

ANSWERS



SECTION - I

1. Find the numerical value of $\log_3(\tan 60^\circ)^2$.

A. Given that $\log_3(\tan 60^\circ)^2$

$$= \log_3(\sqrt{3})^2$$

$$= \log_3 3 = 1$$

2. In a survey an agency taken in contienment zone found that the number of people has chances to suffer with Covid-19 due to smoking is 10 less than two third the number of people by direct contact with diseased person. Represent this in linear equation form.

A. Let the number of people having chances to suffer with Covid-19 due to smoking = x
 The number of people by direct contact with diseased person = y

So, $x = \left(\frac{2}{3}\right)y - 10$

$\Rightarrow 3x = 2y - 30$

$\Rightarrow 3x - 2y + 30 = 0$

3. If α, β, γ are the zeroes of the polynomial $px^3 + qx^2 + rx + s$,

then which of the following option is correct one ?

i) $\alpha + \beta + \gamma$ a) $-\frac{d}{a}$

ii) $\alpha\beta + \beta\gamma + \gamma\alpha$ b) $-\frac{b}{a}$

iii) $\alpha\beta\gamma$ c) $\frac{c}{a}$

A) i - a, ii - b, iii - c

B) i - c, ii - a, iii - b

C) i - b, ii - c, iii - a

D) i - b, ii - a, iii - c

A. (C)

4. If the surface area of a hemisphere is 's', then express 'r' in term of 's'.

A. $2\pi r^2 = s \Rightarrow r = \sqrt{\frac{s}{2\pi}}$

5. Orbits of the celestial objects are defined by a mathematical concept. Identify that concept and write it.

A. Quadratic equations.

6. Let A, B are two sets such that $n(A) = 5$, $n(B) = 7$, then find the maximum number of elements in $A \cup B$.

A. 12 elements in $A \cup B$.

7. Find the slope of the line joining the two given points (4, -8) and (5, -2).

A. Slope = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 + 8}{5 - 4} = 6$

8. Name the quadrilateral, which satisfies both the conditions given below.

A : Diagonals are equal.

B : All sides are equal.

- a) Rhombus
- b) Parallelogram
- c) Rectangle
- d) Square

A. (d)

9. In $\triangle ABC$ and $\triangle DEF$, if $\angle B = \angle E$, $\angle C = \angle F$, then which of the following is a true statement?

A) $\frac{AB}{DE} = \frac{CA}{EF}$ B) $\frac{BC}{EF} = \frac{AB}{FD}$

C) $\frac{AB}{DE} = \frac{BC}{EF}$ D) $\frac{CA}{FD} = \frac{AB}{EF}$

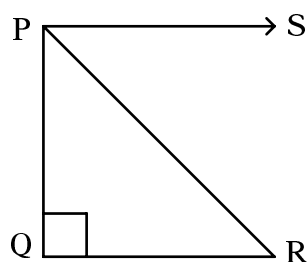
A. (C)

10. How much the slope of the line passing through the points (2a, 3b) and (2b, 3a) ?

A. $x_1 = 2a, y_1 = 3b,$
 $x_2 = 2b, y_2 = 3a$

$$\begin{aligned} \text{Slope} = m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3a - 3b}{2b - 2a} = \frac{3(a - b)}{2(b - a)} = \frac{-3}{2} \end{aligned}$$

11. Name the angle of depression from the figure given below in which $\angle Q = 90^\circ$.



A. $\angle SPR$ is the depression angle.

12. \bar{x} means the mean of $x_1, x_2, x_3, \dots, x_n$, then what is the value of $\sum_{i=1}^n (x_i - \bar{x})$?

A. '0'

SECTION - II

13. If $A = \{\text{quadrilaterals}\}$, $B = \{\text{point, line, triangle}\}$. State whether $A \subset B$ or $B \subset A$ or any answer.

A. Given,

$A = \{\text{quadrilaterals}\}$ and

$B = \{\text{point, line, triangle}\}$

Sets A and B are disjoint sets, then any other answer is correct.

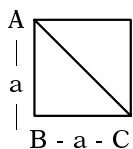
14. Establish the relation between diagonal and side of a square.

Sol. Let the side of a square

$$ABCD = x$$

Then its diagonal AC = Hypotenuse of $\triangle ABC$.

$$\begin{aligned} \therefore AC &= \sqrt{AB^2 + BC^2} \\ &= \sqrt{a^2 + a^2} \\ &= \sqrt{2a^2} \\ &= \sqrt{2} a \end{aligned}$$



So the diagonal of a square is $\sqrt{2} a$ when its side is 'a'.

15. Show that 2 and $-\frac{1}{3}$ are zeroes of the polynomial $3x^2 - 5x - 2$.

Sol. Given $p(x) = 3x^2 - 5x - 2$

$$\begin{aligned} p(2) &= 3(2)^2 - 5(2) - 2 \\ &= 12 - 10 - 2 = 12 - 12 = 0 \end{aligned}$$

$$\begin{aligned} p(-1/3) &= 3\left(-\frac{1}{3}\right)^2 - 5\left(-\frac{1}{3}\right) - 2 \\ &= \frac{1}{3} + \frac{5}{3} - 2 = 2 - 2 = 0 \end{aligned}$$

$\therefore 2$ and $-\frac{1}{3}$ are zeroes of $p(x)$.

16. Express $\log_5 125 = 3$ in its exponential form.

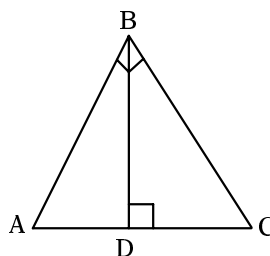
Sol. We know that, if $\log_a x = N$, then $x = a^N$

$$\text{So, } \log_5 125 = 3 \Rightarrow 5^3 = 125$$

$$\{\because x = 125, a = 5, N = 3\}$$

$\therefore 5^3 = 125$ is the exponential form of $\log_5 125 = 3$.

17. Draw the diagram corresponding to "Baudhayana theorem".



A.

18. What do you mean by centroid of a triangle ?

A. The concurrence point at medians of a triangle is called centroid of the triangle.

19. If $A \geq B$, then $\sin A \geq \sin B$. Is it true ? Justify your answer.

Sol. Given statement

"If $A \geq B$, then $\sin A \geq \sin B$ "

Yes, this statement is true.

Because, it is clear from the table below that the $\sin A$ increases as A increases.

A	0°	30°	45°	60°	90°
$\sin A$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1

20. When an observation in a data is abnormally more than or less than the remaining observations in the data, does it affect the mean or mode or median ? Why ?

A. Mean and medians are depending upon given data except mode. So when an observation in a data is abnormally changes it affects those values i.e., mean and median.

SECTION - III

21. Give an example for each of the following :

- i) The product of two irrational numbers is a rational number.
- ii) The product of two irrational numbers is an irrational number.

Sol. i) Let us consider two irrational numbers $\sqrt{2}, \sqrt{50}$.

Their product is

$$= (\sqrt{2})(\sqrt{50}) = \sqrt{100} = 10$$

which is a rational number.

ii) Again let us consider two irrational numbers = $\sqrt{3}, \sqrt{7}$

Their product

$$= (\sqrt{3})(\sqrt{7}) = \sqrt{21}$$

which is an irrational number.

22. Complete the following table for the polynomial

$$y = p(x) = x^3 - 2x + 3$$

x	-1	0	1	2
x^3				
$-2x$				
3				
y				
(x, y)				

Sol.

x	-1	0	1	2
x^3	-1	0	1	8
$-2x$	2	0	-2	-4
3	3	3	3	3
y	4	3	2	7
(x, y)	(-1, 4)	(0, 3)	(1, 2)	(2, 7)

23. The sum of a number and its reciprocal is $\frac{10}{3}$. Find the number.

Sol. Let the number be 'x'.

Its reciprocal is $\frac{1}{x}$

$x + \frac{1}{x} = \frac{10}{3}$, the quadratic equation obtained from this is $3x^2 - 10x + 3 = 0$

After solving, we get

$$x = 3 \text{ or } \frac{1}{3}.$$

\therefore Required number is 3 or $\frac{1}{3}$.

24. Find the 7th term from the end of the Arithmetic Progression 7, 10, 13,, 184.

Sol. Given Arithmetic progression 7, 10, 13,, 184.

Writing it in the reverse

184, 181,, 13, 10, 7

$$a = 184 ; d = 181 - 184 = -3.$$

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

7th term so $n = 7$

$$a_7 = 184 + (7 - 1)(-3)$$

$$= 184 - 6(3)$$

$$= 184 - 18 = 166.$$

25. Find the probability of existing 53 Sundays in a common year.

Sol. In a common year, no. of days = 365

$$\begin{aligned} \text{So number of weeks} &= 365 \\ &= (52)7 + (1) \end{aligned}$$

That means there are 52 weeks and 1 more day in a year.

So this 1 day may be any day of the week.

i.e., from Sunday to Saturday.

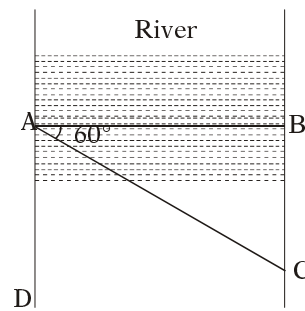
So number of possible outcomes = 7

Number of favourable outcomes for Sunday = 1

Hence the probability for 53

$$\text{Sundays} = \frac{1}{7}$$

26. A boat has to cross a river. It crosses river by making an angle of 60° with bank, due to the stream of river it travels a distance of 450 m to reach another side of river. Draw a diagram to this data.



Sol.

AB - width of river

AD, BC are river banks

AC - The distance travelled in river = 450 m

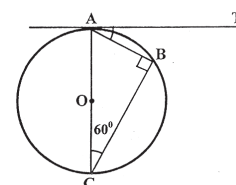
A - initial point

C - terminal point

27. AB is a chord of the circle and AOC is its diameter, such that $\angle ACB = 60^\circ$. If AT is the tangent to the circle at the point A, then find the measure of $\angle BAT$.

Sol. According to the data

$$\angle ACB = 60^\circ$$



AOC = diameter

AB = chord

AT is a tangent to the circle at A.

$$\therefore \angle ACB = 90^\circ$$

(\because semi-circle angle)

$$\angle BAC + \angle ACB = 90^\circ$$

$$\angle BAC + 60^\circ = 90^\circ$$

$$\Rightarrow \angle BAC = 30^\circ$$

$$\text{AT} \perp \text{AOC}, \angle CAT = 90^\circ$$

$$\angle BAC + \angle BAT = 90^\circ$$

$$30^\circ + \angle BAT = 90^\circ$$

$$\Rightarrow \angle BAT = 60^\circ$$

28. The line joining points A(6, 9) and B(-6, -9) are given. In which ratio does the point P(2, 3) divide \overline{AB} ?

Sol. Given: A (6, 9), B (-6, -9) and P (2, 3) divide \overline{AB} internally in the ratio say k : 1.

[By section formula]

Then P (2, 3) =

$$\left(\frac{k(-6) + 1(6)}{k+1}, \frac{k(-9) + 9}{k+1} \right)$$

$$\Rightarrow 2 = \frac{-6k + 6}{k+1} \text{ and}$$

$$3 = \frac{-9k + 9}{k+1}$$

$$\Rightarrow 2k + 2 = -6k + 6 \text{ and}$$

$$3k + 3 = -9k + 9$$

$$\Rightarrow 8k = 6 - 2 \text{ and}$$

$$3k + 9k = 9 - 3$$

$$\Rightarrow k = \frac{4}{8} \text{ and } 12k = 6$$

$$\Rightarrow k = \frac{1}{2} \text{ and } k = \frac{6}{12} \Rightarrow k = \frac{1}{2}$$

\therefore The ratio (k : 1)

$$= \left(\frac{1}{2} : 1 \right) = 1 : 2$$

SECTION - IV

29. a) Use Euclid's division lemma, to show that the cube of any positive integer is of the form $3p$ or $3p + 1$ or $3p + 2$ for any integer 'p'.

Sol. Let 'a' be positive integer

$$a = bq + r, 0 \leq r < b$$

$$b = 3 \text{ so } r = 0, 1, 2$$

Then 'a' can be of the forms

$$3q + 0, 3q + 1, 3q + 2$$

Case (i) :

$$\text{When } a = 3q$$

$$a^3 = (3q)^3 = 3(9q^3)$$

$$= 3p \text{ where } p = 9q^3$$

Case (ii) :

$$\text{When } a = 3q + 1$$

$$a^3 = (3q + 1)^3$$

$$= (3q)^3 + 3(3q)(1)(3q + 1) + (1)^3$$

$$= 3[9q^3 + 3q(3q + 1)] + 1$$

$$= 3p + 1$$

$$\text{where } p = 9q^3 + 3q(3q + 1)$$

Case (iii) :

$$\text{When } a = 3q + 2$$

$$a^3 = (3q + 2)^3$$

$$= (3q)^3 + 3(3q)(2)(3q + 2) + (2)^3$$

$$= 3[9q^3 + 6q(3q + 2)] + 2$$

$$= 3p + 2$$

$$\text{where } p = 9q^3 + 6q(3q + 2)$$

So the cube of any positive integer is of the form $3p$ or $3p + 1$ or $3p + 2$ for any integer 'p'.

(OR)

b) Verify that $3, -1, -\frac{1}{3}$ are the zeroes of the cubic polynomial $p(x) = 3x^3 - 5x^2 - 11x - 3$, and then verify the relationship between the zeroes and the coefficients.

Sol. Comparing the given polynomial with $ax^3 + bx^2 + cx + d$,

we get

$$a = 3, b = -5, c = -11,$$

$d = -3$. Further,

$$p(3) = 3(3)^3 - 5(3^2) - 11(3) - 3 \\ = 81 - 45 - 33 - 3 = 0,$$

$$p(-1) = 3 \times (-1)^3 - 5 \times (-1)^2 - 11 \times \\ (-1) - 3 \\ = -3 - 5 + 11 - 3 = 0$$

$$p\left(-\frac{1}{3}\right) = 3 \times \left(-\frac{1}{3}\right)^3 - 5 \times \left(-\frac{1}{3}\right)^2 - 11 \times \left(-\frac{1}{3}\right) - 3 \\ = -\frac{1}{9} - \frac{5}{9} + \frac{11}{3} - 3 = -\frac{2}{3} + \frac{2}{3} = 0$$

Therefore, 3, -1 and $-\frac{1}{3}$ are the zeroes of $3x^3 - 5x^2 - 11x - 3$.

So, we take $\alpha = 3$, $\beta = -1$ and

$$\gamma = -\frac{1}{3}$$

Now,

$$\alpha + \beta + \gamma = 3 + (-1) + \left(-\frac{1}{3}\right) \\ = 2 - \frac{1}{3} = \frac{5}{3} = \frac{-(-5)}{3} = \frac{-b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = 3 \times (-1) + \\ (-1) \times \left(-\frac{1}{3}\right) + \left(-\frac{1}{3}\right) \times 3 \\ = -3 + \frac{1}{3} - 1 = \frac{-11}{3} = \frac{c}{a}$$

$$\alpha\beta\gamma = 3 \times (-1) \times \left(-\frac{1}{3}\right) \\ = 1 = \frac{-(-3)}{3} = \frac{-d}{a}$$

30. a) The sum of the three terms which are in an Arithmetic Progression is 33. If the prod-

uct of the first and the third terms exceeds the second term by 29, find the Arithmetic Progression.

Sol. Let $a - d$, a , $a + d$ be the three consecutive terms of an A.P.

Sum of three terms is 33

$$a - d + a + a + d = 33$$

$$\therefore a = 11 \text{ --- (1)}$$

Product the first and third terms exceeds the second term by 29

$$(a - d)(a + d) - 29 = a$$

$$a^2 - d^2 = 11 + 29 = 40 \text{ --- (2)}$$

Solving equations (1) and (2)

$$d = \pm 9$$

if

$a = 11$, $d = 9$, then the A.P. is

$$2, 11, 20, \dots$$

if

$a = 11$, $d = -9$, then the A.P. is

$$20, 11, 2, \dots$$

(OR)

b) The radius of a conical tent is 5m and its height is 12m. Calculate the length of the canvas used in making the tent if width of canvas is 2cm.

Sol. Radius of the conical tent (r)
 $= 5$ m.

Height of the tent (h) = 12 m.

\therefore Slant height of the cone

$$(l) = \sqrt{r^2 + h^2} \\ = \sqrt{5^2 + 12^2}$$

$$= \sqrt{25 + 144}$$

$$= \sqrt{169} = 13 \text{ m.}$$

Now, surface area of the tent
 $= \pi r l$

$$= \frac{22}{7} \times 5 \times 13$$

$$= \frac{1430}{7} \text{ m}^2$$

Area of the canvas used
 $= \frac{1430}{7} \text{ m}^2.$

It is given that the width of the canvas = 2m.

Length of the canvas used
 $= \frac{\text{Area}}{\text{Width}}$
 $= \frac{1430}{7} \times \frac{1}{2} = 102.14 \text{ m}$

31. a) If the median of 60 observations given below is 28.5, then find the values of x and y.

Class interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	5	x	20	15	y	5

Sol.

Class interval	Frequency	cf
0 – 10	5	5
10 – 20	x	5 + x
20 – 30	20	25 + x
30 – 40	15	40 + x
40 – 50	y	40 + x + y
50 – 60	5	45 + x + y

$$\text{Median} = l + \frac{\left(\frac{n}{2} - \text{cf}\right)}{f} \times h$$

It is given that $\Sigma f = n = 60$

So, $45 + x + y = 60$

$x + y = 60 - 45 = 15$

$x + y = 15 \dots\dots\dots (1)$

The median is 28.5 which lies between 20 and 30.

\therefore Median class = 20 – 30

Lower boundary of the median class ' l ' = 20

$$\frac{n}{2} = \frac{60}{2} = 30$$

cf - cumulative frequency
 $= 5 + x$

$h = 10$

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

$$\Rightarrow 28.5 = 20 + \frac{30 - 5 - x}{20} \times 10$$

$$28.5 = 20 + \frac{25 - x}{2}$$

$$\frac{25 - x}{2} = 28.5 - 20 = 8.5$$

$$25 - x = 2 \times 8.5$$

$$x = 25 - 17 = 8$$

Also from (1); $x + y = 15$

$$8 + y = 15$$

$$y = 7$$

$\therefore x = 8; y = 7.$

(OR)

b) Prove that

$$\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1}{\sec \theta - \tan \theta}$$

using the identity $\sec^2 \theta = 1 + \tan^2 \theta$.

Sol. L.H.S. = $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1}$

On dividing Nr & Dr by $\cos \theta$, we get

$$\begin{aligned} &= \frac{\frac{\sin \theta}{\cos \theta} - \frac{\cos \theta}{\cos \theta} + \frac{1}{\cos \theta}}{\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\cos \theta} - \frac{1}{\cos \theta}} \\ &= \frac{\tan \theta + \sec \theta - 1}{\tan \theta + \sec \theta + 1} \\ &= \frac{(\tan \theta + \sec \theta) - (\sec^2 \theta - \tan^2 \theta)}{\tan \theta + 1 - \sec \theta} \\ & \quad [\because 1 = \sec^2 \theta - \tan^2 \theta] \\ &= \frac{(\tan \theta + \sec \theta) - ((\sec \theta + \tan \theta)(\sec \theta - \tan \theta))}{\tan \theta + 1 - \sec \theta} \\ & \quad [\because a^2 - b^2 = (a + b)(a - b)] \\ &= \frac{(\tan \theta + \sec \theta) \cancel{(1 - \sec \theta + \tan \theta)}}{\cancel{(\tan \theta - \sec \theta + 1)}} \\ &= \tan \theta + \sec \theta \\ &= \sec \theta + \tan \theta \quad \dots\dots\dots (1) \end{aligned}$$

$$\begin{aligned} \text{R.H.S.} &= \frac{1}{\sec \theta - \tan \theta} \\ &= \frac{1}{\sec \theta - \tan \theta} \times \frac{\sec \theta + \tan \theta}{\sec \theta + \tan \theta} \end{aligned}$$

[By rationalising R.F of $\sec \theta - \tan \theta$ is $\sec \theta + \tan \theta$]

$$\begin{aligned} &= \frac{\sec \theta + \tan \theta}{\sec^2 \theta - \tan^2 \theta} \\ &= \sec \theta + \tan \theta \quad \dots\dots (2) \\ & \quad [\because \sec^2 \theta - \tan^2 \theta = 1] \end{aligned}$$

From (1) and (2), we get

L.H.S. = R.H.S.

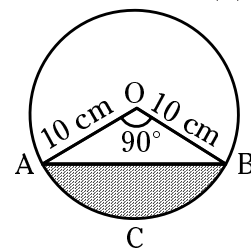
$$\begin{aligned} \therefore \frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} &= \frac{1}{\sec \theta - \tan \theta} \end{aligned}$$

32. a) A chord of circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding :

- Minor segment
- Major segment

(use $\pi = 3.14$)

Sol. Radius of circle (r) = 10 cm
Sector angle (x) = 90°
Radius of sector (r) = 10 cm.



Area of sector OACB

$$\begin{aligned} &= \frac{x}{360} \times \pi r^2 \\ &= \frac{90^\circ}{360^\circ} \times 3.14 \times 10 \times 10 \\ &= 78.5 \text{ Sq. cm} \end{aligned}$$

$$\begin{aligned} \text{Area of } \triangle AOB &= \frac{1}{2} \times 10 \times 10 \\ &= 50 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the Minor Segment} &= \text{Area of sector OACB} \\ &\quad - \text{Area of } \triangle OAB \\ &= 78.5 - 50.0 = 28.5 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of Major Segment} &= \text{Area of the circle} \\ &\quad - \text{Area of the Minor Segment} \\ &= (3.14 \times 10 \times 10) - 28.5 \\ &= 314 - 28.5 = 285.5 \text{ cm}^2 \end{aligned}$$

(OR)

b) A shopkeeper has 100 memory cards in a box. Among them, 15 memory cards are defective. When a person came to the shop to buy a memory card, the shopkeeper drew a memory card at random from the box. Then,

i) what is the probability that this memory card is defective ?

ii) after drawing the first memory card which is defective, it is not placed back in the box. Then another memory card is drawn at random. What is the probability that this memory card is NOT defective ?

Sol. i) Total all possible outcomes = $n(T) = 100$
Number of favourable outcomes = $n(E) = 15$

The probability that memory card is defective

$$= P(E) = \frac{n(E)}{n(T)} = \frac{15}{100} = \frac{3}{20}$$

ii) Removed defective card is not placed in the box, so the probability that memory card is defective

$$= P(E') = \frac{14}{100} = \frac{7}{50}$$

The probability that memory card is NOT defective

$$\begin{aligned} &= 1 - P(E') = 1 - \frac{7}{50} \\ &= \frac{50 - 7}{50} = \frac{43}{50} \end{aligned}$$

33.a) i) Draw the graphs of the following equations $3x - y - 2 = 0$ and $2x + y - 8 = 0$ on the graph paper.

ii) Write down the coordinates of the point of intersection of the above equation.

iii) Find the area of the triangle formed by the lines and the X - axis.

Sol. i) Given equations are

$$3x - y - 2 = 0 \text{ and}$$

$$2x + y - 8 = 0$$

$$\text{Table for } 3x - y - 2 = 0,$$

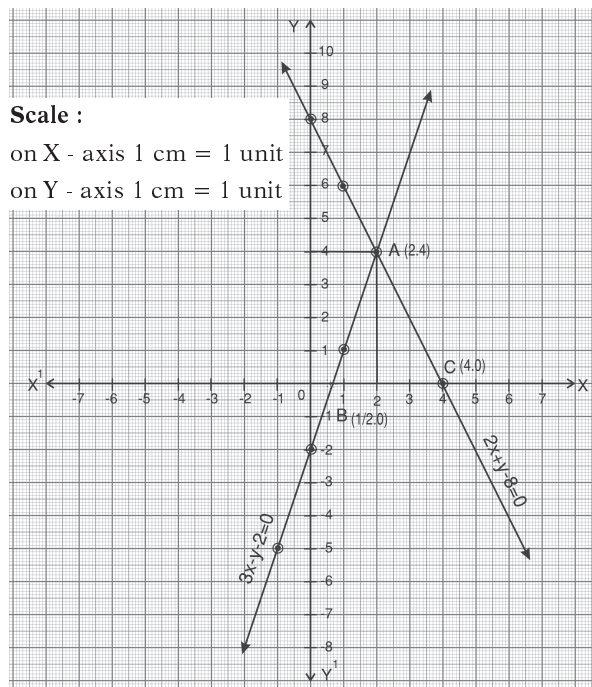
$$y = 3x - 2$$

x	0	1	-1
$y = 3x - 2$	-2	1	-5
(x, y)	(0, -2)	(1, 1)	(-1, -5)

Table for $2x + y - 8 = 0$, $y = -2x + 8$

x	0	4	1
$y = -2x + 8$	8	0	6
(x, y)	(0, 8)	(4, 0)	(1, 6)

Now plot all these points on the graph paper.



ii) From the graph the coordinates of the point of intersection of the given equation is (2, 4).

iii) From the graph
Area of the Triangle

$$= \frac{1}{2} \times \text{base} \times \text{height}$$

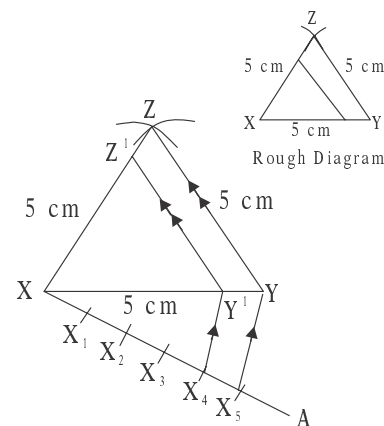
$$= \frac{1}{2} \times 3.5 \times 4$$

$$= 7 \text{ sq. units.}$$

(OR)

b) Construct an equilateral triangle XYZ of side 5 cm and construct another triangle similar to $\triangle XYZ$, such that each of its sides is $\frac{4}{5}$ of the sides of $\triangle XYZ$.

Sol.



Steps of construction :

- * Draw an equilateral triangle XYZ with side 5 cm.
- * Draw a ray \overline{XA} such that $\angle YXA$ is an acute angle.
- * Draw X_1, X_2, X_3, X_4, X_5 arcs on \overline{XA} such that $XX_1 = X_1X_2 = \dots = X_4X_5$
- * Join X_5 and Y.
- * Draw a parallel line to X_5Y through X_4 to meet XY at Y'.
- * Draw a parallel line to YZ through Y' to meet XZ at Z'.
- * $\triangle XY'Z'$ is required similar triangle.





CLASS X

PRE-PUBLIC PAPER MATHEMATICS

1

Time : 3.15 Hrs.]

[Max. Marks : 100

Instructions :

1. Answer **all** the questions in a separate answer Booklet.
2. The question paper consists of **IV** Sections and **33** questions.
3. There is an internal choice in **Section – IV**.
4. Write answers neatly and legibly.

SECTION - I

12 × 1 = 12

Note : 1. Answer **all** the Questions in **ONE WORD** or **PHRASE**.

2. Each question carries **1** Mark.

3. If any question is answered more than once, the answer only will be considered.

1. Find the numerical value of $\log_3(\tan 60^\circ)^2$.
2. In a survey an agency taken in contienment zone found that the number of people has chances to suffer with Covid-19 due to smoking is 10 less than two third the number of people by direct contact with diseased person. Represent this in linear equation form.
3. If α, β, γ are the zeroes of the polynomial $px^3 + qx^2 + rx + s$, then which of the following option is correct one ?

i) $\alpha + \beta + \gamma$ a) $-\frac{d}{a}$

ii) $\alpha\beta + \beta\gamma + \gamma\alpha$ b) $-\frac{b}{a}$

iii) $\alpha\beta\gamma$ c) $\frac{c}{a}$

A) i - a, ii - b, iii - c

B) i - c, ii - a, iii - b

C) i - b, ii - c, iii - a

D) i - b, ii - a, iii - c

4. If the surface area of a hemisphere is 's', then express 'r' in terms of 's'.
5. Orbits of the celestial objects are defined by a mathematical concept. Identify that concept and write it.
6. Let A, B are two sets such that $n(A) = 5$, $n(B) = 7$, then find the maximum number of elements in $A \cup B$.
7. Find the slope of the line joining the two given points (4, -8) and (5, -2).
8. Name the quadrilateral, which satisfies both the conditions given below.

A : Diagonals are equal.

B : All sides are equal.

- a) Rhombus
 - b) Parallelogram
 - c) Rectangle
 - d) Square
9. In $\triangle ABC$ and $\triangle DEF$, if $\angle B = \angle E$, $\angle C = \angle F$, then which of the following is a true statement ?

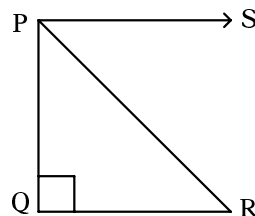
A) $\frac{AB}{DE} = \frac{CA}{EF}$

B) $\frac{BC}{EF} = \frac{AB}{FD}$

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

D) $\frac{CA}{FD} = \frac{AB}{EF}$

10. How much the slope of the line passing through the points (2a, 3b) and (2b, 3a) ?
11. Name the angle of depression from the figure given below in which $\angle Q = 90^\circ$.



12. \bar{x} means the mean of $x_1, x_2, x_3, \dots, x_n$, then what is the value of $\sum_{i=1}^n (x_i - \bar{x})$?

SECTION - II**8 × 2 = 16****Note :** 1. Answer **all** the questions.2. Each question carries **2** Marks.

13. If $A = \{\text{quadrilaterals}\}$, $B = \{\text{point, line, triangle}\}$. State whether $A \subset B$ or $B \subset A$ or any answer.
14. Establish the relation between diagonal and side of a square.
15. Show that 2 and $-\frac{1}{3}$ are zeroes of the polynomial $3x^2 - 5x - 2$.
16. Express $\log_5 125 = 3$ in its exponential form.
17. Draw the diagram corresponding to "Baudhayana theorem".
18. What do you mean by centroid of a triangle ?
19. If $A \geq B$, then $\sin A \geq \sin B$. Is it true ? Justify your answer.
20. When an observation in a data is abnormally more than or less than the remaining observations in the data, does it affect the mean or mode or median ? Why ?

SECTION - III**8 × 4 = 32****Note :** 1. Answer **all** the questions.2. Each question carries **4** Marks.

21. Give an example for each of the following :
 - i) The product of two irrational numbers is a rational number.
 - ii) The product of two irrational numbers is an irrational number.
22. Complete the following table for the polynomial $y = p(x) = x^3 - 2x + 3$

x	-1	0	1	2
x^3				
$-2x$				
3				
y				
(x, y)				

23. The sum of a number and its reciprocal is $\frac{10}{3}$. Find the number.
24. Find the 7th term from the end of the Arithmetic Progression 7, 10, 13,, 184.

