

केंद्रीय विद्यालय संगठन

जबलपुर संभाग



अध्ययन सामग्री

गणित

कक्षा—10

2023—24

## संरक्षक

श्री सोमित श्रीवास्तव

उपायुक्त के वि स जबलपुर संभाग

श्री हीरा लाल

सहायक आयुक्त के वि स जबलपुर संभाग

डॉ सरोज डबास

सहायक आयुक्त के वि स जबलपुर संभाग

श्रीमती किरण शर्मा

सहायक आयुक्त के वि स जबलपुर संभाग

श्री सुनील कुमार सोनी

गणित विषय समन्वयक

प्राचार्य

के वि गढ़ा

## **COURSE STRUCTURE CLASS -X**

<b>Unit</b>	<b>Unit name</b>	<b>marks</b>
<b>1</b>	<b>Number system</b>	<b>06</b>
<b>2</b>	<b>Algebra</b>	<b>20</b>
<b>3</b>	<b>Coordinate Geometry</b>	<b>06</b>
<b>4</b>	<b>Geometry</b>	<b>15</b>
<b>5</b>	<b>Trigonometry</b>	<b>12</b>
<b>6</b>	<b>Mensuration</b>	<b>10</b>
<b>7</b>	<b>Statistics &amp;Probability</b>	<b>11</b>
	<b>Total</b>	<b>80</b>

# Mathamatics-Basic question paper design

## Class X(2023-24)

Time :3houres

Max.Marks :80

S no	Typology of question	Total marks	% weightage(a pprox.)
1	<b>Remembring:</b> Exhibit memory of pereviously learned material by recalling facts ,terms ,basic concepts,and answeres <b>Understanding:</b> demonstrate understanding of facts and ideas by organizing comparing,translating ,interpreting,giving description, and stating main ideas	60	75
2	<b>Applying:</b> solve problems to new situations by applying acquired knowledge,facts ,techniques and rules in adifferent way	12	15
3	<b>Analysing:</b> Examine and break information into part by identifying motives or causes Make inference and find evidence to support genrelization <b>Evaluting:</b> present and defend opinion by making judgment about information,validity of ideas,or quality of work based on a set of criteria <b>Creating:</b> Compile information together In a different way by combining elements in a new pattern or proposing alternative solution	8	10
	<b>Total</b>	80	100

**Mathamatics-standerd  
question paper design  
Class X(2023-24)**

Time :3houres

Max.Marks :80

S no	Typology of question	Total marks	% weightage(approx.)
1	<b>Remembring:</b> Exhibit memory of pereviously learned material by recalling facts ,terms ,basic concepts,and answeres <b>Understanding:</b> demonstrate understanding of facts and ideas by organizing comparing,translating ,interpreting,giving description, and stating main ideas	43	54
2	<b>Applying:</b> solve problems to new situations by applying acquired knowledge,facts ,techniques and rules in adifferent way	19	24
3	<b>Analysing:</b> Examine and break information into part by identifying motives or causes Make inference and find evidence to support genrelization <b>Evaluting:</b> present and defend opinion by making judgment about information,validity of ideas,or quality of work based on a set of criteria <b>Creating:</b> Compile information together In a different way by combining elements in a new pattern or proposing alternative solution	18	22
	<b>Total</b>	<b>80</b>	<b>100</b>

## Chapter -1

### Contets of Real Numbers

1. Rational numbers are these numbers which can be expressed in the form of  $\frac{p}{q}$  where  $p$  and  $q$  are integers and  $q \neq 0$
2. Irrational number are these numbers which can not be expressed in the form of  $\frac{p}{q}$  where  $p, q$  are integers and  $q \neq 0$
3. Real number is the collection of all rational number and irrational numbers
4. If  $a$  and  $b$  are two numbers  $a$  is rational and  $b$  is irrational then  $a+b$  and  $a-b$  are irrational.
5. The fundamental theorem of arithmetics every composite number can be expressed as a product of primes and this factorization is unique apart from the order in which the prime factors occur.
6. If  $p$  is a prime and divides  $a^2$  then  $p$  divides  $a$  where  $a$  is positive integer .
7.  $\text{Lcm}(a,b) \times \text{hcf}(a,b) = a \times b$

STUDY MATERIAL FOR MATHEMATICS STANDARD

NAME OF CHAPTER : -REAL NUMBERS

SECTION A 1 mark questions )

Q1 If  $P = 2n + 13$  and  $Q = n + 7$ , where  $n$  is natural number, then HCF of  $P$  and  $Q$  is

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

Q2 Two natural numbers whose difference is 66 and the least common multiple is 360 are :

- (a) 130 and 164 (b) 172 and 114 (c) 90 and 24 (d) 180 and 114

Q3 Two numbers  $A$  and  $B$  are represented as  $A = x^3y^5$ ,  $B = x^7y^2z^4$

where  $x$ ,  $y$  and  $z$  are prime factors of  $A$  and  $B$

the ratio of LCM of  $A$  and  $B$  to their HCF is :

- (a)  $x^4y^4z^4$  (b)  $x^4y^3z^4$  (c)  $xy^4z^4$  (d)  $x^4y^2z$

Q4 The least prime factor of  $a$  is 7 and the least prime factor of  $b$  is 13, then the least prime factor of  $a + b$  is:

- (a) 7 (b) 13 (c) even prime (d) least odd prime

Q5 If the prime factorisation of a natural number  $N$  is given by

$N = 2^{7 \times 3^{5 \times 5}} \times 7^{8 \times 11}$ , then number of consecutive zeroes in number

$N$  is

- (a) 2 (b) 5 (c) 7 (d) 1

Q6 LCM of  $31 \times 32$  and  $22 \times 33$  is

- (a) 31 (b) 33 (c) 22 (d)  $31 \times 32 \times 33$

Q7 The least number that is divisible by all the numbers from 1 to 10 (both inclusive) is:

- (a) 10 (b) 100 (c) 504 (d) 2520

Q8 The largest number which divides 68 and 120 leaving remainder 3 in each case is :

- (a) 5 (b) 13 (c) 17 (d) 19

Q9 What will be the simplest form of  $(\sqrt{72} + \sqrt{128}) \div \sqrt{2}$

- (a) 14 (b) 8 (c) 6 (d) 2

Q10 The product of two irrational numbers is :

- (a) Always irrational (b) Always rational (c) Sometimes irrational (d) None of these

SECTION B ( 2 marks questions)

Q11 Two numbers are in the ratio 13:17. If their HCF is 5, find the numbers.

Q12 Three numbers are in the ratio 2:3:5. If their HCF is 3000. Find the largest number.

Q13 Least prime factor of a is 5 and least prime factor of b is 13, then what will be the least prime factor of  $a + b$

Q15 Can we have  $n$  belong to  $\mathbb{N}$  where  $7^n$  ends with the digit 0

Q16 Find the pair of natural numbers whose least common multiple is 78 and greatest divisor is 13

Q17 HCF of 144 and 180 is expressed as  $13m-3$ , find the value of  $m$

Q18 Show that  $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 + 7$  is a composite number

Q19 Check whether  $6^n$  ends with zero for any natural number  $n$ .

Q20 What is the ratio of LCM to HCF of lowest prime number and lowest composite number ?

#### SECTION C ( 3 marks questions )

Q21 Find the LCM and HCF of 404 and 96 and verify that  $\text{HCF} \times \text{LCM}$  is equal to product of two given numbers.

Q22 Find the LCM of 2.5, 0.5 and 0.175

Q23 Determine the value of  $p$  and  $q$  so that prime factorisation of 2520 is expressible as  $2^{3 \times} 3^{p \times} q \times 7$

Q24 Prove that  $5 - 2\sqrt{7}$  is irrational given that  $\sqrt{7}$  is irrational

Q25 prove that  $\sqrt{3}$  is an irrational number

Q26 Find the largest number that will divide 398, 436 and 542 leaving remainder 7, 11 and 15 respectively.

Q27 If the HCF of 408 and 1032 is expressible in the form  $1032 \times 2 + 408 \times p$ , then find the value of  $p$

Q28 three bells toll at interval of 9, 12 and 15 minutes respectively. If they start tolling together after what time will they next toll together ?

Q29 Check whether the pair of numbers 847 and 2160 are coprime or not.

Q30 Can two numbers have 15 as their HCF and 175 as their LCM? Give reason

#### SECTION D ( 5 marks questions )

Q31 Find the least number which when divided by 16 leaves the remainder 6, when divided by 19 leaves the remainder 9 and when divided by 21 leaves the remainder 11.

Q32 prove that  $7 - 5\sqrt{7}$  be an irrational number

Q33 The length, breadth and height of a room are 8 m 50 cm, 6 m 25 cm and 4 m 75 cm respectively. Find the length of the longest rod that can measure the dimensions of the room exactly.

Q34 An army contingent of 612 members is to march behind an army band of 48 members in a parade. The two groups are to march in



same number of columns. What is the minimum number of columns in which they can march?

Q35 pens are sold in a pack of 8 and pads are sold in a pack of 12 . find the minimum number of packs of each type that one should buy so that there are equal no of pens and note pads ?

SECTION E (case study 4 marks each)

Q36 To enhance the reading skills of grade X students , the school nominates you and two of your friends to set up a class library. There are two sections - section A and section B of grade X. There are 32 students in section A and 36 students in section B



1 What is the minimum number of books you will acquire for the class library so that they can be distributed equally among students of section A and section B?

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

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

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

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

- (a) Ab            (b)  $a^2b^2$             (c)  $a^3b^2$             (d)  $a^3b^3$

Q 38 A seminar is being conducted by an educational organization where the participants will be the educators of different Subjects. The number of participants in Hindi , English and Mathematics are 60, 84 and 108 respectively

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

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

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

Or

Find the product of LCM and HCF of 60,84 and 108

(MATHS )  
**CHAPTER-2/ POLYNOMIALS**

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**1. GIST OF THE CHAPTER**

- (i) Definition of polynomials
- (ii) Types of Polynomials
- (iii) Zeroes of Polynomials
- (iv) Relationship between Zeroes and coefficients of quadratic polynomials.

**2. KEY POINTS**

1. Polynomials are algebraic expressions made up of variables and constants that have whole number exponents. We know that polynomials can be divided into different categories based on their degree, such as linear, quadratic, and cubic polynomials. Because the polynomial degree is equal to the number of zeros in the formula, the zeros of a polynomial can be simply computed using the polynomial degree.

2. Polynomials of degrees 1, 2 and 3 are called linear, quadratic and cubic polynomials respectively.

3. A quadratic polynomial in  $x$  with real coefficient is of the form  $ax^2 + bx + c$ , where  $a, b, c$  are real numbers with  $a \neq 0$ .

4. A polynomial can have at most the same number of zeros as the degree of polynomial.

5. For quadratic polynomial  $ax^2 + bx + c (a \neq 0)$

$$\text{Sum of zeroes} = -\frac{b}{a}$$

$$\text{Product of zeroes} = \frac{c}{a}$$

6. If  $\alpha, \beta, \gamma$  are the zeroes of the cubic polynomial  $ax^3 + bx^2 + cx + d$ , then

$$\alpha + \beta + \gamma = -b/a ,$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = c/a ,$$

$$\alpha \beta \gamma = -d/a .$$

**3. FORMULA BASED ANALYSIS**

$$ax^2 + bx + c \quad (a \neq 0)$$

$$\text{Sum of zeroes}(\alpha + \beta) = -\frac{b}{a}$$

$$\text{Product of zeroes} \alpha\beta = \frac{c}{a}$$

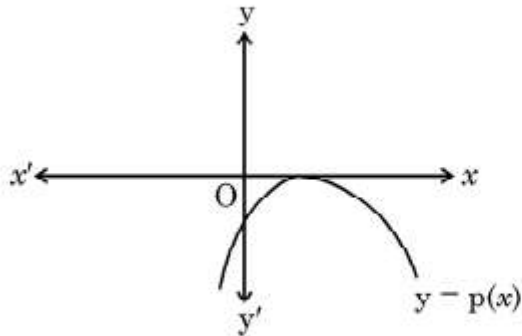
$$x^2 - (\alpha + \beta)x + \alpha\beta$$

Example : Find the zeroes of the polynomial  $x^2 - 3$  and verify the relationship between the zeroes and the coefficients.

Example : Find a quadratic polynomial, the sum and product of whose zeroes are  $-3$  and  $2$ , respectively.

#### 4. SHORTS QUESTIONS BASED ON FORMULAS

1. The graph of  $y = p(x)$  is given, for a polynomial  $p(x)$ . The number of zeroes of  $p(x)$  from the graph is



- (A) 3  
(B) 1  
(C) 2  
(D) 0
2. Which of the following quadratic equations has sum of its roots as 4 ?
- (a)  $2x^2 - 4x + 8 = 0$                       (b)  $-x^2 + 4x + 4 = 0$   
(c)  $\sqrt{2}x^2 - \frac{4}{\sqrt{2}}x + 1 = 0$                       (d)  $4x^2 - 4x + 4 = 0$
3. If one zero of the polynomial  $6x^2 + 37x - (k - 2)$  is reciprocal of the other, then what is the value of  $k$  ?
- (a)  $-4$     (b)  $-6$   
(c)  $6$     (d)  $4$
4. The zeroes of the polynomial  $p(x) = x^2 + 4x + 3$  are given by :
- (a)  $1, 3$     (b)  $-1, 3$   
(c)  $1, -3$     (d)  $-1, -3$
5. If  $\alpha$  and  $\beta$  are the zeroes of the quadratic polynomial  $p(x) = x^2 - ax - b$ , then the value of  $\alpha^2 + \beta^2$  is :
- (a)  $a^2 - 2b$     (b)  $a^2 + 2b$   
(c)  $b^2 - 2a$     (d)  $b^2 + 2a$
6. If  $\alpha, \beta$  are zeroes of the polynomial  $x^2 - 1$ , then value of  $(\alpha + \beta)$  is :
- 1 (a) 2    (b) 1    (c)  $-1$     (d) 0

7. Which of the following is a quadratic polynomial having zeroes  $\frac{-2}{3}$  and  $\frac{2}{3}$  ?
- (A)  $4x^2 - 9$  (B)  $\frac{4}{9}(9x^2 + 4)$   
 (C)  $x^2 + \frac{9}{4}$  (D)  $5(9x^2 - 4)$

8. The number of polynomials having zeroes 3 and 5 is :

- (a) only one (b) infinite (c) exactly two (d) at most two

9. Find the value of 'p' for which the quadratic equation  $px(x - 2) + 6 = 0$  has two equal real roots.

10. If  $\alpha$  and  $\beta$  are the zeroes of the polynomial  $3x^2 + 5x + k$  such that  $\alpha^2 + \beta^2 + \alpha\beta = \frac{19}{9}$ , then find the value of k.

11. If one zero of the polynomial  $p(x) = 6x^2 + 37x - (k - 2)$  is reciprocal of the other, then find the value of k.

12.

If  $\alpha$  and  $\beta$  are the zeroes of the quadratic polynomial  $f(x) = x^2 - x - 4$ , find the value of  $\frac{1}{\alpha} + \frac{1}{\beta} - \alpha\beta$ . 1

13. If one zero of the quadratic polynomial  $x^2 + 3x + k$  is 2, then find the value of k.

14. If one zero of the quadratic polynomial  $x^2 + 3x + k$  is 2, then find the value of k.

## 5. HOT AND CCT BASED FREQUENTLY ASKED QUESTIONS

1. If  $\alpha$  and  $\beta$  are the zeroes of  $x^2 + px + q$ , find the value of  $(\alpha + 2)(\beta + 2)$ .

2. If one zero of the quadratic polynomial  $f(x) = 4x^2 - 8kx + 8x - 9$  is negative of the other, then find the zeroes of  $kx^2 + 3kx + 2$ . (CBSE 2015)

3. If  $\alpha$  and  $\beta$  are zeroes of  $p(x) = kx^2 + 4x + 4$ , such that  $\alpha^2 + \beta^2 = 24$ , find k. (CBSE2013)

4. If  $\alpha$  and  $\beta$  are the zeroes of the polynomial  $p(x) = 2x^2 + 5x + k$ , satisfying the relation,  $\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$ , then find the value of k. (CBSE 2017)

5. In a pool at an aquarium, a dolphin jumps out of the water travelling at 20 cm per second. Its height above water level after t seconds is given by  $h = 20t - 16t^2$ .

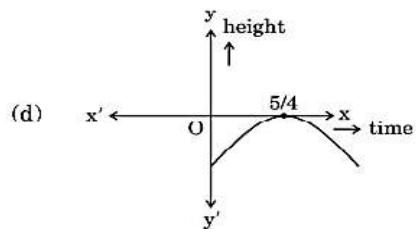
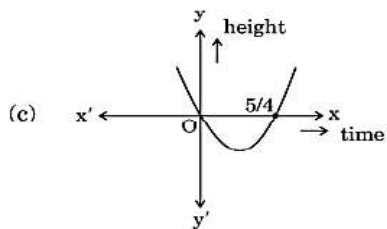
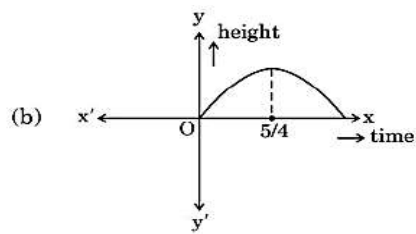
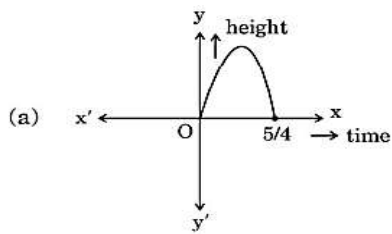
(CBSE 2023)



Based on the above, answer the following questions :

(i) Find zeroes of polynomial  $p(t) = 20t^2 - 16t - 1$

(ii) Which of the following types of graph represents  $p(t)$  ?



(iii) (a) What would be the value of  $h$  at  $t = 3/2$  ? Interpret the result.

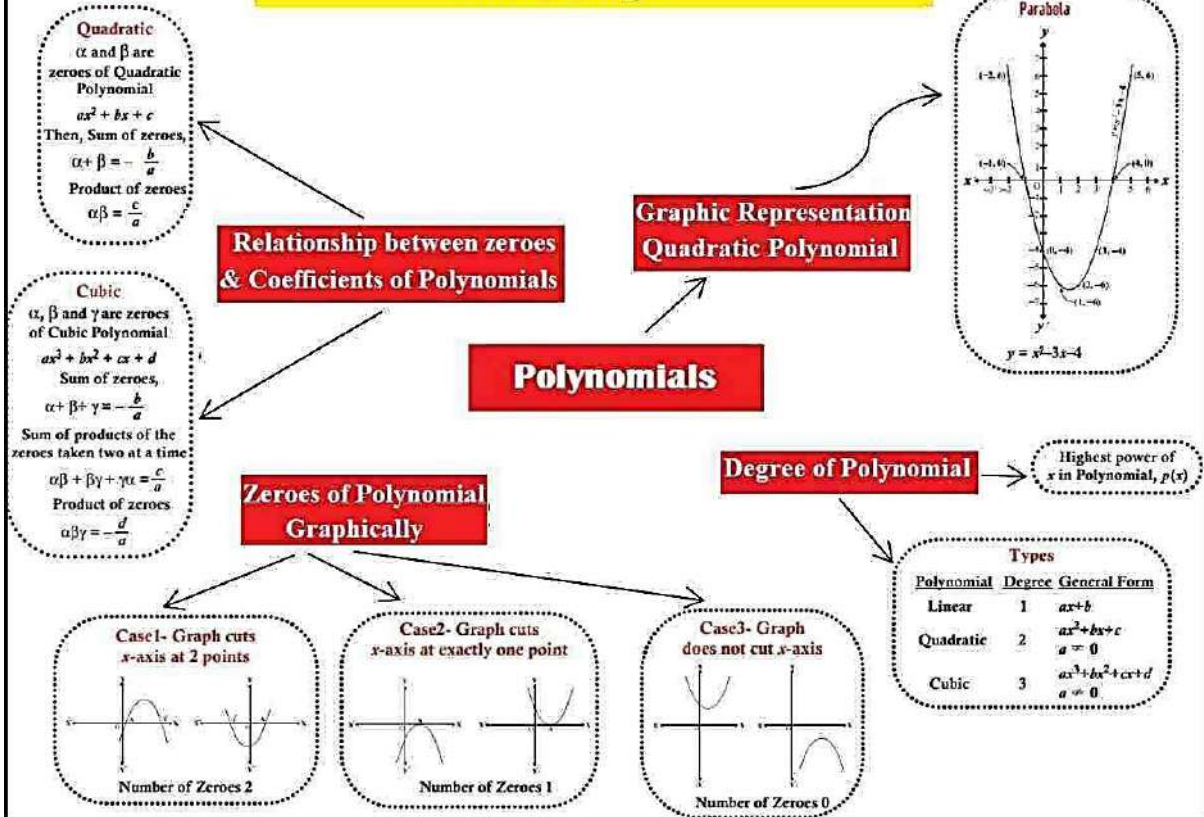
2

OR

(iii) (b) How much distance has the dolphin covered before hitting the water level again ? 2

**6. TRICK WHICH HELP STUDENT IN MEMORIZATION.**

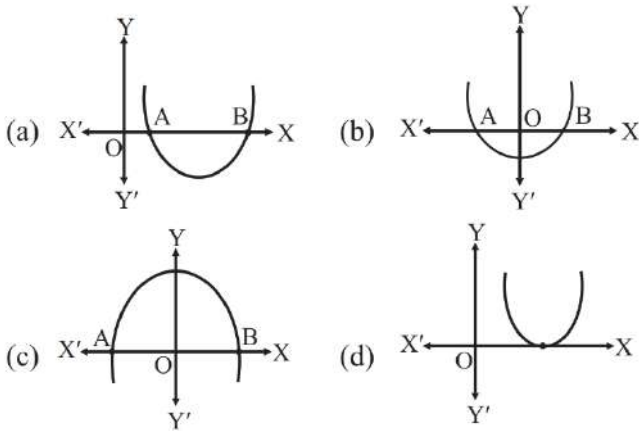
# CBSE Class 10 Maths - Polynomials Mind Map



**QUESTION BANK FOR STUDY MATERIAL**  
**CLASS – X : MATHEMATICS STANDARD**  
**CHAPTER – POLYNOMIAL**

**MULTIPLE CHOICE QUESTIONS (1 Mark each)**

- The zeroes of the polynomial are  $p(x) = x^2 - 10x - 75$   
 (a) 5, -15      (b) 5, 15      (c) 15, -5      (d) -5, -15
- If a and b are zeroes of the polynomial  $2t^2 - 4t + 3$ , then the value of  $a^2b + ab^2$  is:  
 (a)  $3/4$       (b) 2      (c) 3      (d) 4
- If the value of a quadratic polynomial  $p(x)$  is 0 only at  $x = -1$  and  $p(-2) = 2$ , then the value of  $p(2)$  is  
 (a) 18      (b) 9      (c) 6      (d) 3
- The graph of  $x^2 + 1 = 0$   
 (a) Intersects x-axis at two distinct points.      (b) Touches x-axis at a point.  
 (c) Neither touches nor intersects x-axis.      (d) Either touches or intersects x-axis.
- Which of the following is/are not graph of a quadratic polynomial?



- If a and  $1/a$  are the zeroes of the quadratic polynomial  $2x^2 - x + 8k$ , then k is  
 (a) 4      (b)  $1/4$       (c)  $-1/4$       (d) 2
- The zeroes of the quadratic polynomial  $x^2 + 99x + 127$  are  
 (a) both positive      (b) both negative  
 (c) one positive and one negative      (d) both equal
- If one zero of the quadratic polynomial  $x^2 + 3x + k$  is 2, then the value of k is  
 (a) 10      (b) -10      (c) 5      (d) -5
- The quadratic polynomial, the sum of whose zeroes is -5 and their product is 6, is  
 (a)  $x^2 + 5x + 6$       (b)  $x^2 - 5x + 6$       (c)  $x^2 - 5x - 6$       (d)  $-x^2 + 5x + 6$
- The zeroes of the polynomial  $x^2 - 3x - m (m + 3)$  are  
 (a) m, m + 3      (b) -m, m + 3      (c) m, -(m + 3)      (d) -m, -(m + 3)

**ASSERTION REASON BASED QUESTIONS (1 Mark each)**

- If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
- If Assertion is correct but Reason is incorrect.
- If Assertion is incorrect but Reason is correct.



- Assertion:**  $x^3 + x$  has only one real zero.  
**Reason:** A polynomial of nth degree must have n real zeroes.
- Assertion:** Degree of a zero polynomial is not defined.  
**Reason:** Degree of a non-zero constant polynomial is '0'.

**CASE BASED QUESTIONS (4 Marks each)**

CASE 1. Box:

For the box to satisfy certain requirements, its length must be three unit greater than the width, and its height must be two unit less than the width.

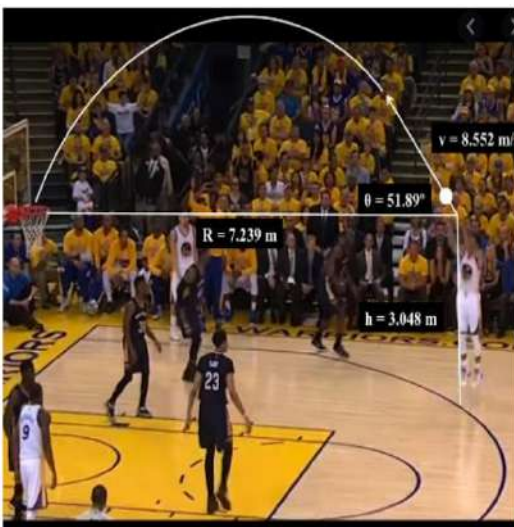


- If width is taken as  $x$ , find the polynomial that represent volume of box. 1
- Find the polynomial that represent the area of paper sheet used to make box. 1
- If it must have a volume of 18 unit, what must be its length and height? 2

OR

If box is made of a paper sheet which cost is Rs 100 per square unit, what is the cost of paper? 2

CASE 2: Basketball and soccer are played with a spherical ball. Even though an athlete dribbles the ball in both sports, a basketball player uses his hands and a soccer player uses his feet. Usually, soccer is played outdoors on a large field and basketball is played indoor on a court made of wood. The projectile (path traced) of soccer ball and basketball are in the form of parabola representing quadratic polynomial.



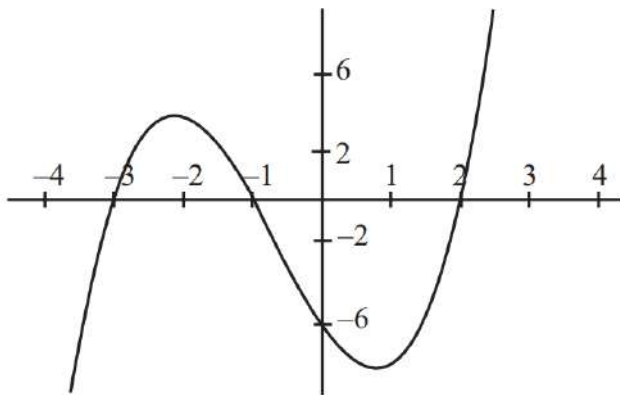
- What is the shape of the path traced shown in the figure? 1
- The graph of parabola opens downwards, what can be the value of  $a$  in the equation  $ax^2 + bx + c$ ? 1

(iii) Find the zeroes of the polynomial  $4\sqrt{3}x^2 + 5x - 2\sqrt{3}$ .

2

OR

Observe the following graph and answer the question.



What will be the expression of the polynomial?

2

### **VSA-I QUESTIONS (2 Marks each)**

1. Find the value of  $k$  for which the zeroes of the polynomials  $3x^2 - 10x + k$  are reciprocal of each other.
2. If the sum of the zeroes of the quadratic polynomial  $3x^2 - kx + 6$  is 3, then find the value of  $k$ .
3. If  $\alpha$  and  $\beta$  are the zeroes of the polynomial  $4x^2 - 2x - 3$ , find the value of  $\frac{1}{\alpha} + \frac{1}{\beta}$ .
4. If 1 is the zero of the polynomial  $ay^2 + ay + 3$  and  $y^2 + y + b$ , then find the value of  $ab$ .
5. If  $\alpha$  and  $\beta$  are the zeroes of the polynomial  $2y^2 + 7y + 5$ , find the value of  $\alpha + \beta + \alpha\beta$ .
6. What number should be added to the polynomial  $x^2 - 5x + 4$  so that 3 is the zero of the polynomial?
7. For what value of  $k$  is  $-4$  a zero of the polynomial  $f(x) = x^2 - x - (2k + 2)$ ?
8. Find the zeroes of the polynomial  $x^2 + x - p(p + 1) = 0$ , where  $p$  is a constant.
9. Find the value of  $p$  so that the polynomial  $px(x - 3) + 9 = 0$  has two equal roots.
10. If  $(x + k)$  is the HCF of  $x^2 - 2x - 15$  and  $x^3 + 27$ , find the value of  $k$ .

### **VSA-II QUESTIONS (3 Marks each)**

1. Find the zeroes of the quadratic polynomial  $6x^2 - 3 - 7x$  and verify the relationship between the zeroes of the coefficients of the polynomial.
2. If  $\alpha$  and  $\beta$  are the zeroes of the polynomial  $kx^2 + 4x + 5$  such that  $\alpha^2 + \beta^2 = 24$ , find the value of  $k$ .
3. Find the zeroes of the quadratic polynomial  $f(x) = x^2 + 3x - 4$  and verify the relationship between the zeroes of the coefficients of the polynomial.
4. Verify whether 2, 3 and  $1/2$  are the zeroes of the polynomial  $p(x) = 2x^3 - 11x^2 + 17x - 6$ .
5. Find the zeroes of the quadratic polynomial  $4x^2 - 4x - 3$  and verify the relationship between the zeroes of the coefficients of the polynomial.
6. Show that  $1/2$  and  $-3/2$  are the zeroes of the quadratic polynomial  $4x^2 + 4x - 3$  and verify the relationship between the zeroes of the coefficients of the polynomial.

7. For what value of  $k$  are the roots of the quadratic polynomial  $kx(x - 2) + 6 = 0$  are equal?
8. Without actually calculating the zeroes, form a quadratic polynomial whose zeroes are reciprocals of the zeroes of the polynomial  $5x^2 + 2x - 3$ .
9. Find a quadratic polynomial whose zeroes are 1 and  $-3$ . Verify the relation between the coefficients and zeroes of the polynomial.
10. If one the zero of a polynomial  $3x^2 - 8x + 2k + 1$  is seven times the other, find the value of  $k$ .

**LONG ANSWER QUESTIONS (5 Marks each)**

1. If  $\alpha$  and  $\beta$  are the zeros of the polynomial  $f(x) = 2x^2 + 5x - k$  satisfying the relation  $\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$ , then find the value of 'k' for this to be possible.
2. If  $\alpha$  and  $\beta$  are the zeros of the polynomial  $f(x) = x^2 - 6x + a$ , find the value of 'a' if  $3\alpha + 2\beta = 20$ .
3. A polynomial is given by  $q(x) = x^2 - kx + \frac{3}{4}$ , where  $k$  is a constant.  
The sum of the zeroes of  $q(x)$  is 2. Using the relationship between the zeroes and coefficients of a polynomial, find the:  
(i) value of  $k$   
(ii) zeroes of  $q(x)$
4. Find the zeroes of the quadratic polynomial  $7y^2 - \frac{11}{3}y - \frac{2}{3}$  and verify the relationship between the zeroes of the coefficients of the polynomial.
5. If the zeroes of the polynomial  $x^2 + px + q$  are double in value to the zeroes of  $2x^2 - 5x - 3$ , find the value of  $p$  and  $q$ .

### CHAPTER 3

#### M.C.Q.

1. If a pair of linear equation given by  $a_1x + b_1y + c_1 = 0$  and  $a_2x + b_2y + c_2 = 0$  has a unique solution then which of the following is true

- (a)  $a_1a_2 = b_1b_2$  (b)  $a_1/a_2 = b_1/b_2$  (c)  $a_1b_2 \neq a_2b_1$  (d)  $a_1/a_2 \neq b_1/b_2$

2. The value of x and y satisfied the two equation  $32x + 33y = 34$  ,  $33x + 32y = 31$  respectively are

- (a) -1,2 (b) -1,4 (c) 1,-2 (d) -1,-4

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

- a)  $-5/2$  (b)  $2/5$  (c)  $15/4$  (d)  $3/2$

4. The lines are given to be parallel the equation of one of the line is  $3x + 4y + 2 = 0$  The equation of the second line can be

- (a)  $9x + 8y + 1 = 0$  (b)  $-9x + 8y + 1 = 0$  (c)  $9x + 8y - 11 = 0$  (d)  $6x + 8y - 1 = 0$

5. What is the value of k such that the following pair of equation have infinitely many solution

$x - 2y = 3$  and  $-3x + ky = -9$

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

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

Mark the correct choice as

- (a) Both A and R are true and R is the correct explanation of A  
(b) Both A and R are true and R is not the correct explanation of A  
(c) A is true but R is false  
(d) A is false but R is true

1. Assertion (A) If 4 chair and 3 table cost Rs 2100 and 5 chairs and 2 tables cost Rs 1750 then the cost of 1 chair is rs Rs 150

Reason ( R) The cost of 1 table is Rs 500

2. Assertion (A) For all real value of c the pair of equations  $x - 2y = 8$  and  $5x - 10y = c$  have a unique solutions.

Reason (R) Two lines are given to parallel The equation of one of the line is  $4x + 3y = 14$  ,  $12x + 9y = 5$

## Chapter 3

### Pair of Linear Equations in Two Variables

#### Important points for students:

- For this academic session (2023-24) we will study only the methods **substitution** and **elimination**.
- In this chapter we have to learn about how to solve the pair of linear equations in two variables.
- The general form of pair of linear equations in two variables  $x$  and  $y$  is  $a_1x + b_1y + c_1 = 0$  and  $a_2x + b_2y + c_2 = 0$  where  $a_1, b_1, c_1$  and  $a_2, b_2, c_2$  are all real numbers.
- In this chapter we should have much more focus on **identifying the coefficients** of  $x$  and  $y$  **with proper sign (+ or -)**.

#### Consistency of system of linear equations in two variables

- A pair of values of the variables  $x$  and  $y$  satisfying each one of the equation is called a **solution of the system**.
- **Consistent System:** A system of linear equations is said to consistent if it has at least one solution.
- **In-consistent System:** A system of linear equation is said to be in-consistent if it has no solution.
- Algebraic interpretation of linear equations in two variables:
  - If  $a_1/a_2 \neq b_1/b_2$  then the pair of linear equations have unique solution.
  - If  $a_1/a_2 = b_1/b_2 \neq c_1/c_2$  then the pair of linear equations has no solution.
  - If  $a_1/a_2 = b_1/b_2 = c_1/c_2$  then the pair of linear equations have infinitely many solutions.

S. No.	Pair of lines	Compare the ratio	Graphical representation	Algebraic interpretation
1.	$a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$	$a_1/a_2 \neq b_1/b_2$	Intersecting lines	Only one (unique) solution
2.	$a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$	$a_1/a_2 = b_1/b_2 \neq c_1/c_2$	Parallel lines	No solution
3.	$a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$	$a_1/a_2 = b_1/b_2 = c_1/c_2$	Coincident lines	Infinite solutions

#### TYPE 1: To check CONSISTENCY of system of linear equations

**Example:** Determine, whether the system of equations is **consistent or in-consistent**.

$$x + y = 14 \quad \text{and} \quad x - y = 4$$

**Solution:** Rearrange the given equation like general form:  $x + y - 14 = 0$   
and  $x - y - 4 = 0$

By comparing we get,  $a_1 = 1$ ,  $b_1 = 1$ ,  $c_1 = -14$ ,  $a_2 = 1$ ,  $b_2 = -1$ ,  
 $c_2 = -4$

$$\frac{a_1}{a_2} = \frac{1}{1}, \quad \frac{b_1}{b_2} = \frac{1}{-1} \quad \frac{c_1}{c_2} =$$
$$- \frac{14}{-4} \text{ Since } \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

Therefore, system of equations has only one solution. Hence, the system of equations is **consistent**.

