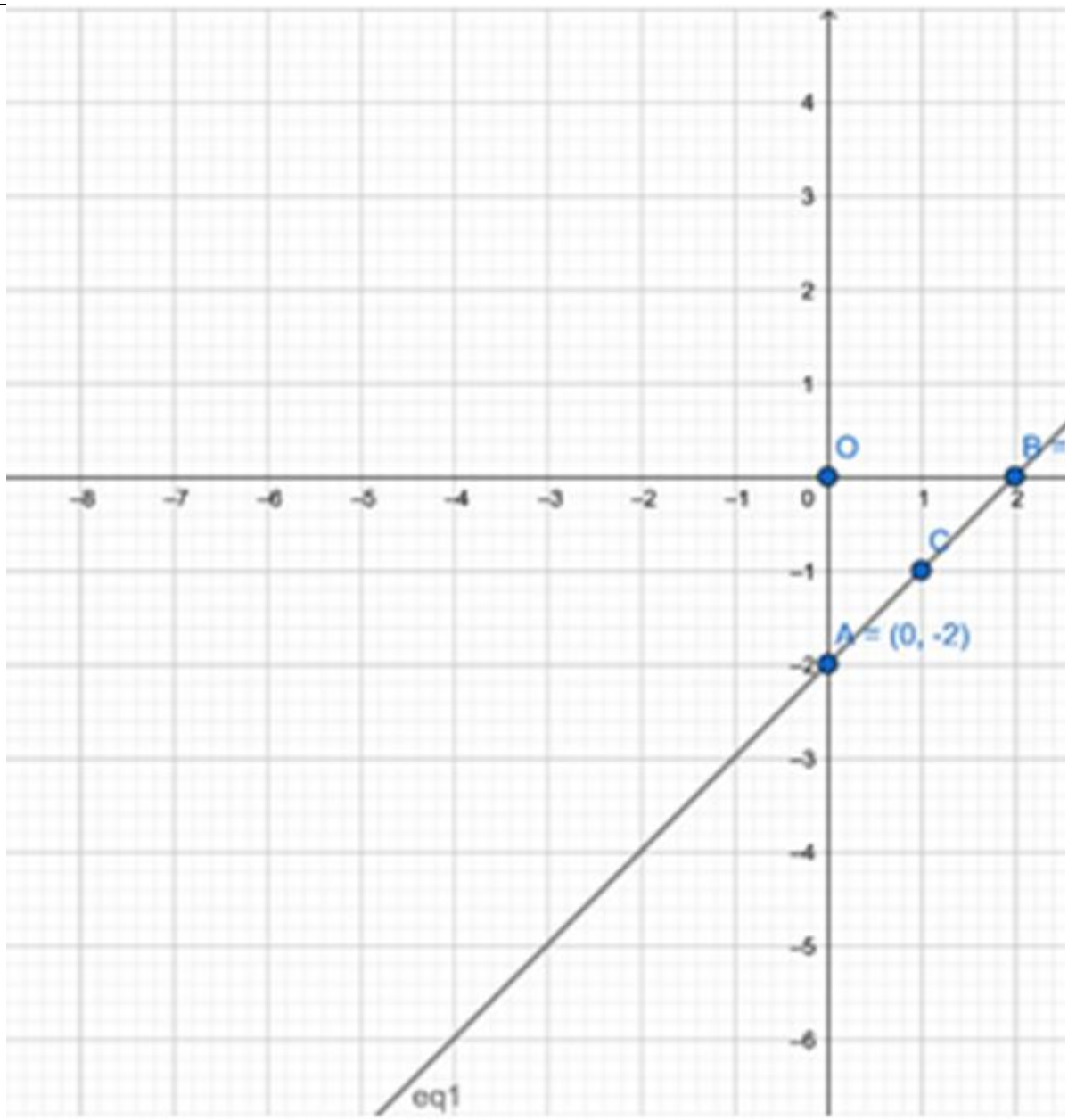
Q2	 y=5 when x=2
Q3	3x-ay =6 then 3x4 –ax3 =6 12-3a =6 therefore a=2
Q4	Let runs scored by Raina be x and runs scored by Dhoni be y. According to statement of the question, we have x + y = 198 x + y – 198 = 0
Q5	Since x = 0 and y = 8 is a solution of given equation 3x – 6y = k 3(0) – 6(8) = k ⇒ k = – 48
Q6	Given linear equation is F = (9 /5)C + 32° Put C = -40°, we have F =(9/5) (-40°) + 32° F = – 72° + 32° F= -40°
Q7	Here, required line is parallel to x-axis and at a distance of 2 units from the origin. ∴ Its equation is y + 2 = 0 or y – 2 = 0
Q8	Since there are infinite lines passing through the point (2, 3). Let, first equation is x + y = 5 and second equation is 2x + 3y = 13
Q9	Solutions are (2,2) (0,3) (6,0) (4,1)

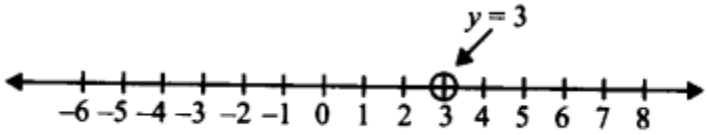
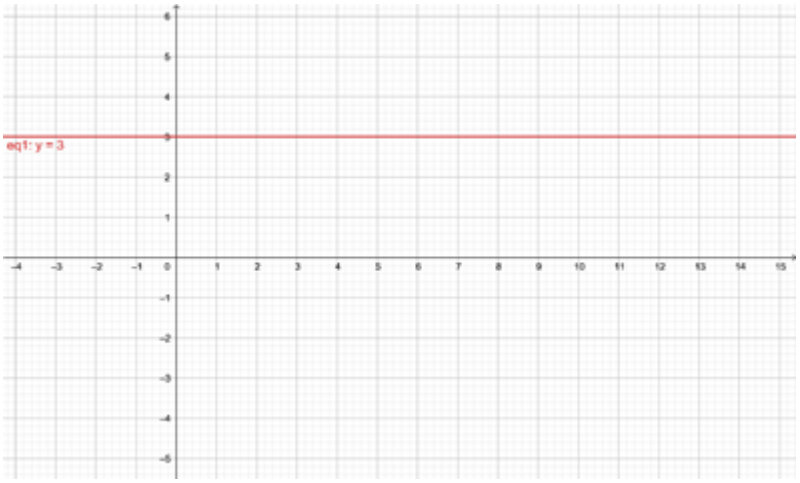
Q10	Given equation is $\pi x + 3y = 25$ $\therefore \quad y = \frac{25-\pi x}{3}$ When $x = 0$, then $y = \frac{25}{3}$. When $x = 1$, then $y = \frac{25-\pi}{3}$. Hence, the two solutions are $x = 0, y = \frac{25}{3}$ and $x = 1, y = \frac{25-\pi}{3}$.
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
Q1	Let the fraction is $\frac{x}{y}$ $\frac{x-2}{y+3} = \frac{1}{4}$ 4(x-2)=y+3 4x-8 =y+3 4x-y-11 = 0 Y = 4x-11 , when x = 3 , y = 1 when x = 4 , y = 5 solutions are (3,1) (4, 5)
Q2	 5x + 2y=330
Q3	y = 20 + 10(x-2) y= 10x

	 We can observe that parking charge for 5 hours is Rs 50
Q4	2(L+B)=80 L+ B =40 Area= L X B (L−2)(B+2)= LB+36 LB−2B+2L-4= LB+36 L−B= 20 Adding (1) and (2) 2L=60 L=30 m And Then B=10 units

Q5	 Total contribution made by both students is *Rs.100* Let the contribution made by Yamini is *Rs.x* and the contribution made by Fatima is *Rs.y* Then equation is x+y =100
Q6	

	y=8+5(x-1) therefore equation is y= 5x+3
Q7	 y= 9/5 c+32 when C=0 ,F =32 when C=5 ,F =41 when C=10 ,F =50 Solutions are(0,32) (5,41) (10,50)

Q8	
Q9	Let the age of B's sister i.e., C be x years. ∴Age of B be 2x years, age of A be (2x + 5) years. And age of A's father i.e., D be 2(2x) + 8 = 4x + 8 years According to the statement of the question, we have 4x + 8 = 48 ⇒ 4x = 48 – 8 = 40 ⇒ x = 40/10 = 10 Age of A = (2x + 5) years i.e., (2 × 10 + 5) years = 25 years Age of B = 2x years = 2 × 10 years = 20 years and Age of C = 1/2 of B's age = 1/2 × 20 years = 10 years
Q10	Since (1, -1) is a solution of the equation 3x – ky = 8 ∴ 3(1) –k(-1) = 8 ⇒ k = 8 – 3 = 5 Thus, the given equation is 3x – 5y = 8

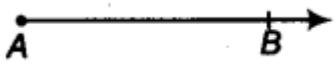
	Put $x = 6$, then $y = \frac{3\times6-8}{5} = \frac{18-8}{5} = \frac{10}{5} = 2$ Hence, the coordinates of another point lying on the graph of 3x – 5y = 8 is (6, 2).
Q11	  0x+1y= 3

KEY POINTS TO REMEMBER

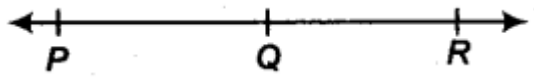
1. Basic Terms and Definitions

(i) Line segment: A part of a line with two endpoints is called a line segment.

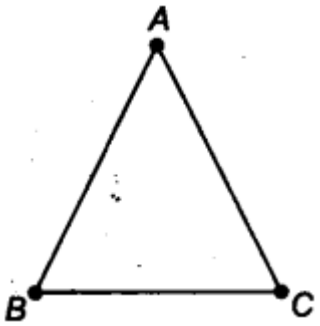
(ii) Ray: A part of a line with one endpoint is called a ray.



(iii) Collinear points and non-collinear points: If three or more than three points he on the same line, then they are called collinear points, otherwise, they are non-collinear points.

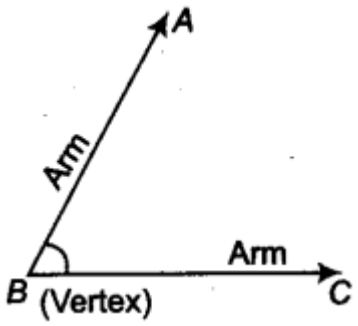


P, Q and R are collinear points.



A, B and C are non-collinear points.

2. **Angle:** An angle is formed when two rays originate from the same endpoint.



Angle ABC is denoted by ∠ABC

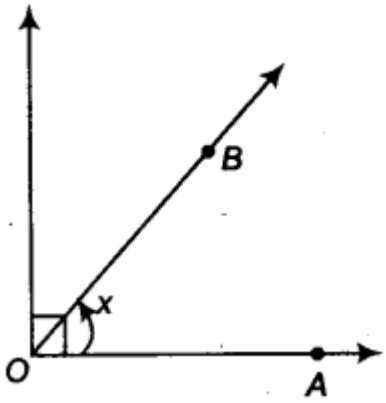
The rays (BA and BC) making an angle are called the arms of ∠ABC.

The end point (B) is called the vertex of ∠ABC.

3. **Types of Angles:** There are different types of angles such as acute angle, right angle, obtuse angle, straight angle and reflex angle.

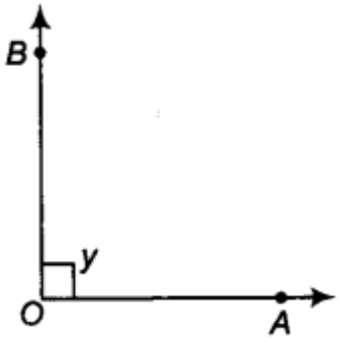
(i) **Acute angle:** An acute angle is an angle which is less than 90°.

Acute angle : 0° < x < 90°.



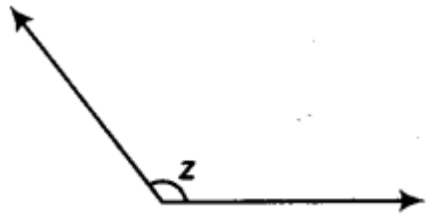
(ii) **Right angle:** A right angle is an angle which is equal to 90°.

Right angle : y = 90°



(iii) **Obtuse angle:** An obtuse angle is an angle which is more than 90° and less than 180°.

Obtuse angle : 90° < z < 180°

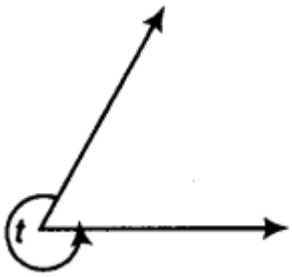


(iv) **Straight angle:** A straight angle is an angle which is equal to 180°.

Straight angle : s = 180°

(v) **Reflex angle:** A reflex angle is an angle, which is more than 180° and less than 360°.

Reflex angle : 180° < t < 360°

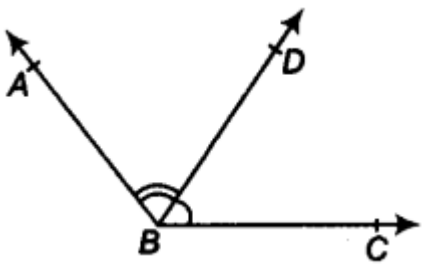


4. **Complementary Angles:** Two angles whose sum is 90° are called complementary angles.

5. **Supplementary Angles:** Two angles whose sum is 180° are called supplementary angles.

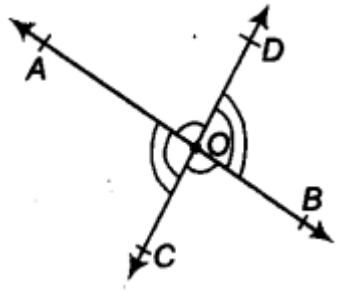
6. **Adjacent Angles:** Two angles are adjacent if they have a common vertex, a common arm and their non-common arms are on different sides of the common arm.

∠ABD and ∠DBC are the adjacent angles. Ray BD is their common arm and point B is their common vertex. Ray BA and ray BC are non-common arms.



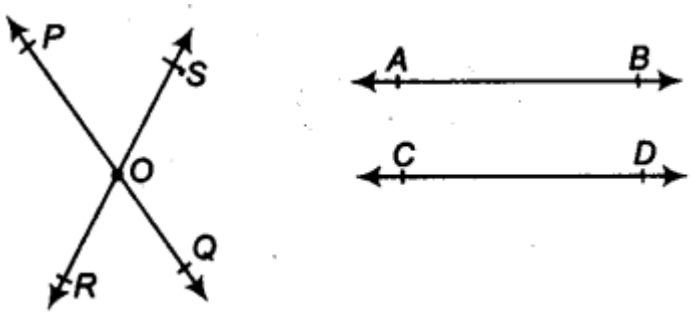
Note: ∠ABC = ∠ABD + ∠DBC

7. **Vertically Opposite Angles:** The vertically opposite angles formed when two lines intersect each other at a point.



Two lines AB and CD intersect each other at point O, then, there are two pairs of vertically opposite angles.
One pair is ∠AOD and ∠BOC and another pair is ∠AOC and ∠BOD.

8. **Intersecting Lines and Non-intersecting Lines**

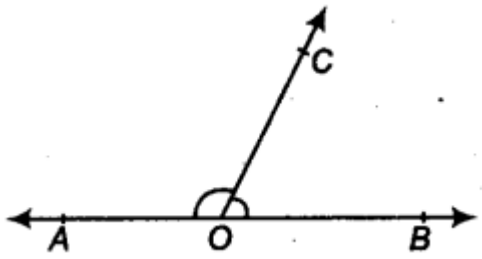


Lines PQ and RS are intersecting lines because they are intersecting each other at O.
Lines AB and CD are non-intersecting (parallel) lines.
Note: The lengths of the common perpendicular at different points on these parallel lines is the same. This equal length is called the distance between two parallel lines.

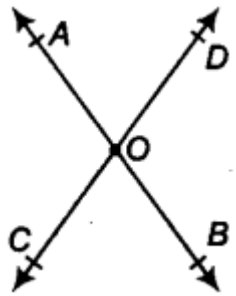
9. **Pairs of Angles**
Linear Pair of Angles: When the sum of two adjacent angles is 180°, then they are called a linear pair of angles.
(i) If a ray stands on a line, then the sum of two adjacent angles so formed is 180°.
(ii) If the sum of two adjacent angles is 180°, then a ray stands on a

line (that is the non-common arms form a line).

$\angle AOC + \angle BOC = 180°$



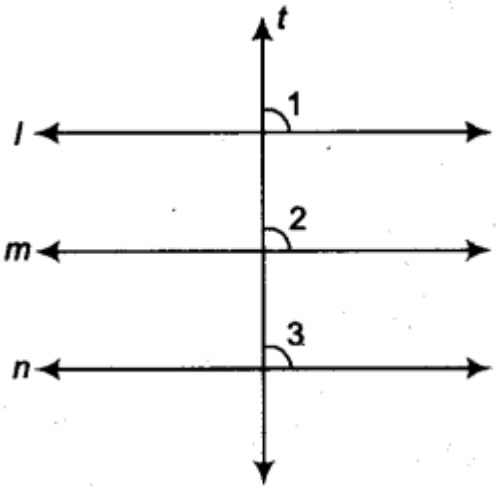
Property: If two lines intersect each other, then the vertically opposite angles are equal.



$\angle AOD = \angle BOC$

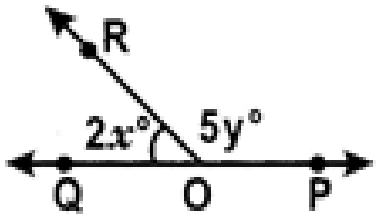
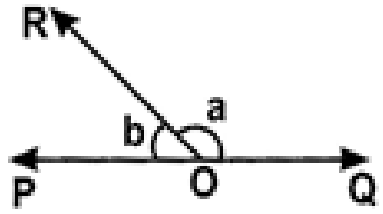
$\angle COA = \angle DOB$

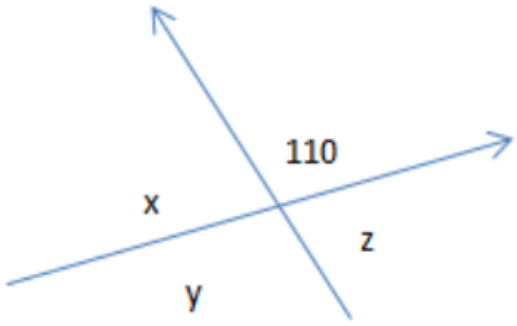
10. **Lines Parallel to the Same Line:** If two lines are parallel to the same line, will they be parallel to each other.



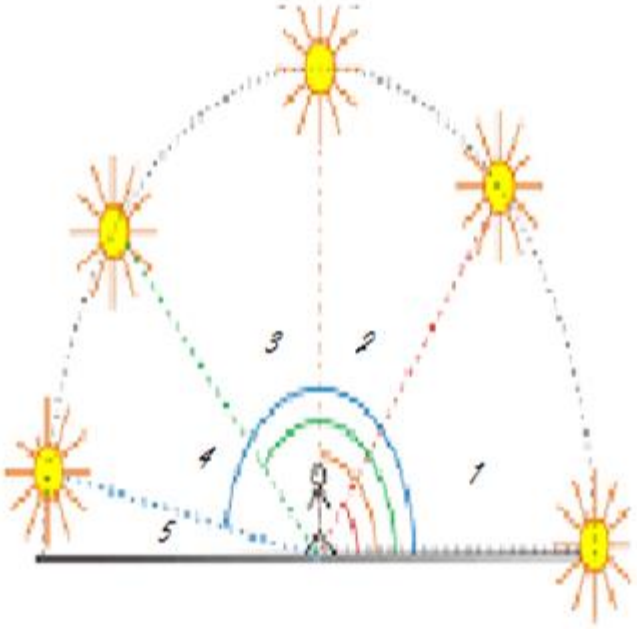
Here, line m parallel to line l and line n parallel to line l.

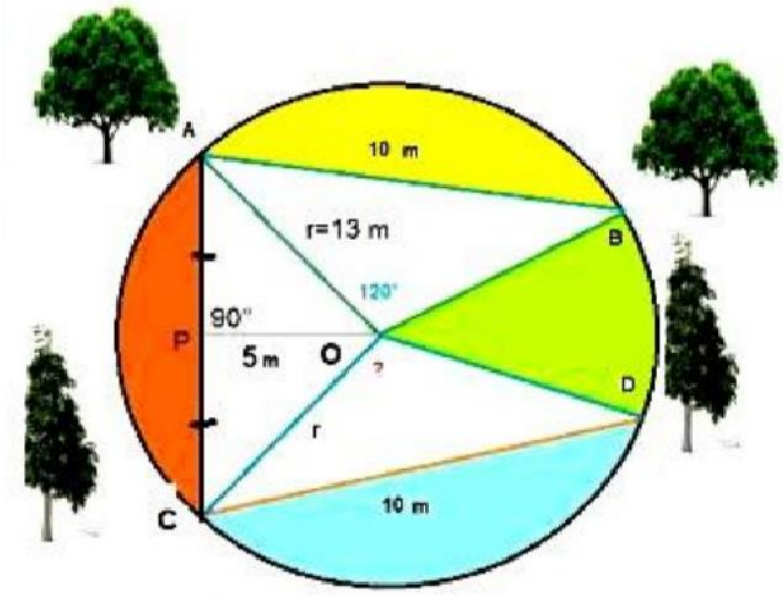
Hence, line m parallel to line n.

	COMPETENCY BASED QUESTIONS
Q.1)	From the given figure, find the value of y when $x=30^0$  a) 25^0 b) 24^0 c) 23^0 d) 22^0
Q.2)	From the figure given, if ∠POR and ∠QOR form a linear pair and $a-b=40^0$, what are the respective values of a and b?  a) $100^0,80^0$ b) $110^0,70^0$ c) $120^0,60^0$ d) $130^0,50^0$
Q.3)	Two parallel lines intersect each other at: a) One point b) Two points c) Three points d) None
Q.4)	The part of line with one end point is called as. a) Line b) Line segment c) None d) ray

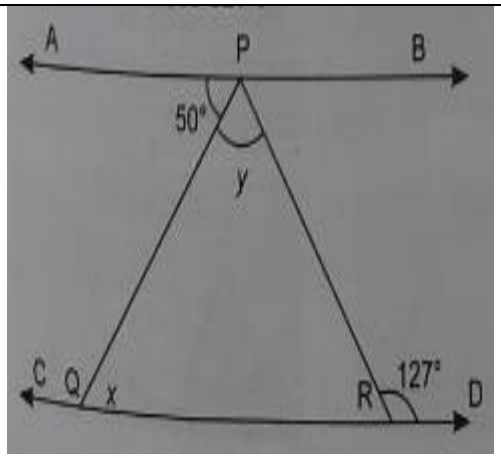
Q.5)	If three or more than three points lie on the same line these points are called as a) Line segment b) Linear points c) Collinear points d) None of these
Q.6)	The end point from which two distinct rays originates to form the angle is called as a) point b) vertex c) Collinear points d) None of these
Q.7)	The angle X is said to be obtuse when it's measure is a) Equal to 90^0 b) Less than 90^0 c) greater than 90^0 but less than 180^0 d) None of these
Q.8)	If X is the reflex angle, then it's measure lies between a) 0^0 to 90^0 b) 90^0 to 180^0 c) 180^0 to 270^0 d) 180^0 to 360^0
Q.9)	Find the value of x, y and z in fig  a) $x=90^0$, $y=110^0$, $z=80^0$

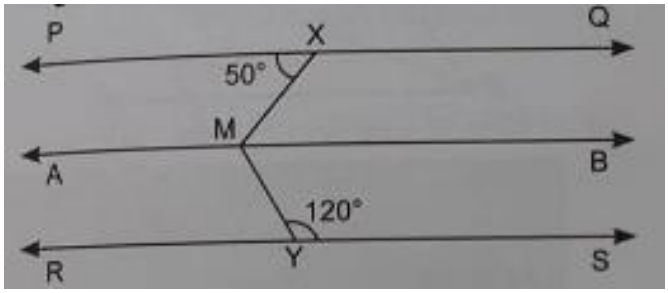
	b) $x=70^0$, $y=100^0$, $z=80^0$ c) $x=70^0$, $y=110^0$, $z=80^0$ d) $x=70^0$, $y=110^0$, $z=70^0$
Q.10)	Two angles whose sum is 90^0 are called a) acute angle b) right angle c) supplementary angle d) complementary angle
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q.1)	**There are two equinoxes every year in March (19 to 21) and September (21 to 24), when the Sun shines directly on the equator, and the length of the night and day are nearly equal. The same day a person is observing the position of the sun as follows-** 1. Early morning the sun is raising in the horizon "Zero angle". 2. Mid-morning the sun is getting higher an "Acute angle". 3. Noon the sun is at the zenith directly overhead "Right angle". 4. Afternoon the sun is setting lower an "Obtuse angle". 5. Evening the sun is ready to set. A very obtuse angle, almost a straight angle.

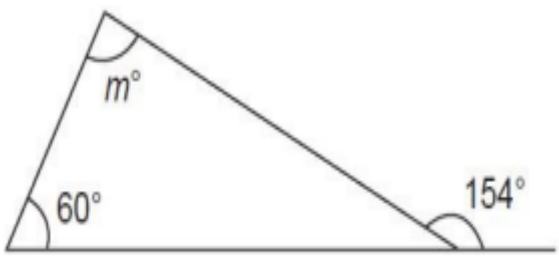
	 Using the above Idea answer the following question---
(i)	If $\angle 3 = 45^0$ and $\angle 4 = 30^0$ then $\angle 5$ = _____ a) 15° b) 65° c) 0° d) 180^0
(ii)	If $\angle 3 = 45^0$ and $\angle 4 = 30^0$, what is supplement of $\angle 3$? a) 130° b) 180° c) 145° d) 135°
(iii)	At noon the sun is at the zenith directly overhead, which angle is formed? a) Acute angle b) Obtuse angle c) Right angle d) Straight angle
(iv)	If $\angle 3 = 45^0$ and $\angle 4 = 30^0$ what is supplement of $\angle 5$? a) 135°

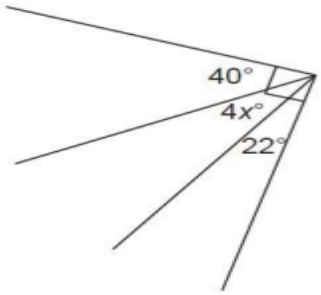
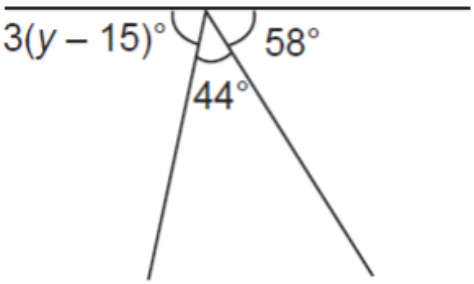
	b) 165° c) 145° d) 155°
(v)	In which month does two equinoxes come every year? a) April & September b) March & August c) March & September d) None of these
Q.2)	A farmer has a circular garden as shown in the picture above. He has a different type of tree, plants and flower plants in his garden. In the garden, there are two mango trees A and B at a distance of AB=10m.Similarly has two Ashoka trees at the same distance of 10m as shown at C and D. AB subtends ∠AOB=120^0 at the center O, The perpendicular distance of AC from center is 5m the radius of the circle is 13m. 
(i)	What is the measure of ∠OCD? a) 60° b) 120° c) 30° d) 100°

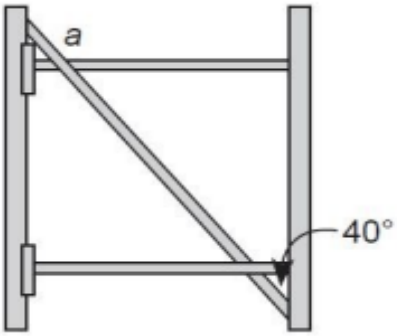
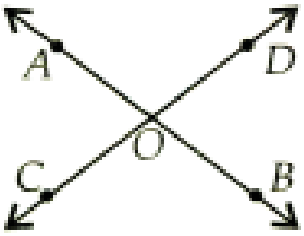
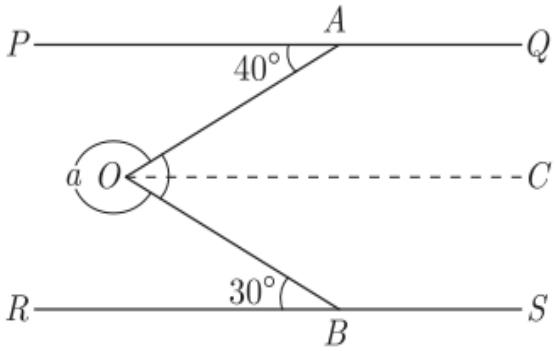
(ii)	What is the angle subtended by CD at the Centre O? a) 60° b) 120° c) 180° d) 100°
(iii)	What is the value of ∠OAB? a) 30° b) 120° c) 60° d) 100°
(iv)	What is the value of ∠ODC? a) 60° b) 120° c) 130° d) 30°
(v)	What is the distance between mango tree A and ashoka tree C? a) 12 b) 24 c) 36 d) 48
Q.3)	In Gurugram city, an under pass road is constructed in a tunnel shape whose cross section was in the form a triangle. In the figure AB is the roof of the under pass and CD is the ground level. The line AB and CD are parallel to each other i.e. AB || CD. The triangle PQR is the face of the cross section of the under pass. Also the angle ∠APQ measures 50° and angle ∠PRD measures 127°.

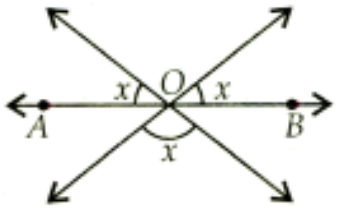
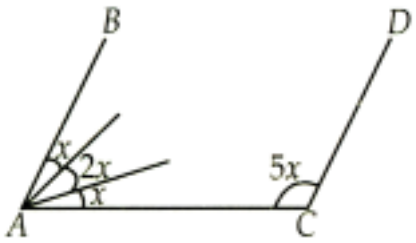
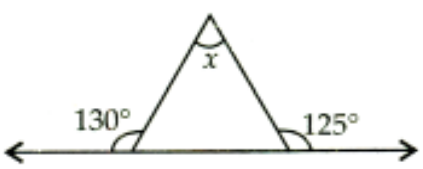
	
(i)	What is the value of x? a) 50° b) 120° c) 130° d) 30°
(ii)	What is the measure of the angle ∠PRQ? a) 61° b) 53° c) 30° d) 30°
(iii)	What is the value of y? a) 60° b) 12° c) 130° d) 77°
(iv)	What is the measure of ∠BPR? a) 60° b) 53° c) 10° d) 30°
(v)	What is the relation between the angles ∠BPR and ∠PRD? a) They are alternate interior angles. b) They are corresponding angles.

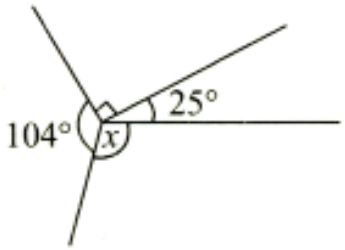
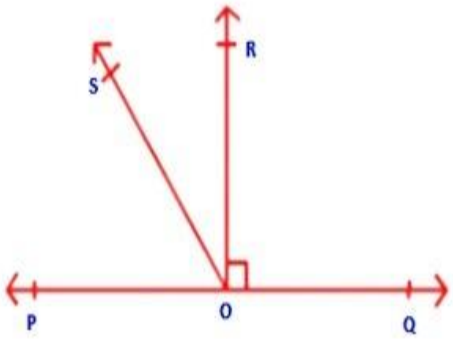
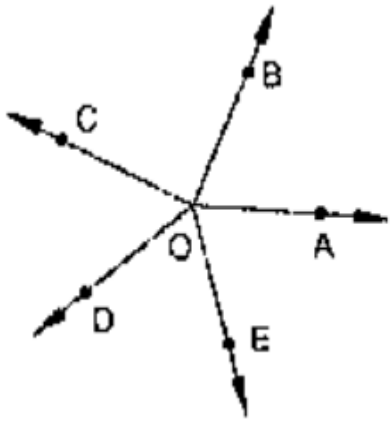
	c) They are consecutive interior angles. d) They are equal angles.
Q.4)	Two parallel roads PQ and RS are at the center of the city. It was decided to put two huge lamp posts at point X and Y and a statue of Mahatma Gandhi to be placed at point M with lots of palm trees to be planted along the line AB which is parallel to both PQ and RS. The area around M is to be decorated with flowering plants and greenery. The angle ∠PXM is of 50° and angle ∠MYS is of 120°. 
(i)	What is the measure of ∠XMB? a) 60° b) 45° c) 80° d) 50°
(ii)	What is the measure of the angle ∠YMB? a) 50° b) 80° c) 60° d) 75°
(iii)	What is the measure of the reflex angle ∠XMY? a) 190° b) 220° c) 250° d) 300°
(iv)	d) What is ratio between the angles ∠XMB and ∠YMB? a) 5:6 b) 2:3

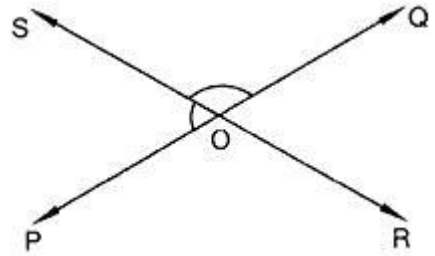
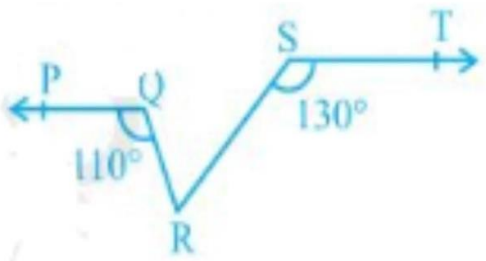
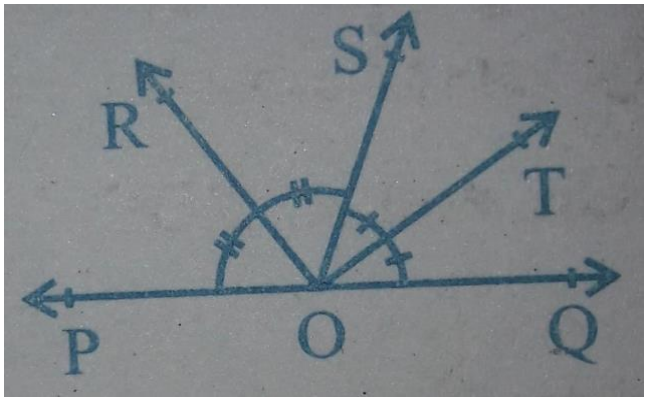
	c) 5:7 d) 3:5
(v)	The pair of angles ∠PXM and ∠BMX are known as: a) Consecutive interior angles b) Corresponding angles c) Alternative interior angles d) Reflexive angles
Q.5)	Our math teacher knows yoga. She asked Nitya to show yoga postures. She made marks on angles. She showed acute, obtuse and right angle through yoga postures.
	