25. Find the probability of existing 53 Sundays in a common year.
26. A boat has to cross a river. It crosses river by making an angle of 60° with bank, due to the stream of river it travels a distance of 450 m to reach another side of river. Draw a diagram to this data.
27. AB is a chord of the circle and AOC is its diameter, such that $\angle ACB = 60^\circ$. If AT is the tangent to the circle at the point A, then find the measure of $\angle BAT$.
28. The line joining points A(6, 9) and B(-6, -9) are given. In which ratio does the point P(2, 3) divide \overline{AB} ?

SECTION - IV

5 × 8 = 40

Note : 1. Answer all the questions.

2. Each Question carries 8 Marks.

3. There is an internal choice for each question.

29. a) Use Euclid's division lemma, to show that the cube of any positive integer is of the form $3p$ or $3p + 1$ or $3p + 2$ for any integer 'p'.

(OR)

- b) Verify that 3, -1, $-\frac{1}{3}$ are the zeroes of the cubic polynomial $p(x) = 3x^3 - 5x^2 - 11x - 3$, and then verify the relationship between the zeroes and the coefficients.

30. a) The sum of the three terms which are in an Arithmetic Progression is 33. If the product of the first and the third terms exceeds the second term by 29, find the Arithmetic Progression.

(OR)

- b) The radius of a conical tent is 5m and its height is 12m. Calculate the length of the canvas used in making the tent if width of canvas is 2cm.

31. a) If the median of 60 observations given below is 28.5, then find the values of x and y.

Class interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	5	x	20	15	y	5

(OR)

b) Prove that $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1}{\sec \theta - \tan \theta}$ using the identity $\sec^2 \theta = 1 + \tan^2 \theta$.

32. a) A chord of circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding :

- i) Minor segment
- ii) Major segment (use $\pi = 3.14$)

(OR)

b) A shopkeeper has 100 memory cards in a box. Among them, 15 memory cards are defective. When a person came to the shop to buy a memory card, the shopkeeper drew a memory card at random from the box. Then,

- i) what is the probability that this memory card is defective ?
- ii) after drawing the first memory card which is defective, it is not placed back in the box. Then another memory card is drawn at random. What is the probability that this memory card is NOT defective ?

33. a) i) Draw the graphs of the following equations $3x - y - 2 = 0$ and $2x + y - 8 = 0$ on the graph paper.

ii) Write down the coordinates of the point of intersection of the above equation.

iii) Find the area of the triangle formed by the lines and the X - axis.

(OR)

b) Construct an equilateral triangle XYZ of side 5 cm and construct another triangle similar to ΔXYZ , such that each of its sides is $\frac{4}{5}$ of the sides of ΔXYZ .





CLASS X

PRE-PUBLIC PAPER

గణిత-శాస్త్రం



సమయం : 3.15 గం.]

[గరిష్ట మార్కులు : 100

విద్యార్థులకు సూచనలు :

1. అన్ని ప్రశ్నలకు సమాధానములు ప్రత్యేక బుక్‌లెట్‌లో మాత్రమే రాయాలి.
2. ప్రశ్నాపత్రంలో నాలుగు విభాగాలు మరియు 33 ప్రశ్నలు ఉండును.
3. విభాగం - IV లో అంతర్గత ఎంపిక ఉంటుంది.
4. సమాధానాలు స్పష్టంగా రాయాలి.

విభాగం - I

12 × 1 = 12

సూచనలు: 1. క్రింద ఇవ్వబడిన అన్ని ప్రశ్నలకు ఒక పదం లేదా ఒక వాక్యంలో జవాబు రాయండి.

2. ప్రతి ప్రశ్నకు 1 మార్కు.

3. ఏదైన ప్రశ్నకు జవాబు ఒకటి కంటే ఎక్కువసార్లు రాసినచో, మొదటిసారి రాసిన జవాబును మాత్రమే పరిగణనలోనికి తీసుకొనబడును.

1. $\log_3(\tan 60^\circ)^2$ యొక్క సంఖ్యాత్మక విలువను కనుగొనుము.

2. ఒక కంటైన్‌మెంట్ జోన్‌లో నిర్వహించిన సర్వేలో కోవిడ్-19 సోకిన వారిలో పొగత్రాగువారు, వ్యాధిగ్రస్తుని ప్రత్యక్షంగా కలిసినవారు కంటే $\frac{2}{3}$ వంతులో 10 తక్కువగా వుండెను. దీనిని రేఖీయ సమీకరణ రూపంలో వ్యక్తపరుచుము.

3. బహుపది $px^3 + qx^2 + rx + s$ యొక్క శూన్యాలు α, β, γ లు అయిన కింది వాటిలో సరైన జతను ఎన్నుకొనుము.

i) $\alpha + \beta + \gamma$

a) $-\frac{d}{a}$

ii) $\alpha\beta + \beta\gamma + \gamma\alpha$

b) $-\frac{b}{a}$

iii) $\alpha\beta\gamma$

c) $\frac{c}{a}$

A) i - a, ii - b, iii - c

B) i - c, ii - a, iii - b

C) i - b, ii - c, iii - a

D) i - b, ii - a, iii - c

4. ఒక అర్ధగోళపు ఉపరితలము వైశాల్యము 's' అయిన దీనిని వ్యాసార్థము 'r' లో వ్యక్తపరచుము.
5. భార వస్తువుల చలనము యొక్క కక్ష్య మార్గంను ఈ గణిత భావనతో నిర్వచిస్తారు. ఆ భావన ఏమిటో వ్రాయుము.
6. A, B లు ఏవైనా రెండు సమితులు. $n(A) = 5$, $n(B) = 7$ అయిన $A \cup B$ లో ఉండదగు గరిష్ట మూలకాల సంఖ్యను కనుగొనుము.
7. $(4, -8)$ మరియు $(5, -2)$ లను కలిపే రేఖాఖండపు వాలును కనుగొనుము.
8. కింది నియమాలను తృప్తిపరచు చతుర్భుజంను వ్రాయుము.

A : కర్ణాలు సమానము.

B : అన్ని భుజాలు సమానము.

a) రాంబస్

b) సమాంతర చతుర్భుజం

c) దీర్ఘచతురస్రం

d) చతురస్రం

9. $\triangle ABC$ మరియు $\triangle DEF$ లలో $\angle B = \angle E$, $\angle C = \angle F$ అయిన కింది వాటిలో ఏది సరైనది ?

A) $\frac{AB}{DE} = \frac{CA}{EF}$

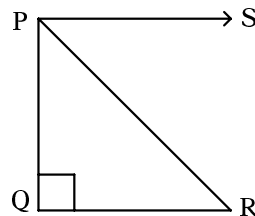
B) $\frac{BC}{EF} = \frac{AB}{FD}$

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

D) $\frac{CA}{FD} = \frac{AB}{EF}$

10. $(2a, 3b)$ మరియు $(2b, 3a)$ ల గుండా పోవు రేఖ వాలు ఎంత ?

11. $\angle Q = 90^\circ$ గా గల కింది పటంలోని నిమ్నకోణమును గుర్తించి వ్రాయుము.



12. $x_1, x_2, x_3, \dots, x_n$ ల సగటు \bar{x} అయిన $\sum_{i=1}^n (x_i - \bar{x})$ విలువ ఎంత ?

విభాగం - II

8 × 2 = 16

- సూచనలు: 1. అన్ని ప్రశ్నలకు సమాధానములు రాయుము.
2. ప్రతి ప్రశ్నకు 2 మార్కులు.

13. $A = \{\text{చతుర్భుజాలు}\}$, $B = \{\text{బిందువు, రేఖ, త్రిభుజం}\}$, అయిన $A \subset B$ లేక $B \subset A$ లేక ఏదైనా వేరొక సమాధానము అగునో ? కాదో ? వ్రాయుము.
14. చతురస్రపు భుజముకు మరియు కర్ణంకు మధ్య గల సంబంధమును వివరించుము.
15. 2 మరియు $-\frac{1}{3}$ లు బహుపది $3x^2 - 5x - 2$ యొక్క శూన్యాలు అని చూపుము.
16. $\log_5 125 = 3$ ను దాని ఘాతాంక రూపములో వ్యక్తపరుచుము.
17. 'బౌద్ధాయన సిద్ధాంతం'కు సరిపడు పటంను గీయుము.
18. ఒక త్రిభుజపు కేంద్రాభాసము అంటే ఏమిటో వ్రాయుము.
19. $A \geq B$ అయిన $\sin A \geq \sin B$ అనడం సరైనదేనా ? నీ సమాధానాన్ని సమర్థించుము.
20. ఒక దత్తాంశంలోని పరిశీలనాంశములలో ఏదేని ఒక పరిశీలనాంశం మిగతా వాటి కంటే అసాధారణంగా ఎక్కువ లేదా తక్కువ అయితే అది ఆ దత్తాంశం యొక్క సగటు లేదా బాహుళకం లేదా మధ్యగతంలో దేనిపై ప్రభావం చూపుతుంది ? ఎందుకు ?

విభాగం - III

8 × 4 = 32

- సూచనలు: 1. అన్ని ప్రశ్నలకు సమాధానములు రాయుము.
2. ప్రతి ప్రశ్నకు 4 మార్కులు.

21. ఈ క్రింది వాటిలో ప్రతీదానికి ఒక ఉదాహరణ వ్రాయండి.
i) రెండు కరణీయ సంఖ్యల లబ్ధము ఒక అకరణీయ సంఖ్య.
ii) రెండు కరణీయ సంఖ్యల లబ్ధము ఒక కరణీయ సంఖ్య.
22. $y = p(x) = x^3 - 2x + 3$ బహుపదికి సంబంధించిన క్రింది పట్టికను నింపండి.

x	-1	0	1	2
x^3				
$-2x$				
3				
y				
(x, y)				

23. ఒక సంఖ్య మరియు దాని వ్యుత్క్రమాల మొత్తం $\frac{10}{3}$ అయిన ఆ సంఖ్యను కనుగొనుము.
24. 7, 10, 13,, 184 అంకశ్రేణిలో చివరి నుండి 7వ పదమును కనుగొనండి.

25. ఒక సాధారణ సంవత్సరంలో 53 ఆదివారాలు ఉండడగు సంభావ్యతను కనుగొనుము.
26. ఒక నావ ఒక నదిని దాటాల్సి ఉంది. నదీప్రవాహం కారణంగా ఆ నదీ తీరంతో 60° ల కోణం చేస్తున్న ఆ నావ 450 మీ. దూరం ప్రయాణించి అవతలి తీరాన్ని చేరింది. ఈ దత్తాంశమునకు పటంను గీయండి.
27. ఒక వృత్తంలో AOC వ్యాసము, $\angle ACB = 60^\circ$ మరియు AB ఒక జ్యా A వద్ద గీసిన స్పర్శరేఖ AT అయితే $\angle BAT$ యొక్క కొలత కనుగొనండి.
28. బిందువులు A(6, 9) మరియు B(-6, -9) లను కలుపు రేఖాఖండమును బిందువు P(2, 3) ఏ నిష్పత్తిలో విభజిస్తుంది ?

విభాగం - IV

5 × 8 = 40

సూచనలు: 1. అన్ని ప్రశ్నలకు సమాధానములు రాయుము.

2. ప్రతి ప్రశ్నకు 8 మార్కులు.

3. ప్రతి ప్రశ్నకు అంతర్గత ఎంపిక కలదు.

29. a) యూక్లిడ్ భాగహార న్యాయమునుపయోగించి ఒక ధన పూర్ణసంఖ్య ఘనము, ఏ పూర్ణ సంఖ్య 'p' కి అయినా $3p$ లేదా $3p + 1$ లేదా $3p + 2$ రూపంలో ఉంటుందని చూపండి.

(లేదా)

- b) ఘన బహుపది $p(x) = 3x^3 - 5x^2 - 11x - 3$ యొక్క శూన్యాలు 3, -1 మరియు $-\frac{1}{3}$ అగునని చూపండి. బహుపది గుణకాలకు, శూన్యాలకు మధ్యగల సంబంధాన్ని సరిచూడండి.

30. a) అంకశ్రేణిలో గల మొదటి మూడు పదముల మొత్తము 33. మొదటి మరియు మూడవ పదముల లబ్ధము, రెండవ పదము కన్నా 29 ఎక్కువ అయిన ఆ అంకశ్రేణిని కనుగొనండి.

(లేదా)

- b) శంఖాకారంలో వున్న గుడారము యొక్క భూ వ్యాసార్థం 5 మీ., ఎత్తు 10 మీ. అయితే ఆ గుడారము నిర్మించడానికి కావలసిన బట్ట వెడల్పు 2 సెం.మీ. అయితే దాని పొడవును కనుగొనుము.

31. a) క్రింది పట్టికలో ఇవ్వబడిన 60 రాశుల మధ్యగతం 28.5 అయిన, x, y విలువలను కనుగొనుము.

తరగతి అంతరం	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
పౌనఃపున్యము	5	x	20	15	y	5

(లేదా)

b) $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1}{\sec \theta - \tan \theta}$ నిరూపించండి.

($\sec^2 \theta = 1 + \tan^2 \theta$ సర్వసమీకరణాన్ని ఉపయోగించి)

32. a) 10 సెం.మీ వ్యాసార్థముగా గల వృత్తములో ఒక జ్యా కేంద్రము వద్ద లంబకోణాన్ని ఏర్పరిస్తే, కింది ఇవ్వబడిన వృత్తఖండాల వైశాల్యాలు కనుగొనండి.

($\pi = 3.14$ అని తీసుకోండి.)

i) అల్ప వృత్త ఖండము

ii) అధిక వృత్త ఖండము

(లేదా)

b) ఒక దుకాణదారుని వద్ద ఒక పెట్టెలో 100 మెమోరీ కార్డులున్నాయి. వాటిలో లోపం కల 15 మెమోరీ కార్డులు కలిసి ఉన్నాయి. ఒక వ్యక్తి ఒక మెమోరీ కార్డును కొనడానికి ఆ దుకాణానికి వచ్చినపుడు దుకాణదారుడు మెమోరీ కార్డుల పెట్టెనుండి ఒక కార్డును యాదృచ్ఛికంగా తీసినాడు.

i) ఆ మెమోరీ కార్డు లోపం కల కార్డు కావడానికి గల సంభావ్యత ఎంత ?

ii) మొదట తీసిన మెమోరీ కార్డు లోపం గల కార్డు అయిన దానిని మరల తిరిగి ఆ పెట్టెలో వేయకుండా, మరియొక మెమోరీ కార్డును యాదృచ్ఛికంగా తీసినట్లయితే అది లోపం లేని మెమోరీ కార్డు అయ్యే సంభావ్యత ఎంత ?

33. a) i) $3x - y - 2 = 0$ మరియు $2x + y - 8 = 0$ సమీకరణాలను గ్రాఫ్ కాగితముపై రేఖాచిత్రాలను గీయండి.

ii) పై రెండు రేఖల ఖండన బిందువును కనుగొనండి.

iii) పై రెండు రేఖలు మరియు X - అక్షముచే ఏర్పడే త్రిభుజ వైశాల్యము కనుగొనండి.

(లేదా)

b) 5 సెం.మీ. భుజము గల ఒక సమబాహు త్రిభుజము ΔXYZ ను నిర్మించి, దాని భుజాలలో ప్రతి భుజం కొలత $\frac{4}{5}$ ఉండునట్లు ΔXYZ కు సరూప త్రిభుజాన్ని నిర్మించండి.



ANSWERS



విభాగం - I

1. $\log_3(\tan 60^\circ)^2$ యొక్క సంఖ్యాత్మక విలువను కనుగొనుము.

జ. $\log_3(\tan 60^\circ)^2 = \log_3(\sqrt{3})^2$
 $= \log_3 3 = 1$

2. ఒక కంటైన్‌మెంట్ జోన్‌లో నిర్వహించిన సర్వేలో కోవిడ్ - 19 సోకిన వారిలో పొగత్రాగువారు, వ్యాధిగ్రస్తుని ప్రత్యక్షంగా కలిసినవారు కంటే $\frac{2}{3}$ వంతులో 10 తక్కువగా వుండెను. దీనిని రేఖీయ సమీకరణ రూపంలో వ్యక్తపరుచుము.

జ. పొగత్రాగుట ద్వారా కోవిడ్ - 19 సోకి భాధపడువారు = x అనుకొనుము.
 వ్యాధిగ్రస్తునికి ప్రత్యక్షంగా సంబంధం కల్గిన వారు = y అనుకొనుము.

కావున, $x = \left(\frac{2}{3}\right)y - 10$
 $\Rightarrow 3x = 2y - 30$
 $\Rightarrow 3x - 2y + 30 = 0$

3. బహుపది $px^3 + qx^2 + rx + s$ యొక్క శూన్యాలు α, β, γ లు అయిన కింది వాటిలో సరైన జతను ఎన్నుకొనుము.

- i) $\alpha + \beta + \gamma$ a) $-\frac{d}{a}$
- ii) $\alpha\beta + \beta\gamma + \gamma\alpha$ b) $-\frac{b}{a}$
- iii) $\alpha\beta\gamma$ c) $\frac{c}{a}$

- A) i - a, ii - b, iii - c
- B) i - c, ii - a, iii - b
- C) i - b, ii - c, iii - a
- D) i - b, ii - a, iii - c

జ. (C)

4. ఒక అర్థగోళపు ఉపరితలము వైశాల్యము 's' అయిన దీనిని వ్యాసార్థము 'r' లలో వ్యక్తపరచుము.

జ. $2\pi r^2 = s \Rightarrow r = \sqrt{\frac{s}{2\pi}}$

5. భార వస్తువుల చలనము యొక్క కక్ష్య మార్గంను ఈ గణిత భావనతో నిర్వచిస్తారు. ఆ భావన ఏమిటో వ్రాయుము.

జ. వర్గ సమీకరణము.

6. A, B లు ఏదైనా రెండు సమితులు.
 $n(A) = 5$, $n(B) = 7$ అయిన $A \cup B$
 లో ఉండదగు గరిష్ట మూలకాల సంఖ్యను
 కనుగొనుము.

జ. $A \cup B$ లో 12 మూలకాలుండును.

7. (4, -8) మరియు (5, -2) లను కలిపే
 రేఖాఖండపు వాలును కనుగొనుము.

జ. వాలు = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 + 8}{5 - 4} = 6$

8. కింది నియమాలను తృప్తిపరచు
 చతుర్భుజంను వ్రాయుము.

A : కర్ణాలు సమానము.

B : అన్ని భుజాలు సమానము.

a) రాంబస్

b) సమాంతర చతుర్భుజం

c) దీర్ఘచతురస్రం

d) చతురస్రం

జ. (d)

9. $\triangle ABC$ మరియు $\triangle DEF$ లలో
 $\angle B = \angle E$, $\angle C = \angle F$ అయిన కింది
 వాటిలో ఏది సరైనది ?

A) $\frac{AB}{DE} = \frac{CA}{EF}$ B) $\frac{BC}{EF} = \frac{AB}{FD}$

C) $\frac{AB}{DE} = \frac{BC}{EF}$ D) $\frac{CA}{FD} = \frac{AB}{EF}$

జ. (C)

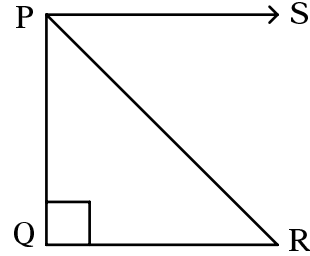
10. (2a, 3b) మరియు (2b, 3a) ల గుండా
 పోవు రేఖ వాలు ఎంత ?

జ. $x_1 = 2a$, $y_1 = 3b$,
 $x_2 = 2b$, $y_2 = 3a$

వాలు = $m = \frac{y_2 - y_1}{x_2 - x_1}$

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

11. $\angle Q = 90^\circ$ గా గల కింది పటంలోని
 నిమ్నకోణమును గుర్తించి వ్రాయుము.



జ. $\angle SPR$ అనునది నిమ్నకోణము.

12. $x_1, x_2, x_3, \dots, x_n$ ల సగటు \bar{x}
 అయిన $\sum_{i=1}^n (x_i - \bar{x})$ విలువ ఎంత ?

జ. '0'

విభాగం - II

13. $A = \{\text{చతుర్భుజాలు}\}$, $B = \{\text{బిందువు, రేఖ, త్రిభుజం}\}$, అయిన $A \subset B$ లేక $B \subset A$ లేక ఏదైనా వేరొక సమాధానము అగునో ? కాదో ? వ్రాయుము.

సాధన. దత్తాంశము ప్రకారం,

$A = \{\text{చతుర్భుజాలు}\}$ మరియు

$B = \{\text{బిందువు, రేఖ, త్రిభుజం}\}$

A మరియు B లు వియుక్త సమితులు కనుక వేరొక సమాధానము సరియైనది.

14. చతురస్రపు భుజముకు మరియు కర్ణంకు మధ్య గల సంబంధమును ఏర్పరుచుము.

సాధన. చతురస్ర భుజము = x అనుకొనుము.

చతురస్ర కర్ణము = AC = ΔABC యొక్క కర్ణము.

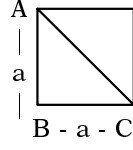
$$\therefore AC = \sqrt{AB^2 + BC^2}$$

$$= \sqrt{a^2 + a^2}$$

$$= \sqrt{2a^2}$$

$$= \sqrt{2} a$$

\therefore చతురస్ర భుజము 'a' అయిన దాని కర్ణము $\sqrt{2} a$ అగును.



15. 2 మరియు $-\frac{1}{3}$ లు బహుపది $3x^2 - 5x - 2$ యొక్క శూన్యాలు అని చూపుము.

సాధన. దత్తాంశం = $p(x) = 3x^2 - 5x - 2$

$$p(2) = 3(2)^2 - 5(2) - 2$$

$$= 12 - 10 - 2 = 12 - 12 = 0$$

$$p(-1/3) = 3\left(-\frac{1}{3}\right)^2 - 5\left(-\frac{1}{3}\right) - 2$$

$$= \frac{1}{3} + \frac{5}{3} - 2 = 2 - 2 = 0$$

\therefore 2 మరియు $-\frac{1}{3}$ లు బహుపది $p(x)$ కు శూన్యాలు అగును.

16. $\log_5 125 = 3$ ను దాని ఘాతాంక రూపములో వ్యక్తపరుచుము.

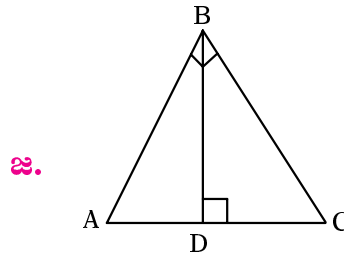
సాధన. $\log_a x = N$ అయిన $x = a^N$ అగును.

$$\text{కనుక } \log_5 125 = 3 \Rightarrow 5^3 = 125$$

$$\{\because x = 125, a = 5, N = 3\}$$

$\therefore 5^3 = 125$ అనునది $\log_5 125 = 3$ యొక్క ఘాతరూపము.

17. 'బౌద్ధాయన సిద్ధాంతం'కు సరిపడు పటంను గీయుము.



18. ఒక త్రిభుజపు కేంద్రాభాసము అంటే ఏమిటో వ్రాయుము.

జ. త్రిభుజ మధ్యగత రేఖల ఖండన బిందువును ఆ త్రిభుజపు కేంద్రాభాసము లేక గురుత్వకేంద్రము అంటారు.

19. $A \geq B$ అయిన $\sin A \geq \sin B$ అనడం సరైనదేనా? నీ సమాధానాన్ని సమర్థించుము.

సాధన. ఇచ్చిన ప్రవచనము

" $A \geq B$ అయిన $\sin A \geq \sin B$ ". ఈ ప్రవచనము సత్యమే అనుటను క్రింది పట్టిక తెల్పుచున్నది. 'A' కోణము విలువ పెరిగే కొలదీ దాని sine విలువ పెరుగుచుండును.

A	0°	30°	45°	60°	90°
$\sin A$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1

20. ఒక దత్తాంశంలోని పరిశీలనాంశములలో ఏదేని ఒక పరిశీలనాంశం మిగతా వాటి కంటే అసాధారణంగా ఎక్కువ లేదా తక్కువ అయితే అది ఆ దత్తాంశం యొక్క సగటు లేదా బాహుళకం లేదా మధ్యగతంలో దేనిపై ప్రభావం చూపుతుంది ? ఎందుకు ?

జ. ఒక దత్తాంశం యొక్క సగటు లేదా మధ్యగతాలు పరిశీలన అంశాలపై ఆధారపడును. కాని బాహుళకం పరిశీలన అంశాలపై ఆధారపడదు. కనుక ఒక దత్తాంశంలోని పరిశీలనాంశాలలో ఏదేని ఒక పరిశీలనాంశం మిగతా వాటికంటే అసాధారణంగా ఎక్కువ లేదా తక్కువ అయితే అది ప్రభావం చూపును.

విభాగం - III

21. ఈ క్రింది వాటిలో ప్రతీదానికి ఒక ఉదాహరణ వ్రాయండి.

- రెండు కరణీయ సంఖ్యల లబ్ధము ఒక అకరణీయ సంఖ్య.
- రెండు కరణీయ సంఖ్యల లబ్ధము ఒక కరణీయ సంఖ్య.

సాధన. i) $\sqrt{2}$ మరియు $\sqrt{50}$ లు రెండు కరణీయ సంఖ్యలు.

$$\sqrt{2}, \sqrt{50} \text{ ల లబ్ధము}$$

$$= (\sqrt{2})(\sqrt{50}) = \sqrt{100} = 10$$

\therefore 10 ఒక అకరణీయ సంఖ్య.

ii) $\sqrt{3}$ మరియు $\sqrt{7}$ లు రెండు కరణీయ సంఖ్యలు.

$$\sqrt{3}, \sqrt{7} \text{ ల లబ్ధము } \sqrt{21} \text{ ఒక కరణీయ సంఖ్య.}$$

22. $y = p(x) = x^3 - 2x + 3$ బహుపదికి సంబంధించిన క్రింది పట్టికను నింపండి.

x	-1	0	1	2
x^3				
$-2x$				
3				
y				
(x, y)				

సాధన.

x	-1	0	1	2
x^3	-1	0	1	8
$-2x$	2	0	-2	-4
3	3	3	3	3
y	4	3	2	7
(x, y)	(-1, 4)	(0, 3)	(1, 2)	(2, 7)

23. ఒక సంఖ్య మరియు దాని వ్యుత్క్రమాల మొత్తం $\frac{10}{3}$ అయిన ఆ సంఖ్యను కనుగొనుము.

సాధన. ఒక సంఖ్యను 'x' అనుకొనుము

$$\text{దీని వ్యుత్క్రమము} = \frac{1}{x}$$

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

నుండి ఏర్పడే వర్గసమీకరణము

$$3x^2 - 10x + 3 = 0$$

సమీకరణమును సాధించగా

$$x = 3 \text{ లేదా } \frac{1}{3}.$$

\therefore కావలసిన సంఖ్య 3 లేదా $\frac{1}{3}$.

24. 7, 10, 13,, 184 అంకశ్రేణిలో చివరి నుండి 7వ పదమును కనుగొనండి.

సాధన. ఇచ్చిన అంకశ్రేణి

$$7, 10, 13, \dots, 184.$$

దీనిని ఆ చివరి నుంచి రాయగా

$$184, 181, \dots, 13, 10, 7$$

$$a = 184 ; d = 181 - 184 = -3.$$

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

$$7\text{వ పదము కావున } n = 7$$

$$a_7 = 184 + (7 - 1)(-3)$$

$$= 184 - 6(3)$$

$$= 184 - 18 = 166.$$

25. ఒక సాధారణ సంవత్సరంలో 53 ఆదివారాలు ఉండడగు సంభావ్యతను కనుగొనుము.

సాధన. సాధారణ సంవత్సరంలో గల రోజుల సంఖ్య = 365

సాధారణ సంవత్సరంలో గల వారాల సంఖ్య = 365

$$= (52) 7 + (1)$$

దీనిని బట్టి 52 వారాలు ఒక రోజు ఉండును.

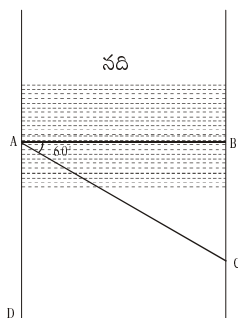
ఆ ఒకరోజు వారంలో ఆదివారం నుండి శనివారం వరకు ఏదైనా రోజు ఉండుటకు ఏర్పడు మొత్తం పర్యవసానాలు = 7

ఆదివారం అనుకూల పర్యవసానాల సంఖ్య = 1

$$\therefore 53 \text{ ఆదివారాలు ఉండు సంభావ్యత} = \frac{1}{7}$$

26. ఒక నావ ఒక నదిని దాటాల్సి ఉంది. నదీప్రవాహం కారణంగా ఆ నదీ తీరంతో 60° ల కోణం చేస్తున్న ఆ నావ 450 మీ. దూరం ప్రయాణించి అవతలి తీరాన్ని చేరింది. ఈ దత్తాంశమునకు పటంను గీయండి.

సాధన.



AB నది వెడల్పు, AD, BC లు నదీ తీరాలు.

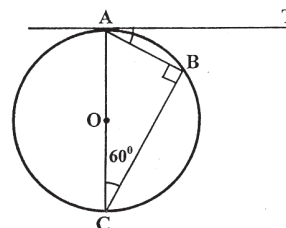
AC - నావ ప్రయాణించిన దూరం = 450 మీ.

A - నావ బయలుదేరిన స్థానం

C - నావ తుది స్థానం

27. ఒక వృత్తంలో AOC వ్యాసము, $\angle ACB = 60^\circ$ మరియు AB ఒక జ్యా A వద్ద గీసిన స్పర్శరేఖ AT అయితే $\angle BAT$ యొక్క కొలత కనుగొనండి.

సాధన. దత్తాంశం ప్రకారం $\angle ACB = 60^\circ$



AOC = వ్యాసం

AB = జ్యా

A వద్ద AT స్పర్శరేఖ

$$\therefore \angle ACB = 90^\circ$$

(\because అర్థ వృత్తంలోని కోణం)

$$\angle BAC + \angle ACB = 90^\circ$$

$$\angle BAC + 60^\circ = 90^\circ$$

$$\Rightarrow \angle BAC = 30^\circ$$

$$AT \perp AOC, \angle CAT = 90^\circ$$

$$\angle BAC + \angle BAT = 90^\circ$$

$$30^\circ + \angle BAT = 90^\circ$$

$$\Rightarrow \angle BAT = 60^\circ$$

28. బిందువులు A(6, 9) మరియు B(-6, -9) లను కలుపు రేఖాఖండమును బిందువు P(2, 3) ఏ నిష్పత్తిలో విభజిస్తుంది ?