### PRACTICE QUESTIONS

Determine, whether the following system of equations is **consistent or inconsistent**.

1.  $x + y = 20$  and  $x - y = 4$
2.  $x + y = 25$  and  $x - y = 5$
3.  $x + y = 14$  and  $x + y = 4$
4.  $x + 2y = 3$  and  $2x + 4y = 6$

**TYPE 2: Solving pair of linear equations by Substitution Method)**

**Example:** Solve the following system of equation by **substitution method**:

$$x + y = 14 \quad \text{and} \quad x - y = 4$$

**Solution:** Given equations are

$$x + y = 14 \quad \text{..... (i)}$$

$$x - y = 4 \quad \text{.....(ii)}$$

from equation (ii) find x in term of y

$$x = y + 4 \quad \text{..... (iii)}$$

substitute

this x

in (i),

we

get

(y +

4) +

y =

14

$$\text{or } 2y + 4 = 14$$

o

r

2

y

=

1

4

-

4

o

r

2

y

=

1

0

$$\text{or } y = 10/2$$

$$\text{or } y = 5$$

Now from equation (iii) we find the value of

x with the help of (y = 5)  $x = 5 + 4 = 9$

Thus, x = 9 and y = 5 ..... **Ans**

**PRACTICE QUESTIONS**

Solve the following system of equation by **substitution method**:

1.  $x + y = 20$  and  $x - y = 4$
2.  $x + 2y = 25$  and  $x - 2y = 5$
3.  $2x + y = 24$  and  $x - 2y = 7$
4.  $2x + y = 20$  and  $2x - 3y = 12$

**TYPE 3: Solving pair of linear equations by Elimination Method**

In this method, we have to eliminate any of the variables with the help of equating the coefficient.

**Example:** Solve the following system of equation by **elimination method**:

$$2x + y = 24 \quad \text{and} \quad x - 2y = 7$$

**Solution:** Given equations are

$$2x + y = 24 \quad \dots\dots\dots (i)$$

$$x - 2y = 7 \quad \dots\dots\dots(ii)$$

Here, if we multiply by 2 in equation (i) and adding with equation (ii), we get  $4x +$

$$2y = 48 \quad \dots\dots\dots (i) \times 2$$

$$x - 2y = 7 \quad \dots\dots(ii)$$

$$5x = 55$$

Or  $x = 55/5$

Or  $x = 11$

Now, in equation (i) putting the value of x to find y

$$2 \times 11 + y = 24$$

Or  $22 + y = 24$

Or  $y = 24 - 22$

Or  $y = 2$

Thus,  $x = 11$  and  $y = 2$

**Ans.**

**PRACTICE QUESTIONS**

Solve the following system of equation by **elimination method**:

1.  $x + y = 16$  and  $x - y = 4$
2.  $x + y = 20$  and  $x - y = 4$
3.  $x + 2y = 25$  and  $x - 2y = 5$



and  $x - 2y =$

5

4.  $2x + y = 20$  and  $2x - 3y = 1$

**TYPE 4: To Find the Unknown (k) With the Help of Algebraic Interpretation**

To determine the value of **k** (unknown) for which the given system of linear equations has **infinitely many solutions**.

$$2x + 3y = 5 \quad \text{and} \quad 4x + ky = 10$$

**Solution:** Rearrange the given equation in general form  
 $2x + 3y - 5 = 0$  and  $4x +$   
 $ky - 10 = 0$

By comparing we get,  $a_1 = 2$ ,  $b_1 = 3$ ,  $c_1 = -$   
 $5$ ,  $a_2 = 4$ ,  $b_2 = k$ ,  $c_2 = - 10$  For infinitely  
many solutions, we must have  
 $(a_1/a_2 = b_1/b_2 = c_1/c_2)$

$$\frac{2}{4} = \frac{3}{k} = \frac{-5}{-10}$$

Or  $\frac{1}{2} = \frac{3}{k} = \frac{1}{2}$

Or  $k = 2 \times 3$

Or  $k = 6$

..... **Ans.**

Hence, the given system of equations will have infinitely many solutions, if  $k = 6$

**PRACTICE QUESTIONS**

Determine the value of **k** (unknown) for which the given system of equations has **infinitely many solutions**.

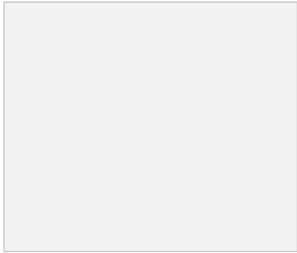
- $5x + 2y = k$  and  $10x + 4y = 6$
- $x + 3y = 4$  and  $kx + 6y = k+6$
- $2x + 3y = 7$  and  $(k-1)x - (k+2)y = 3k$
- $2x + 3y = 2$  and  $(k+2)x + (2k+1)y = 2(k-1)$

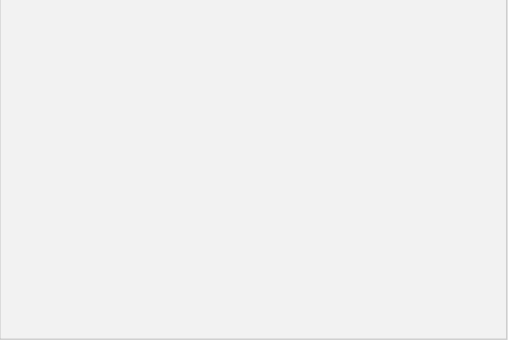
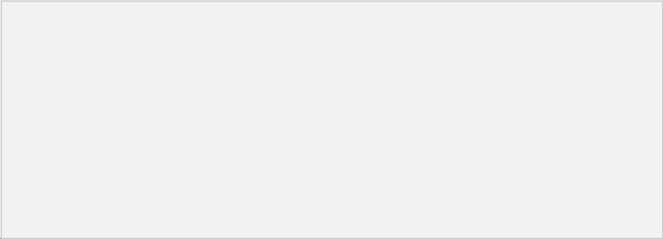
**Type 5: Word problems(HOT)**

- A father's age is three times the sum of the ages of his two children. After 5 years his age will be two times the sum of their ages. Find the present age of the father.
- The difference between two numbers is 26 and one number is three times the other. Find them.
- The larger of two supplementary angles exceeds the smaller by 18 degrees. Find them.
- The sum of the digits of a two-digit number is 9. Also, nine times this number is twice the number obtained by reversing the order of the digits.

Find the number.

5. The sum of a two-digit number and the number obtained by reversing the digits is 66. If the digits of the number differ by 2, find the number. How many such numbers are there?

	<b>CASE BASED/SOURCE BASED</b>
Q 01	<p>Architect: An architect is a skilled professional who plans and designs buildings and generally plays a key role in their construction. Architects are highly trained in the art and science of building design. Since they bear responsibility for the safety of their buildings' occupants, architects must be professionally licensed.</p> <div data-bbox="422 725 719 976" style="text-align: center;"></div> <p>Riddhi is a licensed architect and design very innovative house. She has made a house layout for her client which is given below. In the layout, the design and measurements has been made such that area of two bedrooms and kitchen together is 95 m<sup>2</sup>.</p>

	<p>.</p>  <p>(i) Write pair of linear equations which describe this situation.</p> <p>(ii) What is the length of the outer boundary of the layout?</p> <p>(iii) What is the area of bedroom 1? What is the area of living room in the layout?</p> <p>(iv) What is the cost of laying tiles in Kitchen at the rate of Rs. 50 per sq. m?</p>
Q 2	<p>Mr. RK Agrawal is owner of a famous amusement park in Delhi. Generally he does not go to park and it is managed by team of staff. The ticket charge for the park is Rs 150 for children and Rs 400 for adults.</p> <p>One day Mr. Agrawal decided to random check the park and went there. When he checked the cash counter, he found that 480 tickets were sold and Rs 134500 was collected</p> 

i) Let the number of children visited be  $x$  and the number of adults visited be  $y$ .

Which of the following is the correct system of equation that models the problem?

(a)  $x + y = 480$  and  $3x + 8y = 2690$

(b)  $x + 2y = 480$  and  $3x + 4y = 2690$

(c)  $x + y = 480$  and  $3x + 4y = 2690$

(d)  $x + 2y = 480$  and  $3x + 8y = 2690$

ii) How many children attended?

a) 250

b) 500

c) 230

d) 460

iii) How many adults attended?

(a) 250

(b) 500

(c) 230

(d) 460

iv) How much amount collected if 300 children and 350 adults attended?

(a) Rs 225400

(b) Rs 154000

(c) Rs 112500

(d) Rs 185000

**Q.3:**

A pair of linear equations is represented geometrically as shown below.

## LINEAR EQUATIONS IN TWO VARIABLES

An equation which can be put in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are real numbers, and  $a$  and  $b$  are not both zero ( $a^2 + b^2 \neq 0$ ), is called a linear equation in two variables  $x$  and  $y$ .

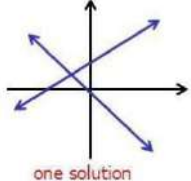
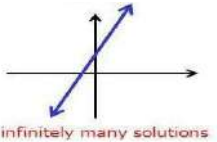
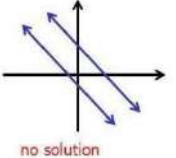
Each solution  $(x, y)$  of a linear equation in two variables,  $ax + by + c = 0$ , corresponds to a point on the line representing the equation, and vice versa.

The general form of a pair of linear equations is

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

### Interpretation of the pairs of equations

Ratio comparison	Graphical representation	Algebraic interpretation	Consistent/ Inconsistent
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Intersecting lines 	Exactly one solution  (unique)	<b>consistent</b>
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Coinciding lines 	Infinite solution	<b>dependent (consistent)</b>
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	Parallel lines 	no solution	<b>Inconsistent</b>

### Algebraic Methods:

#### a) Substitution Method

Following are the steps to solve the pair of linear equations by substitution method:

$$a_1x + b_1y + c_1 = 0 \dots (i) \text{ and}$$

$$a_2x + b_2y + c_2 = 0 \dots (ii)$$

**Step 1:** We pick either of the equations and write one variable in terms of the other

**Step 2:** The expression obtained in Step 1 should be substituted in the other equation to get a linear equation in one variable

**Step 3:** Solve this equation and get the value of one variable

**Step 4:** Substitute this value in the equation obtained in Step 1 to obtain the value of the other variable.

## b) Elimination Method

**Step 1:** First multiply both the equations by some suitable non-zero constants to make the coefficients of one variable (either x or y) numerically equal.

**Step 2:** Then add or subtract one equation from the other so that one variable gets eliminated.

you get an equation in one variable, go to Step 3.

**Step 3:** Solve the equation in one variable (x or y) so obtained to get its value.

**Step 4:** Substitute this value of x (or y) in either of the original equations to get the value of the other variable.

## SHORT ANSWER TYPE QUESTIONS BASED ON FORMULAS

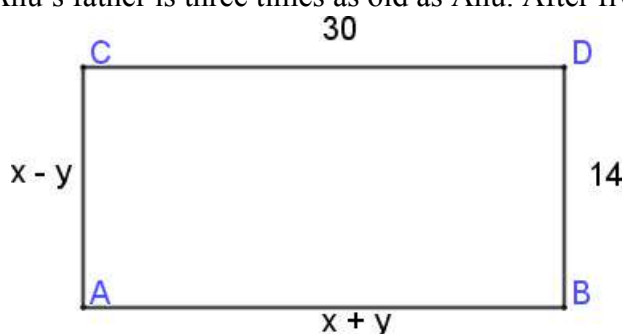
Q1. Solve:  $99x + 101y = 499$ ;  $101x + 99y = 501$

Q2. Find the value of k for which the pair of linear equations  $kx + 3y = k - 2$  and  $12x + ky = k$  has no solution

Q3. Without drawing the graph, find out whether the lines representing the following pair of linear equations intersect at a point, are parallel or coincident.

$$\begin{array}{l} 18x - 7y = 24; \\ \begin{array}{l} 9x - 5y = 10 \\ 7x - 10y = 9 \end{array} \end{array}$$

Q4. Anu's father is three times as old as Anu. After five years, his age will be two and half



times as old as Anu. Represent this situation algebraically only.

Q5. In the given fig, ABCD is a rectangle. Find the value of  $x$  and  $y$ ?

Q6. If sum of two positive numbers is 108 and the difference of these numbers is 8, then find the numbers.

Q7. Solve the following pair of linear equations by substitution method:

i  $3x + 2y - 7 = 0$

ii  $4x + y - 6 = 0$

Q8. Solve the pair of linear equations by elimination method:

i  $x - y + 1 = 0$

ii  $4x + 3y - 10 = 0$

Q9. Find the value of  $k$  for which the given system of equations has infinitely many solutions:

i  $(k - 3)x + 3y = k$

ii  $kx + ky = 12$

Q10. For which value of  $a$  and  $b$  does the following pair of linear equations has infinite number of solutions?

i  $2x - 3y = 7$

ii  $ax + 3y = b$

Q11. Write a pair of linear equations which has a unique solution  $x = 2$  and  $y = -1$ . How many such pairs are possible?

Q12. Solve for  $x$  and  $y$ :

i  $mx - ny = m^2 + n^2$ ;

ii  $x - y = 2n$

Q13. Is the system of linear equations  $2x + 3y - 9 = 0$  and  $4x + 6y - 18 = 0$  consistent? Justify your answer.

Q14. Solve for  $x$  and  $y$ :

i  $\frac{x}{a} + \frac{y}{b} = 2$

ii  $ax - by = a^2 - b^2$

Q15. For which value of  $a$  and  $b$  does the following pair of linear equations has infinite number of solutions?

i  $2x + 3y = 7$

ii  $a(x + y) - b(x - y) = 3a + b - 2$

Q16. There are 20 vehicles – cars and motorcycles in a parking area. If there are 56 wheels together, how many cars and motorcycles are there.

Q17. If  $x - 4$  is a factor of  $x^3 + ax^2 + 2bx - 24$  and  $a - b = 8$ , find the value of  $a$  and  $b$ .

Q18. Are the following pair of linear equations consistent? Justify your answer.

$$2ax + by = a; 4ax + 2by - 2a = 0 ; a, b \neq 0$$

Q19. If  $2x + y = 23$  and  $4x - y = 19$ , find the values of  $5x - 3y$  and  $y - 2x$ .

Q20. Find the solutions of the pair of linear equations  $5x + 10y - 50 = 0$  and  $x + 8y =$

10. Hence find the value of  $m$  if  $y = mx + 5$ .

Q21. Solve by elimination method:

$$3x + 4y = 10$$

$$2x - 2y = 2$$

Q22. Find the two-digit numbers whose sum is 75 and difference is 15

Q23. The age of the father is twice the sum of the ages of his 2 children. After 20 years, his age will be equal to the sum of the ages of his children. Find the age of the father

Q24. On reversing the digit of a two-digit number, number obtained is 9 less than three times the original number. If the difference of these two numbers is 45, find the original number

Q25. Solve:  $ax + by = a - b$  and  $bx - ay = a + b$

Q26. The larger of the supplementary angles exceeds the smaller by  $18^\circ$ . Find the angles

Q27. A fraction becomes  $\frac{1}{3}$  when 2 is subtracted from the numerator and it becomes  $\frac{1}{2}$  when 1 is subtracted from its denominator. Find the fraction.

Q28. Solve by elimination:

a.  $x - y + 1 = 0$  and  $4x + 3y - 10 = 0$

b.  $3x - 4y = 15$  and  $2x - 2y = 8$

Q29. Solve for  $x$  and  $y$ :

$$= 2 \text{ and}$$

$$\frac{x}{a} + \frac{y}{b}$$

$$ax - by = a^2 - b^2$$

Q30. Solve for  $x$  and  $y$  by method of elimination:

$$47x + 31y = 63$$

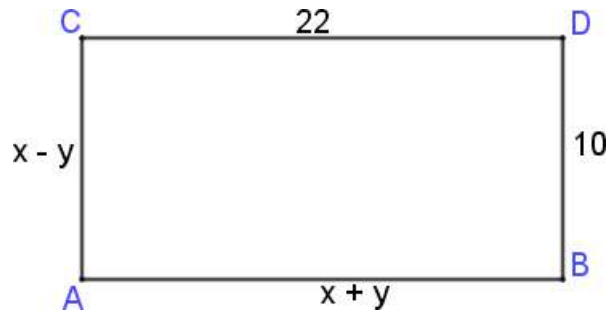
$$31x + 47y = 15$$

Q31. The monthly incomes of A and B are in the ratio 5:4 and their expenditure are in the ratio 7:5. If each save 3000/- per month, find the monthly income of each.

Q32. Four chairs and three tables cost 2100/- and 5 chairs and 2 tables cost 1750/-. Find the cost of a chair and table respectively

Q33. In the given figure ABCD is a rectangle. Find the value of  $x$  and  $y$





- Q34. Yash scored 40 marks in a test, receiving 3 marks for each correct answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each wrong answer, then Yash would have scored 50 marks. How many questions were there in the test?
- Q35. The denominator of a fraction is 4 more than twice the numerator. When both the numerator and denominator are decreased by 6, then denominator becomes 12 times the numerator. Determine the fraction
- Q36. A man has only 20paise coins and 25 paise coins in his purse. If he has 50 coins in all totaling 11.25/-, how many coins of each kind does he have?
- Q37. For each of the following system of equations determine the values of  $k$  for which the given system has no solution
- $$3x - 4y + 7 = 0$$
- $$kx + 3y - 5 = 0$$
- Q38. For what value of  $k$ , will the following system of equations have infinitely many solutions
- $$2x + 3y = 4$$
- $$(k + 2)x + 6y = 3k + 2$$
- Q39. Determine the values of  $a$  and  $b$  for which the following system of linear equations have infinite solutions
- $$2x - (a - 4)y = 2b + 1 ;$$
- $$4x - (a - 1)y = 5b - 1$$
- Q40. A and B each have certain number of oranges. A says to B, "if you give me 10 of your oranges, I will have twice the number of oranges left with you." B replies, "if you give me 10 of your oranges, I will have the same number of oranges as left with you. Find the number of oranges with A and B separately.

## CASE STUDY BASED QUESTIONS

### CASE STUDY -1

Special offers are short-term pricing strategies that businesses, especially shops will adopt to encourage customers to buy from them. During winter season, a shopkeeper sells a jacket at 8% profit and a sweater at 10 % discount thereby getting a sum of 1008. If she had sold the jacket at 10 % profit and the sweater at 8 % discount, she would have got 1028. Denoting the cost price of one jacket by  $x$  and the list price of one sweater by  $y$ , answer the following situations.



I. Represent the first situation algebraically.

- a)  $12x+10y=11200$
- b)  $10x+12y=11200$
- c)  $12x-10y=11200$
- d)  $10x-12y=1120$

II. Represent the second situation algebraically

- a)  $46x+55y=51400$
- b)  $55x+46y=51400$
- c)  $55x-46y=51400$
- d)  $46x-55y=51400$

III. The system of linear equations representing both the situations will have.

- a) Infinite number of solutions
- b) Unique solution
- c) No Solutions
- d) Exactly two solutions

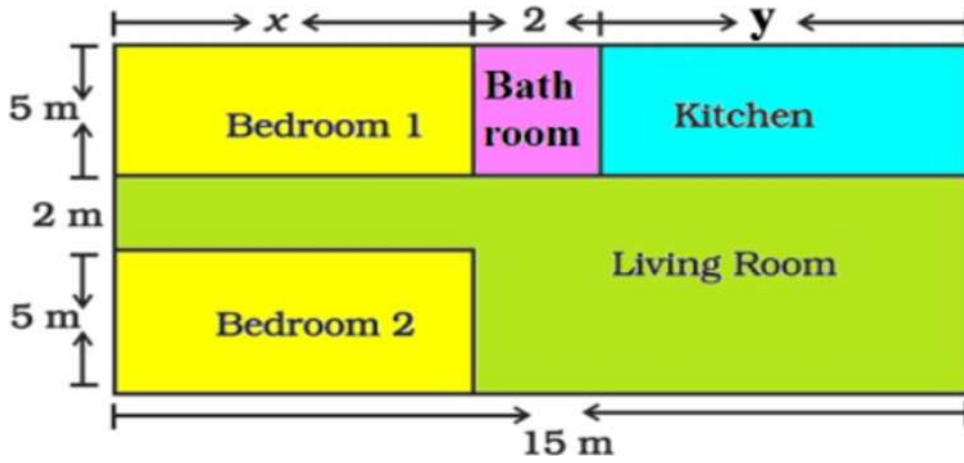
IV. The graph of the system of linear equations representing both the situations will be

- a) Parallel lines
- b) Coincident lines
- c) Intersecting lines
- d) None of these

#### CASE STUDY 2:

Apartments have increasingly become the most supplied property type across cities in India. Their popularity can be attributed to reasons including but not limited to contemporary looks, modern day amenities, in-house maintenance and better security. Inaya is planning to buy a 2BHK apartment and the layout is given below.

The design and the measurement has been made such that area bedrooms and kitchen together is 95 sq.m.



1. Which pair of linear equations in two variables does describe this situation.
- (a)  $x + y = 17$ ,  $3x + y = 15$       (b)  $x + y = 27$ ,  $3x + 4y = 95$   
 (c)  $5x + 2y = 15$ ,  $x + 4y = 12$       (d)  $2x + y = 19$ ,  $x + y = 13$

2. What is the length of the outer boundary of the layout?

- (a) 40 m      (b) 54 m      (c) 27 m      (d) 48 m

3. What is the area of the bedroom 1?

- (a) 30m<sup>2</sup>      (b) 40m<sup>2</sup>      (c) 55m<sup>2</sup>      (d) 35m<sup>2</sup>

4. What is the cost of laying tiles in kitchen at the rate of . 100 per sq.m.

- (a) .3000      (b) .3250      (c) .3500      (d) .3750

**Q 3:**

A pair of linear equations is represented geometrically as shown below.

a) What can you say about the pair of linear equations?

- a) Consistent  
 b) Dependent  
 c) Inconsistent  
 d) consistent and dependent

b) From the graph, find the coordinates of the point, where the line AB intersects the X-axis

- a) (5,0)
- b) (-2,0)
- c) (0,2)
- d) (0,0)

c) From the graph, find the solution of the pair of linear equations

- a) (4,2)
- b) (2,4)
- c) (-2,0)
- d) (5,0)

d) What is the area of the shaded region?

- a) 11 sq. units
- b) 12 sq. units
- c) 13 sq. units
- d) 14 sq. units

## **Chapter-4 Quadratic Equations**

### **1. GIST OF THE CHAPTER:**

Standard form of a quadratic equation  $ax^2 + bx + c = 0$ , ( $a \neq 0$ ).

Solutions of quadratic equations (only real roots) by factorization, and by using quadratic formula.  
Relationship between discriminant and nature of roots.

Situational problems based on quadratic equations related to day to day activities to be incorporated.

### **2. KEY POINTS:**

Roots of a quadratic equation : A real number  $\alpha$  is said to be a root of the quadratic equation  $ax^2 + bx + c = 0$ , if  $a\alpha^2 + b\alpha + c = 0$ .

The roots of the quadratic equation  $ax^2 + bx + c = 0$  are the same as the zeroes of the quadratic polynomial  $ax^2 + bx + c$ .

Finding the roots of a quadratic equation by the method of factorisation : If we can factorise the quadratic polynomial  $ax^2 + bx + c$ , then the roots of the quadratic equation  $ax^2 + bx + c = 0$  can be found by equating to zero the linear factors of  $ax^2 + bx + c$ .

### **3. FORMULA BASED ANALYSIS:**

If  $b^2 - 4ac \geq 0$ , then the real roots of the quadratic equation  $ax^2 + bx + c = 0$  are given by

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

The expression  $b^2 - 4ac$  is called the discriminant (D) of the quadratic equation.

Existence of roots of a quadratic equation: A quadratic equation  $ax^2 + bx + c = 0$  has

- (i) two distinct real roots if  $D = b^2 - 4ac > 0$
- (ii) two equal real roots (i.e., coincident roots) if  $D = b^2 - 4ac = 0$
- (iii) no real roots if  $D = b^2 - 4ac < 0$ .

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

### **4. SHORT QUESTIONS BASED ON FORMULA:**

1. Find the roots of the quadratic equation:  $6x^2 - x - 2 = 0$ .
2. Find the roots of the quadratic equation:  $100x^2 - 20x + 1 = 0$ .
3. Find the roots of the quadratic equation:  $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$
4. Find the roots of the quadratic equation:  $3x^2 - 2\sqrt{6}x + 2 = 0$
5. Find the nature of the roots of the quadratic equation  $2x^2 - 3x + 5 = 0$ . If the real roots exist, find them.

## 5. HOTS AND CCT BASED QUESTION FREQUENTLY ASKED QUESTION:

1. A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.
2. If the quadratic equation  $(1 + m^2)x^2 + 2mcx + c^2 - a^2 = 0$  has equal roots, prove that  $c^2 = a^2 (1 + m^2)$ .
3. Three consecutive positive integers are such that the sum of the square of the first and the product of the other two is 46, find the integers.

### CASE STUDY 1

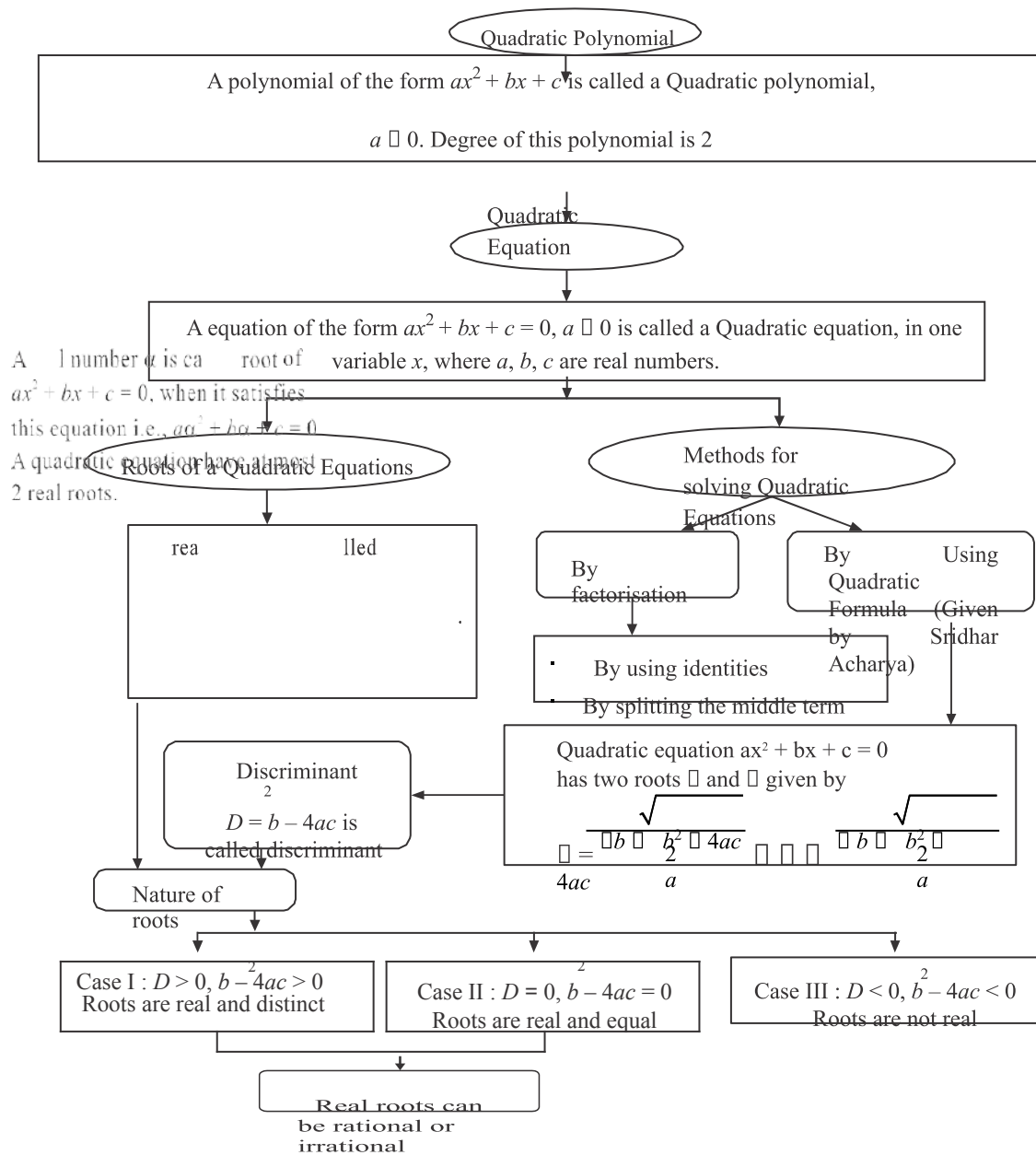
John and Jayant are very close friends. They decided to go to Ranikhet with their families in separate cars. John's car travels at a speed of  $x$  km/hr while Jayant's car travels 5km/hr faster than Johan's car. Johan took 4 hours more than Jayant to complete the journey of 400 km.



1. The distance covered by Jayant's car in two hours is  
a)  $2(x+5)$  km      b)  $(x-5)$  km      c)  $2(x+10)$  km      d)  $(2x+5)$  km
2. The quadratic equation describing the speed of Johan's car is  
a)  $x^2-5x-500=0$       b)  $x^2+4x-400=0$       c)  $x^2+5x-500=0$       d)  $x^2-4x+400=0$
3. The speed of Johan's car in km/hr  
a) 20      b) 15      c) 25      d) 10
4. The speed of Jayant's car in km/hr  
a) 25      b) 20      c) 30      d) 15
5. Time taken by Jayant to travel 400 km is  
a) 20 hours      b) 40 hours      c) 25 hours      d) 16 hours

## 6. TRICK FOR MEMORISING:

### Basic Concepts



## QUADRATIC EQUATIONS

### I. Important Concepts / Results

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

Here  $a$  and  $b$  are the coefficients of  $x^2$  and  $x$  respectively and „ $c$ “ is a constant term. Any value is a solution of a quadratic equation if and only if it satisfies the quadratic equation.

Quadratic formula:

The roots, i.e.,  $\alpha$  and  $\beta$  of a quadratic equation  $ax^2 + bx + c = 0$  are given

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

where  $b^2 - 4ac \geq 0$  or  $x = (-b \pm D)/2a$

Here, the value  $b^2 - 4ac = D$  is known as the discriminant and is generally denoted by  $D$ . „ $D$ “ helps us to determine the nature of roots for a given quadratic equation.

Thus  $D = b^2 - 4ac$ .

The rules are:

If  $D = 0 \Rightarrow$  The roots are Real and Equal.

If  $D > 0 \Rightarrow$  The two roots are Real and Unequal.

If  $D < 0 \Rightarrow$  No Real roots exist.

If  $\alpha$  and  $\beta$  are the roots of the quadratic equation, then Quadratic equation is:

$$x^2 - (\alpha + \beta)x + \alpha\beta = 0 \text{ Or } x^2 - (\text{sum of roots})x + \text{product of roots} = 0$$

Examples i) MCQ

1) 1. Which of the following is not a quadratic equation

(a)  $x^2 + 3x - 5 = 0$  (b)  $x^2 + x^3 + 2 = 0$  (c)  $3 + x + x^2 = 0$  (d)  $x^2 - 9 = 0$

Ans:- (b)  $x^2 + x^3 + 2 = 0$



:Reason: Since it has degree 3.

2) The polynomial equation  $x(x + 1) + 8 = (x + 2)(x - 2)$  is

(a) linear equation (b) quadratic equation (c) cubic equation (d) bi-quadratic equation

Ans:- (a) linear equation

Explanation: We have  $x(x + 1) + 8 = (x + 2)(x - 2)$

$$\Rightarrow x^2 + x + 8 = x^2 - 4$$

$$\Rightarrow x^2 + x + 8 - x^2 + 4 = 0$$

$$\Rightarrow x + 12 = 0, \text{ which is a linear equation.}$$

3) The roots of the quadratic equation  $6x^2 - x - 2 = 0$  are

(a)  $x = -1/3, x = 2/5$  (b)  $x = -1/4, x = 2/3$  (c)  $x = -1/2, x = 2/3$  (d)  $x = -1/7, x = 2/3$

Ans:- (c)  $x = -1/2, x = 2/3$

Explanation:Reason: We have  $6x^2 - x - 2 = 0$

$$\Rightarrow 6x^2 + 3x - 4x - 2 = 0$$

$$\Rightarrow 3x(2x + 1) - 2(2x + 1) = 0$$

$$\Rightarrow (2x + 1)(3x - 2) = 0$$

$$\Rightarrow 2x + 1 = 0 \text{ or } 3x - 2 = 0$$

$$\therefore x = -1/2, x = 2/3$$

4) If one root of the quadratic equation  $2x^2 + kx - 6 = 0$  is 2, the value of k is

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

Ans: (b) -1

Reason: Since  $x = 2$  is a root of the equation  $2x^2 + kx - 6 = 0$

$$\therefore 2(2)^2 + k(2) - 6 = 0$$

$$\Rightarrow 8 + 2k - 6 = 0$$

$$\Rightarrow 2k = -2$$

$$\therefore k = -1$$

5) The roots of the equation  $7x^2 + x - 1 = 0$  are

(a) real and distinct (b) real and equal (c) not real (d) none of these

Answer: (a) real and distinct

Reason: Here  $a = 7$ ,  $b = 1$ ,  $c = -1$

$$\therefore D = b^2 - 4ac = (1)^2 - 4 \times 7 \times (-1) = 1 + 28 = 29 > 0$$

$\therefore$  Roots of the given equation are real and distinct.

**Short Answer type Questions:-**

1) If the equation  $12x^2 + 4kx + 3 = 0$  has real and equal roots, find the value of  $k$

Solution: Here  $a = 12$ ,  $b = 4k$ ,  $c = 3$

Since the given equation has real and equal roots

$$\therefore b^2 - 4ac = 0$$

$$\Rightarrow (4k)^2 - 4 \times 12 \times 3 = 0$$

$$\Rightarrow 16k^2 - 144 = 0$$

$$\Rightarrow k^2 = 9$$

$$\Rightarrow k = \pm 3$$

2) Find the roots of the quadratic equation  $2x^2 + x - 6 = 0$

Solution:  $x^2 - 5x + 2x - 10 = 0$

$$\Rightarrow x(x - 5) + 2(x - 5) = 0$$

$$\Rightarrow (x - 5)(x + 2) = 0$$

Therefore,  $x - 5 = 0$  or  $x + 2 = 0$

$$\Rightarrow x = 5 \text{ or } x = -2$$

3) Find two consecutive positive integers, the sum of whose squares is 365.

Solution: Let us say the two consecutive positive integers are  $x$  and  $x + 1$ .

Therefore, as per the given questions,

$$x^2 + (x + 1)^2 = 365$$

$$\Rightarrow x^2 + x^2 + 1 + 2x = 365$$

$$\Rightarrow 2x^2 + 2x - 364 = 0$$

$$\Rightarrow x^2 + x - 182 = 0$$

$$\Rightarrow x^2 + 14x - 13x - 182 = 0$$

$$\Rightarrow x(x + 14) - 13(x + 14) = 0$$

$$\Rightarrow (x + 14)(x - 13) = 0$$

Thus, either,  $x + 14 = 0$  or  $x - 13 = 0$ ,

$$\Rightarrow x = -14 \text{ or } x = 13$$

Since the integers are positive,  $x$  can be 13 only.

$$\therefore x + 1 = 13 + 1 = 14$$

Therefore, two consecutive positive integers will be 13 and 14.