(i)	The exterior angle of a triangle is equal to the a) sum of the two interior opposite angles. b) sum of the three interior angles. c) difference of two interior angles. d) opposite of the interior angle.
(ii)	The value of m in the figure is 

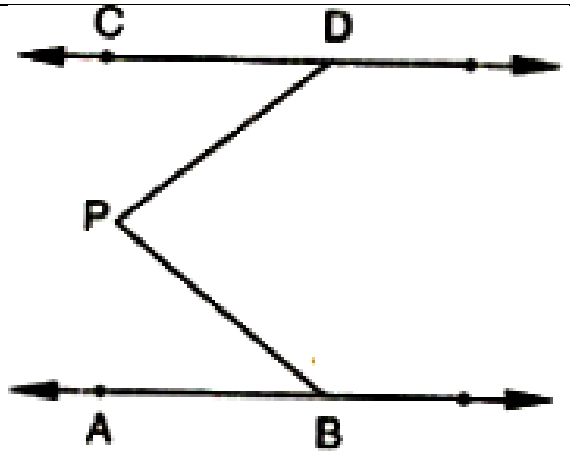
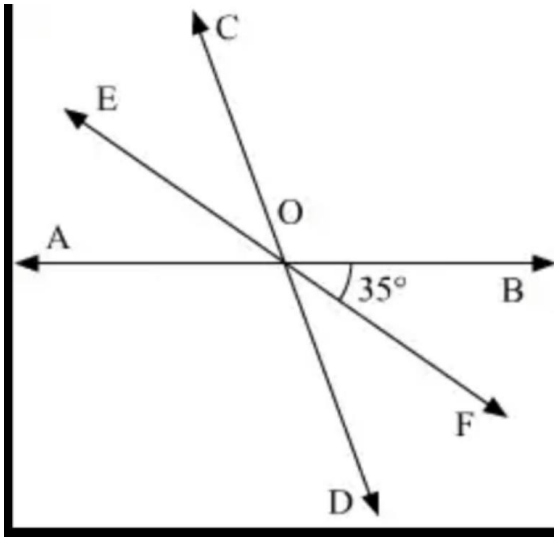
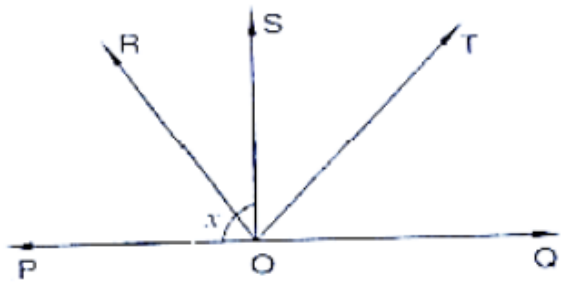
	a) 94° b) 214° c) 84° d) 26°
(iii)	The value of x in the figure is  a) 6° b) 9° c) 7° d) 4°
(iv)	The value of 'y' in the figure is  a) 39° b) 41° c) 45° d) 43°
(v)	Two gates consist of vertical posts, horizontal struts and diagonal beams. The angle 'a' from the figure is:

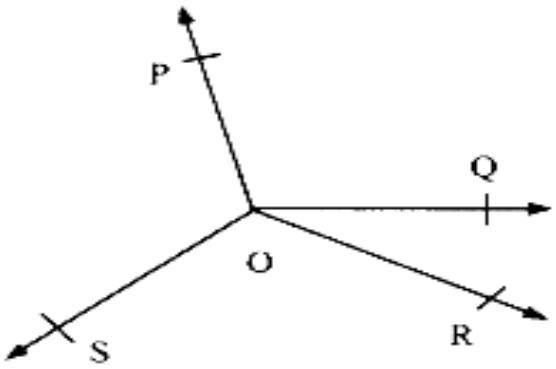
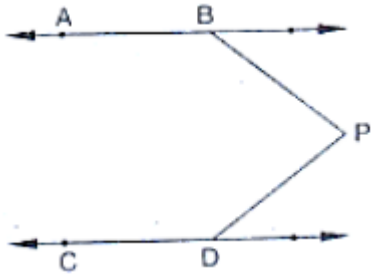
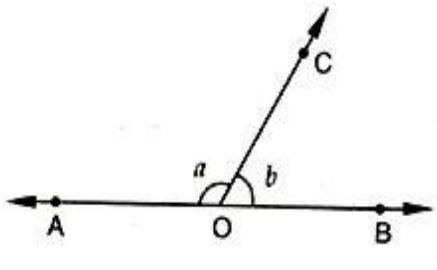
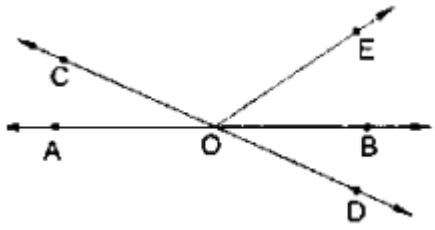
	 a) 140° b) 40° c) 120° d) 50°
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q.1)	An angle is 18^0 less than its complementary angle. The measure of this angle is …….
Q.2)	Line AB and CD intersect at O. If ∠ AOC = $(3x - 10^0)$ and ∠BOD=(20^0-2x), then the value of x is ……. 
Q.3)	Bisectors of the adjacent angles forming a linear pair form a right angle. (True / false)
Q.4)	In the figure, angle a is 

Q.5)	If angle with measure x and y form a complementary pair, then angles $(x + 47^0)$, $(y + 43^0)$ will form a supplementary pair. (True / false)
Q.6)	Lines which are parallel to the same lines are …… to each other.
Q.7)	The value of x if AOB is a straight line, is……. 
Q.8)	Three points will be collinear only when they lie on a line. (True / false)
Q.9)	If two lines intersect each other, then the ……. angles are equal.
Q.10)	If the sum of two adjacent angles is 180^0, then the non-common arms of the angles are in a straight line. (True / false)
	SHORT ANSWER TYPE QUESTIONS
Q.1)	Supplement of angle is one fourth of itself. What is the measure of the angle?
Q.2)	If the supplement of an angle is three times its complement, then what will be the angel?
Q.3)	If AB ll CD, what is the value of x? 
Q.4)	Find the value of x. 

Q.5)	In Δ ABC, ∠A: ∠B: ∠C = 2 : 3 : 5, then find the value of angle B.
Q.6)	Calculate the value of x. 
Q.7)	In Fig., POQ is a line. Ray OR is perpendicular to line PQ. OS is another  ray lying between rays OP and OR. Prove that $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$.
Q.8)	In the given below fig, rays OA, OB, OC, OP and OE have the common end point O. Show that ∠AOB + ∠BOC + ∠COD + ∠DOE + ∠EOA = 360°. 

Q.9)	In Fig., lines PQ and RS intersect each other at point O. If ∠ POR: ∠ ROQ = 5 : 7, find all the angles. 
Q.10)	In Fig., if PQ || ST, ∠ PQR = 110° and ∠ RST = 130°, find ∠ QRS. 
	LONG ANSWER TYPE QUESTIONS
Q.1)	In Fig., ray OS stands on a line POQ. Ray OR and ray OT are angle bisectors of ∠ POS and ∠ SOQ, respectively. If ∠ POS = x, find ∠ ROT. 
Q.2)	If one of the four angles formed by two intersecting lines is a right angle, then show that each of the four angles is a right angle.
Q.3)	In the below fig, lines AB and CD are parallel and P is any point as shown in the figure. Show that ∠ABP + ∠CDP = ∠DPB.

	
Q.4)	Two lines AB and CD intersect at O. If ∠AOC + ∠COB + ∠BOD = 270°, find the measures of ∠AOC, ∠COB, ∠BOD and ∠DOA.
Q.5)	AB, CD and EF are three concurrent lines passing through the point O such that OF bisects ∠BOD. If ∠BOF = 35°, find ∠BOC and ∠AOD 
Q.6)	In below fig, ray OS stand on a line POQ. Ray OR and ray OT are angle bisectors of ∠POS and ∠SOQ respectively. If ∠POS = x, find ∠ROT. 
Q.7)	In Fig., OP, OQ, OR and OS are four rays. Prove that ∠ POQ + ∠ QOR + ∠ SOR + ∠ POS = 360°

	
Q.8)	In the below fig, AB || CD and P is any point shown in the figure. Prove that: ∠ABP+∠BPD+∠CDP = 360° 
Q.9)	In the below Fig, ∠AOC and ∠BOC form a linear pair. if a − 2b = 30°, find a and b. 
Q.10)	In below figure, lines AB and CD intersect at O. If ∠AOC + ∠BOE = 70° and ∠BOD = 40°, find ∠BOE and reflex ∠COE. 

	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans. 1)	$2x+5y=180^0$ $\Rightarrow 2(30) + 5y=180$ $\Rightarrow y=24^0$ So Ans is (b)
Ans. 2)	$b+a=180^0$ …….(1) (Linear pair) $a-b=40^0$ ……..(2) by solving both equations $\Rightarrow a=110^0$, $b=70^0$ So Ans is (b)
Ans. 3)	Ans is (d), None
Ans. 4)	Ans is (d), ray
Ans. 5)	Ans is (c), Collinear points
Ans. 6)	Ans is (b), vertex
Ans. 7)	Ans is (c), greater than 90^0 but less than 180
Ans. 8)	Ans is (c), 180^0 to 270^0
Ans. 9)	Ans is (d), $x=70^0$,$y=110^0$,$z=70^0$
Ans. 10)	Ans is (d), complementary angle
	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
ANS. 1)	
(i)	$\angle 3+\angle 4+\angle 5 = 90^0$ $45^0+30^0 +\angle 5 = 90^0$ $\angle 5 = 15^0$ Ans. (a)
(ii)	135° Ans. (d)
(iii)	Right angle Ans. (c)
(iv)	165° Ans. (b)
(v)	Ans. (c)

ANS. 2)	
(i)	∠OCD = ∠ODC, as OC = OD => ∠OCD + ∠ODC + ∠COD = 180° => 2∠OCD + 120° = 180° => ∠OCD = 30° Ans. (c)
(ii)	120° Ans. (b)
(iii)	∠OCD = ∠ODC as OC = OD => ∠OCD + ∠ODC + ∠COD = 180° => 2∠OCD + 120° = 180° => ∠OCD = 30° ∠ODC = 30° Similarly ∠OAB = 30° Ans. (a)
(iv)	∠OCD = ∠ODC as OC = OD => ∠OCD + ∠ODC + ∠COD = 180° => 2∠OCD + 120° = 180° => ∠OCD = 30° ∠ODC = 30° Ans. (d)
(v)	Distance between A & C = 2 (√(13² - 5²) = 2(12) = 24 m Ans. (b)
ANS. 3)	
(i)	∠ PQD = ∠ APQ ∠ PQD = 50° Ans. (a)
(ii)	∠ PRQ + 127° = 180° ∠ PRQ = 53° Ans. (b)

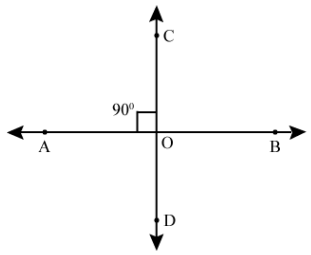
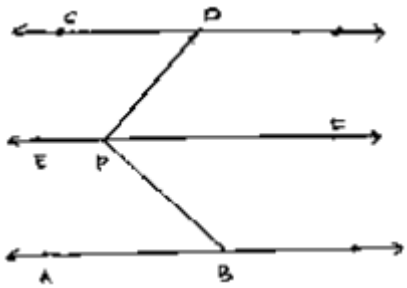
(iii)	∠ PRD = ∠ APR 127° = 50°+ y y= 77° Ans. (d)
(iv)	50°+ y + ∠ BPR = 180° 50°+ 77° + ∠ BPR = 180° ∠ BPR = 53° Ans. (b)
(v)	Ans. (c)
ANS. 4)	
(i)	∠PXM =∠XMB = 50° Ans. (d)
(ii)	∠RYM +∠MYS = 180° ∠RYM = 180°- 120°=60° ∠RYM = ∠YMB=60° Ans. (C)
(iii)	∠ XMY =∠XMB+ ∠YMB =50°+60°=110° So reflex angle of ∠XMY = 360°-110°= 250° Ans. (C)
(iv)	∠XMB : ∠YMB = 50 : 60 = 5:6 Ans. (a)
(v)	Ans. (c)
ANS. 5)	
(i)	e) sum of the two interior opposite angles.
(ii)	we know that, • Exterior angle of a Δ is equal to sum of two opposite interior angles. so, m° + 60° = 154° m° = 154° - 60° m° = 94° so Ans. is (a)
(iii)	40° + 4x° + 22° = 90°

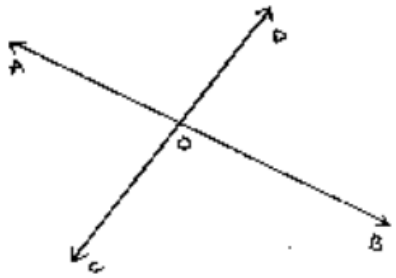
	$4x° = 90°- 40° - 22° = 28°$ $x = 7°$ so Ans. is (c)
(iv)	$3 (y - 15)° + 44° + 58° = 180°$ $3 (y - 15)° = 78°$ $3 y - 45° = 78°$ $y= 41°$ so Ans. is (b)
(v)	Ans. is (a)
	SOLUTIONS TO OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
ANS.1)	(a) 36^0 Let the angle be x . its complement = $x + 18^0$ Now, $x + x + 18^0 = 90^0$ $2x = 90^0 - 18^0$ $2x = 72^0$ $x = 36^0$
ANS.2)	Since vertically opposite angles are always equal $(3x - 10^0) = (20^0 - 2x)$ $3x + 2x = 20^0 + 10^0$ $5x = 30^0$ $x = 6^0$
ANS.3)	True
ANS.4)	$\angle PAO = \angle AOC = 40$ $\angle RPD = \angle BOC = 30$ $\angle a = 360^0 -70^0 - = 290^0$
ANS.5)	True
ANS.6)	parallel
ANS.7)	$\angle 1 = x$ [Vertically opposite angles] Since, AOB is a straight line $x + x + x = 180^0$ $3x = 180^0$ $x = 60^0$

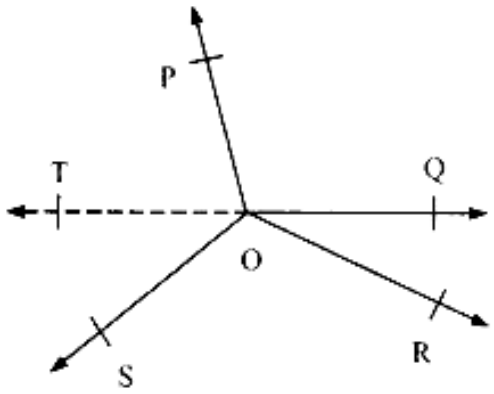
ANS.8)	True
ANS.9)	Vertically opposite.
ANS.10)	True
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
ANS.1)	Let the angle be x its supplement $\frac{1}{4}$ of x $=\frac{1}{4}$ x $x + \frac{1}{4} x = 180^0$ $x = 144^0$
ANS.2)	Let the angle be x. Complement of x = 90^0 - x Supplement of x = 180^0 - x Given that, 180^0 - x = 3 (90^0 - x) 180^0 - x = 270^0 - 3x 2x = 270^0 - 180^0 x =45^0
ANS.3)	Since AB ll CD x + 2x + x + 5x = 180^0 [Co-interior angles] 9x = 180^0 x = 20^0
ANS.4)	x + (180^0 - 130^0) + (180^0 - 125^0) = 180^0 [Angle sum property of a triangle] x + 50^0 + 55^0 = 180^0 x = 75^0
ANS.5)	∠A: ∠B : ∠C = 2 : 3 : 5 ∠A = 2x , ∠B = 3x , ∠C = 5x ∠A +∠B +∠C = 2x + 3x + 5x = 10x 10x = 180^0 [Angle sum property of a triangle] x = 18^0 ∠B = 3 x 18c = 54^0
ANS.6)	From the figure 104^0 + 90^0 + 25^0 + x = 360^0 [Complete Angle]

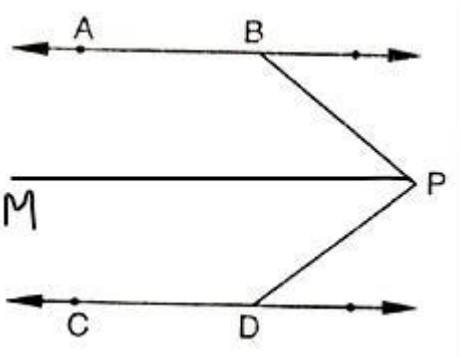
	$x = 360^0 - 219$ $x = 141^0$
ANS.7)	∠POR =∠QOR = 90° (Perpendicular) Now, ∠POR=90° ∠POS + ∠ROS=90°=∠QOR ∠POS + ∠ROS=∠QOR On adding ∠ROS both sides, ∠POS + ∠ROS+∠ROS =∠QOR+∠ROS ∠POS+ 2∠ROS= ∠QOS [∠QOS=∠QOR+∠ROS] 2∠ROS= ∠QOS - ∠POS ∠ROS= ½[∠QOS - ∠POS] Hence, ∠ROS= ½[∠QOS - ∠POS]
ANS.8)	Given that Rays OA, OB, OD and OE have the common end point O. A ray of opposite to OA is drawn Since ∠ AOB and ∠BOF form a linear pair ∠ AOB + ∠ BOF = 180° ∠AOB + ∠ BOC + ∠COF = 180°…….(1) Also ∠ AOE, ∠ EOF form a linear pairs ∠ AOE + ∠ EOF = 180° ∠AOE + ∠ DOF + ∠DOE = 180°…….(2) By adding (1) and (2) equations we get ∠AOB + ∠ BOC + ∠COF +∠AOE + ∠ DOF + ∠DOE = 360° ∠AOB + ∠ BOC + ∠COD +∠DOE + ∠EOA = 360° Hence proved.
ANS.9)	Given : ∠POR : ∠ROQ = 5 : 7 Let ∠POR = 5x & ∠ROQ = 7x By Linear pair axiom, ∠POR + ∠ROQ = 180° 5x + 7x = 180° 12x = 180° x = 180/12 x = 15°

	so, $\angle POR = 5x = 5 \times 15 = 75°$ $\angle ROQ = 7x = 7 \times 15 = 105°$ then, $\angle POR = \angle QOS = 75°$(vertically opposite angles) $\angle ROQ = \angle POS = 105°$ (vertically opposite angles)
ANS.10)	PQR+QRX = 180° Or, QRX = 180°-110° QRX = 70° Similarly, RST +SRY = 180° Or, SRY = 180°- 130° SRY = 50° Now, for the linear pairs on the line XY- QRX+QRS+SRY = 180° Putting their respective values, we get, QRS = 180° – 70° – 50° Hence, QRS = 60°
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
ANS.1)	Ray OS stands on the line POQ. Therefore, $\angle POS + \angle SOQ = 180°$ But, $\angle POS = x$ Therefore, $x + \angle SOQ = 180°$ So, $\angle SOQ = 180° - x$ Now, ray OR bisects $\angle POS$, therefore, $\angle ROS = 1 / 2 \times \angle POS = x/2$ $\angle SOT = 1 / 2 \times \angle SOQ = 1 / 2 \times (180° - x) = 90° - x/2$ Now, $\angle ROT = \angle ROS + \angle SOT = x /2 + 90° - x /2 = 90°$
ANS.2)	Given Two lines AB and CD intersect each other at O. $\angle AOC=90^0$ To prove: $\angle AOD=\angle BOC=\angle BOD=90^0$

	 Proof: ∵ AB and CD intersect each other at O ∴∠AOC=∠BOD and ∠BOC=∠AOD (Vertically opposite angles) But ∠AOC=90^0 ∠BOD=90^0 ∴∠AOC+∠BOC=180^0 (Linear pair) ⇒90^0+∠BOC=180^0 ∠BOC=90^0 ∠AOD=∠BOC=90^0 ∠AOD=∠BOC=∠BOD=90^0
ANS.3)	AB ∥ CD Let, EF be the parallel line to AB and CD which passes through P.  It can be seen from the figure that alternate angles are equal ∠ABP = ∠BPF alternate angles are equal ∠CDP = ∠DPF ∠ABP + ∠CDP = ∠BPF + ∠DPF ∠ABP + ∠CDP = ∠DPB Hence, proved
ANS.4)	∠AOC + ∠COB + ∠BOP = 270° To find: ∠AOC, ∠COB, ∠BOD and ∠BOA

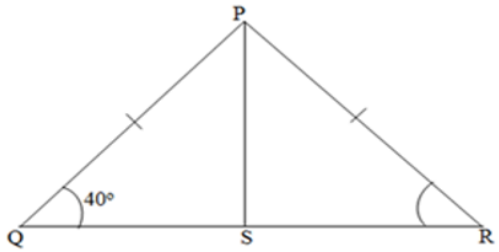
	 Here, ∠AOC + ∠COB + ∠BOD + ∠AOD = 360° (Complete angle) 270° + ∠AOD = 360° ∠AOD = 360° – 270° = 90° Now, ∠AOD + ∠BOD = 180° (Linear pair) 90° + ∠BOD = 180° Therefore, ∠BOD = 90° ∠AOD = ∠BOC = 90° (Vertically opposite angle) ∠BOD = ∠AOC = 90° (Vertically opposite angle)
ANS.5)	Given OF bisects ∠BOD ∠BOF = 35° ∠BOC = ? ∠AOD = ? ∠BOD = 2∠BOF = 70° (Therefore, OF bisects ∠BOD) ∠BOD = ∠AOC = 70°(Vertically opposite angle) Now, ∠BOC + ∠AOC = 180° ∠BOC + 70° = 180° ∠BOC = 110° So, ∠AOD = ∠BOC = 110° (Vertically opposite angle)
ANS.6)	Given that, Ray OS stand on a line POQ Ray OR and OT are angle bisector of ∠POS and ∠SOQ respectively. ∠POS = x ∠POS + ∠QOS = 180°(Linear pair) ∠QOS = 180° – x

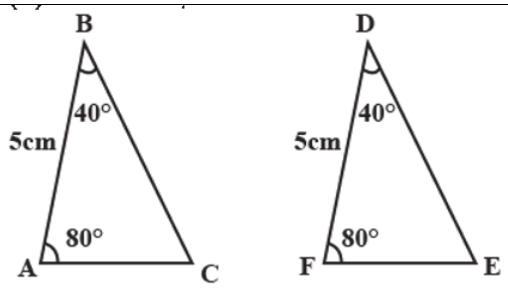
	∠ROS = ½ ∠POS (Given) = ½ x ∠ROS = x/2 Similarly, ∠TOS = (90° - x/2) Therefore, ∠ROT = ∠ROS + ∠ROT = x/2 + 90° - x/2 x2 = 90° Therefore, ∠ROT = 90°
ANS.7)	In Fig., you need to produce any of the rays OP, OQ, OR or OS backwards to a point. Let us produce ray OQ backwards to a point T so that TOQ is a line (see Fig.).  Now, ray OP stands on line TOQ. Therefore, ∠ TOP + ∠ POQ = 180° ……(1) (Linear pair axiom) Similarly, ray OS stands on line TOQ. Therefore, ∠ TOS + ∠ SOQ = 180° …… (2) But ∠ SOQ = ∠ SOR + ∠ QOR So, (2) becomes ∠ TOS + ∠ SOR + ∠ QOR = 180° ……(3) Now, adding (1) and (3), you get ∠ TOP + ∠ POQ + ∠ TOS + ∠ SOR + ∠ QOR = 360° ……. (4) But ∠ TOP + ∠ TOS = ∠ POS Therefore, (4) becomes ∠ POQ + ∠ QOR + ∠ SOR + ∠ POS = 360°

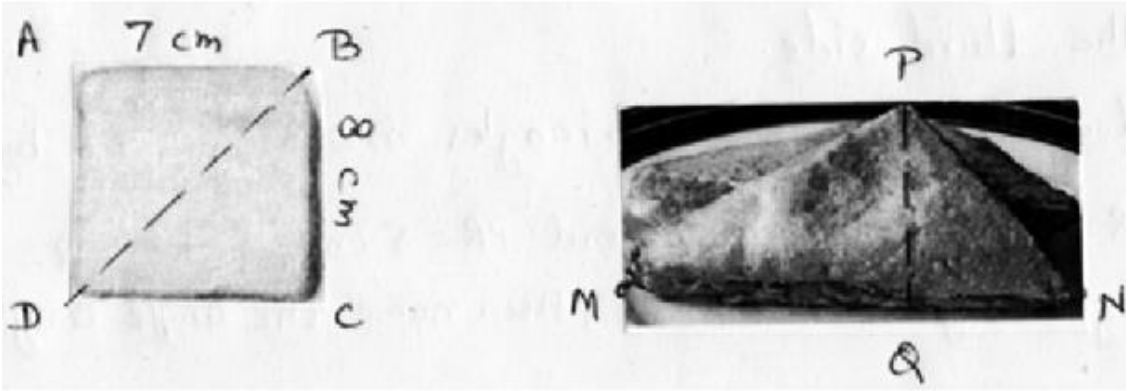
ANS.8)	To Prove: ∠ABP + ∠BPD + ∠CDP = 360° Proof: Construction: Through P draw a line PM ‖ AB or CD.  Since, AB ‖ PM and AB ‖ CD Therefore, AB ‖ PM ∠ABP + ∠BPM = 180° ……(1) CD ‖ PM ∠MPD + ∠CDP = 180° …….(2) Adding eq. (1) and (2), we get ∠ABP + (∠BPM + ∠MPD) + ∠CDP = 360° ∠ABP + ∠BPD + ∠CDP = 360° Hence proved.
ANS.9)	Given : ∠AOC and ∠BOC form a linear pair. If a - 2b = 30°. *∠AOC = a and ∠BOC = b* Therefore, a + b = 180° ……...(i) (a – 2b) = 30° ……(ii) On subtracting equation (2) from (1), we get : a + b - (a – 2b) = 180° – 30° a + b – a + 2b = 180° – 30° 3b = 150° b = 150°/3 b = 50° Since, (a – 2b) = 30° On putting the value of b = 50°

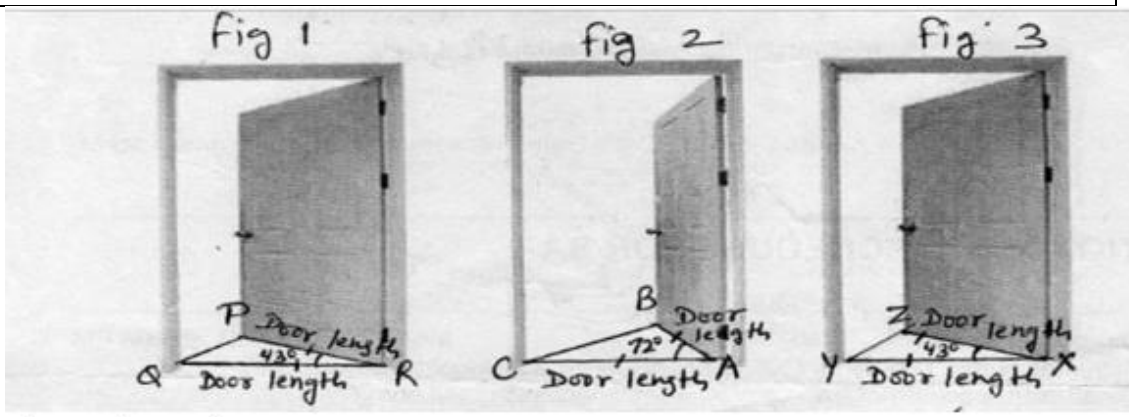
	a – 2 (50) = 30° a – 100° = 30° a = 100°+ 30° a = 130° Hence, the values of a and b are 130° and 50° .
ANS.10)	Lines AB and CD intersect at O. ∠AOC + ∠BOE = 70° (Given) …(1) ∠BOD = 40° (Given) …(2) Since, ∠AOC = ∠BOD (Vertically opposite angles) Therefore, ∠AOC = 40° [From (2)] and 40° + ∠BOE = 70° [From (1)] ⇒ ∠BOE = 70° – 40° = 30° Also, ∠AOC + ∠BOE + ∠COE = 180° (∵ AOB is a straight line) 70° + ∠COE = 180° [From (1)] ⇒ ∠COE = 180° – 70° = 110° Now, reflex ∠COE = 360° – 110° = 250° Hence, ∠BOE = 30° and reflex ∠COE = 250°

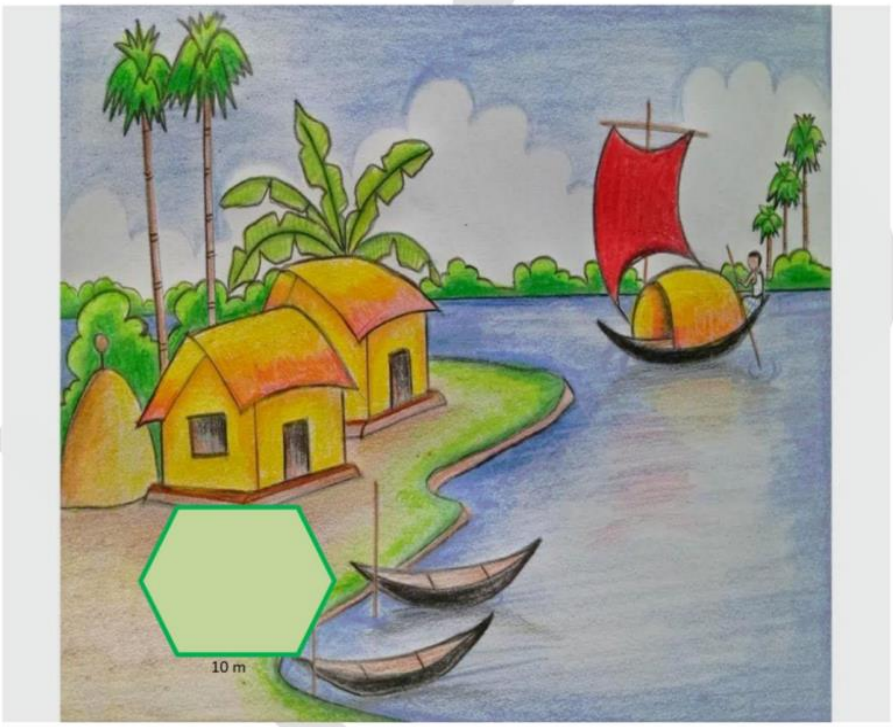
CHAPTER 06: TRIANGLES

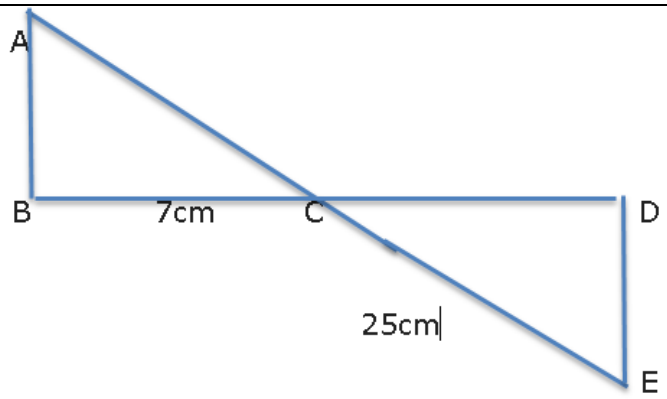
	COMPETENCY BASED QUESTIONS
Q1	In triangles ABC and DEF, AB = FD and ∠A = ∠D. The two triangles will be congruent by SAS axiom if (a) BC = EF (b) AC = DE (c) AC = EF (d) BC = DE
Q2	In the given figure, PS is the median then ∠QPS? a) 40^o b) 90^o c) 80^o d) 50^o
	
Q3	In triangles ABC and DEF, AB = FD and ∠A = ∠D. The two triangles will be congruent by ASA axiom if: a) ∠A = ∠F b) ∠C = ∠D c) ∠B = ∠F d) None
Q4	In two triangles DEF and PQR, if DE = QR, EF = PR and FD = PQ, then a) ΔDEF ≅ ΔPQR b) ΔFED ≅ ΔPRQ c) ΔEDF ≅ ΔRPQ d) ΔPQR ≅ ΔEFD

Q 5	Two sides of a triangle are of length 5 cm and 1.5 cm. The length of the third side of the triangle cannot be: a) 3.6 cm b) 4.1 cm c) 3.8 cm d) 6.9 cm
Q 6	In ΔABC, ∠C = ∠A and BC = 4 cm and AC = 5 cm, then find length of AB. (a) 5 cm (b) 3 cm (c) 4 cm (d) 2.5 cm
Q 7	It is given that ΔABC ≅ ΔFDE and AB = 5 cm, ∠B = 40° and ∠A = 80°. Then which of the following is true? (a) DF = 5 cm, ∠F = 60° (b) DF = 5 cm, ∠E = 60° (c) DE = 5 cm, ∠E = 60° (d) DE = 5 cm, ∠D = 40°
	 Congruent triangles
Q 8	In triangles ABC and PQR, AB = AC, ∠C = ∠P and ∠B = ∠Q. The two triangles are: a) Isosceles but not congruent b) Isosceles and congruent c) Congruent but not isosceles d) Neither congruent nor isosceles

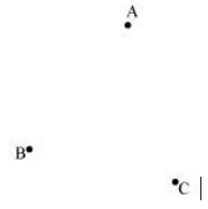
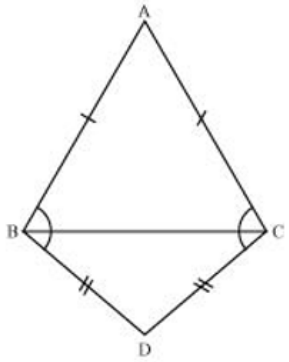
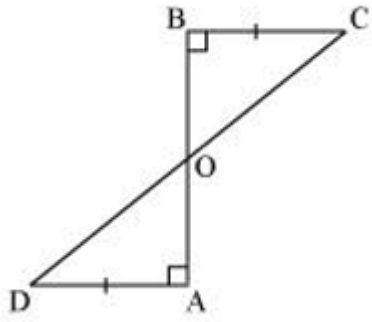
Q 9	In a triangle ABC, ∠B = 35° and ∠C = 60°, then a) ∠A = 80° b) ∠A = 85° c) ∠A = 120° d) ∠A = 145°
Q10	If in ΔPQR, PQ = PR then: a) ∠P = ∠R b) ∠P = ∠Q c) ∠Q = ∠R d) None of these
	CASE STUDY/ SOURCE BASED INTEGRATED QUESTIONS
Q 1	One Sunday morning, Amita decided to have bread-pakodas in breakfast. For preparation, she divided a rectangular bread diagonally into two parts. She served bread-pakodas in a plate of diameter 20cm. On arrival of some guests, she cut the bread-pakoda from the middle as shown in the figure. She served these small bread-pakodas in a plate ofradius 8cm. Everybody enjoyed bread-pakodas with tea.
	
