Government of Karnataka

District Administration and Zilla Panchayath

and

Deputy Director, Department of School Education

Kolar District, Kolar

2024-25

MATHEMATICS (81E)

GLANCE ME ONCE

Questions with AnswersAnswers

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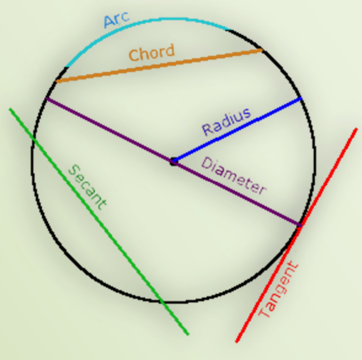
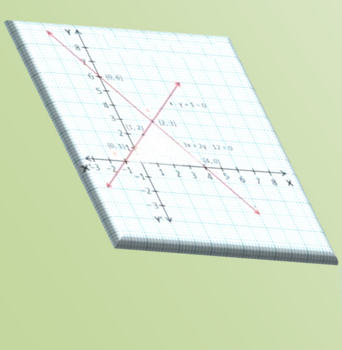
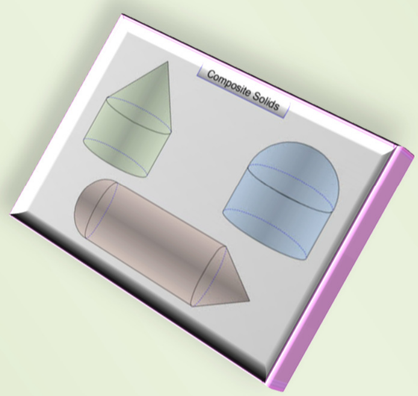






CONTENTS:

UNIT-1: REAL NUMBERS

Multiple Choice Questions	
1	If A and B are any two positive integers then HCF (A, B) x LCM (A, B) is equal to (A) $A + B$ (B) $A - B$ **(C)** $\boldsymbol{A \times B}$ (D) $A \div B$
2	Terminating decimal expansion among the following is (A)$\frac{2}{7}$ (B) $\frac{7}{15}$ **(C)** $\boldsymbol{\frac{11}{20}}$ (D) $\frac{22}{7}$
3	LCM of 18 and 45 is (A) 9 **(B) 90** (C) 63 (D)810
4	(7x11x13+13) is a (A) Prime number (B) **Composite number** (C) Complex number (D) Co-prime numbers
5	H.C.F. of 15 and 40 is **(A) 5** (B) 10 (C) 120 (D) 15
One Mark Questions	
1	What is the H.C.F. of two prime numbers? **Ans: 1 (one)**
2	Write the statement of the Fundamental Theorem of Arithmetic. **Every composite number can be expressed as a product of primes and this factorization is unique except for the order on which the prime factors occur.**
3	If HCF of 52 & 182 is 26, then find their LCM . We know, $H \times L = A \times B$ L = $\frac{52\times182}{26}$ => L = 364
4	Express 90 as the product of its prime factors $\boldsymbol{90 = 2 \times 3^2 \times 5}$

Two Marks Questions

1 Prove that $2-\sqrt{3}$ is an irrational number.

Proof : Let $2-\sqrt{3}$ is a rational number.

=>$2-\sqrt{3} = \frac{p}{q}$ where $q \neq 0$, $p, q \in Z$

$$2-\frac{p}{q}=\sqrt{3}$$

$$\frac{2q-p}{q}=\sqrt{3}$$

Rational number ≠ Irrational number

LHS ≠ RHS

Our assumption is wrong.

∴ $2-\sqrt{3}$ is an irrational number.

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

Proof : Let $5+\sqrt{2}$ is a rational number.

=>$5+\sqrt{2} = \frac{p}{q}$ where $q \neq 0$, $p, q \in Z$

$$\sqrt{2}=\frac{p}{q}-5$$

$$\sqrt{2}=\frac{p-5q}{q}$$

Irrational number ≠ Rational number

LHS ≠ RHS

Our assumption is wrong.

∴ $5+\sqrt{2}$ is an irrational number.

Three Marks Questions

1 Prove that $\sqrt{2}$ is an irrational number.

Proof: Let $\sqrt{2}$ be a rational number.

$\sqrt{2}=\frac{p}{q}$ where $q \neq 0$, p and $q$are co-prime

$\sqrt{2}\,q = p$ squaring on both sides

$2q^2 = p^2$ ……………(1)

∴ $p^2$is divisible by 2 and also$p$is divisible by 2 ………(2)

=>$p = 2r$ ………………. (3)

Substitute equation (3) in (1)

$$2q^2=(2r)^2$$

$$2q^2=(2r)^2$$

$$2q^2=4r^2$$

$$q^2=2r$$

∴ q^2 is divisible by 2 and also q is divisible by 2……..(4)

(2) and (4) => Both p and q have a common factor.

∴both p and q are not co-primes.

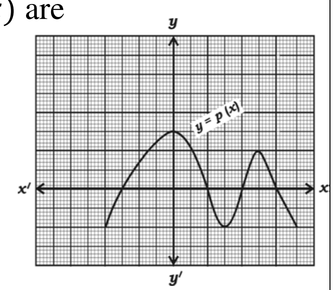
It is contradictory to our assumption.

∴ $\sqrt{2}$ is an irrational number.

UNIT – 2 : POLYNOMIALS

Multiple Choice Questions

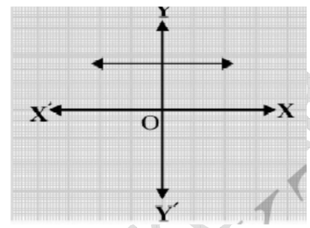
1 In the given graph, the number of zeroes of a polynomial $p(x)$ are



(A) 3 (B) 5

(C) 4 (D) 2

2 In the given graph, the number of zeros of a polynomial $p(x)$ are



(A) 0 (B) 1

(C) 3 (D) 2

3 The degree of the polynomial $g(x) = 4x^5 - 6x^3 + 2x^2 + 5$ is

(A) 3 **(B) 5** (C) 2 (D) 4

4 The degree of a linear polynomial is

(A) 0 **(B) 1** (C) 2 (D) 3

5 The sum of zeroes of a polynomial $p(x) = 3x^2 - 2x - 8$ is

(A) $\frac{3}{2}$ (B) $\frac{-2}{3}$ (C) $\frac{8}{3}$ **(D) $\frac{2}{3}$**

6 When the polynomial $3x^2 - 5x + 6$ is divided by $(x - 2)$, then the remainder is

(A) 8 (B) -8 (C) 3 (D) 2

7 The maximum number of zeroes that a quadratic equation can have is/are

(A) 3 (B) 1 (C) 0 **(D) 2**

8 Zero of the polynomial $5x + 7$ is

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

9 The product of the zeroes of the polynomial $p(x) = x^2 - 5x + 6$ is

(A) 6 (B) 30 (C) 5 (D)5

One Mark Questions

1 Find the sum of zeroes of $x^2 - 9$.

$a = 1,\ b = 0,\ c = -9.$

Sum of zeroes $= -\frac{b}{a} = -\frac{0}{1}$

$\therefore$ **Sum of zeroes $= 0$**

2 Find the zeroes of the polynomial $p(x) = x^2 - 3$.

$x^2 - 3 = 0$

$(x + \sqrt{3})(x - \sqrt{3}) = 0$

$\therefore \boldsymbol{x = -\sqrt{3}\ and\ x = +\sqrt{3}}$

Two Mark Questions

1 Find the quadratic polynomial having zeroes 5 and 3.

Let $\alpha = 5 \ and \ \beta = 3$

$\alpha + \beta = 8$

$$\alpha\beta = 15$$

The quadratic polynomial is of the form

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

$\therefore The \ polynomial \ is \ x^2 - 8x + 15$

2 Find the zeroes of the polynomial $x^2 - 2x - 15$.

$x^2 - 2x - 15 = x^2 - 5x + 3x - 15$

$$= x(x-5) + 3(x-5)$$

$$= (x-5)(x+3)$$

$zero \ of \ x - 5 \ is \ 5$ and

$and \ zero \ of \ x + 3 \ is - 3$

$\therefore zeroes \ of \ x^2 - 2x - 15 \ are \ 5 \ and - 3$

3 Find the quadratic polynomial if, sum and product of its zeroes are -5 and 4 respectively.

Let $\alpha \ and \ \beta$ be the zeroes of the polynomial

Given,
$\alpha + \beta = -5$

$$\alpha\beta = 4$$

The quadratic polynomial is of the form
$x^2 - (\alpha + \beta)x + \alpha\beta$
$=> x^2 - (-5)x + 4$

$\therefore The \ polynomial \ is \ x^2 + 5x + 4$

4 If $\alpha \ and \ \beta$ are the zeroes of the quadratic polynomial $p(x) = ax^2 + bx + c$, then evaluate $\alpha^2\beta + \alpha\beta^2$.

We know, $\alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{c}{a}$

$$\alpha^2\beta + \alpha\beta^2 = \alpha\beta(\alpha + \beta)$$

$$= \frac{c}{a}\left(-\frac{b}{a}\right)$$

$$\therefore \alpha^2\beta + \alpha\beta^2 = -\frac{bc}{a^2}$$

Three Mark Questions

1 Find the quadratic polynomial whose sum and product of zeroes are $2 + \sqrt{3}$ and $2 - \sqrt{3}$ respectively.

Let $\alpha = 2 + \sqrt{3}$ and $\beta = 2 - \sqrt{3}$.

$$\alpha + \beta = 2 + \sqrt{3} + 2 - \sqrt{3}$$

$$\therefore \alpha + \beta = 4$$

$\alpha\beta = \left(2 + \sqrt{3}\right)\left(2 - \sqrt{3}\right)$

$$= 2^2 - \left(\sqrt{3}\right)^2$$

$$= 4 - 3$$

$$\therefore \alpha\beta = 1$$

The quadratic polynomial is of the form

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

$\therefore The \ polynomial \ is \ x^2 - 4x + 1$

UNIT-3: PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Multiple Choice Questions

1. A pair of linear equations $a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$is said to be inconsistent if
   (A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ **(B)** $\boldsymbol{\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}}$ (C)$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (D) $\frac{a_1}{a_2} = \frac{c_2}{c_1}$

2. If two lines representing the pair of linear equations $a_1x + b_1y + c_1 = 0 and\ a_2x + b_2y + c_2 = 0$ intersect at a point, then the correct relation among the following is
   (A) $\boldsymbol{\frac{a_1}{a_2} \neq \frac{b_1}{b_2}}$ (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (C)$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ (D)$\frac{a_1}{a_2} = \frac{b_2}{b_1}$

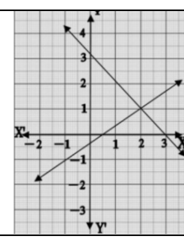
3. The lines representing the pair of linear equations $2x + 3y - 9 = 0\ and\ 4x + 6y - 18 = 0$ are
   (A) intersecting lines (B) perpendicular lines
   (C) parallel lines **(D) coincident lines**

4. The Pair of linear equations $x + 2y = 6\ and\ 3x - 6y = 18$ have
   (A) No solution (B) Infinitely many solutions
   (C) Exactly one solution (D) Two solutions

One Mark Questions

1. The graph represents the pair of linear equations in $'x'$ and $'y'$.
   Write the solution for this pair of equations.

Ans : $\boldsymbol{x = 2\ and\ y = 1}$



2. Write the general form of pair of linear equations in two variables *'x' and 'y'*

$\boldsymbol{a_1x + b_1y + c_1 = 0\ and\ a_2x + b_2y + c_2 = 0}$, where $a_1, b_{1,}, c_{1,} a_2, b_2$ and $c_2$are all real numbers.

3. In the pair of linear equations $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, then write the number of solutions these equations have.

Ans: Infinitely many solutions.

Two Marks Questions

1. Solve the following pair of linear equations by any of the algebraic method: $x + y = 8\ and\ 2x - y = 7$

$$\begin{array}{l} x+y=8 \\ 2x-y=7 \\ \hline 3x\quad =15 \end{array} \quad \text{(addition)}$$
$$x=5$$

Substituting the value of x in $x + y = 8$

$5 + y = 8$

$y = 3$

$\therefore \boldsymbol{x = 5\ and y = 3}$

2. Solve by elimination method: $x + y = 5$ and $2x + 3y = 12$

$x + y = 5$ ----- (1)

$2x + 3y = 12$ ----- (2)

Multiplying the equation (1) by 2 we get

$2x + 2y = 10$ ————— (3)

Solving equation (2) and (3)

$$\begin{array}{l} 2x+3y=12 \\ 2x+2y=10 \\ \hline y = 2 \end{array} \quad \text{(subtraction)}$$

Substitute the value of y in$x + y = 5$, we get$x = 3$

$\therefore \boldsymbol{x = 3\ and y = 2}$

Three or Four Marks Questions.

1.The cost of 5 oranges and 3 apples is Rs.35 and the cost of 2 oranges and 4 apples is Rs. 28. Find the cost of an orange and an apple.

Let the cost of an orange and an apple be x *and* y respectively. =>$5x + 3y = 35$ and

$$2x + 4y = 28$$

$(5x + 3y = 35)$ x 4 => $20x + 12y = 140$

$(2x + 4y = 28)$ x 3 => $6x + 12y = \quad 84$

Multiply the equation (1) by 4 and equation (2) by 3 we get,

$$\begin{array}{r} 20x+12y=140 \\ 6x+12y=84 \\ \hline 14x = 56 \\ x=4 \end{array}$$ (subtraction)

Substituting the value of x in $5x + 3y = 35$

$$5x + 3y = 35$$
$$20 + 3y = 35$$
$$3y = 15$$
$$y = 5$$

$\therefore$ ***The cost of an orange is* Rs. 4 *and That of an apple is* Rs. 5.**

2. Solve: $141x + 93y = 189$ and

$$93x + 141y = 45$$

$141x + 93y = 189$ ------ (1)

$93x + 141y = 45$ ------ (2)

By adding (1) and (2) we get

$$\begin{array}{r} 141x+93y=189 \\ 93x+141y=45 \\ \hline 234x+234y=234 \\ x+y=1 \end{array}$$ $x+y = 1$ ----- (3)

By subtracting (1) by (2) we get

$$\begin{array}{r} 141x+93y=189 \\ 93x+141y=45 \\ \hline 48x-48y=144 \\ x-y=3 \end{array}$$ $x- y = 3$ ---- (4)

Solving (3) and (4)

$$\begin{array}{r} x+y=1 \\ x-y=3 \\ \hline 2x = 4 \\ x=2 \end{array}$$

By substituting the value of x in (3) or (4) we get $y = -1$

$$\therefore \boldsymbol{x = 2 \text{ and } y = -1}$$

3. The sum of two numbers is 50 and their difference is 22, find the numbers.

Let the two numbers be x *and* y.