III. Questions for Practice

**i) MCQ**

1) The quadratic equation  $x^2 + x - 182 = 0$  has degree

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

2) The equation  $(x - 2)^2 + 1 = 2x - 3$  is a

- (a) Linear equation (b) quadratic equation (c) cubic equation  
(d) bi-quadratic equation

3) The quadratic equation whose roots are 1 and

(a)  $2x^2 + x - 1 = 0$  (b)  $2x^2 - x - 1 = 0$  (c)  $2x^2 + x + 1 = 0$  (d)  $2x^2 - x + 1 = 0$

4) The quadratic equation whose one rational root is  $3 + \sqrt{2}$  is

(a)  $x^2 - 7x + 5 = 0$  (b)  $x^2 + 7x + 6 = 0$  (c)  $x^2 - 7x + 6 = 0$  (d)  $x^2 - 6x + 7 = 0$

5) The equation  $2x^2 + kx + 3 = 0$  has two equal roots, then the value of k is

(a)  $\pm\sqrt{6}$  (b)  $\pm 4$  (c)  $\pm 3\sqrt{2}$  (d)  $\pm 2\sqrt{6}$

6) The roots of the quadratic equation  $2x^2 - 2\sqrt{2}x + 1 = 0$  are

7) The roots of the quadratic equation

(a) a, b (b) -a, b (c) a, -b (d) -a, -b

8) The roots of the equation  $(b - c)x^2 + (c - a)x + (a - b) = 0$  are equal, then

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

9) The sum of the squares of two consecutive natural numbers is 313. The numbers are

(a) 12, 13 (b) 13, 14 (c) 11, 12 (d) 14, 15

10) Assertion: If one root of the quadratic equation  $6x^2 - x - k = 0$  is  $2/3$ , then the value of k is 2.

Reason: The quadratic equation  $ax^2 + bx + c = 0$ ,  $a \neq 0$  has almost two roots.

Directions:

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If Assertion is incorrect but Reason is correct.

i) Short Answer Type Questions:-

- 1) Find the roots of the quadratic equation  $2x^2 - x + 18 = 0$
- 2) Find two numbers whose sum is 27 and product is 182.
- 3) Solve :  $\sqrt{2x^2 + 7x + 5} \sqrt{2} = 0$
- 4) Find the roots of the quadratic equation  $2x^2 - x + 4 = 0$  by using Quadratic formula
- 5) Find the roots of the following equations:

Answer

Test-1 Quadratic Equations: M.M.: 20

I Choose the correct answer:- 4 x 1=4 marks

The quadratic equation  $x^2 + x - 182 = 0$  has degree

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

2) The equation  $(x - 2)^2 + 1 = 2x - 3$  is a

- (a) linear equation (b) quadratic equation (c) cubic equation  
(d) bi-quadratic equation

3) The equation  $2x^2 + kx + 3 = 0$  has two equal roots, then the value of k is

- (a)  $\pm\sqrt{6}$                       (b)  $\pm 4$                       (c)  $\pm 3\sqrt{2}$                       (d)  $\pm 2\sqrt{6}$

4) The sum of the squares of two consecutive natural numbers is 313. The numbers are

- (a) 12, 13                      (b) 13,14                      (c) 11,12                      (d) 14,15

II. Answer the following :                      5 X 2 = 10 Marks

- 5) Solve :  $\sqrt{2x^2 + 7x + 5} \sqrt{2} = 0$
- 6) Find the roots of the quadratic equation  $2x^2 - x + 4 = 0$  by using Quadratic formula
- 7) Find the roots of the quadratic equation  $2x^2 - x + 18 = 0$

## Chapter:5 ARITHMETIC PROGRESSIONS

### (A) Gist of Chapter

#### Sequences, Series and Progressions

- A sequence is a finite or infinite list of numbers following a specific pattern. For example, 1, 2, 3, 4, 5,... is the sequence, an infinite sequence of natural numbers.
- A series is the sum of the elements in the corresponding sequence. For example,  $1+2+3+4+5+\dots$  is the series of natural numbers. Each number in a sequence or a series is called a term.
- A progression is a sequence in which the general term can be expressed using a mathematical formula.

#### Arithmetic Progression

An arithmetic progression (AP) is a progression in which the difference between two consecutive terms is constant.

In arithmetic progression, the first term is represented by the letter “a”, the last term is represented by “l”, the common difference between two terms is represented by “d”, and the number of terms is represented by the letter “n”.

Thus, the standard form of the arithmetic progression is given by the formula,

$a, a + d, a + 2d, a + 3d, a + 4d, \dots$

Now, consider the infinite arithmetic progression 2, 5, 8, 11, 14....

Here, first term,  $a = 2$

Common difference = 3

Here, the common difference is calculated as follows:

Second term – first term =  $5 - 2 = 3$

Third term – second term =  $8 - 5 = 3$

Fourth term – third term =  $11 - 8 = 3$

Fifth term – fourth term =  $14 - 11 = 3$

Since the difference between two consecutive terms is constant (i.e., 3), the given progression is an arithmetic progression.

#### Common Difference

The difference between two consecutive terms in an AP (*which is constant*) is the “common difference“(d) of an A.P. In the progression: 2, 5, 8, 11, 14 ...the common difference is 3.

As it is the difference between any two consecutive terms, for any A.P, if the common difference is:

- Positive, the AP is increasing.
- Zero, the AP is constant.
- Negative, the A.P is decreasing.

## Chapter:5 ARITHMETIC PROGRESSIONS

The formula to find the common difference between the two terms is given as:

Common difference,  $d = (a_n - a_{n-1})$  Where,

$a_n$  represents the  $n$ th term of a sequence

$a_{n-1}$  represents the previous term. i.e.,  $(n-1)^{\text{th}}$  term of a sequence.

### Finite and Infinite AP

- A finite AP is an A.P in which the number of terms is finite. For example the A.P: 2, 5, 8.....32, 35, 38
- An infinite A.P is an A.P in which the number of terms is infinite. For example: 2, 5, 8, 11.....

### General Term of AP

In Arithmetic progression,  $a_n$  is called the general term, where  $n$  represents the position of the term in the given sequence.

### The $n$ th Term of an AP

The  $n$ th term of an A.P is given by  $T_n = a + (n-1)d$ , where  $a$  is the first term,  $d$  is a common difference and  $n$  is the number of terms.

### Finding $n$ th Term:

**Example 1:** Determine the tenth term of the arithmetic progression 2, 7, 12, ....

**Solution:**

Given Arithmetic sequence: 2, 7, 12, ...

Here, first term,  $a = 2$

Common difference,  $d = 5$

i.e.,  $7 - 2 = 5$  and  $12 - 7 = 5$ .

And now, we have to find the 10th term of AP.

Hence,  $n = 10$

Thus, the formula to find the  $n$ th term of AP is  $a_n = a + (n-1) d$

Now, substituting the values in the formula, we get

$$a_{10} = 2 + (10 - 1)5$$

$$a_{10} = 2 + 9(5)$$

$$a_{10} = 2 + 45$$

$$a_{10} = 47.$$

Therefore, 10<sup>th</sup> term of the given arithmetic sequence 2, 7, 12, ... is 47.

## Chapter:5 ARITHMETIC PROGRESSIONS

### The General Form of an AP

The general form of an A.P is:  $(a, a + d, a+2d, a+3d.....)$  where  $a$  is the first term and  $d$  is a common difference. Here,  $d=0$ , OR  $d>0$ , OR  $d<0$

### The Sum of Terms in an AP

#### The Formula for the Sum to $n$ Terms of an AP

The sum to  $n$  terms of an A.P is given by:

$$S_n = \frac{n}{2} [2a + (n - 1) d]$$

Where  $a$  is the first term,  $d$  is the common difference and  $n$  is the number of terms.

The sum of  $n$  terms of an A.P is also given by

$$S_n = \frac{n}{2} [a + l]$$

Where  $a$  is the first term,  $l$  is the last term of the A.P. and  $n$  is the number of terms.

#### Finding the Sum of $n$ Terms of an AP:

**Example 2:** Determine the sum of the first 22 terms of the Arithmetic Progression 8, 3, -2, ....

#### Solution

Here, the given arithmetic progression is 8, 3, -2, ...

So, the first term,  $a = 8$

Common difference,  $d = -5$

i.e.,

$$3 - 8 = -5$$

$$-2 - 3 = -5$$

And,  $n = 22$ .

Now, substitute all these values in the formula:  $S_n = \frac{n}{2} [2a + (n - 1) d]$

$$S = \frac{22}{2} [2(8) + (22-1) (-5)]$$

$$S = 11 [16 + (21) (-5)]$$

$$S = 11 [16 - 105]$$

$$S = 11 [-89]$$

$$S = -979$$

Therefore, the sum of the first 22 terms of the given AP is -979.



## Chapter:5 ARITHMETIC PROGRESSIONS

### The Sum of First n Natural Numbers

The sum of first n natural numbers is given by:

$$S_n = \frac{n(n+1)}{2}$$

This formula is derived by treating the sequence of natural numbers as an A.P where the first term (a) = 1 and the common difference (d) = 1.

### Finding the Sum of First n Natural Numbers:

**Example 1:** Find the sum of first 10 natural numbers.

Here, n = 10. Now, substitute the value in the formula,  $S_n = \frac{n(n+1)}{2}$

$$S_{10} = [10(10+1)]/2$$

$$S_{10} = [10(11)]/2$$

$$S_{10} = 110/2$$

$$S_{10} = 55$$

### Key Points:

- An arithmetic progression (AP) is a list of numbers in which each term is obtained by adding a fixed number  $d$  to the preceding term, except the first term  $a$ . The fixed number  $d$  is called its common difference.
- The general form of an AP is  $a, a + d, a + 2d, a + 3d, \dots$
- In the list of numbers  $a_1, a_2, a_3, \dots$  if the differences  $a_2 - a_1, a_3 - a_2, a_4 - a_3, \dots$  give the same value, i.e., if  $a_k - a_{k+1}$  is the same for different values of  $k$ , then the given list of numbers is an AP.
- The  $n$ th term  $a_n$  (or the general term) of an AP is  $a_n = a + (n - 1) d$ , where  $a$  is the first term and  $d$  is the common difference. Note that  $a_1 = a$
- The sum  $S_n$  of the first  $n$  terms of an AP is given by

$$S_n = \frac{n}{2} [2a + (n - 1) d]$$

- If  $l$  is the last term of an AP of  $n$  terms, then the sum of all the terms can also be given by

$$S_n = \frac{n}{2} [a + l]$$

Sometimes  $S_n$  is also denoted by  $S$

- If  $S_n$  is the sum of the first  $n$  terms of an AP, then its  $n^{\text{th}}$  term  $a_n$  is given by

$$a_n = S_n - S_{n-1}$$

- $n$ th Term from the end of an Arithmetic Progression ( AP )

Let the last term of an AP be 'l' and the common difference of an AP is 'd' then the  $n$ th term from the end of an AP is given by

$$l_n = l - (n - 1) d.$$

## Chapter:5 ARITHMETIC PROGRESSIONS

### Assertion Reason Questions

**Directions:**

- (a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.**
- (b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.**
- (c) If Assertion is correct but Reason is incorrect.**
- (d) If Assertion is incorrect but Reason is correct.**

1. *Assertion: If  $S_n$  is the sum of the first  $n$  terms of an A. P., then its  $n$ th term  $a_n$  is given by* 
$$a_n = S_n - S_{n-1}.$$

*Reason: The 10th term of the A. P. 5, 8, 11, 14, ..... is 35.*

2. *Assertion: The sum of the series with the  $n$ th term,*

$t_n = (9 - 5n)$  is (465), when no. of terms  $n = 15$ .

*Reason: Given series is in A. P. and sum of  $n$  terms of an A. P. is*

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

### Shorts Questions based on formula

- 1. Find the 31st term of an AP whose 11th term is 38 and the 16th term is 73.
- 2. If the sum of the first 14 terms of an AP is 1050 and its first term is 10, find the 20th term.
- 3. An AP consists of 50 terms of which 3rd term is 12 and the last term is 106. Find the 29th term.
- 4. If the sum of first 7 terms of an AP is 49 and that of 17 terms is 289, find the sum of first  $n$  terms.
- 5. Find the sum of first 24 terms of the list of numbers whose  $n$ th term is given by  $a_n = 3 + 2n$

## Chapter:5 ARITHMETIC PROGRESSIONS

6. Find the 20th term of the AP whose 7th term is 24 less than the 11th term, first term being 12..
7. An AP consists of 50 terms of which 3rd term is 12 and the last term is 106. Find the 29th term.
8. If the 3rd and the 9th terms of an AP are 4 and  $-8$  respectively, which term of this AP is zero?
9. Which term of the AP : 3, 15, 27, 39, . . . will be 132 more than its 54th term?
10. Determine the AP whose third term is 16 and the 7th term exceeds the 5th term by 12.
11. The sum of 4th term and 8th term of an AP is 24 and the sum of 6th and 10th terms is 44. Find the AP.
12. Which term of the AP:  $-2, -7, -12, \dots$  will be  $-77$ ? Find the sum of this AP up to the term  $-77$ .

### Hots and CCT based frequently asked questions

1. If 7 times the 7th term of an AP is equal to 11 times its 11th term, then its 18th term will be  
(a) 7 (b) 11 (c) 18 (d) 0
2. How many terms of the A.P.  $-9, 17, 25, \dots$  must be taken to give a sum of 636?  
(a) 13 (b) 14 (c) 12 (d) 15
3. The sum of the first 25 terms of an AP whose  $n$ th term is given by  $t_n = 2 - 3n$ , is:  
(a) 925 (b)  $-925$  (c) 875 (d) None of these
4. The first negative term of the AP  $\frac{81}{5}, \frac{77}{5}, \frac{73}{5}, \dots$  is  
(a) 23 (b) 20 (c) 21 (d) 22
5. If  $2x, (x + 10)$  and  $(3x + 2)$  are in AP then  $x = \dots$ ?  
(a) 4 (b) 5 (c) 6 (d) 8
6. The  $n^{\text{th}}$  term of an AP cannot be  $n^2 + 1$ . Justify your answer.
7. Is 0 a term of the AP: 31, 28, 25, ...? Justify your answer.
8. The sum of the first three terms of an AP is 33. If the product of the first and the third term exceeds the second term by 29, find the AP.
9. Find  $a, b$  and  $c$  such that the following numbers are in AP:  $a, 7, b, 23, c$ .
10. Determine the AP whose fifth term is 19 and the difference of the eighth term from the thirteenth term is 20.

## Chapter:5 ARITHMETIC PROGRESSIONS

11. Split 207 into three parts such that these are in AP and the product of the two smaller parts is 4623.
12. In an AP, if  $S_n = n(4n + 1)$ , find the AP.
13. If sum of first 6 terms of an AP is 36 and that of the first 16 terms is 256, find the sum of first 10 terms.
14. In an AP, if  $S_n = 3n^2 + 5n$  and  $a_k = 164$ , find the value of k.
15. The sum of the first five terms of an AP and the sum of the first seven terms of the same AP is 167. If the sum of the first ten terms of this AP is 235, find the sum of its first twenty terms.
16. Solve the equation :  $1 + 4 + 7 + 10 + \dots + x = 287$
17. Find the sum of the integers between 100 and 200 that are
  - (i) divisible by 9
  - (ii) not divisible by 9
18. Show that the sum of an AP whose first term is a, the second term b and the last term c, is equal to  $\frac{(a+c)(b+c-2a)}{2(b-a)}$
19. The ratio of the 11th term to the 18th term of an AP is 2 : 3. Find the ratio of the 5th term to the 21st term, and also the ratio of the sum of the first five terms to the sum of the first 21 terms.
20. The eighth term of an AP is half its second term and the eleventh term exceeds one third of its fourth term by 1. Find the 15th term.
21. The first term of an AP is -5 and the last term is 45. If the sum of the terms of the AP is 120, then find the number of terms and the common difference.

### Case Based Questions

1. Aditya is celebrating his birthday. He invited his friends. He bought a packet of toffees/candies which contains 120 candies. He arranges the candies such that in the first row there are 3 candies, in second there are 5 candies, in third there are 7 candies and so on.



On the basis of the above information, answer any four of the following questions:

- (i) Find the total number of rows of candies.
  - (ii) Find the number of candies in last row.
  - (iii) Find the difference in number of candies placed in 7th and 3rd rows.
2. Your elder brother wants to buy a car and plans to take loan from a bank for his car. He repays his total loan of Rs 1,18,000 by paying every month starting with the first

## Chapter:5 ARITHMETIC PROGRESSIONS

instalment of Rs 1000. If he increases the instalment by Rs 100 every month, answer the following:



- (i) What amount will be paid by him in the 30th instalment?
  - (ii) What amount of loan does he still have to pay after the 30th instalment?
  - (iii) How many months is required to pay entire loan amount?
3. India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6th year and 22600 in 9th year.

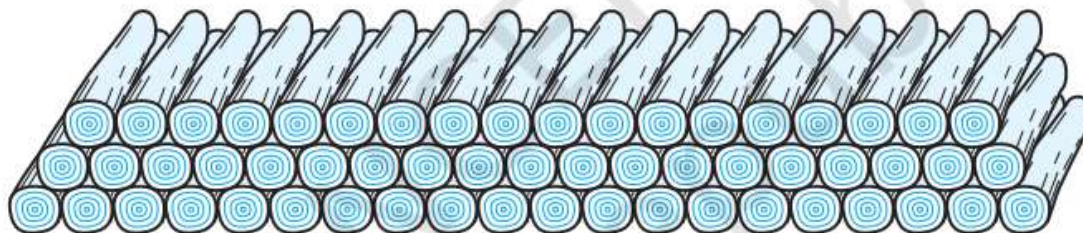


- (i) In which year, the production is Rs 29,200. (answer:  $n=12$ )
  - (ii) Find the production during first year.(answer: 5000)
  - (iii) Find the difference of the production during 7th year and 4th year.  
(answer: 6600)
4. The students of a school decided to beautify the school on the Annual Day by fixing colorful flags on the straight passage of the school. They have 27 flags to be fixed at intervals of every 2 m. The flags are stored at the position of the middle most flag. Ruchi was given the responsibility of placing the flags. Ruchi kept her books where the flags were stored. She could carry only one flag at a time.

## Chapter:5 ARITHMETIC PROGRESSIONS

- (i) How much distance did she cover in completing this job and returning back to collect her books? (answer: 728 m)
- (ii) What is the maximum distance she travelled carrying a flag? (answer: 26 m)

5. 200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on.



- (i) Determine AP related to above situation.
- (ii) In how many rows are the 200 logs placed?
- (iii) How many logs are in the top row?

6. In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato, and the other potatoes are placed 3 m apart in a straight line. There are ten potatoes in the line



A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket.

- (i) Determine the A.P related to the above situation.
- (ii) What is the total distance the competitor has to run? (370 m)
- (iii) What is the maximum distance she travelled carrying a flag?

Or

Find the total distance covered by the competitor after placed the second potato in the bucket?

7. In the month of April to June 2022, the exports of passenger cars from India increased by 26% in the corresponding quarter of 2021–22, as per a report. A car manufacturing company planned to produce 1800 cars in 4th year and 2600 cars in 8th year. Assuming that the production increases uniformly by a fixed number every year.



## Chapter:5 ARITHMETIC PROGRESSIONS

- I. Find the production in the 1st year.
- II. Find the production in the 12th year.
- III. Find the total production in first 10 years.

[OR]

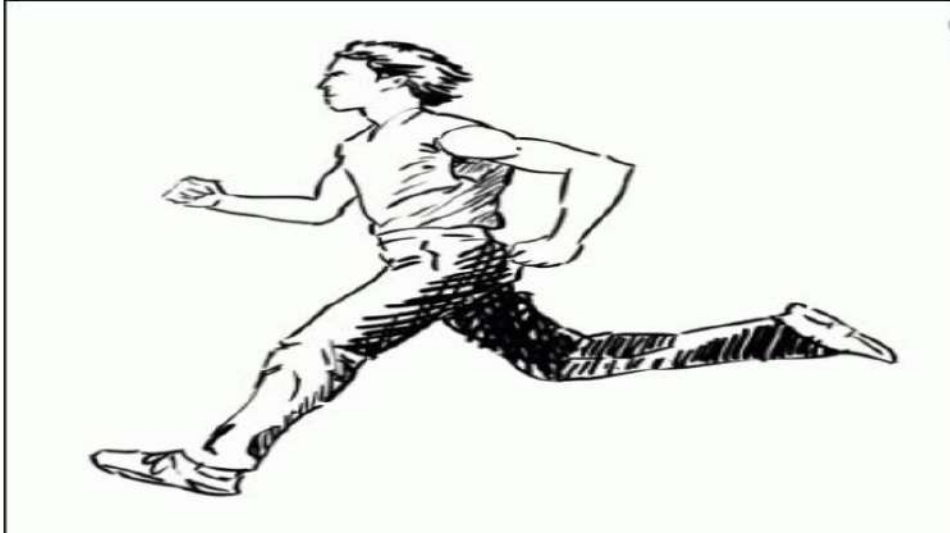
In how many years will the total production reach 31200 cars?

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



- (i) If the first circular row has 30 seats, how many seats will be there in the 10th row?
  - (ii) For 1500 seats in the auditorium, how many rows need to be there?  
OR  
If 1500 seats are to be arranged in the auditorium, how many seats are still left to be put after 10th row?
  - (iii) If there were 17 rows in the auditorium, how many seats will be there in the middle row?
9. Your friend Veer wants to participate in a 200m race. He can currently run that distance in 51 seconds and with each day of practice it takes him 2 seconds less. He wants to do in 31 seconds

## Chapter:5 ARITHMETIC PROGRESSIONS



- (i) Determine the A.P related to the above situation.
- (ii) Find the minimum number of days he needs to practice till his goal achieved.
- (iii) Find the total distance run by him to achieve the target.

10. A road roller (sometimes called a roller-compactor, or just roller) is a compactor-type engineering vehicle used to compact soil, gravel, concrete, or asphalt in the construction of roads and foundations. Similar rollers are used also at landfills or in agriculture. Road rollers are frequently referred to as steamrollers, regardless of their method of propulsion. RCB Machine Pvt Ltd started making road roller 10 year ago. Company increased its production uniformly by fixed number every year. The company produces 800 rollers in the 6th year and 1130 rollers in the 9th year.



On the basis of the above information, answer any four of the following questions:

- (i) Determine A.P related to above situation.
- (ii) Find the company's total production up to 9<sup>th</sup> year.
- (iii) In which year the company's production was 1350 rollers?



**CLASS : X**

**SUBJECT : MATHS (STANDARD)**

**SUBJECT CODE : 241**

**CHAPTER : ARITHMETIC PROGRESSION**

**MULTIPLE CHOICE QUESTIONS (1 Mark Each)**

1. The  $n$ th term of an A.P. 5, 2, -1, -4, -7 ... is
  - (a)  $2n + 5$
  - (b)  $2n - 5$
  - (c)  $8 - 3n$
  - (d)  $3n - 8$
2. The 10th term from the end of the A.P. 4, 9, 14, ..., 254 is
  - (a) 209
  - (b) 205
  - (c) 214
  - (d) 213
3. If  $2x$ ,  $x + 10$ ,  $3x + 2$  are in A.P., then  $x$  is equal to
  - (a) 0
  - (b) 2
  - (c) 4
  - (d) 6
4. Which term of the AP: 21, 42, 63, 84, ... is 210?
  - (A) 9<sup>th</sup>
  - (B) 10<sup>th</sup>
  - (C) 11<sup>th</sup>
  - (D) 12<sup>th</sup>
5. The number of multiples of 4 between 10 and 250 is:
  - (a) 50
  - (b) 40
  - (c) 60

(d)30

6. If the sum of  $n$  terms of an A.P. is  $2n^2 + 5n$ , then its  $n^{\text{th}}$  term is

(a)  $4n - 3$

(b)  $3n - 4$

(c)  $4n + 3$

(d)  $3n + 4$

7. The middle most term (s) of the AP:  $-11, -7, -3, \dots, 49$  is:

(a) 18, 20

(b) 19, 23

(c) 17, 21

(d) 23, 25

8. If the 2<sup>nd</sup> term of an AP is 13 and the 5th term is 25, what is its 7<sup>th</sup> term?

(a) 30

(b) 33

(c) 37

(d) 38

9. The next term of the AP:  $\sqrt{8}, \sqrt{18}, \sqrt{32}, \dots$  is

(a)  $5\sqrt{2}$

(b)  $5\sqrt{3}$

(c)  $3\sqrt{3}$

(d)  $3\sqrt{5}$

10. If an AP has  $a_1=1$ ,  $a_n=20$  and  $S_n=399$ , then the value of  $n$  is

(a) 20

(b) 32

(c) 38

(d) 40

### **ASSERTION REASON BASED QUESTIONS (1 Mark Each)**

Questions number 11 and 12 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

11. Assertion (A): Common difference  $d$  of the AP 132, 120, 108, 96, .... is -12

Reason (R): Common difference of the AP  $a, a+d, a+2d, a+3d, \dots$  is given as  $d(\text{common difference}) = \text{second term} - \text{first term}$ .

12. Assertion (A): Fourth term from the end of the AP 8, 11, 14, ...., 65 is 56.

Reason (R):  $n$ th term from the end of an AP with last term  $l$  and common difference  $d$  is  $l - (n-1)d$

### SHORT ANSWER TYPE QUESTIONS – I (2 Marks Each)

13. Which term of the sequence 48, 43, 38, 33..... is the first negative term?
14. In a flower bed, there are 23 rose plants in the first row, 21 in the second, 19 in the third, and so on. There are 5 rose plants in the last row. How many rows are there in the flower bed?
15. If the 3rd and the 9th terms of an AP are 4 and -8, respectively, then which term of this AP is zero.
16. In an AP, if  $S_n = n(4n + 1)$ , find the AP.
17. A man saves Rs. 10 on the first day of the month Rs 20 on the second day Rs. 30 on the third day and so on What will be saving in 30 days
18. If 9<sup>th</sup> term of an AP is zero, prove that its 29<sup>th</sup> term is double the 19<sup>th</sup> term.
19. Three numbers are in AP and their sum is 24. Find the middle term
20. If the sum of first  $m$  terms of an AP is  $am^2 + bm$ , find the common difference.
21. Find the number of natural numbers between 101 and 999 which are divisible by both 2 and 5
22. If the sum of the first 14 terms of an AP is 1050 and its first term is 10, find the 20<sup>th</sup> term.

### SHORT ANSWER TYPE QUESTIONS – II (3 Marks Each)

23. The sum of the first 9 terms of an AP is 171 and the sum of its first 24 terms is 996. Find the first term and the common difference.
24. If the sum of first  $m$  terms of an A.P. is the same as the sum of its first  $n$  terms, then show that the sum of its first  $(m + n)$  terms is zero.
25. Find the sum of  $n$  terms of the series:  $(4 - \frac{1}{n}) + (4 - \frac{2}{n}) + (4 - \frac{3}{n}) + \dots$

26. The  $p$ th term of an AP is  $\frac{1}{7}(2p - 1)$ . Find the sum of its first  $n$  terms.
27. Find the sum of last five terms of arithmetic progression 5, 15, 25..., 215, 225
28. The sum of the third and seventh terms of an AP is 10 and their sum of fourth and ninth terms is 13 find the sum of first fourteen terms of an AP.
29. In an AP, the sum of its first ten terms is  $-80$  and the sum its next ten terms is  $-280$ . Find the AP.
30. Three numbers are in AP. If the sum of these numbers be 27 and the product 648, find the numbers.
31. In a school, students decided to plant trees in and around the school to reduce air pollution. It was decided that the number of trees, that each section of each class will plant, will be double of the class in which they are studying. If there are 1 to 12 classes in the school and each class has two sections, find how many trees were planted by the students.
32. Ramkali saves Rs 5 in the first week, of a year and increased her weekly savings by Rs 1.75. If in the  $n^{\text{th}}$  week her weekly savings became Rs 20.75, find  $n$ .

### LONG ANSWER QUESTIONS (5 Marks Each)

33. If  $m$ th term of an AP is  $\frac{1}{n}$  and  $n$ th term is  $\frac{1}{m}$ . Show that  $(mn)$ th term of this AP is 1.
34. The 7<sup>th</sup> term of an AP is 5 more than twice its 8<sup>th</sup> term. If the 11<sup>th</sup> term of the AP is 43, then find its  $n$ th term.
35. If the  $p^{\text{th}}$ ,  $q^{\text{th}}$  and  $r^{\text{th}}$  terms of an AP be  $a$ ,  $b$ ,  $c$  respectively, then show that  $a(q - r) + b(r - p) + c(p - q) = 0$ .
36. If the sum of first  $n$ ,  $2n$  and  $3n$  terms of an AP be  $S_1$ ,  $S_2$  and  $S_3$  respectively, then prove that  $S_3 = 3(S_2 - S_1)$
37. The sum of the first  $n$  terms of an AP whose first term is 8 and the common difference is 20 is equal to the sum of first  $2n$  terms of another AP whose first term is  $-30$  and the common difference is 8. Find  $n$ .

### CASE STUDY BASED QUESTIONS (4 Marks Each)

38. Priya is preparing for the Bicycle Marathon. Her racing bicycle has a device to calculate the no. of kilometers she cycled. She decides to increase the distance she cycles everyday by a fixed number of kilometers.



i) On the first day Priya cycled 8 km. In 10 days she cycled a total of total of 170 km. Find fixed no.of kilometer by which she increases her distance everyday. (1)

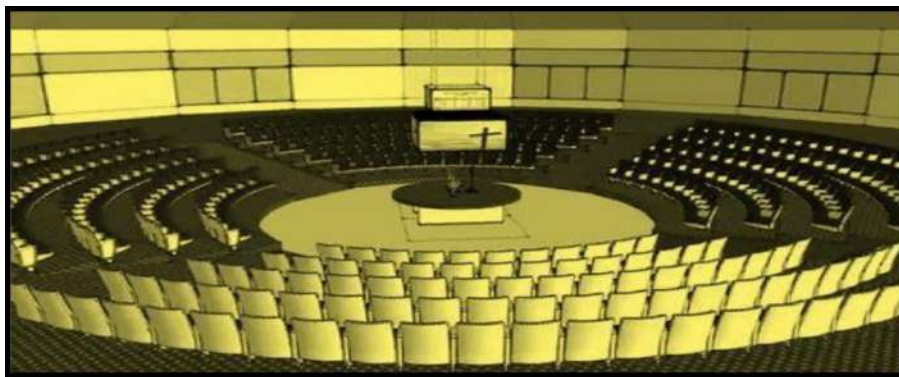
ii) Using data of (i) find How many kilometer did She cycle on the third day? (1)

iii) Priya plans to go on a cycle tour from Bangalore to Mangalore covering 425 Km.She travels 20 km on day 1 and increases the distance covered each day by 5 km. In how many days will She reach her destination? (2)

OR

If Priya travels 10 km on the first day and increases the distance she cycles everyday by 3 km. Find the distance travelled by her in 20 days.

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



i) If the first circular row has 30 seats, how many seats will be there in the 10th row? (1)

ii) If there were 17 rows in the auditorium, how many seats will be there in the middle row? (1)

iii) For 1500 seats in the auditorium, how many rows need to be there? (2)

OR

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

-----**THANK YOU**-----

# TRIANGLES

## KEY POINTS

- Two figures having same shapes (size may or may not same) are called similar figures
- Pair of all regular polygons are similar figures
- All circles are similar figures
- .All equilateral triangles are similar

**Similar triangles:** If two triangles are said to be similar if

- (a) Their corresponding angles are equal
- (b) Ratio of their corresponding sides are equal/proportional

**Basic proportionality Theorem [ or Thales theorem ].**

Basic proportionality Theorem/ Thales Theorem: If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio

**Solution:**

**Given That:** A triangle ABC in which a line parallel to side BC intersects other two sides AB and AC at D and E respectively.

**To Prove:**  $\frac{AD}{DB} = \frac{AE}{EC}$ .

**Construction:** Join BE and CD and then draw  $DM \perp AC$  and  $EN \perp AB$ .

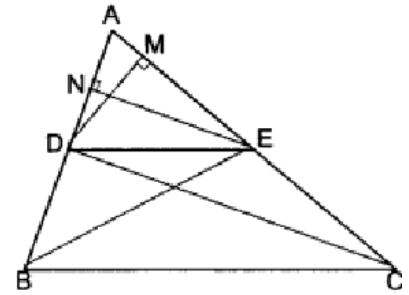
**Proof:** Area of  $\triangle ADE = \left(\frac{1}{2} \text{ base} \times \text{height}\right)$ .

So,  $ar(\triangle ADE) = \frac{1}{2} (AD \times EN)$

and  $ar(\triangle BDE) = \frac{1}{2} (DB \times EN)$

Similarly,  $ar(\triangle ADE) = \frac{1}{2} (AE \times DM)$

and  $ar(\triangle DEC) = \frac{1}{2} (EC \times DM)$



**Fig. 7.45**

Therefore,  $\frac{ar(\triangle ADE)}{ar(\triangle BDE)} = \frac{\frac{1}{2} AD \times EN}{\frac{1}{2} DB \times EN} = \frac{AD}{DB} \dots(i)$

and  $\frac{ar(\triangle ADE)}{ar(\triangle DEC)} = \frac{\frac{1}{2} AE \times DM}{\frac{1}{2} EC \times DM} = \frac{AE}{EC} \dots(ii)$

Now,  $\triangle BDE$  and  $\triangle DEC$  are on the same base  $DE$  and between the same parallel lines  $BC$  and  $DE$ .