సాధన. A (6, 9), B (-6, -9) ను P (2, 3)

$m_1 : m_2$ నిష్పత్తిలో విభజిస్తుంది అనుకొందాం.

$$(2, 3) = \left(\frac{m_1(-6) + m_2(6)}{m_1 + m_2}, \frac{m_1(-9) + m_2(9)}{m_1 + m_2} \right)$$

$$(2, 3) = \left(\frac{-6m_1 + 6m_2}{m_1 + m_2}, \frac{-9m_1 + 9m_2}{m_1 + m_2} \right)$$

$$\therefore 2 = \frac{-6m_1 + 6m_2}{m_1 + m_2}$$

$$\Rightarrow 2m_1 + 2m_2 = -6m_1 + 6m_2$$

$$\Rightarrow 8m_1 = 4m_2$$

$$\frac{m_1}{m_2} = \frac{4}{8} = \frac{1}{2}$$

$$m_1 : m_2 = 1 : 2$$

విభాగం - IV

29.a) యాక్సిడ్ భాగహార న్యాయము నుపయోగించి ఒక ధన పూర్ణసంఖ్య ఘనము, ఏ పూర్ణ సంఖ్య 'p' కి అయినా $3p$ లేదా $3p + 1$ లేదా $3p + 2$ రూపంలో ఉంటుందని చూపండి.

సాధన. 'a' ఒక ధనపూర్ణ సంఖ్య అనుకొనిన

$$a = bq + r, 0 \leq r < b$$

$$b = 3 \text{ కావున } r = 0, 1, 2$$

అయిన 'a' యొక్క వివిధ రూపాలు

$$3q + 0, 3q + 1, 3q + 2$$

సందర్భం (i) :

$$a = 3q \text{ అయినపుడు}$$

$$a^3 = (3q)^3 = 3(9q^3)$$

$$= 3p \text{ దీనిలో } p = 9q^3$$

సందర్భం (ii) :

$$a = 3q + 1 \text{ అయినపుడు}$$

$$a^3 = (3q + 1)^3$$

$$= (3q)^3 + 3(3q)(1)$$

$$(3q + 1) + (1)^3$$

$$= 3[9q^3 + 3q(3q + 1)] + 1$$

$$= 3p + 1$$

$$\text{దీనిలో } p = 9q^3 + 3q(3q + 1)$$

సందర్భం (iii) :

$$a = 3q + 2 \text{ అయినపుడు}$$

$$a^3 = (3q + 2)^3$$

$$= (3q)^3 + 3(3q)(2)$$

$$(3q + 2) + (2)^3$$

$$= 3[9q^3 + 6q(3q + 2)] + 2$$

$$= 3p + 2$$

$$\text{దీనిలో } p = 9q^3 + 6q(3q + 2)$$

ప్రతి ధన పూర్ణ సంఖ్య యొక్క ఘనం

$$3p \text{ లేదా } 3p + 1 \text{ లేదా } 3p + 2$$

రూపంలో ఉంటుంది.

(లేదా)

b) ఘన బహుపది $p(x) = 3x^3 - 5x^2 - 11x - 3$ యొక్క శూన్యాలు 3, -1

మరియు $-\frac{1}{3}$ అగునని చూపండి.

బహుపది గుణకాలకు, శూన్యాలకు మధ్యగల సంబంధాన్ని సరిచూడండి.

సాధన. ఇచ్చిన ఘన బహుపది $p(x) = 3x^3 - 5x^2 - 11x - 3$ ని $ax^3 + bx^2 + cx + d$ తో

$$సరిపోల్చిన $a = 3, b = -5, c = -11,$$$

$$d = -3 \text{ అగును. దీని నుండి}$$

$$p(3) = (3 \times 3^3) - (5 \times 3^2)$$

$$- (11 \times 3) - 3$$

$$= 81 - 45 - 33 - 3 = 0$$

$$p(-1) = 3 \times (-1)^3 - 5 \times (-1)^2 - 11$$

$$\times (-1) - 3$$

$$= -3 - 5 + 11 - 3 = 0$$

$$p\left(-\frac{1}{3}\right) = 3 \times \left(-\frac{1}{3}\right)^3 - 5 \times \left(-\frac{1}{3}\right)^2$$

$$- 11 \times \left(-\frac{1}{3}\right) - 3$$

$$= -\frac{1}{3} - \frac{5}{3} + \frac{11}{3} - 3$$

$$= -\frac{1}{9} - \frac{5}{9} + \frac{11}{3} - 3 = -\frac{2}{3} + \frac{2}{3}$$

$$= 0 \text{ అగును.}$$

కావున $3x^3 - 5x^2 - 11x - 3$ యొక్క శూన్యాలు 3, -1 మరియు $-\frac{1}{3}$ అని చూపడమైనది.

ఇప్పుడు $\alpha = 3$, $\beta = -1$ మరియు $\gamma = -\frac{1}{3}$ తీసుకొంటే

$$\alpha + \beta + \gamma = 3 + (-1) + \left(-\frac{1}{3}\right)$$

$$= 2 - \frac{1}{3}$$

$$= \frac{5}{3} = \frac{-(-5)}{3} = \frac{-b}{a},$$

$$\alpha\beta + \beta\gamma + \gamma\alpha$$

$$= 3 \times (-1) + (-1) \times \left(-\frac{1}{3}\right) + \left(-\frac{1}{3}\right) \times 3$$

$$= -3 + \frac{1}{3} - 1 = \frac{-11}{3} = \frac{c}{a},$$

$$\alpha\beta\gamma = 3 \times (-1) \times \left(-\frac{1}{3}\right)$$

$$= +1 = \frac{-(-3)}{3} = \frac{-d}{a}.$$

30. a) అంకశ్రేణిలో గల మొదటి మూడు పదముల మొత్తము 33. మొదటి మరియు మూడవ పదముల లబ్ధము, రెండవ పదము కన్నా 29 ఎక్కువ అయిన ఆ అంకశ్రేణిని కనుగొనండి.

సాధన. అంకశ్రేణిలో మూడు వరుస పదాలు $a - d$, a , $a + d$ అనుకొనుము.

మూడు పదాల మొత్తము 33

$$a - d + a + a + d = 33$$

$$\therefore a = 11 \text{ --- (1)}$$

మొదటి మరియు మూడవ పదముల లబ్ధము, రెండవ పదము కన్నా 29 ఎక్కువ.

$$(a - d)(a + d) - 29 = a$$

$$a^2 - d^2 = 11 + 29 = 40 \text{ --- (2)}$$

(1), (2) లను సాధించగా,

$$d = \pm 9$$

$a = 11$, $d = 9$ అయితే ఆ శ్రేణి

$$2, 11, 20, \dots$$

$a = 11$, $d = -9$ అయితే ఆ శ్రేణి

$$20, 11, 2, \dots$$

(లేదా)

b) శంఖాకారంలో వున్న గుడారము యొక్క భూ వ్యాసార్థం 5 మీ., ఎత్తు 12 మీ. అయితే ఆ గుడారము నిర్మించడానికి కావలసిన బట్ట వెడల్పు 2 సెం.మీ. అయితే దాని పొడవును కనుగొనుము.

సాధన. గుడారము భూ వ్యాసార్థం (r) = 5 మీ.

గుడారము ఎత్తు (h) = 12 మీ.

\therefore శంఖువు ఏటవాలు ఎత్తు

$$(l) = \sqrt{r^2 + h^2}$$

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

$$= \sqrt{25 + 144}$$

$$= \sqrt{169} = 13 \text{ మీ.}$$

గుడారపు ఉపరితల వైశాల్యం = $\pi r l$

$$= \frac{22}{7} \times 5 \times 13$$

$$= \frac{1430}{7} \text{ మీ.}^2$$

\therefore ఉపయోగించిన గుడ్డ వైశాల్యం

$$= \frac{1430}{7} \text{ మీ.}^2.$$

గుడ్డ యొక్క వెడల్పు = 2 మీ.।

(\because దత్తాంశం ప్రకారం)

$$\therefore \text{ గుడ్డ యొక్క పొడవు} = \frac{\text{వైశాల్యం}}{\text{వెడల్పు}}$$

$$= \frac{1430}{7} \times \frac{1}{2} = 102.14 \text{ మీ.।}$$

31. a) క్రింది పట్టికలో ఇవ్వబడిన 60 రాశుల మధ్యగతం 28.5 అయిన, x, y విలువలను కనుగొనుము.

తరగతి అంతరం	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
పౌనఃపున్యము	5	x	20	15	y	5

సాధన.

తరగతి అంతరం	పౌనఃపున్యము	సంచిత పౌనఃపున్యము
0 - 10	5	5
10 - 20	x	(5 + x) స.పౌ
(20 - 30) <small>l = 20</small>	20	25 + x
30 - 40	15	40 + x
40 - 50	y	40 + x + y
50 - 60	5	45 + x + y
n = 45 + x + y		

దత్తాంశము ప్రకారం మధ్యగతము = 28.5

$$\therefore \text{మధ్యగతము} = l + \frac{\left(\frac{n}{2} - cf\right)}{f} \times h$$

l = మధ్యగత తరగతి దిగువ హద్దు = 20

$$\frac{n}{2} = \frac{60}{2} = 30$$

cf = సంచిత పౌనఃపున్యము = 5 + x,

f = 20, h = 10

\(\therefore\) మధ్యగతము

$$\Rightarrow 20 + \frac{30 - 5 - x}{20} \times 10 = 28.5$$

$$\Rightarrow \frac{30 - 5 - x}{2} = 28.5 - 20 = 8.5$$

$$\Rightarrow 25 - x = 2 \times 8.5$$

$$\Rightarrow x = 25 - 17 = 8$$

n = 60 (ఇచ్చినది)

$$\therefore n = 45 + x + y = 60$$

$$\Rightarrow x + y = 60 - 45 = 15$$

$$\therefore 8 + y = 15 [\because x = 8]$$

$$y = 7$$

$$\therefore x = 8; y = 7.$$

(లేదా)

$$b) \frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1}{\sec \theta - \tan \theta}$$

నిరూపించండి.

$$(\sec^2 \theta = 1 + \tan^2 \theta)$$

సర్వసమీకరణాన్ని ఉపయోగించి

$$\text{సాధన. L.H.S.} = \frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1}$$

లవ, హారాలను $\cos \theta$ చే భాగించగా

$$= \frac{\frac{\sin \theta}{\cos \theta} - \frac{\cos \theta}{\cos \theta} + \frac{1}{\cos \theta}}{\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\cos \theta} - \frac{1}{\cos \theta}}$$

$$= \frac{\tan \theta + \sec \theta - 1}{\tan \theta + \sec \theta + 1}$$

$$(\tan \theta + \sec \theta) -$$

$$= \frac{(\sec^2 \theta - \tan^2 \theta)}{\tan \theta + 1 - \sec \theta}$$

$$[\because 1 = \sec^2 \theta - \tan^2 \theta]$$

$$(\tan \theta + \sec \theta) -$$

$$[(\sec \theta + \tan \theta)]$$

$$= \frac{(\sec \theta - \tan \theta)}{\tan \theta + 1 - \sec \theta}$$

$$[\because a^2 - b^2 = (a + b)(a - b)]$$

$$= \frac{(\tan \theta + \sec \theta) (1 - \sec \theta + \tan \theta)}{(\tan \theta - \sec \theta + 1)}$$

$$= \tan \theta + \sec \theta$$

$$= \sec \theta + \tan \theta \quad \dots\dots\dots (1)$$

$$\text{R.H.S.} = \frac{1}{\sec \theta - \tan \theta}$$

$$= \frac{1}{\sec \theta - \tan \theta} \times \frac{\sec \theta + \tan \theta}{\sec \theta + \tan \theta}$$

[sec θ - tan θ యొక్క అకరణీయ కారణరాశి sec θ + tan θ]

$$= \frac{\sec \theta + \tan \theta}{\sec^2 \theta - \tan^2 \theta}$$

$$= \sec \theta + \tan \theta \quad \dots\dots (2)$$

[$\because \sec^2 \theta - \tan^2 \theta = 1$]

(1), (2) ల నుండి L.H.S. = R.H.S.

$$\therefore \frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1}$$

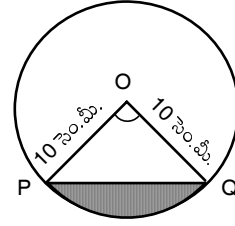
$$= \frac{1}{\sec \theta - \tan \theta}$$

32. a) 10 సెం.మీ వ్యాసార్థముగా గల వృత్తములో ఒక జ్యా కేంద్రము వద్ద లంబకోణాన్ని ఏర్పరిస్తే, కింది ఇవ్వబడిన వృత్తఖండాల వైశాల్యాలు కనుగొనండి.

($\pi = 3.14$ అని తీసుకోండి.)

- i) అల్ప వృత్త ఖండము
- ii) అధిక వృత్త ఖండము

సాధన.



PQ జ్యా కేంద్రం వద్ద చేయు కోణం (x°)
= 90°

వృత్త వ్యాసార్థం (r) = 10 సెం.మీ.

i) అల్ప వృత్త ఖండ వైశాల్యము
= POQ సెక్టార్ వైశాల్యము - Δ POQ వైశాల్యము

$$\text{POQ సెక్టార్ వైశాల్యము} = \frac{x}{360} \times \pi r^2$$

$$\Delta \text{POQ వైశాల్యము} = \frac{1}{2}bh$$

\therefore అల్ప వృత్త ఖండ వైశాల్యము

$$= \frac{90}{360} \times 3.14 \times 10 \times 10 - \frac{1}{2} \times 10 \times 10$$

$$= 78.5 - 50 = 28.5 \text{ సెం.మీ}^2$$

ii) అధిక వృత్త ఖండ వైశాల్యము = వృత్త వైశాల్యము - అల్పవృత్త ఖండ వైశాల్యము.
= $\pi r^2 - 28.5$

$$= \frac{22}{7} \times 10 \times 10 - 28.5$$

$$= 314 - 28.5$$

\therefore అల్ప వృత్త ఖండ వైశాల్యము
= 285.5 సెం.మీ.

(లేదా)

b) ఒక దుకాణదారుని వద్ద ఒక పెట్టెలో 100 మెమోరీ కార్డులున్నాయి. వాటిలో లోపం కల 15 మెమోరీ కార్డులు కలిసి ఉన్నాయి. ఒక వ్యక్తి ఒక మెమోరీ కార్డును కొనడానికి ఆ దుకాణానికి వచ్చినప్పుడు దుకాణదారుడు

మెమోరీ కార్డుల పెట్టెనుండి ఒక కార్డును యాదృచ్ఛికంగా తీసినాడు.

i) ఆ మెమోరీ కార్డు లోపం కల కార్డు కావడానికి గల సంభావ్యత ఎంత ?

ii) మొదట తీసిన మెమోరీ కార్డు లోపం గల కార్డు అయిన దానిని మరల తిరిగి ఆ పెట్టెలో వేయకుండా, మరియొక మెమోరీ కార్డును యాదృచ్ఛికంగా తీసినట్లయితే అది లోపం లేని మెమోరీ కార్డు అయ్యే సంభావ్యత ఎంత ?

సాధన. i) మొత్తం పర్యవసానాల సంఖ్య
 $= n(T) = 100$
 అనుకూల పర్యవసానాల సంఖ్య
 $= n(E) = 15$
 ఆ మెమోరీ కార్డు లోపం కల కార్డు కావడానికి గల సంభావ్యత $= P(E)$

$$= \frac{n(E)}{n(T)} = \frac{15}{100} = \frac{3}{20}$$

ii) మొదట తీసిన మెమోరీ కార్డు లోపం గల కార్డు అయిన దానిని మరల తిరిగి ఆ పెట్టెలో వేయలేదు కనుక పెట్టెలో గల లోపం ఉన్న కార్డుల సంఖ్య 14.

ఈ సందర్భంలో తీసిన కార్డు లోపం ఉన్నదగు సంభావ్యత $= P(E')$

$$= \frac{14}{100} = \frac{7}{50}$$

ఈ సందర్భంలో తీసిన కార్డు లోపం లేనిదగు సంభావ్యత $= 1 - P(E')$

$$= 1 - \frac{7}{50} = \frac{50 - 7}{50} = \frac{43}{50}$$

33.a) i) $3x - y - 2 = 0$ మరియు $2x + y - 8 = 0$ సమీకరణాలను గ్రాఫ్ కాగితముపై రేఖాచిత్రాలను గీయండి.

ii) పై రెండు రేఖల ఖండన బిందువును కనుగొనండి.

iii) పై రెండు రేఖలు మరియు X - అక్షముచే ఏర్పడే త్రిభుజ వైశాల్యము కనుగొనండి.

సాధన. i) సమీకరణాలు : $3x - y - 2 = 0$

$$2x + y - 8 = 0$$

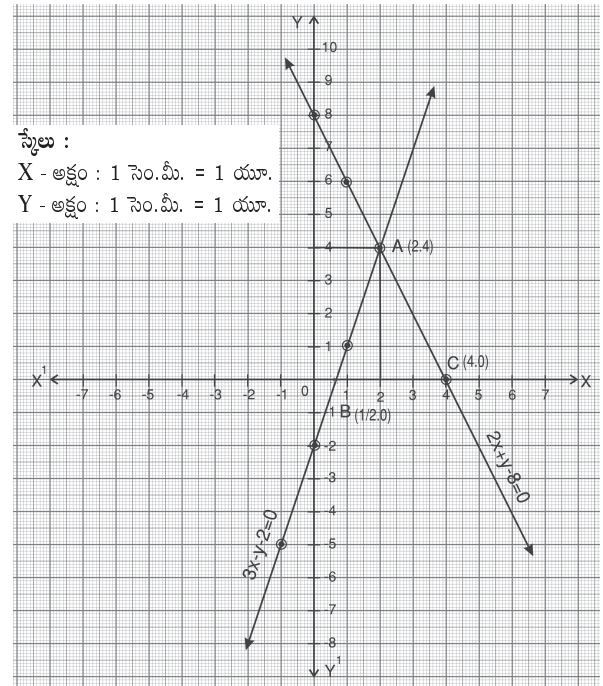
$3x - y - 2 = 0, y = 3x - 2$ విలువల పట్టిక

x	0	1	-1
$y = 3x - 2$	-2	1	-5
(x, y)	(0, -2)	(1, 1)	(-1, -5)

$2x + y - 8 = 0, y = -2x + 8$ విలువల పట్టిక

x	0	4	1
$y = -2x + 8$	8	0	6
(x, y)	(0, 8)	(4, 0)	(1, 6)

బిందువులను గ్రాఫ్ పేపర్పై గుర్తించిన



ii) గ్రాఫ్ నుండి రెండు రేఖల ఖండన బిందువు = (2, 4).

iii) గ్రాఫ్ నుండి X-అక్షముచే ఏర్పడే త్రిభుజ వైశాల్యము

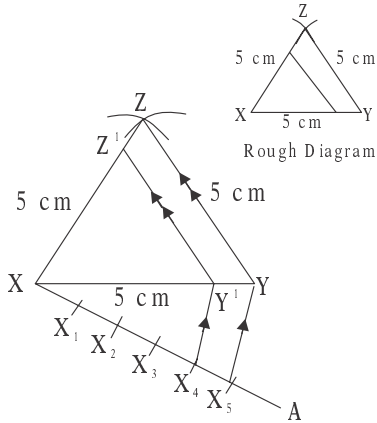
$$= \frac{1}{2} \times \text{భూమి} \times \text{ఎత్తు}$$

$$= \frac{1}{2} \times 3.5 \times 4 = 7 \text{ చ. యూ.}$$

(లేదా)

b) 5 సెం.మీ. భుజము గల ఒక సమబాహు త్రిభుజము $\triangle XYZ$ ను నిర్మించి, దాని భుజాలలో ప్రతి భుజం కొలత $\frac{4}{5}$ ఉండునట్లు $\triangle XYZ$ కు సరూప త్రిభుజాన్ని నిర్మించండి.

సాధన.



నిర్మాణ క్రమం :

- * 5 సెం.మీ. భుజంగా సమబాహు త్రిభుజం XYZ ని గీచితిని.
- * $\angle YXA$ అల్పకోణం అగునట్లు \overline{XA} ను గీచితిని.
- * \overline{XA} పై $XX_1 = X_1X_2 = \dots\dots = X_4X_5$ అగునట్లు X_1, X_2, X_3, X_4, X_5 చాపరేఖలను గీచితిని.
- * X_5 చాపరేఖను, Y ని కలిపితిని.
- * X_4 గుండా X_5Y కి సమాంతరంగా XY ని Y^1 వద్ద ఖండించేటట్లు గీచితిని.
- * Y^1 గుండా YZ కి సమాంతరంగా XZ ని Z^1 వద్ద ఖండించునట్లు Y^1Z^1 ను గీచితిని.
- * $\triangle XY^1Z^1$ కావాల్సిన త్రిభుజం.



SSC Public Exams July – 2020

Model Paper Set . 1

MATHEMATICS PAPER

(ENGLISH MEDIUM)

(Max.Marks: 100)

CLASS : X

Time: 3.15 Hrs

Instructions :

1. Answer all the questions in a separate answer booklet.
2. The question paper consists of 4 sections and 33 questions.
3. There is internal choice in Section – IV .
4. Write answers neatly and legibly.

Section – I

Note:

1. Answer all the questions in one WORD or PHRASE
2. Each Question carries 1 Mark.

12 X 1 = 12 Marks

- 1) Evaluate : $\log_4(1 + \tan 45^\circ)^2$.
- 2) In a survey an agency found that the number of people has asthma due to smoking is 5 more than two – third the number of people suffers from other diseases. Which of the following linear equation represents the situation?
A. $y = 15 + 2x$
B. $3y = 15 + 2x$
C. $y = 15 - 3x$
D. $3y = 5 + 2x$

- 3) If α, β, γ are the zeroes of the polynomial $ax^3 + bx^2 + cx + d$, which of the following matching is correct ?

- A. $\alpha + \beta + \gamma$
- B. $\alpha\beta + \beta\gamma + \gamma\alpha$
- C. $\alpha\beta\gamma$

- i. $\frac{-d}{a}$
- ii. $\frac{-b}{a}$
- iii. $\frac{c}{a}$

Choose the correct one

- A. A – i, B – ii , C – iii
- B. A – ii, B – iii , C – i

- C. A – iii, B – i, C – ii
- D. A – ii , B – i, C – iii

- 4) Number of diagonals that a dodecagon has ?
- 5) Find the nature of roots of $2x^2 - 3x + 5 = 0$
- 6) Ramana says “The TSA of a hemisphere is half of the TSA of a sphere.” Do you agree with Ramana ? Why?
- 7) Choose the correct answer satisfying the following statements
Statement (A) : All the Congruent figures are Similar
Statement (B) : All the Similar figures are always Congruent

- A. Both A and B are True
- B. Statement A is True and Statement B is False
- C. Statement A is False and Statement B is True
- D. Both A and B are False

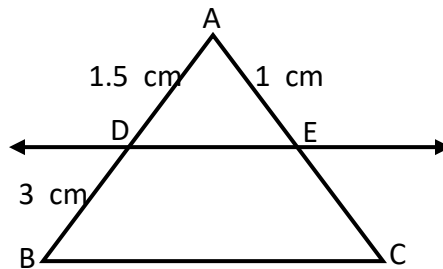
- 8) If $\sin 30^\circ = \cos x$ then $x = ?$
- A. 90°
 - B. 0°
 - C. 60°
 - D. 30°
- 9) Which of the following cannot be the probability of an event?
- A) 2.3
 - B) -1.5
 - C) 15%
 - D) Both A & B
- 10) What is the slope of the line passing through the points $(2a, 3b)$ and $(2b, 3a)$?
- 11) If a man walks 6 m to East and 8 m to North, then distance from the away to the origin is =
- 12) The mean value can be calculated from both ungrouped and grouped data. Which one do you think is more accurate? Why?

Section – II

Note:

1. Answer all the questions
2. Each Question carries 2 Marks. 8 X 2 = 16 Marks

- 13) $A = \{ \text{set of Quadrilaterals} \}$; $B = \{ \text{Square, rectangle, trapezium, rhombus} \}$.
State whether $A \subset B$ or $B \subset A$. Justify your answer.
- 14) The taxi fare after each kilometer when the fare is ₹20 for the first km and rises by ₹8 for each additional kilometer. Which progression is involved in the list of numbers of the situation?
- 15) If a, b, c are in GP, then find the relation between a, b and c .
- 16) Find the edge of a cube whose volume is 1000 cm^3 .
- 17) The top of a clock tower is observed at angle of elevation of α° and the foot of the tower is at the distance of d meters from the observer. Draw the diagram for this data
- 18) In $\triangle ABC$, if $DE \parallel BC$ then find EC



- 19) Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of any game?
- 20) If $A \geq B$, then $\cos A \geq \cos B$. Is it true? Justify your answer

Section – III

Note:

1. Answer all the questions
2. Each Question carries 4 Marks.

8 X 4 = 32 Marks

- 21) If $2^{(x+1)} = 3^{(1-x)}$ then find the value of x .
- 22) Check whether -3 and 3 are the zeroes of the polynomial $x^2 - 9$.
- 23) The sum of the reciprocals of Rehman's ages, (in years) 3 years ago and 5 years from now is $\frac{1}{3}$. Find his present age.
- 24) Check whether -150 is a term of the A.P: $11, 8, 5, 2, \dots$
- 25) Find the mean of $x - 6, x - 2, x + 1, x + 3,$ and $x + 4$?
- 26) In a right angle triangle ABC, right angle is at B, if $\tan A = \sqrt{3}$ then find the value of
 (i) $\sin A \cos C + \cos A \sin C$ (ii) $\cos A \cos C - \sin A \sin C$
- 27) Suppose you are shooting an arrow from the top of a building at an height of 6 m to a target on the ground at an angle of depression of 60° . What is the distance between you and the object?
- 28) One card is drawn from a well-shuffled deck of 52 cards. Calculate the probability that the card will (i) be an ace, (ii) not be an ace

Section – IV

Note:

1. Answer all the questions
2. Each Question carries 8 Marks.
3. There is an internal choice for each question

5 X 8 = 40 Marks

- 29) (a) A sum of ₹ 700 is to be used to give seven cash prizes to students of a school for their overall academic performance. If each prize is ₹ 20 less than its preceding prize, find the value of each of the prizes.

(OR)

- (b) A vessel is in the form of an inverted cone. Its height is 8cm. and the radius of its top is 5 cm. It is filled with water up to the rim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, $\frac{1}{4}$ of the water flows out. Find the number of lead shots dropped into the vessel

- 30) (a) If $A = \{x : x \text{ is a natural number}\}$, $B = \{x : x \text{ is an even natural number}\}$,
 $C = \{x : x \text{ is an odd natural number}\}$ and $D = \{x : x \text{ is a prime number}\}$ then
 find $A \cap B$, $A \cap C$, $A \cap D$, $B \cap C$, $B \cap D$ and $C \cap D$

(OR)

- (b) 2 women and 5 men can together finish an embroidery work in 4 days while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone and 1 man alone to finish the work.

- 31) (a) For which value of acute angle of θ , $\frac{\cos\theta}{1-\sin\theta} + \frac{\cos\theta}{1+\sin\theta} = 4$ is true?

(OR)

- (b) The median of the following data is 525. Find the value of x and y , if the total frequency is 100.

Class Interval	0 – 100	100 – 200	200 – 300	300 – 400	400 – 500	500 – 600	600 – 700	700 – 800	800 – 900	900 – 1000
Frequency	2	5	x	12	17	20	y	9	7	4

- 32) (a) A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding (i) Minor segment (ii) Major segment

(OR)

- (b) The angle of elevation of the top of a tower from two points at a distance of 4 m and 9 m, find the height of the tower from the base of the tower and in the same straight line with it are complementary

- 33) (a) Check whether the following equations are consistent or inconsistent.
 Solve them graphically $2x + y - 5 = 0$ and $3x - 2y - 4 = 0$

(OR)

- (b) Construct a triangle similar to a given triangle ABC with its sides equal to $\frac{3}{4}$ of corresponding sides of ΔABC

SSC Public Exams July – 2020

Model Paper Set . 2

MATHEMATICS PAPER

(ENGLISH MEDIUM)

(Max.Marks: 100)

CLASS : X

Time: 3.15 Hrs

Instructions :

1. Answer all the questions in a separate answer booklet.
2. The question paper consists of 4 sections and 33 questions.
3. There is internal choice in Section – IV .
4. Write answers neatly and legibly.

Section – I

Note:

1. Answer all the questions in one WORD or PHRASE
2. Each Question carries 1 Mark.

12 X 1 = 12 Marks

- 1) An empty set is a finite set. Is this statement true or false? Why?
- 2) If $\log_3 27$ is a root of quadratic equation $x^2 + 5x + P = 0$, then find the value of 'P'
A. 27
B. 3
C. 24
D. -24

- 3) Which of the following matching is correct ?

- | | |
|---|---------------|
| A. The shape of vertical cut out of a cylinder is | i. triangle |
| B. The shape of vertical cut out of a cone is | ii. rectangle |
| C. The shape of horizontal cut out of cylinder is | iii. circle |

Choose the correct one

- | | |
|----------------------------|----------------------------|
| A. A – i, B – ii , C – iii | C. A – iii, B – i, C – ii |
| B. A – ii, B – iii , C – i | D. A – ii , B – i, C – iii |
- 4) Choose the correct answer satisfying the following statements

Statement (A) : The product of two irrational numbers is always a rational number

Statement (B): The sum of two irrational numbers need not be irrational.