According to the data

$x + y = 50$ ------ (1)

$x - y = 22$ ------ (2)

Solving (1) and (2)

$$\begin{array}{r} x+y=50 \\ x-y=22 \\ \hline 2x = 72 \\ x=36 \end{array}$$ (addition)

By Substituting the value of x in (1) we get

$$x + y = 50$$
$$36 + y = 50$$
$$y = 14$$

$\therefore$ ***The two numbers are* 36 *and* 14.**

4. If twice the age of the son is added to age of the father the sum is 56. But if twice the age of the father is added to the age of the son, then the sum is 82. Find the ages of the father and the son.

Let the age of son be *'x'* years and
the age of father be *'y'* years

$2x + y = 56$ ------ (1)

$x + 2y = 82$ ------ (2)

Multiply the equation (2) by 2 we get

$2x + 4y = 164$ ---- (3)

Solving (1) and (3)
$$\begin{array}{r} 2x+4y=164 \\ 2x + y= 56 \\ \hline 3y=108 \\ y=36 \end{array}$$

By substituting the value of y in (1) we get x=10

$\therefore$ **The age of the son and the age of father are 10 years and 36 years respectively.**

5) 4 men and 6 boys can finish a piece of work in 5 days, while 3 men and 4 boys can finish the same work in 7 days. Find the time taken by one man alone or then by 1 boy alone.

Number of days taken by 1 man = x days.
Number of days taken by 1 boy = y days.
Work done by 1 man in 1 day = $\frac{1}{x}$
Work done by 1 boy in 1 day = $\frac{1}{y}$

$$\frac{4}{x}+\frac{6}{y}=\frac{1}{5} \text{ ----- (1) ; } \frac{3}{x}+\frac{4}{y}=\frac{1}{7} \text{ ----- (2)}$$

Take $\frac{1}{x}=a$, $\frac{1}{y}=b$, then (1) and (2) becomes

$4a + 6b = \frac{1}{5}$ $\quad 20a + 30b = 1$ ----- (3)

$3a + 4b = \frac{1}{7}$ $\quad 21a + 28b = 1$ ----- (4)

By solving (3) and (4) we get $x = 35, y = 70$

∴ One man will take 35 days and One boy will take 70 days to finish the work.

6) Ritu can row, down-stream 20 km in 2 hours, and upstream 4 km in 2 hours. Find her speed of rowing in still water and the speed of the current.

Let the speed of Ritu in still water be = x km/h.
Speed of current be y km/h.
The speed of downstream = $(x + y)$ km/h.
The speed of upstream = $(x - y)$ km/h

$$\text{Time} = \frac{\text{distance}}{\text{speed}}$$

$t_1 = \frac{20}{(x+y)} = 2 \quad 2x + 2y = 20$ ---(1)

$t_2 = \frac{4}{(x-y)} = 2 \Rightarrow 2x - 2y = 4$ --- (2)

$$\begin{array}{r} 2x + 2y = 20 \\ 2x - 2y = 4 \\ \hline 4x \quad = 24 \end{array}$$

$\Rightarrow x = 6$

Considering $2x + 2y = 20$
$2(6) + 2y = 20 \Rightarrow \quad y = 4$

∴ The speed of Ritu in still water = 6 km/hr

and the speed of the stream = 4 km/hr.

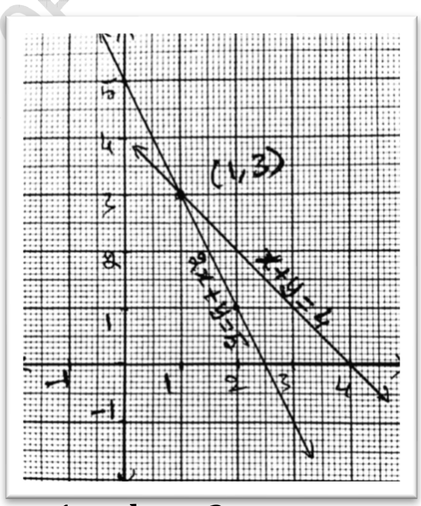
7) Solve graphically:
$2x + y = 5 \quad and \quad x + y = 4.$

$2x + y = 5$
$y = 5 - 2x$

x	0	1	2
y	5	3	1

$x + y = 4$
$y = 4 - x$

x	1	2	3
y	3	2	1



∴ x = 1 and y = 3

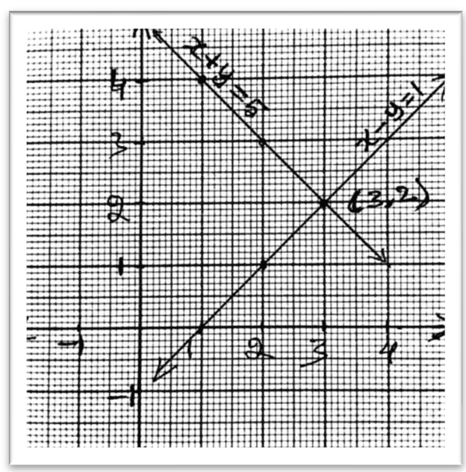
8) Solve graphically:
$x + y = 5 \; and \; x - y = 1$

$x + y = 5$
$y = 5 - x$

x	1	2	3
y	4	3	2

$x - y = 1$
$y = x - 1$

x	1	2	3
y	0	1	2



∴ x = 3 and y = 2

UNIT-4 : QUADRATIC EQUATIONS

Multiple Choice Questions

1 The value of the discriminant of a quadratic equation is 3. Then the nature of its roots is

(A) Real and Distinct (B) Real and equal
(C) There is no any root (D) Imaginary numbers

2 The standard form of quadratic equation is

(A) $ax^2 - bx + c = 0$ **(B)** $\boldsymbol{ax^2 + bx + c = 0}$
(C) $ax^2 - bx - c = 0$ (D) $ax^2 + bx - c = 0$

3 The quadratic equation whose roots are -1 and 2 is

(A) $\boldsymbol{x^2 - x - 2 = 0}$ (B) $x^2 - x + 2 = 0$
(C) $x^2 + x - 2 = 0$ (D) $x^2 + x + 2 = 0$

4 The standard form of the quadratic equation $x(x + 1) = 30$ is

(A) $x^2 - x = 30$ **(B)** $\boldsymbol{x^2 + x - 30 = 0}$ (C) $x^2 - x - 30 = 0$ (D) $x^2 - x = 30$

5 "Sum of the squares of two consecutive odd numbers is 130." Mathematical form of this statement is

(A) $x^2 + (x + 1)^2 = 130$ (B) $x^2 + (2x)^2 = 130$ **(C)** $\boldsymbol{x^2+(x+2)^2=130}$ (D) $(x + 2x)^2 = 130$

6 If the roots of $ax^2 + bx + c = 0$ are equal, then the correct relation among the following is

$(\boldsymbol{A})\ \boldsymbol{\frac{b}{2a} = \frac{2c}{b}}$ (B) $b^2 + 4ac = 0$ (C) $\frac{b}{2a} = \frac{b}{2c}$ (D) a = b

One Mark Questions

1 Write the standard form of a quadratic equation. **Ans:** $\boldsymbol{ax^2 + bx + c = 0, \text{ where } a \neq 0}$

2 Find the discriminant of the quadratic equation $x^2 + 2x + 1 = 0$

$b^2 - 4ac = 2^2 - 4(1)(1)$
$= 4 - 4$
$\therefore \boldsymbol{b^2 - 4ac = 0}$

3 Find the roots of the quadratic equation $x^2 - 25 = 0$

$x^2 = 25$
$x = \sqrt{25}$
$\therefore \boldsymbol{x = \pm 5}$

4 Write the discriminant of the quadratic equation $ax^2 + bx + c = 0$

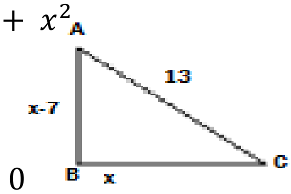
Ans: $\boldsymbol{b^2 - 4ac}$

5 Write the formula to find the roots of the quadratic equation $ax^2 + bx + c = 0$

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

Two Marks Questions

1	Solve the quadratic equation $x^2 + 7x + 12 = 0$ by Factorization method $x^2 + 3x + 4x + 12 = 0$ $x(x+3) + 4(x+3) = 0$ $(x+3)(x+4) = 0$ $x + 3 = 0 \ or \ x + 4 = 0$ $x = -3 \ or \ x = -4$	2	Solve the quadratic equation $x^2 + x - 6 = 0$ by Factorization method $x^2 + 3x - 2x - 6 = 0$ $x(x+3) - 2(x+3) = 0$ $(x+3)(x-2) = 0$ $x + 3 = 0 \ or \ x - 2 = 0$ $x = -3 \ or \ x = 2$
3	Solve the quadratic equation $2x^2 - 15x + 18 = 0$ by Factorization method $2x^2 - 12x - 3x + 18 = 0$ $2x(x-6) - 3(x-6) = 0$ $(x-6)(2x-3) = 0$ $x - 6 = 0 \ or \ 2x - 3 = 0$ $x = 6 \ or \ x = \frac{3}{2}$	4	Solve the quadratic equation $3x^2 - x - 14 = 0$ by Factorization method $3x^2 + 6x - 7x - 14 = 0$ $3x(x+2) - 7(x+2) = 0$ $(x+2)(3x-7) = 0$ $x + 2 = 0 \ or \ 3x - 7 = 0$ $x = -2 \ \ or \ x = \frac{7}{3}$
5	Solve $2x^2 - 5x + 3 = 0$ by using the quadratic formula. $a = 2, \quad b = -5, \quad c = 3$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(3)}}{2(2)}$ $x = \frac{5 \pm \sqrt{25 - 24}}{4}$ $x = \frac{5 \pm 1}{4}$ $x = \frac{5+1}{4} \text{or} \frac{5-1}{4}$ $\boldsymbol{x = \frac{3}{2} \ or \ x = 1}$	6	Solve $x^2 + 2x + 4 = 0$ by using the quadratic formula. $a = 1, \quad b = 2, \quad c = 4$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(4)}}{2(1)}$ $x = \frac{-2 \pm \sqrt{4 - 16}}{2}$ $x = \frac{-2 \pm \sqrt{-12}}{2}$ $x = \frac{-2 \pm \sqrt{4(-3)}}{2}$ $x = \frac{2(-1 \pm \sqrt{-3})}{2}$ $\boldsymbol{x} = (\boldsymbol{-1 + \sqrt{-3}})$ or $\boldsymbol{x} = (\boldsymbol{-1 - \sqrt{-3}})$

7	Find the nature of the roots of the equation $4x^2 - 12x + 9 = 0$ $a = 4, \quad b = -12, \quad c = 9$ $b^2 - 4ac = (-12)^2 - 4(4)(9)$ $= 144 - 144$ $b^2 - 4ac = 0$ $\therefore$**Roots are Real and Equal**	8	Find the nature of the roots of the equation $x^2 + 2x - 15 = 0$ $a = 1, \quad b = 2, \quad c = -15$ $b^2 - 4ac = (2)^2 - 4(1)(-15)$ $= 4 + 60$ $= 64$ $Here \ b^2 - 4ac > 0$ $\therefore$ **Roots are Real and Distinct**
9	Find the nature of the roots of the equation $x^2 - x + 12 = 0$ $a = 1, \quad b = -1, \quad c = 12$ $b^2 - 4ac = (-1)^2 - 4(1)(12)$ $= 1 - 48 \quad = -47$ $Here \ b^2 - 4ac < 0$ $\therefore$**The equation has no real roots.**	10	Find the value of 'k' if the quadratic equation $x^2 - kx + 4 = 0$ has equal roots. $a = 1, \quad b = -k, \quad c = 4$ Given; Roots are Equal $\therefore b^2 - 4ac = 0$ $(-k)^2 - 4(1)(4) = 0$ $k^2 - 16 = 0$ $k^2 = 16$ $k = \pm\sqrt{16} \quad \therefore \boldsymbol{k = \pm 4}$
Three Marks Questions			
1	A girl is twice as old as her sister. Four years hence, the product of their ages (in years) will be 160. Find their present ages. Let the present age of sister be 'x' years and girls present age be '$2x$' years Product of their ages 4 years hence = $(x + 4)(2x + 4)$ $\therefore (x + 4)(2x + 4) = 160$ $2x^2 + 12x - 144 = 0$ $x^2 + 6x - 72 = 0$ $x^2 + 12x - 6x - 72 = 0$ $x(x + 12) - 6(x + 12) = 0$ $x = -12 \ or \ x = 6$ Age cannot be negative =>$x = 6$ $\therefore$ **Girl's present age is 12 years and present age of her sister is 6 years**	2	The altitude of a right triangle is 7 cm less than its base. If the hypotenuse is 13 cm. find the other two sides. Let the base is 'x'cm and altitude is $(x - 7)$ cm and hypotenuse is 13 cm By Pythagoras theorem. $13^2 = (x - 7)^2 + x^2$ $169 = x^2 + 49 - 14x + x^2$  $2x^2 - 14x - 120 = 0$ $x^2 - 7x - 60 = 0$ $x^2 - 12x + 5x - 60 = 0$ $x(x - 12) + 5(x - 12) = 0$ $x - 12 = 0 \quad or \ x + 5 = 0$ $x = 12 \quad or \ x = -5$ **Base is 12 cm and Altitude is 5 cm**

3 The difference of squares of two positive numbers is 180. The square of small number is 8 times the big number. Find the numbers.