So,  $ar(\triangle BDE) = ar(\triangle DEC) \dots(iii)$

Therefore, from (i), (ii) and (iii) we have,  $\frac{AD}{DB} = \frac{AE}{EC}$

**Second Part**

As  $DE \parallel BC$

$\therefore \frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{AD}{DB} + 1 = \frac{AE}{EC} + 1$

$\Rightarrow \frac{AD + DB}{DB} = \frac{AE + EC}{EC} \Rightarrow \frac{AB}{DB} = \frac{AC}{EC}$

**Criterion of similarity (AAA, AA, SSS, SAS)**

Revision notes

- In two triangles, if the corresponding angles are equal, then the corresponding sides are in the same ratio, then the triangles are similar (AAA similarity criterion)

If in two triangles, the two angles of one triangle are respectively equal to the corresponding angles of the other triangle, then the two triangles are similar. (AA similarity criterion)

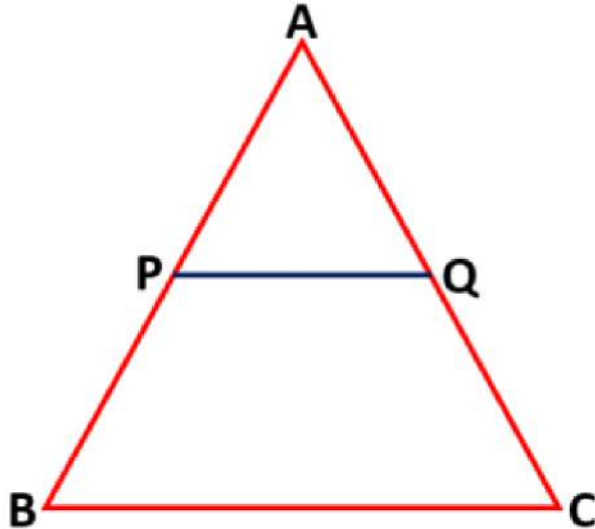
- If the corresponding sides of any two triangles are proportional, then the Corresponding angles are equal and the two triangles are similar (SSS similarity Criterion)

- If one angle of a triangle is equal to one angle of the other triangle and the Corresponding sides including are proportional. Then the triangle are similar (SAS Criterion)



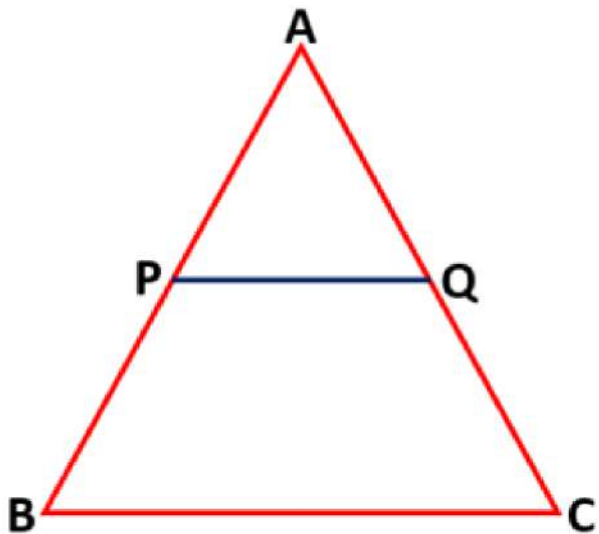
## MCQS

1) In the given figure  $PQ \parallel BC$ , If  $AP=3\text{cm}$ ,  $PB=4\text{cm}$  and  $AQ=6\text{cm}$  find  $QC$



a) 2cm b) 6cm c) 8cm d) none of these

2) In the given figure in triangle  $ABC$ ,  $PQ \parallel BC$  and  $\frac{AP}{PB} = \frac{3}{5}$ ,  $AQ = 28\text{cm}$ , find  $QC$



a) 10cm b) 10.5 cm c) 46.6 cm d) 9.5 cm

3) All ----- triangles are similar

a) scalene b) isosceles c) equilateral d) right

4) In  $\triangle ABC$ , if  $DE \parallel BC$ ,  $AD = x$ ,  $DB = x - 2$ ,  $AE = x + 2$  and  $EC = x - 1$ , then value of  $x$  is  
a. 3 b. 4 c. 5 d. 6

5) In  $\triangle LMN$ ,  $\angle L = 50^\circ$  and  $\angle N = 60^\circ$ , If  $\triangle LMN \sim \triangle PQR$ , then find  $\angle Q$

a.  $40^\circ$  b.  $50^\circ$  c.  $60^\circ$  d.  $120^\circ$

6) In triangles  $ABC$  and  $DEF$ ,  $\angle B = \angle E$ ,  $\angle F = \angle C$  and  $AB = 3DE$ . Then, the two triangles are  
a. congruent but not similar

b. similar but not congruent

c. neither congruent nor similar

d. congruent as well as similar

7) In  $\triangle ABC$ , given that  $DE \parallel BC$ , D is the midpoint of AB and E is a midpoint of AC. The ratio AE:EC is \_\_.  
 a. 1:1 b. 2:1 c. 1:3 d. 3:1

8) If in two  $\triangle$ s ABC and DEF,  $AB/DF = BC/EF = CA/ED$ , then  
 a.  $\triangle ABC \sim \triangle DEF$

b.  $\triangle ABC \sim \triangle EDF$

c.  $\triangle ABC \sim \triangle EFD$

d.  $\triangle ABC \sim \triangle DFE$

(Level -1)

1. If in two triangles, corresponding angles are equal, then the two triangles are.....

Ans. Equiangular then similar

2.  $\triangle ABC$  is a right angled at B. BD is perpendicular upon AC. If  $AD=a$ ,  $CD=b$ , then  $AB^2 =$

Ans.  $a(a+b)$

3. The area of two similar triangles are  $32\text{cm}^2$  and  $48\text{cm}^2$ . If the square of a side of the first  $\triangle$  is  $24\text{cm}^2$ , then the square of the corresponding side of 2<sup>nd</sup> triangle will be

Ans.  $36\text{cm}^2$

4. ABC is a triangle with  $DE \parallel BC$ . If  $AD=2\text{cm}$ ,  $BD=4\text{cm}$  then find the value DE:BC

Ans. 1:3

5. In  $\triangle ABC$ ,  $DE \parallel BC$ , if  $AD=4x-3$ ,  $DB=3x-1$ ,  $AE=8x-7$  and  $BC=5x-3$ , then find the values of x are:

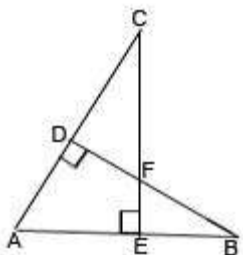
Ans. 1,  $-\frac{1}{2}$

(Level - 2)

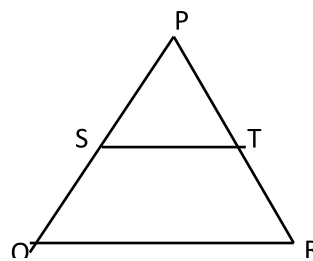
1. In given fig.  $BD \perp AC$  and  $CE \perp AB$  then prove that

(a)  $\triangle AEC \sim \triangle ADB$

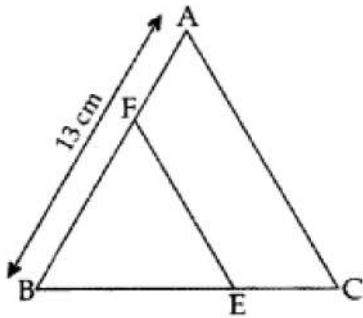
(b)  $CA/AB = CE/DB$



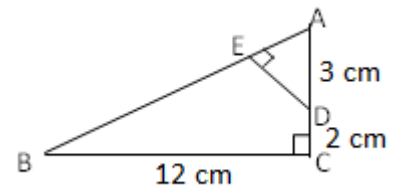
2. In the given figure fig.  $\frac{PS}{SQ} = \frac{PT}{TR}$ , and  $\angle PST = \angle PQR$ . Prove that  $\triangle PQR$  is an isosceles triangle.



3. the figure,  $EF \parallel AC$ ,  $BC = 10$  cm,  $AB = 13$  cm and  $EC = 2$  cm, find  $AF$ .



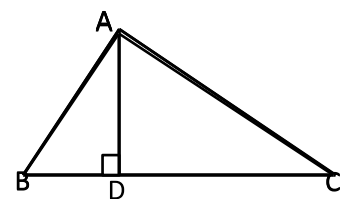
4. In given fig.  $\triangle ABC$  is right angled at  $C$  and  $DE \perp AB$ . Prove that  $\triangle ABC \sim \triangle ADE$  and hence find length of  $AE$  and  $DE$ .



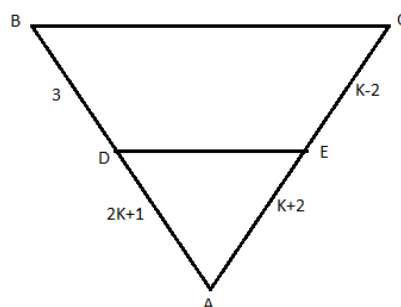
Ans.  $\frac{15}{17}$ ,  $\frac{36}{17}$

5. In a  $\triangle ABC$ , if  $DE \parallel AC$  and  $DF \parallel AE$ , prove that  $\frac{EF}{BF} = \frac{EC}{BE}$

6. In given fig.  $AD \perp BC$ , if  $\frac{BD}{AD} = \frac{DA}{DC}$ , prove that  $ABC$  is a right angled triangle.



7. What is the value of  $K$  in given figure if  $DE \parallel BC$ .



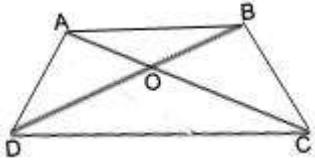
Ans.  $K=4, -1$

Ans. 300m

**Level - 3**

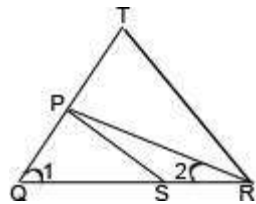
1. In given figure,  $AB \parallel DC$  and  $\frac{AO}{OC} = \frac{BO}{OD}$  then find the value of  $x$ , if  $OA = 2x + 7$ ,  $OB = 4x$ ,  $OD = 4x - 4$  and  $OC = 2x + 4$

Ans. 7



2. PQR is a right angled triangle with  $\angle P = 90^\circ$ . If  $PM \perp QR$ , then show that  $PM^2 = QM \times MR$

3. In given fig.  $\frac{QR}{QS} = \frac{QT}{PR}$  and  $\angle 1 = \angle 2$ . Show that  $\Delta PQS \sim \Delta TQR$ .



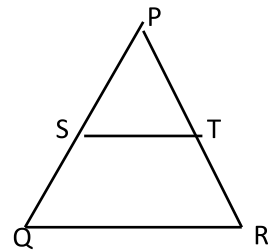
4. Find the length of altitude of an equilateral triangle of side 2cm.

Ans.  $\sqrt{3}$  cm

Ans. 21 cm<sup>2</sup>

5. In given fig.  $\frac{PS}{SQ} = \frac{PT}{TR} = 3$ . If area of  $\Delta PQR$  is 32cm<sup>2</sup>, then find the area of the quad. STQR

Ans. 14 cm<sup>2</sup>

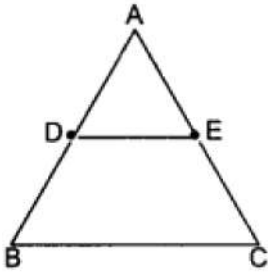


6. M is the mid-point of the side CD of a ||gm ABCD. The line BM is drawn intersecting AC at L and AD produced at E. Prove that  $EL = 2BL$ .

**Level - 4**

2. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, prove that the other two sides are divided into the same ratio.

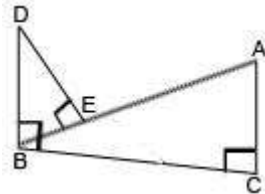
Using the above result, do the following: In Fig.  $DE \parallel BC$  and  $BD = CE$ . Prove that  $\triangle ABC$  is an isosceles triangle.



8. CM and RN are respectively the medians of  $\triangle ABC$  and  $\triangle PQR$ . If  $\triangle ABC \sim \triangle PQR$ , prove that  
 (i)  $\triangle AMC \sim \triangle PNR$                       (ii)  $CM/RN = AB/PQ$                       (iii)  $\triangle CMB \sim \triangle RNQ$

**SELF EVALUATION**

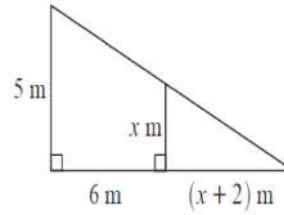
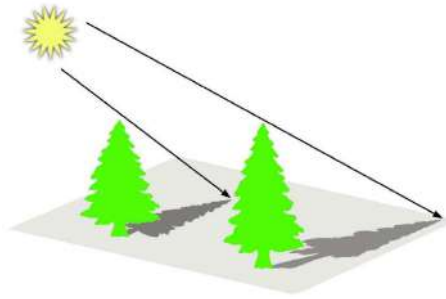
1. The diagonal BD of a ||gm ABCD intersects the line segment AE at the point F, where E is any point on the side BC. Prove that  $DF \times EF = FB \times FA$ .
2. In fig.  $DB \perp BC, DE \perp AB$  and  $AC \perp BC$ . Prove that  $BE/DE = AC/BC$ .



3. Sides AB, AC and median AD of a triangle ABC are respectively proportional to sides PQ, PR and median PM of another triangle PQR. Show that  $\triangle ABC \sim \triangle PQR$ .

CASE STUDY I

In the hot Indian summers, we are all glad to have the trees and their shade. But do you know how shadows are formed? Shadows are formed when light, for example, sunlight, falls on opaque objects. Consider the shadows of two trees A and B. The shadow of two trees A and B formed at 6 pm on a particular day is given in the diagram. The height of tree A is 5m and the height of tree B is 7m. The length of the shadow of tree B is 21m.



- 1) What is the length of the shadow of tree A?
- 2) What concept is used for finding the height of the tree?
- 3) What is the value of  $x$  in figure 2

#### CASE STUDY 2

Mountaineering is the perfect activity for adventure lovers. Every year, several mountaineers attempt to climb

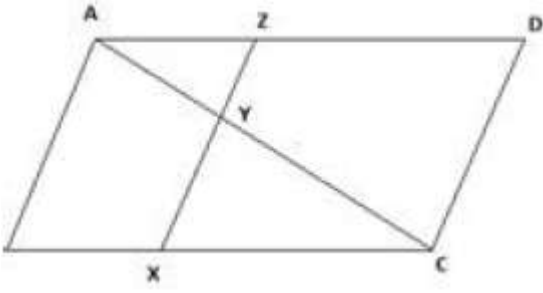


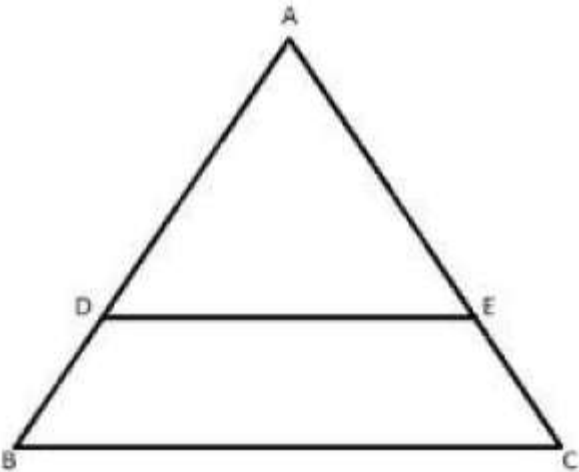
the Mount Everest.

The path of two mountaineers from the base camps B and C are shown above. D and E are two mid camping areas in between their paths and the line joining D and E is parallel to the line joining B and C.

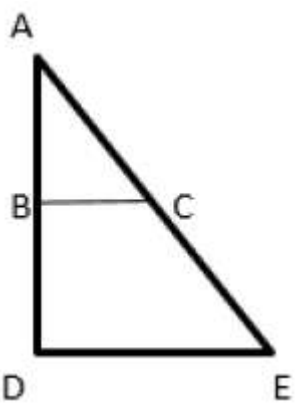
- 1) Find the distance between E and C
- 2) What is the ratio of the distance between DE and BC?

**Question pattern for Study Material**  
**Chapter6 TRIANGLE**  
**X- Maths**

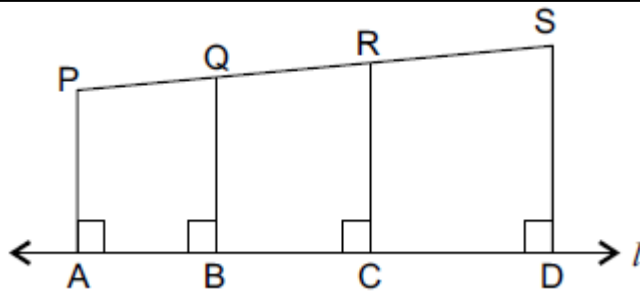
SL.NO	QUESTION
(i)	Multiple Choice questions (10 questions) One marks each.
1	<p>Which of the following is not a similarity criterion for two triangles?</p> <p>(a) AAA</p> <p>(b) SAS</p> <p>(c) SSS</p> <p>(d) ASA</p> <p>Answer: (d) ASA</p>
2	<p>ABCD is a parallelogram with diagonal AC. If a line XY is drawn such that <math>XY \parallel AB</math>. <math>BX/XC=?</math></p>  <p>(A) <math>(AY/AC)</math></p> <p>(B) <math>DZ/AZ</math></p> <p>(C) <math>AZ/ZD</math></p> <p>(D) <math>AC/AY</math></p> <p>Answer: (C) <math>AZ/ZD</math></p>
3	<p>In <math>\triangle ABC</math>, <math>AC = 15</math> cm and <math>DE \parallel BC</math>. If <math>AB/AD=3</math>, Find EC.</p>

	<p>(A) 5cm          (B) 10 cm          (C) 2.5cm          (D) 9cm          Answer: (B) 10 cm</p>
4	<p><math>\triangle ABC</math> is an acute angled triangle. DE is drawn parallel to BC as shown. Which of the following are always true?</p> <p>i) <math>\triangle ABC \sim \triangle ADE</math>          ii) <math>AD/BD = AE/EC</math>          iii) <math>DE = BC/2</math></p> <p>(A) Only (i)          (B) (i) and (ii) only          (C) (i), (ii) and (iii)          (D) (ii) and (iii) only</p>  <p>Answer: (B) (i) and (ii) only</p>
5	<p>In <math>\triangle ABC</math> and <math>\triangle DEF</math>, <math>\angle A = \angle E = 40^\circ</math> and <math>AB/ED = AC/EF</math>. Find <math>\angle B</math> if <math>\angle F</math> is <math>65^\circ</math></p> <p>(A) <math>85^\circ</math>          (B) <math>75^\circ</math>          (C) <math>35^\circ</math>          (D) <math>65^\circ</math></p> <p>Answer: (B) <math>75^\circ</math></p>



6	<p>The triangles ABC and ADE are similar</p>  <p>Which of the following is true?</p> <p>(A) <math>EC/AC=AD/DE</math></p> <p>(B) <math>BC/BD=CE/DE</math></p> <p>(C) <math>AB/AD=BC/DE</math></p> <p>(D) All of the Above</p> <p>Answer: (C) <math>AB/AD=BC/DE</math></p>
7	<p>If in <math>\triangle CAB</math> and <math>\triangle FED</math>, <math>AB/EF=BC/FD=AC/ED</math>, then:</p> <p>(A) <math>\triangle ABC \sim \triangle DEF</math></p> <p>(B) <math>\triangle CAB \sim \triangle DEF</math></p> <p>(C) <math>\triangle ABC \sim \triangle EFD</math></p> <p>(D) <math>\triangle CAB \sim \triangle EFD</math></p> <p>Answer: (C) <math>\triangle ABC \sim \triangle EFD</math></p>
8	<p>A tower of height 24m casts a shadow 50m and at the same time, a girl of height 1.8m casts a shadow. Find the length of the shadow of girl.</p> <p>(A) 3.75m</p> <p>(B) 3.5m</p> <p>(C) 3.25m</p> <p>(D) 3m</p> <p>Answer: (A) 3.75 m</p>
9	<p>If the distance between the top of two trees 20 m and 28 m tall is 17 m, then the horizontal distance between the trees is :</p>

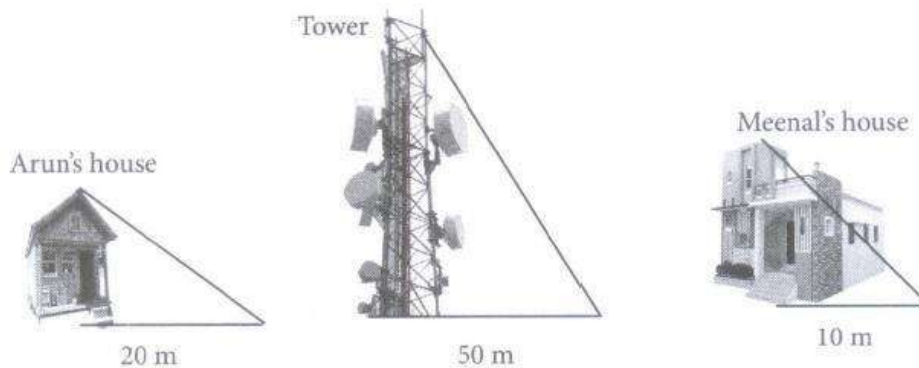
	<p>(A) 11m</p> <p>(B) 31m</p> <p>(C) 15m</p> <p>(D) 9m</p> <p>Answer: (C) 15m</p>
10	<p>If <math>\Delta ABC</math> and <math>\Delta DEF</math> are similar such that <math>2AB = DE</math> and <math>BC = 8</math> cm, then Find EF.</p> <p>(A) 16 cm</p> <p>(B) 12 cm</p> <p>(C) 8 cm</p> <p>(D) 4 cm</p> <p>Answer: (A) 16 cm</p>
(ii)	<p>Assertion Reason Based (2 questions ) One mark each</p> <p>Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:</p> <p>(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).</p> <p>(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).</p> <p>(c) Assertion (A) is true but reason (R) is false.</p> <p>(d) Assertion (A) is false but reason (R) is true.</p>
1	<p>Assertion: All congruent triangles are similar but the similar triangles need not congruent</p> <p>Reason: : If <math>\Delta ABC</math> and <math>\Delta PQR</math> are congruent triangles, then they are also different triangles</p> <p>Ans: d) both assertion and reason are false.</p>
2	<p>Assertion (A): In the given figure, <math>PA \parallel QB \parallel RC \parallel SD</math>.</p> <p>Reason (R): If three or more line segments are perpendiculars to one line, then they are parallel to each other.</p> <p>.</p>



Answer: (a)

(iii) case based questions (2 case study with 1 mark, 1 mark and 2marks question , 2mark question with one choice)

1 Meenal was trying to find the height of the tower near his house. She is using the properties of similar triangles. The height of Meenal's house is 20 m. When Meenal's house casts a shadow of 10m long on the ground, at the same time, the tower casts a shadow of 50 m long and Arun's house casts a shadow of 20 m long on the ground as shown below.



(i) What is the height of the tower?

- (a) 100 m      (b) 50 m      (c) 15 m      (d) 45 m

Answer: (a) 100 m

(ii) What will be the length of the shadow of the tower when Meenal's house casts a shadow of 15 m?

- (a) 45 m      (b) 70 m      (c) 75 m      (d) 72 m

Answer: (c) 75 m

(iii) Height of Arun's house is

- (a) 80 m      (b) 75 m      (c) 60 m      (d) 40 m

Answer: (d) 40 m

(iv) If the tower casts a shadow of 40 m, then find the length of the shadow of Arun's house

- (a) 18 m      (b) 17 m      (c) 16 m      (d) 14 m

Answer: (b) 17 m

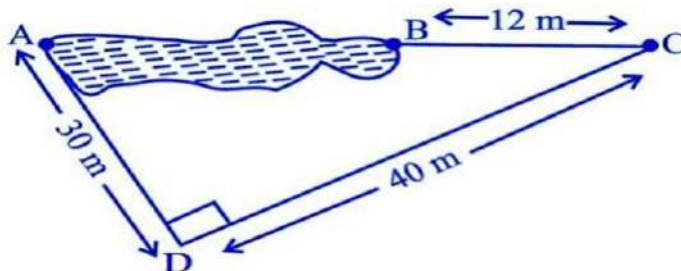
(v) If the tower casts a shadow of 40 m, then what will be the length of the shadow of Meenal's house?

- (a) 7 m (b) 9 m (c) 4 m (d) 8 m

Answer: (d) 8 m

2

Rohan wants to measure the distance of a pond during the visit to his native. He marks points A and B on the opposite edges of a pond as shown in the figure below. To find the distance between the points, he makes a right-angled triangle using rope connecting B with another point C are a distance of 12m, connecting C to point D at a distance of 40m from point C and the connecting D to the point A which is are a distance of 30m from D such the  $\angle ADC = 90^\circ$ .



1. Which property of geometry will be used to find the distance AC?

- a) Similarity of triangles  
b) Thales Theorem  
c) Pythagoras Theorem  
d) Area of similar triangles
2. What is the distance AC?

- a) 50m  
b) 12m  
c) 100m  
d) 70m

3. Which of the following does not form a Pythagoras triplet?

- a) (7,24,25)
- b) (15,8,17)
- c) (5,12,13)
- d) (21,20,28)

4. Find the length AB?

- a) 12m
- b) 38m
- c) 50m
- d) 100m

5. Find the length of the rope used.

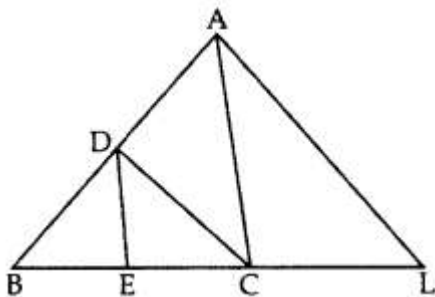
- a) 120m
- b) 70m
- c) 82m
- d) 22m

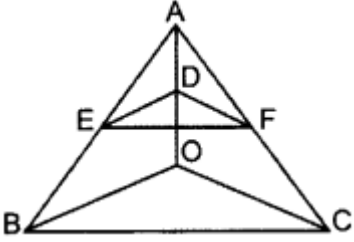
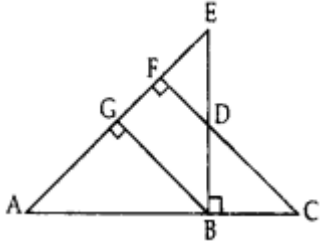
ANSWER:

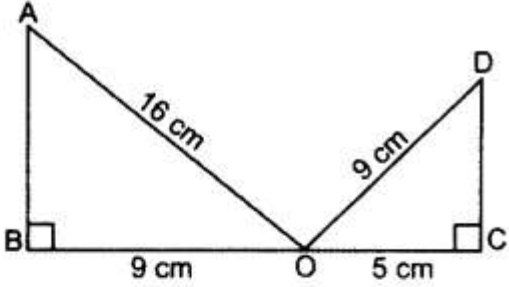
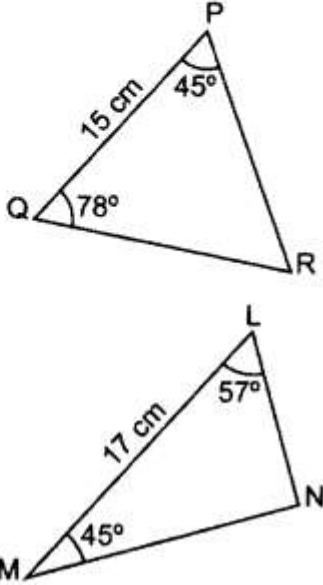
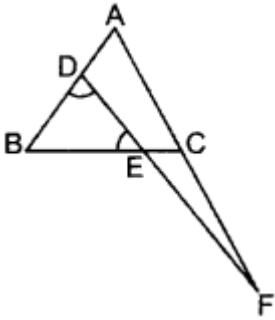
- 1. c)Pythagoras Theorem
- 2. a)50m
- 3. d)(21,20,28)
- 4. b)38m
- 5. c)82m

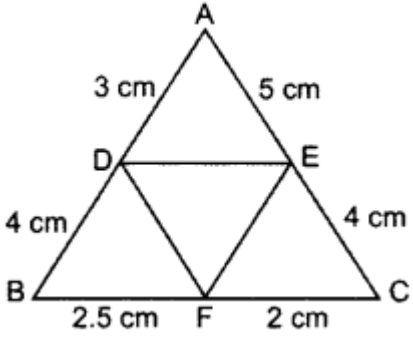
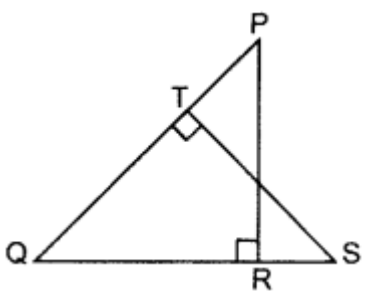
(iv) V.S.A. I 2 marks (10 questions )

1 In the given figure,  $CD \parallel LA$  and  $DE \parallel AC$ . Find the length of CL if  $BE = 4$  cm and  $EC = 2$  cm. (2012)



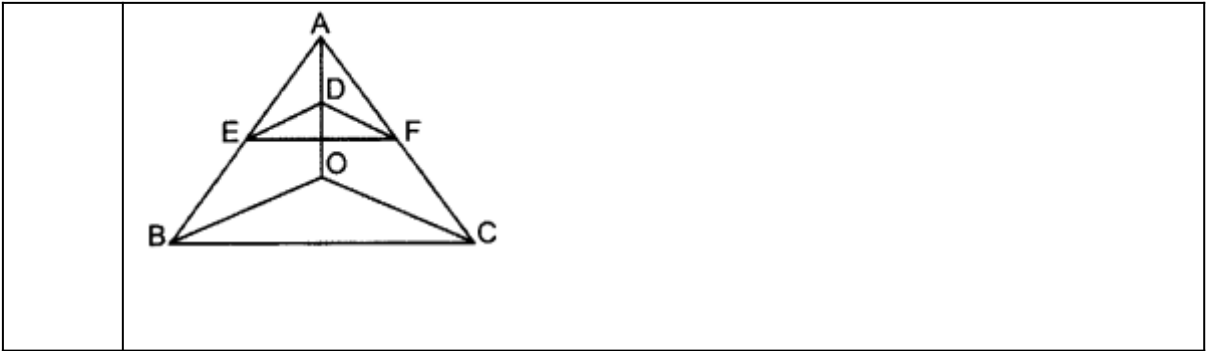
2	f a line segment intersects sides AB and AC of a $\Delta ABC$ at D and E respectively and is parallel to BC, prove that $AD/AB=AE/AC$ . (2013)
3	In a $\Delta ABC$ , $DE \parallel BC$ with D on AB and E on AC. If $AD/DB=3/4$ , find $BC/DE$ . (2013)
4	<p>In the figure, if <math>DE \parallel OB</math> and <math>EF \parallel BC</math>, then prove that <math>DF \parallel OC</math>. (2014)</p> 
5	If the perimeters of two similar triangles ABC and DEF are 50 cm and 70 cm respectively and one side of $\Delta ABC = 20$ cm, then find the corresponding side of $\Delta DEF$ . (2014)
6	A vertical pole of length 8 m casts a shadow 6 m long on the ground and at the same time a tower casts a shadow 30 m long. Find the height of tower. (2014)
7	<p>In given figure, <math>EB \perp AC</math>, <math>BG \perp AE</math> and <math>CF \perp AE</math> (2015)</p> <p>Prove that:</p> <p>(a) <math>\Delta ABG \sim \Delta DCB</math></p> <p>(b) <math>BC/BD=BE/BA</math></p> 
8	$\Delta ABC \sim \Delta PQR$ . AD is the median to BC and PM is the median to QR. Prove that $AB/PQ=AD/PM$ . (2017D)
9	State whether the given pairs of triangles are similar or not. In case of similarity mention the criterion. (2015)

	<p>(a) </p> <p>(b) </p>
10	<p>Let ABC be a triangle and D and E be two points on side AB such that AD = BE. If DP    BC and EQ    AC, then prove that PQ    AB. (2013)</p>
(v)	<p>V.S.A. II 3 MARKS (10 QUESTIONS)</p>
1	<p>In the figure, <math>\angle BED = \angle BDE</math> &amp; E divides BC in the ratio 2 : 1. Prove that <math>AF \times BE = 2 AD \times CF</math>. (2015)</p> 
2	<p>In the given figure, AD = 3 cm, AE = 5 cm, BD = 4 cm, CE = 4 cm, CF = 2 cm, BF = 2.5 cm, then find the pair of parallel lines and hence their lengths. (2015)</p>

	
3	<p>If sides AB, BC and median AD of <math>\triangle ABC</math> are proportional to the corresponding sides PQ, QR and median PM of PQR, show that <math>\triangle ABC \sim \triangle PQR</math>. (2017OD)</p>
4	<p>In <math>\triangle ABC</math>, altitudes AD and CE intersect each other at the point P. Prove that: (2014)</p> <p>(i) <math>\triangle APE \sim \triangle CPD</math></p> <p>(ii) <math>AP \times PD = CP \times PE</math></p> <p>(iii) <math>\triangle ADB \sim \triangle CEB</math></p> <p>(iv) <math>AB \times CE = BC \times AD</math></p>
5	<p>In the figure, PQR and QST are two right triangles, right angled at R and T respectively. Prove that <math>QR \times QS = QP \times QT</math>. (2014)</p> 
6	<p>In Figure, <math>AB \perp BC</math>, <math>FG \perp BC</math> and <math>DE \perp AC</math>. Prove that <math>\triangle ADE \sim \triangle GCF</math>. (2016 OD)</p>

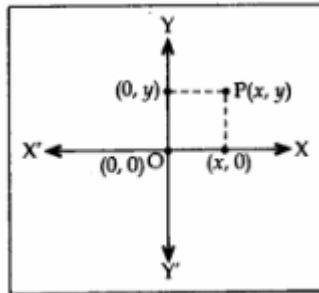


7	In $\triangle DEW$ , $AB \parallel EW$ . If $AD = 4$ cm, $DE = 12$ cm and $DW = 24$ cm, then find the value of $DB$ .
8	In $\triangle ABC$ , from $A$ and $B$ altitudes $AD$ and $BE$ are drawn. Prove that $\triangle ADC \sim \triangle BEC$ . Is $\triangle ADB \sim \triangle AEB$ and $\triangle ADB \sim \triangle ADC$ ?
9	In $\triangle ABC$ , if $\angle ADE = \angle B$ , then prove that $\triangle ADE \sim \triangle ABC$ . Also, if $AD = 7.6$ cm, $AE = 7.2$ cm, $BE = 4.2$ cm and $BC = 8.4$ cm, then find $DE$ .
10	Right angled triangles $BAC$ and $BDC$ are right angled at $A$ and $D$ and they are on same side of $BC$ . If $AC$ and $BD$ intersect at $P$ , then prove that $AP \times PC = PB \times PD$
(vi)	Long Answer 5 marks each (5 questions )
1	Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, then other two sides are divided in the same ratio.
2	In $\triangle ABC$ , $X$ is any point on $AC$ . If $Y, Z, U$ and $V$ are the middle points of $AX, XC, AB$ and $BC$ respectively, then prove that $UY \parallel VZ$ and $UV \parallel YZ$ .
3	In $\triangle ABC$ , $AD$ is the median to $BC$ and in $\triangle PQR$ , $PM$ is the median to $QR$ .  <b>If <math>\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}</math>, prove that <math>\triangle ABC \sim \triangle PQR</math>.</b>
4	If one diagonal of a trapezium divides the other diagonal in the ratio $1 : 3$ . Prove that one of the parallel sides is three times the other.
5	In the figure, if $DE \parallel OB$ and $EF \parallel BC$ , then prove that $DF \parallel OC$ . (2014)



	<b>Chapter -7 CONTENT OF THE COORDINATE GEOMETRY (CLASS X: )</b>
	<p><b>Gist of the chapter</b>  Coordinate Geometry is a part of geometry that uses two or more numbers to specify the position of any point, figure or object. The position of the object can be defined in a line or a plane or three dimensional space and so on. Below are the types of Coordinate System.</p> <p><b>Cartesian Coordinate System</b> - It is the coordinate system where the position of the point or object is defined by two or more axis. There are two types of Cartesian Coordinate System:</p> <p><b>a)Plane</b> - In this system the object is not limited to a line. The position of the object anywhere on a plane can be defined by two perpendicular number lines named as x-axis (horizontal line) and y-axis (vertical line).</p> <p><b>b)Two-Dimensional</b> - In three Dimension, the position of a point in a space can be specified by three perpendicular number lines called X-axis. Y-axis . Coordinate geometry teaches us the location of a point on a plane. For example, the coordinates of a point are (x, y), where x-coordinate (abscissa) denotes the distance of a point from the y-axis and y-coordinate (ordinate) denotes the distance of the point from the x-axis.</p>
	<p><b>KEY POINTS</b></p> <ul style="list-style-type: none"> <li>● The horizontal line is referred to as the X axis, and the vertical as Y axis. The axes divide the plane into four quadrants (labelled in red)</li> <li>● The point of intersection of the two axes is referred to as the Origin (O)</li> <li>● The coordinates of each point are denoted by an ordered pair of numbers (x, y)</li> <li>● The x-coordinate of a point is referred to as its abscissa and the y-coordinate as its ordinate</li> <li>● The abscissa of a point is its 'signed' distance from the Y-axis. By signed, it means that towards the right of the Y-axis, the abscissa is positive, whereas on the left it is negative. (This is a convention).</li> <li>● Similarly, the ordinate of a point is its signed distance from the X-axis.</li> <li>● Using the above convention, the origin has the coordinates (0, 0) and we can determine the signs of x and y coordinates of a point (indicated in blue) in the four quadrants</li> </ul>
	<b>FORMULA BASED ANALYSIS</b>

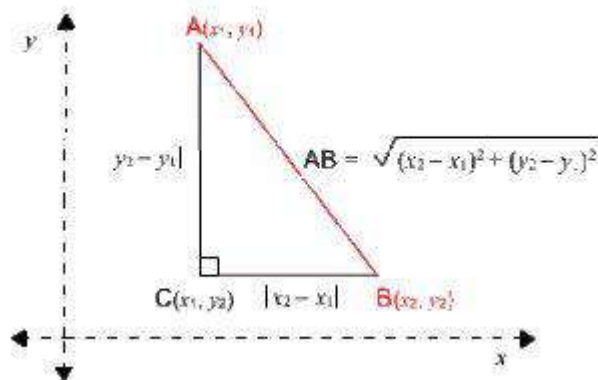
- Position of a point P in the Cartesian plane with respect to co-ordinate axes is represented by the ordered pair (x, y).