(i)	After cutting rectangular bread diagonally, which type of triangular bread is obtained? (a) Equilateral (b) Scalene **(c) Isosceles** **(d) Irregular**

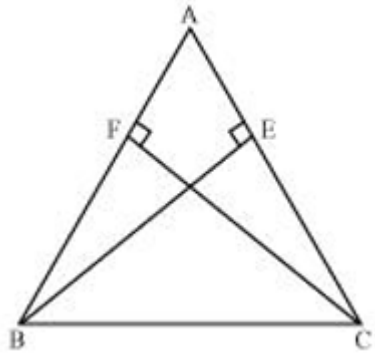
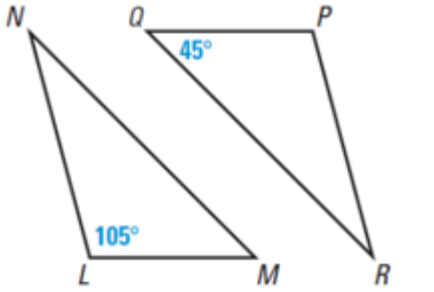
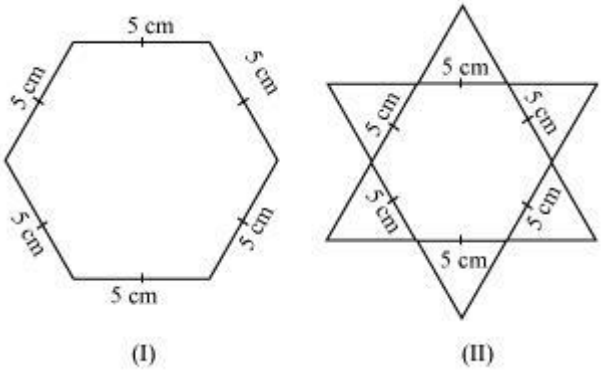
(ii)	The line-segment that divided the bread-pakoda from the middle is called. (a)Diagonal (b)AItitude **(c) Base** **(d) Median**
(iii)	What is the smallest diameter of the circular plate in which the piece of bread-pakoda can be serve? a) $\sqrt{110}$ cm (b) $\sqrt{111}$ cm **(c)** $\sqrt{112}$ **cm** **(d)** $\sqrt{113}$ **cm**
(iv)	Which of the following is true based on the images? (a)MQ=QN (b)ΔABD ≅ ΔCDB (c) PM+PN=MN (d) ΔPQM ≅ ΔPQN
(v)	Name the largest angle in the bread-pakoda. (a) QMP (b) QNP (c)NPM (d) MPQ
Q 2	Ritesh opened the door at an angle of 43° to enter the class. In the recess, he came out of the class by opening the door at an angle of 72°. After the recess, he again opened the door at 43° and entered the class. The door length is 80cm.
	
(i)	The type of the triangle formed by opening the door is (a) Equilateral (b) Isosceles (c) Scalene (d) Irregular
(ii)	Which of the following triangles are congruent? (b) ΔPQR andΔ ABC (b) ΔPQR and ΔZYX **(c) ΔABC and ΔXYZ** **(d) ΔACB and ΔXYZ**
(iii)	What is the congruency criteria for these two triangles? (c) SSS (b)ASA **(c) SAS** **(d) RHS**
(iv)	In figure 2, which is the largest side?

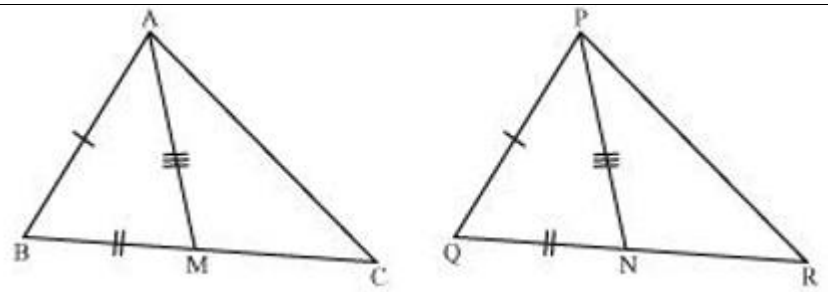
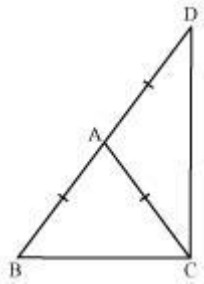
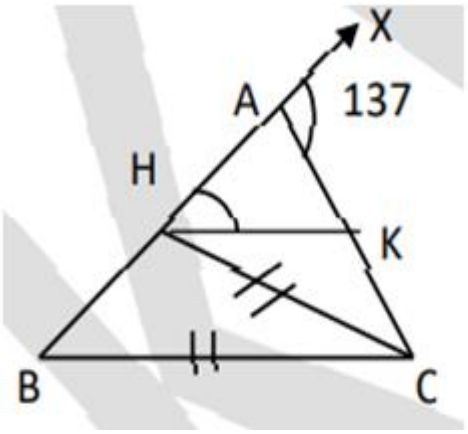
	(a) BC (b)AB (c)AC (d)AII sides are equal
Q 3	Dinesh has a regular hexagonal shaped plot in a corner of village Ramgarh. Each side of the hexagonal plot is 10 m. He wants to fill the hexagonal shaped plot by equilateral triangles shaped tiles. 
(i)	How many equilateral triangles of side 10 m are there in the hexagonal plot? A. 2 B. 4 C. 6 D. 8
(ii)	What is the area of the hexagonal shaped plot? A. $100\sqrt{3}$ m^2 B. $150\sqrt{3}$ m^2 C. $200\sqrt{3}$ m^2 D. $250\sqrt{3}$ m^2
(iii)	If each side of equilateral triangular shaped tile is 2 m, then what is the area of each tile? (a) $\sqrt{2}$ (b) $\sqrt{3}$ (c) $\sqrt{4}$ (d) $\sqrt{5}$

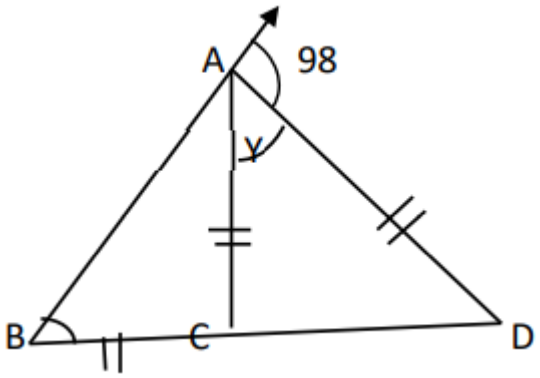
(iv)	What is the number of equilateral triangular tiles of side 2 m that is required to fill the hexagonal plot? A. 150 B. 200 C. 250 D. 300
Q 4	There is a river is in a village. The villagers want to measure its breadth without crossing the river as force of water's current is very high. Aniket a student of class IX of their village came and told "I can measure the breadth of the river without crossing it." He came on the bank of river at a point A and imagines a point B just opposite on the other bank. He moved to C and then D such that C is the equidistant from A and D. Then he moves to E such that A, C and E are the on the same line.
	
(i)	Is ΔABC and ΔEDC congruent?
(ii)	What congruence criteria she uses to find the breadth of the river? A. SAS B. ASA C. SSS D. RHS
(iii)	What is the length of DE? A. 5 metres B. 7 metres C. 24 metres D. 30 metres.
(iv)	If BC = 7 m and CE = 25 m, find the breadth of the river. A. 18 metres

	B. 20 metres C. 22 metres D. 24 metres.
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q 1	In Δ ABC, AB=AC and $\angle$B=40°. Find $\angle$C.
Q 2	Write correct symbolic form of congruency if AB=QR, BC=PR and CA=PQ.
Q 3	The_____is the largest side of a right-angled triangle.
Q 4	What does 'R' stands for in RHS congruence?
Q 5	Choose the correct answer If two sides and the included angle of one triangle are equal to two sides and the included angle of the other triangle, then the two triangles are congruent. _____ (SAS, ASS, SSS)
Q 6	Choose the correct answer If two angles and the included side of one triangle are equal to two angles and the included side of the other triangle, then the two triangles are congruent. _____ (ASA, ASS, SSS).
Q 7	**Two circles are congruent if their _____are same.**
Q 8	State true/false Two angles opposite to the two equal sides of an isosceles triangle are also equal.
Q 9	State true/false If there are two right-angled triangles then they will be congruent if their hypotenuse and any one side are equal.
Q 10	State true/false If the two angles and a side of one triangle is respectively equal to the two angles and a side of another triangle, then they are called congruent triangles.
	SHORT ANSWER TYPE QUESTIONS
Q 1.	In a huge park people are concentrated at three points (see the given figure)

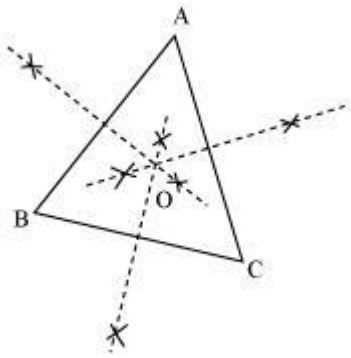
	
	A: where there are different slides and swings for children, B: near which a man-made lake is situated, C: which is near to a large parking and exit. Where should an ice-cream parlour be set up so that maximum number of persons can approach it?
Q 2.	ABC is an isosceles triangle with AB = AC. Drawn AP ⊥ BC to show that ∠B = ∠C.
Q 3	ABC and DBC are two isosceles triangles on the same base BC (see the given figure). Show that ∠ABD = ∠ACD.
	
Q 4	AD and BC are equal perpendiculars to a line segment AB (See the given figure). Show that CD bisects AB.
	
Q 5	ABC is an isosceles triangle in which altitudes BE and CF are drawn to equal sides AC and AB respectively (see the given figure). Show that these altitudes are equal.

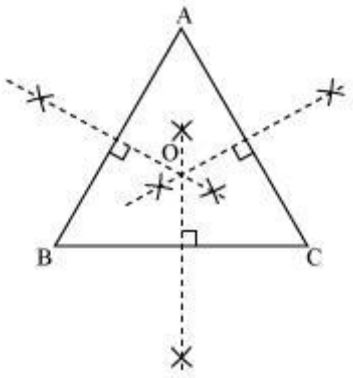
	
Q 6.	ABC is a triangle. Locate a point in the interior of ΔABC which is equidistant from all the vertices of ΔABC.
Q 7	Find the ∠P, ∠R, ∠N and ∠M if ΔLMN ≅ ΔPQR.
	
	LONG ANSWER TYPE QUESTIONS
Q 1	Show that in a right-angled triangle, the hypotenuse is the longest side.
Q 2	How many equilateral triangles of side 1 cm as you can make in the following figures? Which has more number of triangles? 
Q 3	Two sides AB and BC and median AM of one triangle ABC are respectively equal to sides PQ and QR and median PN of ΔPQR (see the given figure). Show that: (i) ΔABM ≅ ΔPQN (ii) ΔABC ≅ ΔPQR

	
Q 4	In right triangle ABC, right angled at C, M is the mid-point of hypotenuse AB. C is joined to M and produced to a point D such that DM = CM. Point D is joined to point B (see the given figure). Show that: (i) ΔAMC ≅ ΔBMD (ii) ∠DBC is a right angle. (iii) ΔDBC ≅ ΔACB
Q 5	ΔABC is an isosceles triangle in which AB = AC. Side BA is produced to D such that AD = AB (see the given figure). Show that ∠BCD is a right angle. 
Q 6	Show that the angles of an equilateral triangle are 60º each.
Q 7	BE and CF are two equal altitudes of a triangle ABC. Using RHS congruence rule, prove that the triangle ABC is isosceles.
Q 8	If AB = AC, CH = CB and HK || BC and ∠CAX=137
	

	1) Calculate the angle of ∠ACB. 2) Calculate the angle of∠ CHK. 3) Calculate the angle ∠AHK. 4) Sum of ∠CBH and ∠AHK
Q 9	From the adjoining figure ABD. Angle ABC = x and angle CAD = y. AC = BC, AC = AD
	
	A. Find the value of x. B. Find the value of y. C. Find∠ ADC. D. Find∠ BAD.
	SOLUTIONS TO COMPETENCY BASED QUESTIONS 1. b 2. b 3. c 4. b 5. d 6. c 7. b 8. a 9. b 10. c

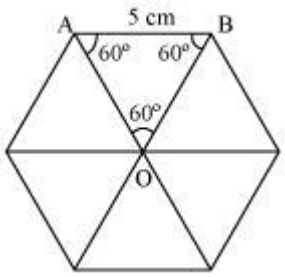
	SOLUTIONS TO case study TYPE QUESTIONS CS-1 ANSWERS 1. Scalene 2. (a) diagonal 3. (d) $\sqrt{113}$ 4. b) ΔABD ≅ ΔCDB 5. a) IP CS-2 ANSWERS i)b) Isosceles ii)b) ΔPQR and ΔZYX iii) c) SAS iv) (a) BC CS-3 i) C ii) B iii) Root 3 iv) A CS-4 i) Correct explanation ii) b iii)c iv)d
	SOLUTIONS of Objective TYPE QUESTIONS
	1. 40° 2. ABC -QRP 3. Hypotenuse 4. Right angle 5. SAS 6. ASA 7. Radii 8. True

	9. True 10. True
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
1.	A, B and C form a triangle. In a triangle, the circumcentre is the only point that is equidistant from its vertices. So, the ice-cream parlour should be set up at the circumcentre O of ΔABC.  In this situation, maximum number of persons can approach it. We can find circumcentre O of this triangle by drawing perpendicular bisectors of the sides of this triangle.
2	In ΔAPB and ΔAPC, ∠APB = ∠APC (Each 90º) AB =AC (Given) AP = AP (Common) ∴ ΔAPB ≅ ΔAPC (Using RHS congruence rule) ⇒ ∠B = ∠C (By using CPCT)
3	Let us join AD. In ΔABD and ΔACD, AB = AC (Given) BD = CD (Given) AD = AD (Common side) ∴ ΔABD ≅ ΔACD (By SSS congruence rule) ⇒ ∠ABD = ∠ACD (By CPCT)

4	In ΔBOC and ΔAOD, ∠BOC = ∠AOD (Vertically opposite angles) ∠CBO = ∠DAO (Each 90º) BC = AD (Given) ∴ ΔBOC ≅ ΔAOD (AAS congruence rule) ∴ BO = AO (By CPCT) ⇒ CD bisects AB.
5	In ΔAEB and ΔAFC, ∠AEB and ∠AFC (Each 90º) ∠A = ∠A (Common angle) AB = AC (Given) ∴ ΔAEB ≅ ΔAFC (By AAS congruence rule) ⇒ BE = CF (By CPCT)
6	Circumcentre of a triangle is always equidistant from all the vertices of that triangle. Circumcentre is the point where perpendicular bisectors of all the sides of the triangle meet together.  In ΔABC, we can find the circumcentre by drawing the perpendicular bisectors of sides AB, BC, and CA of this triangle. O is the point where these bisectors are meeting together. Therefore, O is the point which is equidistant from all the vertices of ΔABC.
7.	If Δ LMN ≅ ΔPQR, then ∠L=∠P

	∠M =∠Q ∠N =∠R So, ∠L=∠P = 105° ∠M =∠Q = 45° ∠M + ∠N + ∠L = 180° (Sum of three angles of a triangle is 180°) 45° + 105° + ∠N = 180° ∠N = 180°- 45° + 105° ∠N = 30° ∠N = ∠R = 30°
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
1.	Let us consider a right-angled triangle ABC, right-angled at B. In ΔABC, ∠A + ∠B + ∠C = 180° (Angle sum property of a triangle) ∠A + 90º + ∠C = 180° ∠A + ∠C = 90° Hence, the other two angles have to be acute (i.e., less than 90º). ∴ ∠B is the largest angle in ΔABC. ⇒ ∠B > ∠A and ∠B > ∠C ⇒ AC > BC and AC > AB [In any triangle, the side opposite to the larger (greater) angle is longer.] Therefore, AC is the largest side in ΔABC. However, AC is the hypotenuse of ΔABC. Therefore, hypotenuse is the longest side in a right-angled triangle.

2.



Area of $\Delta OAB = \frac{\sqrt{3}}{4}(\text{side})^2 = \frac{\sqrt{3}}{4}(5)^2$

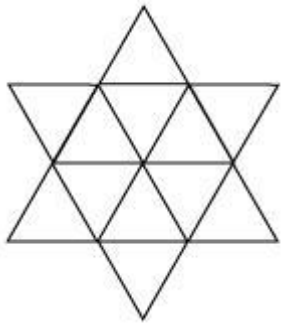
$= \frac{\sqrt{3}}{4}(25) = \frac{25\sqrt{3}}{4}\ \text{cm}^2$

Area of hexagonal-shaped *rangoli* $= 6 \times \frac{25\sqrt{3}}{4} = \frac{75\sqrt{3}}{2}\ \text{cm}^2$

Area of equilateral triangle having its side as 1 cm $= \frac{\sqrt{3}}{4}(1)^2 = \frac{\sqrt{3}}{4}\ \text{cm}^2$

Number of equilateral triangles of 1 cm side that can be filled in this hexagonal-shaped *rangoli* $= \frac{\frac{75\sqrt{3}}{2}}{\frac{\sqrt{3}}{4}} = 150$

Star-shaped *rangoli* has 12 equilateral triangles of side 5 cm in it.



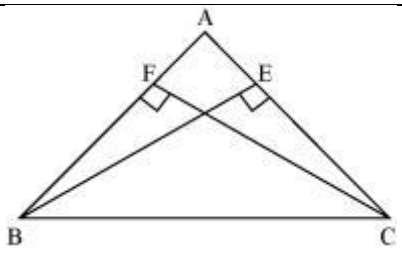
Area of star-shaped *rangoli* $= 12 \times \frac{\sqrt{3}}{4} \times (5)^2 = 75\sqrt{3}$

Number of equilateral triangles of 1 cm side that can be filled in this star-shaped *rangoli* $= \frac{75\sqrt{3}}{\frac{\sqrt{3}}{4}} = 300$

Therefore, star-shaped *rangoli* has more equilateral triangles in it.

3.	(i) In ΔABC, AM is the median to BC. ∴ BM = $\frac{1}{2}$ BC In ΔPQR, PN is the median to QR. ∴ QN = $\frac{1}{2}$ QR However, BC = QR ∴ $\frac{1}{2}$ BC = $\frac{1}{2}$ QR ⇒ BM = QN … (1) In ΔABM and ΔPQN, AB = PQ (Given) BM = QN [From equation (1)] AM = PN (Given) ∴ ΔABM ≅ ΔPQN (SSS congruence rule) ∠ABM = ∠PQN (By CPCT) ∠ABC = ∠PQR … (2) (ii) In ΔABC and ΔPQR, AB = PQ (Given) ∠ABC = ∠PQR [From equation (2)] BC = QR (Given) ⇒ ΔABC ≅ ΔPQR (By SAS congruence rule)
4.	(i) In ΔAMC and ΔBMD, AM = BM (M is the mid-point of AB) ∠AMC = ∠BMD (Vertically opposite angles) CM = DM (Given) ∴ ΔAMC ≅ ΔBMD (By SAS congruence rule)

	∴ AC = BD (By CPCT) And, ∠ACM = ∠BDM (By CPCT) (ii) ∠ACM = ∠BDM However, ∠ACM and ∠BDM are alternate interior angles. Since alternate angles are equal, It can be said that DB || AC ⇒ ∠DBC + ∠ACB = 180º (Co-interior angles) ⇒ ∠DBC + 90º = 180º ⇒ ∠DBC = 90º (iii) In ΔDBC and ΔACB, DB = AC (Already proved) ∠DBC = ∠ACB (Each 90°) BC = CB (Common) ∴ ΔDBC ≅ ΔACB (SAS congruence rule)
5	AB = AC (Given) ⇒ ∠ACB = ∠ABC (Angles opposite to equal sides of a triangle are also equal) In ΔACD, AC = AD ⇒ ∠ADC = ∠ACD (Angles opposite to equal sides of a triangle are also equal) In ΔBCD, ∠ABC + ∠BCD + ∠ADC = 180º (Angle sum property of a triangle) ⇒ ∠ACB + ∠ACB +∠ACD + ∠ACD = 180º ⇒ 2(∠ACB + ∠ACD) = 180º ⇒ 2(∠BCD) = 180º

	⇒ ∠BCD = 90º
6	consider that ABC is an equilateral triangle. Therefore, AB = BC = AC AB = AC ⇒ ∠C = ∠B (Angles opposite to equal sides of a triangle are equal) Also, AC = BC ⇒ ∠B = ∠A (Angles opposite to equal sides of a triangle are equal) Therefore, we obtain ∠A = ∠B = ∠C In ΔABC, ∠A + ∠B + ∠C = 180° ⇒ ∠A + ∠A + ∠A = 180° ⇒ 3∠A = 180° ⇒ ∠A = 60° ⇒ ∠A = ∠B = ∠C = 60°
7	 In ΔBEC and ΔCFB, ∠BEC = ∠CFB (Each 90°) BC = CB (Common) BE = CF (Given) ∴ ΔBEC ≅ ΔCFB (By RHS congruency) ⇒ ∠BCE = ∠CBF (By CPCT)

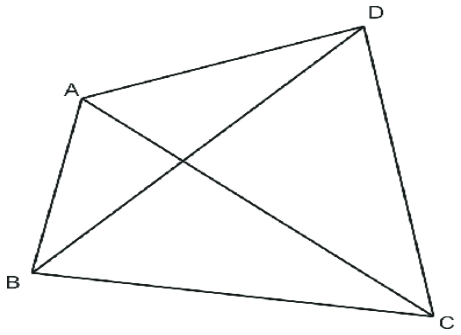
	∴ AB = AC (Sides opposite to equal angles of a triangle are equal) Hence, ΔABC is isosceles.
8.	1.1 ∠ABC = ∠ACB (AB = AC) ∠CAX = 2∠ABC, ∠ACB = 68.5 1.2 ∠CHK = 180 - 137= 43 1.3) AHK = 68.5 1.4) ∠CBH + ∠AHK= 68.50 +68.50 = 137
9.	1 ∠ACD =2x = ∠ADC 98 = x + 2x, x= 98/3 2. y = 180 - 2x -2x= 180 – 4x = 180 – 398/3 = 148/3 3. 196/3 4. 82^0

CHAPTER 08: QUADRILATERALS

KEY POINTS

1.Quadrilateral: It is a closed figure bounded by four line segments.

- A quadrilateral has four sides, four angles and four vertices.



(i) Two pairs of opposite sides e.g. AB & CD, AD & BC.

(ii) Two pairs of opposite angles e.g. ∠A & ∠C, ∠B & ∠D.

(iii) Four pairs of adjacent sides, AB & BC, BC & CD, CD & AD, AD & AB.

(iv) Line segment joining the opposite vertices are called diagonals.

e.g. AC & BD.

- The sum of angles of a quadrilateral is 360°.

2. Types of Quadrilateral:

Parallelogram: A quadrilateral in which both pairs of opposite sides are parallel is called a parallelogram.
In a parallelogram,

- A diagonal divides it into two congruent triangles.
- Opposite sides are equal.
- Opposite angles are equal.
- Diagonals bisect each other.

Rectangle: A parallelogram whose one of the angles is a right angle is called a rectangle.

- Diagonals of a rectangle bisect each other and are equal.

  Rhombus: A parallelogram having all sides equal is called a rhombus.
- Diagonals of a rhombus bisect each other at right angles.

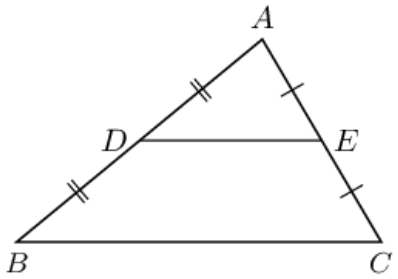
  Square: A square is a rhombus whose one angle is a right angle.
- Diagonals of a square bisect each other at right angles and are equal.

  Trapezium : A trapezium is a quadrilateral whose one pair of opposite sides is parallel.

  Kite: A quadrilateral in which two pairs of adjacent sides are equal.

  Mid-point Theorem

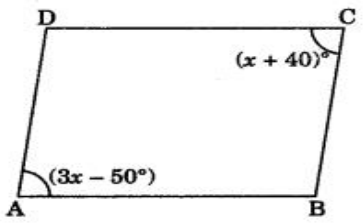
  The line segments joining the mid-points of two sides of a triangle is parallel to the third side and equal to half of it.

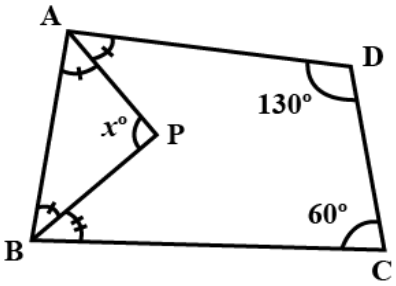
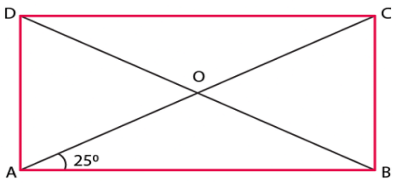
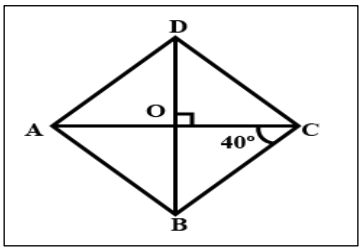


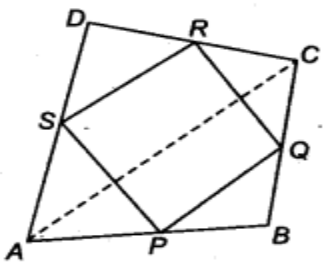
  e.g. In ΔABC, D and E are the mid-points of AB and AC respectively.

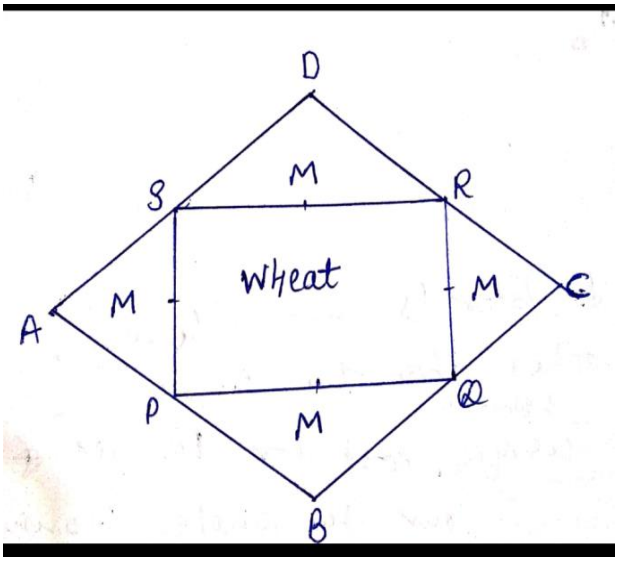
  Then DE ∥ BC and DE = ½ BC.

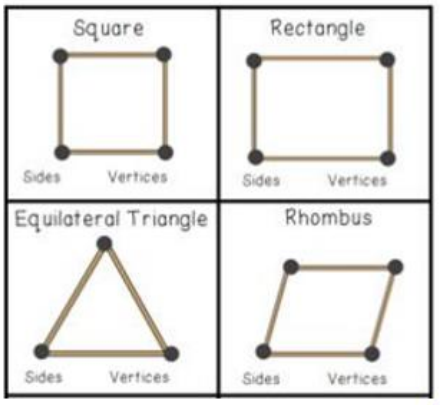
  Converse: A line through the mid-point of a side of a triangle and parallel to another side bisects the third side.
- The quadrilateral formed by joining the mid-points of the sides of a quadrilateral, in order, is a parallelogram.

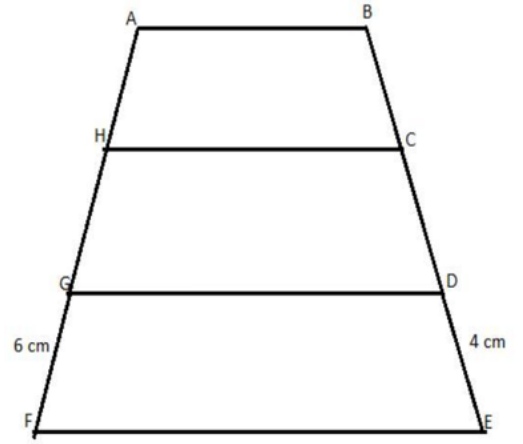
	COMPETENCY BASED QUESTIONS **(MULTIPLE CHOICE QUESTIONS)**
Q1	The three angles of a quadrilateral are 75°, 90° and 105°. The fourth angle is a) 90° b) 95° c) 105° d) 120°
Q2	In the given figure, ABCD is a parallelogram in which a pair of opposite angles is given. The value of x is  a) 40° b) 45° c) 50° d) 55°
Q3	In a parallelogram ABCD, if $\angle A$ = 75°, then $\angle B$ = _____. a) 75° b) 105° c) 15° d) 95°
Q4	Which of the following statement is correct for a square? a) Diagonals are equal and bisect each other at right angles. b) Diagonals are unequal and do not bisect each other. c) Diagonals are equal and do not bisect each other. d) Diagonals are unequal and bisect each other at right angles.
Q 5	The lines joining the mid-points of the adjacent sides of a quadrilateral enclose a _____. a) Square b) rectangle c) rhombus d) parallelogram
Q 6	Two adjacent angles of a rhombus are (3x- 40°) and (2x +20°). The measurement of the greater angle is a) 160° b) 100° c) 80° d) 120°
Q 7	The quadrilateral formed by joining the mid-points of the

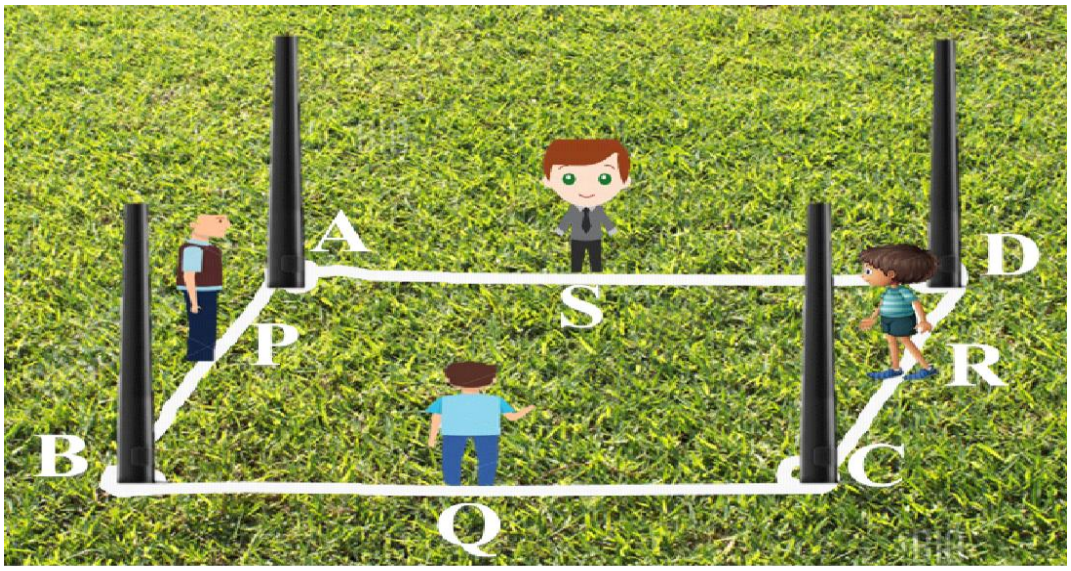
	consecutive sides of a rectangle is a _____. a) Square b) rhombus c) parallelogram d) trapezium
Q 8	In quadrilateral ABCD, AP and BP are bisectors of $\angle A$ and $\angle B$ respectively, then the value of x is  a) 60° b) 85° c) 95° d) 100°
Q 9	Points D, E are the mid-points of sides AB and AC of ΔABC. If the length of the line segment DE= 6.5 cm, then the length of side BC is equal to a) 6.5 cm b) 26 cm c) 13 cm d) 5.5 cm
Q 10	A diagonal of a rectangle is inclined to one side of the rectangle at 25°. The acute angle between the diagonals ($\angle AOD$) is _  a) 55° b) 50° c) 40° d) 25°
Q 11	ABCD is a rhombus such that $\angle ACB = 40°$. Then $\angle ADB$ is _____. a) 40° b)45° c)50° d) 60° 
Q 12	The line segment joining the mid-points of the two sides of a triangle is parallel to the third side and _____ of it.

	a) Half b) one-third c) one-fourth d) equal
Q 13	If the diagonals of a quadrilateral bisect each other at right angles, then the quadrilateral is a _____. a) Trapezium b) rhombus c) parallelogram d) rectangle
Q 14	Two angles of a quadrilateral are 50° and 80° and other two angles are in the ratio 8:15, then the remaining two angles are a) 50°,130° b) 80°, 150° c) 70°, 160° d) 60°, 170°
Q 15	ΔPQR is formed by joining the mid-points of sides BC, CA and AC respectively. If ΔABC is an equilateral triangle with side 12 cm, then the length of PQ is a) 6 cm b) 12 cm c) 3 cm d) 16 cm
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
I	**<u>QUADRILATERAL BY PAPER FOLDING</u>** The Maths teacher gave students some coloured papers in the shape of a quadrilateral. She asked them to make a parallelogram from the quadrilateral ABCD using paper folding. She made the following parallelogram. 
(i)	How can a parallelogram be formed by using paper folding? a) Joining the sides of quadrilateral. b) Joining the mid-points of the sides of quadrilateral. c) Joining the various quadrilaterals. d) None of these.
(ii)	Which of the following is true?