Let the bigger number be x and smaller be y

Given $x^2 - y^2 = 180$ and $y^2 = 8x$

$\therefore x^2 - 8x = 180$

$x^2 - 8x - 180 = 0$

$x^2 - 18x + 10x - 180 = 0$

$x(x - 18) + 10(x - 18) = 0$

$(x - 18)(x + 10) = 0$

$=> x = 18 \ or \ x = -10$

$y^2 = 8(18) \ => y^2 = 144 \ \therefore y = 12$

∴The numbers are 18 and 12

4 The sum of the squares of two consecutive positive integers is 13. Find the numbers.

Let the numbers be $x \ and \ (x + 1)$

$x^2 + (x + 1)^2 = 13$

$x^2 + x^2 + 1 + 2x = 13$

$2x^2 + 2x - 12 = 0$

$x^2 + x - 6 = 0$

$x^2 + 3x - 2x - 6 = 0$

$x(x + 3) - 2(x + 3) = 0$

$(x + 3) = 0 \ or \ (x - 2) = 0$

$x = -3 \ or \ x = 2$

The other number $= x + 1 = 3$

∴The numbers are 2 and 3

Four Marks Questions

1 A person on tour has Rs 4200 for his expenses. If he extends his tour for 3 days, he has to cut down his daily expenses by Rs 70. Find the original duration of the tour.

original duration of the tour be 'x' days.

Given, $\frac{4200}{x} - \frac{4200}{x+3}$=70

4200$\left(\frac{1}{x} - \frac{1}{x+3}\right) = 70$

$$\frac{(x + 3) - x}{x(x + 3)} = \frac{70}{4200}$$

$x(x + 3) = 180$

$x^2 + 3x - 180 = 0$

$x^2 + 15x - 12x - 180 = 0$

$(x + 15)(x - 12) = 0$

$x + 15 = 0 \ or \ x - 12 = 0$

$x = -15 \ or \ x = 12$

number of days can't be negative

$=> x = 12$

∴Original duration of the tour is 12 days.

2 A motor boat whose speed in still water is 18km/hr, takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream.

Let the speed of the stream be $x \ km/hr$

Speed of the boat in upstream =*(18-x) km/hr*

Speed of the boat downstream =*(18+x) km/hr*

$$Speed = \frac{distance}{time}$$

The time taken to go upstream = $\frac{24}{18-x}$ and the time taken to go downstream = $\frac{24}{18+x}$

Given,$\frac{24}{18-x} - \frac{24}{18+x} = 1$

$\frac{24(18+x) - 24(18-x)}{(18-x)(18+x)}$=1

$24(18 + x) - 24(18 - x) = (18 - x)(18 + x)$

$x^2 + 48x - 324 = 0$

$x^2 + 54x - 6x - 324 = 0$

$x(x + 54) - 6(x + 54) = 0$

$(x + 54)(x - 6) = 0$

$x = -54 \ or \ x = 6$ speed can't be negative

∴The speed of the stream is 6km/hr

UNIT-5: ARITHMETIC PROGRESSION

Multiple Choice Questions

1. The n[th] term of an arithmetic progression with first term 'a' and common difference 'd', is
   (A) $a_n=a+(n-1)d$ (B) $a_n=a-(n-1)d$ (C) $a_n=a-(n+1)d$ (D) $a_n=a+(n+1)d$

2. In an arithmetic progression, if the first term is 'a' and the common difference is 'd' , then the sum of its first 'n' terms is
   (A)$S_n=\frac{2}{n}[a+(n-1)d]$ (B)$S_n=2[a+(n-1)d]$
   (C)$S_n=\frac{n}{2}[a+(n-1)d]$ **(D)$S_n=\frac{n}{2}[2a+(n-1)d]$**

3. If a_1, a_2, a_3, a_4, ... are in arithmetic progression, then the common difference is
   (A) a_2-a_1 (B) a_1-a_2 (C) a_2-a_3 (D) a_3-a_4

4. The common difference of the arithmetic progression,3,7,11,15, …. . is
   (A) -4 (B) 3 **(C) 4** (D) 5

5. An arithmetic progression among the following is
   (A) 3,5,7,10, . . (B) 3,5,6,9,. . (C) -2,-1,0,3, . . **(D) 4,7,10,13, . .**

6. If the n[th] term of an arithmetic progression is 3n-2, then its 9[th] term is
   (A) 15 **(B) 25** (C) 29 (D) 11

7. If the terms $4, x, 10$ are in arithmetic progression, then the value of 'x' is
   (A) 6 **(B) 7** (C) 8 (D) 9

8. The 25[th] term of an arithmetic progression, 3,8,13,18, …… is
   (A) 25 **(B) 123** (C) 128 (D) 80

9. The sum of the first 30 odd natural numbers is
   (A) 300 (B) 600 (C) 150 **(D) 900**

10. The sum of 5+10+15+20+……………………… to 10 terms is
   (A) 50 (B) 75 (C) 100 **(D) 275**

One Mark Questions

1. Write the formula to find the sum of first 'n' terms of an arithmetic progression with the first term 'a' and the last term a_n.

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

2. Write the formula to find the sum of first 'n' terms of an arithmetic progression whose the first term is 'a' and the common difference is 'd'.

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

3. If the common difference of an arithmetic progression is 3, then find the value of a_7-a_2.

$a_7-a_2=a+6d-(a+d)$
$=a+6d-a-d = 5d = 5(3) = 15$ $\therefore a_7-a_2 = \mathbf{15}$

Two Marks Questions

1. If the first and the last term of an A.P are 4 and 40 respectively. Find the sum of first 20 terms.

$a=4, \quad l=40, \quad n=20$

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

$S_{20}=\frac{20}{2}(4+40) = 10\text{x}44=440$

$\therefore \mathbf{S_{20} = 440}$

2. Find the 12th term of an A.P, 2, 5, 8, 11, . . using formula

$a=2, \quad d=5-2=3, \quad n=12$

$a_n=a+(n-1)d$

$a_{12}=2+(12-1)3$

$= 2+33 = 35$

$\therefore \mathbf{a_{12} = 35}$

3. Find the sum of first 20 terms of the arithmetic series 2+7+12+……………… using the formula.

$a=2, \quad d=5, \quad n=20$

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

$S_{20}=\frac{20}{2}[2(2)+(20-1)(5)]$

$= 10[4+95]$

$= 10[99] = 990 \quad \therefore \mathbf{S_{20} = 990}$

4. Find the 10th term from last (towards the first term) of the A.P, 4, 7, 10, 13, . . . 64.

From last term, the A.P becomes

64, . . . 13,10,7,4.

$a=64 \quad d= 10-13= -3, n=10$

$a_n=a+(n-1)d$

$a_{10}=64+(10-1)(-3)$

$= 64-27$

$= 37 \quad \therefore \mathbf{a_{10} = 37}$

5. Examine, whether 92 is a term of the A.P., 2, 5, 8, 11, . .

$a=2 \quad d= 5-2= 3$

Let $a_n=92$

$a_n=a+(n-1)d$

$92=2+(n-1)3 \qquad = 2+3n-3 \quad 3n= 93 \qquad n= 31$

Since n is a whole number, 92 is a term of the A.P 2,5,8,11, . .

Three Marks questions

1. The interior angles of a quadrilateral are in A.P. The smallest among them is 15^0. Find the measure of remaining angles.

Let the angles be $a-3d, a-d, a+d, a+3d$.

By the angle sum property of quadrilateral

$(a-3d)+(a-d)+(a+d)+(a+3d) = 360°$

$4a = 360° \quad => a = 90°$

Substituting the value of "a" in a-3d =15

$90° - 3d = 15°$

$=> d = 25°$

The measure of remaining angles 65^0, 115^0 and 165^0

2. In an A.P., the 3rd term is 3 and the 5th term is −11. Find its 50th term.

$a_3=3, a_5 = -11 \quad a_{50} = ?$

$a+2d= 3$

$a+4d= -11$ *(subtraction)*

$-2d= 14 \quad => \quad d= -7$

Substituting the value of "d" in a+2d= 3

$a+2(-7) =3 \quad => \quad a=17$

$a_n=a+(n-1)d$

$a_{50}=17+(50-1)(-7)$

$\mathbf{a_{50} = -326}$

Four or Five Marks Questions

1. In an A.P, the sum of 3^{rd} and 6^{th} term is 28 and the sum of 4^{th} and 8^{th} term is 34. Find the A.P.

According to the data

$a_3 + a_6 = 28$

$a+2d+a+5d=28$

$2a+7d=28$ ---------- (1)

$a_4 + a_8 = 34$

$a+3d+a+7d=34$

$2a+10d=34$ ---------- (2)

solving (1) and (2)

$2a+7d=28$

$2a+10d=34$ *(subtraction)*

$-3d = -6 \Rightarrow d=2$

Substituting the value of *"d"* in

$a + 5d = 17$

$a = 7$

A.P. is 7, 9, 11, 13, ...

2. A sum of Rs. 1600 is to be used to give ten cash prizes to the students of a school for their overall academic performances. If each prize is Rs 20 less than its preceding prize, find the value of each of the prizes.

Here, $n = 10, d = -20.$

Let the amounts of the prizes be

$a, a-20, a-40, \ldots\ldots, a-180$

$a + a-20 + a-40 + \ldots\ldots + a-180 = 1600$

$a = a,\ l = a-180,\ S_n=1600,\ n=10$

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

$S_{10} = \frac{10}{2}[a + a - 180]$

$1600 = 5(2a - 180)$

$2a - 180 = 320 \quad \Rightarrow a = 250$

Value of each prize is 250,230,210, ------------70

3. The 4^{th} term of an A.P is 14 and 8^{th} term is 8 less than twice the 5^{th} term. Find the sum of first 25 terms of the A.P.

$a_4=14,\ a_8=2a_5 - 8,\ S_{25}=?$

$a + 3d = 14$ ------ (1)

$a + 7d = 2(a + 4d) - 8$

$a + d = 8$ -------- (2)

solving (1) and (2)

$a+3d=14$

$a+d = 8$

$2d=6$

$d=3$

By substituting the value of "d" in $a + d = 8$ we get

$a = 5$

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

$S_{25} = \frac{25}{2}[2x5 + (25-1)3]$

$= \frac{25}{2}[10+72] \quad \therefore \mathbf{S_{25} = 1025}$

4. The sum of three terms of an A.P is 18 and the sum of the squares of extremes is 104. Find the A.P and the sum of first 40 terms.

Let the three terms be $a-d, a, a+d$

$(a-d) + (a) + (a+d) = 18$

$3a = 18 \quad \mathbf{a = 6}$

$(a-d)^2 + (a+d)^2 = 104$

$a^2+d^2-2ad+a^2+d^2+2ad = 104$

$2a^2+2d^2 = 104$

$a^2+d^2 = 52$

$6^2+d^2=52 \quad \mathbf{d = \pm 4}$

Let $d = 4$, then t**he A.P is 2,6,10, . . .**

$a = 2, d = 4, n = 40, S_n = ?$

Sum of 40 terms is $S_n = \frac{n}{2}[2a + (n-1)d]$

$S_{40} = \frac{40}{2}[2x2 + (40-1)4]$

$\therefore \mathbf{S_{40} = 3200}$

UNIT-6: TRIANGLES

Multiple Choice Questions

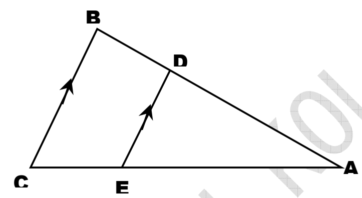
1. A pole of height 10m casts a shadow of length 4m on the ground. At the same time the length of the shadow cast by a building of height 50m is

   (A) 20m (B) 10m (C) 25m (D) 30m

2. In the given figure, DE ∥ BC, then $\frac{AD}{DB} =$

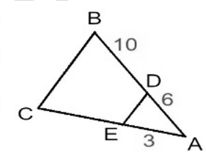
   (A) $\frac{BD}{AD}$ (B) $\frac{BC}{DE}$

   (C) $\frac{CE}{AE}$ **(D)** $\boldsymbol{\frac{AE}{EC}}$



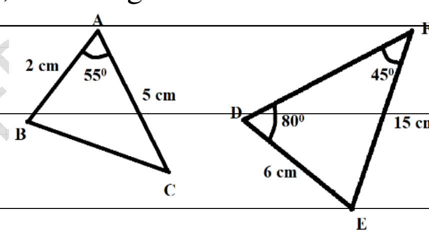
3. In the adjoining figure, in ΔABC, DE∥BC, if AD = 6cm, BD = 10cm and AE=3cm then CE is

   (A) 5 (B) 3 (C) 6 (D) 10



4. In the adjoining figure, similarity criterion used to say that, the triangles are similar is

(A) S.S.S. **(B) S.A.S.** (C) A.A.A. (D) A.S.A



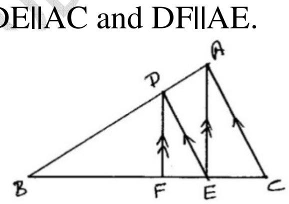
One Mark questions

1. Write the statement of Basic proportionality (Thales) theorem.

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

Three marks questions

1. In the adjoining figure, DE∥AC and DF∥AE. Prove that $\frac{BF}{FE} = \frac{BE}{EC}$



In ΔBEA, DF∥AE

$\frac{BF}{FE} = \frac{BD}{DA}$------(1)

In ΔBCA, DE∥AC

$\frac{BE}{EC} = \frac{BD}{DA}$------(2)

From equation (1) and (2)

$\frac{BF}{FE} = \frac{BE}{EC}$

∴ **Hence the proof.**

2. In the adjoining figure, AP and BQ are perpendiculars on AB. prove that $\frac{AO}{PO} = \frac{BO}{QO}$.

In ΔAOP and ΔBOQ

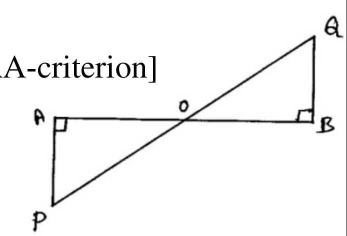
$\angle OAP = \angle OBQ = 90^0$ [Given]

$\angle AOP = \angle BOQ$ [Vertically opposite angles]

∴ ΔAOP~ΔBOQ [By AA-criterion]

$\frac{AO}{BO} = \frac{PO}{QO}$

∴ $\frac{AO}{PO} = \frac{BO}{QO}$



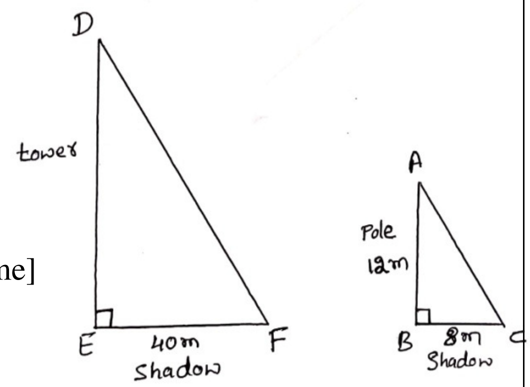
3. A vertical pole of height 12m casts a shadow of length 8m on the plane ground. At the same time a tower casts a shadow of length 40m on the plane ground. Find the height of the tower.