- | | |
|---|---|
| A. Both A and B are True | C. Statement A is False and Statement B is True |
| B. Statement A is True and Statement B is False | D. Both A and B are False |
- 5) If $x = \alpha$ is a solution of a quadratic equation $ax^2 + bx + c = 0$ then
A) $a\alpha^2 + b\alpha + c = 0$
B) α is called a root of the quadratic equation
C) Both A & B
D) None of these

- 6) In an Arithmetic Progression there are 'n' terms between 'a' and 'b' then common difference is?
- 7) The length of the diagonal of a square is $7\sqrt{2}$ then the area of the square in cm^2 is?
- 8) If G is the centroid of $\triangle ABC$, then Ar. of $\triangle GAB$
- | | |
|---------------------------------|--------------------------------|
| A. $\frac{1}{13} \triangle ABC$ | C. $\frac{1}{2} \triangle ABC$ |
| B. $\frac{1}{4} \triangle ABC$ | D. $\frac{1}{3} \triangle ABC$ |
- 9) In a cyclic quadrilateral ABCD, $\cos A + \cos B + \cos C + \cos D = ?$
- 10) The value of $\tan 150^\circ = \dots\dots\dots$
- 11) Which of the following is not related to deck of cards?
- | | |
|-------------|----------|
| A) heart | C) clubs |
| B) diamonds | D) Blue |
- 12) Lessthan Ogive and Greaterthan Ogives are intersecting at the point A(25,40), then Median of the data is $\dots\dots\dots$

Section – II

Note:

1. Answer all the questions
2. Each Question carries 2 Marks. 8 X 2 = 16 Marks

- 13) If $V = \{a, e, i, o, u\}$ and $B = \{a, i, k, u\}$, find $V - B$ and $B - V$.
- 14) Solve the Linear equations $3x + 2y = 11$ and $2x + 3y = 4$ by elimination method.
- 15) Samantha told her son "Seven years ago I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be". Write the pair of linear equation to represent the data .
- 16) In an Arithmetic Progression $a = 5$, $a_4 = 9\frac{1}{2}$, find a_2 and a_3 .
- 17) $\sin \theta = \frac{4}{3}$ does exist for some value of angle θ ?
- 18) Area of a circle is 78.5 sq.cm and the area of the minor segment of the same circle is 35 cm^2 . What is the area of the major segment ?
- 19) Let $\triangle ABC \sim \triangle PQR$ and $\frac{PQ}{AB} = K$, if $K > 1$ then draw rough diagram of the $\triangle ABC$ and $\triangle PQR$

- 20) In a School S.A. 1 exams marks of Mathematics of X class students, 10 students got 42 marks, 4 students got 58 marks, 8 students got 35 marks and 12 students got 30 marks. What is the mode of the marks of the students?

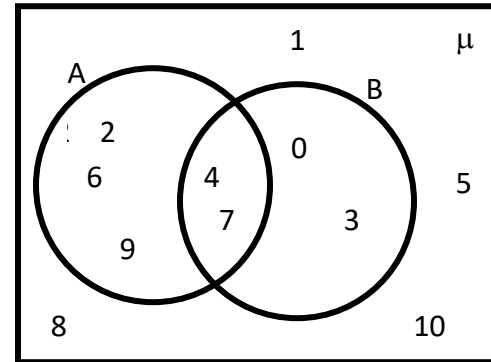
Section – III

Note:

1. Answer all the questions
2. Each Question carries 4 Marks.

8 X 4 = 32 Marks

- 21) From the adjacent figure verify that $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- 22) Find the quadratic polynomial, for the zeroes α and β are $\frac{-1}{2}$ and $\frac{-3}{2}$ respectively
- 23) Find two consecutive odd positive integers, sum of whose squares is 290
- 24) A women self help group (DWACRA) is supplied a rectangular solid (cuboid shape) of wax with diameters 66 cm., 42 cm., 21 cm., to prepare cylindrical candles each 4.2 cm. in diameter and 2.8cm. of height. Find the number of candles.
- 25) Find the value of 'K' for which the points are collinear (K, K) (2, 3) and (4, -1).
- 26) A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground by making 30o angle with the ground. The distance between the foot of the tree and the top of the tree on the ground is 6 m. Find the height of the tree before falling down.
- 27) A box contains 3 blue, 2 white, and 4 red marbles. If a marble is drawn at random from the box, what is the probability that it will be (i) white (ii) black
- 28) Given $\text{Cot}\theta = \frac{7}{8}$, then evaluate $\frac{(1+\text{Sin}\theta)(1-\text{Sin}\theta)}{(1+\text{Cos}\theta)(1-\text{Cos}\theta)}$



Section – IV

Note:

1. Answer all the questions
2. Each Question carries 8 Marks.
3. There is an internal choice for each question

5 X 8 = 40 Marks

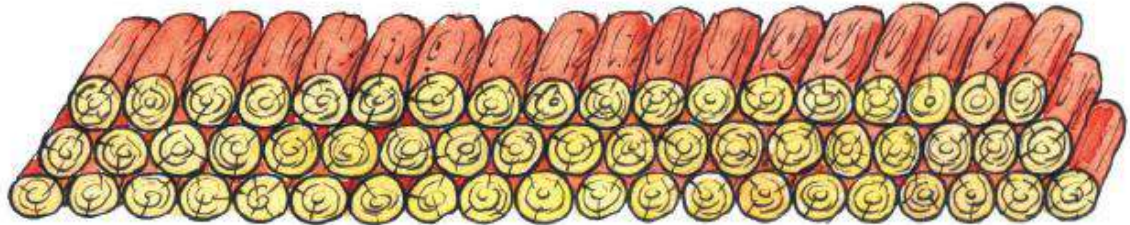
- 29) (a) Prove that $\sqrt{p} + \sqrt{q}$ is a irrational number where p and q are primes.

(OR)

- (b) In each of the following, state whether $A = B$ or not. Justify your answer.
- (i) $A = \{a, b, c, d\}$ $B = \{d, c, a, b\}$
 - (ii) $A = \{4, 8, 12, 16\}$ $B = \{8, 4, 16, 18\}$
 - (iii) $A = \{2, 4, 6, 8, 10\}$ $B = \{x : x \text{ is a positive even integer and } x < 10\}$
 - (iv) $A = \{x : x \text{ is a multiple of } 10\}$ $B = \{10, 15, 20, 25, 30, \dots\}$

30) (a)

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. In how many rows are the 200 logs placed and how many logs are in the top row?



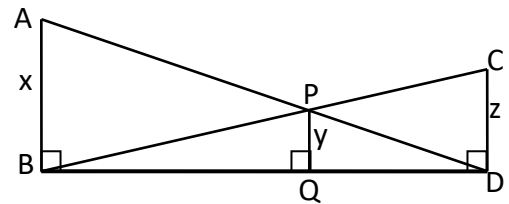
(OR)

(b) A solid consisting of a right circular cone standing on a hemisphere, is placed upright in a right circular cylinder full of water and touches the bottom. Find the volume of water left in the cylinder, given that the radius of the cylinder is 3 cm. and its height is 6cm. The radius of the hemisphere is 2 cm. and the height of the cone is 4 cm

31) (a) Find a relation between x and y such that the point (x, y) is equidistant from the points (-2, 8) and (-3, -5)

(OR)

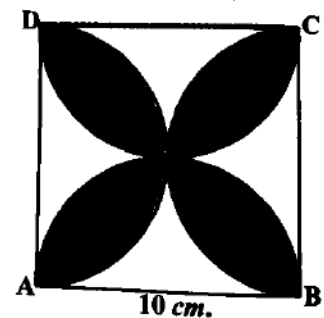
(b) AB, CD, PQ are perpendicular to BD.
 AB=x, CD=y and PQ=z. Prove that $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$



32) (a) Find the area of the shaded region in figure, where ABCD is a square of side 10 cm. and semicircles are drawn with each side of the square as diameter (use $\pi = 3.14$)

(OR)

(b) Prove that $\sqrt{\frac{1+\cos \theta}{1-\cos \theta}} = \operatorname{Cosec} \theta + \cot \theta$



33) (a) Draw the graph of polynomial $p(x) = x^2 - 7x + 10$ and find zeroes. Justify the answer.

(OR)

(b) Construct an Isosceles triangle whose base is 8 cm and altitude is 4 cm. Then, draw another triangle whose sides are $1\frac{1}{2}$ times the corresponding sides of the Isosceles triangle.

MATHEMATICS

RAPID TEST - 1 : ANSWERS

SECTION - I

1. What is the value of $\log_{\frac{2}{3}}\left(\frac{27}{8}\right)$?

Sol. $\log_{\frac{2}{3}}\left(\frac{27}{8}\right) = \log_{\frac{2}{3}}\frac{3^3}{2^3} = \log_{\frac{2}{3}}\left(\frac{3}{2}\right)^3$
 $(\because \log x^m = m \log x)$
 $(\because \log x^x = 1)$

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

$$= -3 \times \log_{\frac{2}{3}}\frac{2}{3} = -3(1) = -3$$

2. If $A = \{1, 2, 3\}$ and $\phi = \{\}$, find $A \cap \phi$.

Sol. $A = \{1, 2, 3\}$ and $\phi = \{\}$
 $A \cap \phi = \{1, 2, 3\} \cap \{\} = \{\} = \phi$
 $\therefore A \cap \phi = \phi$

3. Choose the correct answer satisfying the following statements.

Statement (A) : The ratio of volumes of cone and cylinder of same base and same height is 3 : 1

Statement (B) : The ratio of volumes of sphere and cone of same radius and same height is 2 : 1

- i) Both A and B are true
- ii) A is true, B is false
- iii) A is false, B is true
- iv) Both A and B are false

Sol. iv) Both A and B are false

Answer questions 4 and 5 based on the data given below.

"The cost of 1 kg potatoes and 2kg tomatoes was ₹30 on a certain day. After two days the cost of 2 kg potatoes and 4 kg tomatoes was found to be ₹66".

4. Write a pair of linear equations in two variables x and y from the data.

Sol. $x + 2y = 30$ [Let potatoes be x and
 $2x + 4y = 66$ tomatoes be y]

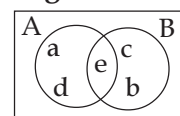
5. Which system of linear equations in two variables does the data represent?

Sol. $\frac{a_1}{a_2} = \frac{1}{2}; \frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}; \frac{c_1}{c_2} = \frac{30}{66} = \frac{10}{22} = \frac{5}{11}$
 $\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

So, these are parallel lines.

The data represents inconsistent system.

6. Find $n(A \cup B)$ from the figure.



Sol. From the figure $n(A \cup B) = \{a, b, c, d, e\}$
 $n(A \cup B) = 5$

7. The perimeters of two similar triangles are 24 cm and 18 cm respectively. If one side of the first triangle is 8 cm then what is the corresponding side of second triangle ?

Sol. Perimeters of two similar triangles are 24 cm and 18 cm.

One side of first triangle = 8 cm

Let the corresponding side of second triangle be x cm.

The ratio of perimeters of two similar triangles = The ratio of corresponding sides.

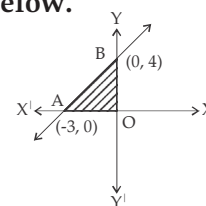
$$\frac{24}{18} = \frac{8}{x} \Rightarrow \frac{4}{3} = \frac{8}{x} \Rightarrow 4 \times x = 8 \times 3$$

$$x = \frac{24}{4} = 6$$

The corresponding side of second triangle = 6 cm.

8. Find the area of the shaded triangle, in the figure given below.

Sol. The triangle formed by a line with coordinates is a right angled triangle.



$$\begin{aligned} \text{Area of } \triangle AOB &= \frac{1}{2} |ab| \\ &= \frac{1}{2} |OA \times OB| \Rightarrow = \frac{1}{2} |-3 \times 4| \\ &= \frac{1}{2} \times -12^\circ \\ &= 6 \text{ sq.units } (\because \text{-ve sign does not take into consideration in area}) \end{aligned}$$

9. In $\triangle ABC$ and $\triangle DEF$, if $\angle B = \angle E$, $\angle C = \angle F$, then which of the following is a true statement ?

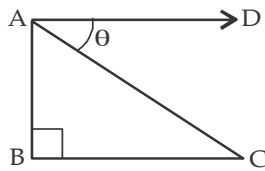
A) $\frac{AB}{DE} = \frac{CA}{EF}$ B) $\frac{BC}{EF} = \frac{AB}{FD}$
 C) $\frac{AB}{DE} = \frac{BC}{EF}$ D) $\frac{CA}{FD} = \frac{AB}{EF}$

Sol. C) $\left(\frac{AB}{DE} = \frac{BC}{EF}\right)$



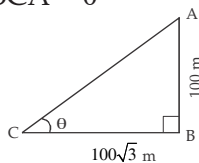
10. Name the 'angle of depression' from the figure given below in which $\angle B = 90^\circ$

Sol. Angle of depression
 $= \angle DAC = \theta$



11. A tower of height 100 m casts a shadow of length $100\sqrt{3}$ m then what is the angle of elevation of the sun at that time ?

Sol. Height of the tower = $AB = 100$ m
 Length of the shadow = $BC = 100\sqrt{3}$ m
 Angle of elevation = $\angle BCA = \theta$
 $\tan \theta = \frac{AB}{BC}$
 $\tan \theta = \frac{100}{100\sqrt{3}} = \frac{1}{\sqrt{3}}$
 $\tan \theta = \tan 30^\circ \Rightarrow \theta = 30^\circ$
 Angle of elevation = 30°



12. The length of the minutes hand of a clock is 7 cm, then how much distance does it cover in one hour ?

Sol. The length of a minute hand of a clock = 7 cm
 Radius = $r = 7$ cm
 The distance covered by minute hand in 1 hour = circumference of a circle.
 $= 2\pi r \Rightarrow 2 \times \frac{22}{7} \times 7 \Rightarrow 44$ cm

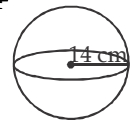
SECTION - II

13. Find the common difference of the terms of A.P. $(x - y), (x + y), (x + 3y), \dots$

Sol. $(x - y), (x + y), (x + 3y), \dots$ are in A.P.
 Common difference (d) = $a_2 - a_1$
 $= x + y - (x - y)$
 $= x + y - x + y = 2y$

14. Find the surface area of a sphere of radius 14 cm. (Take $\pi = \frac{22}{7}$)

Sol. Radius of a sphere (r) = 14 cm
 Surface area of a sphere = $4\pi r^2$
 $= 4 \times \frac{22}{7} \times 14 \times 14^2$
 $= 2,464 \text{ cm}^2$



15. Reduce the pair of equations

$$\frac{2}{x} + \frac{3}{y} = 13 \text{ and } \frac{5}{x} + \frac{4}{y} = -2 \quad (x \neq 0, y \neq 0)$$

into a pair of linear equations in two variables 'a' and 'b'.

Sol. $\frac{2}{x} + \frac{3}{y} = 13 \Rightarrow 2\left(\frac{1}{x}\right) + 3\left(\frac{1}{y}\right) = 13$

$$\frac{5}{x} + \frac{4}{y} = -2 \Rightarrow 5\left(\frac{1}{x}\right) + 4\left(\frac{1}{y}\right) = -2$$

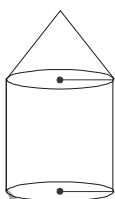
Let $\frac{1}{x} = a$ and $\frac{1}{y} = b$ then

$$2a + 3b = 13 \text{ and } 5a + 4b = -2$$

\therefore The required pair of linear equations in two variables 'a' and 'b' are $2a + 3b = 13$ and $5a + 4b = -2$.

16. Draw a rough diagram of a solid, showing the combination of a cone and cylinder, whose base, radii are same.

Sol. The solid, showing the combination of a cone and cylinder whose base radii are same.



17. In the given figure, $\overline{AB} \parallel \overline{QR}$ and $PA = 2\text{ cm}$, $AQ = 3\text{ cm}$, then find the ratio of areas of ΔPQR and ΔPAB .

Sol. In the adjacent figure

$$\overline{AB} \parallel \overline{QR} \text{ and } PA = 2\text{ cm}$$

$$AQ = 3\text{ cm}$$

In ΔPAB & ΔPQR

$$\angle PAB = \angle PQR$$

(\therefore corresponding angles)

$$\angle PBA = \angle PRQ$$

(\therefore corresponding angles)

$$\angle APB = \angle QPR$$

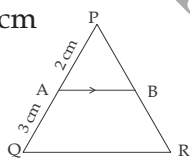
(\therefore common angles)

$$\angle PAB \sim \angle PQR \text{ (\therefore by AAA similarity rule)}$$

$$\frac{\text{ar } \Delta PQR}{\text{ar } \Delta PAB} = \left(\frac{PQ}{PA}\right)^2$$

$$\left(\frac{5}{2}\right)^2 = \frac{25}{4} = 25 : 4$$

$$\therefore \text{ar } \Delta PQR : \text{ar } \Delta PAB = 25 : 4$$

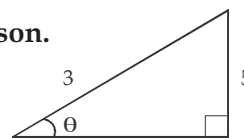


18. Simplify $\cot^2\theta - \frac{1}{\sin^2\theta}$.

$$\begin{aligned} \text{Sol. } \cot^2\theta - \frac{1}{\sin^2\theta} &= \cot^2\theta - \text{cosec}^2\theta \\ &= -1 [\text{cosec}^2\theta - \cot^2\theta] \\ &= -1 (1) \quad [\because \text{cosec}^2\theta - \cot^2\theta = 1] \\ &= -1 \end{aligned}$$

19. Does $\sin\theta = \frac{5}{3}$ exist for an acute angle θ ? Give reason.

$$\text{Sol. } \sin\theta = \frac{5}{3}$$



$$\sin\theta = \frac{\text{Opposite side}}{\text{Hypotenuse}} = \frac{5}{3}$$

Here the hypotenuse is smaller than opposite side of θ in a right angle triangle.

It is impossible, because hypotenuse is the longer side of right angle triangle.

\therefore Hence $\sin\theta = \frac{5}{3}$ does not exist for an acute angle θ .

20. What are equally likely events? Give one example.

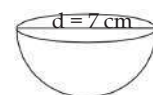
Sol. *Equally likely event* : Two or more events are said to be equally likely if each one of them has an equal chance of occurrence.

- Ex : 1. Selecting a number from 0 to 9.
2. Getting head when a coin is tossed.

SECTION – III

21. Find the volume and total surface area of a hemisphere of diameter 7 cm.

$$\text{(Take } \pi = \frac{22}{7} \text{)}$$



Sol. Given that the diameter of hemisphere = $d = 7\text{ cm}$.

$$\text{Radius} = r = \frac{d}{2} = \frac{7}{2} = 3.5 \text{ cm.}$$

$$\begin{aligned} \text{Volume of hemisphere} &= \frac{2}{3} \pi r^3 \\ &= \frac{2}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 3.5 \\ &= \frac{269.50}{3} = 89.83 \text{ cm}^3. \end{aligned}$$

$$\begin{aligned} \text{T.S.A. of a hemisphere} &= 3\pi r^2 \\ &= 3 \times \frac{22}{7} \times 3.5 \times 3.5 \\ &= 115.5 \text{ cm}^2. \end{aligned}$$

22. If $x^2 + y^2 = 10xy$, then prove that $2 \log(x - y) = \log x + \log y + 3 \log 2$

Sol. $x^2 + y^2 = 10xy$
 $x^2 + y^2 - 2xy = 10xy - 2xy$
 $(x - y)^2 = 8xy$
 $\log(x - y)^2 = \log 8xy$
 $[\because \log a^m = m \log a]$

$$2 \log(x - y) = \log 8 + \log x + \log y$$

$[\because \log ab = \log a + \log b]$

$$2 \log(x - y) = \log 2^3 + \log x + \log y$$

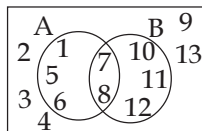
$$2 \log(x - y) = 3 \log 2 + \log x + \log y$$

$$2 \log(x - y) = \log x + \log y + 3 \log 2$$

23. Read the diagram and answer the following.

Find i) $A \cup B$;

ii) $A - B$



Sol. From the diagram

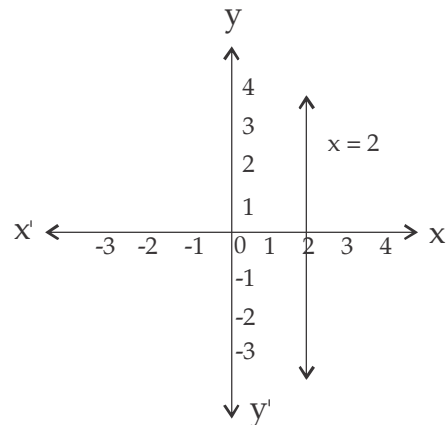
i) $A \cup B = \{1, 5, 6, 7, 8, 10, 11, 12\}$

ii) $A - B = \{1, 5, 6\}$

24. Draw a rough diagram (graph) of linear equation $x = 2$.

Sol. The graph of $x = 2$

$x = 2$ is a line which is parallel to Y-axis with the distance of 2 units.



25. The hypotenuse of a right triangle is 6 m more than twice the shortest side. If the third side is 2m less than hypotenuse, find the sides of the triangle.

Sol. Let the shortest side be x m.
 Then hypotenuse = $(2x + 6)$ m and third side = $(2x + 4)$ m.

By Pythagoras theorem, we have

$$(2x + 6)^2 = x^2 + (2x + 4)^2$$

$$4x^2 + 24x + 36 = x^2 + 4x^2 + 16x + 16$$

$$x^2 - 8x - 20 = 0$$

$$x^2 - 10x + 2x - 20 = 0$$

$$(x - 10)(x + 2) = 0$$

$$x = 10 \text{ or } x = -2$$

but x can't be negative as side of a triangle.

$$\therefore x = 10$$

Hence, the sides of the triangle are 10m, 26m, 24m.

26. Find the mean of the following data.

x_i	5	8	10	15	18	20
f_i	2	3	5	4	4	2

Sol.

x_i	f_i	$f_i x_i$
5	2	10
8	3	24
10	5	50
15	4	60
18	4	72
20	2	40
$\Sigma f_i = 20$		$\Sigma f_i x_i = 256$

$$\text{A.M} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= \frac{256}{20}$$

$$= 12.8$$

$$\therefore \text{Mean} (\bar{x}) = 12.8$$

27. A bag contains 5 red, 5 green and 5 white balls of the same size. A ball is drawn at random from the bag. Is the probability of picking up a ball of any colour equally likely or not? Justify.

Sol. A bag contains 5 red, 5 green and 5 white balls of same size.

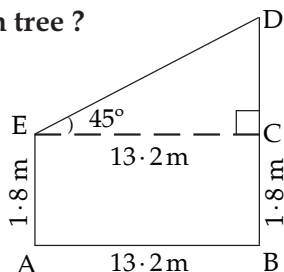
A ball is drawn at random from the bag
 \therefore The probability of picking up any

$$\text{colour ball} = \frac{5}{15} = \frac{1}{3}$$

Since all the coloured balls picking up is equally likely outcomes.

28. An observer of height 1.8 m is 13.2 m away from a palm tree. The angle of elevation of the top of tree from his eyes is 45° . What is the height of the palm tree?

Sol.



From the figure :

AE = height of the observer = 1.8m

BC = AE = 1.8m

AB = distance between the observer and the palm tree.

$$= 13.2 \text{ m}$$

EC = AB = 13.2 m ; $\angle DEC = 45^\circ$

$$\text{In } \triangle CDE, \tan 45^\circ = \frac{CD}{CE}$$

$$\Rightarrow 1 = \frac{CD}{13.2 \text{ m}} \Rightarrow CD = 13.2 \text{ m}$$

\therefore Height of the palm tree

$$BD = BC + CD$$

$$= 1.8 \text{ m} + 13.2 \text{ m}$$

$$= 15 \text{ m}$$

SECTION - IV

29. Two metallic spheres of radii 6 cm and 8 cm are melted along with another sphere and made into a big sphere of radius 12 cm. Find the radius of the third sphere.

Sol. The radii of two metallic spheres are $r_1 = 6 \text{ cm}$ and $r_2 = 8 \text{ cm}$

These two metallic spheres are melted with another sphere with radius r_3

= x cm and made into big sphere.

The radius of big sphere = R
= 12 cm.

∴ Volume of three metallic spheres
= Volume of big sphere

$$\frac{4}{3}\pi r_1^3 + \frac{4}{3}\pi r_2^3 + \frac{4}{3}\pi r_3^3 = \frac{4}{3}\pi R^3$$

$$\frac{4}{3}\pi [r_1^3 + r_2^3 + r_3^3] = \frac{4}{3}\pi R^3$$

$$6^3 + 8^3 + x^3 = 12^3$$

$$216 + 512 + x^3 = 1728$$

$$728 + x^3 = 1728$$

$$x^3 = 1728 - 728$$

$$x^3 = 1000$$

$$x = 10$$

∴ The radius of third metallic sphere
= 10 cm.

(OR)

If the Geometric Progressions 162, 54,

18..... and $\frac{2}{81}, \frac{2}{27}, \frac{2}{9}, \dots$ have their n^{th}
terms equal then find the value of 'n'.

Sol. Given geometric progression

162, 54, 18...

$$\text{Here } a = 162; r = \frac{54}{162} = \frac{1}{3}$$

$$n^{\text{th}} \text{ term } a_n = a r^{n-1}$$

$$a_n = 162 \left(\frac{1}{3}\right)^{n-1}$$

$$\text{Given G.P.} = \frac{2}{81}, \frac{2}{27}, \frac{2}{9}$$

$$a = \frac{2}{81}; r = \frac{\frac{2}{27}}{\frac{2}{81}} = \frac{2}{27} \times \frac{81}{2} = 3$$

$$n^{\text{th}} \text{ term } a_n = a r^{n-1}$$

$$a_n = \frac{2}{81} (3)^{n-1}$$

Given that n^{th} terms of these geometric
progressions are equal.

$$162 \left(\frac{1}{3}\right)^{n-1} = \frac{2}{81} (3)^{n-1}$$

$$162 \times \frac{1}{3^{n-1}} = \frac{2}{81} (3)^{n-1}$$

$$(3^{n-1})(3^{n-1}) = \frac{81}{2} \times \frac{81}{2} = 81 \cdot 81$$

$$3^{n-1+n-1} = 3^4 \times 3^4$$

$$3^{2n-2} = 3^8$$

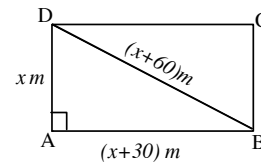
$$\therefore 2n-2 = 8 \Rightarrow 2n = 8 + 2 = 10$$

$$n = \frac{10}{2} = 5$$

30. The diagonal of a rectangular field is
60m more than its breadth. If the
length is 30 m more than its breadth,
find the dimensions of the field.

Sol. Let the shortest side of the rectangular
field = x m.

Longer side is 30 mts more than the
shorter side.



∴ Longer side = (x + 30) m.

The diagonal of a rectangular field is
60m more than the shorter side.

Diagonal = (x + 60) m.

ABD is a right angle triangle.

$$BD^2 = AD^2 + AB^2$$

$$(x + 60)^2 = x^2 + (x + 30)^2$$

$$x^2 + 120x + 3600 = x^2 + x^2 + 60x + 900$$

$$x^2 + 120x + 3600 - x^2 - x^2 - 60x - 900$$

$$= 0$$

$$x^2 - 60x - 2700 = 0$$

$x^2 - 60x - 2700 = 0$ which is a quadratic
equation.

Here a = 1; b = -60; c = -2700

$$b^2 - 4ac = (-60)^2 - 4(1)(-2700)$$

$$= 3600 + 10800 = 14400 > 0$$

$$\text{Therefore } x = \frac{-(-60) \pm \sqrt{(14400)}}{2 \times 1}$$

$$= \frac{60 \pm 120}{2} = \frac{60 + 120}{2}, \frac{60 - 120}{2}$$

$$x = \frac{60 + 120}{2} = \frac{180}{2} = 90$$

$$x = \frac{60 - 120}{2} = \frac{-60}{2} = -30$$

Sides of a rectangle cannot be negative.

Therefore the shorter side of the rectangular field = 90 mts.

Longer side = $90 + 30 = 120$ mts.

(OR)

A toy top is in the form of a cone mounted on a hemi-sphere. The diameter of the base and the height of the cone are 6 cm and 4 cm respectively. Determine the surface area of the toy. (Take $\pi = 3.14$)

Sol. Diameter of the cone (d) = 6cm

$$\text{Radius of the cone (r)} = \frac{d}{2} = \frac{6}{2} \text{ cm} \\ = 3 \text{ cm}$$

Height of the cone (h) = 4cm

$$\text{Slant height (l)} = \sqrt{r^2 + h^2} \\ = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} \\ = \sqrt{25} = 5 \text{ cm}$$

$$\therefore \text{Surface area of cone} = \pi r l \\ = 3.14 \times 3 \times 5 \text{ cm}^2 \\ = 47.1 \text{ cm}^2$$

$$\text{Surface area of hemisphere} = 2\pi r^2 \\ = 2 \times 3.14 \times 3 \times 3 \text{ cm}^2 \\ = 56.52 \text{ cm}^2$$

$$\text{Thus, Total surface area of the toy} \\ = \text{SA of cone} + \text{SA of hemisphere} \\ = 47.1 \text{ cm}^2 + 56.52 \text{ cm}^2 \\ = 103.62 \text{ cm}^2$$

31. Show that the given points (1, 7), (4, 2), (-1, -1), and (-4, 4) are the vertices of a square.

Sol. Let A (1,7), B (4,2), C (-1,-1) and D (-4, 4) be the given points.

One way of showing that ABCD is a square is to use the property that all its sides should be equal and both its diagonals should also be equal.

$$\text{Sides are } AB = d = \sqrt{(1-4)^2 + (7-2)^2} \\ = \sqrt{9+25} = \sqrt{34} \text{ units}$$

$$BC = \sqrt{(4+1)^2 + (2+1)^2} = \sqrt{25+9} \\ = \sqrt{34} \text{ units}$$

$$CD = \sqrt{(-1+4)^2 + (-1-4)^2} = \sqrt{9+25} \\ = \sqrt{34} \text{ units}$$

$$DA = \sqrt{(-4-1)^2 + (4-7)^2} = \sqrt{25+9} \\ = \sqrt{34} \text{ units}$$

and diagonals are

$$AC = \sqrt{(1+1)^2 + (7+1)^2}$$

$$= \sqrt{4+64} = \sqrt{68} \text{ units}$$

$$BD = \sqrt{(4+4)^2 + (2-4)^2} = \sqrt{64+4} \\ = \sqrt{68} \text{ units}$$

Since $AB = BC = CD = DA$ and $AC = BD$. So all the four sides of the quadrilateral ABCD are equal and its diagonals AC and BD are also equal. Therefore, ABCD is a square.

(OR)

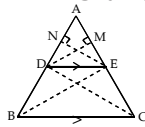
- i) State and prove the "Basic Proportionality theorem".
- ii) Using the theorem, find the length of AE, if $AD = 1.8$ cm, $BD = 5.4$ cm, $EC = 7.2$ cm.

Sol. i) 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.