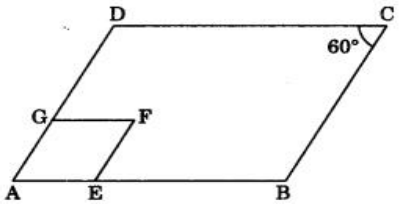
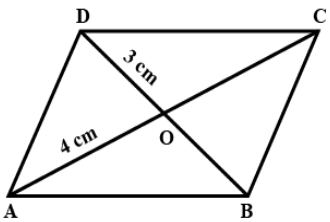
	a) PQ = AC b) PQ= ½ AC c) 3PQ= AC d) PQ=2RS
(iii)	Why paper folding method is adopted by the teacher?
(iv)	Which of the following is the correct combination? a) PS=AC b) QR=AC c) PS=QR d) PS=RS
(v)	Explain the geometrical principle underlying the activity and justify.
II	**MOHAN'S WHEAT FARM** A farmer Mohan have a field ABCD. Field ABCD is in the shape of a rhombus and P, Q, R and S are the mid-points of the sides AB, BC, CD and DA respectively. The farmer wants to crop wheat in area PQRS and mustard crop in rest of the region. 
(i)	Which shape is formed by the region of wheat crop?
(ii)	Find the diagonal AC if the side of rhombus field 12m and diagonal BD is 20m?
(iii)	The farmer wants to fence the field with the wire, and then what is the length of wire required if side of rhombus is 12 m?
(iv)	Find all the three angles of the field if the corner angle A is 70°
(v)	If the side of the rhombus field is 20 m, then what length of

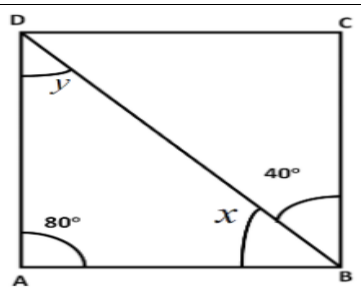
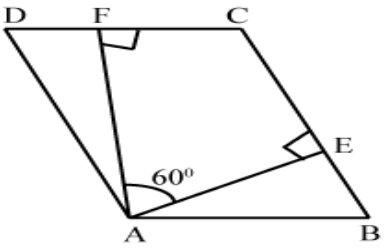
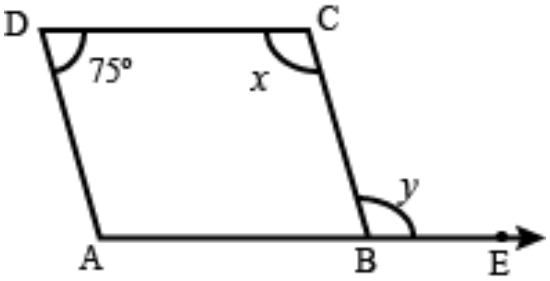
	fencing wire is required for two complete round of the field?
III	**ACTIVITY WITH STICKS** During Maths Lab activity, teacher gives four sticks of length 6 cm, 6 cm, 4 cm and 4 cm to teach different types of quadrilaterals.
	
(i)	A student formed a rectangle with these sticks. What is the length of the diagonal of the rectangle formed? a) $6\sqrt{13}$ b) $3\sqrt{13}$ c) $\sqrt{13}$ d) $2\sqrt{13}$
(ii)	Which quadrilaterals can be formed with these sticks? a) Kite, rectangle, rhombus b) Parallelogram, rectangle, trapezium c) Kite, rectangle, Parallelogram d) Square, rectangle, kite
(iii)	How many types of quadrilaterals are possible with this sticks? a) 1 b) 2 c) 3 d) 4
(iv)	Which statement is true? a) Opposite sides of a parallelogram are equal. b) A kite is a parallelogram. c) Diagonals of a parallelogram bisect each other. d) A trapezium is a parallelogram.
(v)	A diagonal of a parallelogram divides it into two _____ triangles.

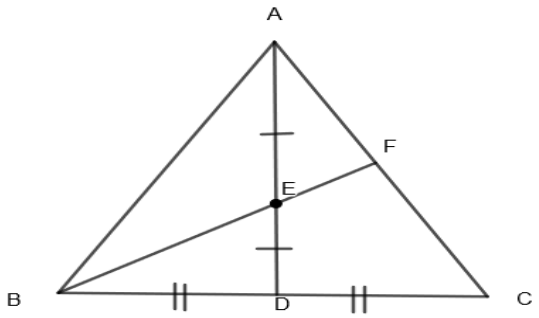
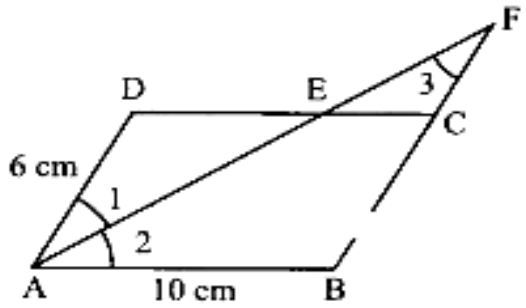
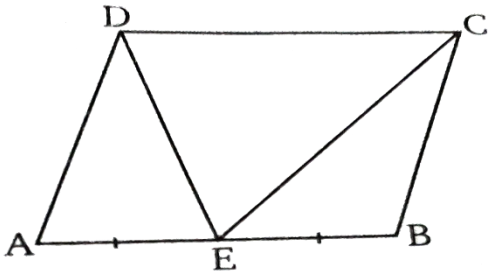
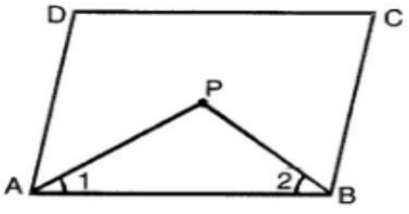
	a) Similar b) congruent c) equilateral d) right angled
IV	**SOHAN'S CARD** Sohan wants to show gratitude towards his teacher by giving her a card made by him. He has three pieces of trapezium pasted one above the other as shown in the figure. These pieces are in a way such that AB ∥ HC ∥ GD ∥ FE. Also BC = CD = DE and GF= 6 cm.
	
(i)	The three pieces of trapezium pasted one above the other makes the card ABEF of which shape?
(ii)	If AH:AF = 1:3, What is BC:BE?
(iii)	If AH = 5 cm, HF = 20 cm, find BC: CE?
(iv)	If $\angle GFE = 70°$, find $\angle AHC$.
(v)	Sohan wants to decorate the card by putting up a coloured tape on non-parallel sides of trapezium. Find the total length of coloured tape required if DE = 4 cm and GF = 6 cm?
V	**PLAYING THROW BALL** In a village, four boys were playing in a ground. They planned to device a game using geometrical concepts. Ramesh took the lead and planned in the following manner: Four poles were marked in the ground as A, B, C, D. With the help of a rope, the poles were joined to form a quadrilateral.

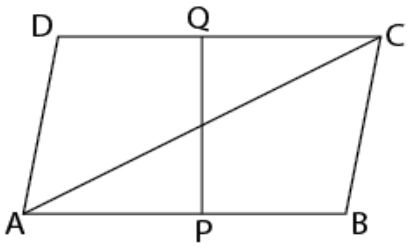
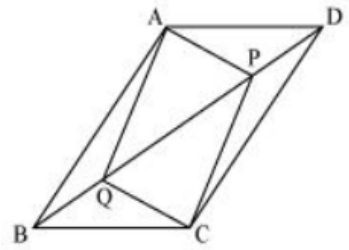
	Now, Ramesh selected four boys such as P, Q, R and S and placed in the mid-points of the rope paths... After making this arrangement, they started playing throw ball in the order from P to Q; Q to R; R to S and finally from S to P.  On the basis of this arrangement, Ramesh asks the following questions to the other boys:
(i)	Which geometrical shape is generated by PQRS? (a) Square (b) Rhombus (c) Rectangle (d) Parallelogram
(ii)	Justify the shape generated by PQRS with a geometrical principle.
(iii)	What shape is expected by the join of PQRS if ABCD forms a rhombus?
(iv)	If PQ = 10 m, what is the distance between the two poles A & C?
(v)	If AC = 30 m, find RS?
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q 1	State whether the following statement is true or false?

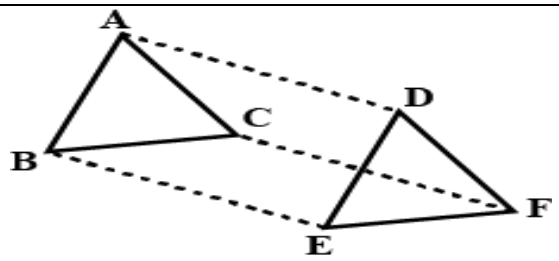
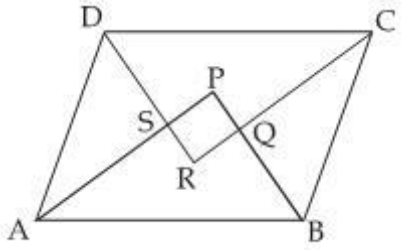
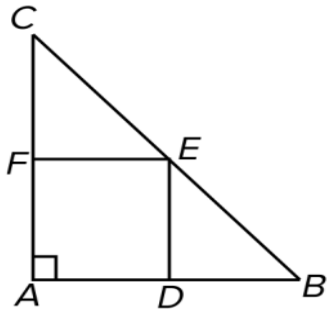
a)	Every rhombus is a square. ( )
b)	Every square is a rectangle. ( )
c)	The bisectors of any two consecutive angles of parallelogram intersect at right angles. ( )
d)	The angles of a rhombus are bisected by the diagonals. ( )
e)	In a parallelogram, the sum of any two consecutive angles is 180°.( )
Q 2	Fill in the blanks:
a)	If the diagonals of a parallelogram are equal, then it is a _____.
b)	If the diagonals of a rhombus are equal, then it is a _____.
c)	If ABCD is a parallelogram with adjacent angles A and B equal to each other, then the parallelogram is a _____.
d)	If the diagonals of a rhombus are 18 cm and 24 cm, then the side of the rhombus is _____.
e)	The diagonals of a parallelogram _____ each other.
Q 3	Match the two columns. Column I Column II
i)	The diagonals of a rectangle are of a) parallelogram
ii)	The diagonals of a parallelogram b) rhombus
iii)	Each square is a c) is parallel to the third side
iv)	Every rectangle is a d) equal length
v)	Line joining midpoints of two sides of triangle e) bisect each other
Q 4	ABCD is a parallelogram. If $\angle A = 65°$, then find $(\angle B + \angle D)$.

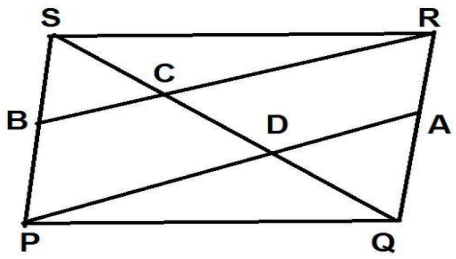
Q 5	In a quadrilateral ABCD, $\angle A + \angle D = 180°$. What special name can be given to this quadrilateral?
Q 6	In figure, ABCD and AEFG are two parallelograms. If $\angle C = 60°$, determine $\angle F$. 
Q 7	Can all the angles of a quadrilateral be acute angles? Give reason for your answer.
Q 8	In ΔABC, AB=5 cm, BC= 8cm and CA= 7 cm. if D and E are respectively the mid-points of AB and BC, determine the length of DE.
Q 9	In a parallelogram PQRS, $\angle P$ =110°, $\angle Q$= 2y+10° and $\angle R$= 5x+10°. Find the values of x and y.
Q 10	In a rhombus PQRS, diagonals PR and QS meet each other at O. If $\angle PRQ = 50°$, find $\angle PSQ$.
	SHORT ANSWER TYPE QUESTIONS
Q 1	In the given figure, ABCD is a rhombus, OA= 4 cm and OD= 3 cm. find the perimeter of the rhombus. 
Q 2	In the given figure, ABCD is a parallelogram. Find the measure of the angles x and y.

	
Q 3	The angle between the two altitudes of a parallelogram through the vertex of an obtuse angle of the parallelogram is 60°. Find the angles of the parallelogram. 
Q 4	ABCD is a trapezium in which AB‖DC and $\angle A = \angle B = 45°$. Find the other two angles of the trapezium.
Q 5	ABCD is a parallelogram in which $\angle ADC$=75° and side AB is produced to point E as shown in the figure. Find x + y. 
Q 6	In the given figure, ABC is triangle, AD is a median and E is the mid-point of AD. BE is joined and produced to intersect AC in a point F. Prove that AF = $\frac{1}{3}$ AC.

	
Q 7	In a parallelogram, ABCD, AB= 10cm and AD= 6cm. The bisector of $\angle A$ meets DC in E. AE and BC produced meet at F. Find the length of CF. 
Q 8	In the given figure, ABCD is a parallelogram; E is the mid-point of AB and DE bisects $\angle D$. Prove that BC=BE. 
Q 9	In a parallelogram, ABCD, bisectors of consecutive angles A and B intersect at P. Prove that $\angle APB$= 90° 

Q 10	Points P and Q have been taken on opposite sides of AB and CD of a parallelogram ABCD such that AP = CQ. (see fig.) Show that AC and PQ bisect each other at O. 
	LONG ANSWER TYPE QUESTIONS
Q 1	In the given figure, ABCD is a parallelogram. Two points P and Q are taken on diagonal BD such that DP=BQ. Show that: i) ΔAPD≅ ΔCBQ ii) AP = CQ iii) ΔAQB ≅ ΔCPD iv) AQ = CP 
Q 2	In ΔABC and Δ DEF, AB=DE, AB ‖ DE, BC=EF and BC ‖ EF. Vertices A, B and C are joined to vertices D, E and F respectively. (See fig.) Show that (i) quadrilateral ABED is a parallelogram. ii)quadrilateral BEFC is a parallelogram. iii) AD ‖ CF and AD = CF. iv) Quadrilateral ACFD is a parallelogram. v) AC = DF vi) ΔABC ≅ ΔDEF

	
Q 3	Show that bisectors of angles of a parallelogram form a rectangle. 
Q 4	Prove that the figure formed by joining the mid-points of the pairs of adjacent sides of a quadrilateral is a parallelogram.
Q 5	If ABCD is a rhombus, show that $AC^2 + BD^2 = 4\ AB^2$.
Q 6	A diagonal of a parallelogram bisects one of its angles. Show that it is a rhombus.
Q 7	ABCD is a rectangle in which diagonal AC bisects $\angle A$ as well $\angle C$. Show that (i) ABCD is a square (ii) diagonal BD bisects $\angle B$ as well as $\angle D$.
Q 8	A square is inscribed in an isosceles right triangle so that the square and the triangle have one angle common. Show that the vertex of the square opposite the vertex of the common angle bisects the hypotenuse. 

Q 9	In the figure, PQRS is a parallelogram in which A and B are mid-points of sides QR and PS respectively. PA and RB intersect diagonal QS at D and C respectively. If QS= 12 cm, then find the length of CD. 
Q 10	ABCD is a rhombus and P, Q, R and S are the mid-points of AB,BC,CD and AD respectively. Show that quadrilateral PQRS is a rectangle.

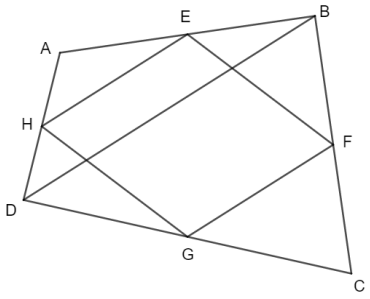
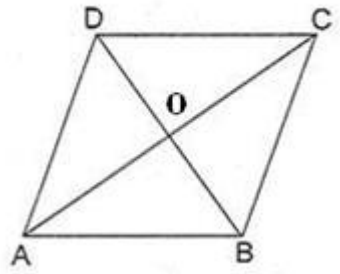
	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	a) 90°
Ans 2	b) 45°
Ans 3	c) 105°
Ans 4	a) Diagonals are equal and bisect each other at right angles.
Ans 5	d) Parallelogram
Ans 6	b) 100° [3x- 40° + 2x+20°=180°, 5x-20°=180°, x=100°]
Ans 7	c) Rhombus
Ans 8	c) 95° [$\angle A+\angle B$ =360°- (130°+60°)= 170° (angle sum prop.) ½ ($\angle A+\angle B$) +x =180°, x=95°]
Ans 9	c)13 cm [BC= 2 x DE = 2 x 6.5 = 13]
Ans 10	a) 50° [AC=BD ∴ OA=OB ⇒ $\angle OAB=\angle OBA$=25°, $\angle AOB$=130°, $\angle AOD$= 180°- 130°= 50°
Ans 11	© 50° [In ΔBOC, $\angle CBO$= 180°- (90°+ 40°) = 50° $\angle CBO = \angle ADB$ = 50°(Alt. in. ∠s)
Ans 12	a) Half
Ans 13	b) Rhombus
Ans 14	b) 80°, 150° [50°+80°+8x+15x= 360°, x= 10]
Ans 15	a) 6 cm [by mid-point Thm. PQ= ½ AB, PQ=QR=RP =6]

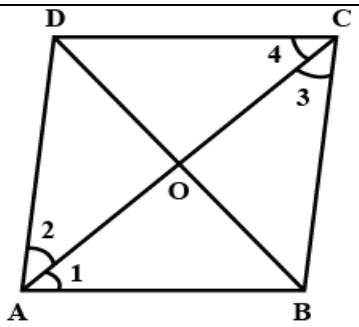
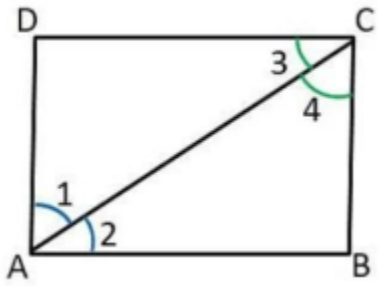
	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Ans I (i)	(b) Joining the mid-points of the sides of quadrilateral.
ii)	(b) PQ = ½ AC
iii)	It is an easy, effective and accurate method. Activity based learning of students.
iv)	(c) PS=QR
v)	Principle of Mid-point theorem is used.
Ans II	(i) Rectangle
ii)	BC=12 m, OB=10m (diagonals bisect), $OC^2 = 12^2 - 10^2$, $OC=\sqrt{144-100}$ $OC= 2\sqrt{11}$, AC= 2x $2\sqrt{11} = 4\sqrt{11}$
iii)	4 x 12 = 48 m
iv)	$\angle A=\angle C$ = 70° (opp. $\angle's$ are equal), $\angle C + \angle D$= 180°(adj. angles supplementary), $\angle B= \angle D$ = 180°- 70°= 110°
V)	20 x 4 = 80m, for two rounds, 80 x 2 = 160 m
Ans III	(i) d)2 $\sqrt{13}$ [$6^2+ 4^2= 52$, diagonal = $\sqrt{52}= 2\sqrt{13}$]
(ii)	(c) Kite, rectangle, Parallelogram
iii)	(c) 3
iv)	a) Opposite sides of a parallelogram are equal.
v)	b) Congruent
Ans IV(i)	Trapezium

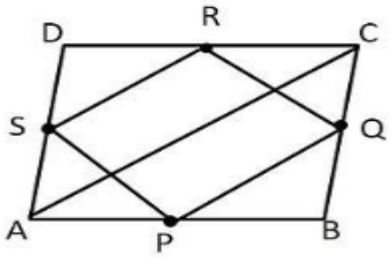
ii)	$\frac{AH}{AF} = \frac{BC}{BE} = \frac{1}{3}$ [Three parallel lines making equal intercepts on any transversal will make equal intercepts on other transversal also]
iii)	$\frac{AH}{HF} = \frac{BC}{CE} = \frac{5}{20} = \frac{1}{4}$.
iv)	∠ AHC = ∠ GFE = 70° (corresponding angles).
v)	12+18 = 30 cm
Ans V (i)	(d) parallelogram
ii)	ABCD is a quadrilateral. Therefore, line joining the mid-points of the sides of a quadrilateral forms a parallelogram. (using midpoint theorem and joining diagonals)
iii)	Rectangle
iv)	AC= 2 x PQ= 2x 10 = 20 m (by mid-point theorem)
v)	RS = ½ AC = ½ 30 = 15m
	SOLUTIONS TO OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Ans 1	a) False b) True c) True d) True e) True
Ans 2	a) Rectangle b) square c) rectangle d) 15 cm e) bisect
Ans 3	i) → d ii) → e iii) → b iv) → a v) → c
Ans 4	Adj angles are supplementary.∴ ∠ B= 180° - 65°, ∠ B=∠ D= 115° (∵Opp angles of parallelogram are equal)∠ B +∠D=115°+115°= 230°
Ans 5	∠A+∠D= 180°. But these are co-interior angles⇒AB ‖ CD. Since one pair of opp. side is equal, it is a trapezium.
Ans 6	∠ C=∠A (ABCD is a ‖ gm), ∠ F=∠A= 60° (AEFG is a ‖ gm)

Ans 7	No, because sum of all the angles will be less than 360°.
Ans 8	DE ‖ AC and DE = ½ AC (mid-point theorem) DE = ½ AC,DE=½ 7= 3.5 cm
Ans 9	∠P=∠R (opp. angles of ‖ gm), 110°= 5x+10°, x = 20° 110°+ 2y + 10°= 180° (adj. angles are supple) , y=30°
Ans 10	∠PRQ= ∠RPS (alt. angles), ∠POS = 90°(diagonals bisect) ∠POS + ∠SPO + ∠PSO = 180°, 90°+50°+∠PSQ =180°,∠PSQ =40°
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
Ans 1	4^2+ 3^2= AB^2, AB= $\sqrt{16+9} = \sqrt{25}$ = 5cm Perimeter = 4 x 5 = 20 cm
Ans 2	Y=40° (alt. angles). In ΔABD, 80° + 40° + x = 180°, x= 60°
Ans 3	In quadrilateral AFCE, 60° + 90° + 90° + ∠C = 360°, ∠C= 360°-240°=120°. ∠C = ∠A = 120°Also, ∠B = ∠D = $\frac{120^\circ}{2}$ = 60°
Ans 4	∠A + ∠D = 180° (co-interior angles), ∠D = 180° - 45°= 135° ∠B + ∠C = 180° (co-interior angles), ∠C = 180°- 45° = 135°
Ans 5	x+75°= 180°(co-int angles), x=180°-75° = 105° ∠x = ∠y = 105°(alternate int. angles)
Ans 6	Construction: Draw DK ‖ BF. In ΔADK, E is the mid pt of AD & EF ‖ DK. ∴ F is the mid pt of AK.---1 In ΔBCF, D is the mid pt of BC & DK ‖ BF. ∴ K is the mid pt of CF--

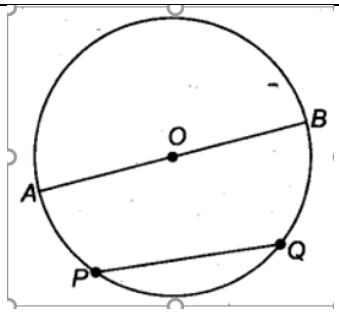
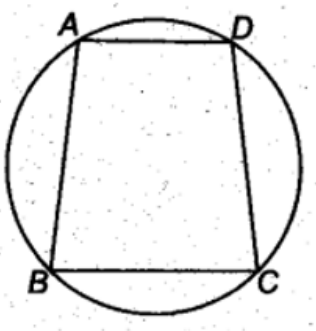
	-2 From 1 & 2, AF=FK=CK, Also, AC=AF+FK+CK, AC=3AF, AF=1/3 AC.
Ans 7	Given, $\angle BAE = \angle EAD$---1 $\angle EAD = \angle EFB$---2 (alt int ∠s) From 1 & 2,$\angle BAE = \angle EFB \implies$ BF=AB, BC+CF=AB, 6+CF=10,CF=4cm
Ans 8	$\angle CDE = \angle EDA$(given)---1, $\angle CDE = \angle AED$(Alt. ∠s) From 1 & 2, $\angle EDA = \angle AED$. ∴ AD=AE---3 In ABCD, AD=BC----4, $\implies$ AE=BC---5, Also AE= BE---6 From 5 & 6, BE = BC.
Ans 9	∠A + ∠B = 180°(co-int angles), ½ ∠A+ ½ ∠B= 90° $\angle PAB + \angle PBA$= 90°. By angle sum, $\angle PAB + \angle PBA$ +∠APB= 180° 90° +$\angle APB$= 180°, $\angle APB$ = 90°
Ans 10	In ΔAOP. ΔCOQ, AP= CQ (given). $\angle OAP = \angle OCQ$(Alt. angles) ∠AOP=$\angle QOC$ (V.O.A), ΔAOP ≅ ΔCOQ By AAS cong. rule. ∴ OA=OC & OP=OQ.
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
Ans 1	In ΔAPD and ΔCBQ, DP=BQ, ∠ADP=∠CBQ (Alt. ∠s), AD=BC (Opp sides of ‖gm) ∴ ΔAPD ≅ ΔCBQ by SAS. ∴ AP=CQ (cpct) Similarly, ΔAQB ≅ ΔCPD ∴ AQ=CP Hence APCQ is a ‖gm
Ans 2	In quadrilateral ABED, AB=DE and AB‖ DE, ∴ ABED is a ‖gm---1 In quadrilateral BEFC, BC=EF and BC‖ EF, ∴ BEFC is a ‖gm---2 From 1 & 2, AD=CF & AD ‖ CF. ∴ ACFD is a ‖gm.

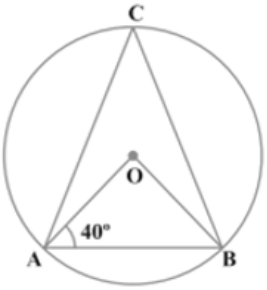
	AC=DF. In ΔABC and ΔDEF, AB=DE, BC=EF, CA=FD. ∴ By SSS, ΔABC ≅ ΔDEF.
Ans 3	In ΔADS, ∠ADS + ∠DAS = ½ ∠D+½ ∠A= ½ (∠D+∠A) =½ 180°=90° Also, ∠ADS + ∠DAS + ∠ASD= 180°, 90°+∠ASD = 180° ⟹ ∠ASD = 90° Thus ∠ASD=∠PSR= 90° (VOA) Similarly, ∠SRQ = ∠RQP = ∠QPS=90° ∴ PQRS is a rectangle.
Ans 4	 Construction: Join BD. In ΔBCD, G and F are the mid pts of CD and BC respectively. ∴ GF ∥ BD & GF= ½ BD------ 1 In ΔABD, E and H are the mid pts of AB and AD respectively. ∴ EH ∥ BD & EH= ½ BD------ 2 From 1 & 2, EH ∥ GF & EH= GF. ∴ EFGH is a ∥gm
Ans 5	 Diagonals of a rhombus bisect each other at rt. angles. ∴ OA = ½ AC, OB= ½ BD

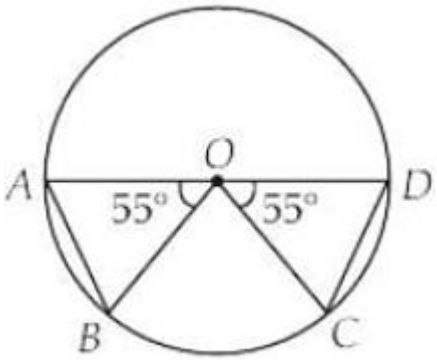
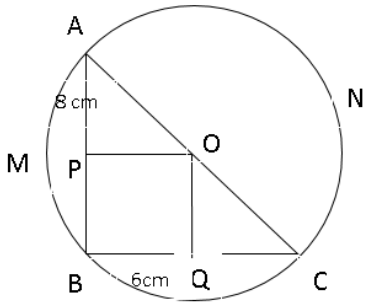
	$\angle AOB=90°$ ∴ $AB^2= OA^2+OB^2 \Longrightarrow AB^2 = (\frac{1}{2} AC)^2+ (\frac{1}{2} BD)^2$ $AB^2= \frac{1}{4} AC^2+ \frac{1}{4} BD^2$ ∴ $4\ AB^2= AC^2+ BD^2$.
Ans 6	 Given: AC bisects ∠A. ∴ $\angle 1= \angle 2$------(1), $\angle 2 = \angle 3$ (alter. $\angle s$)------(2) From 1 & 2, $\angle 1= \angle 3$. ∴ AB=BC (sides opp. to equal angles) Also, AB=CD & AD=BC (Opp. sides of ∥gm) $\Longrightarrow$ ABCD is a ∥gm in which sides AB=BC=CD=AD
Ans 7	 In ΔABC and ΔADC,$\angle 1= \angle 2$, $\angle 3= \angle 4$, AC=AC. So, ΔABC ≅ ΔADC by AAS ∴ BC=CD, AB=AD (sides opp. to equal angles) ∴ AB=BC=CD=AD. Also ABCD is a rectangle. ∴ ABCD is a square.
Ans 8	Let,$\angle A$=90°, AB=AC ,$\angle A=\angle C$= 45° ($\angle s$ opp. to equal sides) In rt ΔBDE & ΔFCE, ∠CFE = ∠EDB =90°, ∠ C = ∠B = 45° $\Longrightarrow$ DE=EF (Sides square) ∴ By AAS, ΔDBE ≅ ΔFEC ∴ BE=CE (cpct) ∴ E bisects BC.

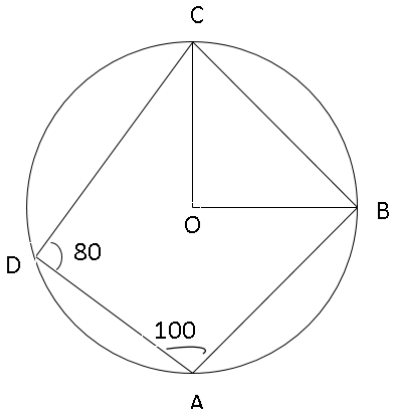
Ans 9	PS=QR (opp sides of ‖gm) , PB=AR (∵ ½ PS= ½ QR) ∴ PARB is a ‖gm, ∴ PA ‖ BR ∵ B is mid pt of PS and BR ‖ PA ∴ C is the mid pt of SD. ∴ SC = CD. ∵ D is mid pt of QC ∴ QD=CD Thus, SC=CD=QP. QS=12 cm ∴ CD= $\frac{1}{3}$ QS= $\frac{1}{3}$ x 12 = 4 cm
Ans 10	
	In ΔABC, P is the mid pt of AB and Q is the mid pt of BC. ∴ PQ ‖ AC and PQ = ½ AC------1 In ΔADC, R is the mid pt of CD and S is the mid pt of AD. ∴ SR ‖ AC and SR = ½ AC------2 From 1 & 2 PQRS is a ‖gm. Now AB=BC (sides of rhombus) ∴ ½ AB= ½ BC ⟹PB=BQ In ΔPBQ, PB = BQ ∴ ∠QPB=∠ PQB Now in ΔAPS and ΔCQR, AP=CQ, AS=CR, PS=QR ∴ΔAPS ≅ΔCQR by SSS. ∴ ∠ APS = ∠CQR cpct Now ∠ APS + ∠SPQ + ∠BPQ = 180° And ∠ CQR + ∠PQR + ∠PQB = 180° ∠ APS + ∠SPQ + ∠BPQ = ∠ CQR + ∠PQR + ∠PQB But ∠APS=∠CQR and ∠BPQ= ∠PQB ∴ ∠SPQ = ∠PQR ∠SPQ+ ∠PQR= 180°, ∠SPQ+∠SPQ = 180° ∴ ∠SPQ = 90° PQRS is a ‖ gm with one angle 90°. ∴ PQRS is a rectangle.