Length of the vertical pole = AB = 12m

Length of the shadow casts by the pole = BC = 8m

Length of the shadow casts by the tower = EF = 40m

Let the height of the tower = h m



$In\ \Delta ABC and\ \Delta DEF$

$\angle B = \angle E = 90^0$

$\angle C = \angle F$ [The angles made by sun at the same time]

$\therefore \Delta ABC \sim \Delta DEF$ [By AA-criterion of similarity]

$$\frac{AB}{DE} = \frac{BC}{EF}$$

$$\frac{12}{h} = \frac{8}{40} \qquad \frac{12\times40}{8} = h$$

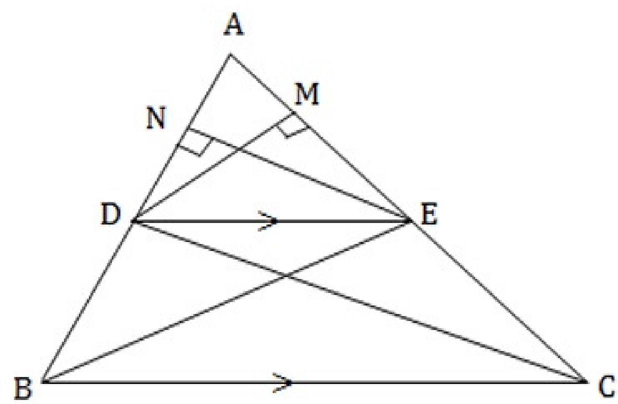
$$h = 60$$

∴ **Height of the tower = 60m.**

Four or Five marks questions: -

1. State and prove the Basic proportionality (Thales') theorem.

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



Data : In ΔABC $DE \parallel BC$.

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

Construction : Draw $DM \perp AC$ and $EN \perp AB$. Join BE and CD .

Proof :

$$\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} \quad (\because \text{Area of } \Delta = \frac{1}{2} \times \text{base} \times \text{height})$$

$$\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{AD}{DB} \quad \text{---------->} (1)$$

$$\frac{ar(\Delta ADE)}{ar(\Delta CED)} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} \quad (\because \text{Area of } \Delta = \frac{1}{2} \times \text{base} \times \text{height})$$

$$\frac{ar(\Delta ADE)}{ar(\Delta CED)} = \frac{AE}{EC} \quad \text{---------->} (2)$$

But ΔBDE and ΔCED are standing on the same base DE and between $DE \parallel BC$.

$ar(\Delta BDE) = ar(\Delta CED)$ ----------> (3)

$\therefore$ from equations (1), (2) and (3)

$$\frac{AD}{DB} = \frac{AE}{EC}$$

Hence the proof.

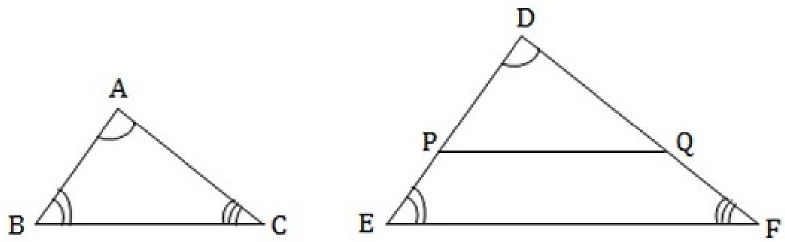
2 Prove that "If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio (proportion) and hence the two triangles are similar".

Data: In ΔABC and ΔDEF

$\angle A = \angle D$

$\angle B = \angle E$

$\angle C = \angle F$



To prove: $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

Construction: Mark points P and Q on DE and DF such that DP=AB and DQ=AC. Join PQ.

Proof: In ΔABC and ΔDPQ

$\angle A = \angle D$ [Data]

AB=DP [Construction]

AC=DQ [Construction]

$\therefore \Delta ABC \cong \Delta DPQ$ [SAS postulate]

BC=PQ [By CPCT] -----(1)

$\angle B = \angle P$ [By CPCT]

$\angle B = \angle E$ [Data]

$\angle P = \angle E$ [Axiom 1]

$PQ || EF$

$\frac{DP}{DE} = \frac{PQ}{EF} = \frac{DQ}{DF}$ [Corollary of BPT]

$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ [From (1) and construction]

$\therefore$ **Hence the proof.**

UNIT-7: CO ORDINATE GEOMETRY

Multiple Choice Questions

1. The co-ordinates of the mid-point of the line segment joining the points (2,0) and (6,0) is

   (A) (2,4) (B) (2,6) **(C) (4,0)** (D) (0,4)

2. The distance of point (4, -3) from the origin

   (A) 4 $units$ **(B) 5 $units$** (C) 9 $units$ (D) 16 $units$

3. The perpendicular distance of the point P (2, 3) from the x-axis is

   (A) 1 unit (B) 2 units **(C) 3 units** (D) 5 units

4. The Coordinates of the origin is

   (A) (1,1) **(B) (0,0)** (C) (0,1) (D) (1,0)

5. The coordinates of a point P on the x-axis are of the form

   (A) $(x, 0)$ (B) $(0, y)$ (C) $(y, 0)$ (D) $(0, x)$

6. If M (6, 3) is the midpoint of line joining P (-2, 5) and Q (8, y) then y =

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

7. Distance of the point $P(x, y)$ from the origin is

   (A) $\sqrt{(x-y)^2}$ (B) $\sqrt{x^2 - y^2}$ **(C) $\sqrt{x^2 + y^2}$** (D) $\sqrt{(x+y)^2}$

One Mark Questions

1. What is the value of the *y*-coordinate of a point on *x*-axis? **Ans: 0**

2. Write the coordinates of the origin.
   OR
   Write the coordinates of the point of intersection of *x-axis* and *y-axis*. **Ans: (0,0)**

3. Write the coordinates of the midpoint of a line segment joining the points $P\ (x_1, y_1)$ and $Q(x_2, y_2)$.

   Ans: $P(x, y) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

4. Find the distance of the point (3, 4) from the origin.

   Distance from the origin $d = \sqrt{x^2 + y^2}$

   $d = \sqrt{3^2 + 4^2}$

   $\Rightarrow d = \sqrt{9 + 16}$

   $\Rightarrow d = \sqrt{25}$

   $\therefore$ **$d = 5$ units.**

5. Find the co-ordinates of the midpoint of the line segment joining the points (0, 8) and (4, 0).

   $P(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

   $P(x, y) = \left(\frac{0+4}{2}, \frac{8+0}{2}\right)$

   $P(x, y) = \left(\frac{4}{2}, \frac{8}{2}\right)$

   $\boldsymbol{P(x, y) = (2, 4)}$

Two Marks Questions

1 Find the distance between the points (3,2) and (-5,8).

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(-5-3)^2 + (8-2)^2}$

$= \sqrt{(-8)^2 + (6)^2}$

$= \sqrt{(64 + 36)}$

$= \sqrt{100}$ $\therefore$ $\boldsymbol{d = 10}$ **units**

2 If the distance between the points $(4, p)$ *and* $(1, 0)$ is 5 units, find the value of 'p' $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$5 = \sqrt{(1-4)^2 + (0-p)^2}$ [Squaring on both sides]

$25 = (-3)^2 + p^2$

$25 = 9 + p^2$

$25 - 9 = p^2$

$16 = p^2$

$\therefore \boldsymbol{p = \pm 4}$

3 Find the coordinates of the midpoint of the line segment joining the points $(2, 3)$ and $(4, 7)$.

$Midpoint\ P(x, y) = \left(\frac{x_1 + x_2}{2}, \quad \frac{y_1 + y_2}{2}\right)$

$= \left(\frac{2+4}{2}, \quad \frac{3+7}{2}\right)$

$= \left(\frac{6}{2}, \quad \frac{10}{2}\right)$

$\therefore \boldsymbol{Midpoint\ P(x, y) = (3, 5)}$

4 Find the radius of the circle whose center is $(3, 2)$ and if the circle passes through $(-5, 6)$.

Radius is the distance between center and any point on the circle.

$\therefore$ Radius of the circle $=$ d

$= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(-5-3)^2 + (6-2)^2}$

$= \sqrt{(-8)^2 + (4)^2}$

$= \sqrt{80}$ $\therefore$ **Radius of circle** $= \boldsymbol{4\sqrt{5}}$ **units**

Three Marks Questions

1 Find the co-ordinates of the point which divides the line segment joining the point (1,6) and (4,3) in the ratio 1:2.

$P(x, y) = \left[\frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}, \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}\right]$

$= \left[\frac{(1)(4)+2(1)}{1+2}, \frac{(1)(3)+(2)(6)}{1+2}\right]$

$= \left[\frac{4+2}{3}, \frac{3+12}{3}\right]$

$= \left[\frac{6}{3}, \frac{15}{3}\right]$

$\therefore \boldsymbol{P(x, y) = (2, 5)}$

2	In what ratio does the point $(-4, 6)$ divide the line segment joining the points $(-6, 10)$ and $(3, -8)$? $\therefore$ P(x,y) = $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$ $(-4, 6)$ = $\left(\frac{3m_1-6m_2}{m_1+m_2}, \frac{-8m_1+10m_2}{m_1+m_2}\right)$ =>$-4 = \frac{3m_1-6m_2}{m_1+m_2}$ and $6 = \frac{-8m_1+10m_2}{m_1+m_2}$ Consider, $-4 = \frac{3m_1-6m_2}{m_1+m_2}$ $-4m_1 - 4m_2 = 3m_1 - 6m_2$ $2m_2 = 7m_1$ => $\frac{m_1}{m_2} = \frac{2}{7}$ $\therefore$ $\boldsymbol{m_1 : m_2}$**= 2 : 7**
3	Find the value of 'p'if the point A(0, 2) is equidistant from $(3, p)$ and $(p, 3)$. Let$B(3, p)$ and $C(p, 3)$ Given AB = AC $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\sqrt{(0-3)^2 + (2-p)^2} = \sqrt{(p-0)^2 + (3-2)^2}$ $(0-3)^2 + (2-p)^2 = (p-0)^2 + (3-2)^2$[squaring on both sides] $9 + 4 + p^2 - 4p = p^2 + 1$ $13 - 4p = 1$ $-4p = 1 - 13$ $-4p = -12$ $\therefore \boldsymbol{p = 3}$

Four Marks Questions	
1	Show that the points K(4, 5), L(7, 6), M(6, 3) and N(3, 2) are the vertices of a rhombus. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ K(4, 5), L(7, 6) KL = $\sqrt{(7-4)^2 + (6-5)^2} = \sqrt{(3)^2 + (1)^2} = \sqrt{9+1} = \sqrt{10}$ units. L(7, 6), M(6, 3) LM = $\sqrt{(6-7)^2 + (3-6)^2} = \sqrt{(-1)^2 + (-3)^2} = \sqrt{1+9} = \sqrt{10}$ units. M(6, 3), N(3, 2) MN = $\sqrt{(3-6)^2 + (2-3)^2} = \sqrt{(-3)^2 + (-1)^2} = \sqrt{9+1} = \sqrt{10}$ units. N(3, 2), K(4, 5) NK = $\sqrt{(3-4)^2 + (2-5)^2} = \sqrt{(-1)^2 + (-3)^2} = \sqrt{1+9} = \sqrt{10}$ units. KL = LM = MN = NK Here all sides are equal. **∴ K, L, M and N are the vertices of a Rhombus.**

UNIT-8 : INTRODUCTION TO TRIGONOMETRY

Multiple Choice Questions

1. If $sin\theta = \frac{12}{13}$, then the value of $cosec\ \theta$ is

   (A) $\frac{5}{12}$ (B) $\frac{5}{13}$ **(C) $\mathbf{\frac{13}{12}}$** (D) $\frac{12}{13}$

2. The value of $tan 45^o$ is

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

3. If $2cos\theta = 1$ and θ is an acute angle then the value of θ is

   (A) 0° (B) 30° (C) 45° **(D) 60°**

4. If $cos\theta = \frac{1}{2}$, then the value of $tan\theta$ is

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

5. $\frac{\sin A}{cosA}$ is equal to

   (A) $\sec A$ (B) $\text{cosec}\, A$ **(C) $\tan A$** (D) $\cot A$

6. $(1 + cos\theta)\,(1 - cos\theta) =$

   (A) $sin^2\theta$ (B) $tan^2\theta$ (C) $\text{cosec}^2 A$ (D) $\sec^2 A$

One Mark Questions

1. Find the value of $(1 + tan^2\theta).\,cos^2\theta$.

   $(1 + tan^2\theta).\,cos^2\theta = \sec^2\theta \times \frac{1}{sec^2\theta}$

   $= \mathbf{1}$

2. If $sinA = \frac{1}{2}$ where A is an acute angle then find the value of A.

   $sinA = \mathbf{\frac{1}{2}}$

   $sinA = \sin 30^o \Rightarrow \mathbf{A = 30^o}$

Two Marks Questions

3. Show that $(tanA\,.\,sinA) + cosA = secA$

   $LHS = \left(\frac{sinA}{cosA} \times sinA\right) + \cos A$

   $= \frac{sin^2 A}{\cos A} + cosA$

   $= \frac{sin^2 A + cos^2 A}{\cos A} = \frac{1}{\cos A}$

   $= \sec A$

4. If $A=60^0$, $B=30^0$ then show that $cos(A + B) = cosA.cosB - sinA.sinB$

   $cos(A + B) = cosA.cosB - sinA.sinB$

   $cos(60^o + 30^o) = cos60^o.cos30^o - sin\,60^o.sin\,30^o$

   $cos\,90° = \frac{1}{2} \times \frac{\sqrt{3}}{2} - \frac{\sqrt{3}}{2} \times \frac{1}{2}$