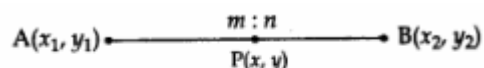
Any point on the X-axis is of the form (x, 0).

Any point on the Y-axis is of the form (0, y).

- Distance Formula to find distance between two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is  $D = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$

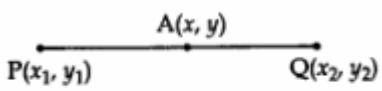


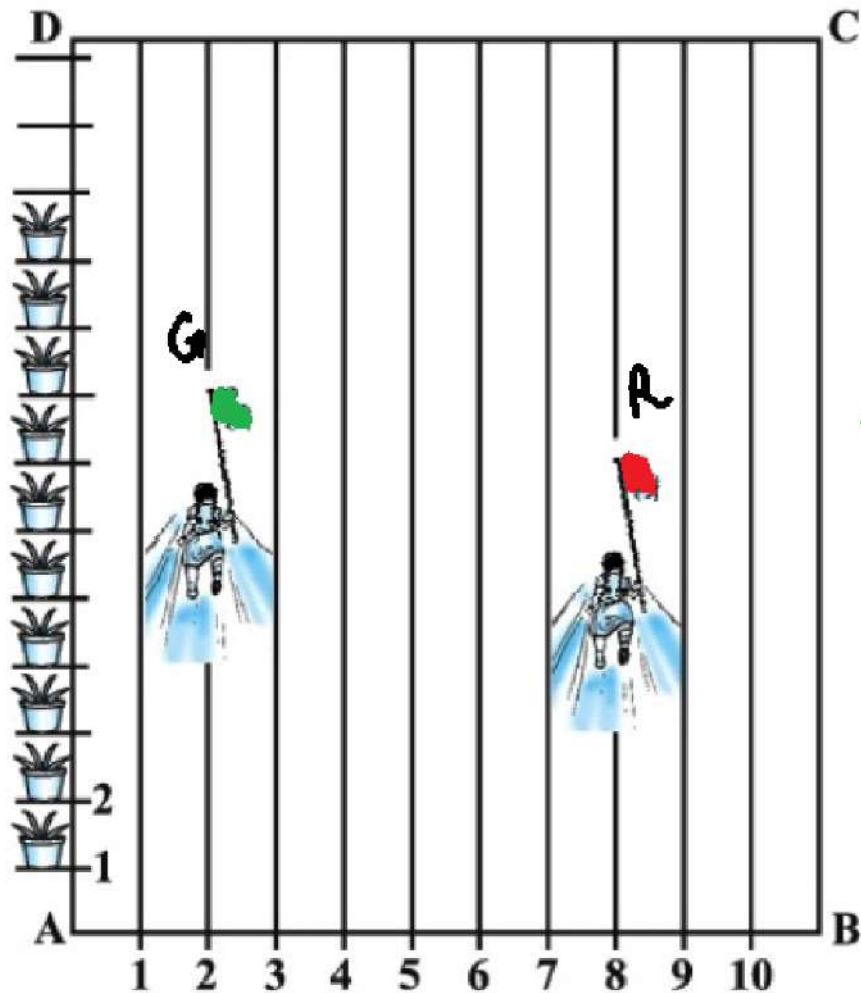
- Section Formula:  $((m_1x_2 + m_2x_1)/m_1 + m_2, (m_1y_2 + m_2y_1)/m_1 + m_2)$   
The coordinates of the point which divides the line segment joining the points A(x<sub>1</sub>, y<sub>1</sub>) and B(x<sub>2</sub>, y<sub>2</sub>) internally in the ratio m : n are:



$$P(x, y) = \left( \frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right)$$

The above formula is section formula. The ratio m: n can also be written as mn : 1 or k : 1, The co-ordinates of P can also be written as  $P(x,y) = \frac{kx_2 + x_1k+1}{k+1}, \frac{ky_2 + y_1k+1}{k+1}$

	<p>The mid-point of the line segment joining the points P(x<sub>1</sub>, y<sub>1</sub>) and Q(x<sub>2</sub>, y<sub>2</sub>) is</p>  $A(x, y) = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ <p>Here m : n = 1 : 1.</p>
	<p>Short questions based on formulas</p> <p>i) Determine the value of 'k', for which the points (7, - 2), (5, 1), (3, k) are collinear.</p> <p>ii) Find the distance of the point (α, β) from the origin is</p> <p>iii) If (a/3, 4) is the mid-point of the segment joining the points P(-6, 5) and R(-2, 3), then the value of 'a' is</p>
	<p>HOT and CCT BASED questions</p> <p>i) Find distance between A(10 cos θ, 0) and B(0, 10 sin θ).</p> <p>ii) Find the fourth vertex of parallelogram ABCD whose three vertices are A(- 2, 3), B(6, 7) and C(8, 3).</p> <p>iii) <b>If O(p/3, 4) is the midpoint of the line segment joining the points P(-6, 5) and Q(-2, 3), the value of p is.</b></p> <p style="text-align: center;">CCT-1</p> <p>In order to conduct Sports Day activities in your School, lines have been drawn with chalk powder at a distance of 1 m each, in a rectangular shaped ground ABCD, 100 flowerpots have been placed at a distance of 1 m from each other along AD, as shown in given figure below. Niharika runs 1/4 th the distance AD on the 2nd line and posts a green flag. Preet runs 1/5 th distance AD on the eighth line and posts a red flag.</p>



1. Find the position of green flag  
 a) (2,25) b) (2,0.25) c) (25,2) d) (0, -25)
2. Find the position of red flag  
 a) (8,0) b) (20,8) c) (8,20) d) (8,0.2)
3. What is the distance between both the flags?  
 a)  $\sqrt{41}$  b)  $\sqrt{11}$  c)  $\sqrt{61}$  d)  $\sqrt{51}$
4. If Rashmi has to post a blue flag exactly halfway between the line segment joining the two flags, where should she post her flag?  
 a) (5, 22.5) b) (10,22) c) (2,8.5) d) (2.5,20)
5. If Joy has to post a flag at one-fourth distance from green flag, in the line segment joining the green and red flags, then where should he post his flag?  
 a) (3.5,24) b) (0.5,12.5) c) (2.25,8.5) d) (25,20)

**ANSWERS:**

1. a) (2,25)

2. c) (8,20)

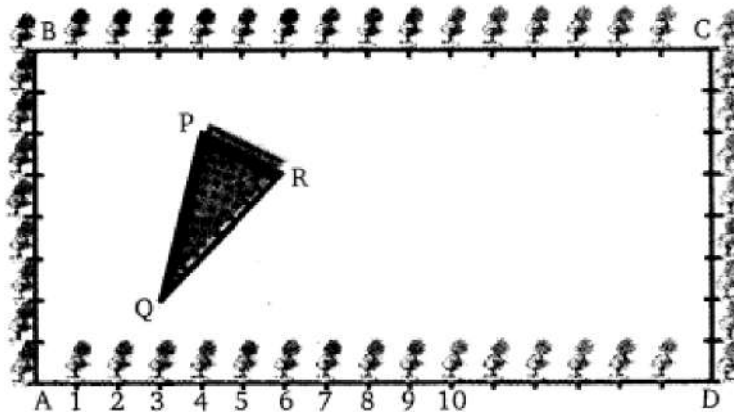
3. c)  $\sqrt{61}$

4. a) (5, 22.5)

5. a) (3.5,24)

CCT-2

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



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

a) (4,6) b) (6,4) c) (0,6) d) (4,0)

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

a) (8,6) b) (3,10) c) (10,3) d) (0,6)

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

a) (6,13) b) (-6,13) c) (-13,6) d) (13,6)

4. Calculate the area of the triangles if A is the origin

a) 4.5 b) 6 c) 8 d) 6.25

5. Calculate the area of the triangles if C is the origin

a) 8 b) 5 c) 6.25 d) 4.5

Tricks which help students in memorization.

- The students need to ensure that they understand all important concepts before beginning with memorizing the formulas. They can also seek guidance from their teachers and friends to gain proficiency in learning concepts.
- They can also go through the derivation of these formulas to develop a rock-solid foundation as well as understand the underlying concepts.
- It is important to practice a variety of questions based on median formulas to ensure a thorough conceptual understanding of all important formulas.

**MATHS**  
**ON COORDINATE GEOMETRY**

**MULTIPLE CHOICE QUESTIONS ( 1 mark each )**

1. The point on X – axis which is equidistant from the points (2,-2) and (-4,2) is  
a) (1,0)      b) (2,0)      c) (0,2)      d) (-1,0)
2. The figure formed by the points A (a,a), B (-a,-a) and C (  $-\sqrt{3}a, \sqrt{3}a$  ) will be  
a) An isosceles triangle      c) an equilateral triangle  
b) A scalene triangle      d) none of the above
3. Find the coordinates of the point which is equidistant from the vertices of a triangle ABC, where A (3,-1), B ( -1,-6) and C (4,-1)  
a) ( 2, -8/3)      b) ( -2, 8/3)      c) ( 2/3 ,8)      d) ( -2/3, 8)
4. The point of intersection of the line represented by  $3x - y = 3$  and Y- axis is given by  
a) (0,-3)      b) (0,3)      c) (2,0)      d) (-2,0)
5. The distance between the points (  $a\cos\theta + b\sin\theta, 0$  ) and ( 0,  $a\sin\theta - b\cos\theta$  ) is  
a)  $a^2 + b^2$       b)  $a^2 - b^2$       c)  $\sqrt{a^2 + b^2}$       d)  $\sqrt{a^2 - b^2}$
6. The distance of the point (-6,8) from X –axis is  
a) 6 units      b) -6 units      c) 8 units      d) 10 units
7. The distance between the points P ( -11/3,5) and Q ( -2/3,5) is  
a) 6 units      b) 4 units      c) 2 units      d) 3 units
8. The perpendicular bisector of a line segment A ( -8,0) and B ( 8,0 ) passes through a point (0,k). The value of k is  
a) 0 only      b) 0 or 8 only      c) any real number      d) any non zero real number
9. The point which divides the line segment joining the points ( 7,-6) and (3,4) in the ratio 1:2 internally lies in the  
a) I quadrant      b) II quadrant      c) III quadrant      d) IV quadrant
10. Point P divides the line segment joining R(-1,3) and S(9,8) in the ratio k:1.If P lies on the line  $x-y+2=0$ , then value of k is  
a)  $2/3$       b)  $1/2$       c)  $1/3$       d)  $1/4$

**ASSERTION REASON BASED ( 1 mark each)**

Q. 11 and 12 contains an assertion followed by a reason. Read them carefully and answer the questions on the basis of the following options ,select the one that best describes the two statements.

- a) If both assertion and reason are correct and reason is the correct explanation of assertion.
- b) If both assertion and reason are correct but reason is not the correct explanation of assertion.
- c) If assertion is correct but reason is incorrect.



d) If assertion is incorrect but reason is correct.

11. **Assertion** If the points  $A(4,3)$  and  $B(x,5)$  lie on a circle with centre  $O(2,3)$ , then the value of  $x$  is 2.

**Reason** Centre of a circle is the mid-point of each chord of the circle.

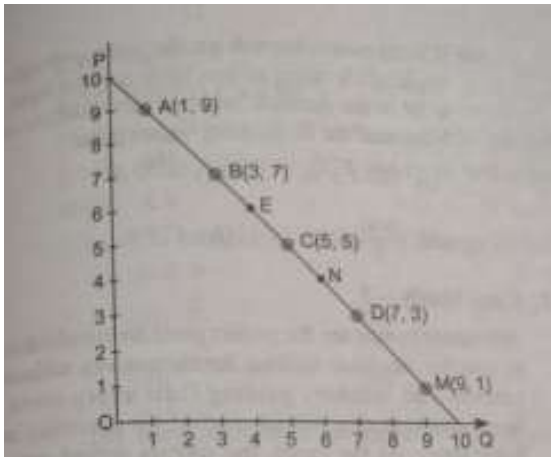
12. **Assertion** Three points  $A, B,$  and  $C$  are such that  $AB + BC > AC$ , then they are collinear

**Reason** Three points are collinear if they lie on a straight line.

### CASE BASED QUESTIONS ( 4 marks each)

13. A water park or waterpark is an amusement park that features water play areas such as swimming pools, water slides, splash pads, water playgrounds, as well as area of floating, bathing etc. A group of class  $x$  students goes to water park.

Four students go for a water slide. Their respective position in the water slide at an instant is given below:



a. If  $E$  is midpoint of  $AD$  then coordinates of  $E$  are:

- i.  $(4, 5)$
- ii.  $(6, 4)$
- iii.  $(4, 6)$
- iv.  $(5, 4)$

b. IF  $D$  slides to  $M$  then distance covered by  $D$  is:

- i. 8 units
- ii. 6 units
- iii.  $4\sqrt{2}$  units
- iv.  $2\sqrt{2}$  units

c. If there is an emergency switch at  $N$  such that  $AN: DN = 2 : 3$  the coordinates of  $N$  are:

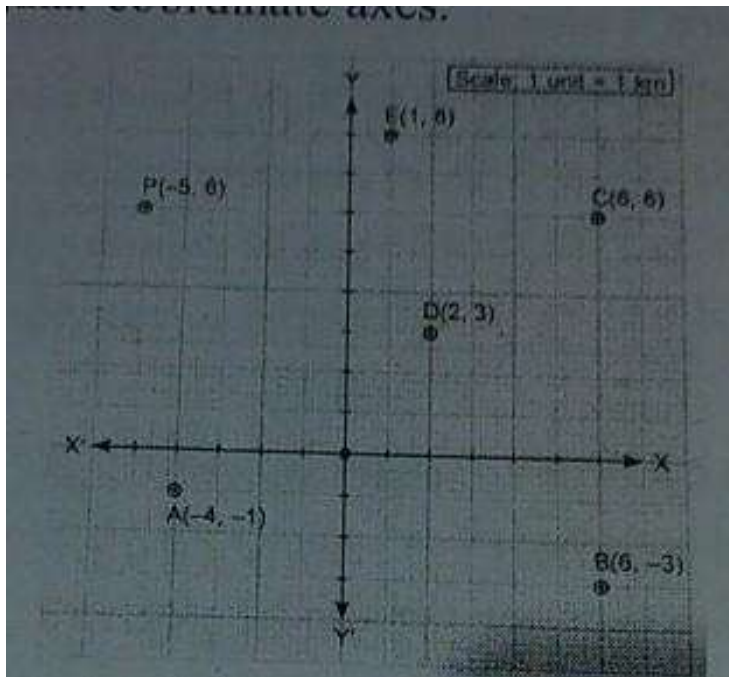
- i.  $(17/4, 33/4)$
- ii.
- iii.  $(17/4, 33/5)$
- iv.  $(17/5, 33/5)$
- iv  $(17/5, 33/4)$

**OR**

What is the ratio of distance of B from A to its distance from D:

- i. 1: 2
- ii. 2: 1
- iii. 2: 3
- iv. 3: 2

14. Five ships are positioned in the Indian Ocean. Their positions were plotted on a graph paper in reference to a rectangular coordinate axes. An enemy ship is spotted at  $P(-5,6)$ .



a) What is the distance between P and E

- i.  $\sqrt{40}$  KM
- ii.  $\sqrt{50}$  KM
- iii.  $\sqrt{25}$  KM
- iv.  $\sqrt{20}$  KM

b) Midpoint of BD?

- i. (4, 2)
- ii. (5, 1)
- iii. (4, 0)
- iv. (3, 0)

c) We find a rock at new position G such that B G and C are in a straight line at BG GC = 3:1 then the coordinates of G are

- i. (6, 4)
- ii. (6, 15/4)
- iii. (6, 3)
- Iv (6, 2)

OR

Ship D is moved to a position which is midpoint of AE find the distance moved by D?

- i.  $\sqrt{50}$ KM
- ii.  $(\sqrt{50})/4$  KM
- iii.  $(\sqrt{50})/3$ KM
- iv.  $(\sqrt{50})/2$ KM

### VERY SHORT ANSWER TYPE QUESTIONS ( 2 marks each )

15. Find the radius of the circle whose end points of diameter are (24, 1) and (2, 23).
16. Find the points on the X-axis which is equidistant from the point (-1, 0) and (5, 0).
17. Find the coordinates of a point A, where AB is the diameter of a circle, whose center is (4, -3) and B is (2,6).
18. If a centroid of a triangle is (3, -5) and two vertices of triangle are (4, -8) and (3, 6) then find the third vertex.
19. Find the coordinates of points on the X-axis which are at a distance of 17 units from the point (11, -8).
20. If A is a point on Y-axis whose ordinate is 4 and coordinates of point B is (-3, 1) then find distance AB.
21. If  $(3, \frac{3}{4})$  is the midpoint of the line segment joining the points (k,0) and  $(7, \frac{3}{2})$  then find the value of k.
22. The center of a circle is  $(4a-2, 6a+2)$  and is passing through the point  $(-6, -2)$ . If diameter of the circle is 40 units, find the value of a.
23. A point A is at a distance of  $\sqrt{10}$  from the point (4, 3). Find the coordinates of point A, if its ordinate is twice of its abscissa.

24. Find the ratio in which the line  $2x + y - 4 = 0$ , divides the line segment joining the point A(2, -2) and B(3, 7).

### SHORT ANSWER TYPE QUESTIONS ( 3 marks each)

25. Find the perimeter of the triangle formed by points (0, 0) (1, 0) and (0, 1).
26. Find the angle subtended at the origin by the line segment whose end points are (0, 100) and (10, 0)
27. Show that if a circle has its center at the origin and a point P(5, 0) lies on it, then the point Q(6, 8) lies outside the circle.
28. If the point C(-1, 2) divided internally, the line segment joining A(2, 5) and B(x, y) In the 3:4 ratio, find the coordinates of B.
29. P(-2, 5) and Q (3, 2) are two points. Find the coordinates of the point R on PQ such that  $PR = 2QR$ .
30. Find the points which lies on the perpendicular bisector of the line segment joining the points A(-2, -5) and (2, 5).
31. The vertices of a triangle are (a, b-c) (b, c-a) (c, a-b). Prove that its centroid lies on the X axis
32. AOBC is a rectangle whose three vertices are A(0, 3), O(0, 0), and B(5, 0). What are the lengths of the diagonals?
33. Find the relation between x and y such that the point (x, y) is equidistant from the point (7,1) and (3, 5).
34. Show that quadrilateral PQRS formed by vertices P (22,5), Q (7,10), R (12,11) and S (3,24) is not a parallelogram.

### LONG ANSWER TYPE QUESTIONS ( 5 marks each)

35. The vertices of a  $\Delta ABC$  are A(5, 5) B(1, 5) and C (9, 1). A line is drawn to intersect side AB and AC at P and Q, respectively, such that  $\frac{AP}{AB} = \frac{AQ}{AC} = \frac{3}{4}$  Find the length of the line segment PQ.
36. A circle passing through the points (0, 0), (-2, 1) and (-3, 2). Find the Coordinates of the center of circle and find the radius.
37. Find the coordinates of the points which divide the line segment joining A(-2, -2) and B(2, 8) into four equal parts.
38. Points P, Q, R, S and T divide the line segment joining the points A(1, 2) and B(6, 7) in 6 equal parts. Find coordinates of P,Q,R, S and T.
39. The points (3, -4) and (-6, 5) are the end points of a diagonal of a parallelogram. If one of the end points of the second diagonal is (-2, 1) then find it's other end point.

### ANSWER KEY

1. d

2. b
3. a
4. a
5. c
6. c
7. d
8. a
9. d
10. a
11. c
12. c
13. a i)  
b iv)  
c iii) OR i)
14. a i)  
b iii)  
c ii) or iv)
15.  $11\sqrt{2}$  units
16. (2,0)
17. (6,-12)
18. (2,-13)
19. (26,0) and (-4,0)
20.  $3\sqrt{2}$  units
21.  $k = -1$
22. 2
23. (3,6) and (1,2)
24. 2:9
25.  $2 + \sqrt{2}$
26.  $\pi/2$
27. Appropriate proof
28. (-5,-2)
29. (4/3,3)
30. (0,0)
31. Appropriate proof
32.  $\sqrt{34}$  units
33.  $x - y = 2$
34. Appropriate proof
35.  $3\sqrt{5}$  units
36. (3/2,11/2) radius =  $\sqrt{130}/2$  units
37. (-1,1/2), (0,3) and (1,11/2)
38. P(11/6,17/6) Q(8/3,11/3) R(7/2,9/2) S(13/3,16/3) T(31/6,37/6)
39. (-1,10)

## CHAPTER 8 INTRODUVTION TO TRIGONOMETRY

### CONTENT OF THE CHAPTER

#### i) Gist of the chapter

a) Trigonometric Ratios:  $\sin A$ ,  $\cos A$ ,  $\tan A$ ,  $\operatorname{cosec} A$ ,  $\sec A$  and  $\cot A$

The ratios  $\operatorname{cosec} A$ ,  $\sec A$  and  $\cot A$  are respectively, the reciprocals of the ratios  $\sin A$ ,  $\cos A$  and  $\tan A$ .

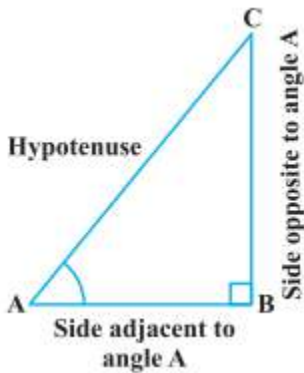
The values of the trigonometric ratios of an angle do not vary with the lengths of the sides of the triangle, if the angle remains the same.

b) Trigonometric Ratios of Some Specific Angles :  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and  $90^\circ$

c) Trigonometric Identities : an equation involving trigonometric ratios of an angle is called a trigonometric identity, if it is true for all values of the angle(s) involved.

#### ii) Key points

1. Let us take a right triangle ABC as shown in Fig



In this right triangle ABC, right-angled at B,

$$\sin A = \frac{\text{side opposite to angle } A}{\text{hypotenuse}} = \frac{BC}{AC}$$

$$\cos A = \frac{\text{side adjacent to angle } A}{\text{hypotenuse}} = \frac{AB}{AC}$$

$$\tan A = \frac{\text{side opposite to angle } A}{\text{side adjacent to angle } A} = \frac{BC}{AB}$$

$$\cot A = \frac{\text{side adjacent to angle } A}{\text{side opposite to angle } A} = \frac{AB}{BC}$$

$$\sec A = \frac{\text{hypotenuse}}{\text{side adjacent to angle } A} = \frac{AC}{AB}$$

$$\operatorname{cosec} A = \frac{\text{hypotenuse}}{\text{side opposite to angle } A} = \frac{AC}{BC}$$

2.

$$\sin A = \frac{1}{\operatorname{cosec} A}$$

$$\cos A = \frac{1}{\sec A}$$

$$\tan A = \frac{1}{\cot A} = \frac{\sin A}{\cos A}$$

$$\operatorname{cosec} A = \frac{1}{\sin A}$$

$$\sec A = \frac{1}{\cos A}$$

$$\cot A = \frac{1}{\tan A} = \frac{\cos A}{\sin A}$$

3. If one of the trigonometric ratios of an acute angle is known, the remaining trigonometric ratios of the angle can be easily determined.

4. The values of trigonometric ratios for angles  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and  $90^\circ$ .

$\angle A$	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$
sin A	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos A	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan A	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
cosec A	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec A	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
cot A	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

5. The value of sin A or cos A never exceeds 1, whereas the value of sec A or cosec A is always greater than or equal to 1.
6. Trigonometric identities

$\sin^2 A + \cos^2 A = 1$	$\sin^2 A = 1 - \cos^2 A$	$\cos^2 A = 1 - \sin^2 A$
$1 + \tan^2 A = \sec^2 A$	$1 = \sec^2 A - \tan^2 A$	$\tan^2 A = \sec^2 A - 1$
$1 + \cot^2 A = \text{cosec}^2 A$	$1 = \text{cosec}^2 A - \cot^2 A$	$\cot^2 A = \text{cosec}^2 A - 1$

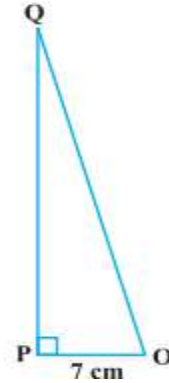
### iii) Formula Based Analysis

#### iv) Shorts questions based on formulas

- Given  $\tan A = \frac{4}{3}$ , find the other trigonometric ratios of the angle A.
- Given  $15 \cot A = 8$ , find sin A and sec A
- In  $\Delta ABC$ , right-angled at B,  $AB = 24$  cm,  $BC = 7$  cm. Determine : (i) sin A, cos A  
(ii) sin C, cos C
- Evaluate the following : (i)  $\sin 60^\circ \cos 30^\circ + \sin 30^\circ \cos 60^\circ$   
(ii)  $2 \tan^2 45^\circ + \cos^2 30^\circ - \sin^2 60^\circ$
- Express the trigonometric ratios sin A, sec A and tan A in terms of cot A

#### v) HOT and CCT based frequently asked questions

1. In  $\Delta OPQ$ , right-angled at P,  $OP = 7$  cm and  $OQ - PQ = 1$  cm (see Fig. 8.12). Determine the values of  $\sin Q$  and  $\cos Q$ .



2. If  $\sin(A - B) = \frac{1}{2}$ ,  $\cos(A + B) = \frac{1}{2}$   $0^\circ < A + B \leq 90^\circ$ ,  $A > B$ , find A and B

3.  $\frac{\cos A - \sin A + 1}{\cos A + \sin A - 1} = \operatorname{cosec} A + \cot A$ , using the identity  $\operatorname{cosec}^2 A = 1 + \cot^2 A$

**vi) Trick which help student in memorization.**

To make Trigonometric table students can follow the steps given below:

**Step 1:** Make a table listing the top row of angles as  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $90^\circ$  and write all trigonometric functions in the first column as sin, cos, tan, cosec, sec, cot.

**Step 2:** To Find out the value of sin

Write down the angles  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $90^\circ$  in ascending order and allocate them values 0, 1, 2, 3, 4 according to the order.

**Step 3:** Divide the values by 4 and the square root of the entire value.

They will get the values  $0$ ,  $\frac{1}{2}$ ,  $\frac{1}{\sqrt{2}}$ ,  $\frac{\sqrt{3}}{2}$  and 1

**Step 4:** To get the values of cos A reverse the order of values from 1 to zero

**Step 5:**  $\tan A$  is sin A upon cos A, so divide the value of sin A by the values of cos A

**Step 6:** For cot A reverse the order of values of tan A from not defined to 0

**Step 7:** sec A is one by cos A, so take the reciprocal of values of cos A

**Step 8:** For the values of cosec A reverse the order of values of sec A from

$\angle A$	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$
Sin A	$\sqrt{\frac{0}{4}} = 0$	$\sqrt{\frac{1}{4}} = \frac{1}{2}$	$\sqrt{\frac{2}{4}} = \frac{1}{\sqrt{2}}$	$\sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$	$\sqrt{\frac{4}{4}} = 1$
Cos A	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan A	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	n.d.
cot A	n.d.	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0
sec A	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	n.d.
cosec A	n.d.	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1



KENDRIYA VIDYALAYA DHANA  
INTRODUCTION TO TRIGONOMETRY  
QUESTIONS PATTERN FOR QUESTION BANK

Very Short answer type Questions. ( 1 Mark Questions)

- Q. 1. If  $\sin A + \cos B = 1$ ,  $A = 30^\circ$  and B is an acute angle, then find the value of B
- Q. 2. If  $\sin \theta = \cos \theta$ , then find the value of  $2 \tan \theta + \cos 2 \theta$ .
- Q.3.If  $\tan A = \cot B$ , then find the value of  $(A + B)$ .
- Q.4.If  $\sin \alpha = \frac{\sqrt{3}}{2}$  and  $\cos \beta = 0$ , then find the value of  $\beta - \alpha$ .
- Q.5. Evaluate:  $\sin^2 60^\circ + 2 \tan 45^\circ - \cos^2 30^\circ$ .
- Q.6. If  $\sec \theta \cdot \sin \theta = 0$ , then find the value of  $\theta$ .
- Q.7. What happens to value of  $\cos \theta$  when  $\theta$  increases from  $0^\circ$  to  $90^\circ$  ?
- Q.8. Find the value of :  $\sin 30^\circ \cdot \cos 60^\circ + \cos 30^\circ \cdot \sin 60^\circ$  Is it equal to  $\sin 90^\circ$  or  $\cos 90^\circ$  ?
- Q.9. Find the value of  $(1 + \tan^2 \theta)(1 - \sin \theta)(1 + \sin \theta)$
- Q.10. If  $x = 2 \sin^2 \theta$  and  $y = 2 \cos^2 \theta + 1$ , then find the value of  $x + y$
- Q.11. Find the value of  $\left( \sin^2 \theta + \frac{1}{1 + \tan^2 \theta} \right)$
- Q.12. If  $\sin A + \sin^2 A = 1$ , then find the value of the expression  $(\cos^2 A + \cos^4 A)$ .
- Q. 13 . If  $\tan \theta = \frac{5}{12}$ , find the value of  $\sec \theta$
- Q.14. If  $k + 1 = \sec^2 \theta(1 + \sin \theta)(1 - \sin \theta)$ , then find the value of k.
- Q.15. If  $\sin \theta + \cos \theta = \sqrt{2} \cos \theta$ , ( $\theta \neq 90^\circ$ ) then the value of  $\tan \theta$ .

Short Answer type Questions- I ( 2 Marks Questions)

- Q.1.If  $\tan A = \frac{3}{4}$ , find the value of  $\frac{1}{\sin \sin A} + \frac{1}{\cos \cos A}$ .
- Q.2. If  $\sqrt{3} \sin \theta - \cos \theta = 0$  and  $0^\circ < \theta < 90^\circ$ , find the value of  $\theta$ .
- Q.3. Evaluate:  $\frac{3 \tan^2 30^\circ + 3 \tan^2 60^\circ + \operatorname{Cosec} 30^\circ - \tan 45^\circ}{\cot^2 45^\circ}$
- Q.4.If  $\tan (A + B) = 1$  and  $\tan (A - B) = \frac{1}{\sqrt{3}}$ ,  $0^\circ < A + B < 90^\circ$ ,  $A > B$ , then find the values of A and B.
- Q.5 If  $4 \tan \theta = 3$ , evaluate  $\frac{4 \sin \theta - \cos \theta + 1}{4 \sin \theta + \cos \theta - 1}$
- Q.6. If  $\sin (A + 2B) = \frac{\sqrt{3}}{2}$  and  $\cos(A + 4B) = 0$ ,  $A > B$ , and  $A + 4B \leq 90^\circ$ , then find A and B.
- Q.7. Prove that:  $1 + \frac{\cot^2 \alpha}{1 + \operatorname{Cosec} \alpha} = \operatorname{cosec} \alpha$
- Q.8. Prove that:  $\frac{\sin^4 \theta + \cos^4 \theta}{1 - 2 \sin^2 \theta \cos^2 \theta} = 1$
- Q.9.Show that  $\tan^4 \theta + \tan^2 \theta = \sec^4 \theta - \sec^2 \theta$ .
- Q.10. Express the trigonometric ratio of  $\sec A$  and  $\tan A$  in terms of  $\sin A$ .
- Q.11. If  $3 \tan \theta = 4$  Find the value of  $\frac{5 \sin \theta - 3 \cos \theta}{5 \sin \theta + 2 \cos \theta}$ .
- Q.12. If,  $\Delta ABC$  is a right angled at B,  $BC = 7$  cm and  $AC - AB = 1$  cm Find the value of  $\cos A + \sin A$ .

Q.13. If  $\cot \theta = \frac{12}{5}$ , Then find the value of  $(\sin \theta + \cos \theta) \operatorname{cosec} \theta$ .

Q.14. If  $\tan \theta = \frac{4}{3}$ , Then Find the value of  $\left[ \frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} \right]$ .

Q.15. If  $\sin \theta = x$  and  $\sec \theta = y$ , Then Find the value of  $\cot \theta$ .

### Short Answer Type Questions-II( 3 Marks Questions)

Q.1. If, in a triangle ABC right angled at B, AB = 6 units and BC = 8 units, then find the value of  $\sin A \cdot \cos C + \cos A \cdot \sin C$ .

Q.2. If  $\sqrt{3} \cot^2 \theta - 4 \cot \theta + \sqrt{3} = 0$ , then find the value of  $\cot^2 \theta + \tan^2 \theta$ .

Q.3.  $\sin \theta + \cos \theta = \sqrt{3}$ , then prove that  $\tan \theta + \cot \theta = 1$

Q.4. If  $1 + \sin^2 \theta = 3 \sin \theta \cos \theta$ , prove that  $\tan \theta = 1$  or  $\frac{1}{2}$

Q.5. Prove that:  $\frac{\cot \theta + \operatorname{cosec} \theta - 1}{\cot \theta - \operatorname{cosec} \theta + 1} = \frac{1 + \cos \theta}{\sin \theta}$ .

Q.6. If  $\sin \theta + \cos \theta = \sqrt{2}$ , prove that  $\tan \theta + \cot \theta = 2$ .

Q.7. Prove that:  $\sin \theta (1 + \tan \theta) + \cos \theta (1 + \cot \theta) = \sec \theta + \operatorname{cosec} \theta$ .

Q.8. Prove that:  $(\cot \theta - \operatorname{cosec} \theta)^2 = \frac{1 - \cos \theta}{1 + \cos \theta}$

Q.9. Prove that:  $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1}{\sec \theta - \tan \theta}$

Q.10. Prove that:  $\frac{\cos \theta - \sin \theta + 1}{\cos \theta + \sin \theta - 1} = \operatorname{cosec} \theta + \cot \theta$

Q.11. If  $\operatorname{cosec} \theta - \cot \theta = 2 \cot \theta$ , then prove that  $\operatorname{cosec} \theta + \cot \theta = 2 \operatorname{cosec} \theta$ .

Q.12. Prove that:  $\sqrt{\frac{1 + \sin \theta}{1 - \sin \theta}} + \sqrt{\frac{1 - \sin \theta}{1 + \sin \theta}} = 2 \sec \theta$ .

Q. 13.  $\frac{\sin A - 2 \sin^3 A}{2 \cos^3 A - \cos A} = \tan A$ .

Q.14. Prove that:  $\sec A (1 - \sin A) (\sec A + \tan A) = 1$

Q.15. Determine the value of x such that

$$2 \operatorname{cosec}^2 30^\circ + x \sin^2 60^\circ - \frac{3}{4} \tan^2 30^\circ = 10.$$

## CHAPTER : 9 APPLICATION TO TRIGONOMETRY (CLASS X )

### (Gist of the Chapter)

The topic heights and distance is one of the applications of Trigonometry, which is extensively used in real-life. The words height and distance are frequently used in the trigonometry while dealing with its applications. In the height and distances application of trigonometry, the following concepts are included:

- Measuring the heights of towers or big mountains
- Determining the distance of the shore from the sea
- Finding the distance between two celestial bodies

It should be noted that finding the height of bodies and distances between two objects is one of the most important applications of trigonometry.

### Key Points :-

1) Line of Sight – The line which is drawn from the eyes of the observer to the point being viewed on the object is known as the line of sight.