Given : In $\triangle ABC$, $DE \parallel BC$ which intersects sides AB and AC at D and E respectively.

$$\text{RTP : } \frac{AD}{DB} = \frac{AE}{EC}$$

Construction : Join B, E and C, D and then draw $DM \perp AC$ and $EN \perp AB$



Proof : Observe that $\triangle BDE$ and $\triangle CDE$ are on the same base DE and between same parallels BC and DE .

$$\text{So ar}(\triangle BDE) = \text{ar}(\triangle CDE)$$

$$\text{So } \frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle BDE)} = \frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle CDE)}$$

$$\frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times BD \times EN} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM}$$

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

Hence proved.

ii) In $\triangle ABC$, $DE \parallel BC$

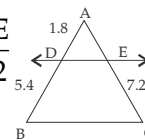
$$\text{By B.P.T. } \frac{AD}{DB} = \frac{AE}{EC}$$

$$\frac{1.8}{5.4} = \frac{AE}{7.2} \Rightarrow \frac{6}{18} = \frac{AE}{7.2}$$

$$18 \times AE = 7.2 \times 6$$

$$AE = \frac{43.2}{18} = 2.4$$

$$AE = 2.4$$



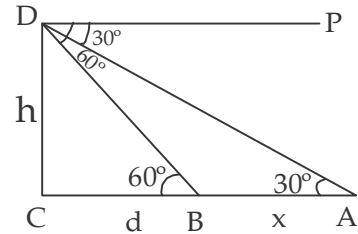
32. A man on the top of a vertical tower observes a car moving at a uniform speed coming directly towards it. If it takes 12 seconds to change the angle of depression from 30° to 60° , then how long will the car take to reach the tower from that point ?

Sol. Let the distance travelled by the car in 12 seconds = x m.

Height of the tower = $CD = h$ m.

The remaining distance to be travelled by the car = $BC = d$ m.

$$AC = AB + BC = (x + d) \text{ m.}$$



$$\angle PDA = \angle DAC = 30^\circ$$

(\because Alternate interior angles)

$$\angle PDB = \angle CBD = 60^\circ$$

$$\text{From } \triangle BCD, \tan 60^\circ = \frac{CD}{BC}$$

$$\sqrt{3} = \frac{h}{d} \Rightarrow h = \sqrt{3} d \dots\dots\dots (1)$$

$$\text{From } \triangle ACD, \tan 30^\circ = \frac{CD}{AC}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x + d} \Rightarrow h = \frac{x + d}{\sqrt{3}} \dots\dots\dots (2)$$

From (1) & (2), we get

$$\frac{x + d}{\sqrt{3}} = \sqrt{3} d$$

$$x + d = 3d \Rightarrow x = 2d \Rightarrow d = \frac{x}{2}$$

The time taken to travel 'x'

$$m = 12 \text{ sec}$$

The time taken to travel the distance of

$$'d' \text{ m} = \frac{x}{2} = \frac{12}{2} = 6 \text{ sec}$$

(OR)

Two digit numbers are formed by the digits 0, 1, 2, 3, 4 where the digits are not repeated. Find the probability that

- the number formed is greater than 42.
- the number formed is a multiple of 4.

Sol. Two digit numbers are formed by the digits 0, 1, 2, 3, 4, where the digits are not repeated

They are [10, 12, 13, 14, 20, 21, 23, 24, 30, 31, 32, 34, 40, 41, 42, 43]

∴ Total possible outcomes

$$[\text{sample space}] = 16$$

i) Let 'E' be the event that the number formed is greater than 42.

Number of favourable outcomes to event E is = 1 [43]

Probability of an event 'E' is P(E)

$$= \frac{\text{No. of favourable outcomes}}{\text{Total no of outcomes}}$$

$$= \frac{1}{16}$$

ii) Let 'F' be the event that the number formed is a multiple of 4.

Number of favourable outcomes to event 'F' is

$$= 5 [12, 20, 24, 32, 40]$$

Probability of an event 'F' is

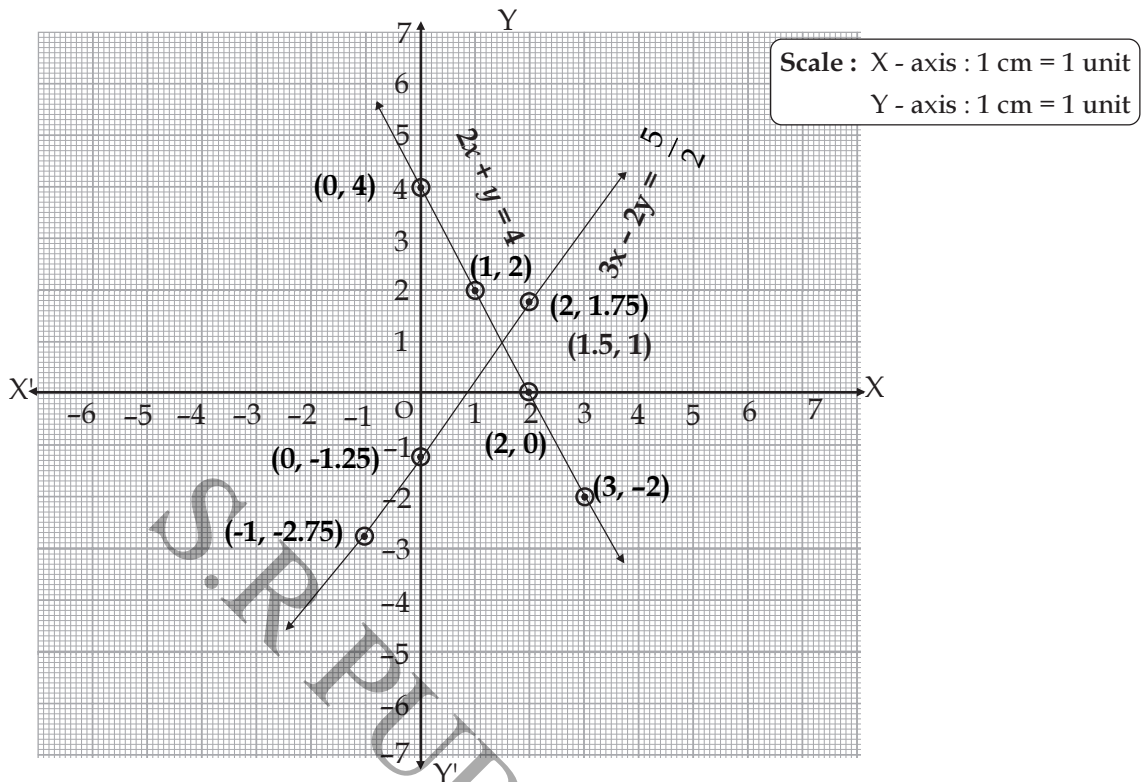
$$P(F) = \frac{5}{16}$$

33. Solve the equations $2x + y = 4$ and $3x - 2y = \frac{5}{2}$ graphically.

Sol.

For the equation $2x + y = 4$		
x	$y = 4 - 2x$	(x, y)
0	$y = 4 - 2(0) = 4 - 0 = 4$	(0, 4)
1	$y = 4 - 2(1) = 4 - 2 = 2$	(1, 2)
2	$y = 4 - 2(2) = 4 - 4 = 0$	(2, 0)
3	$y = 4 - 2(3) = 4 - 6 = -2$	(3, -2)

For the equation $3x - 2y = \frac{5}{2}$		
x	$2(3x - 2y) = 5 \Rightarrow 6x - 4y = 5$ $4y = 6x - 5 \Rightarrow y = \frac{6x - 5}{4}$	(x, y)
0	$y = \frac{6(0) - 5}{4} = \frac{0 - 5}{4} = \frac{-5}{4} = -1.25$	(0, -1.25)
2	$y = \frac{6(2) - 5}{4} = \frac{12 - 5}{4} = \frac{7}{4} = 1.75$	(2, 1.75)
-1	$y = \frac{6(-1) - 5}{4} = \frac{-11}{4} = -2.75$	(-1, -2.75)

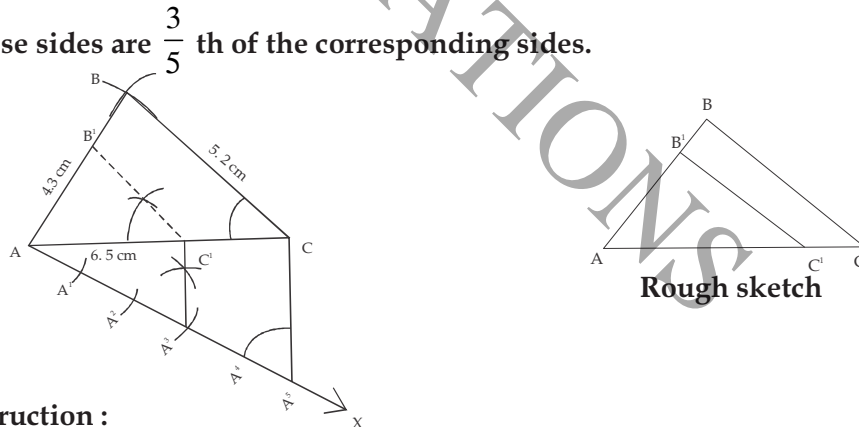


From the graph the system of linear equations has unique solution

i.e, $\left(\frac{3}{2}, 1\right)$ (or) $(1.5, 1)$

Draw ΔABC with sides 4.3 cm, 5.2 cm and 6.5 cm and then construct a triangle similar to ΔABC , whose sides are $\frac{3}{5}$ th of the corresponding sides.

Sol.



Steps of construction :

1. Construct a triangle ABC with sides 4.3 cm, 5.2 cm and 6.5 cm.
2. Draw a ray AX making an acute angle with AC on the side opposite to vertex 'B'.
3. Locate 5 points A_1, A_2, A_3, A_4 and A_5 on AX so that $AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5$
4. Join A_5C and draw a line parallel to A_5C through A_3 intersects AC at C^1 .
5. Draw another line parallel to CB through C^1 intersects AB.
6. ΔAB^1C^1 is our required similar triangle.



MODEL PAPER

MATHEMATICS



Time : 3.15 Hrs

Max. Marks : 100

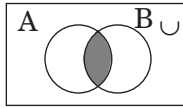
- Instructions :**
1. 15 minutes are allotted for reading the question paper in addition to 3.00 hours for writing the answers.
 2. All answers should be written in the separate answer booklet.
 3. There are four sections in the questions.
 4. There is internal choice in Section-IV.
 4. Write answers should be visible and legibly.

Section I

Note: 1. Answer all the questions.

2. Each question carries 1 mark.

(12 × 1 = 12)

1. If $x + \frac{1}{x} = \frac{17}{4}$ then find the value of x .
2. Write the decimal form of $\frac{17}{8}$.
3. The cost of a note book is twice the cost of pen. Write a linear equation in two variables to represent this statement.
4. If α, β, γ are the zeroes of the cubic polynomial $4x^3 + 8x^2 - 6x - 2$ then find $\alpha\beta\gamma$.
5. In a cone $l = 10$ cm, $r = 5$ cm then find the CSA of a cone.
6. In the adjacent Venn-diagram, write the set represented by the shaded region.

7. Find the height of an equilateral triangle of side $2\sqrt{3}$ units.
8. What is the value of $\tan^2 30^\circ + 2 \cot^2 60^\circ$?
9. If $(1, 2), (-1, b), (-3, -4)$ are collinear, then find the value of b .
10. Can mode be calculated for grouped data with unequal class sizes ?
11. In a well shuffled deck of 52 cards, find the probability of not a face card.
12. Draw a rough diagram of two externally touching circles and their tangents.

Section II

Note: 1. Answer all the questions.

2. Each question carries 2 marks.

(8 × 2 = 16)

13. Given that $a = 5, d = 3, a_n = 50$ find n .
14. A sphere of maximum volume is cut out from a solid hemisphere of radius 6 cm. Find the volume of the cut out sphere.

15. The larger of two complimentary angles is double the smaller. Find the angles.
16. Find the surface area of a sphere of radius 14 cm $\left(\text{Take } \pi = \frac{22}{7} \right)$
17. What is the difference between secant of the circle and tangent to the circle ?
18. Is it right to say $\cos (60^\circ + 30^\circ) = \cos 60^\circ \cdot \cos 30^\circ - \sin 60^\circ \cdot \sin 30^\circ$?
19. Explain the formula for mode for a grouped data.
20. If the shadow of a tower is $\sqrt{3}$ times its height, then find the angle of of the sun's altitude.

Section III

Note: 1. Answer all the questions.

2. Each question carries 4 marks.

(8 × 4 = 32)

21. Find the volume of a right circular cone with radius 6 cm and height 7 cm.
22. Explain why $7 \times 11 \times 13 + 13$ and $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ are composite numbers.
23. State the reasons for the following :
 - (1) $(1, 2, 3, \dots, 10) \neq \{x / x \in \mathbb{N} \text{ and } 1 < x < 10\}$
 - (2) $(2, 3, 5, 7, 9) \neq \{x / x \text{ is a prime number}\}$
24. Find whether the equations $x^2 - 4x + 1.5 = 0$ and $2x^2 + 3 = 8x$ are consistent or not.
25. Given that $\cot \theta = \frac{7}{8}$. Then evaluate $\frac{(1 + \sin \theta)(1 - \sin \theta)}{(1 + \cos \theta)(1 - \cos \theta)}$.
26. In right angle triangle ABC, 8 cm, 15 cm and 17 cm are the lenghs of AB, BC and CA respectively. Then, find out $\sin A$, $\cos A$ and $\tan A$.
27. In what ratio does the point $(-4, 6)$ divide the line segment joining the points A $(-6, 10)$, B $(3, -8)$?
28. Length of the shadow of a 15 meter high pole is $5\sqrt{3}$ meters at 10 O' clock in the morning. Then what is the angle of elevation of the sun rays with the ground at the time ?

Section IV

Note: 1. Answer all the questions.

2. Each question carries 8 marks.

3. There is internal choice for each question.

(5 × 8 = 40)

29. (a) A sphere, a cylinder and a cone are of the same radius and same height. Find the ratio of their curved surface areas ?

(Or)

 (b) Subba Rao started to work in 1995 at an annual salary of Rs. 5000 and received an increment of Rs. 200 each year. In which year did his income reach Rs. 7000 ?
30. (a) A toy is made in the form of hemisphere surmounted by a right cone whose circular base is joined with the plane surface of the hemisphere. The radius of the base of the cone is 7 cm and its volume is $\frac{3}{2}$ of the hemisphere. Calculate the height of the cone and the surface area of the toy correct to 2 places of decimal $\left(\text{Take } \pi = 3\frac{1}{7} \right)$.

(Or)

- (b) If two of the zeroes of the polynomial $x^4 + 3x^3 - 7x^2 - 27x - 18$ are -1 and -2 , find the other zeroes.

31. (a) Prove that $\sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} = \operatorname{cosec} \theta + \cot \theta$

(Or)

- (b) Find the value of y for which the distance between the points $P(2, -3)$ and $Q(10, y)$ is 10 units.
32. (a) In a retail market, fruit vendors were selling oranges kept in packing baskets. These baskets contained varying number of oranges. The following was the distribution of oranges according to the number of baskets :

Number of oranges	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34
Number of baskets	15	110	135	114	25

Find the mean number of oranges kept in each basket. Which method of finding the mean did you choose ?

(Or)

- (b) A car has two wipers which do not overlap. Each wiper has a blade of length 25 cm sweeping through an angle of 115° . Find the total area cleaned at each sweep of the blades. $\left(\text{use } \pi = \frac{22}{7}\right)$.
33. (a) Draw the graph of $p(x) = x^2 + 3x - 4$. Using the graph find the zeroes. Justify your answer.

(Or)

- (b) The annual profits earned by 30 shops in a locality give rise to the following distribution :

Profit (in lakhs)	Number of shops (frequency)
More than or equal to 5	30
More than or equal to 10	28
More than or equal to 15	16
More than or equal to 20	14
More than or equal to 25	10
More than or equal to 30	7
More than or equal to 35	3

Draw both ogives for the above data. Hence obtain the median profit.

ANSWERS**Section I**

1. If $x + \frac{1}{x} = \frac{17}{4}$ then find the value of x .

Solution :

$$4 \text{ (or) } \frac{1}{4}$$

2. Write the decimal form of $\frac{17}{8}$.

Solution :

$$2.125$$

3. The cost of a note book is twice the cost of pen. Write a linear equation in two variables to represent this statement.

Solution :

Let the cost price of note book = Rs. x ,

Cost price of Pen = Rs. y

So, $x = 2y$ (or) $x - 2y = 0$.

4. If α, β, γ are the zeroes of the cubic polynomial $4x^3 + 8x^2 - 6x - 2$ then find $\alpha\beta\gamma$.

Solution :

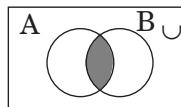
$$\begin{aligned} \alpha\beta\gamma &= -\frac{d}{a} = -\frac{\text{Constant of term}}{\text{Coefficient of } x^3} \\ &= \frac{-(-2)}{4} = \frac{2}{4} = \frac{1}{2} \end{aligned}$$

5. In a cone $l = 10$ cm, $r = 5$ cm then find the CSA of a cone.

Solution :

$$\begin{aligned} \text{CSA of cone} &= \pi rl = \frac{22}{7} \times 5 \times 10 \\ &= \frac{1100}{7} = 157 \frac{1}{7} \text{ cm}^2. \end{aligned}$$

6. In the adjacent Venn-diagram, write the set represented by the shaded region.



Solution :

$$A \cap B$$

7. Find the height of an equilateral triangle of side $2\sqrt{3}$ units.

Solution :

$$\frac{\sqrt{3}}{2} \times 2\sqrt{3} = 3 \text{ units.}$$

8. What is the value of $\tan^2 30^\circ + 2 \cot^2 60^\circ$?

Solution :

$$1 \left[\tan^2 \left(\frac{1}{\sqrt{3}} \right) + 2 \times \left(\frac{1}{\sqrt{3}} \right)^2 \right]$$

9. If $(1, 2), (-1, b), (-3, -4)$ are collinear, then find the value of b .

Solution :

$$-1 \quad (\text{AB} + \text{BC} = \text{AC})$$

10. Can mode be calculated for grouped data with unequal class sizes ?

Solution :

No, Mode can't be calculated for grouped data with unequal class sizes.

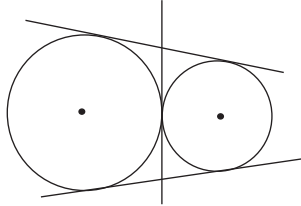
11. In a well shuffled deck of 52 cards, find the probability of not a face card.

Solution :

$$\frac{40}{52} \text{ (No. of face cards = 12)}$$

12. Draw a rough diagram of two externally touching circles and their tangents.

Solution :



Section II

13. Given that $a = 5$, $d = 3$, $a_n = 50$ find n .

Solution :

$$a = 5 ; d = 3 ; a_n = 50$$

$$a_n = 50$$

$$a + (n - 1) d = 50$$

$$5 + (n - 1) 3 = 50$$

$$(n - 1) 3 = 50 - 5$$

$$3(n - 1) = 45$$

$$15$$

$$n - 1 = \frac{45}{3} = 15$$

$$1$$

$$n - 1 = 15$$

$$n = 15 + 1 = 16$$

$$\therefore n = 16$$

14. A sphere of maximum volume is cut out from a solid hemisphere of radius 6 cm. Find the volume of the cut out sphere.

Solution :

Diameter of sphere = radius of hemisphere = 6 cm.

Radius of sphere = 3 cm

$$V = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 3^3 = \frac{792}{7} = 113.14 \text{ cm}^3.$$

$V = 113.14 \text{ cm}^3$, is the volume of the cut out sphere.

15. The larger of two complimentary angles is double the smaller. Find the angles.

Solution :

Let x be the smaller angle.

Then the larger angle = $2x$.

Given Two angles are complementary, then their sum = 90° .

$$x + 2x = 90^\circ$$

$$3x = 90^\circ$$

$$x = 30^\circ$$

Smaller angle (x) = 30°

Larger angle = $2x = 2 \times 30^\circ = 60^\circ$.

16. Find the surface area of a sphere of radius 14 cm (Take $\pi = \frac{22}{7}$)

Solution :

Radius of sphere $r = 14$ cm

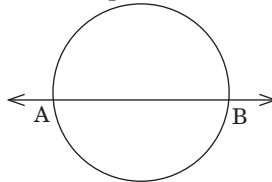
Surface area of sphere = $4\pi r^2$

$$= 4 \times \frac{22}{7} \times 14 \times 14 = 2464 \text{ sq.cm.}$$

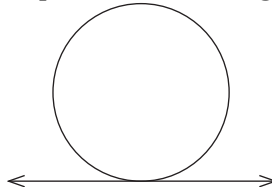
17. What is the difference between secant of the circle and tangent to the circle ?

Solution :

A line intersects the circle at two distinct points is called secant of the circle.



A line touches the circle at only one point is called tangent to the circle.



18. Is it right to say $\cos (60^\circ + 30^\circ) = \cos 60^\circ \cdot \cos 30^\circ - \sin 60^\circ \cdot \sin 30^\circ$?

Solution :

$$\text{LHS} = \cos (60^\circ + 30^\circ)$$

$$= \cos 90^\circ = 0$$

$$\text{RHS} = \cos 60^\circ \cdot \cos 30^\circ - \sin 60^\circ \cdot \sin 30^\circ$$

$$= \frac{1}{2} \cdot \frac{\sqrt{3}}{2} - \frac{\sqrt{3}}{2} \cdot \frac{1}{2}$$

$$= \frac{\sqrt{3}}{4} - \frac{\sqrt{3}}{4} = 0$$

\therefore LHS = RHS.

Thus, the given equation is right.

19. Explain the formula for mode for a grouped data.

Solution :

A class with maximum frequency is chosen as the modal class.

$$\text{Then, Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

Here

l = lower boundary of the modal class

h = length of the modal class

f_1 = frequency of the modal class

f_0 = frequency of the preceding class to the modal class.

f_2 = frequency of the succeeding class the modal class.

20. If the shadow of a tower is $\sqrt{3}$ times its height, then find the angle of of the sun's altitude.

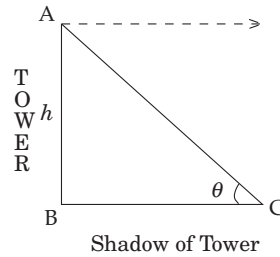
Solution :

AB = h m (Tower)

Shadow of tower BC = $\sqrt{3} h$.

$$\begin{aligned} \tan \theta &= \frac{AB}{BC} = \frac{h}{\sqrt{3} h} \\ &= \frac{1}{\sqrt{3}} = \tan 30^\circ. \end{aligned}$$

$\therefore \theta = 30^\circ$ (Angle of the sun's altitude).



Section III

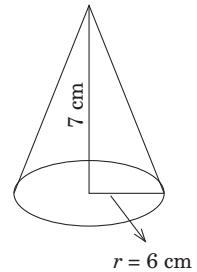
21. Find the volume of a right circular cone with radius 6 cm and height 7 cm.

Solution :

Given $r = 6$ cm, $h = 7$ cm.

$$\begin{aligned} \text{Volume of a right circular cone} &= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \times \frac{22}{7} \times (6 \text{ cm})^2 \times (7 \text{ cm}) \\ &= \frac{1}{3} \times \frac{22}{7} \times 36 \text{ cm}^2 \times 7 \text{ cm} = 264 \text{ cm}^3 \end{aligned}$$

\therefore Volume of the right circular cone = 264 cm^3 .



22. Explain why $7 \times 11 \times 13 + 13$ and $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ are composite numbers.

Solution :

(i) $7 \times 11 \times 13 + 13$ can be written by left distributive law as

$$13 \times (7 \times 11 + 1) = 13 \times (77 + 1) = 13 \times 78$$

This number has two other numbers 13 and 78 as factors besides 1 .

(Also $78 = 2 \times 3 \times 13$)

$\therefore 7 \times 11 \times 13 + 13$ is a composite number

(ii) $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ can be written by left distributive law as $5 (7 \times 6 \times 4 \times 3 \times 2 \times 1 + 1)$

It is clear that the number has 5 as a factor besides '1'.

So the given number is a composite number.

23. State the reasons for the following :

(1) $\{1, 2, 3, \dots, 10\} \neq \{x / x \in \mathbf{N} \text{ and } 1 < x < 10\}$

(2) $\{2, 3, 5, 7, 9\} \neq \{x / x \text{ is a prime number}\}$

Solution :

(1) $\{1, 2, 3, \dots, 10\} \neq \{x / x \in \mathbf{N} \text{ and } 1 < x < 10\}$: Reason : According to the condition $1 < x < 10$, and 10 are not the element of the set mentioned in the set builder form since the first element is 2 and the last element is 9 only.

(2) $\{2, 3, 5, 7, 9\} \neq \{x / x \text{ is a prime number}\}$: Reason : The element '9' of the set on the left hand side is not a prime because in addition to 1 and 9 it has another factor 3. Therefore there is one element in the L.H.S. set '9' which is not a prime.

24. Find whether the equations $x^2 - 4x + 1.5 = 0$ and $2x^2 + 3 = 8x$ are consistent or not.

Solution :

$$\text{Given equation } x^2 - 4x + 1.5 = 0 \quad \text{--- (1)}$$

$$\text{and } 2x^2 + 3 = 8x$$

$$2x^2 - 8x + 3 = 0 \quad \text{--- (2)}$$

Put $x^2 = y$ in (1) and (2), we get

$$y - 4x + 1.5 = 0$$

$$-4x + y + 1.5 = 0 \quad \text{--- (3)}$$

$$2y - 8x + 3 = 0$$

$$-8x + 2y + 3 = 0 \quad \text{--- (4)}$$

From (3) and (4), we get

$$\frac{a_1}{a_2} = \frac{-4}{-8} = \frac{1}{2}$$

$$\frac{b_1}{b_2} = \frac{1}{2}$$

$$\frac{c_1}{c_2} = \frac{1.5}{3} = \frac{15}{30} = \frac{1}{2}$$

$$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

\therefore The equations are consistent.

25. Given that $\cot \theta = \frac{7}{8}$. Then evaluate $\frac{(1 + \sin \theta)(1 - \sin \theta)}{(1 + \cos \theta)(1 - \cos \theta)}$.

Solution :

$$\cot \theta = \frac{7}{8}$$

In $\triangle ABC$

$$\begin{aligned} AC^2 &= AB^2 + BC^2 \\ &= 7^2 + 8^2 = 49 + 64 = 113 \end{aligned}$$

$$AC^2 = 113$$

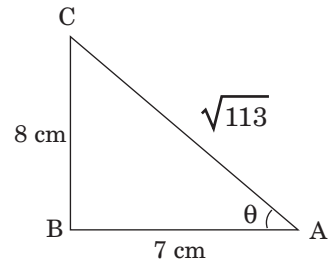
$$AC = \sqrt{113}$$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{8}{\sqrt{113}}$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{7}{\sqrt{113}}$$

$$\begin{aligned} \frac{(1 + \sin \theta)(1 - \sin \theta)}{(1 + \cos \theta)(1 - \cos \theta)} &= \frac{\left(1 + \frac{8}{\sqrt{113}}\right)\left(1 - \frac{8}{\sqrt{113}}\right)}{\left(1 + \frac{7}{\sqrt{113}}\right)\left(1 - \frac{7}{\sqrt{113}}\right)} \\ &= \frac{(1)^2 - \left(\frac{8}{\sqrt{113}}\right)^2}{(1)^2 - \left(\frac{7}{\sqrt{113}}\right)^2} = \frac{1 - \frac{64}{113}}{1 - \frac{49}{113}} = \frac{\frac{113 - 64}{113}}{\frac{113 - 49}{113}} = \frac{49}{64} \end{aligned}$$

$$\therefore \frac{(1 + \sin \theta)(1 - \sin \theta)}{(1 + \cos \theta)(1 - \cos \theta)} = \frac{49}{64}$$



26. In right angle triangle ABC, 8 cm, 15 cm and 17 cm are the lengths of AB, BC and CA respectively. Then, find out $\sin A$, $\cos A$ and $\tan A$.

Solution :

In right angle triangle ABC, it is given AB = 8 cm, BC = 15 cm and CA = 17 cm.

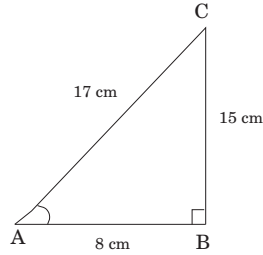
Clearly, the largest side = CA

= hypotenuse and $\angle B = 90^\circ$.

$$\text{Now, } \sin A = \frac{BC}{AC} = \frac{15}{17}$$

$$\cos A = \frac{AB}{AC} = \frac{8}{17}$$

$$\tan A = \frac{BC}{AB} = \frac{15}{8}$$



27. In what ratio does the point $(-4, 6)$ divide the line segment joining the points $A(-6, 10)$, $B(3, -8)$?

Solution :

Let $(-4, 6)$ divide AB internally in the ratio of $m_1 : m_2$. Using the section formula, we get

$$(-4, 6) = \left(\frac{3m_1 - 6m_2}{m_1 + m_2}, \frac{-8m_1 + 10m_2}{m_1 + m_2} \right) \quad \dots (1)$$

We know that if $(x, y) = (a, b)$ then $x = a$ and $y = b$

$$\text{So, } -4 = \frac{3m_1 - 6m_2}{m_1 + m_2}$$

$$-4m_1 - 4m_2 = 3m_1 - 6m_2 \quad \text{i.e., } 7m_1 = 2m_2$$

$$\frac{m_1}{m_2} = \frac{2}{7} \quad \text{i.e., } m_1 : m_2 = 2 : 7$$

We should verify that the ratio satisfies the y-coordinates also.

$$\text{Now, } \frac{-8m_1 + 10m_2}{m_1 + m_2} = \frac{-8 \frac{m_1}{m_2} + 10}{\frac{m_1}{m_2} + 1} \quad (\text{Dividing throughout by } m_2)$$

$$= \frac{-8 \frac{2}{7} + 10}{\frac{2}{7} + 1} = \frac{-\frac{16}{7} + 10}{\frac{9}{7}}$$

$$= \frac{-16 + 70}{9} = 6$$

Therefore, the point $(-4, 6)$ divides the line segment joining the points $A(-6, 10)$ and $B(3, -8)$ in the ratio $2 : 7$.

28. Length of the shadow of a 15 meter high pole is $5\sqrt{3}$ meters at 10 O' clock in the morning. Then what is the angle of elevation of the sun rays with the ground at the time ?

Solution :

Height of the pole $AB = 15$ m

Length of its shadow $BC = 5\sqrt{3}$ m

In $\triangle ABC$

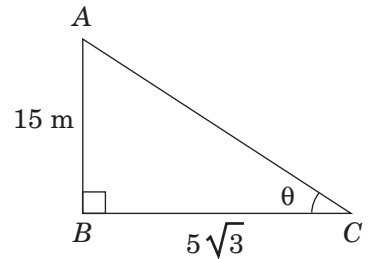
$$\angle ACB = \theta^\circ$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{AB}{BC}$$

$$\begin{aligned} \tan \theta &= \frac{15}{5\sqrt{3}} = \frac{3}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} \\ &= \frac{3 \times \sqrt{3}}{3} = \sqrt{3} \end{aligned}$$

$$\tan \theta = \sqrt{3}. \text{ We know } \tan 60^\circ = \sqrt{3}$$

$\therefore \theta = 60^\circ$ is the required angle of elevation of the sunrays with the ground.