   $0 = 0$

Three Marks Questions

1	Show that, $\frac{\sin\theta}{1-\cos\theta} = cosec\theta + \cot\theta$ L.H.S = $\frac{\sin\theta}{1-\cos\theta}$ $= \frac{\sin\theta}{1-\cos\theta} \times \frac{1+\cos\theta}{1+\cos\theta}$ $= \frac{\sin\theta\ (1+\cos\theta)}{1-\cos^2\theta}$ $= \frac{\sin\theta\ (1+\cos\theta)}{\sin^2\theta}$ $= \frac{(1+\cos\theta)}{\sin\theta}$ $= \frac{1}{\sin\theta} + \frac{\cos\theta}{\sin\theta}$ $= cosec\theta + \cot\theta$ = RHS	2	Show that, $\frac{1+\cot^2 A}{1+\tan^2 A} = \cot^2 A.$ LHS $= \frac{1+\cot^2 A}{1+\tan^2 A}$ $= \frac{cosec^2 A}{\sec^2 A}$ $= \frac{\frac{1}{\sin^2 A}}{\frac{1}{\cos^2 A}}$ $= \frac{1}{\sin^2 A} \times \frac{\cos^2 A}{1}$ $= \frac{\cos^2 A}{\sin^2 A}$ $= \cot^2 A$ RHS
3	Prove that $\frac{\cos\theta - 2\cos^3\theta}{2\sin^3\theta - \sin\theta} = \cot\theta$ L.H.S = $\frac{\cos\theta - 2\cos^3\theta}{2\sin^3\theta - \sin\theta}$ $= \frac{\cos\theta\ (1 - 2\cos^2\theta)}{\sin\theta (2\sin^2\theta - 1)}$ $= \frac{\cos\theta\ (1 - \cos^2\theta - \cos^2\theta)}{\sin\theta (\sin^2\theta + \sin^2\theta - 1)}$ $= \frac{\cos\theta\ (\sin^2\theta - \cos^2\theta)}{\sin\theta (\sin^2\theta - \cos^2\theta)}$ $= \frac{\cos\theta}{\sin\theta}$ $= \cot\theta$ $= R.H.S$	4	If $\sin\theta = \frac{1}{2}$, then show that $3\cos\theta - 4\cos^3\theta = 0.$ *Given,* $\sin\theta = \frac{1}{2}$ $\sin\theta = \sin 30^0$ $=> \theta = 30^0$ $LHS = 3\cos\theta - 4\cos^3\theta$ $= 3\cos 30^0 - 4\cos^3 30^0$ $= 3\left(\frac{\sqrt{3}}{2}\right) - 4\left(\frac{\sqrt{3}}{2}\right)^3$ $= 3\left(\frac{\sqrt{3}}{2}\right) - 4\left(\frac{3\sqrt{3}}{8}\right)$ $= 3\left(\frac{\sqrt{3}}{2}\right) - 3\left(\frac{\sqrt{3}}{2}\right)$ $= 0$ *R.H.S*

5	Prove that $\sqrt{\frac{1+sinA}{1-sinA}} = secA + tanA$. LHS $= \sqrt{\frac{1+sinA}{1-sinA}}$ $= \sqrt{\frac{1+sinA}{1-sinA}} \text{x} \sqrt{\frac{1+sinA}{1+sinA}}$ $= \sqrt{\frac{(1+sinA)(1+sinA)}{(1-sinA)(1+sinA)}}$ $= \sqrt{\frac{(1+sinA)^2}{1-sin^2A}}$ $= \sqrt{\frac{(1+sinA)^2}{cos^2A}}$ $= \frac{1+sin\text{A}}{\text{cosA}}$ $= \frac{1}{\text{cosA}} + \frac{sin\text{A}}{\text{cosA}}$ $= secA + tanA$ $= RHS$	6	Prove that $\frac{sin\,\theta}{1+\cos\theta} + \frac{1+cos\theta}{sin\theta} = 2\,cosec\,\theta$. LHS$= \frac{sin\theta}{1+cos\theta} + \frac{1+cos\theta}{sin\theta}$ $= \frac{sin^2\theta + (1+cos\theta)^2}{(1+cos\theta)sin\theta}$ $= \frac{sin^2\theta + 1^2 + cos^2\theta + 2cos\theta}{(1+cos\theta)sin\theta}$ $= \frac{1+1+2cos\theta}{(1+cos\theta)sin\theta}$ $= \frac{2+2cos\theta}{(1+cos\theta)sin\theta}$ $= \frac{2(1+cos\theta)}{(1+cos\theta)sin\theta}$ $= \frac{2}{sin\theta}$ $= 2\,cosec\theta$ $= RHS$

UNIT-9 : SOME APPLICATIONS OF TRIGONOMETRY

Two Marks Questions

1 The top of a building is observed from a point on the ground $100\sqrt{3}ft.$ away from its base. If the angle of elevation is 30^0, then find the height of the building.

Let A be the point of observation and C be the top of the building.

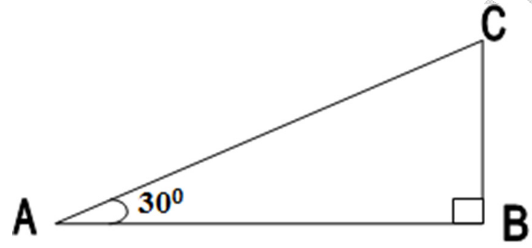
Then AB=$100\sqrt{3}ft$ and $\angle A = 30^0$

$$tanA = \frac{BC}{AB}$$

$$tan30^0 = \frac{BC}{100\sqrt{3}}$$

$$\frac{1}{\sqrt{3}} = \frac{BC}{100\sqrt{3}}$$

=> BC= 100m



∴ **height of the building is 100ft**.

2 A kite flying at a height of $50\sqrt{3}m$ above the ground is tied to a point on the ground by a thread of 100m length without any slack. Find the angle formed by the thread with the ground.

Let P be the point on the ground where thread is tied and
R be the position of kite.

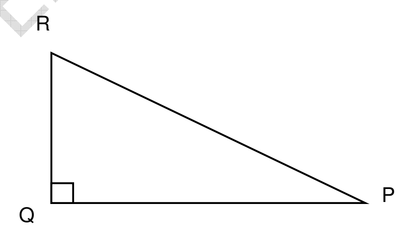
Then QR=$50\sqrt{3}m$ and PR= 100m

$$sinP = \frac{QR}{PR}$$

$$sinP = \frac{50\sqrt{3}}{100}$$

$$sinP = \frac{\sqrt{3}}{2}$$

=> $\angle P = 60^0$



∴**Thread makes an angle of 60^0 with the ground.**

3 In an amusement park, there is a slide of height $6m$, which is inclined at an angle of 30^0 to the ground. Then, find the length of the slide.

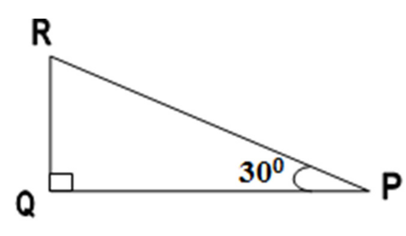
Let QR be the height of the slide and $\angle P$ is the angle of inclination
PR is the length of the slide
Then QR=6m and $\angle P = 30^0$

$$sinP = \frac{QR}{PR}$$

$$sin30^0 = \frac{6}{PR}$$

$$\frac{1}{2} = \frac{6}{PR}$$

=> PR= 12m



∴**The length of the slide is 12m**.

Three Marks Questions

1 The angle of elevation of a cloud is 30° from a point 60 m above a lake and from the same point, the angle of depression of the reflection of cloud in the lake is 60^0. Find the height of the cloud.

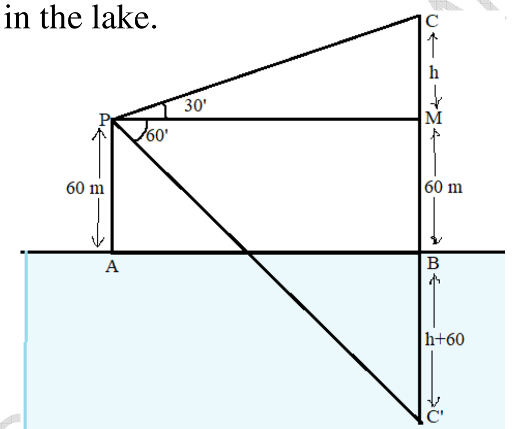
Let AB be the surface of lake.

P be the point of observation. AP=60 m

Let C be the position of cloud. C' be its reflection in the lake.

CB=C'B

Let CM $= h$, then C'B= $(h + 60)$



In Δ CMP, $\tan 30^0 = \frac{h}{PM}$

$$PM = \sqrt{3}h \text{ ------ } (1)$$

In Δ PMC' $\tan 60^0 = \frac{C\prime M}{PM}$

$$\sqrt{3} = \frac{h+60+60}{PM}$$

$$PM = \frac{h+120}{\sqrt{3}} \text{ -------(2)}$$

From (1) and (2) $\sqrt{3}h = \frac{h+120}{\sqrt{3}}$ $\Rightarrow h = 60\ m$

CB=CM+MB = 60+60 = 120 m

Height of the cloud from the surface of the lake is 120 m.

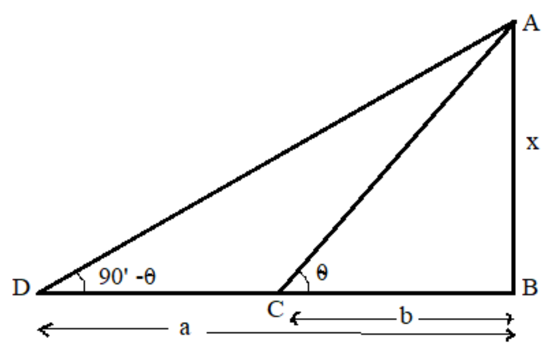
2 The angle of elevation of the top of a tower from two points on the ground at distances 'a' and 'b' meters from the base of a tower and in the same straight line with it are complementary. Prove that height of the tower is $\sqrt{ab}$ meter.

Height of the tower be 'x' m

$$tan\theta = \frac{x}{b} \text{ ----}(i)$$

$$tan(90° - \theta) = \frac{x}{a}$$

$$cot\theta = \frac{x}{a} \text{ -------}(ii)$$



Multiplying (i) and (ii)

$$tan\theta x\ cot\theta = \frac{x}{b} \text{x} \frac{x}{a}$$

$$1 = \frac{x^2}{ab} x^2 = ab$$

$$\Rightarrow x = \sqrt{ab}$$

∴**Height of the tower is $\sqrt{ab}$ meter.**

3 The top of a tower is observed from two points on the same straight line on the ground. The distances of these points from the base of the tower is $a \text{ and } b$ meters. If the angles of elevation are complementary prove that the height of the tower is $\sqrt{ab}$ meter.

Let CD be the building of height 60 m and

AB be the tower

$\angle FCA = \angle CAE = 30^0$

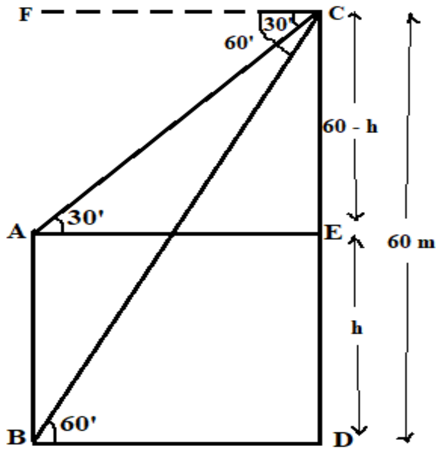
$\angle FCB = \angle CBD = 60^0$

In ΔACE, $tan30° = \frac{CE}{AE}$

$$\frac{1}{\sqrt{3}} = \frac{60-h}{AE}$$

$$AE = (60-h)\sqrt{3}$$

$$AE = BD = (60-h)\sqrt{3}$$



In ΔBCD, $tan60° = \frac{60}{BD}$

$\sqrt{3} = \frac{60}{(60-h)\sqrt{3}}$ =>$(60-h)3 = 60$

$60 - h = 20$

$h = 60 - 20$ ∴ $\boldsymbol{height\ of\ the\ tower = 40\ m}$

4 The deck of a ship is 10m high from the level of water. A man standing on it observes the top of a hill with an angle of elevation 60° and from the same point,he observes the base of thesame hill at an angle of depression 30°.Then, find the distance of the ship from the hill and also the height of the hill.

In ΔADE, $tan60° = \frac{h}{AD}$

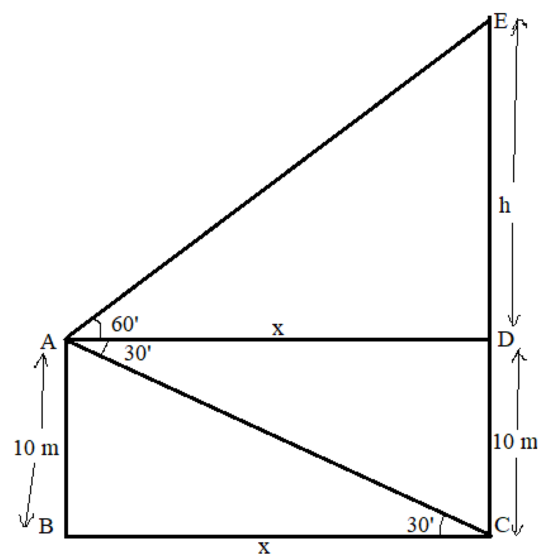
$$\sqrt{3} = \frac{h}{x}$$

$h = x\sqrt{3}$ --------(i)

In ΔABC, $tan30° = \frac{AB}{BC}$

$$\frac{1}{\sqrt{3}} = \frac{10}{x}$$

=>$x = 10\sqrt{3}$ ----(ii)

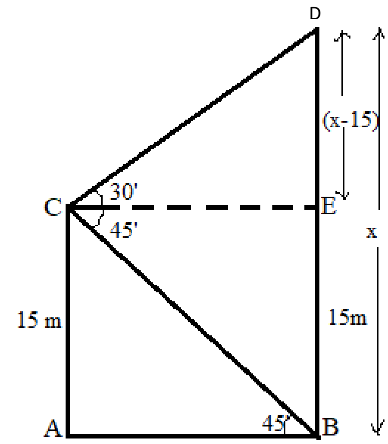
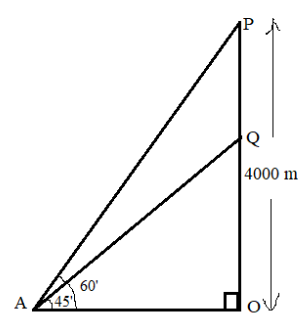


Distance of the ship from the hill =$10\sqrt{3}$ m

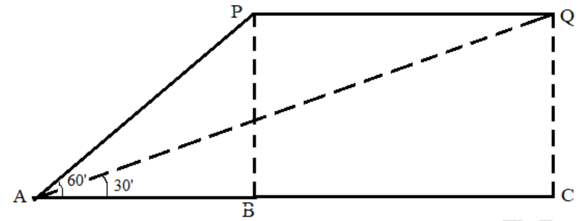
Substituting (ii) in (i) gives $h = 10\sqrt{3}\ x\ \sqrt{3}$

$h = 30\ m$

=>Height of the hill = 30+10 = 40 m.