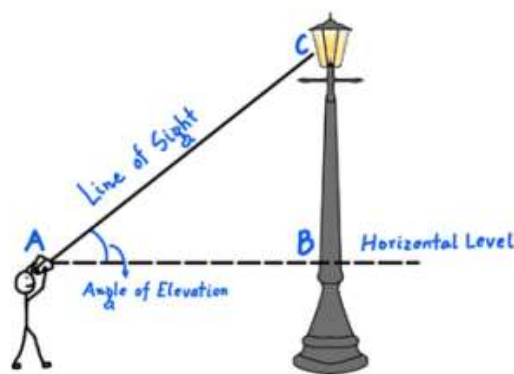


Figure 1: Angle of Elevation: A boy looking at the lamp

2) Angle of Elevation – The angle of elevation of the point on the object (above horizontal level) viewed by the observer is the angle which is formed by the line of sight with the horizontal level.

3) Angle of Depression – The angle of depression of the point on the object (below horizontal level) viewed by the observer is the angle which is formed by the line of sight with the horizontal level.

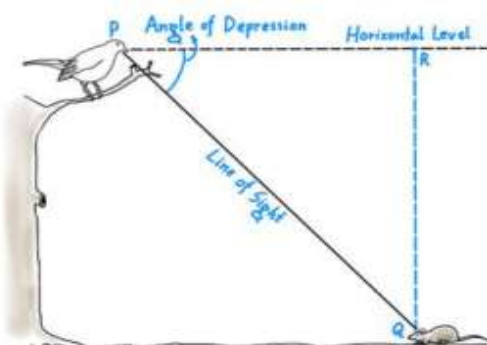


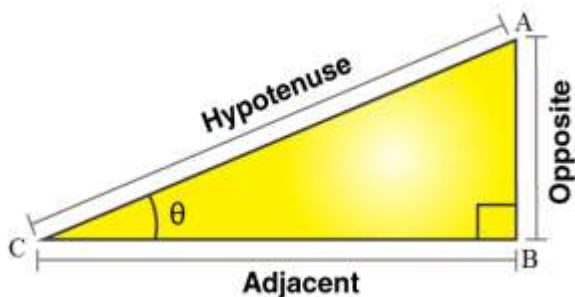
Figure 2: Angle of Depression: A bird viewing a rat

### FORMULAE BASED ANALYSIS :-

Any two of the three parameters (Height, Distance of an object from the foot, Angle of elevation or the angle of depression) will be provided in the question.

This type of problems can be solved using the formulas given below :-

In right triangle ABC,



$$\sin \theta = \text{Opposite/Hypotenuse} = AB/AC$$

$$\cos \theta = \text{Adjacent/Hypotenuse} = BC/AC$$

$$\tan \theta = \text{Opposite/Adjacent} = AB/BC$$

### SHORT QUESTIONS BASED ON FORMULA

- Q1. The height of a tower is 10 m. What is the length of its shadow when Sun's altitude is  $45^\circ$  ?
- Q2. If the ratio of the height of a angle tower and the length of 7 its shadow is  $\sqrt{3} : 1$ , what is the of elevation of the Sun ?
- Q3. What is the angle of elevation of the Sun when the length of the shadow of a vertical pole is equal to its height ?
- Q4. From a point on the ground, 20 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is  $60^\circ$ , what is the height of the tower ?
- Q5. The angle of elevation of the top of a tower at a point on the ground is  $30^\circ$ . What will be the angle of elevation, if the height of the tower is tripled?

### HOT and CCT based frequently asked questions :

#### CASE STUDY-1

A group of students of class X visited India Gate on an education trip. The teacher and students had interest in history as well. The teacher narrated that India Gate, official name Delhi Memorial, originally called All-India War Memorial, monumental sandstone arch in New Delhi, dedicated to the troops of British India who died in wars fought between 1914 and 1919. The teacher also said that India Gate, which is located at the eastern end of the Rajpath (formerly called the Kingsway), is about 138 feet (42 m) in height



Q1. What is the angle of elevation if they are standing at a distance of 42m away from the monument?

- a)  $30^\circ$
- b)  $45^\circ$
- c)  $60^\circ$
- d)  $90^\circ$

Q2. They want to see the tower at an angle of  $60^\circ$ . So, they want to know the distance where they should stand and hence find the distance.

- a) 25.24 m
- b) 20.12 m
- c) 42 m
- d) 24.64 m

Q3. If the altitude of the Sun is at  $60^\circ$ , then the height of the vertical tower that will cast a shadow of length 20 m is

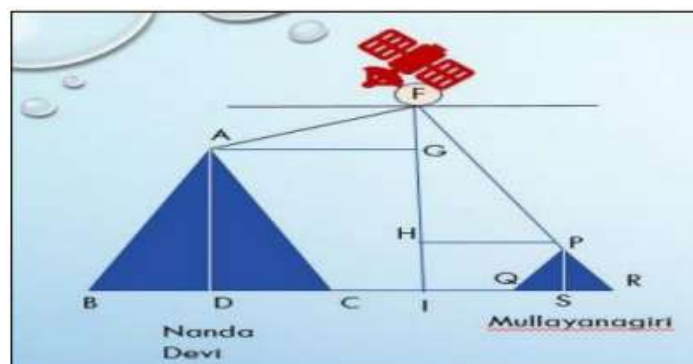
- a)  $20\sqrt{3}$  m
- b)  $20/\sqrt{3}$  m
- c)  $15/\sqrt{3}$  m
- d)  $15\sqrt{3}$  m

Q4. The ratio of the length of a rod and its shadow is 1:1. The angle of elevation of the Sun is

- a)  $30^\circ$
- b)  $45^\circ$
- c)  $60^\circ$
- d)  $90^\circ$

#### CASE STUDY-2

A Satellite flying at height  $h$  is watching the top of the two tallest mountains in Uttarakhand and Karnataka, them being Nanda Devi (height 7,816m) and Mullayanagiri (height 1,930 m). The angles of depression from the satellite, to the top of Nanda Devi and Mullayanagiri are  $30^\circ$  and  $60^\circ$  respectively. If the distance between the peaks of the two mountains is 1937 km, and the satellite is vertically above the midpoint of the distance between the two mountains.



Q1) The distance of the satellite from the top of Nanda Devi is

- a) 1139.4 km
- b) 577.52 km
- c) 1937 km
- d) 1025.36 km

Q2) The distance of the satellite from the top of Mullayanagiri is

- a) 1139.4 km
- b) 577.52 km
- c) 1937 km
- d) 1025.36 km

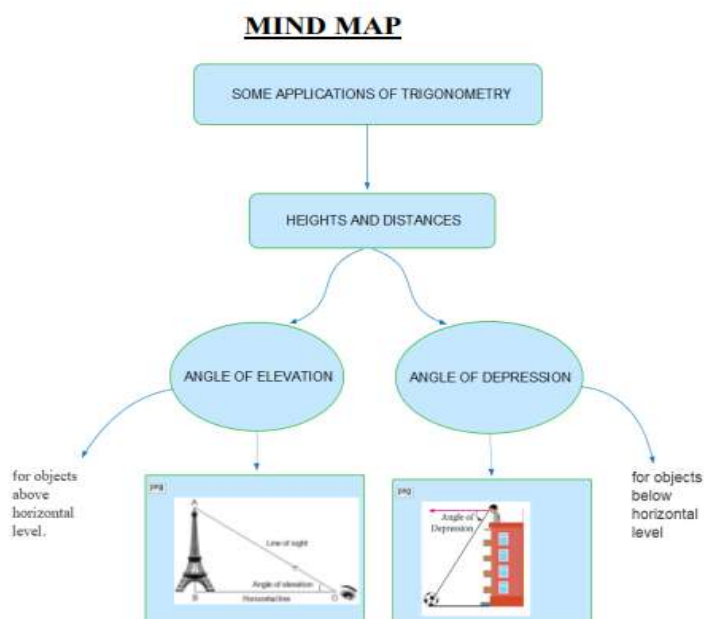
Q3) The distance of the satellite from the ground is

- a) 1139.4 km
- b) 577.52 km
- c) 1937 km
- d) 1025.36 km

Q4) What is the angle of elevation if a man is standing at a distance of 7816m from Nanda Devi?

- a)  $30^\circ$
- b)  $45^\circ$
- c)  $60^\circ$
- d)  $0^\circ$

**Trick which help students in memorization.**



## CHAPTER : 9 APPLICATION TO TRIGONOMETRY (CLASS X )

### MULTIPLE CHOICE QUESTIONS

Q1. If the length of the shadow of a tree is decreasing then the angle of elevation is:

- (a) Increasing
- (b) Decreasing
- (c) Remains the same
- (d) None of the above

Q2. The angle of elevation of the top of a building from a point on the ground, which is 30 m away from the foot of the building, is  $30^\circ$ . The height of the building is:

- (a) 10 m
- (b)  $30/\sqrt{3}$  m
- (c)  $\sqrt{3}/10$  m
- (d) 30 m

Q3. If the height of the building and distance from the building foot's to a point is increased by 20%, then the angle of elevation on the top of the building:

- (a) Increases
- (b) Decreases
- (c) Do not change
- (d) None of the above

Q4. If a tower 6m high casts a shadow of  $2\sqrt{3}$  m long on the ground, then the sun's elevation is:

- (a)  $60^\circ$
- (b)  $45^\circ$
- (c)  $30^\circ$
- (d)  $90^\circ$

Q5. The angle of elevation of the top of a building 30 m high from the foot of another building in the same plane is  $60^\circ$ , and also the angle of elevation of the top of the second tower from the foot of the first tower is  $30^\circ$ , then the distance between the two buildings is:

- (a)  $10\sqrt{3}$  m
- (b)  $15\sqrt{3}$  m
- (c)  $12\sqrt{3}$  m
- (d) 36 m

Q6. The angle formed by the line of sight with the horizontal when the point is below the horizontal level is called:

- (a) Angle of elevation
- (b) Angle of depression
- (c) No such angle is formed
- (d) None of the above

**Q7. The angle formed by the line of sight with the horizontal when the point being viewed is above the horizontal level is called:**

- (a) Angle of elevation
- (b) Angle of depression
- (c) No such angle is formed
- (d) None of the above

**Q8. From a point on the ground, which is 15 m away from the foot of the tower, the angle of elevation of the top of the tower is found to be  $60^\circ$ . The height of the tower (in m) standing straight is:**

- (a)  $15\sqrt{3}$
- (b)  $10\sqrt{3}$
- (c)  $12\sqrt{3}$
- (d)  $20\sqrt{3}$

**Q9. The line drawn from the eye of an observer to the point in the object viewed by the observer is said to be**

- (a) Angle of elevation
- (b) Angle of depression
- (c) Line of sight
- (d) None of the above

**Q10. When the shadow of a pole H m high is  $\sqrt{3}$  H m long, the angle of elevation of the Sun is**

- (a)  $30^\circ$
- (b)  $60^\circ$
- (c)  $45^\circ$
- (d)  $15^\circ$

#### **ASSERTION REASON BASED QUESTIONS**

**1) Assertion: The angle of elevation of an object viewed, is the angle formed by the line of sight with the horizontal when it is above the horizontal level.**



**reason: The angle of depression. of an object viewed, is the angle formed by the line of sight with the horizontal when it is below the horizontal level.**

- a) Both assertion and reason are correct and reason is correct explanation for assertion.
- b) Both Assertion and Reason are correct but reason is not correct explanation for assertion.
- c) Assertion is correct but reason is false.
- d) Both Assertion and Reason are false.

**2) Assertion: The line of sight is the line drawn from the eye of an observer to the point in the object viewed by the observer.**

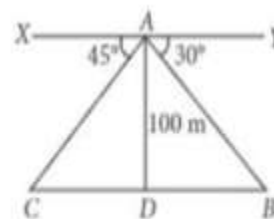
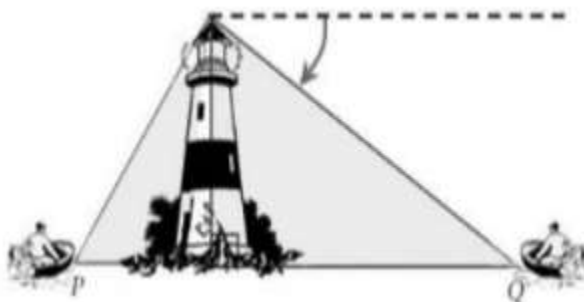
**reason: trigonometric ratios are used to find height or length of an object or distance between two distant**

- a) Both assertion and reason are correct and reason is correct explanation for assertion.
- b) Both Assertion and Reason are correct but reason is not correct explanation for assertion.
- c) Assertion is correct but reason is false.
- d) Both Assertion and Reason are false.

**CASED BASED QUESTIONS:**

**CASE STUDY 1:**

A boy is standing on the top of light house. He observed that boat P and boat Q are approaching to light house from opposite directions. He finds that angle of depression of boat P is  $45^\circ$  and angle of depression of boat Q is  $30^\circ$ . He also knows that height of the light house is 100m.



Based on the above information, answer the following questions.

1. Measure of  $\angle ACD$  is equal to

- (a)  $30^\circ$
- (b)  $45^\circ$
- (c)  $60^\circ$
- (d)  $90^\circ$

2. If  $\angle YAB = 30^\circ$ , then  $\angle ABD$  is also  $30^\circ$ , why?

- (a) vertically opposite angles

- (b) alternate interior angles
- (c) alternate exterior angles
- (d) corresponding angles

3. Length of CD is equal to

- (a) 90m (b) 60m (c) 100m (d) 80m

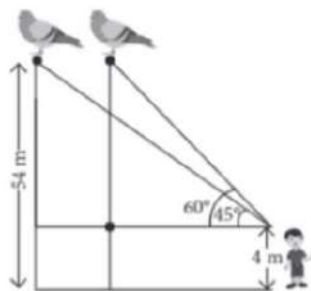
**OR**

Length of BD is equal to

- (a) 50m (b) 100m (c)  $100\sqrt{2}$  m (d)  $100\sqrt{3}$  m

**CASE STUDY 2:**

A boy 4 m tall spots a pigeon sitting on the top of a pole of height 54m from the ground. The angle of elevation of the pigeon from the eyes of boy at any instant is  $60^\circ$ . The pigeon flies away horizontally in such a way that it remained at a constant height from the ground. After 8 seconds, the angle of evaluation of the pigeon from the same point is  $45^\circ$ . Based on the above information answer the following questions (take  $\sqrt{3} = 1.73$ )



1. Find the distance of first position of the pigeon from the eyes of the boy

- (a) 54m (b) 100m (c)  $100\sqrt{3}$  m (d)  $100\sqrt{3}$  m

2. If the distance between the positions of pigeon increases, then the angle of elevation

- (a) Increases (b) Decreases (c) Remains unchanged (d) can't say

3. Find the distance between the boy and the pole.

- (a) 50m (b)  $50\sqrt{3}$  m (c)  $50\sqrt{3}$  m (d)  $60\sqrt{3}$  m

**or**

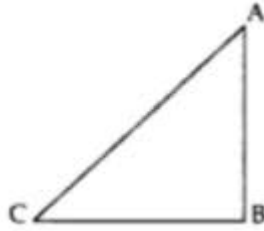
How much distance the pigeon covers in 8 seconds?

- (a) 12.13m (b) 19.60m (c) 21.09m (d) 26.32m

**VERY SHORT ANSWER I (2 MARKS)**

1. A ladder 15 m long just reaches the top of a vertical wall. If the ladder makes an angle of  $60^\circ$  with the wall, then calculate the height of the wall.

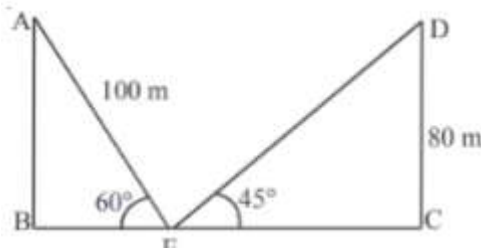
2. In the given figure, a tower AB is 20 m high and BC, its shadow on the ground, is  $20\sqrt{3}$  m long. Find the Sun's altitude.



3. The string of a kite is 100 m long and it makes an angle of  $60^\circ$  with the horizontal. Find the height of the kite, assuming that there is no slack in the string.

4. A tree 12 m high, is broken by the storm. The top of the tree touches the ground making an angle  $30^\circ$ . At what height from the bottom the tree is broken by the storm?

5. In the figure, find the value of BC.



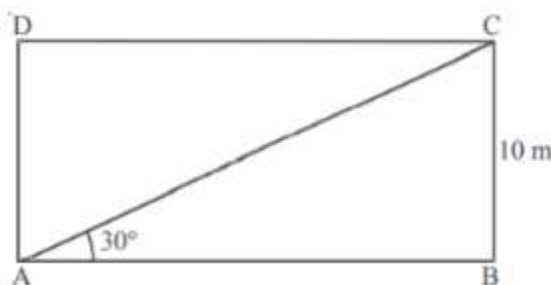
6. Find the angle of elevation of a point which is at a distance of  $10\sqrt{3}$  m from the base of a tower 30m high.

7. The height of the tower is 15 m. What is the length of its shadow when sun's altitude is  $45^\circ$ ?

8. A 1.5 m tall boy stands at a distance of 2m from lamp post and casts a shadow of 4.5 m on the ground. Find the height of the lamp post?

9. The tops of two poles of height 20m and 14 m are connected by a wire. Find the length of the wire if it makes an angle of  $30^\circ$  with horizontal?

10. In the given figure, find the perimeter of rectangle ABCD.



**VERY SHORT ANSWER II (3 MARKS)**

- Find the angle of elevation of the sun when the shadow of a pole  $h$  metres high is  $\sqrt{3} h$  metres long.
- A ladder 15 metres long just reaches the top of a vertical wall. If the ladder makes an angle of  $60^\circ$  with the wall, find the height of the wall.
- Two pillars of equal heights are on either side of a road, which is hundred metres wide. The angles of elevation of the tops of the pillars are  $60^\circ$  and  $30^\circ$  at a point on the road between the pillars. Find the position of the point between the pillars?

4. From a point on the ground, the angles of elevation of the bottom and top of a water tank kept on the top of the 30 m high building are  $30^\circ$  and  $45^\circ$  respectively. Find the height of the water tank?
5. From the top of a multi-storeyed building, 90m high, the angles of depression of the top and the bottom of a tower are observed to be  $30^\circ$  and  $60^\circ$  respectively. Find the height of the tower?
6. Two ships are there in the sea on either side of a lighthouse in such a way that the ships and the base of the lighthouse are in the same straight line. The angles of depression of two ships as observed from the top of the lighthouse are  $60^\circ$  and  $45^\circ$ . If the height of the lighthouse is 200m, find the distance between the two ships.
7. From the top of a 300 metre high light-house, the angles of depression of two ships, which are due south of the observer and in a straight line with its base, are  $60^\circ$  and  $30^\circ$ . Find their distance apart?
8. A Statue, 1.6 m tall, stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is  $60^\circ$  and from the same point, the angle of elevation of the top of the pedestal is  $45^\circ$ . Find the height of the pedestal? (Use  $\sqrt{3} = 1.73$ )
9. A peacock is sitting on the top of a tree. It observes a serpent on the ground making an angle of depression of  $30^\circ$ . The peacock with the speed of 300 metre/ minute catches the serpent in 12 seconds. What is the height of the tree?
10. An aero plane, at an altitude of 1200 m, finds that two ships are sailing towards it in the same direction. The angles of depression of the ships as observed from the aeroplane are  $60^\circ$  and  $30^\circ$  respectively. Find the distance between the two ships?

### Long Answer Type Questions

1. A person standing on the bank of a river observes that angle of elevation of the top of a tree standing on the opposite bank is  $60^\circ$ . When he moves 30m away from the bank, he finds the angle of elevation to be  $30^\circ$ . Find the height of the tree and the width of the river.
2. At a point on a level ground, the angle of elevation  $\alpha$  of a vertical tower is found to be such that  $\tan \alpha = 5/12$ . On walking 192m towards the tower, the angle of elevation becomes  $\beta$  such that  $\tan \beta = 3/4$ . Find the height of the tower.
3. A boy whose eye level is 1.3m from the ground, spots a balloon moving with wind in a horizontal line at some height from the ground. The angle of elevation of the balloon from the eyes of the boy at any instant is  $60^\circ$ . After 12 seconds, the angle of elevation reduces to  $30^\circ$ . If the speed of wind at that moment is  $29\sqrt{3}$  m/s, then find the height of the balloon from the ground.
4. Two pillars of equal height stand on either side of the roadway which is 150m wide. From a point on the roadway between the pillars, the elevations of the top of the pillars are  $60^\circ$  and  $30^\circ$ . Find the height of the pillars and the position of the point.
5. The angle of elevation of the top of the building from the foot of the tower is  $30^\circ$  and the angle of elevation of the top of the tower from the foot of the building is  $60^\circ$ . If the tower is 60m high, find the height of the building.

**CLASS : X**  
**SUBJECT: MATHS**  
**CHAPTER:- CIRCLES**

**GIST OF THE LESSON :**

Introduction

Tangent to a circle at, point of contact

(Prove) The tangent at any point of a circle is perpendicular to the radius through the point of contact.

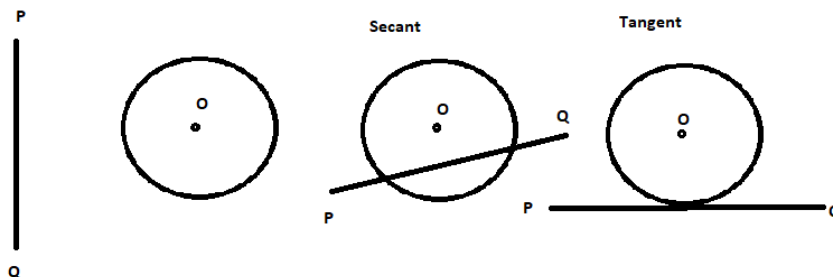
(Prove) The lengths of tangents drawn from an external point to a circle are equal

**KEY POINTS :**

Fundamentals:

Consider a circle a circle  $C(O, r)$  and a line  $PQ$ . There can be three possibilities given below:

- a. Non intersecting line w.r.t circle
- b. A line intersects circle in two distinct points, this line is called a **Secant**.
- c. A line which intersect circle exactly at one point is called a **Tangent**.

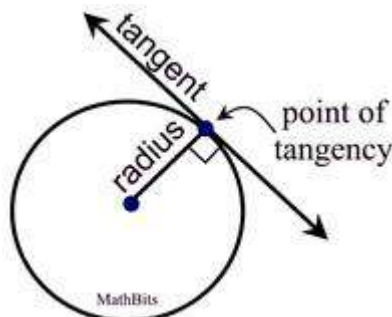


From a point  $P$  inside a circle, the number of tangents drawn to the circle = 0

From a point on a circle, the number of tangents drawn to the circle = 1

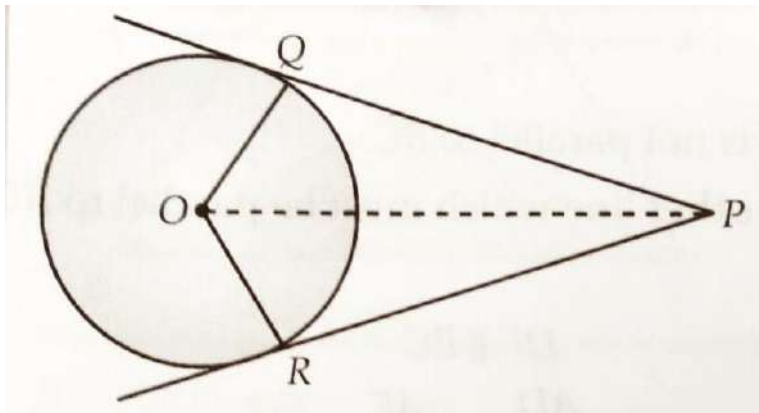
From a point outside the circle, the number of tangents drawn to the circle = 2

Point of contact :- A line which intersect / touches a circle at a point.



**Theorem 1:-** The tangent at any point of a circle is perpendicular to the radius at the point of contact.

**Theorem 1:-** The length of two tangents from an external point to a circle are equal.



### FORMULA BASED ANALYSIS :

In the above figure :

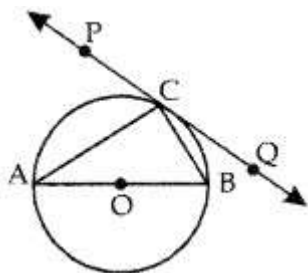
Radius OQ and OR are perpendicular to the tangent QP and PR therefore by Pythagoras theorem we can find OP

$$OQ^2 + QP^2 = OP^2$$

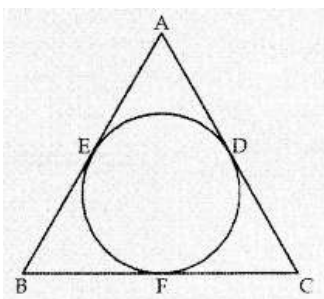
$$\angle QOP + \angle QPR = 180^\circ$$

### SHORT QUESTIONS BASED ON FORMULA :

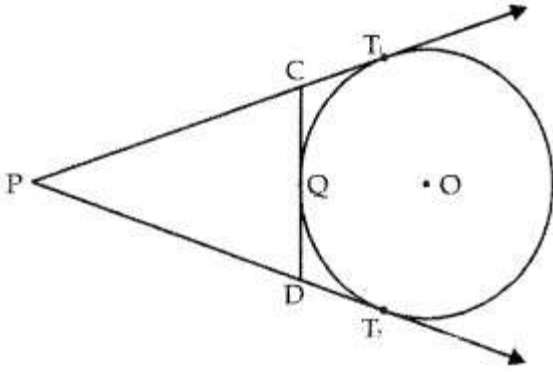
Q1. In figure, PQ is a tangent at a point C to a circle with centre O. If AB is a diameter and  $\angle CAB = 30^\circ$ , find  $\angle PCA$



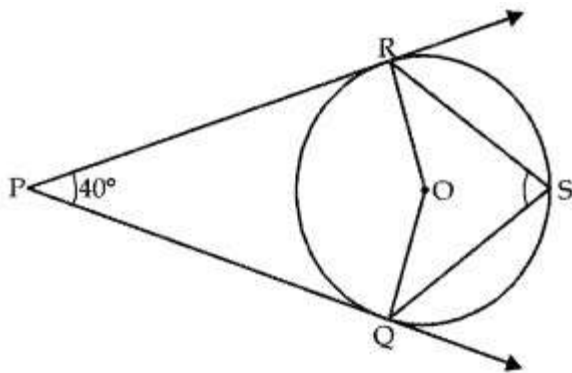
Q2. In fig., if  $AD = 15$  cm,  $CF = 12$  cm and  $BE = 7$  cm, then find the perimeter of the triangle ABC.



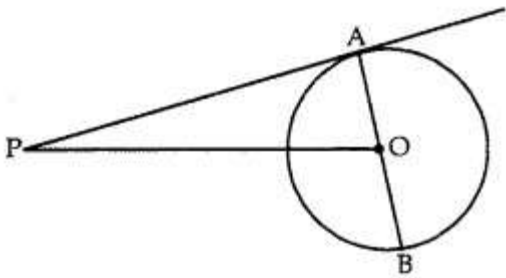
Q3. In fig.,  $PT_1$  and  $PT_2$  are tangents to the circle drawn from an external point P, CD is a third tangent touching circle at Q. If  $PT_2 = 12$  cm and  $CQ = 2$  cm. What is the length of PC?



Q4. In fig., PQ and PR are tangents drawn from P. If  $\angle QPR = 40^\circ$ , then find  $\angle QSR$ .

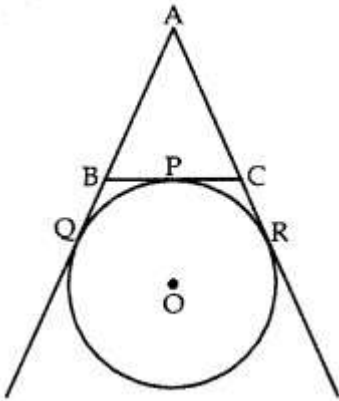


Q5. In fig. FA is a tangent from an external point P to a circle with centre O. If  $\angle POB = 115^\circ$ , then find  $\angle APO$ .

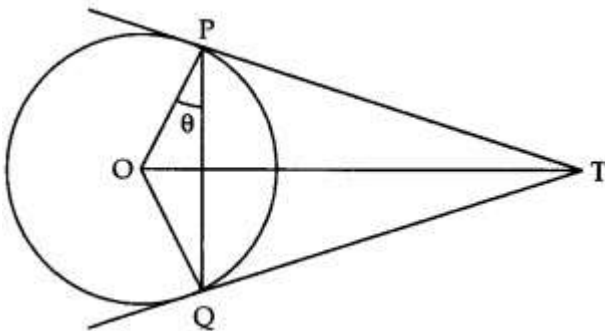


### **HOT AND CCT BASED FREQUENTLY ASKED QUESTIONS :**

Q1. A circle touches the side BC of a  $\Delta ABC$  at P, and touches AB and AC produced at Q and R respectively as shown in fig. Show that  $AQ = \frac{1}{2}$  (Perimeter of  $\Delta ABC$ ).



Q2. Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that  $\angle PTQ = 2\angle OPQ$ .

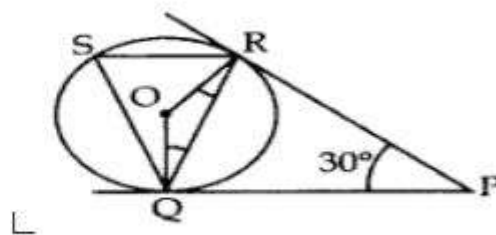
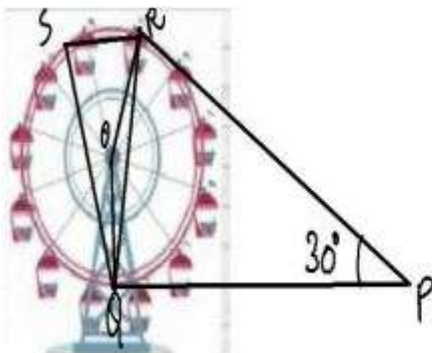


Q3. In figure, two equal circles, with centres O and O', touch each other at X. OO' produced meets the circle with centre O' at A. AC is tangent to the circle with centre O, at the point C. O'D is perpendicular to AC.

Find the value of  $\frac{DO}{CO}$

### (CASE STUDY BASED QUESTIONS)

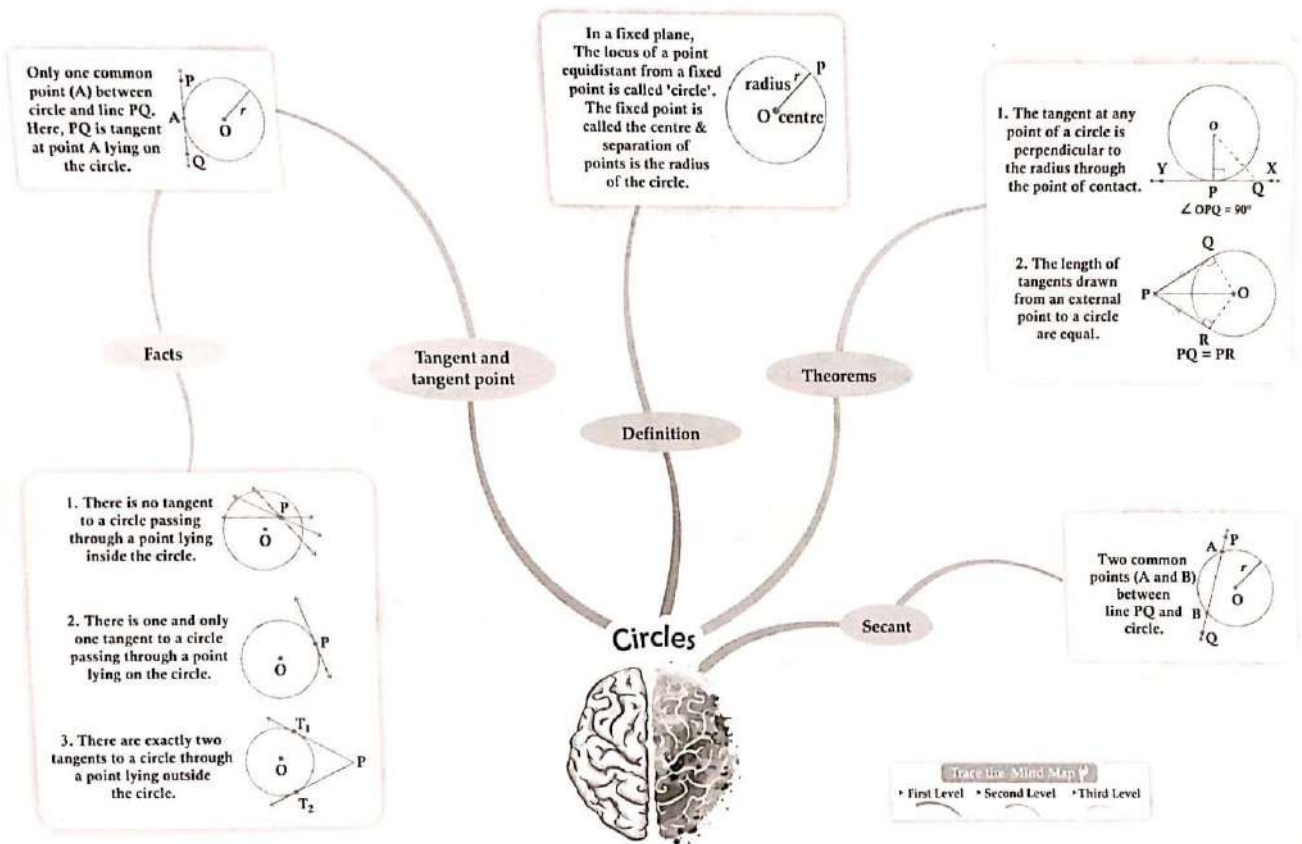
A Ferris wheel (or a big wheel in the United Kingdom) is an amusement ride consisting of a rotating upright wheel with multiple passenger-carrying components (commonly referred to as passenger cars, cabins, tubs, capsules, gondolas, or pods) attached to the rim in such a way that as the wheel turns, they are kept upright, usually by gravity. After taking a ride in Ferris wheel, Aarti came out from the crowd and was observing her friends who were enjoying the ride. She was curious about the different angles and measures that the wheel will form. She forms the figure as given below and answers the following questions given below:-





1. In the given figure find  $\angle ROQ$
2. Find  $\angle RQP$
3. Find  $\angle RSQ$
4. Find  $\angle ORP$

**TRICK WHICH HELP STUDENT IN MEMORIZATION :**



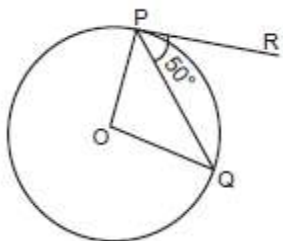
**Question pattern for study material**  
**Class X**  
**Topic -Circle**

E

**SECTION A (V.S.A 1X10=10)**

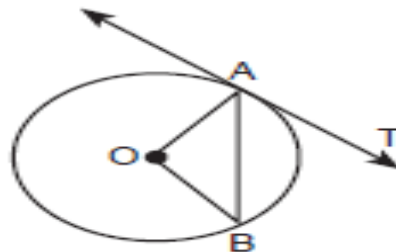
- 1 A line through point of contact and passing through centre of circle is known as  
(a) tangent (b) chord (c) normal (d) segment 1
- 2 From a point P which is at a distance of 13 cm from the centre O of a circle of radius 5 cm, the pair of tangents PQ and PR to the circle are drawn. Then the area of the quadrilateral PQOR is 1  
(a)  $60 \text{ cm}^2$  (b)  $65 \text{ cm}^2$  (c)  $30 \text{ cm}^2$  (d)  $32.5 \text{ cm}^2$

- 3 In figure if O is centre of a circle, PQ is a chord and the tangent PR at P makes an angle of  $50^\circ$  with PQ, then  $\angle POQ$  is equal to

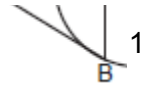


- (a)  $100^\circ$  (b)  $80^\circ$  (c)  $90^\circ$  (d)  $75^\circ$  1

- 4 In figure, O is the centre of a circle, AB is a chord and AT is the tangent at A. If  $\angle AOB = 100^\circ$ , then  $\angle BAT$  is equal to 1  
(a)  $100^\circ$  (b)  $40^\circ$  (c)  $50^\circ$  (d)  $90^\circ$

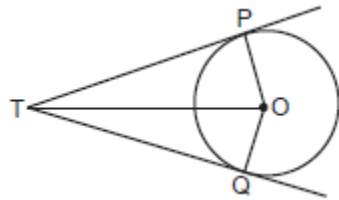


- 5 In the figure PA and PB are tangents to the circle with centre O. If  $\angle APB = 60^\circ$ , then  $\angle AOB$  is (a)  $30^\circ$  (b)  $60^\circ$  (c)  $90^\circ$  (d)  $15^\circ$



1

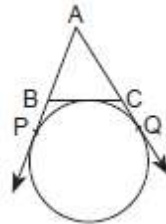
- 6 In the given figure, TP and TQ are two tangents to a circle with centre O, such that  $\angle POQ = 110^\circ$ . Then  $\angle PTQ$  is equal to



1

- (a)  $55^\circ$  (b)  $70^\circ$  (c)  $110^\circ$  (d)  $90^\circ$

- 7 In figure, AP, AQ and BC are tangents to the circle. If  $AB = 5$  cm,  $AC = 6$  cm and  $BC = 4$  cm, then the length of AP (in cm) is



1

- (a) 7.5 (b) 15 (c) 10 (d) 9

8.