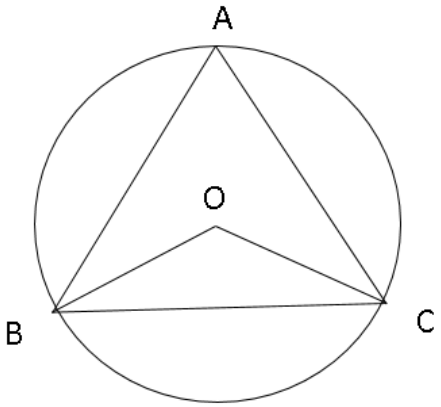
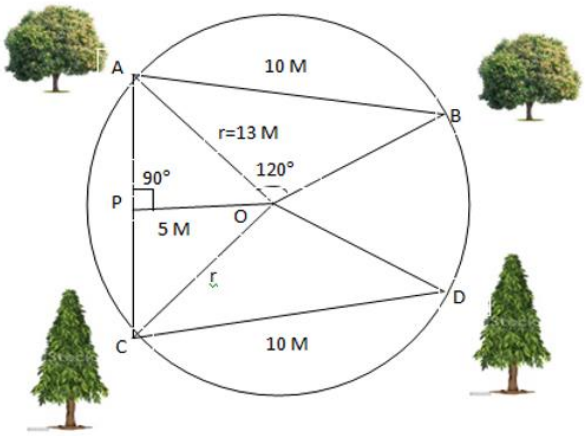
CHAPTER 10: CIRCLES

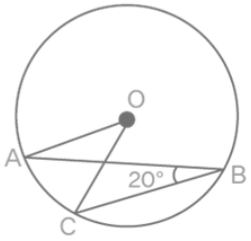
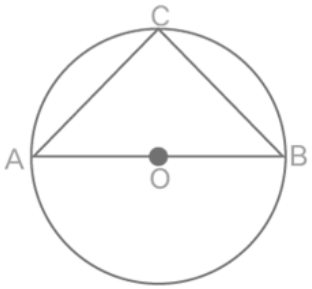
	1. Circle: The collection of all points in a plane which are at a fixed distance from a fixed point in the plane is called a circle. 2.Chord: Suppose, we take any two points on a circle, then the line segment PQ is called the chord of the circle.
	
	The chord which passes through the Centre of the circle is called a diameter AB of the circle. 3.Arc: A piece of a circle between two points is called an arc. If P and Q are any two points on them, the PQ is an arc of the circle and it is denoted by AB. 4.Circumference: The length of the complete circle is called its circumference. 5.Semi-circle: A diameter of a circle divides it into two equal parts which an arc. Each of these two arcs is called a semi-circle. 6.Congruent Circles (Arc): Two circles are said to be congruent if and only if either of them can be superposed on the other so as to cover exactly. 7.Cyclic Quadrilateral: A quadrilateral ABCD is called cyclic if all the four vertices of it lie on a circle.
	
	8 Important Theorems: • The perpendicular from the centre of a circle to a chord bisects the chord and it is vice-versa. • Equal chords of a circle (or of congruent circles) are equidistant from the centre.

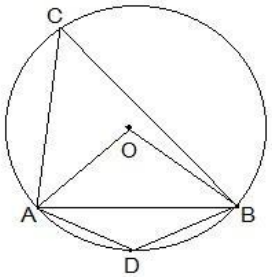
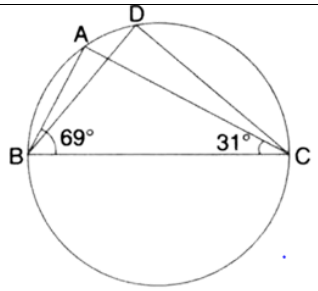
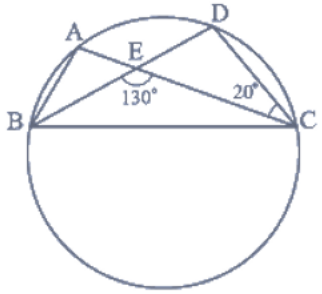
	• It two chords of a circle are equal, then their corresponding, arcs are congruent and conversely, if two arcs are congruent, then their corresponding chords are equal. • Congruent arcs of a circle subtend equal angles at the centre. • The angle subtended by an arc at the centre is double the angle subtended by it any point on the remaining part of the circle. • Angle in the same segment of a circle is equal. • The sum of either pair of opposite angles of a cyclic quadrilateral is 180° and vice-versa. • The angle in a semi-circle is a right angle. If two chords of a circle are equal, then their corresponding arcs (minor, major or semi-circle) are congruent and vice-versa.
	COMPETENCY BASED QUESTIONS
Q1	AD is a diameter of a circle and AB is a chord. If AD = 34 cm, AB = 30 cm, the distance of AB from the Centre of the circle is: (a) 17 cm (b) 15 cm (c) 4 cm (d) 8 cm
Q2	AB = 12 cm, BC = 16 cm and AB is perpendicular to BC, then the radius of the circle passing through the points A, B and C is: (a) 6 cm (b) 8 cm (c) 10 cm (d) 12 cm
Q3	ABCD is a cyclic quadrilateral such that AB is a diameter of the circle circumscribing it and ∠ADC = 140º, then ∠BAC is equal to: (a) 80º (b) 50º (c) 40º (d) 30º
Q4	In Figure, if ∠OAB = 40º, then ∠ACB is equal to: (a) 80º (b) 50º (c) 40º (d) 30º 
Q 5	The radius of a circle is 13 cm and the length of one of its chords is 10 cm. The distance of the chord from the centre is (a) 6 cm (b) 8 cm (c) 10 cm (d) 12 cm
Q 6	AD is diameter of a circle and AB is a chord. If AD = 50 cm, AB = 48 cm, then the distance of AB from the centre of the circle is: (a) 6 cm (b) 8 cm (c) 5 cm (d) 7 cm
Q 7	In a circle, O is a centre of a circle, A, B and C are the points on a circle, such that ∠ABC=20 º, then ∠AOC is equal to: (a) 10^0 (b) 20^0 (c) 30^0 (d) 40^0
Q 8	A chord is at a distance of 8 cm from the centre of a circle of radius 17 cm. The length of the chord is: (a) 25 cm (b) 12.5 cm (c) 30 cm (d) 9 cm
Q 9	The radius of a circle which has a 6 cm long chord, 4 cm away from the centre of the circle is: (a) 9 cm (b) 8 cm (c) 10 cm (d) 5 cm

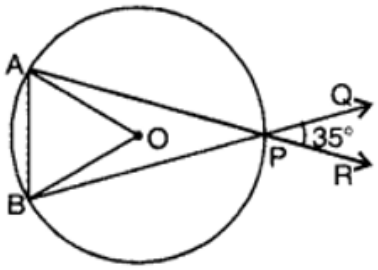
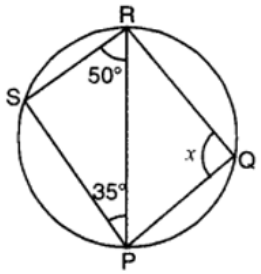
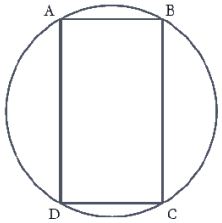
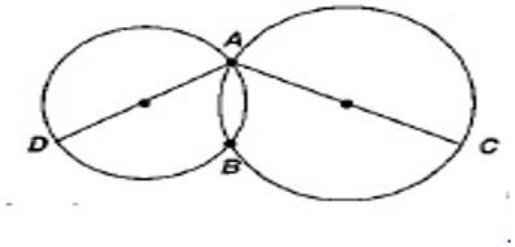
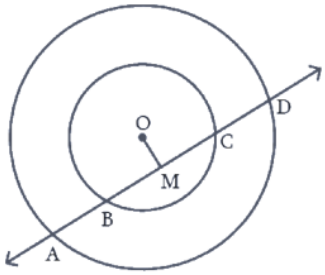
Q10	In the given figure, O is the centre of the circle. ∠AOB=∠COD=55 º and CD=5.5 cm, then AB is equal to (a) 9 cm (b) 8 cm (c) 10 cm (d) 5.5 cm
	
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q 1	Q1 Three girls Reshma, Salama and Mandeep are playing a game by standing on a circle of radius 5 metre. Reshma throws a ball to Salma, Salma to Mandeep and Mandeep to Reshma. The distance between Resham to Mandeep is 6 metre and Reshma to salma is 8 metre. If O is the centre of the circle then answer the following questions.
(i)	Diameter of the circle: (a) 6 m (b) 8 m (c) 10 m (d) 12 m
(ii)	Measure of ∠ MRS: (a) 180° (b) 90° (c) 100° (d) 80°
(iii)	Area of Triangle RMS: (a)10 m^2 (b)20 m^2 (c)24 m^2 (d) 40 m^2
(iv)	Length of longest chord of a circle : (a)6 m (b) 8 m (c) 10 m (d) 12 m
(v)	What is the distance between Mandeep and Salma? (a) 6 m (b) 8 m (c) 10 m (d) 12 m
Q 2	As class IX teacher entered in the class, she told students to do some practice in a circle chapter. She draws two line segment AB and BC so that AB = 8 cm, BC = 6 cm and draw a circle through the three points A, B and C.
	
	i. Dilip drew AB and BC as per the figure. ii. He drew perpendicular OP and OQ to the line segment AB and BC respectively.

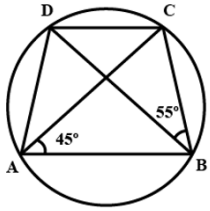
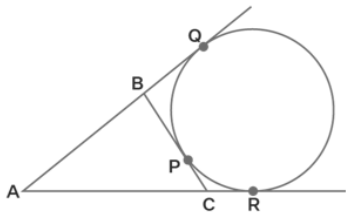
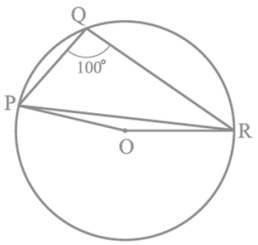
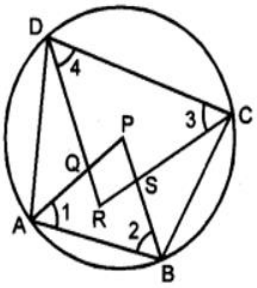
(i)	What you called the line segment AC? (a) Arc (b) Diameter (c) Radius (d) Chord
(ii)	What is the measure of ∠ ABC? (a)60° (b) 90° (c)45° (d 75°
(iii)	What do you call the region enclosed by minor arc AB and Chord AB? (a) Arc (b)Sector (c)Major segment (d)Minor segment
(iv)	What do you call the region enclosed by major arc AB and chord AB? (a) Arc (b) Sector (c) Major segment (d) Minor segment
(v)	What is the radius of the circle? (a) 4 cm (b) 3 cm (c) 7 cm (d) 5 cm
Q 3	There was a circular park in Defence colony at Delhi. For fencing purpose Poles A, B, C and D were installed at the circumference of the park. Ram tied wires from A to B, B to C and C to D and D to A. He managed to measure the ∠A = 100° and ∠ D = 80°.The point O is at the centre of the park.Now answer the following questions:
	
(i)	What is the value of ∠ABC? (a) 80° (b) 100° (c) 90° (d) 70°
(ii)	What is the value of ∠BCD? (a) 80° (b) 100° (c) 90°(d) 70°
(iii)	What is the special type of quadrilateral ABCD? (a) Square (b)Rectangle (C)Cyclic quadrilateral(d) Trapezium
(iv)	What is the property of cyclic quadrilateral? (a) Opposite angles are supplementary (b) Adjacent angles are equal (C) Opposite angles are equal (D) Adjacent angles are complementary
(v)	What do you call the region enclosed by the radii OB, OC and the minor arc BC? (a)Segment (b)Arc (c)Chord (d) Sector
Q 4	Government of India is working regularly for the growth of handicapped persons. For this, three STD booths situated at A, B, C

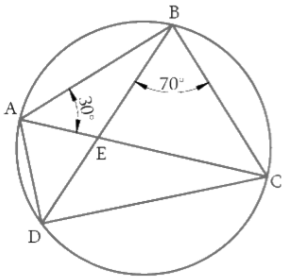
	as shown in the figure, which are operated by handicapped persons. These three booths are equidistant from each other as shown in the figure.
	
(i)	Which type of Δ ABC in the given figure? (a) Equilateral triangle(b) Isosceles triangle (c) Right angled triangle
(ii)	Measure of ∠ABC is (a) 45° (b) 60° (c) 30° (d) 90°
(iii)	if AB = 6 m, the value of BC+CA is (a) 10 (b) 12 (c) 14 (d) 16
(iv)	Measure of ∠BOC is (a) 90° (b) 100° (c) 120° (d) 50°
(v)	Value of ∠OBC + ∠OCB is (a) 60° (b) 30° (c) 45° (d) 90°
Q 5	A farmer has a circular garden as shown in the picture below. He has a different type of trees, plants and flower plants in his garden. In the garden, there are two mango trees A and B at a distance of AB = 10 m. Similarly, he has two Ashoka trees at the same distance of 10 m as shown at C and D. AB subtends ∠AOB = 120° at the centre O. The perpendicular distance of AC from centre is 5 m. The radius of the circle is 13 m.
	
(i)	What is the value of ∠AOB? (a) 60° (b) 120° (c) 100° (d) 80°
(ii)	What is the distance between mango tree A and ashoka tree C? (a) 12 cm (b)24 cm (c) 13 cm(d) 15 cm

(iii)	What is the value of ∠OAB? (a) 60° (b) 120° (c) 30° (d) 90°
(iv)	What is the value of ∠COD? (a) 60° (b) 120° (c) 30° (d) 90°
(v)	What is the value of ∠ODC? (a) 90° (b) 120° (c) 60° (d) 30°
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
	Write True or False and justify your answer in each of the following:
Q 1	Two chords AB and CD of a circle are each at distances 4 cm from the centre. Then AB = CD.
Q 2	Two chords AB and AC of a circle with centre O are on the opposite sides of OA. Then ∠OAB = ∠OAC .
Q 3	If AOB is a diameter of a circle and C is a point on the circle, then $AC^2 + BC^2 = AB^2$.
	FILL IN THE BLANKS
Q 4	Two congruent circles with centres O and O' intersect at two points A and B. Then ∠AOB =_____ .
Q 5	A circle of radius 3 cm can be drawn through two points A, B.The maximum possible length of AB =_____.
Q 6	Segment of a circle is the region between an arc and _____ of the circle.
Q 7	In Figure, if ∠ABC = 20º, then find the ∠AOC.
	
Q 8	In Figure, if AOB is a diameter of the circle and AC = BC, then find the ∠CAB.
	
Q 9	AB is a chord of a circle with radius 'r'. If P is any point on the circle such that ∠APB is a right angle, then find AB.
Q 10	What is the measure of the angle subtended by a semi-circle at centre?

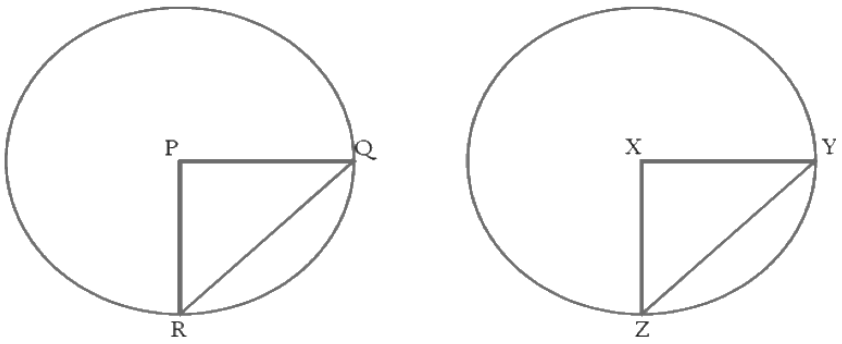
	SHORT ANSWER TYPE QUESTIONS
Q 1	Prove that Equal chords of a circle subtend equal angles at the centre.
Q 2	If two intersecting chords of a circle make equal angles with the diameter passing through their point of intersection, prove that the chords are equal.
Q 3	A chord of a circle is equal to the radius of the circle. Find the angle subtended by the chord at a point on the minor arc and also at a point on the major arc. 
Q 4	In Figure, ∠ ABC = 69°, ∠ ACB = 31°, find ∠ BDC.
	
Q 5	In Figure, A, B, C and D are four points on a circle. AC and BD intersect at a point E such that ∠ BEC = 130° and ∠ ECD = 20°. Find ∠ BAC.
	
Q 6	In the given figure, O is the centre of the circle with chords AP and BP being produced to R and Q respectively. If ∠QPR = 35°, find the measure of ∠AOB.

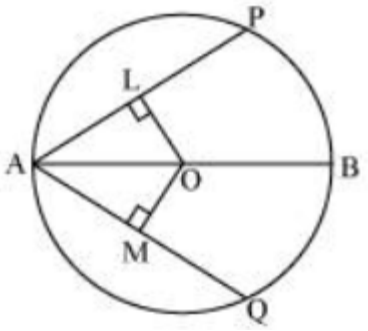
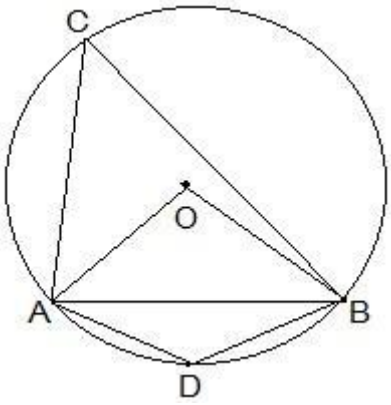
	
Q 7	In the figure, PQRS is a cyclic quadrilateral. Find the value of x.
	
Q 8	Prove that a cyclic parallelogram is a rectangle. 
Q 9	Two circles intersect at two points A and B. AD and AC are diameters to the two circles (see Figure). Prove that B lies on the line segment DC.
	
Q 10	If a line intersects two concentric circles (circles with the same centre) with centre O at A, B, C and D, prove that AB = CD (see Figure).
	

	LONG ANSWER TYPE QUESTIONS
Q 1	Prove that the angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.
Q 2	ABCD is a cyclic quadrilateral in which AC and BD are its diagonals. If ∠ DBC = 55° and ∠ BAC = 45°, find ∠ BCD.
	
Q 3	△ ABC and △ADC are two right triangles with common hypotenuse AC. Prove that ∠ CAD = ∠ CBD.
Q 4	ABCD is a parallelogram. The circle through A, B and C intersects CD (produce if necessary) at E. Prove that AE = AD.
Q 5	If a circle touches the side BC of a triangle ABC at P and extended sides AB and AC at Q and R, respectively, prove that AQ = 1/ 2 (BC + CA + AB)
	
Q 6	∠ PQR = 100°, where P, Q and R are points on a circle with centre O. Find ∠ OPR. 
Q 7	Show that the quadrilateral formed by angle bisectors of a cyclic quadrilateral is also cyclic.
	

Q 8	ABCD is a cyclic quadrilateral whose diagonals intersect at a point E. If ∠DBC = 70°, ∠ BAC is 30°, find ∠BCD. Further, if AB = BC, find ∠ ECD. 
Q 9	If diagonals of a cyclic quadrilateral are diameters of the circle through the vertices of the quadrilateral, prove that it is a rectangle
Q 10	If the non-parallel sides of a trapezium are equal, prove that it is cyclic.

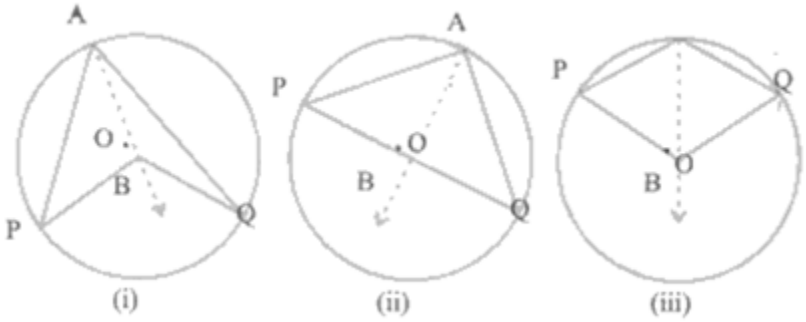
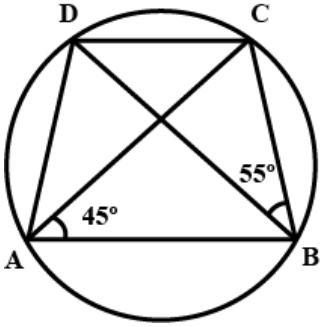
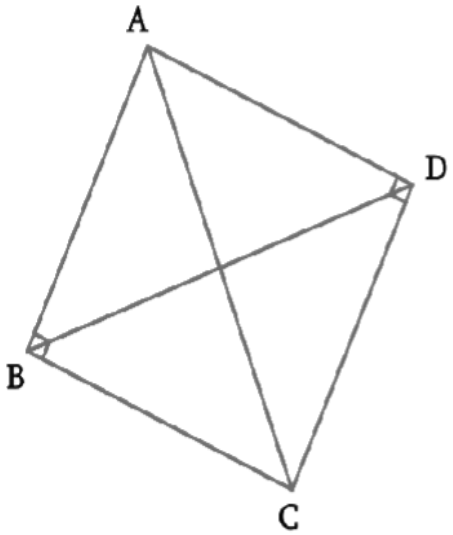
	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	(C) $17^2-15^2=8^2$,8÷2=4cm
Ans2	(C) $12^2+16^2=20^2$,20÷2=10cm
Ans3	(B) ∠ABC = 180º - 140º, ∠BAC + 90º + 40º = 180º,∠BAC = 50º
Ans4	(B) ∠ABO=40 º. ∠O=100, ∠C=100÷2=50
Ans5	(D) $13^2-5^2=12^2$,12cm
Ans6	(D) $25^2-24^2=7^2$,7cm
Ans7	(A) ∠AOC = 2 × 20° , ∠AOC = 40°
Ans8	(C) $17^2-8^2=15^2$,15+15=30cm
Ans9	(D) $4^2+3^2=5^2$,5cm
Ans10	(D) OA = OD, OB = OC, ∠ AOB = ∠ COD,Δ AOB= Δ COD (By SAS) AB = CD = 5.5 cm
	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
1	(i)c,(ii)b,(iii)c,(iv)c,(v)c
2	b,b,d,c,d
3	b,a,c,a,d
4	A,b,b,c,c
5	B,b,c,a,d
	SOLUTIONS TO OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
1	True
2	True
3	True
4	∠AO'B
5	6 cm
6	chord
7	We know that Angle at the centre of the circle is twice the angle at the circumference subtended by the same arc. ∠AOC = 2 ∠ABC It is given that ∠ABC = 20º Substituting the values ∠AOC = 2 × 20º ∠AOC = 40º Therefore, ∠AOC is equal to 40º.

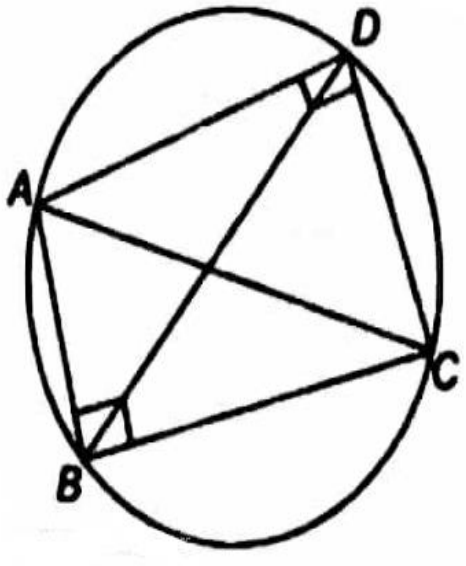
8	We know that Diameter subtends a right angle to the circle ∠BCA = 90º … (1) It is given that AC = BC As the angles opposite to equal sides are equal ∠ABC = ∠CAB … (2) In triangle ABC using the angle sum property ∠CAB + ∠ABC + ∠BCA = 180º From equations (1) and (2) ∠CAB + ∠CAB + 90º = 180º 2∠CAB = 180 º - 90 º 2∠CAB = 90 º Dividing both sides by 2 ∠CAB = 45º, Therefore, ∠CAB is equal to 45º.
9	It is given to us that, ∠ APB = 90°. We know that a right angle is formed inside a circle when a triangle is inscribed inside a semicircle. Thus, the chord used to form the right angle has to be the diameter of the circle. Thus, chord AB is the diameter of the circle, that is, it is equal to 2r.
10	Angle subtended by a diameter/ semicircle on any point of a circle is 90°
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
1	Using equal angles at the centers and the fact that circles are congruent, we prove the statement using Side-Angle-Side (SAS criteria) and corresponding parts of congruent triangles (CPCT).  Draw chords QR and YZ in two congruent circles as shown above. Join the radii PR, PQ, and XY, XZ respectively. Given that chords subtend equal angles at the center. So, ∠ QPR = ∠ YXZ. We need to prove that chords are equal, that is, QR = YZ Since the circles are congruent, their radii will be equal. PR = PQ = XZ = XY Consider the two triangles ΔPQR and ΔXYZ. PQ = XY (Radii are equal) ∠ QPR = ∠ YXZ (Chords subtend equal angles at center)

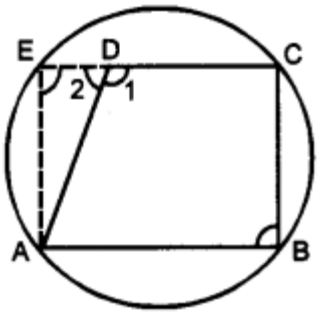
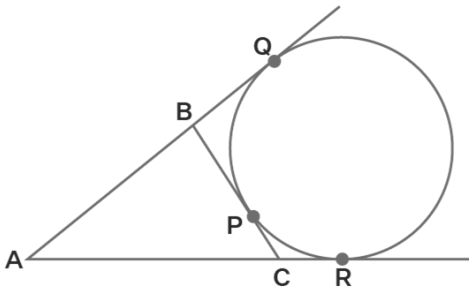
	PR = XZ (Radii are equal) By SAS criteria, ΔPQR is congruent to ΔXYZ. So, QR = YZ (Corresponding parts of congruent triangles) Hence proved if chords of congruent circles subtend equal angles at their center then the chords are equal.
2	 Given:**AB** is the diameter of the circle with centre **O**.**AP** and **AQ** are two intersecting chords of the circle such that ∠**PAB = ∠QAB** Proof: In △**AOL** and △**AOM** ∠**OLA = ∠OMB** (each **90∘**) **OA = OA** (common line) ∴∠**OAL = ∠OAM** (∠**PAB = ∠QAB)** ∴△ **AOL** ≅ △ **AOM** by AAS congruence criterion ⇒**OL = OM** by CPCT ⇒ Chords **AP** and **AQ** are equidistant from centre **O** ⇒ **AP=AQ**(chords which are equidistant from the centre are equal.)
3	 The chord AB is equal to the radius of the circle. OA and OB are the two radii of the circle. From ΔOAB. AB = OA = OB = radius of the circle. ΔOAB is an equilateral triangle. ∴ AOC = 60° And, ACB = ½ AOB So, ACB = ½ × 60° = 30° Now, ACBD is a cyclic quadrilateral, ADB +ACB = 180° (Since they are the opposite angles of a cyclic quadrilateral)

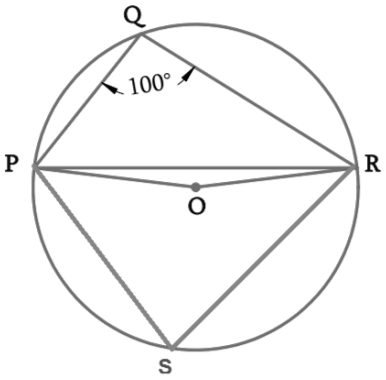
	So, ADB = 180°-30° = 150° So, the angle subtended by the chord at a point on the minor arc and also at a point on the major arc is 150° and 30° respectively.
4	Consider the ΔABC, the sum of all angles will be 180°. ∠ABC + ∠BAC + ∠ACB = 180° 69° + ∠BAC + 31° = 180° ∠BAC = 180° -100° = 80° We know that angles in the same segment of a circle are equal. So, ∠BDC = ∠BAC = 80°
5	Consider the straight-line BD. As the line AC intersects with the line BD, the sum of two adjacent angles so formed is 180°. Therefore, ∠BEC + ∠DEC = 180° 130° + ∠DEC = 180° ∠DEC =180° - 130° = 50° Consider the ΔDEC, the sum of all angles will be 180º. ∠DEC + ∠EDC + ∠ECD = 180° 50° + ∠EDC + 20° = 180° ∠EDC = 180° - 70° = 110° ∴∠BDC = ∠EDC = 110° We know that angles in the same segment of a circle are equal. ∴∠BAC = ∠BDC = 110°
6	∠APB = ∠RPQ = 35° [vertically opposite angles] Now, ∠AOB and ∠APB are angles subtended by an arc AB at centre and at the remaining part of the circle. ∴ ∠AOB = 2∠APB = 2 × 35° = 70°
7	**In ΔPRS, by using angle sum property, we have** **∠PSR + ∠SRP + ∠RPS = 180°** **∠PSR + 50° + 35° = 180°** **∠PSR = 180° – 85° = 95°** **Since PQRS is a cyclic quadrilateral** **∴ ∠PSR + ∠PQR = 180°** **[∵ opposite angles of a cyclic quadrilateral are supplementary]** **95° + x = 180°** **x = 180° – 95°** **x = 85°**
8	Let ABCD be the cyclic parallelogram. We know that opposite angles of a parallelogram are equal. ∠A = ∠C and ∠B = ∠D ... (1) We know that the sum of either pair of opposite angles of a cyclic quadrilateral is 180°. ∠A + ∠C = 180° ∠A + ∠A = 180° (From equation (1)) 2∠A = 180°

	∠A = 90° We know that if one of the interior angles of a parallelogram is 90°, all the other angles will also be equal to 90°. Since all the angles in the parallelogram are 90°, we can say that parallelogram ABCD is a rectangle.
9	Join AB. ∠ ABD = 90° (Angle in a semicircle) ∠ ABC = 90° (Angle in a semicircle) So, ∠ ABD + ∠ ABC = 90° + 90° = 180° Therefore, DBC is a line. That is B lies on the line segment DC.
10	Draw a perpendicular from the center of the circle OM to the line AD. We can see that BC is the chord of the smaller circle, and AD is the chord of the bigger circle. We know that perpendicular drawn from the center of the circle bisects the chord. ∴ BM = MC ... (1) and, AM = MD ... (2) Subtracting (2) from (1), we obtain AM − BM = DM − CM ∴ AB = CD
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
1	Given : An arc PQ of a circle subtending angles POQ at the centre O and PAQ at a point A on the remaining part of the circle. To prove :POQ=2PAQ To prove this theorem we consider the arc AB in three different situations, minor arc AB, major arc AB and semi-circle AB. Construction : Join the line AO extended to B. Proof : BOQ=OAQ+AQO .....(1) Also, in △ OAQ, OA=OQ [Radii of a circle] Therefore, ∠ OAQ=∠ OQA [Angles opposite to equal sides are equal] ∠ BOQ=2∠ OAQ .....(2) Similarly, BOP=2∠ OAP .....(3) Adding 2 & 3, we get, ∠ BOP+∠ BOQ=2(∠ OAP+∠ OAQ) ∠ POQ=2∠ PAQ .....(4) For the case 3, where PQ is the major arc, equation 4 is replaced by Reflex angle, ∠ POQ=2∠ PAQ

	
2	 ∠ CAD = ∠ DBC = 55° (Angles in the same segment) Therefore, ∠ DAB = ∠ CAD + ∠ BAC = 55° + 45° = 100° But ∠ DAB + ∠ BCD = 180° (Opposite angles of a cyclic quadrilateral) So, ∠ BCD = 180° – 100° = 80°
3	We know that, the sum of all angles in a triangle is 180°. If the sum of pair of opposite angles in a quadrilateral is 180°, then it is a cyclic quadrilateral.  Consider ΔABC, ∠ABC + ∠BCA + ∠CAB = 180° (Angle sum property of a triangle)

	$90° + \angle BCA + \angle CAB = 180°$ $\angle BCA + \angle CAB = 90°$.....(1) Consider ΔADC, $\angle CDA + \angle ACD + \angle DAC = 180°$ (Angle sum property of a triangle) $90° + \angle ACD + \angle DAC = 180°$ $\angle ACD + \angle DAC = 90°$.....(2) Adding Equations (1) and (2), we obtain $\angle BCA + \angle CAB + \angle ACD + \angle DAC = 180°$ $(\angle BCA + \angle ACD) + (\angle CAB + \angle DAC) = 180°$ $\angle BCD + \angle DAB = 180°$.....(3) However, it is given that $\angle B + \angle D = 90° + 90° = 180°$.....(4) From Equations (3) and (4), it can be observed that the sum of the measures of opposite angles of quadrilateral ABCD is 180°. Therefore, it is a cyclic quadrilateral. Since it is a cylclic quadrilateral the below figure can be drawn.  Consider chord CD. $\angle CAD$ and $\angle CBD$ are formed on the same segment CD. $\angle CAD = \angle CBD$ (Angles in the same segment are equal)

4	 Given : ABCD is a parallelogram. Circle through A, B and C intersects CD produced in E. To Prove: AE = AD Proof : ABCE is a cyclic quadrilateral. ∴∠B + ∠E = 180° …(i) ABCD is a parallelogram. ∴∠B = ∠1 … (ii) Also, ∠1 + ∠2 = 180° [linear pair] ∠B + ∠2 = 180° …(iii) [using (ii)] Now, from (i) and (iii), we have ∠B + ∠E = ∠B + ∠2 ∠E = ∠2 In ΔDE, we have ∠E = ∠2 ⇒ AD = AE [side opposite to equal angles of a A]
5	If the angles subtended by the chords of a circle at the centre are equal, then the chords are equal., BQ = BP CP = CR, and AQ = AR Now, 2AQ = AQ + AR = (AB + BQ) + (AC + CR) = AB + BP + AC + CP = (BP + CP) + AC + AB = BC + CA + AB i.e., AQ = 1/ 2 (BC + CA + AB). 
6	The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle. A quadrilateral ABCD is called cyclic if all the four vertices of it lie on a circle and the sum of either pair of opposite angles of a cyclic quadrilateral is 180°. Mark any point on the major arc side (opposite side to point Q) as S.