Four Marks Questions	
1	From a window 15 m high above the ground in a street, the angles of elevation and depression of the top and foot of another house on the opposite side of the street are 30^0 and 45^0 respectively. Show that the height of the opposite house is 23.66m.(take $\sqrt{3}$=1.73) AB – ground, C- position of window BD – house in the opposite side of the street $\underline{\lfloor DCE} = 30^0$, $\underline{\lfloor ECB} = \underline{\lfloor CBA} = 45^0$ AC = BE = 15 m, Let BD = $x\ m$, $\therefore DE = (x - 15)\ m$ In ΔCDE, $tan30° = \frac{x-15}{CE}$ $\frac{1}{\sqrt{3}} = \frac{x-15}{CE}$ => $CE = \sqrt{3}(x - 15)$ In ΔACB, $tan45° = \frac{AC}{AB}$ $1 = \frac{15}{\sqrt{3}(x-15)}$ (since AB =CE) $\sqrt{3}(x - 15) = 15$ $(x - 15) = \frac{15}{\sqrt{3}}$ $x - 15 = 8.66$ $x = 23.66\ m$ 
2	An aeroplane when flying at a height of 4000 m from the ground passes vertically above another aero plane at an instant when the angles of the elevation of the two planes from the same point on the ground are 60^0 and 45^0 respectively. Find the vertical distance between the aeroplanes at that instance. Let P and Q be the positions of two aero planes, when Q is vertically below P and OP=4000 m A be the point of observation on the ground  In ΔAOP and in Δ AOQ $tan60° = \frac{OP}{OA}$ $tan45° = \frac{OQ}{OA}$ $\sqrt{3} = \frac{4000}{OA}$ $1 = \frac{OQ}{OA}$ $OA = \frac{4000}{\sqrt{3}}$ OQ = OA Vertical distance PQ = OP – OQ PQ = $4000 - \frac{4000}{\sqrt{3}}$ => $\frac{4000\sqrt{3}-4000}{\sqrt{3}}$ => $\frac{4000(\sqrt{3}-1)}{\sqrt{3}}$ $\therefore \boldsymbol{The\ vertical\ distance = 1690.53\ m}$

3 The angle of elevation of a jet plane from a point A on the ground is 60^0. After a flight of 30 seconds, the angle of elevation changes to 30^0. if the jet plane is flying at a constant height of $3600\sqrt{3}$ m, find the speed of the plane.



Let P and Q be the two positions of plane

A be the point of observation

In Δ ABP, $tan60° = \frac{PB}{AB}$ => $\sqrt{3} = \frac{3600\sqrt{3}}{AB}$

$AB = 3600\, m$

In Δ ACQ, $tan30° = \frac{CQ}{AC}$ => $\frac{1}{\sqrt{3}} = \frac{3600\sqrt{3}}{AC}$

AC = 10800 m

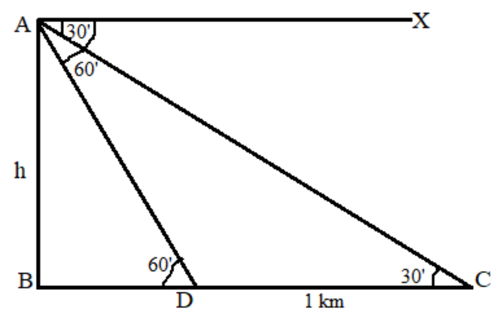
BC = 10800 – 3600

BC = 7200 m

but BC=PQ => Distance travelled is 7200 m

Speed of the plane = $\mathbf{\frac{7200}{30} = 240\ m/s}$

4 A person at the top of a hill observes that the angles of depression of two consecutive kilo meter stones on a road leading to the foot of the hill and on the same vertical plane containing the position of the observer are 30^0 and 60^0. Find the height of the hill.



AB – hill

C and D are kilometer stones

AX is the horizontal through A

A is the position of observation

|XAC = |ACD = 30^0,|XAD = |ADB = 60^0

In ΔABC, $tan30° = \frac{AB}{BC}$ => $\frac{1}{\sqrt{3}} = \frac{h}{BC}$

$BC = h\sqrt{3}$ -----(i)

In ΔABD, $tan60° = \frac{h}{BD}$ => $\sqrt{3} = \frac{h}{BD}$

$BD = \frac{h}{\sqrt{3}}$ -------(ii)

$BC = BD + DC$ => $h\sqrt{3} = \frac{h}{\sqrt{3}} + 1$

$h\sqrt{3} - \frac{h}{\sqrt{3}} = 1$

$\frac{3h-h}{\sqrt{3}} = 1$

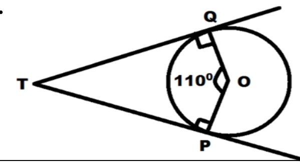
∴ **Height of the hill.** $= \frac{\sqrt{3}}{2}\ km.$

UNIT-10 : CIRCLES

Multiple Choice Questions

1 In the figure, TP and TQ are the tangents drawn to a circle with centre O. If ∠POQ = 110^o, then the value of $\angle PTQ$ is

(A) 70^o (B) 80^o (C) 60^o (D) 140^o



2 The tangents drawn at the ends of a diameter of a circle are

(A) perpendicular to each other **(B) parallel to each other** (C) equal (D) intersect

3 A straight line which intersects a circle at two distinct points is

(A) tangent (B) chord **(C) secant** (D) diameter

4 If the angle between the two tangents to a circle is 40^0 , then the angle between the radii is

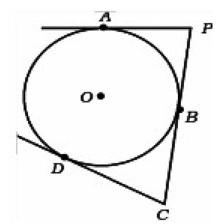
(A) 90^0 (B) 100^0 **(C) 140^0** (D) 180^0

5 Distance between two parallel tangents of a circle of radius 3.5cm is

(A) 3.5cm **(B) 7cm** (C) 10cm (D) 14cm.

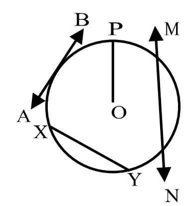
6 In the given figure PA, PC and CD are the tangents to a circle with Centre O. If CD = 5 cm and AP = 3 cm, then length of the tangent PC is

(A) 8 cm (B) 5 cm (C) 3 cm (D) 2 cm



7 In the figure, Chord of the circle with Centre 'O' is

(A) XY (B) OP (C) MN (D) AB



8 A tangent of length 8 cm is drawn from an external point 'A' to a circle of radius 6 cm. Then the distance between 'A' and the center of the circle is

(A) 12 cm (B) 5 cm **(C) 10 cm** (D) 14 cm

9 Maximum number of tangents drawn to a circle from an external point is

(A) 2 (B) 3 (C) 4 (D) 5

One Mark Questions

1 What is the measure of the angle between radius and tangent at the point of contact? **Ans: 90^o**

2 Define the Secant of a Circle.

A line that intersects a circle at two points is called a Secant.

3 Define the tangent of a circle.

A line that touches a circle at only one point is called a Tangent.

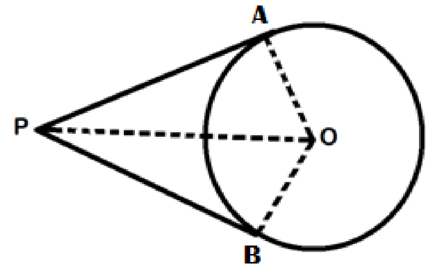
4 Define Point of contact of a circle.

The common point of the tangent and the circle is called the Point of contact.

Three Marks Questions

1 Prove that "the length of tangents drawn from an external point to a circle are equal."

Given: 'O' is the center of the circle, 'P' is an external point. AP and BP are the tangents



To Prove: AP = BP

Construction: Join OA, OB and OP.

Proof:

In ΔOQP and ΔORP

∠OAP = ∠OBP = 90^0 [Theorem 4.1]

OP = OP [Common side]

OA = OB [Radii of same circle]

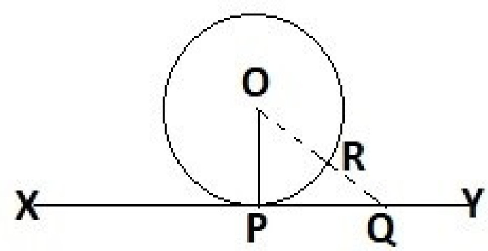
$\Delta OAP \cong \Delta OBP$ [RHS Postulate]

AP=BP [CPCT]

Hence proved.

2 Prove that "the tangent at any point of a circle is perpendicular to the radius through the point of contact."

Given: XY is the tangent at P to the circle with center 'O'



To Prove : OP _|_ XY

Construction : Mark Any point 'Q' on XY, join OQ and it cuts the circle at R

Proof : OR < OQ

OR = OP (Radii of the same circle)

∴OP < OQ

This holds good for all the points on XY

∴ OP is the least distance

=>OP _|_ XY

UNIT-11: AREAS RELATED TO CIRCLES

Multiple Choice Questions

1. Area of Quadrant of a circle with radius '*r*' is

   A. $\frac{\pi r^2}{2}$ **B. $\frac{\pi r^2}{4}$**   C. πr D. $\frac{\pi r}{2}$

2. If the radius of a semicircle is 7cm, the length of its arc is

   A. $11cm$ B. $44cm$ **C. $22cm$**   D. $14cm$

3. Length of the arc of a sector with radius 9 cm and the angle 120^0 is

   A. $2\pi cm$ B. $3\pi cm$ **C. $6\pi cm$**   D. $9\pi\ cm$

4. If the angle of a sector is '*P*'(in degrees) and radius is '*R*' then its area is

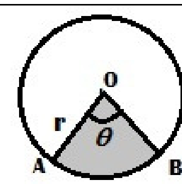
   A. $\frac{P}{180}$ x$2\pi R$ B. $\frac{P}{180}\ x\pi R^2$ C. $\frac{P}{360}$ x$2\pi R$ **D. $\frac{P}{720}\ x\ 2\pi R^2$**

5. If the ratio of circumference of two circles is 4: 5 then the ratio of their areas is

   A. 4:5   **B. 16:25**   C. 64:125   D. 5:4

One Mark Questions

1. Write the formula to find the area of the shaded region in the given figure.



$$\frac{\theta}{360^0}\ \text{x}\ \pi r^2$$

2. Define the segment of a circle.

   A segment is a region covered by a chord and a corresponding arc.

3. What is meant by a sector of the circle?

   The area bounded by two radii and the corresponding arc of a circle is called the Sector.

4. If the diameter of a semicircle is 14cm, then find its perimeter [use $\pi = \frac{22}{7}$]

   Perimeter of the semicircle $= \pi r + d$

   $$= \frac{22}{7}\text{x}\frac{14}{2} + 14$$

   $\therefore$ **Perimeter of the semicircle $= 36\ cm$**

5. If the area of a circle and the perimeter are numerically equal, then find the radius of that circle.

   $$\pi r^2 = 2\pi r$$

   $$\therefore r = 2\ units$$

Two Marks Questions (Use $\pi = \frac{22}{7}$ unless given)

1 In a circle of radius 21 cm an arc subtends an angle 60^0 at the Centre of the circle. Find the length of the arc formed in the circle.

Length of the arc= $\frac{\theta}{360^o} \times 2\pi r$

$= \frac{60^o}{360^o} \times 2 \times \frac{22}{7} \times 21$

$\therefore$ **Length of the arc = 22 cm**

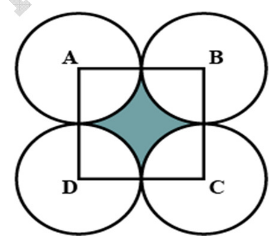
2 In a circle of radius 21 cm and arc subtends angle 60^0 at the Centre of the circle, find the area of sector formed in the circle.

Area of the sector $= \frac{\theta}{360^o} \text{ X } \pi r^2$

$= \frac{60^o}{360^o} \times \frac{22}{7} \times 21 \times 21$

$\therefore$**Area of the sector = 231 sq.cm**

3 In the figure ABCD is a square of side 14 cm. With Centre A, B , C & D four circles are drawn such that each circle touch externally two of the remaining three circles. Find the Area of the shaded region.



Radius of each quadrant = $\frac{14}{2}$ = 7 cm

Area of the shaded region = Area of the square – Area of 4 Quadrants.

Area of the shaded region $= 14^2 - 4 \times \frac{\pi r^2}{4}$

$= 196 - 4 \times \frac{22}{7} \times \frac{7 \times 7}{4}$

$= 196 - 154$

$\therefore$**Area of the shaded region**= $\mathbf{42\ cm^2}$

4 A drain cover is made from a square metal plate of side 40 cm having 441 holes of diameter 1 cm each drilled in it. Find the area of the remaining square plate.