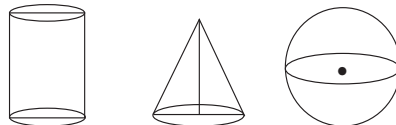


Section IV

29.(a) A sphere, a cylinder and a cone are of the same radius and same height. Find the ratio of their curved surface areas ?

Solution :

Let r be the common radius of a sphere, a cone and cylinder.



Height of the sphere = its diameter = $2r$.

Then, the height of the cone = height of cylinder = height of sphere = $2r$.

$$\begin{aligned} \text{Let } l \text{ be the slant height of cone, } l &= \sqrt{r^2 + h^2} \\ &= \sqrt{r^2 + (2r)^2} = \sqrt{5} r \end{aligned}$$

$$\therefore S_1 = \text{Curved surface area of sphere} = 4\pi r^2$$

$$S_2 = \text{curved surface area of cylinder, } 2\pi r h = 2\pi r \times 2r = 4\pi r^2$$

$$S_3 = \text{Curved surface area of cone} = \pi r l = \pi r \times \sqrt{5} r = \sqrt{5} \pi r^2$$

Ratio of curved surface area as

$$\therefore S_1 : S_2 : S_3 = 4\pi r^2 : 4\pi r^2 : \sqrt{5} \pi r^2 = 4 : 4 : \sqrt{5}$$

(Or)

- (b) *Subba Rao started to work in 1995 at an annual salary of Rs. 5000 and received an increment of Rs. 200 each year. In which year did his income reach Rs. 7000 ?*

Solution :

$$a_1 = ₹ 5000 \text{ (starting salary). Increment } (d) = \text{Rs. } 200$$

$$a_n = ₹ 7000$$

$$a_1 + (n - 1) d = 7000$$

$$5000 + (n - 1) 200 = 7000$$

$$(n - 1) 200 = 7000 - 5000$$

$$(n - 1) 200 = 2000$$

$$n - 1 = \frac{2000}{200} = 10$$

$$n = 10 + 1$$

$$\therefore n = 11$$

In the year $1995 + 11 = 2006$ his salary will be ₹ 7000

- 30.(a) *A toy is made in the form of hemisphere surmounted by a right cone whose circular base is joined with the plane surface of the hemisphere. The radius of the base of the cone is 7 cm and its volume is $\frac{3}{2}$ of the hemisphere. Calculate the height of the cone and the surface area of the toy correct to 2 places of decimal (Take $\pi = 3\frac{1}{7}$).*

Solution :

A toy is made in the form of hemisphere surmounted by a Right cone.

Radius of the base of the cone (r) = 7 cm

Let the height of cone be = h

\therefore Radius of the hemisphere (r) = 7 cm

$$\text{Volume of the cone} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \times 7 \times 7 \times h \text{ cm}^3$$

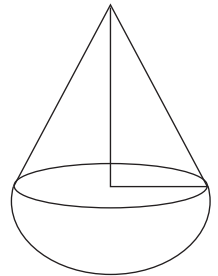
$$\text{Volume of the hemisphere} = \frac{2}{3} \pi r^3 = \frac{2}{3} \pi \times 7 \times 7 \times 7 \text{ cm}^3$$

But volume of cone = $\frac{3}{2}$ of the Hemisphere.

$$\frac{\pi}{3} \times 7 \times 7 \times h = \frac{2\pi}{3} \times 7 \times 7 \times 7$$

$$\begin{aligned} \text{Length of the cone } h &= \frac{2\pi}{3} \times \frac{7 \times 7 \times 7}{7 \times 7 \times \pi} \\ &= \frac{14}{3} = 4.66 = 4.7 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Surface area of the Toy} &= \text{Surface area of hemisphere} + \text{Surface area of cone} \\ &= 2\pi r^2 + \pi r l \end{aligned}$$



$$\begin{aligned}
&= 2 \times \frac{22}{7} \times 7 \times 7 + \frac{22}{7} \times 7 \times \sqrt{7^2 + 4 \cdot 7^2} \\
&= 308 + 22 \sqrt{49 + 22 \cdot 09} \\
&= 308 + 22 \sqrt{71 \cdot 09} \\
&= 308 + 22 \times 8 \cdot 4 \\
&= 308 + 184 \cdot 8 \\
&= 492 \cdot 8
\end{aligned}$$

\therefore Surface area of the Toy = $492 \cdot 8 \text{ cm}^2$ (Nearly).

(Or)

(b) If two of the zeroes of the polynomial $x^4 + 3x^3 - 7x^2 - 27x - 18$ are -1 and -2 , find the other zeroes.

Solution :

Since two of the zeroes of the polynomial are -1 and -2 , $(x + 1)$ and $(x + 2)$ divide the given polynomial.

Let us divide the polynomial with $(x + 1)$ and $(x + 2)$

$$\begin{array}{r}
x^3 + 2x^2 - 9x - 18 \\
x + 1 \overline{) x^4 + 3x^3 - 7x^2 - 27x - 18} \\
\underline{x^4 + x^3} \\
2x^3 - 7x^2 \\
\underline{2x^3 + 2x^2} \\
-9x^2 - 27x \\
\underline{-9x^2 - 9x} \\
18x + 18 \\
\underline{18x + 18} \\
0 \quad \text{R} \\
x^2 - 9 \\
x + 2 \overline{) x^3 + 2x^2 - 9x - 18} \\
\underline{x^3 + 2x^2} \\
-9x - 18 \\
\underline{-9x - 18} \\
0 \quad \text{R}
\end{array}$$

The quotient is $x^2 - 9$. $x^2 - 9$.

$$\Rightarrow (x^2) - (3)^2 = (x + 3)(x - 3).$$

The other two zeroes of the given polynomial are 3 and -3

31. (a) Prove that $\sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} = \operatorname{cosec} \theta + \cot \theta$

Solution :

$$\begin{aligned}
 \text{LHS} &= \sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} \quad (\text{multiply and divide by } 1 + \cos \theta) \\
 &= \sqrt{\frac{1 + \cos \theta}{1 - \cos \theta} \times \frac{1 + \cos \theta}{1 + \cos \theta}} \\
 &= \sqrt{\frac{(1 + \cos \theta)^2}{1^2 - \cos^2 \theta}} \\
 &= \sqrt{\frac{(1 + \cos \theta)^2}{\sin^2 \theta}} \\
 &= \sqrt{\left(\frac{1 + \cos \theta}{\sin \theta}\right)^2} \\
 &= \frac{1 + \cos \theta}{\sin \theta} = \frac{1}{\sin \theta} + \frac{\cos \theta}{\sin \theta} \\
 &= \operatorname{cosec} \theta + \cot \theta = \text{R.H.S.}
 \end{aligned}$$

(Or)

(b) Find the value of y for which the distance between the points $P(2, -3)$ and $Q(10, y)$ is 10 units.

Solution :

The distance between $P(2, -3)$, $Q(10, y) = 10$ units (given)

$$\begin{aligned}
 (\text{Using } d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}) \\
 \sqrt{(10 - 2)^2 + [y - (-3)]^2} &= 10 \\
 \sqrt{(8)^2 + (y + 3)^2} &= 10 \\
 \sqrt{64 + y^2 + 6y + 9} &= 10 \\
 \sqrt{y^2 + 6y + 73} &= 10
 \end{aligned}$$

Squaring on both sides

$$\begin{aligned}
 \left(\sqrt{y^2 + 6y + 73}\right)^2 &= 10^2 \\
 y^2 + 6y + 73 &= 100 \\
 y^2 + 6y + 73 - 100 &= 0 \\
 y^2 + 6y - 27 &= 0 \quad (\text{This is a quadratic equation}) \\
 y^2 + 9y - 3y - 27 &= 0 \\
 y(y + 9) - 3(y + 9) &= 0 \\
 (y + 9)(y - 3) &= 0 \\
 y + 9 &= 0 \\
 y &= -9 \\
 y - 3 &= 0 \\
 y &= 3
 \end{aligned}$$

$\therefore y = -9$ or 3 .

32. (a) *In a retail market, fruit vendors were selling oranges kept in packing baskets. These baskets contained varying number of oranges. The following was the distribution of oranges according to the number of baskets :*

<i>Number of oranges</i>	<i>10 – 14</i>	<i>15 – 19</i>	<i>20 – 24</i>	<i>25 – 29</i>	<i>30 – 34</i>
<i>Number of baskets</i>	<i>15</i>	<i>110</i>	<i>135</i>	<i>114</i>	<i>25</i>

Find the mean number of oranges kept in each basket. Which method of finding the mean did you choose ?

Solution :

Number of oranges	Number of baskets (f)	Mid values (x)	$d_i = x_i - 22$	$f_i d$
10 – 14	15	12	- 10	- 150
15 – 19	110	17	- 5	- 550
20 – 24	135	22 (a)	0	0
25 – 29	115	27	5	575
30 – 34	25	32	10	250
	$\Sigma f_i = 400$			$\Sigma f_i d_i = 125$

Here we have $a = 22, \Sigma f_i d_i = 125, \Sigma f_i = 400$

$$\begin{aligned} \text{So, mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 22 + \frac{125}{400} \\ &= 22 + 0.31 \\ &= 22.31 \end{aligned}$$

By using the assumed mean method, 22 oranges are kept on average in a box.

(Or)

- (b) *A car has two wipers which do not overlap. Each wiper has a blade of length 25 cm sweeping through an angle of 115° . Find the total area cleaned at each sweep of the blades. (use $\pi = \frac{22}{7}$).*

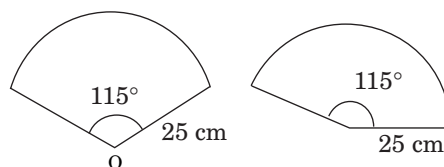
Solution :

Length of the each wiper (r) = 25 cm

Angle swept by each wiper in one sweep (θ) = 115°

Area cleaned by two wipers in one sweep

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



$$\begin{aligned}
 &= 2 \times \frac{115^\circ}{360^\circ} \times \frac{22}{7} \times 25 \times 25 \text{ cm}^2 \\
 &= \frac{158125}{126} \text{ cm}^2 \\
 &= 1254.96 \text{ cm}
 \end{aligned}$$

\therefore Area cleaned by two wipers = 1254.96 cm².

33.(a) Draw the graph of $p(x) = x^2 + 3x - 4$. Using the graph find the zeroes. Justify your answer.

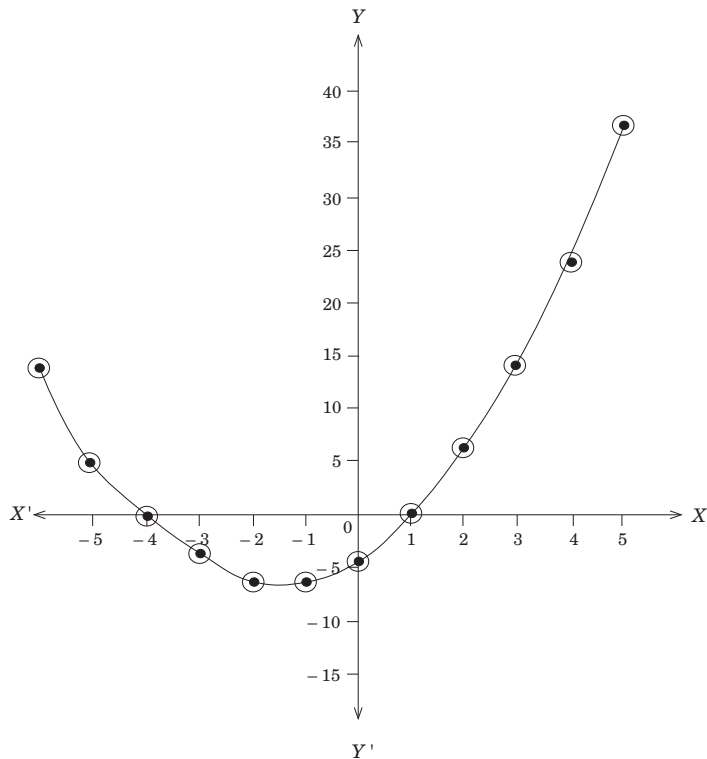
Solution :

$$p(x) = x^2 + 3x - 4$$

Table : $x^2 + 3x - 4$

x	-5	-4	-3	-2	-1	0	1	2	3	4	5
x^2	25	16	9	4	1	0	1	4	9	16	25
$3x$	-15	-12	-9	-6	-3	0	3	6	9	12	15
-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-6
$y = x^2 + 3x - 4$	6	0	-4	-6	-6	-4	0	6	14	24	36

(x, y) : (-5, 6), (-4, 0), (-3, -4), (-2, -6), (-1, -6), (0, -4), (1, 0), (2, 6), (3, 14), (4, 24), (5, 36)



Zeroes of $p(x)$ are -4 and 1 . Justification: The graph of $p(x)$ touches the X-axis at -4 and 1 .
(Or)

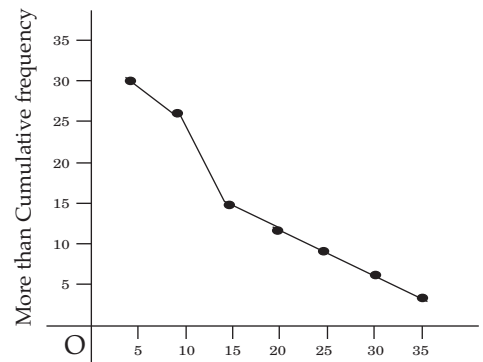
(b) *The annual profits earned by 30 shops in a locality give rise to the following distribution :*

<i>Profit (in lakhs)</i>	<i>Number of shops (frequency)</i>
<i>More than or equal to 5</i>	30
<i>More than or equal to 10</i>	28
<i>More than or equal to 15</i>	16
<i>More than or equal to 20</i>	14
<i>More than or equal to 25</i>	10
<i>More than or equal to 30</i>	7
<i>More than or equal to 35</i>	3

Draw both ogives for the above data. Hence obtain the median profit.

Solution :

We first draw the coordinate axes, with lower limits of the profit along the horizontal axis, and the cumulative frequency along the vertical axis. Then, we plot the points (5, 30), (10, 28), (15, 16), (20, 14), (25, 10), (30, 7) and (35, 3). We join these points with a smooth curve to get the more than ogive, as shown in the figure.



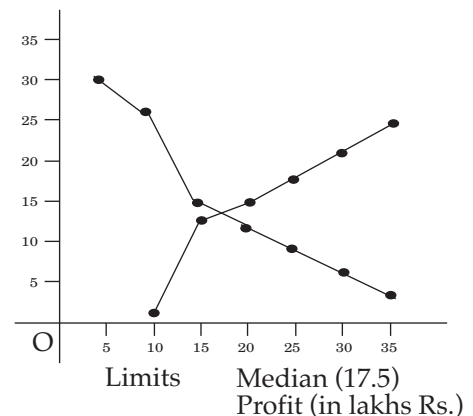
Lower limits of profit (in lakhs Rs.)

Now, let us obtain the classes, their frequencies and the cumulative frequency from the table above.

Classes	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40
Number of shops	2	12	2	4	3	4	3
Cumulative frequency	2	14	16	20	23	27	30

Using the upper limits and less than cumulative frequencies, we plot (10, 2), (15, 14), (20, 16), (25, 20), (30, 23), (35, 27), (40, 30) on the same axes to get the less than ogive, as shown in the figure.

The abscissa of their point of intersection is nearly 17.5 which is the median. This can also be verified by using the formula. Hence, the median profit in lakhs is ₹17.5.





MODEL PAPER

MATHEMATICS



Time : 3.15 Hrs

Max. Marks : 100

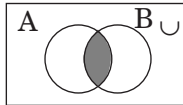
- Instructions :**
1. 15 minutes are allotted for reading the question paper in addition to 3.00 hours for writing the answers.
 2. All answers should be written in the separate answer booket.
 3. There are four sections in the questions.
 4. There is internal choice in Section-IV.
 4. Write answers should be visible and legibly.

Section I

Note: 1. Answer all the questions.

2. Each question carries 1 mark.

(12 × 1 = 12)

1. If $x + \frac{1}{x} = \frac{17}{4}$ then find the value of x .
2. Write the decimal form of $\frac{17}{8}$.
3. The cost of a note book is twice the cost of pen. Write a linear equation in two variables to represent this statement.
4. If α, β, γ are the zeroes of the cubic polynomial $4x^3 + 8x^2 - 6x - 2$ then find $\alpha\beta\gamma$.
5. In a cone $l = 10$ cm, $r = 5$ cm then find the CSA of a cone.
6. In the adjacent Venn-diagram, write the set represented by the shaded region.

7. Find the height of an equilateral triangle of side $2\sqrt{3}$ units.
8. What is the value of $\tan^2 30^\circ + 2 \cot^2 60^\circ$?
9. If $(1, 2), (-1, b), (-3, -4)$ are collinear, then find the value of b .
10. Can mode be calculated for grouped data with unequal class sizes ?
11. In a well shuffled deck of 52 cards, find the probability of not a face card.
12. Draw a rough diagram of two externally touching circles and their tangents.

Section II

Note: 1. Answer all the questions.

2. Each question carries 2 marks.

(8 × 2 = 16)

13. Given that $a = 5, d = 3, a_n = 50$ find n .
14. A sphere of maximum volume is cut out from a solid hemisphere of radius 6 cm. Find the volume of the cut out sphere.

15. The larger of two complimentary angles is double the smaller. Find the angles.
16. Find the surface area of a sphere of radius 14 cm $\left(\text{Take } \pi = \frac{22}{7} \right)$
17. What is the difference between secant of the circle and tangent to the circle ?
18. Is it right to say $\cos (60^\circ + 30^\circ) = \cos 60^\circ \cdot \cos 30^\circ - \sin 60^\circ \cdot \sin 30^\circ$?
19. Explain the formula for mode for a grouped data.
20. If the shadow of a tower is $\sqrt{3}$ times its height, then find the angle of of the sun's altitude.

Section III

Note: 1. Answer all the questions.

2. Each question carries 4 marks.

(8 × 4 = 32)

21. Find the volume of a right circular cone with radius 6 cm and height 7 cm.
22. Explain why $7 \times 11 \times 13 + 13$ and $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ are composite numbers.
23. State the reasons for the following :
 - (1) $(1, 2, 3, \dots, 10) \neq \{x / x \in \mathbb{N} \text{ and } 1 < x < 10\}$
 - (2) $(2, 3, 5, 7, 9) \neq \{x / x \text{ is a prime number}\}$
24. Find whether the equations $x^2 - 4x + 1.5 = 0$ and $2x^2 + 3 = 8x$ are consistent or not.
25. Given that $\cot \theta = \frac{7}{8}$. Then evaluate $\frac{(1 + \sin \theta)(1 - \sin \theta)}{(1 + \cos \theta)(1 - \cos \theta)}$.
26. In right angle triangle ABC, 8 cm, 15 cm and 17 cm are the lenghs of AB, BC and CA respectively. Then, find out $\sin A$, $\cos A$ and $\tan A$.
27. In what ratio does the point $(-4, 6)$ divide the line segment joining the points A $(-6, 10)$, B $(3, -8)$?
28. Length of the shadow of a 15 meter high pole is $5\sqrt{3}$ meters at 10 O' clock in the morning. Then what is the angle of elevation of the sun rays with the ground at the time ?

Section IV

Note: 1. Answer all the questions.

2. Each question carries 8 marks.

3. There is internal choice for each question.

(5 × 8 = 40)

29. (a) A sphere, a cylinder and a cone are of the same radius and same height. Find the ratio of their curved surface areas ?

(Or)

 (b) Subba Rao started to work in 1995 at an annual salary of Rs. 5000 and received an increment of Rs. 200 each year. In which year did his income reach Rs. 7000 ?
30. (a) A toy is made in the form of hemisphere surmounted by a right cone whose circular base is joined with the plane surface of the hemisphere. The radius of the base of the cone is 7 cm and its volume is $\frac{3}{2}$ of the hemisphere. Calculate the height of the cone and the surface area of the toy correct to 2 places of decimal $\left(\text{Take } \pi = 3\frac{1}{7} \right)$.

(Or)

- (b) If two of the zeroes of the polynomial $x^4 + 3x^3 - 7x^2 - 27x - 18$ are -1 and -2 , find the other zeroes.

31. (a) Prove that $\sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} = \operatorname{cosec} \theta + \cot \theta$

(Or)

- (b) Find the value of y for which the distance between the points $P(2, -3)$ and $Q(10, y)$ is 10 units.
32. (a) In a retail market, fruit vendors were selling oranges kept in packing baskets. These baskets contained varying number of oranges. The following was the distribution of oranges according to the number of baskets :

Number of oranges	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34
Number of baskets	15	110	135	114	25

Find the mean number of oranges kept in each basket. Which method of finding the mean did you choose ?

(Or)

- (b) A car has two wipers which do not overlap. Each wiper has a blade of length 25 cm sweeping through an angle of 115° . Find the total area cleaned at each sweep of the blades. $\left(\text{use } \pi = \frac{22}{7}\right)$.
33. (a) Draw the graph of $p(x) = x^2 + 3x - 4$. Using the graph find the zeroes. Justify your answer.

(Or)

- (b) The annual profits earned by 30 shops in a locality give rise to the following distribution :

Profit (in lakhs)	Number of shops (frequency)
More than or equal to 5	30
More than or equal to 10	28
More than or equal to 15	16
More than or equal to 20	14
More than or equal to 25	10
More than or equal to 30	7
More than or equal to 35	3

Draw both ogives for the above data. Hence obtain the median profit.



SSC PUBLIC EXAMINATIONS: JULY – 2020
ANDHRA PRADESH MATHEMATICS FORUM (APMF)
MATHEMATICS – MODEL PAPER -1(KEY)



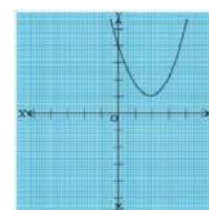
Time: 3Hrs. 15Min Exam date: 06-06-202 Max. Marks: 100 Marks

SECTION – I

1. $a = 2^{2020} \times 3^2$ and $b = 2 \times 3^{2020}$
 $LCM = (2^{2020} \times 3^{2020})$

2. $B = \{ x : x + 5 = 5, x \in Z \}$
 $x + 5 = 5$
 $x = 0 \in Z$
 $B = \{ 0 \}$
 So B is Not null set

3. $ax^2 + bx + c$ where $a > 0$, which have no real roots



4. Number of skirts = x , Number of pants = y
 The number of skirts are two less than twice the number of pants purchased
 $x = 2y - 2$ -----(i)

5. $(x^2 + 1)^2 - x^2 = 0$
 $(x^2 + 1 + x)(x^2 + 1 - x) = 0$
 $x^2 + 1 + x = 0$ and $x^2 + 1 - x = 0$
 for both the equations $\Delta < 0$ So No real roots

6. In an AP
 $a_n = (4n + 1)$
 $a_1 = 5$
 $a_2 = 9$
 So $d = a_2 - a_1 = 9 - 5 = 4$

7. EM (ii) for TM (i)

8. $A = (\sin 30^\circ, \tan 0^\circ) = (\frac{1}{2}, 0)$
 $B = (\sec 60^\circ, \cot 45^\circ) = (2, 1)$
 Mid point = $(\frac{\frac{1}{2} + 2}{2}, \frac{0 + 1}{2}) = (\frac{5}{4}, \frac{1}{2})$

9. i) Mean of the first 10 Whole Numbers = $\frac{0+1+2+\dots+9}{10} = \frac{45}{10} = 4.5$
 (ii) Median of first 10 Natural Numbers = $\frac{5+6}{2} = 5.5$
 (iii) Range of first 10 Natural Numbers = $10 - 1 = 9$
 Ans : C

10. Converse of Basic Proportionality Theorem: In a triangle, if a line segment intersecting two sides and divides them in the same ratio, then it will be **parallel** to the third side

$$11. P(E) = \frac{n(E)}{n(S)} = \frac{4}{11}$$

$$12. \tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 89^\circ$$

$$= \tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 45^\circ \tan 46^\circ \dots \tan 89^\circ$$

$$= \tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 45^\circ \cot 44^\circ \dots \cot 1^\circ$$

$$= \tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 44^\circ \times 1 \times \frac{1}{\tan 44^\circ} \times \frac{1}{\tan 43^\circ} \dots \frac{1}{\tan 1^\circ}$$

$$= 1$$

SECTION -II

13. Quadratic polynomial whose sum of zeros = $\frac{1}{4}$

Quadratic polynomial whose product of zeros = -1

The required polynomial f(x) is,

$$\Rightarrow k[x^2 - (1/4)x + (-1)]$$

$$\Rightarrow k[x^2 - \frac{1}{4}x - 1]$$

Let k=4

$$f(x) = 4[x^2 - \frac{1}{4}x - 1]$$

$$f(x) = 4x^2 - x - 1$$

14.

$$2x - ky + 3 = 0,$$

here $a_1 = 2$, $b_1 = -k$, $c_1 = 3$

$$4x + 6y - 5 = 0$$

$a_2 = 4$, $b_2 = 6$, $c_2 = -5$

$$a_1/a_2 = b_1/b_2$$

$$\Rightarrow 2/4 = -k/6$$

$$\Rightarrow K = -3$$

15. $kx(x-2) + 6 = 0$ have equal roots

$$Kx(x-2)+6=0$$

$$Kx^2-2Kx+6=0$$

The given equation is in the form of $ax^2+bx+c=0$, where

$$a=k, b=-2k, c=6.$$

Given they are equal roots. So,

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

$$\Rightarrow 4k^2-24k=0$$

$$\Rightarrow 4K(k-6)=0$$

$$\Rightarrow K=0 \text{ or } k=6$$

16. Since they are consecutive terms and hence $b=3$

So, $x, x+2, x+3$

$$\Rightarrow (x+2)/x = (x+3)/(x+2)$$

$$\Rightarrow (x+2)^2 = x(x+3)$$

$$\Rightarrow x^2+4x+4 = x^2+3x$$

$$\Rightarrow 4x+4 = 3x$$

$$\Rightarrow 4x-3x = -4$$

$$\Rightarrow x = -4$$

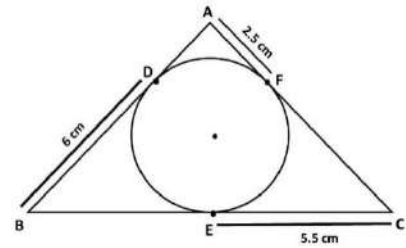
17. From external points tangents lengths are equal

$$AD = AF = 2.5 \text{ cm}$$

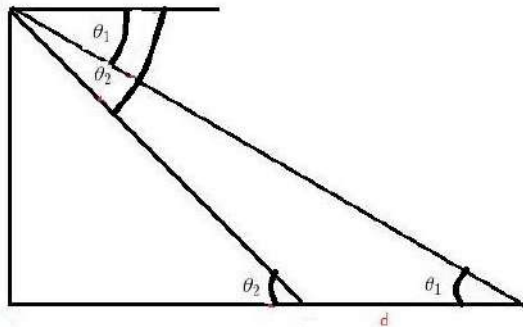
$$BD = BE = 6 \text{ cm}$$

$$CE = CF = 5.5 \text{ cm}$$

$$\text{Perimeter} = 2.5 + 6 + 6 + 5.5 + 5.5 + 2.5 = 28 \text{ cm}$$



18.



19. A coin is tossed 3 times.

The possible outcomes if a coin is tossed 3 times is

$$S = \{(HHH), (TTT), (HTT), (THT), (THH), (TTH), (HTH), (HHT)\}$$

$$n(S) = 8$$

$$E = \{(HHH), (THH), (HTH), (HHT)\}$$

$$n(E) = 4$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

20. Mode Formula for Grouped Data:

$$\text{Mode} = L + \left(\frac{f_1 - f_0}{(f_1 - f_0) + (f_1 - f_2)} \right) \times h \quad \text{Where,}$$

L = Lower limit Mode class

f₁ = Frequency of modal class

f₀ = Frequency of class preceding the modal class

f₂ = Frequency of class succeeding the modal class

h = Size of class interval

21. Let a be the positive integer and $b=3$

$$\text{We know } a = bq + r, 0 \leq r < b$$

$$\text{Now, } a = 3q + r, 0 \leq r < 3$$

The possibilities of remainder is 0, 1, or 2.

Case 1 : When $a=3q$

$$a^2 = (3q)^2 = 9q^2 = 3q \times 3q = 3m \text{ where } m = 3q^2$$

Case 2 : When $a=3q+1$

$$a^2 = (3q+1)^2 = (3q)^2 + (2 \times 3q \times 1) + (1)^2 = 3q(3q+2) + 1 = 3m+1 \quad \text{where } m = q(3q+2)$$

Case 3: When $a=3q+2$

$$a^2 = (3q+2)^2 = (3q)^2 + (2 \times 3q \times 2) + (2)^2 = 9q^2 + 12q + 4 = 9q^2 + 12q + 3 + 1 = 3(3q^2 + 4q + 1) + 1 = 3m+1$$

where $m = 3q^2 + 4q + 1$

Hence, from all the above cases, it is clear that square of any positive integer is of the form $3m$ or $3m+1$.

22. Given $A = \{x : x \in \mathbb{N}, x < 6\}$
 $A = \{1, 2, 3, 4, 5\}$
 $B = \{x : x \in \mathbb{N}, 4 \leq x \leq 7\}$
 $B = \{4, 5, 6, 7\}$
 $A - B = \{1, 2, 3, 4, 5\} - \{4, 5, 6, 7\} = \{1, 2, 3\}$
 $B - A = \{4, 5, 6, 7\} - \{1, 2, 3, 4, 5\} = \{6, 7\}$

23. Let the measure of the smaller angle be x° and that of the larger angle be y° .
The larger angle is 3° less than twice the measure of the smaller angle, so

$$y^\circ = 2x - 3^\circ \quad (1)$$

Given, the two angles are complementary,

$$\begin{aligned} x + y &= 180^\circ \\ \Rightarrow x + (2x - 3^\circ) &= 180^\circ \\ \Rightarrow x + 2x - 3^\circ &= 180^\circ \\ \Rightarrow 3x &= 183^\circ \\ \Rightarrow x &= 61^\circ \end{aligned}$$

Substituting the value of x in equation (1)

$$\begin{aligned} y &= 2(61) - 3 \\ \Rightarrow y &= 119^\circ. \end{aligned}$$

Hence, the measures of the two angles are 61° and 119° .