The common point of a tangent to a circle with the circle is called \_\_\_\_\_  
 (a) centre (b) point of contact (c) end point (d) none of these.

9.

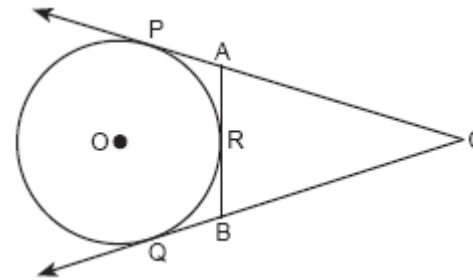
Distance of chord AB from the centre is 12 cm and length of the chord is 10 cm. Then diameter of the circle is

- A. 26 cm      B. 13 cm      C.  $\sqrt{244}$  cm      D. 20 cm

- 10 ABCD is a cyclic quadrilateral. If  $\angle DBC = 80^\circ$ ,  $\angle BAC$  is  $40^\circ$ , find  $\angle BCD$ .  
 (a)  $80^\circ$       (b)  $60^\circ$       (c)  $90^\circ$       (d)  $70^\circ$

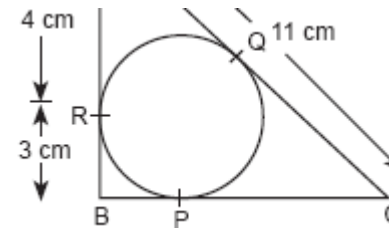
**SECTION B ( 2X10 =20 )**

1 In figure, CP and CQ are tangents to a circle with centre O. ARB is another tangent touching the circle at R. If CP = 11 cm, and BC = 7 cm, then find the length of BR.



2

- 2 In figure,  $\triangle ABC$  is circumscribing a circle. Find the length of BC.



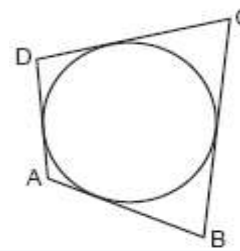
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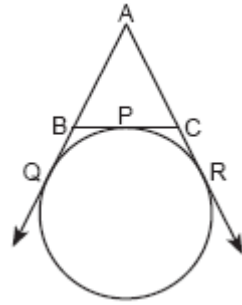
- 3 In figure, a circle touches all the four sides of a quadrilateral ABCD whose sides are AB = 6 cm, BC = 9 cm and CD = 8 cm. Find the length of side AD.

2

- 4 In figure, a circle touches the side BC of  $\triangle ABC$  at P and touches AB and AC produced at Q and R respectively. If AQ = 5 cm, find the perimeter of  $\triangle ABC$ .

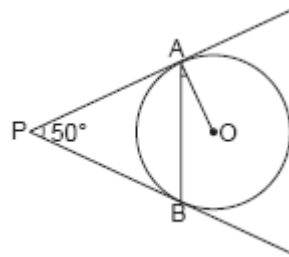
2





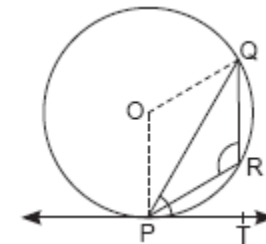
5 The two tangents from an external point P to a circle with centre O are PA and PB. If  $\angle APB = 70^\circ$ , what is the value of  $\angle AOB$ ? 2

6 In figure, PA and PB are tangents to the circle with centre O such that  $\angle APB = 50^\circ$ . Write the measure of  $\angle AOB$ .



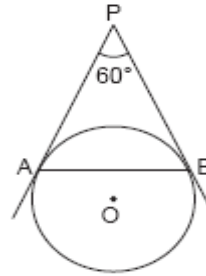
2

7 In figure, PQ is a chord of a circle with centre O and PT is a tangent. If  $\angle QPT = 60^\circ$ , find  $\angle PRQ$ .



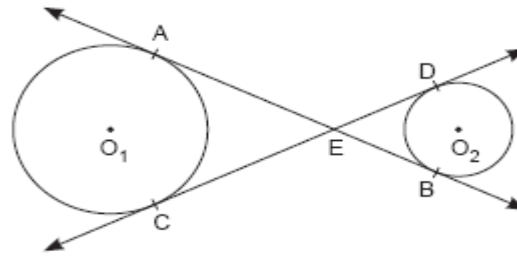
2

- 8 In figure, AP and BP are tangents to a circle with centre O, such that  $AP = 5$  cm and  $\angle APB = 60^\circ$ . Find the length of chord AB.



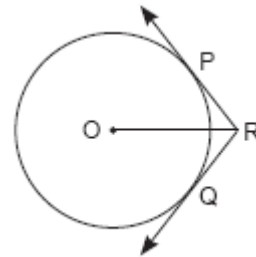
2

- 9 In figure, common tangents AB and CD to the two circles with centres  $O_1$  and  $O_2$  intersect at E. Prove that  $AB = CD$ .



2

- 10 In figure, two tangents RQ and RP are drawn from an external point R to the circle with centre O. If  $\angle PRQ = 120^\circ$ , then prove that  $OR = PR + RQ$ .

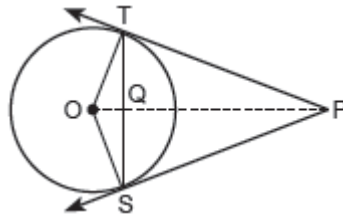


2

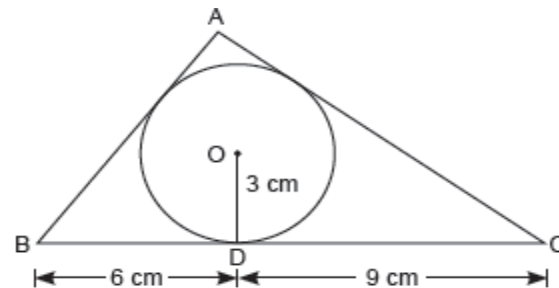
**SECTION C (3X10=30)**

1. Prove that the lengths of the tangents drawn from an external point to a circle are equal.
2. Prove that the tangent to a circle is perpendicular to the radius through the point of contact
3. Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that  $\angle PTQ = 2 \angle OPQ$ .
4. PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q intersect at a point T. Find the length TP.
5. Prove that the parallelogram circumscribing a circle is a rhombus.
6. A quadrilateral ABCD is drawn to circumscribe a circle. Prove that  $AB + CD = AD + BC$

7. In figure, from an external point P, two tangents PT and PS are drawn to a circle with centre O and radius  $r$ . If  $OP = 2r$ , show that  $\angle OTS = \angle OST = 30^\circ$ .



8. In figure, a triangle ABC is drawn to circumscribe a circle of radius 3 cm, such that the segments BD and DC are respectively of lengths 6 cm and 9 cm. If the area of  $\triangle ABC$  is  $54 \text{ cm}^2$ , then find the lengths of sides AB and AC.



9. AB is a chord of length 24 cm of a circle of radius 13 cm. The tangents at A and B intersect at a point C. Find the length AC.

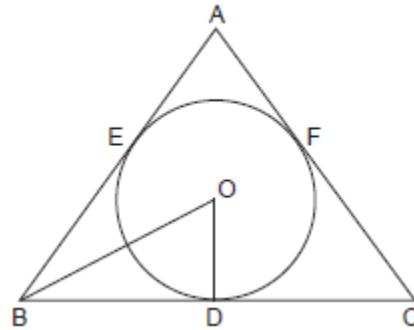
10. If  $XY$  and  $X'Y'$  are two parallel tangents to a circle with centre  $O$  and another tangent  $AB$  with point of contact  $C$  intersecting  $XY$  at  $A$  and  $X'Y'$  at  $B$ . Prove that  $\angle AOB = 90^\circ$ .

**SECTION D LONG ANSWER (5X5=25)**

Q1. A circular region is inscribed in a triangular boundary as shown in figure. Each boundary of triangular part is act as tangent to the circle, where  $O$  is centre of circle and  $OD \perp BC$ .

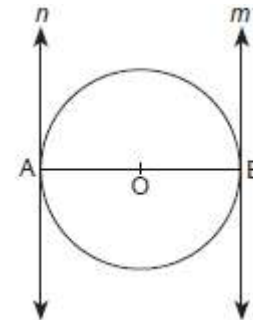
Answer the questions based on above

- (a) What will be the radius of the circle, if  $BD = 24$  cm and  $OB = 25$  cm?
- (b) Determine  $CD$ , if  $OC = 26$  cm.
- (c) As  $AB$  and  $AC$  act as tangents to the circle at  $E$  and  $F$  and  $AE = 8$  cm, then what is the perimeter of  $\triangle ABC$ .
- (d) Determine area of  $\triangle BOC$ . (e) What is the area of  $\triangle ABC$ ?



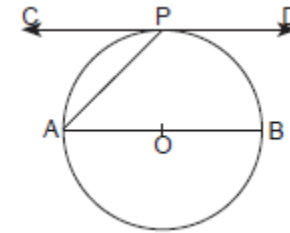
Q2. A circle can have at most two parallel tangents, one at a point on it and the other at a point diametrically opposite to it. Here  $AB$  is diameter of a circle and tangent  $n$  and tangent  $m$  are parallel to each other.

Answer the questions based on above.





- (a) What is the distance between two parallel tangents of a circle of radius 6 cm.
- (b) Two parallel tangents touches the circle at points A and B. Find the distance between parallel tangents if area of circle is  $25\pi$   $\text{cm}^2$ . (
- (c) What is the maximum number of parallel tangents a circle can have?
- (d) CD is tangent to circle at P. If  $\angle PAB = 30^\circ$ . Determine  $\angle CPA$ , where O is centre of circle.
- (e) How many tangents can be drawn to a circle from a point lying inside the circle?



### SECTION E (4X2=8)

#### CASE STUDY QUESTION

Smita always finds it confusing with the concepts of tangent and secant of a circle. But this time she has determined herself to get concepts easier. So, she started listing down the differences between tangent and secant of a circle along with their relation. Here, some points in question form are listed by Smita in her notes.

**A line that intersects a circle exactly at two points is called**

- (a) Secant (b) Tangent (c) Chord (d) Both (a) and (b)

**The number of tangents that can be drawn on a circle is**

- (a) 1 (b) 0 (c) 2 (d) Infinite

**The number of tangents that can be drawn to a circle from a point, not on it, is**

- (a) 1 (b) 2 (c) 0 (d) Infinite

**Number of secants that can be drawn to a circle from a point on it is**

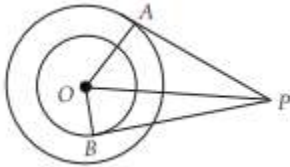
- (a) infinite (b) 1 (c) 2 (d) 0

Q2. If a tangent is drawn to a circle from an external point, then the radius at the point of contact is perpendicular to the tangent.

Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.

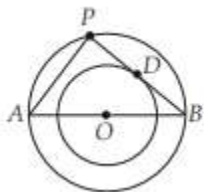
- (a) 8 cm (b) 4 cm (c) 10 cm (d) 6 cm

In the given figure, O is the centre of two concentric circles of radii 5 cm and 3 cm. From an external point P tangent, PA and PB are drawn to these circles. If PA = 12 cm, then PB =



- (a)  $2\sqrt{10}$  cm (b)  $2\sqrt{5}$  cm  
(c)  $4\sqrt{10}$  cm (d)  $4\sqrt{5}$  cm

The diameter of the two concentric circles is 10 cm and 6 cm. AB is the diameter of the bigger circle and BD is the tangent to the smaller circle touching it at D and intersecting the larger circle at P on producing. Find the length of BP.



- (a) 4 cm (b) 16 cm (c) 10 cm (d) 8 cm

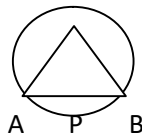
## Chapter 11

Areas of sector and segments of a circle area of the sector of circle

$$\text{Area of the sector of angle } \Theta = \frac{\Theta}{360} \times \pi r^2$$

$$\text{Length of an are of a sector of angle } \Theta = \frac{\Theta}{360} \times 2\pi r$$

Area of segment = Area of sector OAPB – Area of  $\Delta$  OAB



If  $\Theta = 90^\circ$  or

Example: suppose in figure ..AOB=90 then find the area of sector length of are APB and area of segtment APB if the eados of circle is

$$7 \text{ cm area of sector} = \frac{\Theta}{360} \times \pi r^2 =$$

$$\text{Length of are APB} = \frac{90 \times 2 \times 22 \times 7}{360 \times 7} = 11 \text{ cm}$$

## CHAPTER – 11

### AREA RELATED TO CIRCLE

<b>General Instructions: 1. This Question Pattern for study material has 5 Sections A, B, C, D, E and F.</b>
<b>2. Section A has 10 Multiple Choice Questions (MCQs) carrying 1 mark each.</b>
<b>3. Section B has 2 questions Assertion Reason based one marks each.</b>
<b>4. Section C has 10 questions Very Short Answer type - I questions carrying 2 marks each.</b>
<b>5. Section D has 10 questions Very Short Answer type - II questions carrying 3 marks each.</b>
<b>6. Section E has 5 Long Answer (LA) type questions carrying 5 marks each.</b>
<b>7. Section F has 2 Case Based integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.</b>

#### Section A

#### Section A consists of 10 questions of 1 mark each.

- The area of a sector of a circle with radius 6 cm if the angle of the sector is  $60^\circ$ .  
(a)  $142/7$  (b)  $152/7$  (c)  $132/7$  (d)  $122/7$
- In a circle of radius 21 cm, an arc subtends an angle of  $60^\circ$  at the centre. The length of the arc is; (a) 20cm (b) 21cm (c) 22cm (d) 25cm
- The area of a circle is  $49\pi\text{ cm}^2$ . Its circumference is  
(a)  $7\pi\text{ cm}$  (b)  $14\pi\text{ cm}$  (c)  $21\pi\text{ cm}$  (d)  $28\pi\text{ cm}$
- The perimeter of circular field is 242 cm. The area of the field is  
(a)  $9317\text{ cm}^2$  (b)  $18634\text{ cm}^2$  (c)  $4658.5\text{ cm}^2$  (d) none of these
- The circumference of two circles are in the ratio 2 : 3. The ratio of their areas is  
(a) 2 : 3 (b) 4 : 9 (c) 9 : 4 (d) none of these
- On increasing the diameter of circle by 40%, its area will be increased by  
(a) 40% (b) 80% (c) 96% (d) none of these
- The areas of the two circle are in the ratio 4: 9. The ratio of their circumference is  
(a) 2 : 3 (b) 4 : 9 (c) 9 : 16 (d) 4 : 9
- The radius of wheel is 0.25 m. How many revolutions will it make in covering 11 km?  
(a) 2800 (b) 4000 (c) 5500 (d) 7000

9. A steel wire when bent in the form of a square, encloses an area of 121 sq. cm. The same wire is bent in the form of a circle. Find the area of the circle.

- (a) 111 cm<sup>2</sup> (b) 184 cm<sup>2</sup> (c) 154 cm<sup>2</sup> (d) 259 cm<sup>2</sup>

10. A bicycle wheel makes 5000 revolutions in moving 11 km. Find the diameter of the wheel.

- (a) 60 cm (b) 70 cm (c) 66 cm (d) 68 cm

### Section B

(2 questions Assertion Reason based one marks each.)

11. **Assertion (A):** The diameter of circle whose area is equal to the sum of the area of two circles of radii 24 cm and 7 cm is 50 cm.

**Reason (R):** If the perimeter and the area of a circle are numerically equal, then the radius of the circle is 2 units.

Mark the correct choice as.

- A. Both assertion and reason are correct but and the reason is the correct explanation for the assertion.
- B. Both assertion and reason are correct but the reason is not the correct explanation for the assertion.
- C. Assertion is correct but the reason is incorrect.
- D. Assertion is incorrect but the reason is correct.

12. **Assertion (A):** If circumference of two circles are equal, then their area will be equal.

**Reason (R):** If the area of two circles are equal, then their circumference are equal.

- A. Both assertion and reason are correct but and the reason is the correct explanation for the assertion.
- B. Both assertion and reason are correct but the reason is not the correct explanation for the assertion.
- C. Assertion is correct but the reason is incorrect.
- D. Assertion is incorrect but the reason is correct.

### Section C

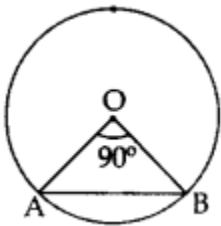
(10 questions Very Short Answer type - I questions carrying 2 marks each.)

13. A paper is in the form of a rectangle ABCD in which AB = 18 cm and BC = 14 cm. A semicircular portion with BC as diameter is cut off. Find the area of the remaining paper.
14. A steel wire, bent in the form of a square, encloses an area of 121 sq. cm. The same wire is bent in the form of a circle. Find the area of the circle.
15. A road, which is 7m wide, surrounds a circular park whose circumference is 352m. Find the area of the road.
16. A racetrack is in the form of a ring whose inner and outer circumference are 437 m and 503 m respectively. Find the width of the track and also its area.
17. If the radius of a circle is 4.2 cm, compute its area.
18. A chord subtends an angle of  $90^\circ$  at the centre of a circle whose radius is 20 cm. Compute the area of the corresponding minor segment of the circle.
19. A square is inscribed in a circle. Calculate the ratio of the area of the circle and the square.
20. The cost of fencing a circular field at the rate of Rs. 24 per metre is Rs. 5280. The field is to be ploughed at the rate of Rs. 0.50 per  $m^2$ . Find the cost of ploughing the field (Take  $\pi = 22/7$ )
21. The circumference of a circle is 22 cm. Calculate the area of its quadrant (in  $cm^2$ ).
22. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

### . Section D

(10 questions Very Short Answer type - II questions carrying 3 marks each.)

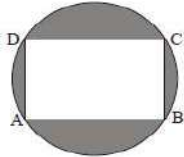
23. Find the area of the major segment APB, in the figure of a circle of radius 35 cm and  $\angle AOB = 90^\circ$ . (Use  $\pi = 22/7$ )



24. In a circle of radius 21 cm, an arc subtends an angle of  $60^\circ$  at the centre. Find:  
 (i) the length of the arc  
 (ii) area of the sector formed by the arc. [Use  $\pi = 22/7$ ]

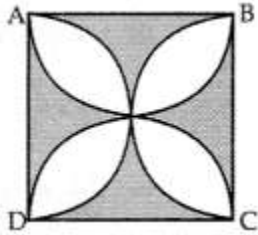
25. A chord of a circle of radius 14 cm subtends an angle of  $120^\circ$  at the centre. Find the area of the corresponding minor segment of the circle. (Use  $\pi = 22/7$  and  $3 - \sqrt{3} = 1.73$ )

26. Find the area of the shaded region in the given figure if  $AB = 8$  cm,  $AC = 10$  cm and  $BC = 6$  cm.

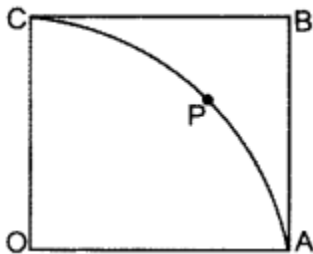


27. Find the area of the shaded region if the radii of two concentric circles are 7 cm and 3.5 cm.

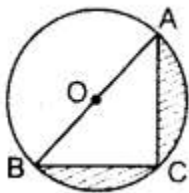
28. In Figure, ABCD is a square of side 14 cm. Semi-circles are drawn with each side of square as diameter. Find the area of the shaded region. [Use  $\pi = 22/7$ ]



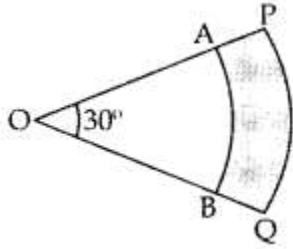
29. In Figure, OABC is a square of side 7 cm. If OAPC is a quadrant of a circle with centre O, then find the area of the shaded region. [Use  $\pi = 22/7$ ]



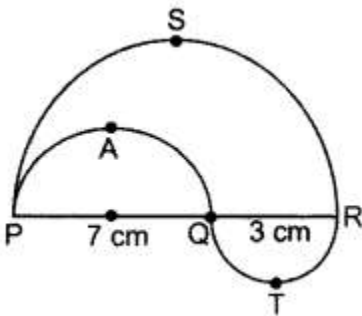
30. In Figure, O is the centre of a circle such that diameter  $AB = 13$  cm and  $AC = 12$  cm. BC is joined. Find the area of the shaded region. (Take  $\pi = 3.14$ )



31. In the Figure, PQ and AB are respectively the arcs of two concentric circles of a radii 7 cm and 3.5 cm and centre O. If  $\angle POQ = 30^\circ$ , then find the area of the shaded region. [Use  $\pi = 22/7$ ]



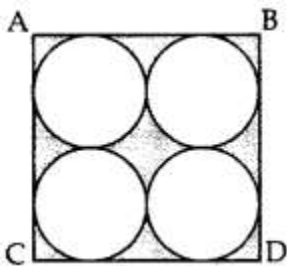
32. In the figure, PSR, RTQ and PAQ are three semicircles of diameters 10 cm, 3 cm and 7 cm respectively. Find the perimeter of the shaded region. [Use  $\pi = 3.14$ ]



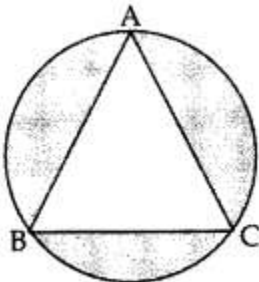
### Section E

(5 Long Answer (LA) type questions carrying 5 marks each.)

33. Find the area of the shaded region in Figure, where ABCD is a square of side 28 cm.

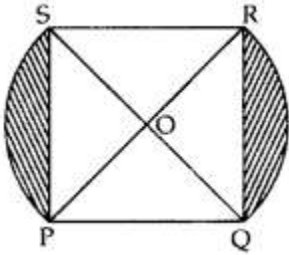


34. In Figure, an equilateral triangle has been inscribed in a circle of radius 6 cm. Find the area of the shaded region. [Use  $\pi = 3.14$ ]

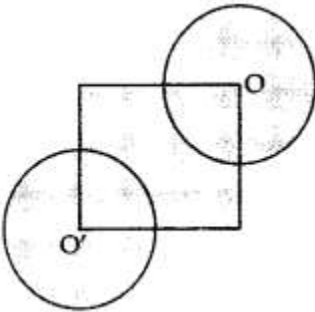




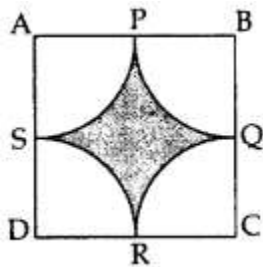
35. In Figure, PQRS is a square lawn with side  $PQ = 42$  metres. Two circular flower beds are there on the sides PS and QR with centre at O, the intersection of its diagonals. Find the total area of the two flower beds (shaded parts).



36. In the Figure, the side of square is 28 cm and radius of each circle is half of the length of the side of the square where O and O are centres of the circles. Find the area of shaded region.



37. Find the area of the shaded region in Figure, where arcs drawn with centres A, B, C and D intersect in pairs at mid-points P, Q, R and S of the sides AB, BC, CD and DA respectively of a square ABCD, where the length of each side of square is 14 cm. (Use  $\pi = 22/7$ )



### Section F

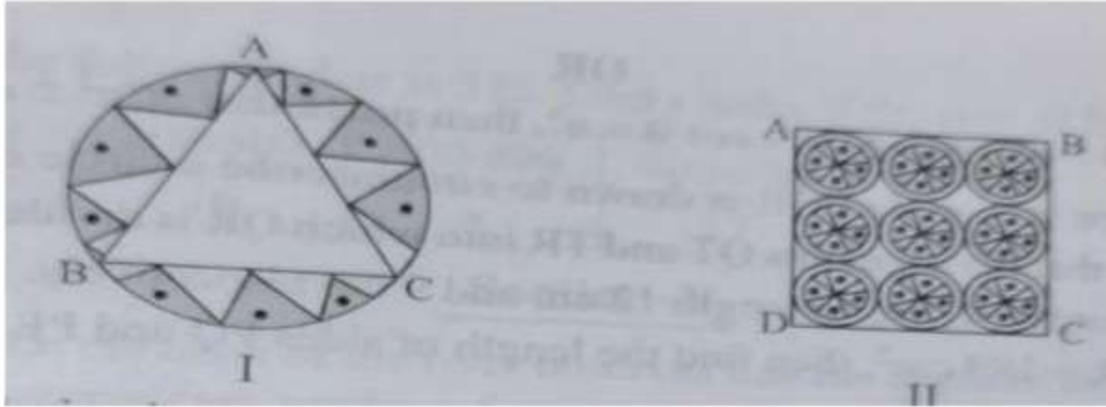
**(2 Case Based integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.)**

38. Principle of a school decided to give badges to students who are chosen for the post of Head boy, Head girl, Prefect and Vice Prefect. Badges are circular in shape with two colour area, red and silver, as shown in figure. The diameter of the region representing red colour is 22 cm and silver colour is filled in 10.5 cm wide ring. Based on the above information, answer the following questions.



- (i) The radius of circle representing the red region is  
(a) 9 cm (b) 10 cm (c) 11 cm (d) 12 cm
- (ii) Find the area of the red region.  
(a) 380.28 cm<sup>2</sup> (b) 382.28 cm<sup>2</sup> (c) 384.28 cm<sup>2</sup> (d) 378.28 cm<sup>2</sup>
- (iii) Find the radius of the circle formed by combining the red and silver region.  
(a) 20.5 cm (b) 21.5 cm (c) 22.5 cm (d) 23.5 cm.

39. Pookalam is the flower bed or flower pattern designed during Onam in Kerala. It is similar as Rangoli in North India and Kolam in Tamil Nadu. During the festival of Onam, your school is planning to conduct a Pookalam competition. Your friend who is a partner in competition, suggests two designs given below. Observe these carefully.



Design I: This design is made with a circle of radius 32cm leaving equilateral triangle ABC in the middle as shown in the given figure.

Design II: This Pookalam is made with 9 circular design each of radius 7cm.

Refer Design I:

- i. The side of equilateral triangle is
- ii. The altitude of the equilateral triangle is
- iii. Area of the remaining portion of the square ABCD is

## CHAPTER : SURFACE AREAS AND VOLUMES

CLASS : X

SUBJECT : MATHS

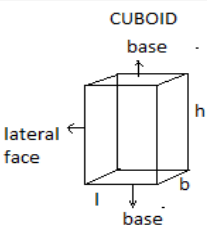
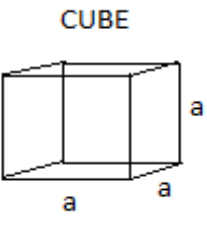
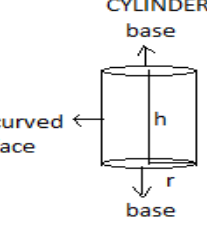
### GIST OF THE LESSON :

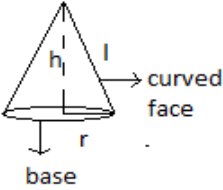
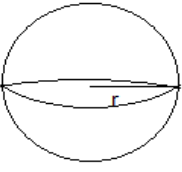
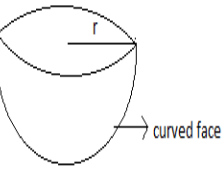
- 1). Introduction
- 2). Surface area and volumes of cuboid
- 3). Surface area and volumes of cube
- 4). Surface area and volumes of cylinder
- 5). Surface area and volumes of cone
- 6). Surface area and volumes of sphere
- 7). Surface area and volumes of hemisphere

### KEY POINTS :

- \*\* Surface area of a cuboid =  $2(lb + bh + hl)$
- \*\* Surface area of a cube =  $6a^2$
- \*\* Curved surface area of a cylinder =  $2\pi rh$
- \*\* Total surface area of a cylinder =  $2\pi r(r + h)$
- \*\* Curved surface area of a cone =  $\pi rl$
- \*\* Total surface area of a right circular cone =  $\pi rl + \pi r^2$ , i.e.,  $\pi r(l + r)$
- \*\* Surface area of a sphere of radius  $r = 4\pi r^2$
- \*\* Curved surface area of a hemisphere =  $2\pi r^2$
- \*\* Total surface area of a hemisphere =  $3\pi r^2$
- \*\* Volume of a cuboid =  $l \times b \times h$
- \*\* Volume of a cube =  $a^3$
- \*\* Volume of a cylinder =  $\pi r^2 h$
- \*\* Volume of a cone =  $\frac{1}{3}\pi r^2 h$
- \*\* Volume of a sphere of radius  $r = \frac{4}{3}\pi r^3$
- \*\* Volume of a hemisphere =  $\frac{2}{3}\pi r^3$

### FORMULA BASED ANALYSIS :

S.NO.	SHAPE	CSA	TSA	VOLUME	NOMENCLATURE
1		$2(lh+bh)$	$2(lb+lh+bh)$	$lbh$	$l = \text{Length}$ $b = \text{Breadth}$ $h = \text{Height}$
2		$4a^2$	$6a^2$	$a^3$	$a = \text{Length or side}$
3		$2\pi rh$	$2\pi r(r + h)$	$\pi r^2 h$	$r = \text{radius of base}$ $h = \text{height}$

4	<p style="text-align: center;"><b>CONE</b></p> 	$\pi r l$	$\pi r(r + l)$	$\frac{1}{3} \pi r^2 h$	$r =$ radius of base $h =$ height $l =$ slant height $l = \sqrt{r^2 + h^2}$
5	<p style="text-align: center;"><b>SPHERE</b></p> 	$4\pi r^2$	$4\pi r^2$	$\frac{4}{3} \pi r^3$	$r =$ radius
6	<p style="text-align: center;"><b>HEMISPHERE</b></p> 	$2\pi r^2$	$3\pi r^2$	$\frac{2}{3} \pi r^3$	$r =$ radius

**SHORT QUESTIONS BASED ON FORMULA :**

Q1. A right circular cone of radius 3 cm had a curved surface area of  $47.1 \text{ cm}^2$ . Find the volume of cone.

Q2. A metallic sphere of radius 4.2 cm is melted and recast into the shape of a cylinder of radius 6 cm.

Find the height of the cylinder.

Q3. A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm

and the height of the cone is equal to its radius. Find the volume of the solid in terms of  $\pi$ .

Q4. If a cone of height  $h$  and a sphere have same radii  $r$  and same volume, then find  $r : h$ .

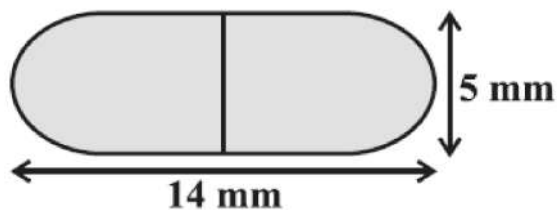
Q5. From a solid cube of side 7 cm, a conical cavity of height 7 cm and radius 3 cm is hollowed out.

Find the volume of the remaining solid.

**HOT AND CCT BASED FREQUENTLY ASKED QUESTIONS : (HOT QUESTIONS)**

Q1. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends.

The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm. Find its surface area.



Q2. A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the

cylindrical part are 2.1 m and 4 m respectively, and the slant height of the top is 2.8 m, find the area of the canvas used for making the tent. Also, find the cost of canvas of the tent at the rate of Rs.500/m<sup>2</sup>.

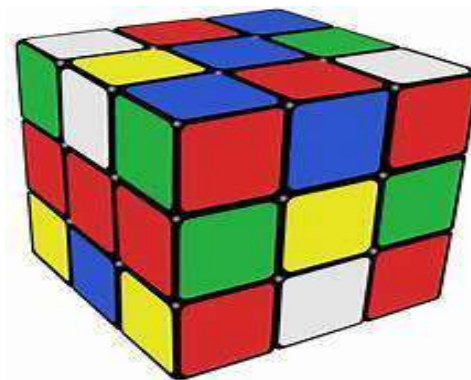
Q3. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid to the nearest cm<sup>2</sup>.

Q4. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the total surface area of the article.

Q5. Rachel, an engineering student, was asked to make a model shaped like a cylinder with two cones attached at its two ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model that Rachel made. (Assume the outer and inner dimensions of the model to be nearly the same.)

### **(CASE STUDY BASED QUESTIONS)**

On a Sunday, your Parents took you to a fair. You could see lot of toys displayed, and you wanted them to buy a RUBIK's cube and strawberry ice-cream for you. Observe the figures and answer the questions:



1. The length of the diagonal if each edge measures 6cm is

a)  $3\sqrt{3}$

b)  $3\sqrt{6}$

c)  $\sqrt{12}$

d)  $6\sqrt{3}$

2. Volume of the solid figure if the length of the edge is 7cm is-

- a) 256 cm<sup>3</sup>                                      b) 196 cm<sup>3</sup>                                      c) 343 cm<sup>3</sup>                                      d) 434 cm<sup>3</sup>

3. What is the curved surface area of hemisphere (ice cream) if the base radius is 7cm?

- a) 309 cm<sup>2</sup>                                      b) 308 cm<sup>2</sup>                                      c) 803 cm<sup>2</sup>                                      d) 903 cm<sup>2</sup>

4. Slant height of a cone if the radius is 7cm and the height is 24 cm \_\_\_\_

- a) 26cm                                      b) 25 cm                                      c) 52 cm                                      d) 62cm

5. The total surface area of cone with hemispherical ice cream is

- a) 858 cm<sup>2</sup>                                      b) 885 cm<sup>2</sup>                                      c) 588 cm<sup>2</sup>                                      d) 855 cm<sup>2</sup>

**TRICK WHICH HELP STUDENT IN MEMORIZATION :**

S.NO.	MEASUREMENT	PRISM SHAPED	PYRAMID SHAPED
1	Examples	Cube, Cuboid, Cylinder, Sphere,	Pyramid with various base, Cone
2	CSA	Perimeter of base X height	$\frac{1}{2}$ X Perimeter of base X Slant height
3	TSA	Perimeter of base X height + 2 X Area of base <b>Or</b> CSA + 2 X Area of base	Perimeter of base X height + Area of base <b>Or</b> CSA + Area of base
4	VOLUME	Area of base X height	$\frac{1}{3}$ X Area of base X height

TIPS:

1). Area X Rate = Cost

2). Density =  $\frac{Mass}{Volume}$

3). 1 m<sup>3</sup> = 1000 L

4). 1 m<sup>3</sup> = 1 kL

5). 1 L = 1000 cm<sup>3</sup>

6). Speed =  $\frac{Distance}{Time}$

7). 1 km = 1000 m = 10<sup>5</sup> cm

8). 1 km/hr =  $\frac{5}{18}$  m/s

9). 1 hectare = 10000 m<sup>2</sup>

**=0=0=0=0=0=0=0=====THANK YOU=====0=0=0=0=0=0=0=**

## CHAPTER 12

### SURFACE AREA AND VOLUME

#### Multiple Choice questions

- 2 cubes each of volume  $27\text{cm}^3$  are joined end to end Find the surface area of the resulting cuboid  
(a)  $90\text{cm}^2$  (b)  $120\text{cm}^2$  (c)  $216\text{cm}^2$  (d)  $80\text{cm}^2$
- A cylindrical pencil sharpened at one edge is the combination of  
(a) a cone and a cylinder (b) a hemisphere and a cylinder (c) two cylinders (d) a frustum
- The radius of a sphere in cm whose volume is  $12\pi\text{cm}^3$  is  
(a) 3 (b)  $3\sqrt{3}$  (c)  $3^{\frac{2}{3}}$  (d)  $3^{\frac{1}{3}}$
- A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to the radius The volume of solid is  
(a)  $\pi\text{cm}^3$  (b)  $2\pi\text{cm}^3$  (c)  $2\pi\text{cm}^3$  (d)  $1\text{cm}^2$

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

Mark the correct choice as

- (a) Both A and R are true and R is the correct explanation of A  
(b) Both A and R are true and R is not the correct explanation of A  
(c) A is true but R is false  
(d) A is false but R is true
- Assertion (A) If the volume of two spheres are in the ratio 64:27 then the ratio of their surface area is 4:3  
Reason (R) If the surface area of two spheres are in the ratio 16:9 the ratio of their volume is 64:27



## VERY SHORT ANSWERS

1. 2 cubes each of volume  $64 \text{ cm}^3$  are joined end to end. Find the surface area of the resulting cuboid
2. A toy is in the form of a cone of radius  $3.5 \text{ cm}$  mounted on a hemisphere of same radius. The total height of the toy is  $15.5 \text{ cm}$ . Find the total surface area of the toy.
3. A cubical block of side  $7 \text{ cm}$  is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have? Find the surface area of the solid.
4. A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to  $1 \text{ cm}$  and the height of the cone is equal to its radius. Find the volume of the solid in terms of  $\pi$ .