Area of each hole $= \pi r^2$

$= \frac{22}{7} \times \left(\frac{1}{2}\right)^2$

$= \frac{11}{14} cm^2$

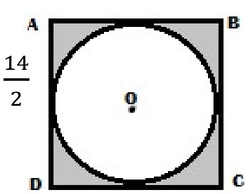
Area of 441 holes = 441 x $\frac{11}{14}$ = 346.5 cm^2

Area of Square metal plate = 40^2=1600 cm^2

Area of remaining square plate = 1600 – 346.5

= 1253.5 cm^2

5 In the figure, a circle is circumscribed in a square ABCD. If each side of the square is 14cm find the area of shaded region



Radius of the circle; $r = \frac{14}{2}$

r = 7cm

Ar(shaded region) = Ar(Square) – Ar(Circle)

$= (side)^2 - \pi r^2$

$= 14^2 - \frac{22}{7} \times 7 \times 7$

$= 196 - 154$

$\therefore$**Area of the shaded region**= **42 cm^2**

Three Marks Questions (Use $\pi = \frac{22}{7}$ unless given)

1 Find the area of a quadrant of a circle, where the circumference of circle is 44cm.

$2\pi r$ = Circumference

$$2\pi r = 44 \text{ cm}$$

$$2 \times \frac{22}{7} \times r = 44$$

$$r = \frac{44 \times 7}{22 \times 2} \Rightarrow r = 7 \text{ cm}$$

Area of quadrant $= \frac{1}{4} \times \pi r^2$

$$= \frac{1}{4} \times \frac{22}{7} \times 7 \times 7$$

$$= \frac{77}{2}$$

∴**Area of quadrant $= \mathbf{38.5\ cm^2}$**

2 Area of a sector of a circle of radius 14 cm is 154 cm^2. Find the length of the corresponding arc of the sector.

Given, $r = 14\ cm$ Area of sector $= 154\ cm^2$

$$\frac{\theta}{360^o} \times \pi r^2 = 154$$

$$\frac{\theta}{360^o} \times \frac{22}{7} \times 14 \times 14 = 154$$

$$\frac{\theta}{360^o} \times 22 \times 2 \times 14 = 154$$

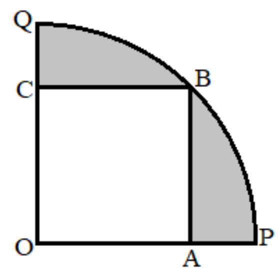
$$\theta = \frac{154 \times 360}{22 \times 2 \times 14} \Rightarrow \theta = 90^0$$

Length of an arc $= \frac{\theta}{360^o} \times 2\pi r$

$$= \frac{90^o}{360^o} \times 2 \times \frac{22}{7} \times 14$$

∴**Length of the arc $= \mathbf{22\ cm}$**

3 OABC is a square inscribed in a quadrant OPBQ. If OA = 20 cm. (use $\pi = 3.14$)



Ar(Square) $= 20^2 = 400 cm^2$

Radius of the quadrant; r= OB

$$r = OB = \sqrt{OA^2 + AB^2}$$

$$= \sqrt{20^2 + 20^2} \Rightarrow r = 20\sqrt{2}\ cm$$

Ar(Quadrant) $= \frac{\pi r^2}{4}$

$$= \frac{3.14 \times (20\sqrt{2})^2}{4}$$

$$= \frac{3.14 \times 400 \times 4}{4}$$

Ar(Quadrant)$= 628\ cm^2$

Ar(Shaded region) = $\boldsymbol{Ar(Quadrant) - Ar(Square)}$

$$= 628 - 400$$

$$\therefore \boldsymbol{Area\ of\ the\ shaded\ region = 228\ cm^2}$$

UNIT 12: SURFACE AREAS AND VOLUMES

Multiple Choice Questions

1. The volume of a hemisphere of radius 'r' is
   (A)πr^2 (B)$\frac{4}{3}\pi r^3$ (C) $4\pi r^3$ **(D) $\frac{2}{3}\pi r^3$**

2. If two solid hemispheres with same radii of their bases are joined together along their bases, then, the curved surface area of the new solid formed is
   (A)$3\pi r^2$ **(B) $4\pi r^2$** (C) $5\pi r^2$ (D) $6\pi r^2$

3. A cylinder and a cone are of same heights and same radii of their bases. If the volume of the cylinder is $924cm^3$ then, the volume of the cone is
   (A) $924\ cm^3$ **(B) $308cm^3$** (C) $462\ cm^3$ (D) $38\ cm^3$

4. While conversion of a solid from one shape to another, the volume of the new shape will
   (A) increases (B) decreases **(C) remain unaltered** (D) doubled

5. The surface area of a sphere of radius $7cm$ is
   (A) $308\ cm^2$ (B) $154cm^2$ **(C) $616cm^2$** (D) $462\ cm^2$

6. *Three cubes of edge 4 cm* are *joined end to end*, then the volume of the cuboid so formed is
   (A) $162\ cm^3$ (B) $172\ cm^3$ (C) $182\ cm^3$ **(D) $192\ cm^3$**

7. The radius of the base of a cone is 9cm and slant height is 15cm, then its height is
   (A) 6cm (B) 3cm (C) 5cm **(D) 12cm**

One Mark Questions

1. Find the ratio of the total surface areas of a sphere and a solid hemisphere having equal radii. $\frac{\text{Area of sphere}}{\text{Area of solid hemisphere}} = \frac{4\pi r^2}{3\pi r^2}$

   $\frac{A_1}{A_2} = \frac{4}{3} \therefore \boldsymbol{A_1 : A_2 = 4 : 3}$

2. If the area of base of a right circular cylinder is $38.5cm^2$ and its height is 6cm, then find its volume.
   Given: $area = \pi r^2 = 38.5cm^2, h = 6cm, V = ?$

$$Volume\ of\ a\ cylinder = \pi r^2 h = 38.5 \times 6$$

$$\therefore \boldsymbol{Volume\ of\ a\ cylinder = 231\ cm^3}$$

Two Marks Questions

1. Two cubes of edge 8cm each are kept together joining their faces to form a cuboid. Find the total surface area of the cuboid.

Given: $l = 8 + 8 = 16cm, b = 8cm,\ h = 8cm,$ $T.S.A\ Of cuboid = ?$

$$T.S.A. of a cuboid = 2[lb + bh + hl]$$

$$= 2[(16)(8) + (8)(8) + (8)(16)]$$

$$\therefore \boldsymbol{T.S.A. of\ a\ cuboid = 640cm^2}$$

2. If the total surface area of a cube is $150cm^2$, find its volume.

$$T.S.A\ \ Of\ a\ cube = 6a^2$$

$$150 = 6a^2$$

$$a = 5cm$$

$$Volume of a cube = \ a^3 = 5^3$$

$$\therefore \mathbf{Volume\ of\ a\ cube = 125cm^3}$$

3. A metal container is in the shape of a frustum of a cone of height 21 cm and radii of its circular ends are 8 cm and 20 cm. Find its capacity.

$r_1 = 20cm, r_2 = 8cm,\ \ h = 21cm$

$$Capacity = \mathrm{V} = \frac{1}{3}\pi\mathrm{h}(\mathrm{r_1}^2 + \mathrm{r_2}^2 + \mathrm{r_1}\mathrm{r_2})$$

$$= \frac{1}{3} \times \frac{22}{7} \times 21(20^2 + 8^2 + 20 \times 8)$$

$$\therefore \boldsymbol{Volume = 13728cm^3}$$

4. If the total surface area of a hemispherical bowl is $308cm^2$, then find its radius.

$$TSA\ of\ hemisphere = 2\pi r^2 = 308$$

$$2 \times \frac{22}{7} \times r^2 = 308$$

$$r^2 = \frac{308 \times 7}{2 \times 22}$$

$$\therefore \boldsymbol{Radius\ of\ the\ bowl = 7cm}$$

Three Marks Questions

1. The diameter of a solid metallic sphere is 6cm. It is melted and drawn into a wire having diameter of the uniform cross-section is 0.2cm. Find the length of the wire.

$radius\ of\ the\ sphere\ R = 3cm,$
$radius\ of\ the\ wire\ (cylinder) r = 0.1cm length\ of\ the\ wire\ (cylinder) h = ?$

$$Volume\ of\ cylinder = Volume\ of\ sphere$$

$$\pi r^2 h = \frac{4}{3}\pi R^3$$

$$\pi(0.1)^2 h = \frac{4}{3}\pi(3)^3$$

$$0.01\pi h = 36\pi$$

$$\therefore \boldsymbol{h = 3600cm = 36m}$$

2. A big solid metal sphere of diameter 48cm is melted and casted into small solid spheres of radius 3cm. Find the number of small solid spheres so formed.

$radius\ of\ big\ solid\ sphere\ R = 24\ cm$
$radius\ of\ small\ solid\ sphere\ r = 3cm$
$Number\ of\ small\ solid\ spheres = ?$

$$Number\ of\ small\ spheres = \frac{V(\ big\ sphere)}{V(a\ small\ \ sphere}$$

$$= \frac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi r^3} = \frac{R^3}{r^3}$$

$$= \frac{24^3}{3^3}$$

$$\therefore \mathbf{The\ number\ of\ small\ solid\ sphere = 512}$$

Four Marks Questions

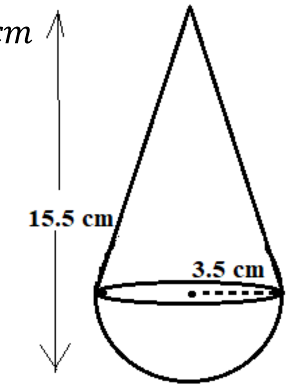
1. A toy is in the form of a cone of radius 3.5 cm mounted on a hemisphere of same radius. The total height of the toy is 15.5 cm. Find the total surface area of the toy.

$$Cone: h = 15.5 - 3.5 = 12cm, r = 3.5cm$$

$Hemisphere: R = 3.5cm$ $Slant\ height: l = \sqrt{h^2 + r^2}$

$$= \sqrt{(12)^2 + (3.5)^2}$$

$$\therefore l = 12.5cm$$



TSA of a toy = CSA of cone + CSA of hemisphere

$$= \pi r l + 2\pi R^2$$

$$= \frac{22}{7} \times 3.5 \times 12.5 + 2 \times \frac{22}{7} \times 3.5 \times 3.5$$

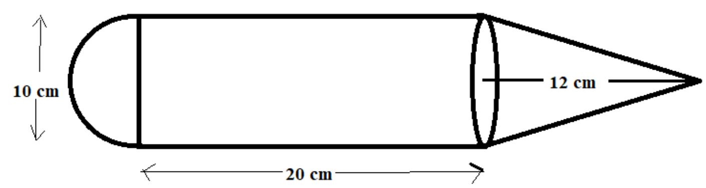
$$\therefore \textbf{TSA of the toy} = \mathbf{214.5\ cm^2}$$

2. A Toy is made in the shape of a cylinder with one hemisphere stuck to one end and a cone to the other end. The length of the cylindrical part of the toy is 20cm and its diameter is 10 cm. If the height of the cone is 12 cm. Find the surface area of the toy.

$Hemisphere: r = 5cm$

$Cylinder: r_1 = 5cm, h_1 = 20cm$

$Cone: r_2 = 5cm, h_2 = 12cm$



$$Slant\ height: l_2 = \sqrt{{r_2}^2 + {h_2}^2}$$

$$= \sqrt{5^2 + 12^2}$$

$$\therefore l_2 = 13cm$$

$TSA\ of\ the\ toy = CSA\ of\ hemisphere + CSA\ of\ cylinder + CSA\ of\ cone$

$$= 2\pi r^2 + 2\pi r_1 h_1 + \pi r_2 l_2$$

$$= \left(2 \times \frac{22}{7} \times 5^2\right) + \left(2 \times \frac{22}{7} \times 5 \times 20\right) + \left(\frac{22}{7} \times 5 \times 13\right)$$

$$= \frac{22}{7} \times 5\ (10 + 40 + 13)$$

$$= \frac{110}{7} \times 63$$

$$\therefore \boldsymbol{TSA\ of\ the\ toy = 990cm^2}$$

Five marks questions

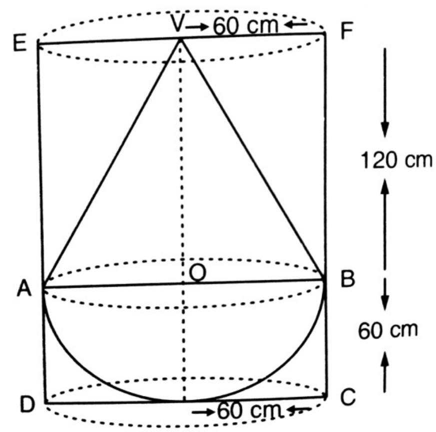
1. A solid consisting of a right cone standing on a hemisphere is placed upright in a right circular cylinder full of water and touches the bottom as shown in the figure. Find the volume of water left in the cylinder, if the radius of the cylinder is 60cm and its height is 180cm, the radius of the hemisphere is 60cm and height of the cone is 120cm, assuming that the hemisphere and the cone have common base.

$$Cylinder: r_{cy} = 60cm, h_{cy} = 180cm Cone: r_{co} = 60cm, h_{co} = 120cm$$

$Hemisphere: r_{hs} = 60cm$

$The\ volume\ of\ the\ water\ left\ out\ in\ the\ cylinder = V$

$V_{water} = V_{cylinder} - V_{cone} - V_{hemisphere}$



$$= \pi {r_{cy}}^2 h_{cy} - \frac{1}{3}\pi {r_{co}}^2 h_{co} - \frac{2}{3}\pi {r_{hs}}^3$$

$$= \pi \times 60^2 \times 180 - \frac{1}{3} \times \pi \times 60^2 \times 120 - \frac{2}{3} \times \pi \times 60^3$$

$$= \pi \times 60^2[180 - 40 - 40]$$

$$= \frac{22}{7} \times 60 \times 60 \times 100 = \frac{22 \times 360000}{7} cm^3$$

$$V = \frac{22 \times 360000}{7 \times (100)^3} m^3$$

$$\therefore \boldsymbol{The\ volume\ of\ the\ water\ leftout\ in\ the\ cylinder = 1.1314 m^3}$$

UNIT :- 13 STATISTICS

Multiple Choise Questions

1. The mean value of 10,15,5, 20 and 50 is

   (A) 10 (B) 5 (C) 15 **(D) 20**

2. The median of 7,3,6,14,13,11,19 is

   (A) 7 (B) 13 **(C) 11** (D) 19

3. The mode of 6,7,2,4,2,8,5,2,2,7 is

   (A) 7 (B) 6 (C) 4 **(D) 2**

4. The measure of central tendency that gives the middle most value of the data is

   (A) midpoint (B) mean **(C) median** (D) mode

5. Mode of the given set of scores is

   (A) Middle most value (B) Least frequent value

   (C) Most frequent value (D) None of these

One Mark Questions

1. Write the empirical relationship between the three measures of central tendency.

   3Median= Mode+ 2Mean

2. Find the median of 24,31,17,29,36,39

   17, 24, 29, 31, 36, 39

$$Median = \frac{29 + 31}{2}$$

$$\therefore \textbf{Median} = \mathbf{30}$$

3. Find the class mark of the class interval 40-50

$$Class\ mark = \frac{lowerlimit + upperlimit}{2}$$

$$Class\ mark = \frac{40 + 50}{2}$$

$$\therefore \textbf{Class mark} = \mathbf{45}$$

Three Marks Questions

1) Find mean for the following frequency distribution.