24. $f(x) = x^3 - 3x^2 + x + 2$
 $q(x) = x - 2$
 $r(x) = -2x + 4$

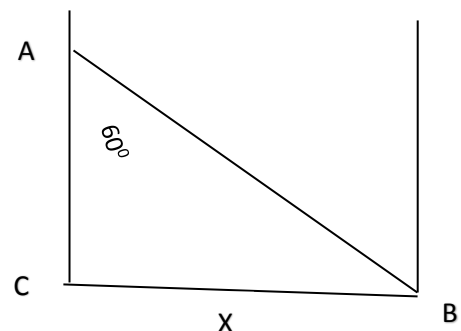
Divisor * Quotient + Remainder = Dividend

$$\begin{aligned} g(x)q(x) + r(x) &= f(x) \\ \Rightarrow g(x)(x-2) + (-2x+4) &= x^3 - 3x^2 + x + 2 \\ \Rightarrow g(x)(x-2) &= x^3 - 3x^2 + x + 2 + 2x - 4 \\ \Rightarrow g(x)(x-2) &= x^3 - 3x^2 + 3x - 2 \\ \Rightarrow g(x) &= x^3 - 3x^2 + 3x - 2 / (x-2) \\ \Rightarrow g(x) &= x^2 - x + 1 \end{aligned}$$

25. $AB =$ Distance traveled by the boat = 450m
 $BC =$ Width of the river = x m

$$\begin{aligned} \sin 60^\circ &= \frac{BC}{AB} \\ \Rightarrow \frac{\sqrt{3}}{2} &= \frac{x}{450} \\ \Rightarrow x &= \frac{450\sqrt{3}}{2} \\ \Rightarrow x &= 225\sqrt{3} \text{ m} \end{aligned}$$

Hence width of the river is $= 225\sqrt{3} \text{ m}$



26. Total outcomes = 100
 $n(S) = 100$
(i) Perfect CUBES are 1, 8, 27, 64
 $n(E) = 4$
 $P(E) = \frac{n(E)}{n(S)} = \frac{4}{100} = \frac{1}{25}$
 $P(\text{getting a perfect CUBE}) = \frac{1}{25}$

(ii) Numbers divisible by 7 are 7, 14, ..., 98, which are 14 in number.

$$P(E) = \frac{n(E)}{n(S)} = \frac{14}{100} = \frac{7}{50}$$

$$P(\text{getting a number which is divisible by 7}) = \frac{7}{50}$$

27.

$$BC+CA=23$$

$$BC-CA = 7$$

Adding these two equations

$$\Rightarrow 2BC=30$$

$$\Rightarrow BC=15$$

Substituting this value in the first equation

$$\Rightarrow 15+CA=23$$

$$\Rightarrow CA=8$$

$BC^2 + AC^2 = AB^2$ (by pythagorus theorem)

$$\Rightarrow (15*15)+(8*8)=AB^2$$

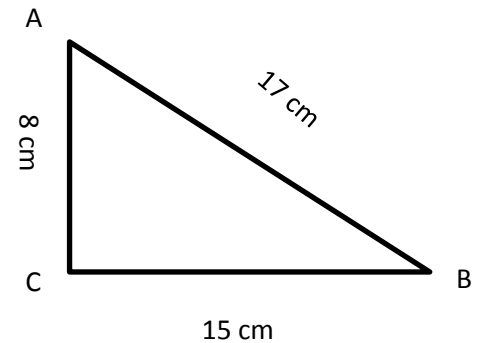
$$\Rightarrow 225+64=AB^2$$

$$\Rightarrow AB^2=289$$

$$\Rightarrow AB=17$$

$$\text{Sin A} = \frac{15}{17}$$

$$\text{Tan B} = \frac{8}{15}$$



28.

We know that for collinear points, the area of the triangle formed by them is 0.

Therefore, Area of triangle = $\frac{1}{2}(x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)) = 0$

$$\text{Here } x_1 = 8, x_2 = k, x_3 = 2.$$

$$y_1 = 1, y_2 = -4, y_3 = -5.$$

Hence,

$$\text{Area of triangle} = \frac{1}{2}(8(-4-(-5)) + k(-5-1) + 2(1-(-4))) = 0$$

$$\Rightarrow 1(8(-4 + 5) + k(-6) + 2(1 + 4)) = 0$$

$$\Rightarrow 8(1) + -6k + 2(5) = 0$$

$$\Rightarrow 8 - 6k + 10 = 0$$

$$\Rightarrow -6k = -10-8$$

$$\Rightarrow -6k = -18$$

$$\Rightarrow k = 3.$$

29. (i)

$$\text{Given } (54)^x = (0.54)^y = 10000$$

$$(54)^x = 10000$$

$$\Rightarrow x = \log_{54} 10000$$

$$\Rightarrow \frac{1}{x} = \log_{10000} 54 \quad \text{----- (i)}$$

$$(0.54)^y = 10000$$

$$\Rightarrow y = \log_{0.54} 10000$$

$$\Rightarrow \frac{1}{y} = \log_{10000} 0.54 \quad \text{----- (ii)}$$

$$\Rightarrow \frac{1}{x} - \frac{1}{y} = \log_{10000} 54 - \log_{10000} 0.54$$

$$\begin{aligned}
&= \log_{10000} (54/0.54) \\
&= \log_{10000} 100 \\
&= \log_{10^4} 10^2 \\
&= \frac{1}{2} \log_{10} 10 \\
&= \frac{1}{2} \times 1 \\
&= \frac{1}{2}
\end{aligned}$$

29. (ii)

Let the speed of the stream be x km/h.

Therefore, the speed of the boat upstream = $(18 - x)$ km/h and the speed of the boat downstream = $(18 + x)$ km/h.

$$\text{The time taken to go upstream} = \frac{\text{distance}}{\text{speed}} = \frac{24}{18 - x} \text{ hours.}$$

$$\text{Similarly, the time taken to go downstream} = \frac{24}{18 + x} \text{ hours.}$$

According to the question,

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

$$\text{i.e., } 24(18 + x) - 24(18 - x) = (18 - x)(18 + x)$$

$$\text{i.e., } x^2 + 48x - 324 = 0$$

Using the quadratic formula, we get

$$\begin{aligned}
x &= \frac{-48 \pm \sqrt{48^2 + 1296}}{2} = \frac{-48 \pm \sqrt{3600}}{2} \\
&= \frac{-48 \pm 60}{2} = 6 \text{ or } -54
\end{aligned}$$

Since x is the speed of the stream, it cannot be negative. So, we ignore the root $x = -54$.
Therefore, $x = 6$ gives the speed of the stream as 6 km/h.

30. (i) Let $l_1, l_2, l_3, l_4, \dots, l_{13}$ be the lengths of semicircles of radii 0.5 cm, 1 cm, 2 cm and $13/2$ cm respectively.

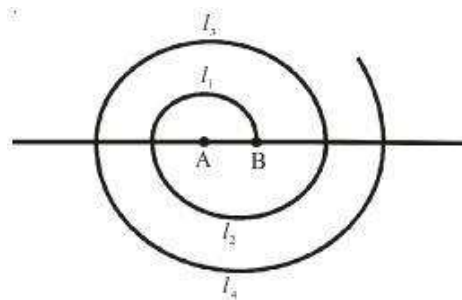
Then, we have

$$\begin{aligned}
l_1 &= \pi \times 0.5 = \pi/2 \text{ cm,} \\
l_2 &= \pi \times 1 = 2(\pi/2) \text{ cm,} \\
l_3 &= \pi \times 1.5 = 3(\pi/2) \text{ cm,} \\
l_4 &= \pi \times 2 = 4(\pi/2) \text{ cm,} \\
&\dots\dots\dots \\
l_{13} &= \pi \times 13/2 = 13(\pi/2) \text{ cm,}
\end{aligned}$$

Therefore,

$$\begin{aligned}
\text{Total length of the spiral} &= l_1 + l_2 + l_3 + l_4 + \dots + l_{13} \\
&= [\pi/2 + 2(\pi/2) + 3(\pi/2) + 4(\pi/2) + \dots + 13(\pi/2)] \text{ cm} \\
&= \pi/2(1 + 2 + 3 + 4 + \dots + 13) \text{ cm} \\
&= \pi/2 \times 13/2 \times (1 + 13) \text{ cm} \\
&= (1/2 \times 22/7 \times 13/2 \times 14) \text{ cm} \\
&= 143 \text{ cm.}
\end{aligned}$$

Hence, the required length of the spiral is 143 cm.



30. (ii).

Volume of wax in the rectangular solid = lbh

$$= (66 \times 42 \times 21) \text{ cm}^3.$$

$$\text{Radius of cylindrical candle} = \frac{4.2}{2} \text{ cm.} = 2.1 \text{ cm.}$$

$$\text{Height of cylindrical candle} = 2.8 \text{ cm.}$$

$$\text{Volume of candle} = \pi r^2 h$$

$$= \frac{22}{7} \times (2.1)^2 \times 2.8$$

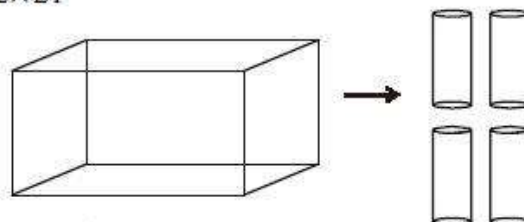
$$\text{Volume of } x \text{ cylindrical wax candles} = \frac{22}{7} \times 2.1 \times 2.1 \times 2.8 \times x$$

\therefore Volume of x cylindrical candles = volume of wax in rectangular shape

$$\therefore \frac{22}{7} \times 2.1 \times 2.1 \times 2.8 \times x = 66 \times 42 \times 21$$

$$x = \frac{66 \times 42 \times 21 \times 7}{22 \times 2.1 \times 2.1 \times 2.8}$$

$$= 1500$$



Hence, the number of cylindrical wax candles is 1500.

31. (i)

Given : AB, CD, PQ are perpendicular to BD ,
 $AB = x$, $CD = y$ and $PQ = z$

Proof :

Consider $\triangle ABD$ and $\triangle PQD$

$$\angle ABD = \angle PQD = 90^\circ$$

$$\angle ADB = \angle PDQ \text{ (common angle)}$$

By A.A similarity ,

$$\triangle ABD \sim \triangle PQD$$

$$PQ/AB = DQ/BD$$

$$\Rightarrow z/x = QD/BD \text{ (C.P.C.T)} \text{ ---(1)}$$

Consider $\triangle CDB$ and $\triangle PQB$

$$\angle CDB = \angle PQB = 90^\circ$$

$$\angle CBD = \angle PBQ \text{ (common angle)}$$

$$\triangle CDB \sim \triangle PQB \text{ (A.A similarity)}$$

$$\text{So , } z/y = BQ/BD \text{ ----(2)}$$

From (1) and (2) we get

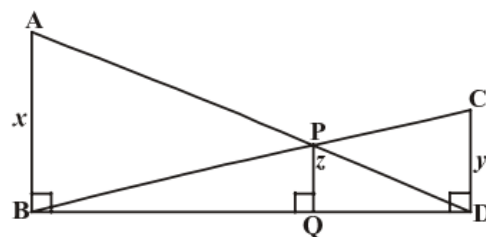
$$z/x + z/y = QD/BD + BQ/BD$$

$$\Rightarrow z(1/x + 1/y) = (QD + BQ)/BD$$

$$\Rightarrow z(1/x + 1/y) = BD/BD$$

$$\Rightarrow z(1/x + 1/y) = 1$$

$$\Rightarrow 1/x + 1/y = 1/z$$



31 .(ii)

Points of trisection are those points which divide a line segment AB in the ratio of 1:2 or 2:1.

$$(x_1, y_1) = (-3, -5)$$

$$(x_2, y_2) = (-6, -8)$$

$$m_1:m_2 = 1:2$$

The point which divides a line segment AB in the ratio $m_1:m_2$ is given by

$$= \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$$

$$= \left(\frac{1 \cdot (-6) + 2 \cdot (-3)}{1 + 2}, \frac{1 \cdot (-8) + 2 \cdot (-5)}{1 + 2} \right)$$

$$= \left(\frac{-12}{3}, \frac{-18}{3} \right)$$

$$= (-4, -6)$$

$$(x_1, y_1) = (-3, -5)$$

$$(x_2, y_2) = (-6, -8)$$

$$m_1:m_2 = 2:1$$

The point which divides a line segment AB in the ratio $m_1:m_2$ is given by

$$= \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$$

$$= \left(\frac{2 \cdot (-6) + 1 \cdot (-3)}{2 + 1}, \frac{2 \cdot (-8) + 1 \cdot (-5)}{2 + 1} \right)$$

$$= \left(\frac{-15}{3}, \frac{-21}{3} \right)$$

$$= (-5, -7)$$

implies (-4, -6) and (-5, -7) are the points required

32. (i)

Class Interval	Frequency	Cumulative frequency
0-10	5	5
10-20	X	5 + x
20-30	20	25 + x (median class)
30-40	15	40 + x
40-50	Y	40 + x + y
50-60	5	45 + x + y
Total	N=60	

Here, it is given that Median = 28.5 and $n = \sum f_i = 60$

Cumulative frequency table for the following data is given.

$$\text{Here } n=60 \Rightarrow n/2 = 30$$

median is 28.5, median class is 20-30

$$l=20, h=30, f=20, c.f.=5+x$$

$$\text{Therefore, Median} = L + \left(\frac{\frac{n}{2} - cf}{(f - cf)} \right) \times h$$

$$28.5 = 20 + \left(\frac{30 - 5 - x}{20} \right) \times 10$$

$$\Rightarrow 28.5 = 20 + \frac{25 - x}{2}$$

$$\Rightarrow 8.5 \times 2 = 25 - x$$

$$\Rightarrow x = 8$$

Also, $45 + x + y = 60$

$$\Rightarrow y = 60 - 45 - x = 15 - 8 = 7.$$

$$x = 8, y = 7$$

32. (ii)

$$(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2$$

$$= \sin^2 A + \operatorname{cosec}^2 A + 2 \sin A \operatorname{cosec} A + \cos^2 A + \sec^2 A + 2 \cos A \sec A$$

$$= \sin^2 A + \cos^2 A + \operatorname{cosec}^2 A + \sec^2 A + 2 \sin A \times 1 / \sin A + 2 \cos A \times 1 / \cos A$$

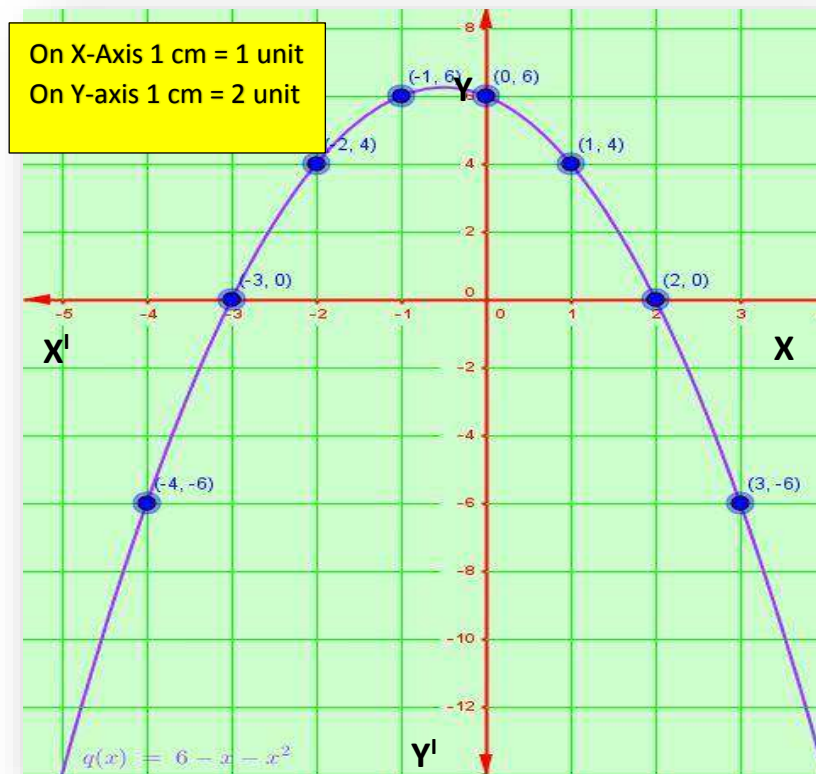
$$= 1 + \operatorname{cosec}^2 A + \sec^2 A + 2 + 2 \quad [\sin^2 A + \cos^2 A = 1]$$

$$= 5 + (1 + \cot^2 A) + (1 + \tan^2 A) \quad [1 + \tan^2 A = \sec^2 A, 1 + \cot^2 A = \operatorname{cosec}^2 A]$$

$$= 7 + \tan^2 A + \cot^2 A$$

33. (i) $y = q(x) = 6 - x - x^2$

x	-4	-3	-2	-1	0	1	2
6	6	6	6	6	6	6	6
-x	4	3	2	1	0	-1	-2
-x ²	-16	-9	-4	-1	0	-1	-4
y = 6 - x - x ²	-6	0	4	6	6	4	0
(x, y)	(-4, -6)	(-3, 0)	(-2, 4)	(-1, 6)	(0, 6)	(1, 4)	(2, 0)



The parabola $y = 6 - x - x^2$ cuts the x-axis at $(-3, 0)$ and $(2, 0)$.

The x-coordinates of these points are zeroes of the polynomial.

\therefore zeroes are -3 and 2

33.(ii)

Analysis :

$\angle APB = 60^\circ$. Join OP.

As we know,

OP is the bisector of $\angle APB$,

$\angle OAP = \angle OPB = \frac{60^\circ}{2} = 30^\circ$ ($\because \triangle OAP \cong \triangle OBP$)

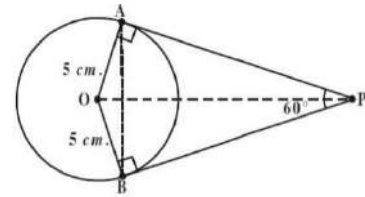
Now In $\triangle OAP$,

$$\sin 30^\circ = \frac{\text{Opp. side}}{\text{Hyp}} = \frac{OA}{OP}$$

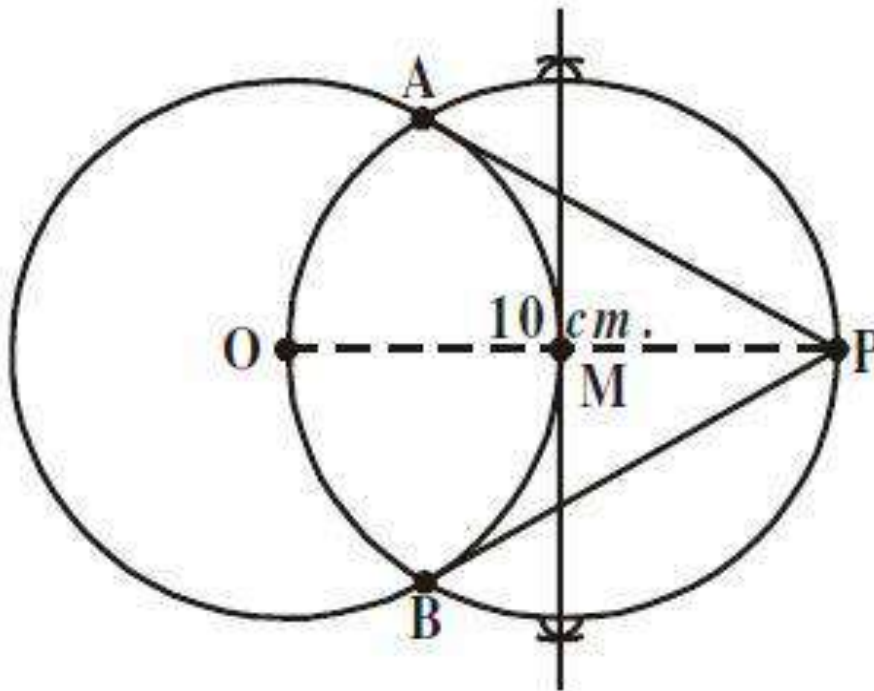
$$\frac{1}{2} = \frac{5}{OP} \text{ (From trigonometric ratio)}$$

$$OP = 10 \text{ cm.}$$

Rough Sketch :



Main Diagram :



Steps of construction :

1. Draw a circle, take a point outside 10 cm from center of the circle let it be P.
2. Join PO and draw a perpendicular bisector of it. Let M be the midpoint of PO
3. Taking M as centre, OM as radius draw a circle to meet previously drawn circle at A, B
4. Join PA and PB. Then PA and PB are the required two tangents.

Test Paper Key prepared by

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MATHEMATICS

RAPID TEST - 2 : ANSWERS

SECTION - I

1. If α, β are the zeroes of polynomial

$ax^2 + bx + c$ then find $\frac{1}{\alpha} + \frac{1}{\beta}$.

Sol. Given polynomial $p(x) = ax^2 + bx + c$

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

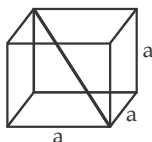
Product of roots $(\alpha\beta) = \frac{c}{a}$

The value of $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = \frac{\frac{-b}{a}}{\frac{c}{a}} = \frac{-b}{c}$.

2. **Statement (A)** : To calculate the quantity of milk inside a bottle we need to find out its area.

Statement (B) : Length of the dark line (diagonal of a cube) given in the diagram is $\sqrt{3}a$

- i) Both A and B are true
- ii) A is true, B is false
- iii) A is false, B is true
- iv) Both A and B are false



Sol. (iii) A is false, B is true

3. Find the 10th term of the series

$\frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \dots$

Sol. Given series $\frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \dots$

Common ratio (r) = $\frac{a_2}{a_1} = \frac{\frac{3}{4}}{\frac{3}{2}} = \frac{2}{4} = \frac{1}{2}$

$= \frac{a_3}{a_2} = \frac{\frac{3}{8}}{\frac{3}{4}} = \frac{4}{8} = \frac{1}{2}$

Hence $\frac{a_2}{a_1} = \frac{a_3}{a_2} = \frac{1}{2}$. So these are in G.P

10th term in G.P = $a_{10} = ar^9$

$= \frac{3}{2} \times \left(\frac{1}{2}\right)^9 = \frac{3}{2^{10}} = \frac{3}{1024}$

4. Match the following.

- A) $\{x : x \text{ is a multiple of } 2\}$ i) Empty set
 - B) $\{x : x \in \mathbb{N} \text{ and } x < 1\}$ ii) Singleton set
 - C) $\{x : x \text{ is a even prime}\}$ iii) Infinite set
- a) A - i, B - ii, C - iii b) A - iii, B - i, C - ii
c) A - ii, B - i, C - iii d) A - iii, B - ii, C - i

Sol. b (A - iii, B - i, C - ii)

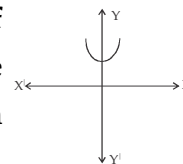
5. If $x + y = 6, x - y = 10$ then find 'y'.

Sol. $x + y = 6$

$x - y = 10$

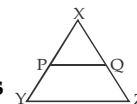
$$\begin{array}{r} - \quad + \quad - \\ \hline 2y = -4 \\ \hline y = \frac{-4}{2} \\ y = -2 \end{array}$$

6. Write the number of zeroes that can be identified from adjacent figure?



Sol. Zero (0).

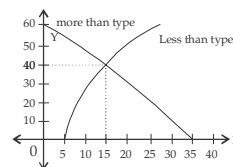
7. In the given figure, P, Q are the mid points of sides XY and XZ, what is the relation between PQ and YZ.



Sol. $PQ \parallel YZ$ and $PQ = \frac{1}{2} YZ$.

8. From the Ogive curve what is the value of median?

Sol. Median value is 15.



9. Find the angle made by the minute hand in a clock during a period of 20 minutes.

Sol. The angle made by minute hand to complete one complete rotation is $= 360^\circ$

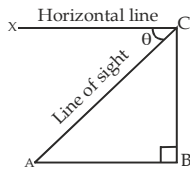
The angle made by minute hand in 60 min = 360°

The angle made by minute hand in 20

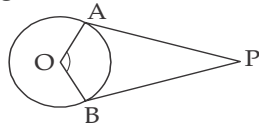
$$\text{min} = \frac{360^\circ}{60} \times 20 = 120^\circ$$

10. Define an angle of depression. Draw an angle of depression.

Sol. **Angle of depression** : The angle of depression of an object viewed, is the angle formed by the line of sight with the horizontal level, i.e., the case when we lower our head to look at the object.



11. In the given figure $\angle APB = 80^\circ$ then find $\angle AOB$.



Sol. From AOBP quadrilateral
 $\angle A + \angle AOB + \angle B + \angle APB = 360^\circ$
 $90^\circ + \angle AOB + 90^\circ + 80^\circ = 360^\circ$
 $\angle AOB + 260^\circ = 360^\circ$
 $\angle AOB = 360 - 260$
 $\angle AOB = 100^\circ$

12. Which of the following is the modal class for the following data?

C.I	0 - 10	10-20	20-30	30-40	40-50
f	7	13	25	3	2

Sol. Modal class is 20 - 30

SECTION - II

13. If $A = \left\{1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}\right\}$, then write 'A' in set - builder form.

Sol. $A = \left\{1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}\right\}$
 $A = \left\{x : x = \frac{1}{n^2}, n \in \mathbb{N}, n \leq 5\right\}$

14. For what value of 'k', the pair of linear equations $2x - ky + 3 = 0, 4x + 6y - 5 = 0$ represent parallel lines ?

Sol. $2x - 5y + 3 = 0$ and $4x + 6y - 5 = 0$ represent parallel lines

$$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{2}{4} = \frac{-k}{6}$$

$$\Rightarrow k = \frac{-2}{4} \times 6 = -3 \Rightarrow \therefore k = -3$$

15. Find the sum and product of roots of the quadratic equation $x^2 - 4\sqrt{3}x + 9 = 0$.

Sol. Given quadratic equation is $= x^2 - 4\sqrt{3}x + 9 = 0$

where $a = 1, b = -4\sqrt{3}, c = 9$

$$\text{Sum of roots } (\alpha + \beta) = \frac{-b}{a} = \frac{-(-4\sqrt{3})}{1} = 4\sqrt{3}$$

$$\text{Product of roots } (\alpha\beta) = \frac{c}{a} = \frac{9}{1} = 9.$$

16. Find the maximum length of a pencil that can be kept in a rectangular box of dimensions 8 cm \times 6 cm \times 2 cm.

Sol. Required length = $\sqrt{l^2 + b^2 + h^2}$
 $\sqrt{8^2 + 6^2 + 2^2} = \sqrt{64 + 36 + 4} = \sqrt{104}$
 $= 2\sqrt{26}$ cm.

17. Find the value of $\sin^2 30^\circ + \cos^2 60^\circ$.

Sol. $\sin^2 30^\circ + \cos^2 60^\circ = \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2$
 $= \frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$

18. A three digit number is formed by the digits 2, 3 and 5 without repetition. What is the probability that the number is divisible by 5 ?

Sol. Possible outcomes for the required three digit numbers with 2, 3, 5
 235, 253, 325, 352, 523, 532

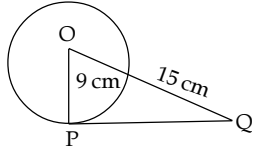
Total number of possible outcomes for the three digit number = 6

Number of favourable outcomes that the three digit number be divisible by 5 = 2.

\therefore Probability for the three digit number be divisible by 5 = $P(E) = \frac{2}{6} = \frac{1}{3}$

19. Calculate the length of tangent from a point 15 cm away from the centre of a circle of radius 9 cm.

Sol. It is given that radius (r) = 9 cm
 OQ (d) = 15 cm
 \therefore Length of the tangent = $\sqrt{d^2 - r^2}$
 = $\sqrt{15^2 - 9^2}$
 = $\sqrt{225 - 81}$
 = $\sqrt{144}$
 = 12 cm



Thus, the length of the tangent = 12 cm.

20. If a die is rolled once, what is the probability of getting a prime number?

Sol. If a die is rolled once the outcomes are 1, 2, 3, 4, 5, 6.
 Total possible outcomes (sample space) = 6
 Number of favourable outcomes to get prime number is = 3 i.e., (2, 3, 5)
 Probability = $P(\bar{E}) = \frac{3}{6} = \frac{1}{2}$

SECTION - III

21. Find the roots of the quadratic equation $(3x - 2)^2 - 4(3x - 2) + 3 = 0$.

Sol. Given equation is
 $(3x - 2)^2 - 4(3x - 2) + 3 = 0$
 Let $3x - 2 = a$ then $a^2 - 4a + 3 = 0$
 $\Rightarrow a^2 - 3a - a + 3 = 0$
 $\Rightarrow a(a - 3) - 1(a - 3) = 0$
 $\Rightarrow (a - 3)(a - 1) = 0$
 $a = 3$ or $a = 1$
 Substitute in $a = 3x - 2$, we get
 $3x - 2 = 3$ or $3x - 2 = 1$
 $3x = 5$ or $3x = 3$
 $x = \frac{5}{3}$ or $x = 1$
 Roots of the given equation are $\frac{5}{3}, 1$.

22. Is the pair of linear equations $3x - y = 40$, $4x - 2y = 50$ consistent or inconsistent? Why?

Sol. Given equations are $3x - y = 40$,
 $4x - 2y = 50$
 Compare them to the standard equations
 $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$
 Here $a_1 = 3$, $b_1 = -1$, $c_1 = -40$
 $a_2 = 4$, $b_2 = -2$, $c_2 = -50$
 $\frac{a_1}{a_2} = \frac{3}{4}$; $\frac{b_1}{b_2} = \frac{-1}{-2} = \frac{1}{2}$
 Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
 Given equations are consistent.

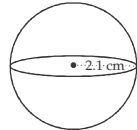
23. Find the 20th term from the end of the A.P : 3, 8, 13,253.

Sol. Given AP : 3, 8, 13, , 253
 Required 20th term from the end of this AP. is
 $\therefore a = 253$; $d = -5$
 $a_{20} = a + (20-1)d$
 $= 253 + 19(-5)$
 $= 253 - 95$
 $= 158$

\therefore The 20th term from the end of this AP is 158.

24. Find the volume and surface area of a sphere of radius 2.1 cm

Sol. Radius of sphere (r) = 2.1 cm



Surface area of sphere
 $= 4 \pi r^2 = 4 \times \frac{22}{7} \times (2.1)^2$
 $4 \times \frac{22}{7} \times \frac{21}{10} \times \frac{21}{10} = \frac{1386}{25} = 55.44 \text{ cm}^2$
 Volume of sphere = $\frac{4}{3} \pi r^3$
 $= \frac{4}{3} \times \frac{22}{7} \times (2.1)^3 = 38.808 \text{ cm}^3$

25. Verify whether the following points are collinear or not. (1, -1), (4, 1), (-2, -3).

Sol. $A(1, -1) = (x_1, y_1)$
 $B(4, 1) = (x_2, y_2)$
 $C(-2, -3) = (x_3, y_3)$
 Area (ΔABC)

$$= \frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

$$= \frac{1}{2} |1(1 + 3) + 4(-3 + 1) + (-2)(-1 - 1)|$$

$$= \frac{1}{2} |1(4) + 4(-2) - 2(-2)| = \frac{1}{2} \times 0 = 0$$

Area of $\Delta ABC = 0$, so A, B, C are collinear

26. A box contains 100 red cards, 200 yellow cards and 50 blue cards. If a card is drawn at random from the box, then find the probability that it will be (i) a blue card, (ii) not a yellow card.