## SHORTS ANSWERS

1. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is  $14 \text{ mm}$  and the diameter of the capsule is  $5 \text{ mm}$ . Find its surface area.
2. A hemispherical depression is cut out from one face of a cubical wooden block such that the diameter  $l$  of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.
3. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are  $15 \text{ cm}$  by  $10 \text{ cm}$  by  $3.5 \text{ cm}$ . The radius of each of the depressions is  $0.5 \text{ cm}$  and the depth is  $1.4 \text{ cm}$ . Find the volume of wood in the entire stand.

## LONG ANSWERS

1. A wooden toy rocket is in the shape of a cone mounted on a cylinder. The height of the entire rocket is  $26 \text{ cm}$ , while the height of the conical part is  $6 \text{ cm}$ . The base of the conical portion has a diameter of  $5 \text{ cm}$ , while the base diameter of the cylindrical portion is  $3 \text{ cm}$ . If the conical portion is to be painted orange and the cylindrical portion yellow, find the area of the rocket painted with each of these colours.
2. A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are  $2.1 \text{ m}$  and  $4 \text{ m}$  respectively, and the slant height of the top is  $2.8 \text{ m}$ , find the area of the canvas used for making the tent. Also, find the cost of the canvas of the tent at the rate of Rs  $500$  per  $\text{m}^2$ .  
(Note that the base of the tent will not be covered with canvas.)
3. A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is  $2 \text{ cm}$  and the diameter of the base is  $4 \text{ cm}$ . Determine the volume of the toy. If a right circular cylinder circumscribes the toy, find the difference of the volumes of the cylinder and the toy.  
(Take  $\pi = 3.14$ )
4. A solid consisting of a right circular cone of height  $120 \text{ cm}$  and radius  $60 \text{ cm}$  standing on a hemisphere of radius  $60 \text{ cm}$  is placed upright in a right circular cylinder full of water such that it touches the bottom. Find the volume of water left in the cylinder, if the radius of the cylinder is  $60 \text{ cm}$  and its height is  $180 \text{ cm}$ .

**CLASS -X****SUBJECT : MATHS****CHAPTER: STATISTICS****MCQ(1 MARKS EACH)**

1.	Which of the following is not a measure of central tendency? A) Mean                                      B) Median C) Mode                                        D) Standard deviation	1														
2.	If the mean of frequency distribution is 7.5 and $\sum f_i x_i = 190 + k$ , $\sum f_i = 30$ , then k is equal to: a) 40                                      b) 55                                      c) 35                                      d) 50	1														
3.	The mode and mean is given by 20 and 8, respectively. Then the median is: (a) 12                                      (b) $13/3$ (c) 15                                      (d) 33	1														
4.	The class mark of a class interval is (a) upper limit + lower limit                                      (b) upper limit – lower limit (c) $\frac{1}{2}$ (upper limit + lower limit)                                      (d) $\frac{1}{2}$ (upper limit – lower limit)	1														
5.	The empirical relationship between the three measures of central tendency is (a) $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$ (b) $2 \text{ Median} = \text{Mode} + 2 \text{ Mean}$ (c) $3 \text{ Median} = \text{Mode} + \text{Mean}$ (d) $3 \text{ Median} = \text{Mode} - 2 \text{ Mean}$	1														
6.	If the mean of five observations is 20, and one of them is 24, what is the mean of the remaining four observations? A) 16                                      B) 18                                      C) 20                                      D) 22	1														
7.	The sum of deviations of a set of observations from their mean is always: A) Zero                                      B) Negative C) Positive                                      D) Undefined	1														
8.	The time, in seconds, taken by 150 athletes to run a 100 m hurdle race are tabulated below: <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="text-align: left;">Time (in seconds)</td> <td>13-14</td> <td>14-15</td> <td>15-16</td> <td>16-17</td> <td>17-18</td> <td>18-19</td> </tr> <tr> <td style="text-align: left;">No. of Athletes</td> <td>2</td> <td>4</td> <td>5</td> <td>71</td> <td>48</td> <td>20</td> </tr> </tbody> </table> <p>The number of athletes who completed the race in less than 17 seconds is (a) 11                                      (b) 71                                      (c) 82                                      (d) 68</p>	Time (in seconds)	13-14	14-15	15-16	16-17	17-18	18-19	No. of Athletes	2	4	5	71	48	20	1
Time (in seconds)	13-14	14-15	15-16	16-17	17-18	18-19										
No. of Athletes	2	4	5	71	48	20										
9.	In the following distribution of the heights of 60 students of a class <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="text-align: left;">HIEGHT (inch)</td> <td>150-155</td> <td>155-160</td> <td>160-165</td> <td>165-170</td> <td>170-175</td> <td>175-180</td> </tr> <tr> <td style="text-align: left;">No. Of Students</td> <td>15</td> <td>13</td> <td>10</td> <td>8</td> <td>9</td> <td>5</td> </tr> </tbody> </table> <p>The upper limit of modal class is</p>	HIEGHT (inch)	150-155	155-160	160-165	165-170	170-175	175-180	No. Of Students	15	13	10	8	9	5	1
HIEGHT (inch)	150-155	155-160	160-165	165-170	170-175	175-180										
No. Of Students	15	13	10	8	9	5										

	(a) 160	(b)315	(c) 155	(d)305													
10.	Which measure of central tendency is given by the x - coordinate of the point of intersection of the more than ogive and less than ogive? (a) mode (b) median (c) mean (d) all the above three measures				1												
<b>ASSERTION &amp; REASON TYPE QUESTION (1 MARK EACH)</b> Question number 11 and 12 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion(A) and the other is labelled as Reason (R). <b>Mark the correct choice as:</b> (a) Both Assertion (A) & Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A). (b) Both Assertion(A) & Reason(R) are true, but Reason(R) is not the correct explanation of Assertion(A). (c) Assertion (A) is true but Reason (R) is false. (d) Assertion (A) is false but Reason (R) is true.																	
11.	<b>Assertion:</b> the mode of the call received on 7 conjugative day 11,13,13, 17, 19, 23, 25 is 13. <b>Reason:</b> The mode is the value that appear most frequent.				1												
12.	<b>Assertion:</b> if the number of runs scored by 11 pair of player of a cricket team of India are 5, 19, 42, 11, 50, 30,21 0, 52, 36, 27 then median is 30 <b>Reason:</b> median is equal to $(\frac{n+1}{2})$ th value if an is ODD.				1												
<b>SHORT ANSWER TYPE QUESTION (2 MARKS EACH )</b>																	
13.	If the mode of 12, 16, 19, 16, x, 12, 16, 19, 12 is 16, then find the value of x .				2												
14.	Find the mean of the distribution:				2												
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Class interval</td> <td style="width: 12.5%;">1-3</td> <td style="width: 12.5%;">3-5</td> <td style="width: 12.5%;">5-7</td> <td style="width: 12.5%;">7-9</td> </tr> <tr> <td>Frequency</td> <td>9</td> <td>22</td> <td>27</td> <td>17</td> </tr> </table>					Class interval	1-3	3-5	5-7	7-9	Frequency	9	22	27	17		
Class interval	1-3	3-5	5-7	7-9													
Frequency	9	22	27	17													
15.	If $\sum f_i = 6$ & $\sum f_i x_i = 5p-7$ and mean = 8, then find value of p.				2												
16.	Find the mean of the following data from this table:				2												
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">X</td> <td style="width: 15%;">5</td> <td style="width: 15%;">10</td> <td style="width: 15%;">15</td> <td style="width: 15%;">20</td> <td style="width: 15%;">25</td> </tr> <tr> <td>f</td> <td>3</td> <td>8</td> <td>5</td> <td>3</td> <td>1</td> </tr> </table>					X	5	10	15	20	25	f	3	8	5	3	1
X	5	10	15	20	25												
f	3	8	5	3	1												
17.	If $\sum f_i x_i = 360$ & $\sum f_i = 12$ find mean and if mode is 48 then find it's median.				2												
18.	Find the mode of the following distribution:				2												
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Class interval</td> <td style="width: 10%;">10-20</td> <td style="width: 10%;">20-30</td> <td style="width: 10%;">30-40</td> <td style="width: 10%;">40-50</td> <td style="width: 10%;">50-60</td> </tr> <tr> <td>Frequency</td> <td>4</td> <td>12</td> <td>20</td> <td>8</td> <td>6</td> </tr> </table>					Class interval	10-20	20-30	30-40	40-50	50-60	Frequency	4	12	20	8	6
Class interval	10-20	20-30	30-40	40-50	50-60												
Frequency	4	12	20	8	6												
19.	If mean, mode and median of an observation is $6p -4$ , $4p+ 3$ , 25 respectively find value of p.				2												

20.	If the median of 12, 13, 16, $x + 2$ , $x + 4$ , 28, 30, 32 is 23, when $x + 2$ , $x + 4$ lie between 16 and 30, then find the value of $x$ .	2												
21.	Find the mode of the following frequency distribution: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>CLASS</td> <td>10-20</td> <td>20-30</td> <td>30-40</td> <td>40-50</td> <td>50-60</td> </tr> <tr> <td>FREQUENCY</td> <td>15</td> <td>10</td> <td>12</td> <td>17</td> <td>4</td> </tr> </table>	CLASS	10-20	20-30	30-40	40-50	50-60	FREQUENCY	15	10	12	17	4	22
CLASS	10-20	20-30	30-40	40-50	50-60									
FREQUENCY	15	10	12	17	4									
22.	Find the value of $y$ from the following observations if these are already arranged in ascending order. The Median is 63. 20, 24, 42, $y$ , $y + 2$ , 73, 75, 80, 99	2												

**SHORT ANSWER TYPE QUESTIONS (3 MARKS EACH)**

23.	The mean of the following distribution is 18. The frequency $f$ in the class interval 19-21 is missing. Determine $f$ . <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Class</td> <td>11-13</td> <td>13-15</td> <td>15-17</td> <td>17-19</td> <td>19-21</td> <td>21-23</td> <td>23-25</td> </tr> <tr> <td>Frequency</td> <td>3</td> <td>6</td> <td>9</td> <td>13</td> <td><math>f</math></td> <td>5</td> <td>4</td> </tr> </table>	Class	11-13	13-15	15-17	17-19	19-21	21-23	23-25	Frequency	3	6	9	13	$f$	5	4	3
Class	11-13	13-15	15-17	17-19	19-21	21-23	23-25											
Frequency	3	6	9	13	$f$	5	4											
24.	The mean of the following data is 27. Find the value of ' $p$ ' <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Classes</td> <td>0-10</td> <td>10-20</td> <td>20-30</td> <td>30-40</td> <td>40-50</td> </tr> <tr> <td>Frequency</td> <td>8</td> <td><math>p</math></td> <td>12</td> <td>13</td> <td>10</td> </tr> </table>	Classes	0-10	10-20	20-30	30-40	40-50	Frequency	8	$p$	12	13	10	3				
Classes	0-10	10-20	20-30	30-40	40-50													
Frequency	8	$p$	12	13	10													
25.	A survey conducted on 30 households in a locality by a group of students resulted in the following frequency table for the number of family members in a household: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Family size</td> <td>1-3</td> <td>3-5</td> <td>5-7</td> <td>7-9</td> <td>9-11</td> </tr> <tr> <td>No. of families</td> <td>7</td> <td>10</td> <td>5</td> <td>6</td> <td>2</td> </tr> </table> Find the mode of this data.	Family size	1-3	3-5	5-7	7-9	9-11	No. of families	7	10	5	6	2	3				
Family size	1-3	3-5	5-7	7-9	9-11													
No. of families	7	10	5	6	2													
26.	If the mean of the following data is 18.75, find the value of $p$ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td><math>X_i</math></td> <td>10</td> <td>15</td> <td><math>p</math></td> <td>25</td> <td>30</td> </tr> <tr> <td><math>F_i</math></td> <td>5</td> <td>10</td> <td>7</td> <td>8</td> <td>2</td> </tr> </table>	$X_i$	10	15	$p$	25	30	$F_i$	5	10	7	8	2	3				
$X_i$	10	15	$p$	25	30													
$F_i$	5	10	7	8	2													
27.	Find mean of following data using assumed mean method : <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Class</td> <td>0-5</td> <td>5-10</td> <td>10-15</td> <td>15-20</td> <td>20-25</td> </tr> <tr> <td>Frequency</td> <td>8</td> <td>7</td> <td>10</td> <td>13</td> <td>12</td> </tr> </table>	Class	0-5	5-10	10-15	15-20	20-25	Frequency	8	7	10	13	12	3				
Class	0-5	5-10	10-15	15-20	20-25													
Frequency	8	7	10	13	12													
28.	A class teacher has the following absentee record of 40 students of a class for The whole term. Find the mean number of days a students was absent. <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Number of days</td> <td>0-6</td> <td>6-12</td> <td>12-18</td> <td>18-24</td> <td>24-30</td> </tr> <tr> <td>No. of students</td> <td>8</td> <td>10</td> <td>14</td> <td>5</td> <td>3</td> </tr> </table>	Number of days	0-6	6-12	12-18	18-24	24-30	No. of students	8	10	14	5	3	3				
Number of days	0-6	6-12	12-18	18-24	24-30													
No. of students	8	10	14	5	3													

29. Data regarding heights of students of Class X of Model School, Dehradun is given below. Calculate the modal height of students of the class.

Height (in cm)	No. of students
150-156	4
156-162	7
162-168	15
168-174	8
174-180	6

30. Calculate the mean of the scores of 20 students in a mathematics test:

MARKS	10-20	20-30	30-40	40-50
NO. OF STUDENTS	4	7	6	1

31. Find the mode of the following frequency distribution:

Class	25-30	30-35	35-40	40-45	45-50	50-55
Frequency	25	35	50	42	38	14

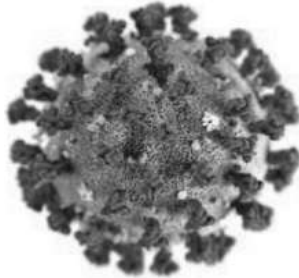
32. For what value of x, is the median of the following frequency distribution 34.5 ?

Class interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	3	5	11	10	x	3	2

**LONG ANSWER TYPE QUESTIONS (5 MARKS EACH)**

33. The median of the following data is 525. Find the values of x and y, if the total frequency is 100.

Class Interval	Frequency
0-100	2
100-200	5
200- 300	x
300- 400	12
400- 500	17
500- 600	20
600- 700	Y
700- 800	9
800- 900	7
900-1000	4

34.	<p>The mean of the following distribution is 18. The frequency/in the class interval 19-21 is missing. Determine f.</p>							5																
<b>Class</b>		11-13	13-15	15-17	17-19	19-21	21-23	23-25																
<b>Frequency</b>		3	6	9	13	f	5	4																
35.	<table border="1"> <tr> <td data-bbox="188 394 389 472"><b>Daily wages (in )</b></td> <td data-bbox="389 394 528 472">100-120</td> <td data-bbox="528 394 675 472">120-140</td> <td data-bbox="675 394 820 472">140-160</td> <td data-bbox="820 394 965 472">160-180</td> <td data-bbox="965 394 1110 472">180-200</td> <td data-bbox="1110 394 1256 472">200-220</td> <td data-bbox="1256 394 1369 472">220-240</td> </tr> <tr> <td data-bbox="188 472 389 555"><b>No. of workers</b></td> <td data-bbox="389 472 528 555">10</td> <td data-bbox="528 472 675 555">15</td> <td data-bbox="675 472 820 555">20</td> <td data-bbox="820 472 965 555">22</td> <td data-bbox="965 472 1110 555">18</td> <td data-bbox="1110 472 1256 555">12</td> <td data-bbox="1256 472 1369 555">13</td> </tr> </table> <p>Daily wages of 110 workers, obtained in a survey, are tabulated below:</p>							<b>Daily wages (in )</b>	100-120	120-140	140-160	160-180	180-200	200-220	220-240	<b>No. of workers</b>	10	15	20	22	18	12	13	5
<b>Daily wages (in )</b>	100-120	120-140	140-160	160-180	180-200	200-220	220-240																	
<b>No. of workers</b>	10	15	20	22	18	12	13																	
36.	<p>The mileage (km per litre) of 50 cars of the same model was tested by a manufacturer and details are tabulated as given below:</p>							5																
Mileage (km/ l)		10-12	12-14	14-16	16-18																			
No. of cars		7	k	18	13																			
<p>Find the value of k, Find the mean mileage. The manufacturer claimed that the mileage of model was 16 km/litre. do you agree with this claim.</p>																								
37.	<p>The following table gives the monthly consumption of 100 families:</p>							5																
<b>Monthly consumption (in units)</b>		130-140	140-150	150-160	160-170	170-180																		
<b>No. of families</b>		15	17	34	24	10																		
<p>Find the median of above data.</p>																								
38.	<p><b>CASE BASED STUDY QUESTIONS (38-39)</b>            Direct income in India was drastically impacted due to the COVID-19 lockdown. Most of the companies decided to bring down the salaries of the employees upto 50%.            The following table shows the salaries (in percent) received by 50 employees during lockdown.</p> <table border="1"> <tr> <td data-bbox="204 1339 568 1406">Salaries received (in %)</td> <td data-bbox="568 1339 655 1406">50-60</td> <td data-bbox="655 1339 743 1406">60-70</td> <td data-bbox="743 1339 831 1406">70-80</td> <td data-bbox="831 1339 919 1406">80-90</td> </tr> <tr> <td data-bbox="204 1406 568 1473">Number of employees</td> <td data-bbox="568 1406 655 1473">18</td> <td data-bbox="655 1406 743 1473">12</td> <td data-bbox="743 1406 831 1473">16</td> <td data-bbox="831 1406 919 1473">4</td> </tr> </table> <p>Based on the above information, answer the following questions.            (i) Total number of persons whose salary is reduced by more than 20% is            (a) 40 (b) 46            (c) 30 (d) 22            (ii) The modal class is            (a) 50-60 (b) 60-70            (c) 70-80 (d) 80-90            (iii) find modal salary received by employee.  <b>OR</b>            Find mean salary received by employee.</p> 							Salaries received (in %)	50-60	60-70	70-80	80-90	Number of employees	18	12	16	4	<p>1</p> <p>1</p> <p>2</p>						
Salaries received (in %)	50-60	60-70	70-80	80-90																				
Number of employees	18	12	16	4																				

39.

In a Vidyalaya there are two sections A and B. 39 students are there in section A and in section B there are 41 students. A periodic test was conducted to assess the performance of students thereafter analyze and plan the teaching learning process accordingly. The marks obtained out of 40 are given below in the table

Marks obtained by the students	Number of students
Less than 5	3
Less than 10	12
Less than 15	22
Less than 20	35
Less than 25	42
Less than 30	60
Less than 35	71
Less than or equal to 40	80

- (i) How many students have obtained more than or equal to 35 marks?  
(ii) Arrange the given data in class interval .  
(iii) find the median of the marks obtained.

**OR**

Find the mode of given data .

---

## CHAPTER 13

### CONTENT

1. The mean for grouped data can be found by

i. Direct Method  $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

ii. Assume mean method  $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$

iii. The step Deviation method  $\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

2. Mode for group data =  $l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$

3. median for group data =  $l + \left( \frac{\frac{n}{2} - cf}{f} \right) \times h$

4. The relation between mean , mode , median

$$3 \text{ Median} = 2 \text{ mean} + \text{mode}$$



# CHAPTER - PROBABILITY

## 1. GIST OF THE CHAPTER:

The theoretical probability (also called classical probability) of an event A, written as  $P(A)$ , is defined as

$$P(A) = \frac{\text{Number of outcomes favorable to A}}{\text{Number of all possible outcomes of the experiment}}$$

## COMPLEMENTARY EVENTS AND PROBABILITY

We denote the event 'not E' by  $\bar{E}$ . This is called the **complement** event of event E.

$$\text{So, } P(E) + P(\bar{E}) = 1$$

i.e.,  $P(E) + P(\bar{E}) = 1$ , which gives us  $P(\bar{E}) = 1 - P(E)$ .

- \* The probability of an event which is impossible to occur is 0. Such an event is called an impossible event.
- \* The probability of an event which is sure (or certain) to occur is 1. Such an event is called a sure event or a certain event.
- \* The probability of an event E is a number  $P(E)$  such that  $0 \leq P(E) \leq 1$
- \* An event having only one outcome is called an elementary event. The sum of the probabilities of all the elementary events of an experiment is 1.

## DECK OF CARDS AND PROBABILITY

A deck of playing cards consists of 52 cards which are divided into 4 suits of 13 cards each. They are black spades (♠) red hearts (♥), red diamonds (♦) and black clubs (♣).

The cards in each suit are Ace, King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3 and 2. Kings, Queens and Jacks are called face cards.



### **IMPORTANT QUESTIONS & SHORT QUESTIONS BASED ON FORMULA:**

1. Two dice are thrown together. Find the probability that the sum of the numbers on the top of the dice is (i) 9 (ii) 10
2. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting (a) red colour ace card (b) a face card or a spade card (c) a black face card
3. Two dice are thrown together. Find the probability that the product of the numbers on the top of the dice is (i) 6 (ii) 12 (iii) 7
4. A die is thrown twice. What is the probability that (i) 5 will not come up either time? (ii) 5 will come up at least once?
5. A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that (i) She will buy it ? (ii) She will not buy it ?
6. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting (i) a king of red color (ii) a face card (iii) a red face card (iv) the jack of hearts (v) a spade (vi) the queen of diamonds
7. Five cards—the ten, jack, queen, king and ace of diamonds, are well-shuffled with their face downwards. One card is then picked up at random.
  - (i) What is the probability that the card is the queen?
  - (ii) If the queen is drawn and put aside, what is the probability that the second card picked up is (a) an ace? (b) a queen?
8. 12 defective pens are accidentally mixed with 132 good ones. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.
9. A piggy bank contains hundred 50p coins, fifty Re 1 coins, twenty Rs 2 coins and ten Rs 5 coins. If it is equally likely that one of the coins will fall out when the bank is turned upside down, what is the probability that the coin (i) will be a 50 p coin ? (ii) will not be a Rs 5 coin?

### **HOTS AND CCT BASED QUESTION FREQUENTLY ASKED QUESTION:**

1. A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be
  - (i) red ?
  - (ii) white ?
  - (iii) not green?
2. (i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective?
  - (ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is not defective ?

3. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears

- (i) a two-digit number      (ii) a perfect square number      (iii) a number divisible by 5.

4. A carton consists of 100 shirts of which 88 are good, 8 have minor defects and 4 have major defects. Jimmy, a trader, will only accept the shirts which are good, but Sujatha, another trader, will only reject the shirts which have major defects. One shirt is drawn at random from the carton. What is the probability that (i) it is acceptable to Jimmy? (ii) it is acceptable to Sujatha?

5. Two customers are visiting a particular shop in the same week (Monday to Saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on (i) the same day? (ii) consecutive days? (iii) different days?

6. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is double that of a red ball, determine the number of blue balls in the bag.

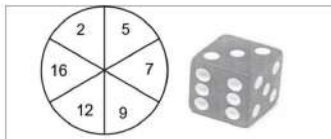
7. A box contains 12 balls out of which  $x$  are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball? If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find  $x$ .

8. A jar contains 24 marbles, some are green and others are blue. If a marble is drawn at random from the jar, the probability that it is green is  $\frac{2}{3}$ . Find the number of blue marbles in the jar.

### CASE STUDY 1

**Diwali Fest is an annual South Asian arts & culture festival produced by the Diwali Celebration Society. In the Diwali fest, a game is played with a fair spinner, shown above. The numbers on the spinner are 2, 5, 7, 9, 12, 16.**

**Sometimes the owner will invite a player who does not win with the spinner to throw the dice as a free bonus.**



**(a) What is the probability that a player will get a special prize because the spinner stops on a perfect square?**

**(b) If the player gets a chance to throw a dice, what is the probability of getting a multiple of 2 on the dice?**

### **CASE STUDY 2**

**On a weekend Rani was playing cards with her family. The deck has 52 cards. If her brother drew one card randomly.**



- 1. Find the probability of getting a king of red colour.**
- 2. Find the probability of getting a face card.**
- 3 Find the probability of getting a jack of hearts.**

### **CASE STUDY 3**

**Rahul and Ravi planned to play Business ( board game) in which they were supposed to use two dice.**



- 1.Ravi got first chance to roll the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 8?**
- 2.Rahul got next chance. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 13?**

**CHAPTER: 14**  
**PROBABILITY**

**MULTIPLE CHOICE QUESTION**

- Q.1. In a throw of a pair of dice, the probability of getting a doublet is:  
(a)  $1/3$                       (b)  $1/6$                       (c)  $5/12$                       (d)  $2/3$
- Q.2 Two unbiased dice are thrown. The probability that the total score is more than 5 is  
(a)  $1/8$                       (b)  $5/18$                       (c)  $7/18$                       (d)  $13/18$
- Q.3 If P (E) is 42% of an event, what is the probability of failure of their event?  
(a) 8%                      (b) 1                      (c) 0                      (d) 58%
- Q.4 If the probability of an event is p, then the probability of its complementary event will be:  
(a)  $1-p$                       (b)  $p-1$                       (c)  $1/p$                       (d)  $-1/p$
- Q.5. Find the probability of getting a king or queen card.  
(a)  $1/26$                       (b)  $2/13$                       (c)  $1/13$                       (d)  $3/26$
- Q.6. The probability that a non leap year selected at random will contain 53 Sundays is  
(a)  $1/7$                       (b)  $2/7$                       (c)  $3/7$                       (d)  $5/7$
- Q.7. The probability of getting a bad egg in a lot of 400 is 0.035. The number of bad eggs in the lot is  
(a) 7                      (b) 14                      (c) 21                      (d) 28
- Q.8. If two dice are thrown in the air, the probability of getting sum as 3 will be  
(a)  $2/18$                       (b)  $3/18$                       (c)  $1/18$                       (d)  $1/36$
- Q 9 . Ashmita and Shreya are sisters, what is the probability that both have birthday on 14th September (ignoring leap year)  
(a)  $1/30$                       (b)  $2/365$                       (c)  $1/366$                       (d)  $1/365$
- Q 10. The probability expressed as a percentage of a particular occurrence can never be  
(a) Anything but a whole number                      (b) greater than 1  
(c) Less than 1                      (d) Less than 100

**ASSERTION REASON BASED**

**(1 marks)**

In the following questions a statement of assertion (A) is followed by a statement of reason (R) mark the correct choice as :

- A) Both assertion (A) and reason(R)are true and reason is the correct explanation of Assertion(A)  
B) Both assertion and reason are true but reason is not the correct explanation of assertion (A)  
C) Assertion is true but reason is false  
D) Assertion is false but reason is true

Q1 **Assertion:** the probability of getting a prime number when a dice is thrown once is  $2/3$

**Reason:** Prime numbers on a dice are 2, 3, 5

- (a) A                      (b) B                      (c) C                      (d) D

Q2 **Assertion:** card numbered as 1, 2, 3.....15 in a box and mixed thoroughly one card is then drawn at random. The probability of drawing an even number is  $\frac{1}{2}$

**Reason:** for any event we have  $0 \leq P(E) \leq 1$

- (a) A                      (b) B                      (c) C                      (d) D

### Very Short Answer

(2 mark)

Q1. Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game?

Q2. What is the probability that an ordinary year has 53 Sundays?

Q3. In a lottery there are 10 prizes and 25 blanks. What is the probability of getting a prize?

Q4. A child has a die whose six faces show the letters as given below: A B C D E A the die is thrown once. What is the probability of getting        (i) A                      (ii) D

Q5. A game consists of tossing a one rupee coin 3 times and noting its outcome each time. Hanif wins if all the tosses give the same result i.e., three heads or three tails, and loses otherwise. Calculate the probability that Hanif will lose the game.

Q6. The probability of selecting a blue marble at random from a jar that contains only blue, black and green marbles is  $\frac{1}{5}$ . The probability of selecting a black marble at random from the same jar is  $\frac{1}{4}$ . If the jar contains 11 green marbles, find the total number of marbles in the jar?

Q7. A bag contains 15 white and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, find the number of black balls in the bag?

Q8. 15 cards numbered 1, 2, 3, 4... 14, 15 are put in a box and mixed thoroughly. A man draws a card at random from the box. Find the probability that the number on the card is

- a). a two-digit number                      b). a perfect square number

Q9. All cards of '10', an ace and queen cards are removed from a well shuffled deck of 52 cards and then one card is drawn randomly from the remaining cards. Find the probability of getting:

- (a) Neither a heart nor a king                      (b) neither an ace nor a king

Q10. Two dice are thrown together. Find the probability that the product of the numbers on the top of the dice is

- (i) 6    (ii) 12

### Short Answer II

(3 MARKS)

Q1. Two dice are numbered 1, 2, 3, 4, 5, 6 and 1, 1, 2, 2, 3, 3, respectively. They are thrown and the sum of the numbers on them is noted. Find the probability of getting each sum from 2 to 9 separately.

Q2. Two dice are thrown simultaneously. Find the probability of getting

- a). an even number on the first dice                      b). an odd number on first dice  
c). an even number as the sum

Q3. All cards of ace, jack and queen are removed from a deck of playing cards. One card is drawn at random from the remaining cards, find the probability that the card drawn

(a) neither a heart nor a king

(b) neither an ace nor a king

(c) neither a red card nor a queen card.

Q4. Two coins are tossed simultaneously. Find the probability of getting

i). at least one head

ii). at most one head

iii). exactly two head

Q5. A bag contains 5 red, 8 green and 7 white balls. One ball is drawn at random from the bag, find the probability of getting

A. a white ball or a green ball

B. neither green ball nor red ball.

C. not green?

Q6. : The probability of selecting a rotten apple randomly from a heap of 900 apples is 0.18.

What is the number of rotten apples in the heap?

Q7. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears

(i) a two-digit number

(ii) a perfect square number

(iii) a number divisible by 5.

Q8. A number  $x$  is selected at random from the numbers 1,2,3 and 4. Another number  $y$  is selected from the numbers 1,4,9, and 16. Find the probability that the product of  $x$  and  $y$  is less than 16.

Q9. A bag contains 12 balls out of which  $x$  are white.

(i) If one ball is drawn at random, what is the probability that it will be a white ball?

(ii) If 6 more white balls are put in the bag, the probability of drawing a white ball will be double that in case (i). Find  $x$

Q10. Tickets numbered 2, 3, 4, 5, .....100, 101 are placed in a box and mixed thoroughly. One ticket is drawn at random from the box. Find the probability that the number on the ticket is

a). a two-digit number

b). a perfect square number

c). a number divisible by 5.

## **CASE BASED QUESTIONS (2).**

### **CLAW CRANE MACHINE**

Q1. After the completion of Session Ending exams, Aman and Riya went to a play station with their parents. They played the game Claw Crane which consisted of 30 teddy bears, 15 elephant soft toys and 35 dolls. The Claw Crane was programmed such that every player gets a toy in each try. Aman and Riya both tried their luck one by one and moved the crane handle to pick up their favourite toy.



Based on this answer the following questions:

(i) If Aman was first to play the game, what is the probability that Aman picks out his favourite elephant toy. (1 mark)

(ii) If Riya plays the game after Aman's win, what is the probability of Riya picking up a Doll. (1 mark)

(iii) If Riya had got the first chance to play the game, what would be the probability of Riya picking up either a teddy bear or a doll. (2 mark)

OR

(iii) Both Riya and Aman won an elephant and a doll respectively in each of their individual trials. After this, they played the game again jointly. What is the probability of them not picking out an elephant or a doll in this trial. (2 mark)

### PIGGY BANK

Q2. Piggybank is normally used by children. Generally, piggy banks have openings besides the slot for inserting coins. We have to smash the piggy bank with a hammer or by other means, to get the money inside it. A child saves her money in her Piggy bank. One day she found that her Piggy Bank contains hundred 50 paisa coins, fifty 1 rupee coins, thirty 2 rupees coins, and twenty 5 rupees coins. If it is equally likely that one of the coins will fall out when the piggy bank is turned upside down.



Answer the following questions:

(i) Find the probability that the fallen coin is a 1 rupee coin. (1 mark)

(ii) Find the probability that the fallen coin is either a 1 or 2 rupees coin. (1 mark)

(iii) Find the probability that the fallen coin is a 10 rupee coin. (2 mark)

OR

(iii) If she sets aside all the 50 paisa coins, find the probability of drawing out a 5 rupee coin.

### Long Answer

(5 marks)

Q1. Two coins are tossed simultaneously. Find the probability of getting:

i) At least one head

ii). At most one head

iii). Exactly two head

iv). Exactly one head

v). No head



Q2. Five cards—the ten, jack, queen, king and ace of diamonds, are removed from the well-shuffled 52 playing cards. One card is then picked up at random. Find the probability of getting:

- (a) Neither a heart nor a king
- (b) neither an ace nor a king
- (c) neither a red card nor a queen card
- (d) a black card or an ace.
- (e) Either a heart or a spade card

Q3. Two dice are thrown simultaneously. Find the probability of getting:

- a). an even number on the first dice
- b). an odd number on first dice
- c). an even number as the sum
- d). a multiple of 5 as the sum
- e). a multiple of 7 as the sum

Q4. The probability of guessing the correct answer to a certain question is  $\frac{x}{12}$ . If the probability of guessing the wrong answer is  $\frac{3}{4}$ , find  $x$ . If a student copies the answer, then its probability is  $\frac{2}{6}$ . If he doesn't copy the answer, then the probability is  $\frac{2y}{3}$ . Find the value of  $y$ .

Q5. A bag contains only red, blue and green balls. Probability of selecting a red ball is  $\frac{1}{3}$ . Probability of selecting a green ball is  $\frac{1}{6}$ . If the bag contains 24 blue balls, what is the total number of the balls in the bag?