Since all points P, Q, R, S lie on the circle, PQRS becomes a cyclic quadrilateral.

We know that the sum of either pair of opposite angles of a cyclic quadrilateral is 180°.

Therefore,

∠PQR + ∠PSR = 180°

100° + ∠PSR = 180°

∠PSR = 180° - 100° = 80°

We know that the angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle.

Therefore,

∠POR = 2∠PSR

= 2 × 80°

= 160°

Consider the ΔOPR. It is an isosceles triangle as OP = OR = Radius of the circle.

Thus, ∠OPR = ∠ORP

Sum of all angles in a triangle is 180°.

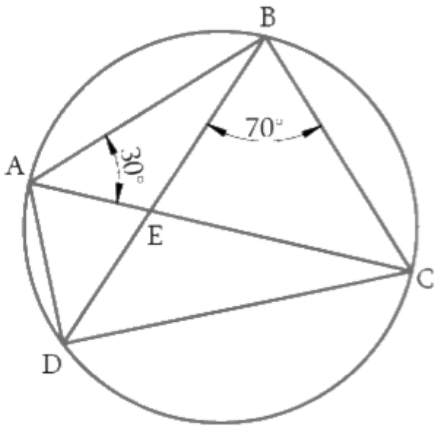
Therefore,

∠OPR + ∠POR + ∠ORP = 180°

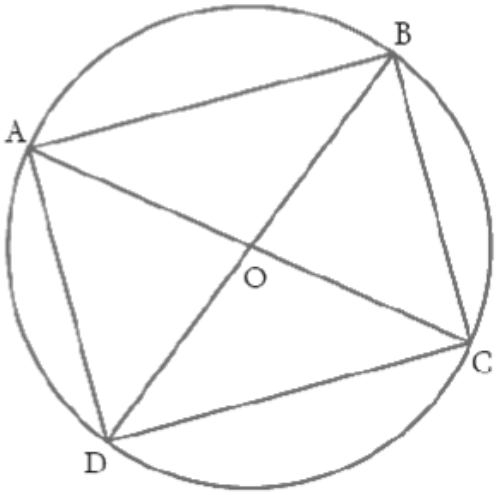
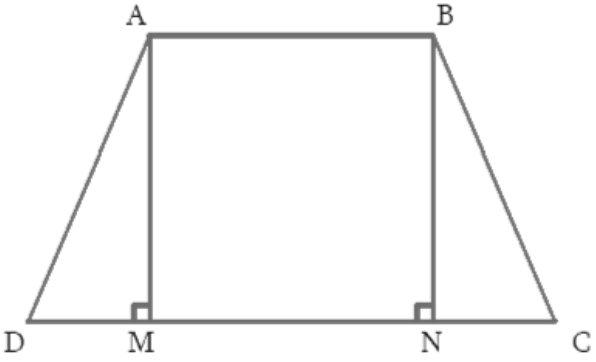
∠OPR + 160° + ∠OPR = 180°

2∠OPR = 180° - 160°

∠OPR = 10°

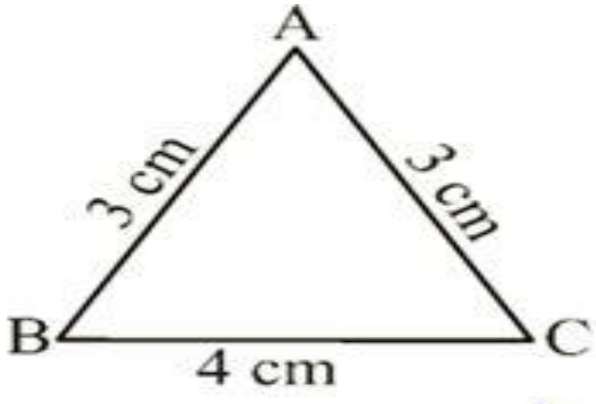
7	**Since ABCD is a cyclic quadrilateral.** **$\therefore \angle A + 2C = 180°$ …(i)** **and $\angle B + \angle D = 180°$…(ii)** **Also, AP, BP, CR and DR are the angle bisectors of ∠A, ∠B, ∠C and ∠D respectively.** **$\angle 1 = \frac{1}{2} \angle A$, $\angle 2 = \frac{1}{2} \angle B$, $\angle 3 = \frac{1}{2} \angle C$ and $\angle 4 = \frac{1}{2} \angle D$** **From (i),we have $\frac{1}{2} \angle A + \frac{1}{2} \angle C = \frac{1}{2} (\angle A + \angle C) = \frac{1}{2}$ x 180° =90° and** **From (ii), $\frac{1}{2} \angle B + \frac{1}{2} \angle D = \frac{1}{2} (\angle B + \angle C) = \frac{1}{2}$ x 180° =90°** **or $\angle 1 + \angle 3 = 90°$** **and $\angle 2 + \angle 4 = 90°$** **Now, in ΔAPB, by angle sum property of a triangle** **$\angle 1 + \angle 2 + \angle P = 180°$ … (iii)** **Again, in ΔCRD, by angle sum property of a triangle** **$\angle 3 + \angle 4 + \angle R = 180°$ …(iv)** **Adding (iii) and (iv), we have** **$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle P + \angle R = 180° + 180°$** **$90° + 90° + \angle P + \angle R = 360°$ [using (ii)]** **$\angle P + \angle R = 360° - 180° = 180°$** **i.e., the sum of one pair of the opposite angles of quadrilateral PQRS is 180°.** **Hence, the quadrilateral PQRS is a cyclic quadrilateral.**
8	 In the triangles, ABD and BCD, ∠CAD = ∠CBD = 70°. (Angles in the same segment are equal) Hence, ∠BAD = ∠CAB + ∠DAC = 30° + 70° = 100° Thus, ∠BAD = 100°

	Since ABCD is a cyclic quadrilateral, the sum of either pair of opposite angles of a cyclic quadrilateral is 180º. ∠BAD + ∠BCD = 180° ∠BCD = 180° - 100° = 80° Thus, ∠BCD = 80° Also given AB = BC. So, ∠BCA = ∠BAC = 30° (Base angles of isosceles triangle are equal) ∠ECD = ∠BCD - ∠BCA = 80° - 30° = 50° Thus, ∠ECD = 50°
9	Let BD be the diameter of the circle, which is also a chord. Then, ∠BOD = 180° Since AC and BD are diameters of the circle ⇒ AC = BD We know that the angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle. ∴∠BAD = 1/2 × ∠BOD = 90° Similarly, ∠BCD = 90° Now, considering AC as the diameter of the circle, we get ∠AOC = 180° We know that the angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle. ∠ABC = 1/2 × ∠AOC = 90° Similarly, ∠ADC = 90° Let us now consider the triangles ΔABC and ΔBAD,

	∠ABC = ∠BAD [Each equal to 90°] AB = BA [Common side of triangle ABC and BAD] AC = BD [Diameter of the circle] ∴ ΔABC ≅ ΔBAD [By RHS congruence criteria] ⇒ BC = AD [By Corresponding parts of Congruent triangles theorem] Similarly, AB = DC As you can see, all the angles at the corners are 90º and the opposite sides are equal. We can say that the shape joining the vertices ABCD is a rectangle. 
10	 Consider ΔAMD and ΔBNC AD = BC (Given) ∠AMD = ∠BNC (90°) AM = BN (Perpendicular distance between two parallel lines is same)

	By RHS congruence, ΔAMD ≅ ΔBNC. Using CPCT, ∠ADC = ∠BCD.....(1) ∠BAD and ∠ADC are on the same side of transversal AD. ∠BAD + ∠ADC = 180° ∠BAD + ∠BCD = 180° [From equation(1)] This equation proves that the sum of opposite angles is supplementary. Hence, ABCD is a cyclic quadrilateral.

CHAPTER 12 : Heron's Formula

	COMPETENCY BASED QUESTIONS
Q1	An isosceles right triangle has an area 8cm^2. The length of its hypotenuse is (a) $\sqrt{16}\ cm$ (b) $\sqrt{48}\ cm$ (c) $\sqrt{32}\ cm$ (d) $\sqrt{24}\ cm$
Q2	The sides of a triangle are 35cm, 54cm, and 61cm, respectively. The length of its longest altitude is (a) $26\sqrt{5}\ cm$ (b) 28 cm (c) $10\sqrt{5}\ cm$ (d) $24\sqrt{5}\ cm$
Q3	The sides of a triangle are 56cm, 60cm. and 52cm. long. The area of the triangle is. (a) 4311 cm^2 (b) 4322 cm^2 (c) 2392 cm^2 (d) None of these
Q4	The area of an equilateral triangle is $16\sqrt{3}$ m^2. Its perimeter is (a) 24m (b) 12m (c) 306 m (d) 48m
Q 5	The perimeter of a triangle is 30cm. Its sides are in the ratio 1 : 3 : 2, then its smallest side is. (a) 15cm (b) 5cm (c) 1 cm (d) 10cm
Q 6	**The sides of a triangle are 3 cm, 4 cm and 5 cm. Its area is:** a) 15 cm^2 b) 12 cm^2 c) 9 cm^2 d) 6 cm^2
Q 7	**The area of ΔABC is:**  a) 20 cm^2 b) 10 cm^2 c) 4√5 cm^2 d) 2√5 cm^2

Q 8	**The area of a triangular sign board of sides 5 cm, 12 cm and 13 cm is:** a) 60 cm^2 b) 30 cm^2 c) 12 cm^2 d) 65/2 cm^2
Q 9	**The perimeter of a right triangle is 60 cm and its hypotenuse is 26 cm. The other two sides of the triangle are:** a) 26 cm, 8 cm b) 25 cm, 9 cm c) 24 cm, 10 cm d) 20 cm, 14 cm
Q10	**The sides of a triangle are in a ratio of 25:14:12 and its perimeter is 510 m. The greatest side of the triangle is:** a) 270 m b) 250 m c) 170 m d) 120 m
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q 11	 In craft class Prince cuts a yellow marble paper in shape of a triangle. The type of triangle is right angled triangle. Hence one angle of triangle is 90^0. Hypotenuse is 5cm and other is 4cm
(i)	What is the type of triangle? **A** equilateral triangle **B** right angled triangle **C** Isosceles triangle **D** none of these
(ii)	What is the area of triangle in cm^2*cm*2? **A** 6 **B** 5 **C**4 **D**3
(iii)	Theorem to find area of right angled triangle is called_____ **A** Alternate angle theorem **B** Verticle angle theorem **C** Pythagoras Theorem **D** none of these

(iv)	In right angled triangle side opposite to 90^o90o is called_____ **A** Right side **B** Left side **C** side one **D** Hypotenuse
(v)	What is the area of triangle in cm^2*cm*2 if one side is 4cm and other 3cm ? **A** 6 **B** 7 **C** 8 **D** 9
Q 12	 Director of DAV Public School planned to fix a signal board, indicating SCHOOL AHEAD across main road. It is an equilateral triangular shaped with side 24 cm. Principal of the school calls the monitor Brajesh of class IX and asked the following questions:
(i)	What is the perimeter of board? **A** 72cm **B** 82cm **C** 90cm **D** 100cm
(ii)	Find area using Heron's formula. **A** $144\sqrt{3}$ cm^2 **B** $150\backslash\sqrt{3}$ cm^2 **C** $160\sqrt{3}$ cm^2 **D** $170\sqrt{3}$ cm^2
(iii)	Sum of all sides is called_____

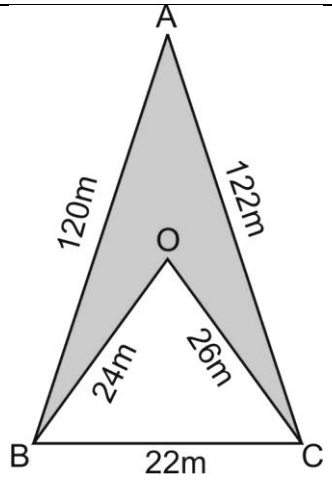
	A volume **B** area **C** Perimeter **D** none of these
IV	If all three sides were 20 cm then perimeter will be_____ **A** 30cm **B** 40cm **C** 50cm **D** 60cm
13	 There is a slide in a park,one of its side wall has been painted in some colour with a message "KEEP THE PARK GREEN AND CLEAN". If the sides of the walls are 15 m, 11 m and 6 m then answer following questions_____
I	Area of wall painted in colour is_____ **A** $20\sqrt{2}$ cm^2 **B** $10\backslash\sqrt{2}$ cm^2 **C** $5\sqrt{2}$ cm^2 **D** $20\backslash\sqrt{3}$ cm^2
II	Perimeter of triangle is_____ **A** 34m **B** 32m **C** 30m **D** 20m
III	Half perimeter is____ **A** 12m **B** 15m **C** 16m **D** 18m

IV	What will be perimeter if sides are 3m, 8m and 6m **A** 22m **B** 23m **C** 25m **D** 17m
V	What will be area if sides are 15m, 10m and 3m **A** 7.64 sqm **B** 30sq m **C** 40sq m **D** 50sq m
14	 Rahul has a field. His field is in shape of triangle. He once decides to measure sides of his land and founds it to be in ratio of 12:17:25. He founds perimeter as 540m
I	First side of field measures____ **A** 120m **B** 130m **C** 140m **D** 150m
II	Second side of field measures_____ **A** 130m **B** 170m **C** 140m **D** 150m
III	Third side of field measures_____ **A** 130m **B** 160 **C** 250m **D** 150m

IV	Half perimeter s of field is_____ **A** 130m **B** 140m **C** 150m **D** 270m
V	Area of field in m^2 is_____ **A** 9000 **B** 5600 **C** 4500 **D** 3400
15	 Raj goes to school and on his way he finds a traftic signal board indicating "SCHOOL AHEAD'. The board is an equilateral triangle with side each side a.
I	Perimeter of equilateral triangle with each side a is _____ **A** 3a **B** $\frac{3}{9}$ a^2 **C** $\frac{2}{3}$ $\mathbf{a^2}$ **D** ¾ a^2
II	If perimeter is 150cm, then how much will each side measure? **A** 70cm **B** 80cm **C** 50cm **D** 90cm
III	If perimeter is 270cm, then how much will each side measure? **A** 50cm **B** 60cm

	C 80cm **D** 90cm
IV	unit of area is_____ **A** Cm^2 **B** Cm^3 **C** cm^4 **D** cm
V	Area of triangle will be_____
v	Area of triangle
	A 3a **B** $\frac{3}{9}$ a^2 **C** $\frac{2}{3}\mathbf{a^2}$ **D** ¾ a^2
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q 16	Find the area of a triangular garden whose sides are 40m., 90m and 70m. (use $\sqrt{5}$ = 2.24)
Q 17	Area of a triangle = _____ × base × height
Q 18	What is the formula of diagonal of the rectangle?
Q 19	What is the formula of semi-perimeter of a triangle?
Q 20	An Isosceles triangle, with base a and equal sides b, what will be it's area formula
Q 21	Diagonal of a Square =
Q 22	Area of a Triangle =
Q 23	Area of a Parallelogram =
Q 24	The area of a Rectangle with length(l) and breadth(b) is ?
Q25	The perimeter of a Rectangle with length(l) and breadth(b) is ?
Q26	The diagonal of a Rectangle with length(l) and breadth(b) is ?

Q27	The area of a Square with side (a) is ?
Q28	The perimeter of a Square with side (a) is ?
Q 29	The diagonal of a Square with side (a) is ?
Q 30	The area of a parallelogram with breadth(b) and altitude(h) is ?
Q 31	The area of a rhombus with diagonals d_1d_1 and d_2d_2 is ?
Q32	The perimeter of a rhombus with diagonals d_1d_1 and d_2d_2 is ?
Q 33	The area of a trapezium with parallel sides a and b and distance between two parallel sides as h is ?
Q34	The area of a regular hexagon with side(a) is ?
	SHORT ANSWER TYPE QUESTIONS
Q 35	Find the area of a triangular garden whose sides are 40m., 90m and 70m. (use $\sqrt{5}$ = 2.24)
Q 36	Find the cost of leveling a ground in the form of a triangle with sides 16m, 12m and 20m at Rs. 4 per sq. meter.
Q 37	Find the area of a triangle, two sides of which are 8cm and 11cm and the perimeter is 32 cm.
Q 38	The area of an isosceles triangle is $12cm^2$. If one of its equal side is 5cm. Find its base.
Q 39	Find the area of a right triangle whose sides containing the right angle are 5cm and 6cm.
	LONG ANSWER TYPE QUESTIONS
Q40	Calculate the area of the shaded region.

	
Q 41	If each sides of a triangle is double, then find the ratio of area of the new triangle thus formed and the given triangle.
Q 42	A field is in the shape of a trapezium whose parallel sides are 25m and 10m. If its non-parallel sides are 14m and 13m, find its area.
Q 43	An umbrella is made by stitching 10 triangular pieces of cloth of 5 different colour each piece measuring 20cm, 50cm and 50cm. How much cloth of each colour is required for one umbrella? $(\sqrt{6} = 2.45)$
Q 44	A triangle and a parallelogram have the same base and some area. If the sides of the triangle are 26cm, 28cm and 30cm and the parallelogram stands on the base 28cm, find the height of the parallelogram.
Q 45	Find the area of a triangle two sides of which are 18cm and 10cm and the perimeter is 42cm.
Q 46	A triangular park ABC has sides 120m, 80m and 50m. A gardener Dhania has to put a fence all around it and also plant grass inside. How much area does she need to plant?
Q 47	A triangular park ABC has sides 120m, 80m and 50m. A gardener Dhania has to put a fence all around it and also plant grass inside. find the cost of fencing it with barbed wire at the rate of Rs 20 per metre leaving a space 3m wide for a gate on one side.
Q 48	The sides of a triangular plot are in the ratio of 3 : 5 : 7 and its perimeter is 300 m. Find its area
Q 49	A traffic signal board, indicating 'SCHOOL AHEAD', is an equilateral triangle. Find the area of the signal board, using Heron's formula if its perimeter is 180 cm?
Q 50	An isosceles triangle has perimeter 30 cm and each of the equal sides is 12 cm. Find the area of the triangle.
Q 51	Find the area of a quadrilateral ABCD in which AB = 3 cm, BC = 4 cm, CD = 4 cm, DA = 5 cm and AC = 5 cm.
Q52	A triangle and a parallelogram have the same base and the same area. If the sides of the triangle are 26 cm, 28 cm and 30 cm, and the parallelogram stands on the base 28 cm, find the height of the parallelogram
Q53	A rhombus shaped field has green grass for 18 cows to graze. If each side of the rhombus is 30 m and its longer diagonal is 48 m, how much area of grass field will each cow be getting?

	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	1 (c) $\sqrt{32}\ cm$ Q. 2 (d) $24\sqrt{5}\ cm$ Q. 3 (d) None of these Q. 4 (a) 24 m. Q. 5 (b) 5 cm. Q. 6 d Q.7 d Q8 b 9 c 10 b
	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
11	i-c ii – a iii - c iv - d v- a
12	I - a ii -a iii- c iv - d
13	i-a ii-b iii – c iv -d v - a
14	I - a ii - b iii- c iv - d v - a
15	I a ii c iii d iv c v d
16	1344 sq m
17	½
18	D = $\sqrt{(l^2 + b^2)}$
19	A= ½ (a+ b+ c)
20	Area = a/4 $\sqrt{(4b^2 - a^2)}$
21	$\sqrt{2}$ side
22	√{s (s-a) (s-b)(s-c)}
23	Base x height
24	lx b
25	2(l + b)
26	$\sqrt{(l^2 + b^2)}$

27	a^2
28	4a
29	√2 a
30	bh
31	½ d_1 x d_2
32	2 √(d_1^2 + $d2^2$)
33	½ (a+ b) h
34	3/2 √3 a^2
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
35	1344 sq. m.
36	384
37	$8\sqrt{30}\ cm^2$
38	6cm.
39	15cm^2
	SOLUTIONS TO LONG ANSWER TYPE QUESTIONS
40	1074m^2
41	2√2
42	196 sq. m.
43	980 cm^2 each.
44	12cm.
45	8 √30 CM^2

46	$375\sqrt{15}\ m^2$
47	Rs. 4940
48	$1500\sqrt{3}\ m^2$
49	$900\sqrt{3}\ cm^2$
50	$9\sqrt{15}\ cm^2$
51	$15.2\ cm^2$
52	12cm
53	$48\ cm^2$

CHAPTER 13 : SURFACE AREA AND VOLUME

	COMPETENCY BASED QUESTIONS
Q1	The surface area of a cube of side 27cm is a)2916cm^2 b)729cm^2 c)4374cm^2 d)19683cm^2
Q2	The diameter of the base of a cylinder of curved surface area 88cm^2 and height 14cm is a)2cm b)25cm c)1cm d)1.5cm
Q3	How many bricks, each measuring 25cmx12.5cmx7.5cm will be needed to construct a wall 15m long, 1.8m high and 37.5cm thick? a)4400 b)4660 c)4575 d)4320
Q4	The number of litres that a cuboidal water tank of dimensions 6mx5mx4.5m can hold is a)270000 b)135000 c)135 d)270
Q5	The volume of resulting cuboid formed when two cubes each of side 6cm are joined end to end is a)864cm^3 b)648cm^3 c)432cm^3 d)416cm^3
Q6	A conical tent is 15m high and the radius of its base is 20m. The cost of the canvas required to make the tent at the rate of Rs7 per m^2(in Rs) is a)10000 b)12000 c)11000 d)9000
Q7	The cost of digging a pit of dimensions 4.5mx2.5mx2.5m at the rate of Rs20 per cubic metre (in Rs) is a)1125 b)562.50 c)1687.50 d)281.25
Q8	If the radius of a sphere is doubled, then the ratio of the volume of the original sphere to that of the new one is a)16:1 b)1:16 c)1:8 d)8:1
Q9	In a cylinder, if the radius is doubled and the height is halved. The curved surface area will be a)halved b)same c)doubled d)4 times
Q10	The curved surface area of right circular cylinder of height 14cm is 88cm^2. The diameter of the base of the cylinder is a)3cm b)2cm c)4cm d)1cm
	CASE STUDY QUESTIONS
Q11	To develop critical and analyzing skills amongst children, maths teacher showed her students a video of 3 D objects and asked the students to identify the 3 D object. One such video was of PWD workers constructing road using road roller. The cylindrical road roller made of iron was 1m long. Its diameter was 54cm and thickness of the iron sheet rolled into the road roller is 9cm.
i)	What is the outer radius of the road roller? a)22cm b) 44cm c) 36cm d) 11cm
ii)	What is the outer curved surface area of the road roller? a) 1548πcm^2 b) 220πcm^2 c) 720πcm^2 d) 7200πcm^2
iii)	If PWD workers constructed 1584m^2 road in one day, find the number of revolutions that the road roller made a) 500 b)1000 c) 100 d)700

iv)	What will be the amount of iron used in road roller?(take∏=3014) a) 178038cm^3 b)406944cm^3 c) 228906cm^3 d) 356076cm^3
v)	If 1cubic cm of iron weighs 10g, what will be the weight of road rollar(in kg)? a)1780.38kg b)4069.44kg c)2289.06kg d)3560.76kg
Q12	Ravi was doing an experiment to find the radius r of a sphere. For this he took a cylindrical container with radius R=7cm and height 10cm. He filled the container half by water. Now he dropped a sphere in the container. He observed that the water level in the container raised 3.40cm
i)	What is the approximate radius of sphere a) 7cm b)5cm c) 4cm d)3cm
ii)	What is the volume of cylinder? a) 700cm^3 b) 500cm^3 c) 1540cm^3 d) 2000cm^3
iii)	What is the approximate volume of sphere? a) 700cm^3 b) 600cm^3 c) 500cm^3 d) 523.8cm^3
iv)	How many litres water can be filled in the full container?(1litre=1000cm^3) a)1.50 b)1.44 c)1.54 d)2
v)	What is the surface area of sphere? a)314.3cm^2 b)300cm^2 c)400cm^2 d)500cm^2
Q13	The residents of a society decided to paint a hall cancer detection centre in their premises. If the floor of the cuboidal hall has a perimeter equal to 250m and height 6m then
i)	Find the cost of painting its 4 walls (including doors etc) at the rate of Rs8 per m^2 a)Rs9000 b)Rs10000 c)Rs11000 d)Rs12000
ii)	What is the amount contributed by each resident, if there are 50 residents in society? a)Rs120 b)Rs240 c)Rs65 d)Rs150
iii)	If there are 200 people in society and 50 litres of water per person every day. Water reservoir measuring 20mx10mx5m. For how many days the water of the tank is sufficient? a)200 b)150 c)100 d)50
iv	If area of floor is 50m^2, how many square shaped tiles of dimension 0.5mx0.5m are required to cover the floor? a)25 b)50 c)100 d)200
v)	What is the ratio of perimeter of floor to perimeter of a tile? a) 125:1 b)250:1 c)125:2 d)125:3
Q14	50 students of class IX planned a visit to old age home and to spend the whole day with its inmates, each one prepared cylindrical flower vase using cardboard to gift the inmates. The radius of cylinder is 4.2cm and height is 11.2cm.
i)	What is the total surface area of each of the cylindrical vase a)248cm^2 b)351.12cm^2 c)304.12cm^2 d)400cm^2
ii)	What is the total amount spent for purchasing the cardboard at the rate of Rs20 per 100cm^2? a)Rs3511.20 b)Rs3010.20 c)Rs3412.12 d)Rs3612.12
iii)	What is the approximate volume of one vase? a)621cm^3 b)800cm^3 c)891cm^3 d)1000cm^3

iv)	What is the approximate amount spent to decorate the curved surface area of a vase at the rate of Rs2per100 m^2? a)Rs6 b)Rs10 c)Rs16 d)Rs20
v)	If radius of cylinder is doubled, then new area of base will be ----- times of original area of base. a)2times b)3 times c)4 times d)no change
Q15	In a grinding mill, there were installed 5 types of mills. These mills used spherical shaped steel balls of radius 5mm, 7mm, 10mm, 14mm, 16mm respectively. For repairing purpose mill needs 10 balls of radius 7mm and 20 balls of radius 3.5m. The workshop was having 20000mm^3 steel which was melted and 10 balls of radius 7mm and 20 balls of radius 3.5m were made and the remaining steel was stored for future use.
i)	What was the volume of 10 balls of radius 7mm? a)14373.3mm^3 b)14000mm^3 c)7000mm^3 d)20000mm^3
ii)	What was the volume of 20 balls of radius 3.5mm? a)2000mm^3 b)1800mm^3 c)1796.6mm^3 d)3593.3mm^3
iii)	How much steel was kept for future use? a)1250mm^3 b)2033.4mm^3 c)1300mm^3 d)2200mm^3
iv)	What was the surface area of one ball of radius 7mm? a)600mm^2 b)616mm^2 c)308mm^2 d)154mm^2
v)	What is the ratio of surface area of a ball of radius 7mm and a ball of radius 3.5mm? a)2:1 b)1:2 c)4:1 d)1:4
	OBJECTIVE TYPE QUESTIONS(OTHER THAN MCQ)
	STATE TRUE OR FALSE(FROM Q1 TO Q5)
Q16	If the radius of a cylinder is doubled and its curved surface area is not changed, the height must be halved.
Q17	A cone, a hemisphere and a cylinder stand on equal bases and have the same height. The ratio of their volumes is 1:2:3.
Q18	If the height of the diagonal of a cube is 6√3cm, then the length of the edge of the cube is 3cm.
Q19	If a sphere is inscribed in a cube, then the ratio of the volume of the cube to the volume of the sphere will be 6: ∏.
Q20	A cylinder and a right circular cone are having the same base and same height. The volume of the cylinder is three times the volume of cone.
	FILL IN THE BLANK
Q21	Total surface area of a cube is 96cm^2. Side of cube is --------.
Q22	Height and radius of base of a cone is 3.5cm and 12cm.Its slant height is -------.
Q23	A cube has numerically equal surface area and volume. Edge of cube is -------.
Q24	Area of the base of a solid hemisphere is 36∏cm^2. Volume of hemisphere is -------.
Q25	Ratio of the surface area to the volume of the sphere of unit radius is --------.
	SHORT ANSWER TYPE QUESTIONS
Q26	Find the capacity in litres of a conical vessel having height 8 cm and slant

	height 10 cm.
Q27	Calculate the surface area of a hemispherical dome of a temple with radius 14 m to be whitewashed from outside.
Q28	The volume of a solid hemisphere is 1152 π cm^3. Find its curved surface area.
Q29	A heap of wheat is in the form of a cone whose diameter is 10.5 m and height is 3 m. Find it volume If 1m^3 wheat cost is ₹10, then find total cost.
Q30	A cylindrical vessel can hold 154 g of water. If the radius of its base is 3.5 cm, and1cm^3 of water weighs 1 g, find the depth of water.
Q31	How much ice-cream can be put into a cone with base radius 3.5 cm and height 12 cm?
Q32	The curved surface area of a cone is 12320 sq. cm, if the radius of its base is 56 cm, find its height.
Q33	Two cubes of edge 6 cm are joined to form a cuboid. Find the total surface area of the cuboid.
Q34	A metallic sphere is of radius 4.9 cm. If the density of the metal is 7.8 g/cm^2, find the mass of the sphere (π = 22/7).
Q35	A rectangular piece of paper is 22 cm long and 10 cm wide. A cylinder is formed by rolling the paper along its length. Find the volume of the cylinder.
	LONG ANSWER TYPE QUESTIONS
Q36	A wall of length 10 m is to be built across an open ground. The height of the wall is 5 m and thickness of the wall is 42 cm. If this wall is to be built with brick of dimensions 42 cm × 12 cm × 10 cm, then how many bricks would be required?
Q37	The volume of cylindrical pipe is 748 cm. Its length is 0.14 m and its internal radius is 0.09 m. Find thickness of pipe.
Q38	Using clay, Anant made a right circular cone of height 48 cm and base radius 12 cm. Versha reshapes it in the form of a sphere. Find the radius and curved surface area of the sphere so formed.
Q39	Salim provides water to a village, having a population of 4000 which requires 150 litres of water per head per day. He has storage tank measuring 20 m × 15 m × 6 m. For how many days will the water of his tank last? He increased the rate for providing water as the dependence of villagers increased on him. Which value is depicted by Salim?
Q40	To maintain beauty of a monument, the students of the school cleaned and painted the dome of the monument. The monument is in the form of a hemisphere. From inside, it was white washed by the students whose area is 249.48 m^2. Find the volume of the air inside the dome. If white washing costs ₹2 per m^2, how much does it costs ?
Q41	The curved surface area of a cylinder is 154 cm. The total surface area of the cylinder is three times its curved surface area. Find the volume of the cylinder.

Q42	It costs ₹3300 to paint the inner curved surface of a 10 m deep well. If the rate cost of painting is of ₹30 per m^2, find : (a) inner curved surface area (b) diameter of the well (c) capacity of the well.
Q43	A dome of a building is in the form of a hemisphere. From inside, it was whitewashed at the cost of ₹498.96. If the rate of whitewashing is ₹4 per square metre, find the : (i) Inside surface area of the dome (ii) Volume of the air inside the dome.
Q44	A right triangle ABC with sides 5 cm, 12 cm and 13 cm is revolved about the side 5 cm. Find the volume of the solid so obtained. If it is now revolved about the side 12 cm, then what would be the ratio of the volumes of the two solids obtained in two cases ?
Q45	A right triangle of hypotenuse 13 cm and one of its sides 12 cm is made to revolve taking side 12 cm as its axis. Find the volume and curved surface area of the solid so formed.