Class Interval	0-10	10-20	20-30	30-40	40-50
Frequency	3	5	9	5	3

Class Interval	**Frequency**	x	fx
0-10	3	5	15
10-20	5	15	75
20-30	9	25	225
30-40	5	35	175
40-50	3	45	135
	$\Sigma f = 25$		$\Sigma fx = 625$

$$Mean = \frac{\Sigma fx}{\Sigma f} = \frac{625}{25}$$

$\therefore$ **Mean** $= \mathbf{25}$

2) Find the Median of the following frequency distribution.

Class interval	0-10	10-20	20-30	30-40	40-50
Frequency	4	7	13	9	3

Class Interval	Frequency	Cumulative Frequency
0-10	4	4
10-20	7	4+7=**11**
20-30	**13**	11+13=24
30-40	9	24+9=33
40-50	3	33+3=36

$nn = 36$, $\frac{n}{2} = 18$, $f = 13$, $cf = 11$,
$h = 10$, $l = 20$

$$Median = l + \left[\frac{\frac{n}{2} - cf}{f}\right] \times h$$

$$Median = 20 + \left[\frac{18 - 11}{13}\right] \times 10$$

$$Median = 20 + 5.38$$

$$\therefore \boldsymbol{Median = 25.38}$$

3) Find the mode of the following frequency distribution.

Class interval	*Frequency*
30-40	4
40-50	7
50-60	9
60-70	11
70-80	6
80-90	2

$f_1 = 11$, $f_0 = 9$, $f_2 = 6$, $l = 60$, $h = 10$

$$Mode = l + \left[\frac{f_{1-f_0}}{2f_1 - f_0 - f_2}\right] \times h$$

$$Mode = 60 + \left[\frac{11 - 9}{2(11) - 9 - 6}\right] \times 10$$

$$Mode = 60 + 2.86$$

$$\therefore \boldsymbol{Mode = 62.86}$$

UNIT-14: PROBABILITY

Multiple choice Questions

1. In an experiment, if number of outcomes favorable to an event is equal to zero, then the event is called,

   (A) sure event (B) complementary event
   (C) impossible event (D) elementary event

2. If the probability of getting rain on a particular day is 0.7, then the probability of not getting rain on that day is.

   (A) $\mathbf{0.3}$ (B) 0.7 (C) 0 (D) 0.03

3. The correct among the following, regarding the probability of occurrence of an event A is

   (A) $0 < P(A) \leq 1$ (B) $0 \leq P(A) < 1$ **(C) $\mathbf{0 \leq P(A) \leq 1}$** (D) $0 < P(A) < 1$

One Mark Questions

1. What is the probability of a 'sure event'?

   Ans: 1 (one)

2. What is the sum of probabilities of all the elementary events of an experiment?

   Ans: 1 (one)

3. A coin is tossed once. If the probability of getting the 'Tail' is $\frac{1}{2}$, then, what is the probability of 'not getting the Tail'?

   Ans: $\mathbf{\frac{1}{2}}$

Two Marks Questions

1. A box contains 4 red marbles, 8 green marbles and 5 white marbles. One marble is taken out at random. Find the probability of the marble taken out to be red.

   Number of all possible outcomes,

   $$n(S) = 4 + 5 + 8 = 17$$

   Let A be the event of taking out the red marble.

   $$\therefore n(A) = 4$$

   $P(A) = \frac{n(A)}{n(S)}$

   $$\therefore P(A) = \frac{4}{17}$$

2. A die, numbered from 1 to 6 on its each face is rolled once. Find the probability of getting an odd number.

   Number of all possible outcomes,

   $$n(S) = 6$$

   Let A be the event of getting an odd number.

   $\therefore n(A) = 3$

   $$P(A) = \frac{n(A)}{n(S)}$$

   $$= \frac{3}{6}$$

   $$\therefore P(A) = \frac{1}{2}$$

3	12 defective pens got mixed with 132 good ones. One pen is taken randomly from the lot. Find the probability of getting a defective pen. Number of all possible outcomes, $n(S) = 12 + 132 = 144$ Let A be the event of taking out a defective pen. $\therefore n(A) = 12$ $P(A) = \frac{n(A)}{n(S)}$ $= \frac{12}{144}$ $\therefore P(A) = \frac{1}{12}$	4	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 a number which is multiple of 10. Number of all possible outcomes, $n(S) = 90$ Let A be the event of taking out a disc bearing a number multiple of 10. $\therefore n(A) = 9$ $P(A) = \frac{n(A)}{n(S)}$ $= \frac{9}{90}$ $\therefore P(A) = \frac{1}{10}$
Three Marks Questions			
1	Two dice, numbered from 1 to 6 on their each face are together rolled once. Find the probability of getting the numbers whose sum is greater than 8. Number of all possible outcomes, $n(S) = 36$ Let A be the event of getting the numbers whose sum is greater than 8.. $\therefore A = \{(3,6), (4,5), (4,6), (5,4), (5,5), (5,6),$ $(6,3), (6,4), (6,5), (6,6)\}$ $=> n(A) = 10$ $P(A) = \frac{n(A)}{n(S)}$ $= \frac{10}{36}$ $\therefore P(A) = \frac{5}{18}$	2	A bag contains 5 red balls and some blue balls. When a ball is drawn at random, if the probability of drawing a blue ball is three times that of a red ball, find the number of blue balls in the bag. Let there be x blue balls in the bag. $\therefore$ Total number of balls in the bag $= 5 + x$ Probability of drawing Red ball; $P(R) = \frac{5}{5+x}$ Probability of drawing Blue ball; $P(B) = \frac{x}{5+x}$ Given, $P(B) = 3P(R)$ $\frac{x}{5+x} = 3\left(\frac{5}{5+x}\right)$ $\frac{x}{5+x} = \frac{15}{5+x}$ $=> x = 15$ $\therefore$ There are 15 blue balls in the bag.

Appendix - 1
Formulae and Mathematical Relations

ARITHMETIC PROGRESSIONS

If an A.P. has 'n' number of terms, whose first term is 'a', and common difference is 'd', then its

Description	Formula	
n^{th} term	$a_n = a + (n-1)d$	
Sum of first 'n' terms	$S_n = \frac{n}{2}[2a + (n-1)d]$	
Sum of first 'n' terms, if the last term 'l' is known	$S_n = \frac{n}{2}(a + l)$	
Sum of first 'n' natural numbers	$\sum_{1}^{n} n = \frac{n(n+1)}{2}$	(a) Sum of first 'n' **Odd** natural numbers = $\boldsymbol{n^2}$
		(b) Sum of first 'n' **Even** natural numbers =$\boldsymbol{n(n+1)}$
General Form of an A.P.	$a, a+d, a+2d, a+3d, \dots\dots\dots\dots\dots, a+(n-1)d$	

PAIR OF LINEAR EQUATIONS WITH TWO VARIABLES

$a_1x + b_1y + c_1 = 0$ *and* $a_2x + b_2y + c_2 = 0$ are the pair of linear equations in $'x'$ *and* $'y'$.

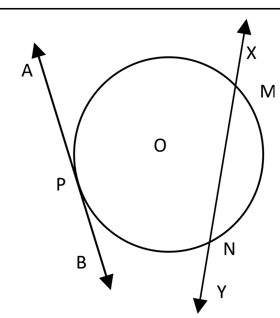
Relation	Type of the Graph	Number of Solutions	Nature of the Equations
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Coinciding lines	Infinitely many solutions	Dependent (Consistent) pair
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	Parallel lines	No solution	Inconsistent pair
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Intersecting lines	Exactly one (Unique) solution	Consistent pair

CIRCLES (Definitions)

A line that **intersects** a circle at **two** points is called a **Secant.** In the figure, **XY** is the secant.

A line that **touches** a circle at only **one** point is called a **Tangent.** In the figure, **AB** is the tangent.

The common point of the tangent and the circle is called the **Point of contact.** In the figure, '**P**' is the point of contact.



Maximum of **two** tangents can be drawn from an external point to a given circle.

AREAS RELATED TO CIRCLES

If the radius of the circle/sector is 'r' and the angle of the sector is 'θ', then

Description	Formula		
Perimeter of the Circle	$2\pi r$		
Length of an arc of a Sector	$\frac{\theta}{360^o}$ x $2\pi r$		
Area of the Circle	πr^2	Ar(Semicircle) $= \frac{\pi r^2}{2}$	Ar(Quadrant) $= \frac{\pi r^2}{4}$
Area of a Sector	$\frac{\theta}{360^0}$ x πr^2		
Area of a Segment	$r^2\left(\frac{\pi\theta}{360^0} - \sin\frac{\theta}{2}\cos\frac{\theta}{2}\right)$		

COORDINATE GEOMETRY

Distance formula [distance between the points A(x_1, y_1) and $B(x_2, y_2)$]	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Distance from the origin to a point A(x, y)	$d = \sqrt{x^2 + y^2}$
Section formula [P(x, y) divides the line joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ internally in the ratio $m_1 : m_2$]	$P(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$
Mid Point formula [P(x, y) is the midpoint of the line joining the points A(x_1, y_1) and $B(x_2, y_2)$]	$P(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

POLYNOMIALS

If α and β are the zeroes of the quadratic Polynomial $ax^2 + bx + c$, then	(i) $\alpha + \beta = -\frac{b}{a}$ (ii) $\alpha\beta = \frac{c}{a}$
If α, β and γ are the zeroes of the cubic polynomial $ax^3 + bx^2 + cx + d$, then	(i) $\alpha + \beta + \gamma = -\frac{b}{a}$ (ii) $\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$ (iii) $\alpha\beta\gamma = -\frac{d}{a}$

QUADRATIC EQUATIONS

Quadratic Formula (Roots of the quadratic equation $ax^2 + bx + c = 0$)	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Discriminant of the quadratic equation $ax^2 + bx + c = 0$ is $\mathbf{b^2 - 4ac}$

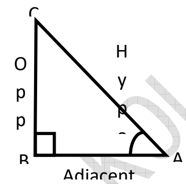
Relation	Nature of the Roots
$b^2 - 4ac = 0$	Roots are Real and Equal
$b^2 - 4ac > 0$	Roots are Real and Distinct
$b^2 - 4ac < 0$	Roots are Imaginary numbers (No Real roots)

INTRODUCTION TO TRIGONOMETRY

Opposite side$---\rightarrow$ Side Opposite to $\angle A$

Adjacent side$---\rightarrow$ Side Adjacent to $\angle A$

Hypotenuse $---\rightarrow$ Side Opposite to Right angle.



Trigonometric Ratios		Reciprocals	Inter relations
$\sin A = \frac{Opposite}{Hypotenuse}$	$cosec\ A = \frac{Hypotenuse}{Opposite}$	$sin\ A = \frac{1}{cosec\ A}$	$tan\ A = \frac{sin\ A}{cos\ A}$
$\cos A = \frac{Adjacent}{Hypotenuse}$	$sec\ A = \frac{Hypotenuse}{Adjacent}$	$cos\ A = \frac{1}{sec\ A}$	
$\tan A = \frac{Opposite}{Adjacent}$	$cot\ A = \frac{Adjacent}{Opposite}$	$\tan A = \frac{1}{cot\ A}$	$cot\ A = \frac{cos\ A}{sin\ A}$

Values of Trigonometric ratios of Standard Angles.

Angles → / Ratios ↓	0^o	30^o	45^o	60^o	90^o
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
cosec	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
cot	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

Trigonometric Identities

$sin^2A + cos^2A = 1$	$tan^2A + 1 = sec^2A$	$cot^2A + 1 = cosec^2A$

STATISTICS

Mean(Average) of the Grouped data	Direct method	$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$ OR $\bar{x} = \frac{\sum fx}{N}$
	Assumed Mean method	$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$
	Step-deviation method	$\bar{x} = a + h\left(\frac{\sum f_i u_i}{\sum f_i}\right)$
Mode of the Grouped data		$l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \text{x}\ h$
Median of the Grouped data		$l + \left(\frac{\frac{n}{2} - cf}{f}\right) \text{x}\ h$
Empirical relationship between the three measures of central tendency		3 Median = Mode + 2 Mean

PROBABILITY

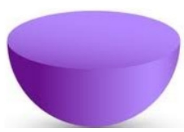
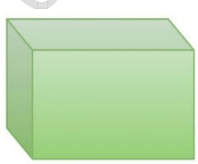
Probability of occurrence of an event 'A'	$P(A) = \frac{Number\ of\ outcomes\ favourable\ to\ A}{Number\ of\ all\ possible\ outcomes}$ i.e., $P(A) = \frac{n(A)}{n(S)}$
1) Probability of a **Sure Event** is **One**	2) Probability of an **Impossible Event** is **Zero**
3) Sum of the probabilities of all primary events of an experiment is **One**	4) $P(E) + P(\bar{E}) = 1$

REAL NUMBERS

Euclid's Division Lemma	Given positive integers a and b, there exist unique integers q and r satisfying $a = bq + r$, where $0 \leq r \leq b$.
For any two positive integers a and b,	$HCF(a, b) \text{x}\ LCM(a, b) = a \text{ x } b$

SURFACE AREAS AND VOLUMES

Radius of base of the right circular solids is $'r'$ and height is $'h'$. Slant height of the cone is $'l'$.

Name of the Solid	Figure	C.S.A	T.S.A	Volume
Cylinder		$2\pi rh$	$2\pi r(r+h)$	$\pi r^2 h$
Cone		πrl	$\pi r(r+l)$ Here $l=\sqrt{r^2+h^2}$	$\frac{1}{3}\pi r^2 h$
Sphere		$4\pi r^2$		$\frac{4}{3}\pi r^3$
Hemisphere		$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$
Frustum of a Cone		$\pi(r_1+r_2)l$	$\pi[l(r_1+r_2)+r_1^2+r_2^2]$ Here $l=\sqrt{(r_1-r_2)^2+h^2}$	$\frac{1}{3}\pi h[r_1^2+r_2^2+r_1r_2]$
Cuboid Length = $\boldsymbol{l}$ Breadth = $\boldsymbol{b}$ Height = $\boldsymbol{h}$		L.S.A = $2(lh+lb)$	$2(lh+lb+bh)$	l x b x h
Cube		L.S.A = 4 x $(side)^2$	6 x $(side)^2$	$(side)^3$