	ANSWERS
	COMPETENCY BASED QUESTIONS
ANS1	c)
ANS2	a)
ANS3	d)
ANS4	b)
ANS5	c)
ANS6	c)
ANS7	b)
ANS8	c)
ANS9	b)
ANS10	b)
	CASE STUDY(ANS)
ANS11(i)	c)27+9=36cm
ii)	d)$2\pi rh=2\pi x36x100=7200\pi cm^2$
iii)	d)(1584x7x100)/2x22x36=700
iv)	a)$\pi h(R^2-r^2)=3.14x100(36^2-27^2)=178038cm^3$
v)	a)178038x10g=1780380/1000kg=1780.38kg
ANS12(i)	b)$(4/3)\pi r^3=\pi x7^2x3.40,r=5$
ii)	c)$(22/7)x7x7x10=1540cm^3$
iii)	c)$(4/3)(22/7)(5^3)=500$(aprox)
iv)	c)1540/1000=1.54
v)	a)$4\pi r^2=4(22/7)(5x5)=314.3cm^2$
ANS13(i)	d)2(l+b)hx8=250x6x8=Rs12000
ii)	b)12000/50=Rs240
iii)	c)(20x10x5x1000)/200x50=100
iv)	d)50/(0.5x0.5)=200
v)	a)250/(4x0.5)=125:1
ANS14(i)	b)$\pi r(2h+r)=(22/7)(4.2)(2x11.2+4.2)=351.12cm^2$
ii)	a)50x351.12x(20/100)=Rs3511.20
iii)	a)$\pi r^2h=(22/7)x4.2x4.2x11.2=621cm^3$
iv)	a)$2\pi rh(2/100)=2x(22/7)x4.2x11.2x(2/100)=Rs6$(approx)
v)	c)$\pi(2r)^2=4(\pi r^2)$
ANS15(i)	a)$10(4/3)\pi r^3=10(4/3)(22/7)(7x7x7)=14373.3mm^3$
ii)	d)$20(4/3)(22/7)(3.5x3.5x3.5=3593.3mm^3$
iii)	b)20000-(14373.3+17966.6)=2033.4
iv)	b)$4(22/7)(7x7)=616mm^2$
v)	c)[4x(22/7)x7x7]/[4x(22/7)x3.5x3.5]=4:1
	OBJECTIVE TYPE QUESTIONS(OTHER THAN MCQ)
ANS16	True,$2\pi rh=2\pi(2r)h/2$
ANS17	True,$(1/3)\pi r^2r$: $(2/3)\pi r^3$: πr^2r
ANS18	False, $a\sqrt{3}=6\sqrt{3},a=6$
ANS19	True,a^3:$(4/3)\ \pi(a/2)^3=6$: π.
ANS20	True
ANS21	4cm, $6a^2=96,a=4cm$
ANS22	12.5cm,$l=\sqrt{r^2+h^2}=\sqrt{12^2+3.5^2}=12.5cm$
ANS23	6cm, $a^3=6a^2$ so edge=6
ANS24	$144\pi cm^2$, $\pi r^2=36\pi$ so r=6cm. volume=$(2/3)\ \pi(6x6x6)=144\pi$
ANS25	3:1, $4\pi(1)^2/(4/3)\ \pi(1)^3=3:1$

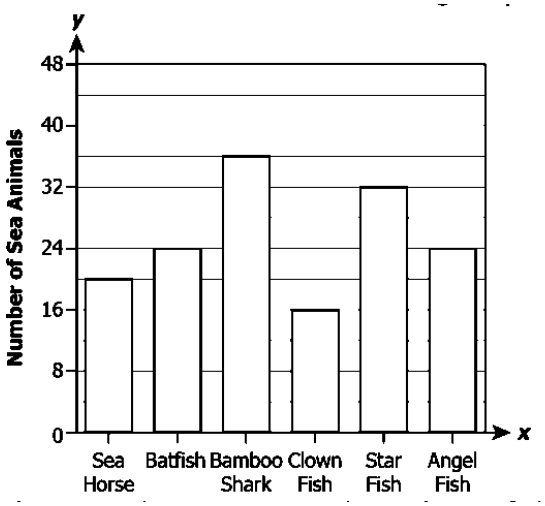
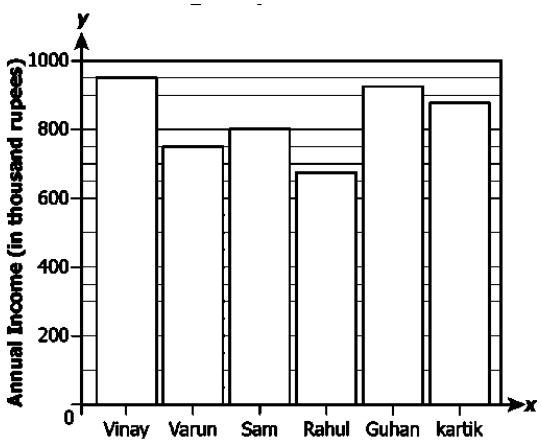
	SHORT ANSWER TYPE QUESTIONS
ANS26	$R^2 + h^2 = l^2$ $\Rightarrow r^2 + 8^2 = 10^2$ $\Rightarrow r^2 = 100 - 64 = 36$ $\Rightarrow r = 6$ cm Now, volume of conical vessel = $(1/3)\pi r^2 h = (1/3) \times (22/7) \times 6 \times 8 =$ 301.71 cm^3 = 0.30171 litre
ANS27	Surface area of dome = $2\pi r^2$ $= 2 \times (22/7) \times 14 \times 14 = 1232\ m^2$ Hence, total surface area to be whitewashed from outside is 1232 m^2.
ANS28	volume of hemisphere = $1152\ \pi\ cm^3$ $\therefore (2/3)\pi r^3 = 1152$ $\Rightarrow r=12$ Now, curved surface area = $2\pi r^2$ $= 2 \times \pi \times (12)^2 = 288\pi\ cm^2$
ANS29	Volume of cone = $(1/3)\pi r^2 h$ $= (1/3) \times (22/7) \times 5.25 \times 5.25 \times 3$ $= 86.625\ m^3$ Cost of $1m^3$ of wheat = ₹10 Cost of 86.625 m^3 of wheat = ₹10 × 86.625 = ₹866.25
ANS30	Since 1 cm^3 of water weighs 1 g. $\therefore$ Volume of cylindrical vessel = 154 cm^3 $\pi r^2 h = 154$ $(22/7) \times 3.5 \times 3.5 \times h = 154$ h = 4cm Hence, the depth of water is 4 cm.
ANS31	radius (r) = 3.5 cm and height (h) = 12 cm $\therefore$ Amount of ice-cream = $(1/3)\ \pi r^2 h$ $= (1/3) \times (22/7) \times 3.5 \times 3.5 \times 12$ $= 154\ cm^3$
ANS32	$\pi rl = 12320$ l = (12320x7)/(22x56) = 70 cm Again, we have $r^2 + h^2 = l^2$ $h^2 = 70^2 - 56^2$ $= 4900 - 3136 = 1764$ $h = \sqrt{1764} = 42$ cm
ANS33	When two cubes are joined end to end, then Length of the cuboid = 6 + 6 = 12 cm Breadth of the cuboid = 6 cm Height of the cuboid = 6 cm Total surface area of the cuboid = 2 (lb + bh + hl)

	= 2(12 × 6 + 6 × 6 + 6 × 12) = 2(72 + 36 + 72) = 2(180) = 360 cm^2
ANS34	radius of metallic sphere (r) = 4.9 cm Volume of sphere=(4/3)(22/7)$(4.9)^3$=493cm^3 mass=493x7.8=3845.4g
ANS35	Since rectangular piece of paper is rolled along its length. ∴ 2πr = 22 r = (22x7)/2x22) = 3.5 cm Height of cylinder (h) = 10 cm ∴ Volume of cylinder = $\pi r^2 h$ = (22/7) × 3.5 × 3.5 × 10 = 385 cm^3
	LONG ANSWER TYPE QUESTIONS
ANS36	length of the wall (L) = 10 m = 1000 cm Breadth of the wall (B) = 42 cm Height of the wall (H) = 5 m = 500 cm ∴ Volume of the wall = L × B × H = 1000 × 42 × 500 cm^3 Volume of each brick = 42 × 12 × 10 cm^3 Number of bricks=(1000x42x500)/42x12x10=4166.67 = 4167 Hence, the required number of bricks is 4167.
ANS37	Internal radius (r) of cylindrical pipe = 0.09 m = 9 cm Length (height) of cylindrical pipe (h) = 0.14 m = 14 cm Let external radius of the cylindrical pipe be R cm. Volume of cylindrical pipe = 748 cm3 ⇒ $\pi(R^2 - r^2)h = 748$ ⇒ $(22/7)(R^2 - 9^2)14 = 748$ ⇒ $R^2 = 81 + 17 = 98$ ⇒ R = √98 = 7√2 cm = 9.9 cm Thus, thickness of the pipe = 9.9 -9 = 0.9 cm
ANS38	Height of cone (h) = 48 cm Radius of the base of cone = 12 cm Let R be the radius of sphere so formed ∴ Volume of sphere = Volume of cone $(4/3)\pi R^3 = (1/3)\pi r^2 h$ $4R^3 = 12 \times 12 \times 48$ $R^3 = 12 \times 12 \times 12$ R = 12 cm Now, curved surface area of sphere = $4\pi R^2$ = 4 × (22/7)× 12 × 12 = 1810.29 cm

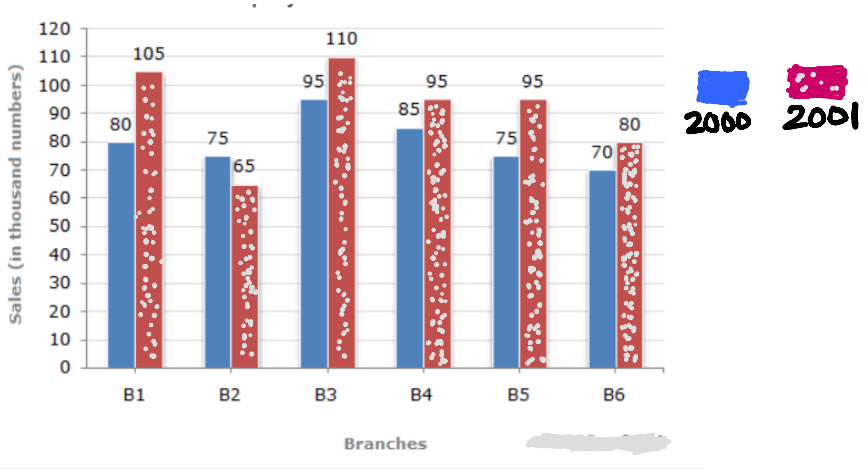
ANS39	the population of the village = 4000 Requirement of water per head per day = 150 litres ∴ Total requirement of water per day = 4000 × 150 litres = 600000 litres Volume of water tank = 20 × 15 × 6 = 1800 m^3 = 1800 × 1000 litres Now, number of days for which water of the tank will last = 1800X1000/600000 = 3 days Hence, water tank can serve for 3 days.
ANS40	dome of the monument is hemispherical in shape, which was whitewashed by the students. Now, total area to be white washed = 249.48 m^2 Cost of white washing = ₹2 per m^2 ∴ Total cost of white washing = ₹2 × 249.48 = ₹498.96 Also, $2\pi r^2$ = 249.48 r^2=(249.48x7)/2x22=158.76, r=12.6 Volume of dome=(2/3)(22/7)$(12.6)^3$ = 4191.264 m^3
ANS41	curved surface area of cylinder = 154 cm^2 (given] Total surface area of cylinder = 3 × curved surface area $2\pi rh + 2\pi r^2 = 3 \times 154$ 3 154 + $2\pi r^2$ = 462 $2\pi r^2 = 462 - 154 = 308$ r^2=49, r=7cm 2πrh=154 h=(154x7)/2x22x7=3.5cm Volume of cylinder=(22/7)$(7)^2$(3.5)=539cm^3
ANS42	cost of painting inner curved surface is ₹30 per m^2 and total cost is ₹3300 Curved surface area=3300/30=110m^2 2πrh=110 r=(110x7)/2x11x10=1.75m Volume=πr^2h=(22/7)x1.75x1.75x10=96.25m^3 Hence, inner curved surface area is 110 m^2, diameter of the well is 2 × 1.75 i.e., 3.5 m and capacity of the well is 96.25 m^3.
ANS43	dome of building is a hemisphere. Total cost of whitewashing inside the dome = ₹498.96 Rate of whitewashing = ₹4 per m^2 Inside surface area of dome=498.96/4=124.74m^2 $2\pi r^2$=124.74

	r^2=(124.74x7)/2x22=19.845 r=4.45m Volume of air inside dome=(2/3)πr^3=(2/3)(22/7)$(4.45)^3$=184.63m^3
ANS44	right triangle ABC with sides 5 cm, 12 cm and 13 cm is revolved about the side 5 cm. ∴ Radius of the base of cone = 12 cm Height of the cone = 5 cm Volume of cone=(1/3)πx12^2x5=720π/3cm^3 Again,right triangle ABC is now revolved about side 12cm. Now, volume of cone=(1/3)πx5^2x12=300π/3cm^3 Required ratio of volumes=720π/3:300π/3=12:5
ANS45	hypotenuse and one side of a right triangle are 13 cm and 12 cm respectively. Third side=$(13^2-12^2)^{1/2}$=5cm Now, given triangle is revolved, taking 12 cm as its axis ∴ Radius of the cone (r) = 5 cm Height of the cone (h) = 12 cm Slant height of the cone (1) = 13 cm ∴ Curved surface area = πrl = π(5)(13) = 65π cm^2 Volume of the cone = (1/3)πr^2h = (1/3)π × 5 × 5 × 12 = 100π cm^3 Hence, the volume and curved surface area of the solid so formed are 100 π cm^3 and 65 π cm^2 respectively.

CHAPTER : STATISTICS

	COMPETENCY BASED QUESTIONS
Q1	The bar graph below shows the number of sea animals in a large aquarium  How many more sea horses are there in the aquarium than clown fishes? (a) 2 (b) 4 (c) 6 (d) 8
Q2	The bar graph shows the annual income of a group of friends.  Who earns the most among the group of friends and how much more does he earn than the one who earns the least? (a) Vinay; Rs 200000 (b) Vinay; Rs 275000 (c) Guhan; Rs 175000 (d) Guhan; Rs 250000
Q3	The bar graph given below shows the sales of books (in thousand number) from six branches of a publishing company during two consecutive years

2000 and 2001.



What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?

(a) 2:3 (b) 4:5 (c) 7:9 (d) 6:9

Q4

To draw a histogram to represent the following frequency distribution:

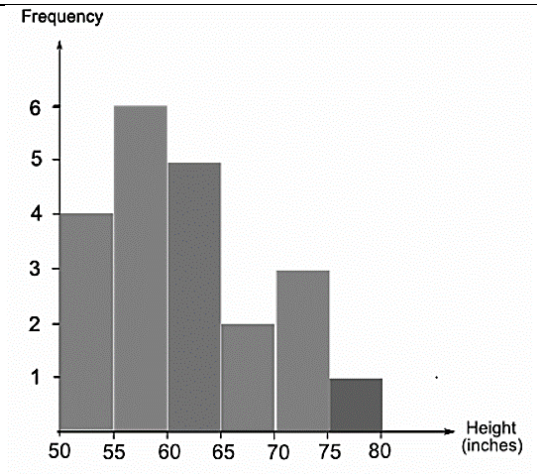
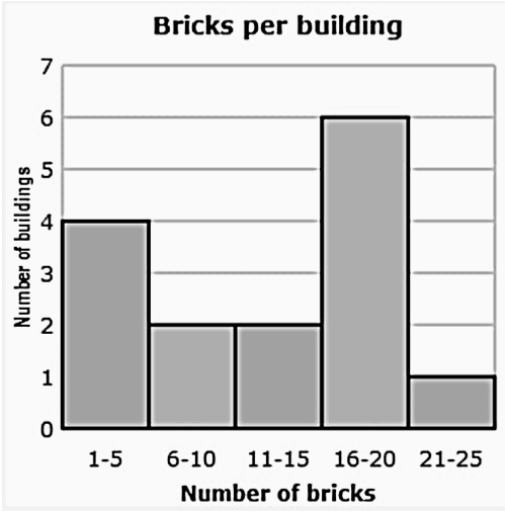
CLASS INTERVAL	5-10	10-15	15-25	25-45	45-75
FREQUENCY	6	12	10	8	15

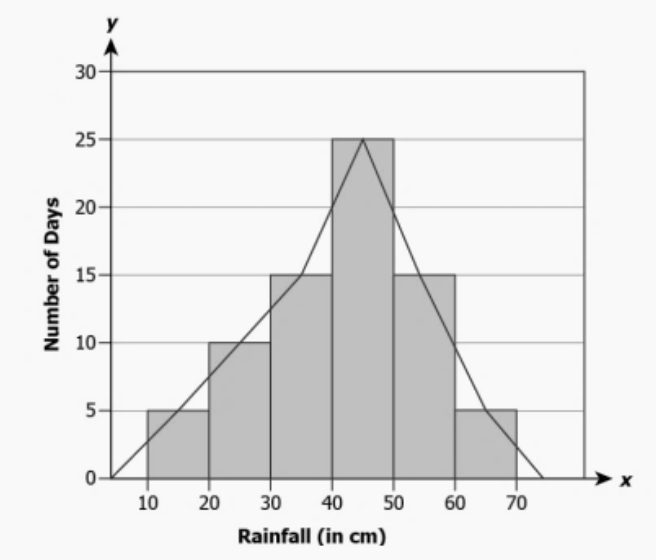
the adjusted frequency for the class 25-45 is:

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

Q 5

The histogram shows the heights of 21 students in a class, grouped into 5-inch groups.

	 How many students were greater than or equal to 60 inches tall? (a) 21 (b) 17 (c) 11 (d) 6
Q 6	In a frequency distribution table, the class interval 150-160 is attached with the frequency 15. So the point on the frequency polygon corresponding to this is (a) (150,15) (b) (155,15) (c) (160-15) (d) (165,15)
Q 7	The architecture student counted the number of bricks in each building in his neighborhood. How many buildings are there in the interval 6-20?  (a) 2 (b) 6 (c) 10 (d) 14
Q 8	The frequency polygon below shows the amount, in cm, of rainfall received on different number of days in a city over a year.



Which of these is true about the frequency polygon?

(a) The maximum amount of rainfall received is between 40-50 cm.

(b) The amount of rainfall received was about 10-20 cm for 10 of the days.

(c) The amount of rainfall received was about 50-60 cm for more than 15 of the days.

(d) There were equal number of days when the rainfall was between 10-20 cm and 60-70 cm.

Q 9

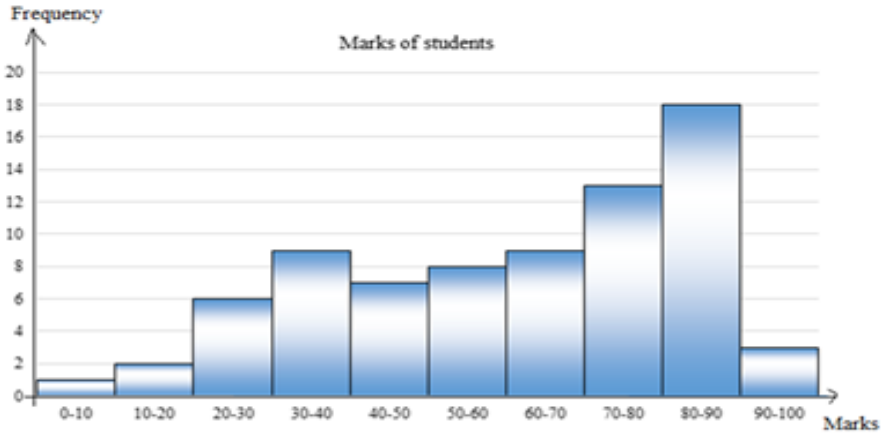
If a frequency polygon is drawn from the following frequency distribution, then its first two points will be

Marks (out of 50)	Number of students
0-10	8
10-20	10
20-30	6
30-40	7
4-50	10

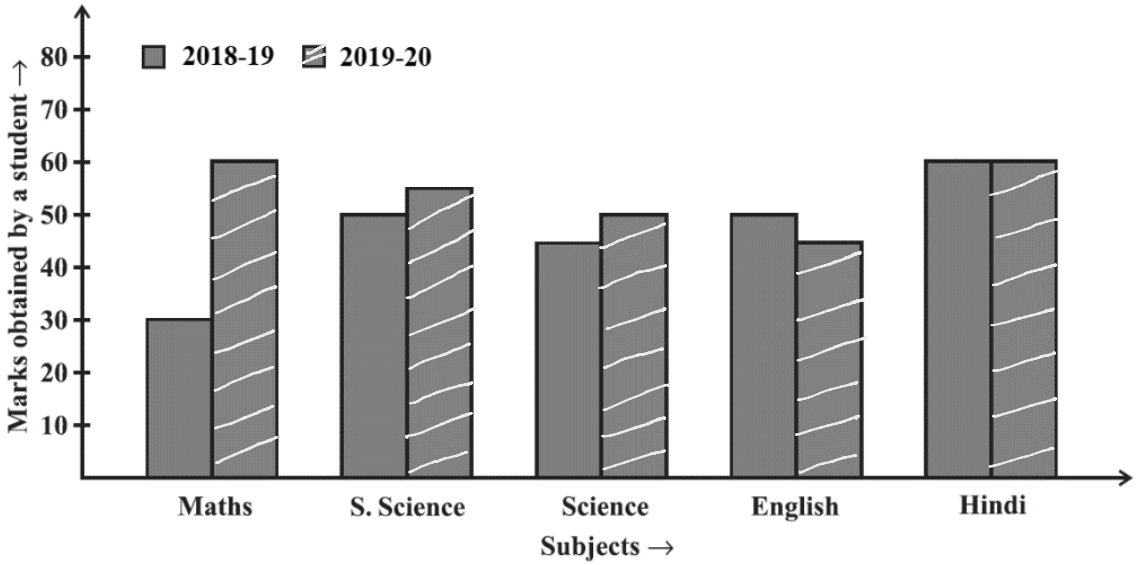
(a) (0,0), (4,0) (b) (-5,0), (5,8) (c) (5,8), (5,10) (d) (0,0), (0,4)

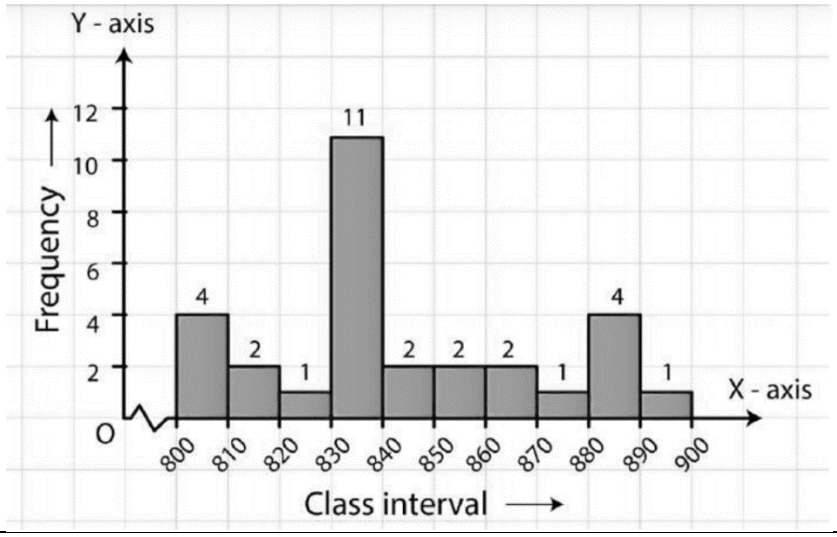
Q10

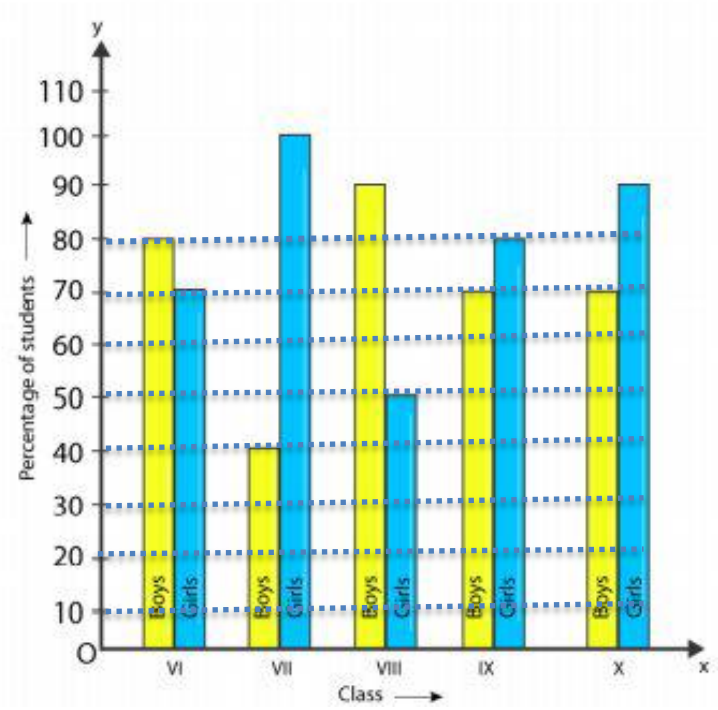
If a frequency polygon is drawn from the following frequency distribution, then its last two points will be

	<table><tr><td>Marks (out of 50)</td><td>Number of students</td></tr><tr><td>0-10</td><td>8</td></tr><tr><td>10-20</td><td>10</td></tr><tr><td>20-30</td><td>6</td></tr><tr><td>30-40</td><td>7</td></tr><tr><td>40-50</td><td>10</td></tr></table> (a) (35,7), (45,10) (b) (45,10), (55,0) (c) (50,5), (50,0) (d) (7,35), (10,45)
	CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Q 1	Anil is a Mathematics teacher in Hyderabad. After Periodic test 3, he asks students to collect the mathematics marks of all the students of Class IX- A, B and C. He prepares the frequency distribution table using the collected marks and draws Histogram using the table as shown in figure. 
(i)	(i) What is the width of the class? (a) 10 (b) 15 (c) 5 (d) None of these
(ii)	What is the total number of students in the Histogram? (a) 80 (b) 74 (c) 79 (d) 82

(iii)	How many students scored 50% and above marks? (a) 35 (b) 51 (c) 42 (d) 45
(iv)	How many students scored less than 50% marks? (a) 19 (b) 26 (c) 27 (d) 23
(v)	What is the range of the collected marks? (a) 60 (b) 59 (c) 53 (d) 100
Q 2	A random survey is done on the number of children belonging to different age groups who play in government parks and the information is given in the form of a histogram given below 
(i)	The number of children belonging to the age group 2 to 4 year are (a) 6 (b) 8 (c) 10 (d) 12
(ii)	on how many children the survey was done? (a) 54 (b) 58 (c) 60 (d) 64
(iii)	which age group children has least frequency? (a) 1-2 (b) 2-4 (c) 7-9 (d) 11-15
(iv)	how many children of age below 9 years goes to government parks?

	(a) 42 (b) 46 (c) 48 (d) 50
(v)	How many children of age 7 years or more goes to government parks? (a) 28 (b) 30 (c) 35 (d) 40
Q 3	The Class teacher of Class X preparing result analysis of a student. She compares the marks of a student obtained (out of 100) in Class IX (2018-19) and Class X (2019-20) using the double bar graph as shown below 
(i)	In which subject has the performance improved the most? (a) Maths (b) Social Science (c) Science (d) English
(ii)	In which subject has the performance deteriorated? (a) Maths (b) Social Science (c) Science (d) English
(iii)	In which subject is the performance at par? (a) Hindi (b) Maths (c) Science (d) English
(iv)	What is the difference of marks in Maths Subject? (a) 5 (b) 30 (c) 0 (d) 10
(v)	What is the percentage of marks obtained by a student in (2019-20)?

	(a) 60% (b) 55% (c) 54% (d) 65%
Q 4	The histogram of weekly wages (in Rs.) of workers in a factory is given below: 
(i)	Which group has the maximum number of workers? (a)800-810 (b)880-890 (c)830-840 (d) 870-880
(ii)	How many workers earn Rs. 850 and more? (a) 8 (b) 10 (c) 14 (d) 20
(iii)	How many workers earn less then Rs, 850? (a) 10 (b) 20 (c) 30 (d) 40
(iv)	What is the class mark of interval 880-890? (a) 800 (b) 865 (c) 870 (d) 885
(v)	Total number of workers (a) 10 (b) 20 (c) 30 (d) 40
Q 5	The following bar graph shows the pass percentage in annual examination of a secondary school. Read the bar graph given below, and choose the correct option each

	
(i)	The pair of classes in which the absolute value of difference of percentages of boys and girls is same? (a) VI, VIII (b) VI, IX (c) VII, IX (d) VIII, X
(ii)	The class in which least percentage of girls failed? (a) VII (b) X (c) IX (d) VIII
(iii)	The class in which least percentage of boys failed? (a) VII, X (b) VII, IX (c) VIII, VI (d) IX,X
(iv)	Classes in which boys performed better than girls? (a) VI (b) VI,VIII (c) VII, IX (d) IX, X
(v)	which class overall result was best? (a) VII (b) X (c) IX (d) VIII
	OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
Q 1	In a histogram the areas of the rectangles are directly proportional to the frequencies of corresponding classes. (True / False)

<table>
<tr><td></td><td></td></tr>
<tr><td>Q 2</td><td>For drawing frequency polygon, we always need to draw a histogram. (True / False)</td></tr>
<tr><td>Q 3</td><td>In histogram of varying width, the adjusted frequency of a class is
$Adjusted\ frequency = \frac{Minimum\ class\ size}{class\ size} \times frequency\ of\ that\ class.$
(True / False)</td></tr>
<tr><td>Q 4</td><td>Frequency polygon is constructed by plotting frequency of the class interval and upper limit of the class interval. (True / False)</td></tr>
<tr><td>Q 5</td><td>Width of the bars have no significance in a histogram. (True / False)</td></tr>
<tr><td>Q 6</td><td>The mid-point of a class is called_____</td></tr>
<tr><td>Q 7</td><td>For drawing frequency polygon, we need _____for x-axis and _____ for y- axis.</td></tr>
<tr><td>Q 8</td><td>In a bar graph 0.4cm length of a bar represents 100 people. The length of bar which represent 1200 people is_____</td></tr>
<tr><td>Q 9</td><td>The class marks of the class interval 140-145 is_____</td></tr>
<tr><td>Q 10</td><td>One of the sides of frequency polygon is the _____axis.</td></tr>
<tr><td></td><td>SHORT ANSWER TYPE QUESTIONS</td></tr>
<tr><td>Q 1</td><td>The following table shows the favourite sports of 250 students of a school.
<table>
<tr><td>Sports</td><td>Cricket</td><td>Football</td><td>Tennis</td><td>Badminton</td><td>Swimming</td></tr>
<tr><td>No. of students</td><td>75</td><td>35</td><td>50</td><td>25</td><td>65</td></tr>
</table>
Represent the data by a bar graph.</td></tr>
<tr><td>Q 2</td><td>The following table shows the interest paid by India (in thousand crore rupees) on external debts during the period 1998−99 to 2002−03.</td></tr>
</table>

Represent the data by a bar graph.

Year	1998–99	1999–2000	2000–01	2001–02	2002–03
Interest (in thousand crore rupees)	70	84	98	106	120

Q3

The air distances of four cities from Delhi (in km) are given

City	Kolkata	Mumbai	Chennai	Hyderabad
Distance from Delhi (in km)	1340	1100	1700	1220

Draw a bar graph to represent the above data.

Q 4

Year	2010–11	2011–12	2012–13	2013–14	2014–15
No. of students	950	1125	1400	1750	1900

The above table shows the year wise strength of a school

Represent the above data by a bar graph.

Q 5

The daily wages of 50 workers in a factory are given below:

Daily wages (in rupees)	140–180	180–220	220–260	260–300	300–340	340–380
Number of workers	16	9	12	2	7	4

Construct a histogram to represent the above frequency distribution.

Q 6

The following table shows the average daily earnings of 40 general stores in a market, during a certain week.

Daily earnings (in rupees)	600–650	650–700	700–750	750–800	800–850	850–900
Number of stores	6	9	2	7	11	5

Draw a histogram to represent the above data.

Q 7

Class interval	8–13	13–18	18–23	23–28	28–33	33–38	38–43
Frequency	320	780	160	540	260	100	80

Draw a histogram for the frequency distribution of the following data

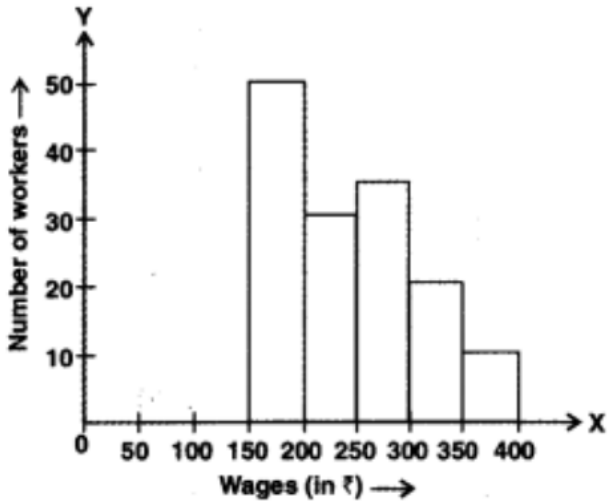
Q 8

Monthly school fee (in Rs):	30–60	60–90	90–120	120–150	150–180	180–210	210–240
Number of schools	5	12	14	18	10	9	4

Construct a histogram for the following data:

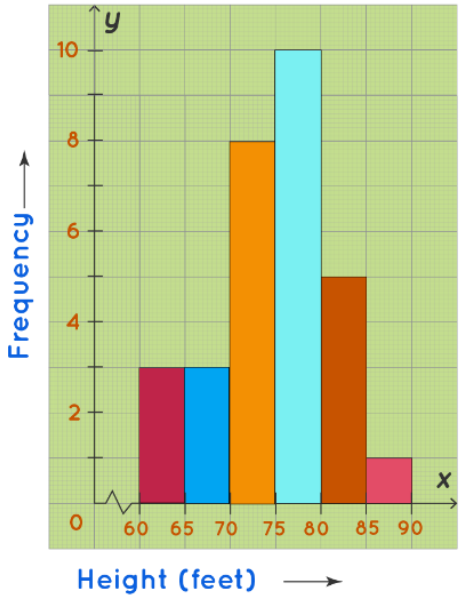
Q 9

In figure, there is a histogram depicting daily wages of workers in a factory. Construct the frequency distribution table.



Q 10

In figure, there is a histogram depicting marks obtained by 43 students. Construct the frequency distribution table.



LONG ANSWER TYPE QUESTIONS

Q 1

Construct a histogram for the following frequency distribution.

Class interval	5–12	13–20	21–28	29–36	37–44	45–52
Frequency	6	15	24	18	4	9

Q 2

The following table shows the number of illiterate persons in the age group (10–58 years) in a town:

	Age (in years)	10–16	17–23	24–30	31–37	38–44	45–51	52–58
	Number of illiterate persons	175	325	100	150	250	400	525

Draw a histogram to represent the above data

Q 3

Draw a histogram to represent the following data.

Class interval	10–14	14–20	20–32	32–52	52–80
Frequency	5	6	9	25	21

Q 4

Draw a histogram to represent the data given below

Marks (g)	0-20	20 – 30	30 – 50	50 – 60
No. of students	10	13	16	11

Q 5

In a study of diabetic patients in a village, the following observations were noted.

Age in years	10–20	20–30	30–40	40–50	50–60	60–70
Number of patients	2	5	12	19	9	4

Represent the above data by a frequency polygon

Q 6

Draw a frequency polygon for the following frequency distribution.

Class interval	1–10	11–20	21–30	31–40	41–50	51–60
Frequency	8	3	6	12	2	7

Q 7

The ages (in years) of 360 patients treated in a hospital on a particular day are given below.

Age in years	10–20	20–30	30–40	40–50	50–60	60–70
Number of patients	90	40	60	20	120	30

Draw a histogram and a frequency polygon on the same graph to represent the above data.

Q 8

Class interval	20–25	25–30	30–35	35–40	40–45	45–50
Frequency	30	24	52	28	46	10

Draw a histogram and the frequency polygon from the above data.

Q 9

Following table gives the distribution of students of sections A and B of a class according to the marks obtained by them.

SECTION A		SECTION B	
MARKS	FREQUENCY	MARKS	FREQUENCY
0-15	5	0-15	3
15-30	12	15-30	16
30-45	28	30-45	25
45-60	30	45-60	27
60-75	35	60-75	40
75-90	13	75-90	10

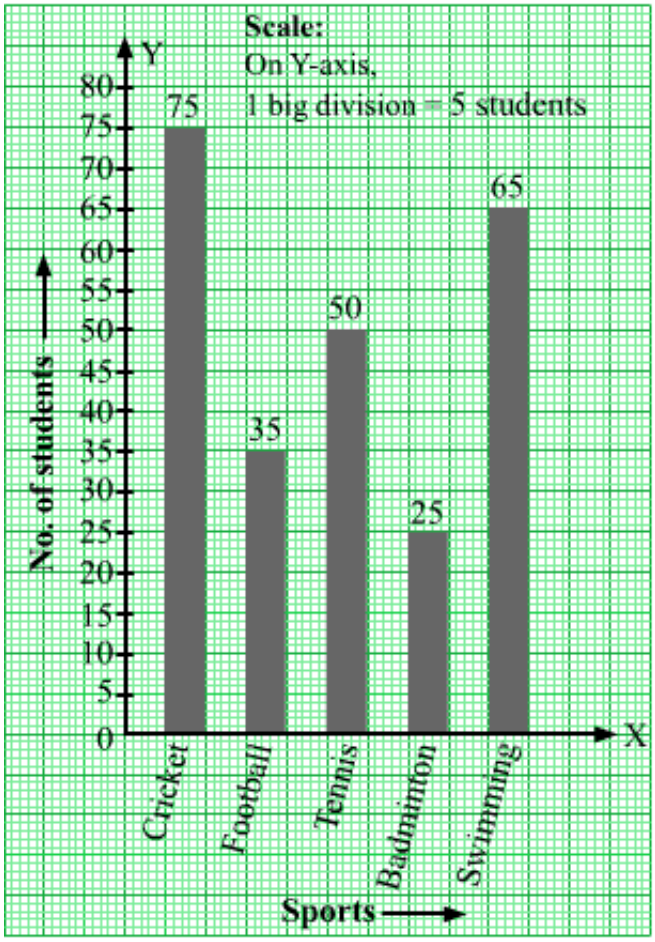
Q 10

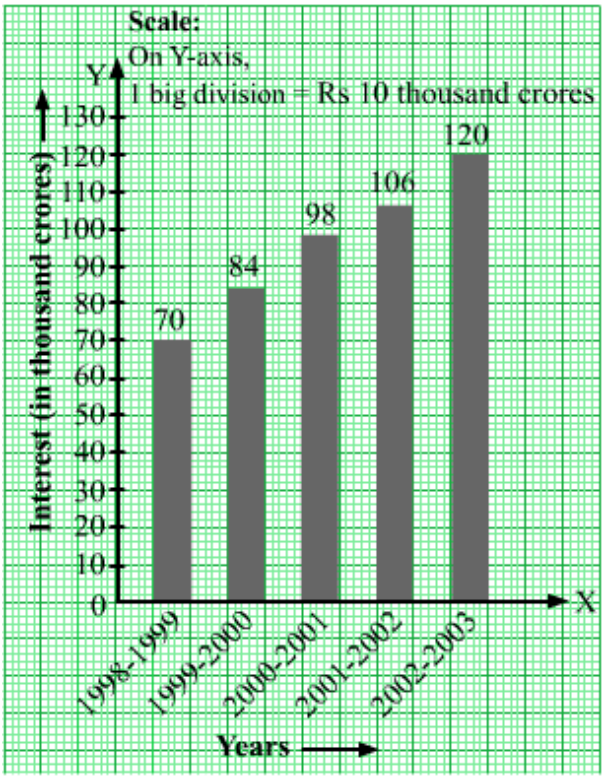
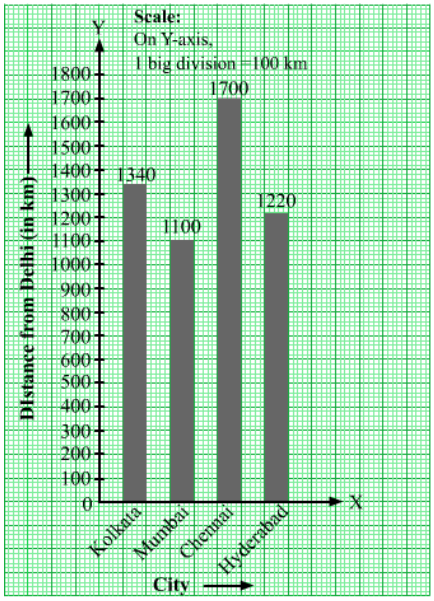
The following are the scores of two groups of class V students in a GK test

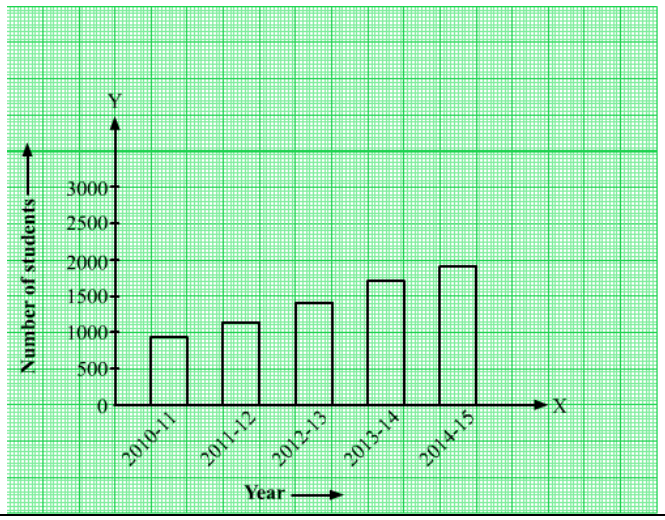
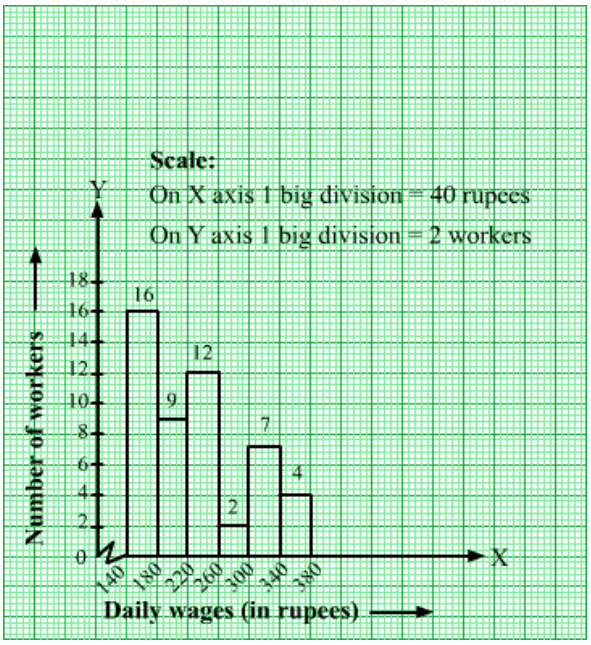
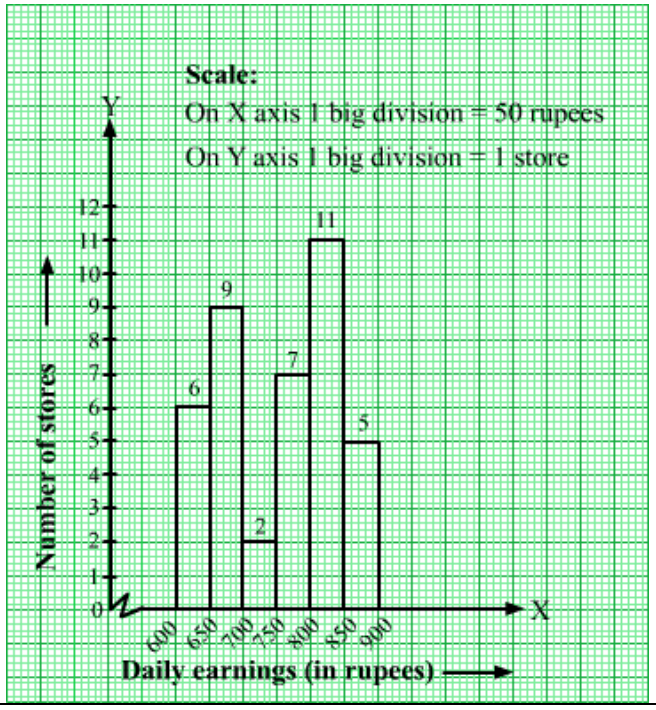
SCORES	GROUP A	GROUP B
50-52	4	2
47-49	10	3
44-46	15	4
41-36	18	8
38-40	20	12
35-37	12	17
32-34	13	22
TOTAL	92	68

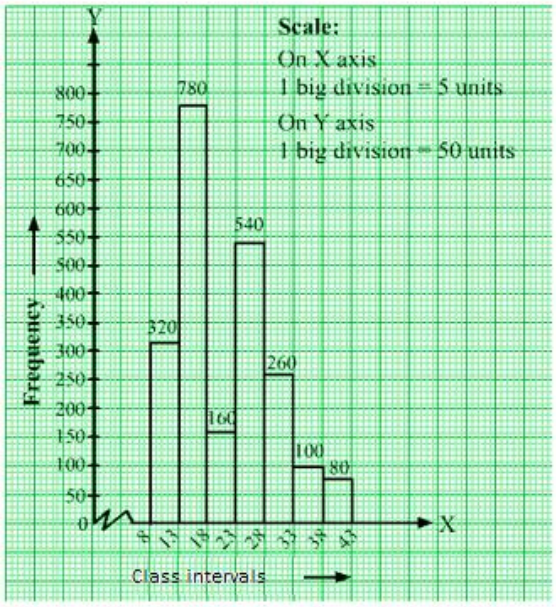
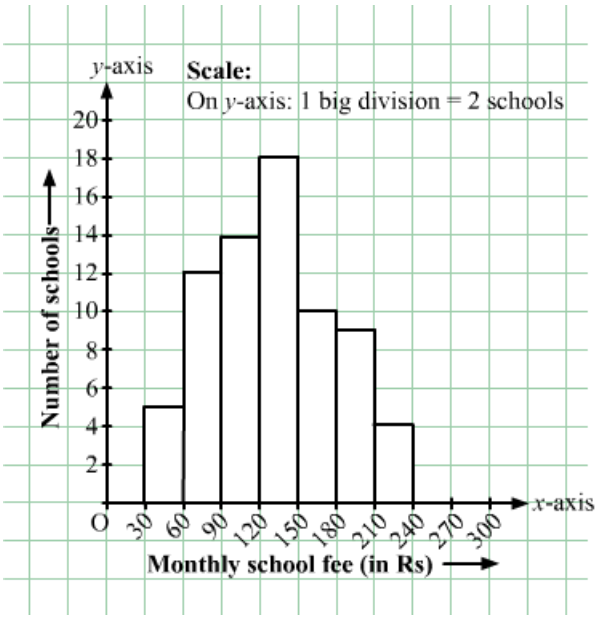
	SOLUTIONS TO COMPETENCY BASED QUESTIONS
Ans 1	(b)4
Ans 2	(b) Vinay; Rs 275000
Ans 3	(c) 7:9
Ans 4	(d) 2
Ans 5	(c) 11
Ans 6	(b) (155,15)
Ans 7	(c) 10
Ans 8	(d) There were equal number of days when the rainfall was between 10-20 cm and 60-70 cm.
Ans 9	(b) (-5,0), (5,8)
Ans 10	(b) (45,10), (55,0)
	SOLUTIONS TO CASE STUDIES/ SOURCE BASED INTEGRATED QUESTIONS
Ans1(i)	(a) 10
(ii)	(b) 74
(iii)	(b) 51
(iv)	(d)23
(v)	(d) 100
Ans2(i)	(c) 10
(ii)	(d) 64
(iii)	(d) 11-15
(iv)	(b) 46
(v)	(a) 28

Ans3(i)	(a) Maths
(ii)	(d) English
(iii)	(a) Hindi
(iv)	(b) 30
(v)	(c) 54%
Ans4(i)	(c)830-840
(ii)	(b) 10
(iii)	(b) 20
(iv)	(d) 885
(v)	(c) 30
Ans5(i)	(b) VI, IX
(ii)	(a) VII
(iii)	(c) VIII
(iv)	(c) VIII, VI
(v)	(b) X
	SOLUTIONS TO OBJECTIVE TYPE QUESTIONS (OTHER THAN MCQs)
1	TRUE
2	FALSE
3	TRUE
4	FALSE
5	FALSE
6	Class mark

7	Class mark, frequency
8	4.8
9	142.5
10	X-axis
	SOLUTIONS TO SHORT ANSWER TYPE QUESTIONS
1	

2	 Scale: On Y-axis, 1 big division = Rs 10 thousand crores Y Interest (in thousand crores) 130 120 110 100 90 80 70 60 50 40 30 20 10 0 70 84 98 106 120 X 1998-1999 1999-2000 2000-2001 2001-2002 2002-2003 Years
3	 Scale: On Y-axis, 1 big division =100 km Y Distance from Delhi (in km) 1800 1700 1600 1500 1400 1300 1200 1100 1000 900 800 700 600 500 400 300 200 100 0 1340 1100 1700 1220 X Kolkata Mumbai Chennai Hyderabad City

4	 Y 3000 2500 2000 1500 1000 500 0 X Number of students 2010-11 2011-12 2012-13 2013-14 2014-15 Year
5	 Scale: On X axis 1 big division = 40 rupees On Y axis 1 big division = 2 workers Y 18 16 14 12 10 8 6 4 2 0 X Number of workers 16 9 12 2 7 4 140 180 220 260 300 340 380 Daily wages (in rupees)
6	 Scale: On X axis 1 big division = 50 rupees On Y axis 1 big division = 1 store Y 12 11 10 9 8 7 6 5 4 3 2 1 0 X Number of stores 6 9 2 7 11 5 600 650 700 750 800 850 900 Daily earnings (in rupees)

7	 Y Scale: On X axis 1 big division = 5 units On Y axis 1 big division = 50 units Frequency 800 750 700 650 600 550 500 400 350 300 250 200 150 100 50 0 320 780 160 540 260 100 80 X Class intervals
8	 y-axis Scale: On y-axis: 1 big division = 2 schools Number of schools 20 18 16 14 12 10 8 6 4 2 O 30 60 90 120 150 180 210 240 270 300 x-axis Monthly school fee (in Rs)

9

CLASS INTERVAL	FREQUENCY
150-200	50
200-250	30
250-300	35
300-350	20
350-400	10
TOTAL	145

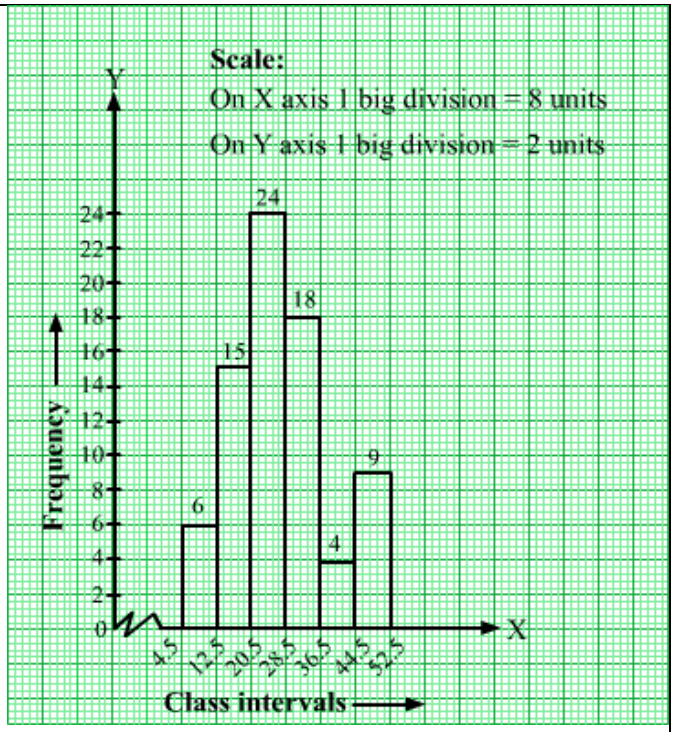
10

CLASS INTERVAL	FREQUENCY
60-65	3
65-70	3
70-75	8
75-80	10
80-85	5
85-90	1
TOTAL	30

SOLUTIONS TO LONG ANSWER TYPE QUESTIONS

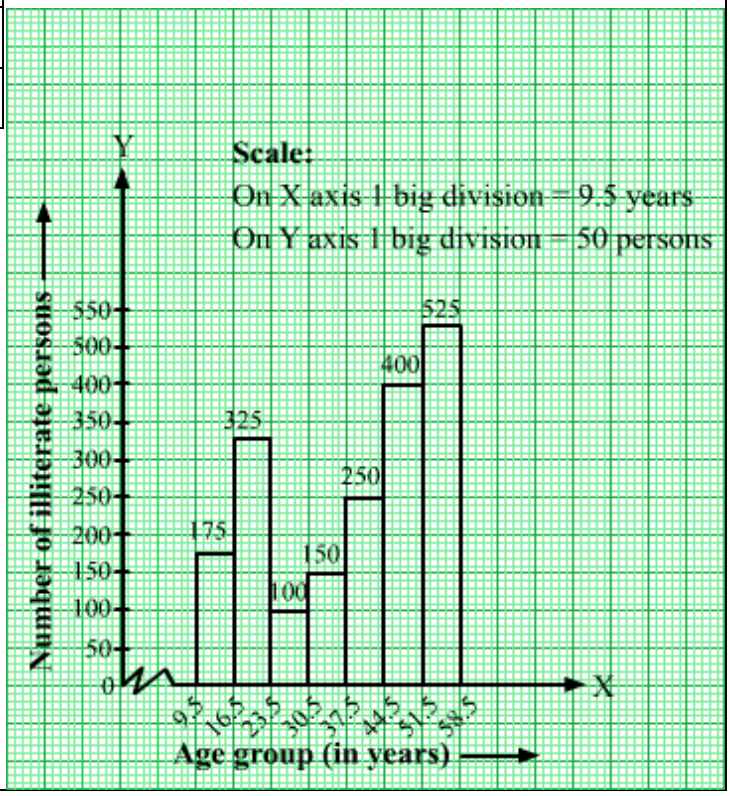
1

Class Interval	Frequency
4.5–12.5	6
12.5–20.5	15
20.5–28.5	24
28.5–36.5	18
36.5–44.5	4
44.5–52.5	9



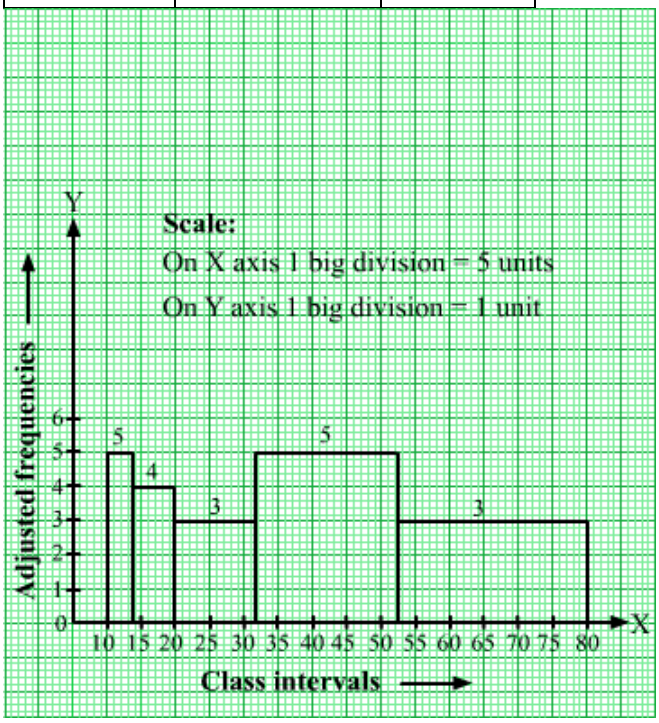
2

Age (in years)	Number of Illiterate Persons
9.5-16.5	175
16.5-23.5	325
23.5-30.5	100
30.5-37.5	150
37.5-44.5	250
44.5-51.5	400
51.5-58.5	525



3

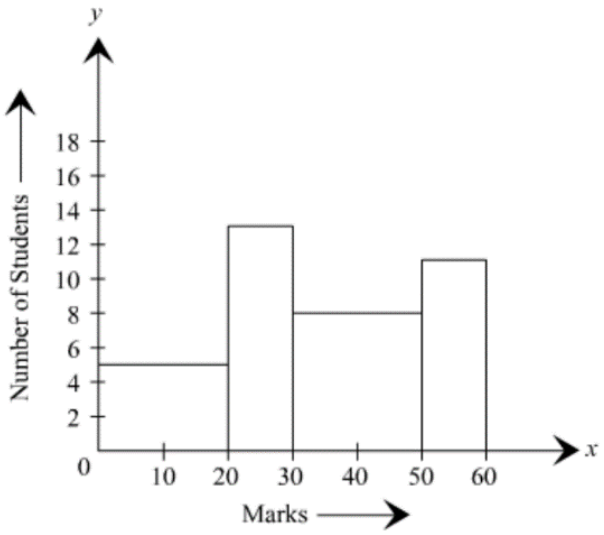
Class Interval	Frequency	Adjusted Frequency
10-14	5	$\frac{4}{4} \times 5 = 5$
14-20	6	$\frac{4}{6} \times 6 = 4$
20-32	9	$\frac{4}{12} \times 9 = 3$
32-52	25	$\frac{4}{20} \times 25 = 5$
52-80	21	$\frac{4}{28} \times 21 = 3$



4

Class	Frequen	Adjusted

Interval	cy	Frequency
0-20	10	$\frac{10}{20} \times 10 = 5$
20-30	13	$\frac{10}{10} \times 13 = 13$
30-50	16	$\frac{10}{20} \times 16 = 8$
50-60	11	$\frac{10}{10} \times 11 = 11$

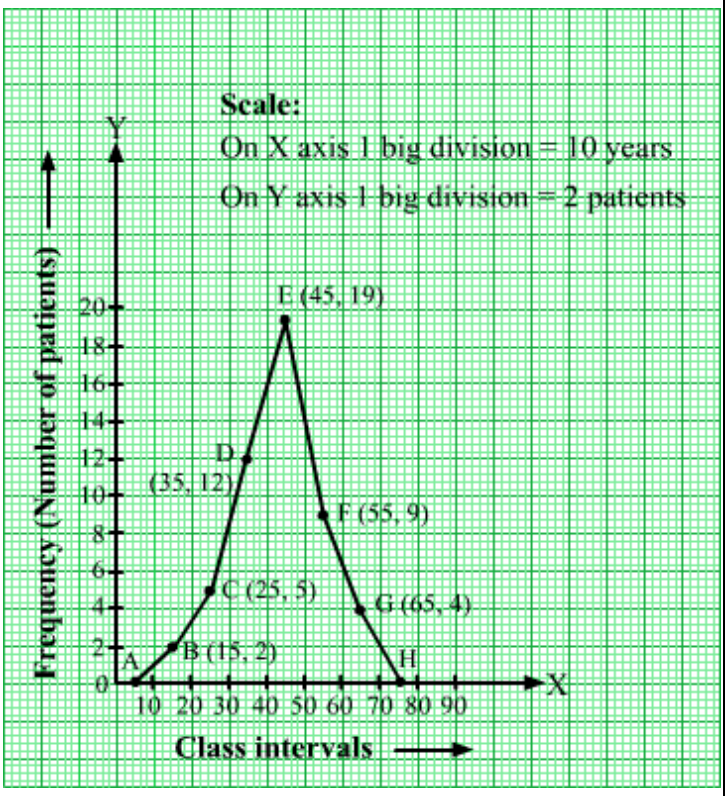


5

We take two imagined classes—one at the beginning (0–10) and other at the end (70–80) each with frequency zero.

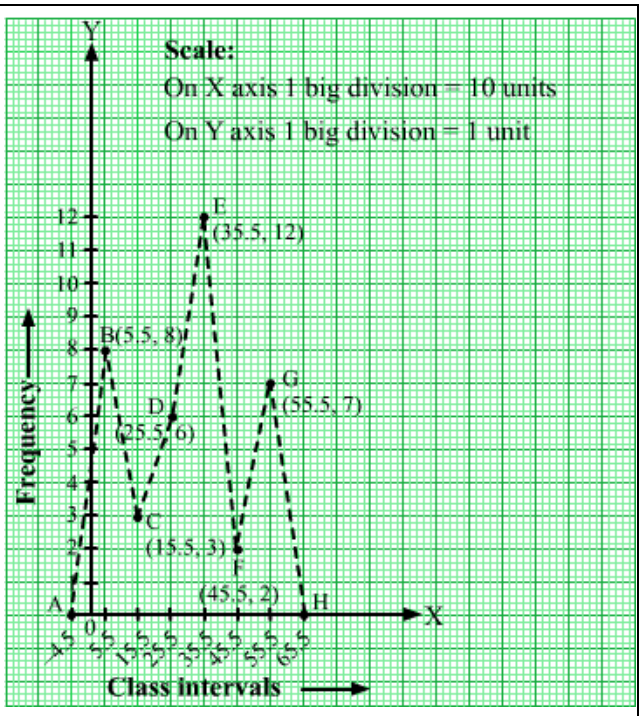
With these two classes, we have the following frequency table:

Age in Years	Class Mark	Frequency (Number of Patients)
0–10	5	0
10–20	15	2
20–30	25	5
30–40	35	12
40–50	45	19
50–60	55	9
60–70	65	4
70–80	75	0

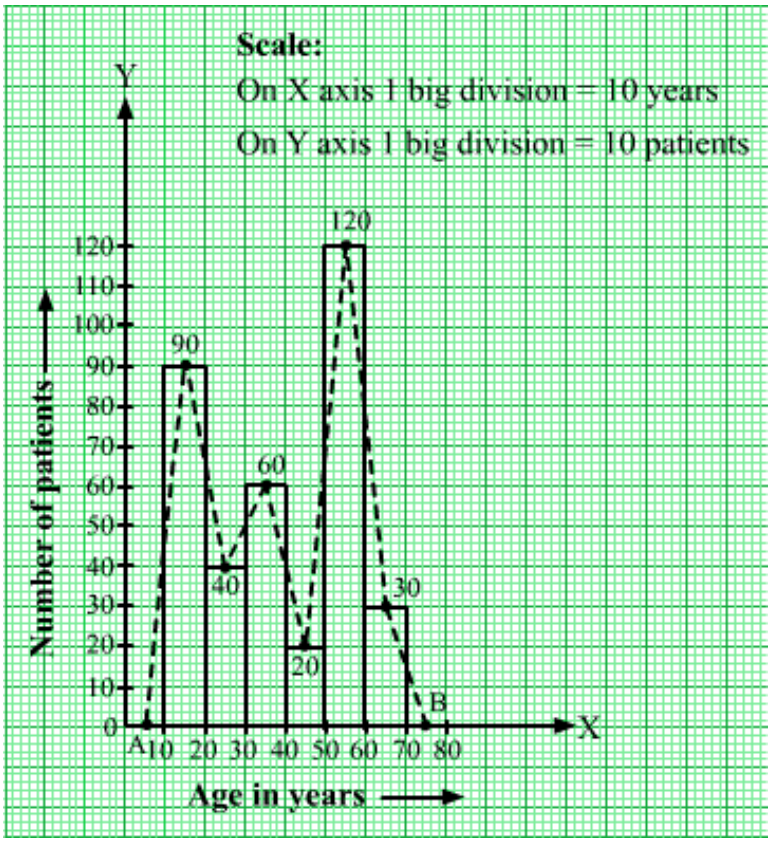


6

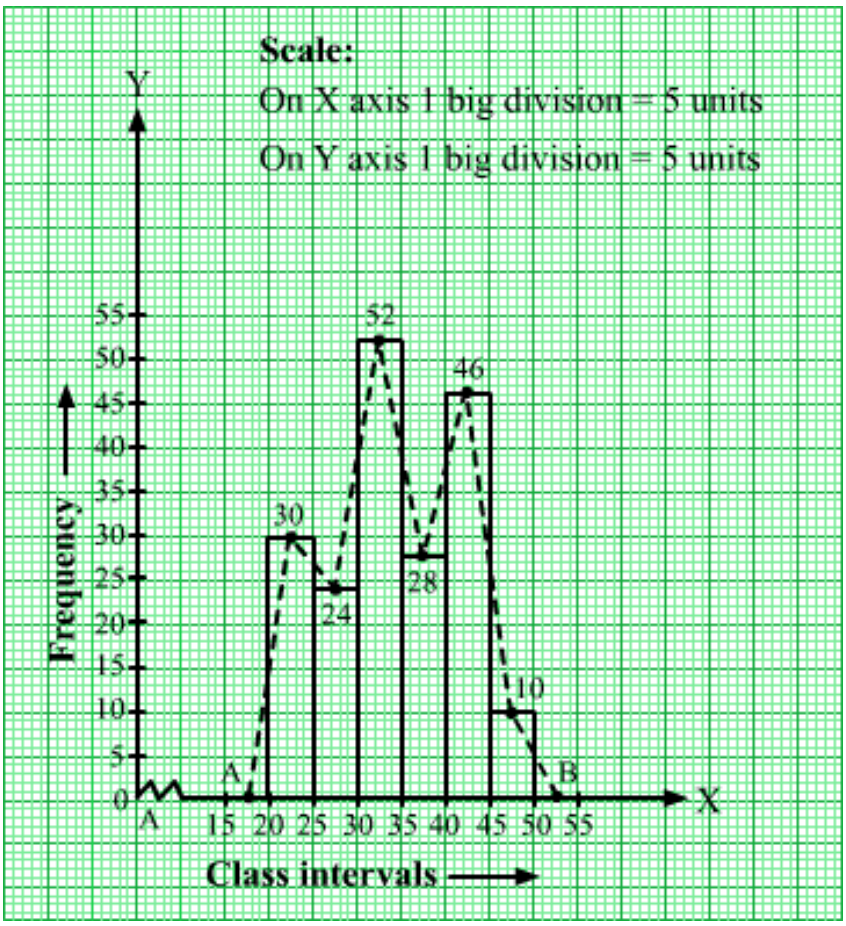
Class Interval	Class Mark	Frequency
-9–0	–4.5	0
1–10	5.5	8
11–20	15.5	3
21–30	25.5	6
31–40	35.5	12
41–50	45.5	2
51–60	55.5	7
61–70	65.5	0



7

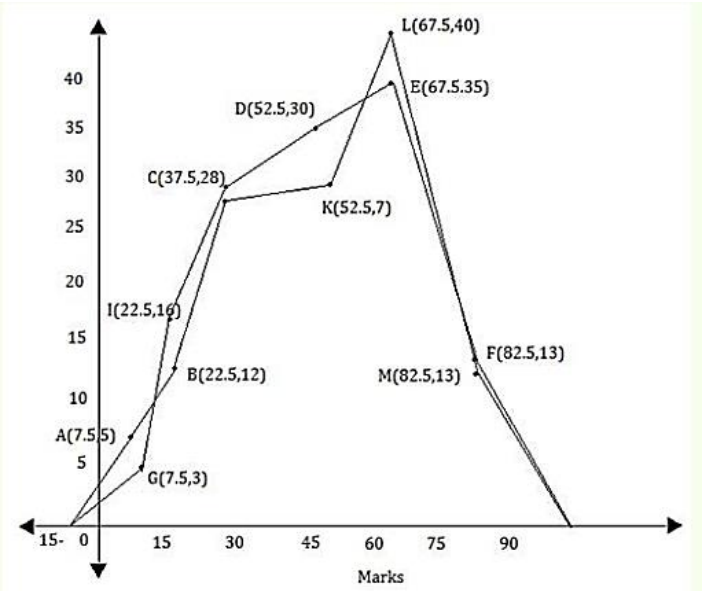


8


Scale:
On X axis 1 big division = 5 units
On Y axis 1 big division = 5 units
Y
X
Frequency
Class intervals
55
50
45
40
35
30
25
20
15
10
5
0
A
15 20 25 30 35 40 45 50 55
30
24
52
28
46
10
A
B

9

		SECTION A	SECTION B
MARKS	CLASS MARKS	FREQUENCY	FREQUENCY
0-15	7.5	5	3
15-30	22.5	12	16
30-45	37.5	28	25
45-60	152.5	30	27
60-75	67.5	35	40
75-90	82.5	13	10



10	

SCORES	CLASS MARKS	GROUP A	GROUP B
50-52	51	4	2
47-49	48	10	3
44-46	45	15	4
41-36	42	18	8
38-40	39	20	12
35-37	36	12	17
32-34	33	13	22