Sol. Total number of cards
 $= 100 + 200 + 50 = 350$
 \therefore Total number of possible outcomes
 $= 350$

i) Number of favourable outcomes for getting a blue card from the box
 $= 50$

Probability for getting a blue card =

$$\frac{\text{Number of favourable outcomes for getting a blue card}}{\text{Total number of possible outcomes}}$$

$$= \frac{50}{350} = \frac{1}{7}$$

ii) Number of favourable outcomes for not getting a yellow card from the box
 $= 150$

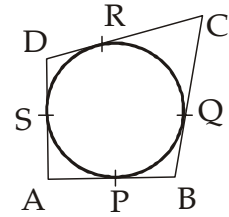
Probability for not getting a yellow card =

$$\frac{\text{Number of favourable outcomes for not getting a yellow card}}{\text{Total number of possible outcomes}}$$

$$= \frac{150}{350} = \frac{3}{7}$$

27. If a circle touches all the four sides of a quadrilateral ABCD at points PQRS, then prove that $AB + CD = BC + DA$.

Sol. The two tangents drawn from a point outside to a circle are equal.
 $\Rightarrow AP = AS, BP = BQ,$
 $DR = DS, CR = CQ.$



By adding
 $AP + BP + DR + CR = AS + BQ + DS + CQ$
 $\Rightarrow AB + CD = BC + DA$
 Hence proved.

28. PQR is a triangle right angled at P and M is a point on QR such that $PM \perp QR$. Show that $PM^2 = QM \cdot MR$.

Sol. Given : In $\Delta PQR, \angle P = 90^\circ$ and $PM \perp QR$
 To prove : $PM^2 = QM \cdot MR$

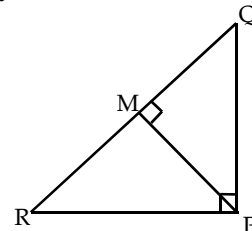
Proof : In ΔPQR and ΔMPR , we have

$$\angle R = \angle MRP \text{ [Common angle]}$$

$$\angle P = \angle PMR = 90^\circ \text{ [given]}$$

$$\therefore \Delta PQR \sim \Delta MPR \text{(1)}$$

[By AA criterion of similarity]



Similarly we can prove

$$\Delta PQR \sim \Delta MQP \text{(2)}$$

From (1) and (2), we get

$$\Delta MPR \sim \Delta MQP$$

The ratio of corresponding sides of similar triangles are equal

$$\Rightarrow \frac{PM}{MR} = \frac{QM}{PM}$$

$$\Rightarrow PM^2 = QM \cdot MR$$

Hence the proof.

SECTION - IV

29. Solve the equations $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$ and $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$.

Sol. Given that $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$ and $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$

Let $\frac{1}{\sqrt{x}} = a$ and $\frac{1}{\sqrt{y}} = b$
 $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2 \Rightarrow 2a + 3b = 2 \dots(1)$
 $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1 \Rightarrow 4a - 9b = -1 \dots(2)$

From (1) and (2)
 $2 \times 1 \Rightarrow 4a + 6b = 4$
 $1 \times 2 \Rightarrow 4a - 9b = -1$
 $\begin{array}{r} - \quad + \quad + \\ \hline \Rightarrow 15b = 5 \Rightarrow b = \frac{1}{3} \end{array}$

Substitute $b = \frac{1}{3}$ in (1)
 $2a + 3(\frac{1}{3}) = 2 \Rightarrow 2a + 1 = 2 \Rightarrow 2a = 1$

$\Rightarrow a = \frac{1}{2} \therefore a = \frac{1}{2}, b = \frac{1}{3}$

but $\frac{1}{\sqrt{x}} = a \Rightarrow \frac{1}{\sqrt{x}} = \frac{1}{2} \Rightarrow \sqrt{x} = 2$
 $\therefore x = 4$

but $\frac{1}{\sqrt{y}} = b \Rightarrow \frac{1}{\sqrt{y}} = \frac{1}{3} \Rightarrow \sqrt{y} = 3$
 $\therefore y = 9$

(Or)

Two cubes each of volume 216 cm^3 are joined end to end together. Find the total surface area of the resulting cuboid.

Sol. Let side of the cube = a cm
 The volume of cube = 216 cm^3
 $\therefore a^3 = 216 \Rightarrow a = 6$
 When two cubes joined end to together then the length of Resulting cuboid
 $(l) = 12 \text{ cm}$
 Breadth $(b) = 6 \text{ cm}$
 Height $(h) = 6 \text{ cm}$

Total surface area of resulting cuboid
 $= 2(lb + bh + hl)$
 $= 2(12 \times 6 + 6 \times 6 + 6 \times 12)$
 $= 2(72 + 36 + 72)$
 $= 2(180)$
 $= 360 \text{ cm}^2$

30. An A.P. has 21 terms. The sum of 10th, 11th, 12th terms is 129. The sum of the last 3 terms is 237, then find the A.P.

Sol. Let first term of A.P be 'a' and common difference be 'd'.

The sum of a_{10}, a_{11}, a_{12} is 129
 $\therefore a + 9d + a + 10d + a + 11d = 129$
 $3a + 30d = 129$
 $a + 10d = 43 \dots\dots\dots(1)$

The sum of last 3 terms is 237
 $\therefore a + 18d + a + 19d + a + 20d = 237$
 $3a + 57d = 237$
 $a + 19d = 79 \dots\dots\dots(2)$

From (1) and (2)
 $a + 19d = 79$
 $a + 10d = 43$
 $\begin{array}{r} - \quad - \quad - \\ \hline 9d = 36 \Rightarrow d = \frac{36}{9} \Rightarrow 4 \end{array}$

Substitute $d = 4$ in (1)
 $a + 10(4) = 43 \Rightarrow a + 40 = 43 \Rightarrow a = 3$
 \therefore The required A.P is
 3, 7, 11, 15, 19,83

(Or)

Solve the quadratic equation $9x^2 - 9x + 2 = 0$ by the method of completing the square.

Sol. $9x^2 - 9x + 2 = 0$
 $9x^2 - 9x = -2$
 $\frac{9x^2}{9} - \frac{9x}{9} = \frac{-2}{9}$
 $x^2 - x = \frac{-2}{9} \dots\dots\dots(1)$

$(\frac{1}{2} \times \text{coefficient of } x)^2 = \left[\frac{1}{2}(-1)\right]^2 = \frac{1}{4}$

adding $\frac{1}{4}$ on both sides of (1)

$$x^2 - x + \frac{1}{4} = \frac{-2}{9} + \frac{1}{4}$$

$$x^2 - x + \left(\frac{1}{2}\right)^2 = \frac{-8+9}{36}$$

$$\left(x - \frac{1}{2}\right)^2 = \frac{1}{36} \Rightarrow x - \frac{1}{2} = \pm \frac{1}{6}$$

$$x - \frac{1}{2} = \frac{1}{6} \text{ or } x - \frac{1}{2} = \frac{-1}{6}$$

$$x = \frac{2}{3} \text{ or } x = \frac{1}{3}$$

31. i) Show that $\sec^2 \theta + \operatorname{cosec}^2 \theta = \sec^2 \theta \cdot \operatorname{cosec}^2 \theta$.

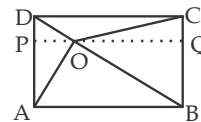
$$\begin{aligned} \text{Sol. } \sec^2 \theta + \operatorname{cosec}^2 \theta &= \frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta} \\ &= \frac{\sin^2 \theta + \cos^2 \theta}{\cos^2 \theta \cdot \sin^2 \theta} \\ &= \frac{1}{\cos^2 \theta \cdot \sin^2 \theta} = \frac{1}{\cos^2 \theta} \cdot \frac{1}{\sin^2 \theta} \\ &= \sec^2 \theta \cdot \operatorname{cosec}^2 \theta \end{aligned}$$

- ii) Prove that $\sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} = \operatorname{cosec} \theta + \cot \theta$.

$$\begin{aligned} \text{Sol. } \sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} &= \sqrt{\frac{(1 + \cos \theta)(1 + \cos \theta)}{(1 - \cos \theta)(1 + \cos \theta)}} \\ &= \sqrt{\frac{(1 + \cos \theta)^2}{1 - \cos^2 \theta}} \\ &= \sqrt{\frac{(1 + \cos \theta)^2}{\sin^2 \theta}} = \frac{1 + \cos \theta}{\sin \theta} \\ &= \frac{1}{\sin \theta} + \frac{\cos \theta}{\sin \theta} \\ &= \operatorname{cosec} \theta + \cot \theta \\ &\text{(Or)} \end{aligned}$$

If 'O' is any point inside the rectangle ABCD, prove that $OB^2 + OD^2 = OA^2 + OC^2$.

- Sol. Through 'O' draw $PQ \parallel AB$ so that P lies on BC



AD and Q lies on BC

$PQ \parallel AB$

$\therefore PQ \perp AD$ and $PQ \perp BC$

From $\triangle OPA$, $OA^2 = AP^2 + OP^2$

From $\triangle OQC$, $OC^2 = OQ^2 + CQ^2$

From $\triangle OQB$, $OB^2 = OQ^2 + BQ^2$

From $\triangle ODP$, $OD^2 = DP^2 + OP^2$

$\therefore OB^2 + OD^2$

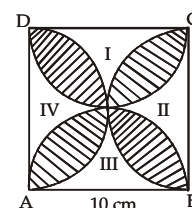
$$\begin{aligned} &= OQ^2 + BQ^2 + DP^2 + OP^2 \\ &= OQ^2 + AP^2 + CQ^2 + OP^2 \\ &= (OQ^2 + CQ^2) + (AP^2 + OP^2) \\ &= OC^2 + OA^2 \end{aligned}$$

32. Find the area of the shaded region in figure, where ABCD is a square of side 10 cm. and semicircles are drawn with each side of the square as diameter

(use $\pi = 3.14$)

- Sol. As in figure, let us name the unshaded regions as I, II, III and IV. From figure, we observe that Area of I + Area of III

$$\begin{aligned} &= \text{Area of ABCD} - \text{Areas of two semicircles each of radius 5 cm.} \\ &= 10 \text{ cm} \times 10 \text{ cm} - 2 \times \frac{1}{2} \times \pi r^2 \\ &= 100 \text{ cm}^2 - 3.14 \times 5 \text{ cm} \times 5 \text{ cm} \\ &= 100 \text{ cm}^2 - 78.5 \text{ cm}^2 = 21.5 \text{ cm}^2 \end{aligned}$$



Similarly, area of II + area of IV
= 21.5 cm²

$$\begin{aligned} \therefore \text{Area of the shaded part} &= \text{Area of ABCD} \\ &\quad - \text{Area of (I + II + III + IV)} \\ &= (100 - 2 \times 21.5) \text{ cm}^2 \\ &= (100 - 43) \text{ cm}^2 = 57 \text{ cm}^2 \end{aligned}$$

(Or)

Prove that the points (-7, -3), (5, 10), (15, 8) and (3, -5) taken in order are the corners of a parallelogram.

Sol. Let A(-7, -3) B(5, 10) C(15, 8) and D(3, -5) be the given points.

$$\begin{aligned} AB = d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(5 - (-7))^2 + (10 - (-3))^2} \\ &= \sqrt{(5 + 7)^2 + (10 + 3)^2} \\ &= \sqrt{(12)^2 + (13)^2} = \sqrt{144 + 169} \\ &= \sqrt{313} \text{ units.} \end{aligned}$$

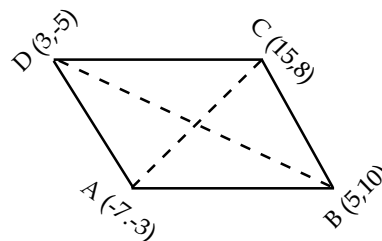
$$\begin{aligned} BC = d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(15 - 5)^2 + (8 - 10)^2} \\ &= \sqrt{(10)^2 + (-2)^2} = \sqrt{100 + 4} \\ &= \sqrt{104} \text{ units.} \end{aligned}$$

$$\begin{aligned} CD = d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(3 - 15)^2 + (-5 - 8)^2} \\ &= \sqrt{(-12)^2 + (-13)^2} \end{aligned}$$

$$= \sqrt{144 + 169} = \sqrt{313} \text{ units.}$$

$$\begin{aligned} DA = d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(3 - (-7))^2 + (-5 - (-3))^2} \\ &= \sqrt{(3 + 7)^2 + (-5 + 3)^2} \\ &= \sqrt{(10)^2 + (-2)^2} = \sqrt{100 + 4} \\ &= \sqrt{104} \text{ units.} \end{aligned}$$

Diagonals :



$$\begin{aligned} AC &= \sqrt{(-7 - 15)^2 + (-3 - 8)^2} \\ &= \sqrt{(-22)^2 + (-11)^2} \\ &= \sqrt{484 + 121} = \sqrt{605} \end{aligned}$$

$$\begin{aligned} BD &= \sqrt{(5 - 3)^2 + [10 - (-5)]^2} \\ &= \sqrt{(2)^2 + (15)^2} \\ &= \sqrt{4 + 225} = \sqrt{229} \end{aligned}$$

Opposite sides AB = CD, BC = DA

Diagonals AC ≠ BD

Therefore ABCD is a parallelogram.

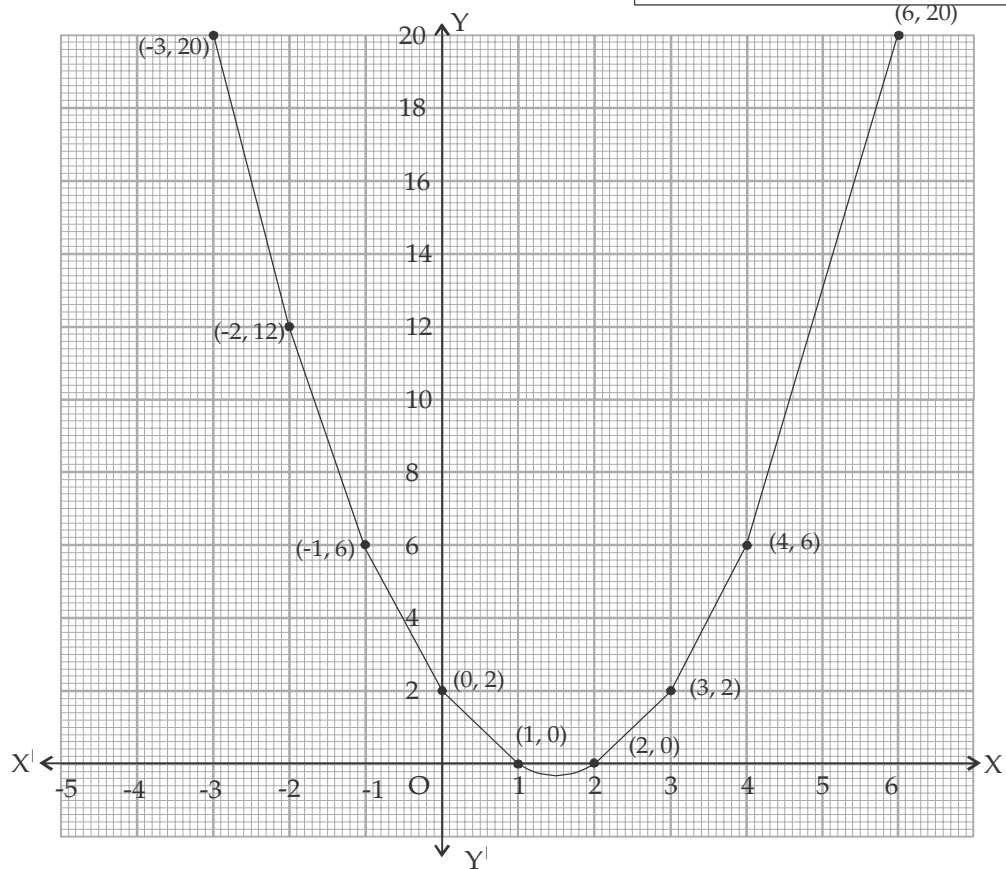
The given points taken in order form a parallelogram.

33. Draw the graph of polynomial $p(x) = x^2 - 3x + 2$ and find its zeroes from the graph.

Sol. Let $p(x) = x^2 - 3x + 2 = y$

x	-3	-2	-1	0	1	2	3	4	6
$y = x^2 - 3x + 2$	20	12	6	2	0	0	2	6	20
(x, y)	(-3, 20)	(-2, 12)	(-1, 6)	(0, 2)	(1, 0)	(2, 0)	(3, 2)	(4, 6)	(6, 20)

Scale : on X - axis 1cm = 1 unit
on Y - axis 1cm = 2 units

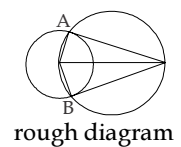
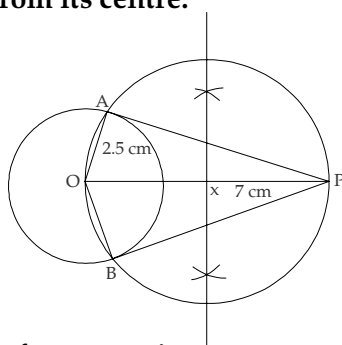


\therefore From the graph zeroes of the polynomial are 1, 2

(Or)

Draw two tangents to a circle of radius 2.5 cm, from a point 'P' at a distance of 7 cm from its centre.

Sol.



Steps of construction :

1. Draw a circle with radius 2.5 cm with centre O
2. Plot a point P such that $OP = 7$ cm
3. Draw perpendicular of OP and draw a circle with radius $XP = XO$ from X
4. Join the two tangents PA and PB

SSC PUBLIC EXAMINATIONS: JULY – 2020

DISTRICT COMMON EXAMINATION BOARD, KADAPA – YSR Dist.

MATHEMATICS – PAPER I & II

Time: 3Hrs. 15Mini

Max. Marks: 100Marks

SECTION – I		12X1=12
Q.NO		Marks
1.	$\log_{10} 0.001 = \log_{10} \frac{1}{1000}$ $= \log_{10} 10^{-3}$ $= -3 \log_{10} 10$ $= -3(1)$ $= -3$	$\frac{1}{2}$ Mark $\frac{1}{2}$ Mark
2.	B [circle]	1 Mark
3.	<p>Given Q.E. is $2x^2 - 4x + 3 = 0$</p> <p>Comparing with $ax^2 + bx + c = 0$</p> <p>We get $a = 2, b = -4, c = 3$</p> <p>Discriminant = $b^2 - 4ac$</p> $= (-4)^2 - 4(2).3$ $= -8$ <p>$\therefore b^2 - 4ac < 0$</p> <p>Hence $2x^2 - 4x + 3$ has no real roots.</p>	$\frac{1}{2}$ Mark $\frac{1}{2}$ Mark
4.	$A = \{-3, -2, -1, 0, 1, 2\}$	1 Mark
5.	0 (Zero)	1 Mark
6.	The number of zeroes is 1, as the graph intersects the x – axis at only one point.	1 Mark
7.	$\tan 2A = \cot(A - 18^\circ)$ $\cancel{\cot} (90^\circ - 2A) = \cancel{\cot}(A - 18^\circ)$ $90^\circ - 2A = A - 18^\circ$ $3A = 108^\circ$ $A = 36^\circ$	$\frac{1}{2}$ Mark $\frac{1}{2}$ Mark

8. $\frac{AD}{DB} = \frac{2.4}{7.2} = \frac{1}{3}$
 $\frac{AE}{EC} = \frac{1.8}{5.4} = \frac{1}{3}$
 $\therefore \frac{AD}{DB} = \frac{AE}{EC}$ } $\frac{1}{2}$ Mark
- By the converse of B.P.T. $DE \parallel BC$. } $\frac{1}{2}$ Mark
9. ii (A is true, B is false) 1 Mark
10. $\sin 0^\circ = 0, \tan 0^\circ = 0$
 $\left(\cos 45^\circ = \frac{1}{\sqrt{2}}, \sin 45^\circ = \frac{1}{\sqrt{2}} \right)$ } $\frac{1}{2}$ Mark
- Slope = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{\frac{1}{\sqrt{2}} - 0}{\frac{1}{\sqrt{2}} - 0} = 1$ } $\frac{1}{2}$ Mark
11. C [i-c, ii-a, iii-b] 1 Mark
12. Total no of out comes = 52
 No of favourable outcomes = 2 } $\frac{1}{2}$ Mark
- P(red queen) = $\frac{2}{52} = \frac{1}{26}$ $\frac{1}{2}$ Mark

SECTION – II

సూచనలు: 1. అన్ని ప్రశ్నలకు జవాబులు రాయండి.

2. ప్రతి ప్రశ్నకు 2మార్కులు.

8X2=16

13. $550 = 300X1 + 250$
 $300 = 250X1 + 50$
 $250 = 50X5 + 0$ } $1\frac{1}{2}$ Mark
- \therefore HCF of 550 and 300 = 50 $\frac{1}{2}$ Mark
14. $x, x + 2, x + 6$ are consecutive terms of G.P
 So, $r = \frac{a_2}{a_1} = \frac{a_3}{a_2}$
 $\Rightarrow \frac{x+2}{x} = \frac{x+6}{x+2}$ } 1Mark
- By doing cross multiplication
 $x^2 + 4x + 4 = x^2 + 6x$
 $2x = 4$
 $x = 2$ } 1Mark

15. Given, radius of the cone (r) = 6cm } $\frac{1}{2}$ Mark
 Height of the cone (h) = 7cm }
 \therefore Volume of the cone = $\frac{1}{3}\pi r^2 h$ $\frac{1}{2}$ Mark
 $= \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 7$ $\frac{1}{2}$ Mark
 $= 264\text{cm}^3$ $\frac{1}{2}$ Mark

16. Given, $F = \{a, b, c\}$ } $\frac{1}{2}$ Mark
 $n(F) = 3$ }
 No of subsets = $2^n = 2^3 = 8$ }
 The list of all subsets of F is } $\frac{1}{2}$ Mark
 $\{a\}, \{b\}, \{c\},$
 $\{a, b\}, \{a, c\}, \{b, c\},$
 $\{a, b, c\}, \emptyset$

17. LHS = $2\cos^2\theta + \frac{2}{(1+\cot^2\theta)}$ } $\frac{1}{2}$ Mark
 $= 2\cos^2\theta + \frac{2}{\operatorname{cosec}^2\theta}$ } $\frac{1}{2}$ Mark
 $= 2\cos^2\theta + 2\sin^2\theta$
 $= 2(\cos^2\theta + \sin^2\theta)$ } $\frac{1}{2}$ Mark
 $= 2(1)$
 $= 2$
 $= \text{RHS}$

Hence it is proved.

18. Centroid: The point of concurrence of medians of the triangle is called centroid. $\frac{1}{2}$ Mark

Centroid of the triangle = $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$ $\frac{1}{2}$ Mark

19. Let $p(-1, 6)$ divides the line segment joining the points } $\frac{1}{2}$ Mark
 $A(-3, 10)$ and $B(6, -8)$ in the ratio $m:n$.
 $x_1 \ y_1 \quad x_2 \ y_2$

$$\text{So, } \frac{mx_2 + nx_1}{m+n} = -1$$

$$= \frac{m(6) + n(-3)}{m+n} = -1$$

1Mark

$$6m - 3n = -m - n$$

$$7m = 2n$$

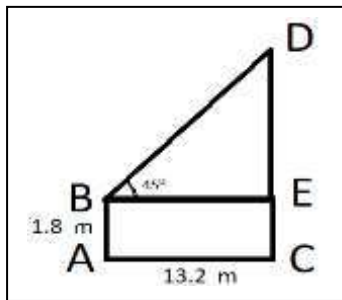
$$\frac{m}{n} = \frac{2}{7}$$

$$m:n = 2:7$$

½ Mark

∴ $p(-1, 6)$ divides \overline{AB} in the ratio 2:7 internally

20.



1Mark

Let AB be the height of the observer = 1.8m

CD be the height of the palm tree

AC be the distance between observer and palm tree.

$$= \angle DBE = 45^\circ$$

1Mark

SECTION – III

8X4=32

21.

$$A = \{1,2,3,4,5\}$$

$$B = \{1,3,5,7,9\}$$

$$A \cup B = \{1,2,3,4,5, 7, 9\} \quad 1 \text{ Mark}$$

$$A \cap B = \{1,3,5\} \quad 1 \text{ Mark}$$

$$A - B = \{2,4\} \quad 1 \text{ Mark}$$

$$B - A = \{7,9\} \quad 1 \text{ Mark}$$

22.

Given polynomial is $x^2 - 3x - 10$

Comparing with $ax^2 + bx + C$

We get $a = 1, b = -3, c = -10$

½ Mark

Let $x^2 - 3x - 10 = 0$

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

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

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

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

$x = 5$ $x = -2$

1½ Mark

Let $\alpha = 5, \beta = -2$

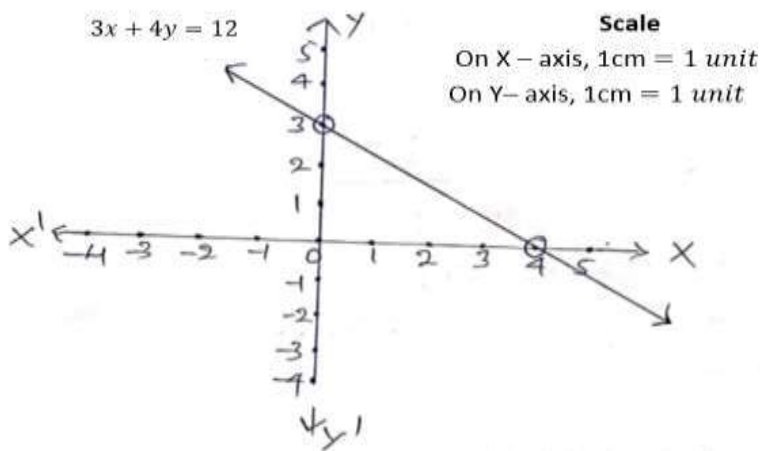
$\alpha + \beta = 5 + (-2) = 3 = \frac{-(-3)}{1} = \frac{-b}{a}$

$\alpha \beta = 5 \times (-2) = -10 = \frac{-10}{1} = \frac{c}{a}$

2 Marks

23. Given equation is $3x + 4y = 12$

x	0	4
y	3	0
(x, y)	(0, 3)	(4, 0)



Award marks as follows:

- For drawing co ordinates axes ½ Mark
- For finding at least two points which satisfy $3x + 4y = 12$ 2 Marks
- Plotting points and joining them 1 Mark
- For writing scale ½ Mark

24. let the no of ₹ 50 notes be x and ₹100 notes be y

½ Mark

By the problem,

$x + y = 25$ _____ ①

$50x + 100y = 2000$ _____ ②

2 Marks

Solving ① and ②

$$\begin{array}{r} \textcircled{1} \times 100 : 100x + 100y = 2500 \\ \textcircled{2} \times 1 : 50x + 100y = 2000 \\ \hline \quad (-) \quad (-) \quad (-) \\ \hline 50x \quad \quad = 500 \end{array} \quad \left. \vphantom{\begin{array}{r} \textcircled{1} \times 100 : 100x + 100y = 2500 \\ \textcircled{2} \times 1 : 50x + 100y = 2000 \\ \hline \quad (-) \quad (-) \quad (-) \\ \hline 50x \quad \quad = 500 \end{array}} \right\} \frac{1}{2} \text{ Mark}$$

$$x = 10 \quad \frac{1}{2} \text{ Mark}$$

Substituting $x = 10$ in equation ①

$$\begin{array}{r} \textcircled{1} \Rightarrow 10 + y = 25 \\ y = 25 - 10 = 15 \end{array} \quad \left. \vphantom{\begin{array}{r} \textcircled{1} \Rightarrow 10 + y = 25 \\ y = 25 - 10 = 15 \end{array}} \right\} \frac{1}{2} \text{ Mark}$$

\therefore No of ₹50 notes = 10

No of ₹ 100 notes = 15

25. Let A(1, 5), B(5, 8), C(13, 14)

$$\text{Distance formula} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad \frac{1}{2} \text{ Mark}$$

$$AB = \sqrt{(5 - 1)^2 + (8 - 5)^2} = \sqrt{16 + 9} = 5 \text{ units.} \quad 1 \text{ Mark}$$

$$BC = \sqrt{(13 - 5)^2 + (14 - 8)^2} = \sqrt{64 + 36} = 10 \text{ units.} \quad 1 \text{ Mark}$$

$$AC = \sqrt{(13 - 1)^2 + (14 - 5)^2} = \sqrt{144 + 81} = 15 \text{ units} \quad 1 \text{ Mark}$$

$$\begin{array}{l} AB = 5 + 10 = 15 \neq AC \\ \text{So we can not draw a triangle with given vertices.} \end{array} \quad \left. \vphantom{\begin{array}{l} AB = 5 + 10 = 15 \neq AC \\ \text{So we can not draw a triangle with given vertices.} \end{array}} \right\} \frac{1}{2} \text{ Mark}$$

26.

**Less than cumulative
Frequency table**

Upper boundaries	LCF
10	5
20	20
30	40
40	63
50	80
60	91
70	100

**More than cumulative
Frequency table**

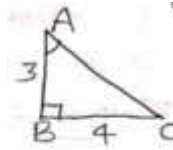
Lower boundaries	MCF
0	100
10	95
20	80
30	60
40	37
50	20
60	9

Marks allocation:

- For less than cumulative frequency table – 2 marks
- For more than cumulative frequency table – 2 marks.

27. Given, $3\tan A = 4$

$$\tan A = \frac{4}{3} = \frac{BC}{AB}$$



1 Mark

By Pythagoras theorem

$$AC^2 = AB^2 + BC^2$$

$$= 3^2 + 4^2$$

$$= 9 + 16$$

$$= 25$$

1Mark

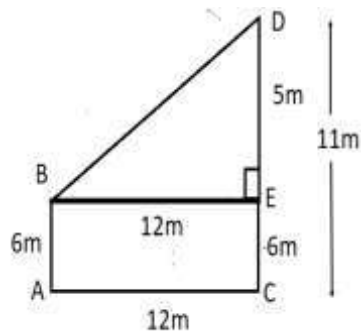
$$AC = \sqrt{25} = 5$$

$$\therefore \sin A = \frac{BC}{AC} = \frac{4}{5}$$

$$\cos A = \frac{AB}{AC} = \frac{3}{5}$$

2 Marks

28.



1 Mark

AB and CD are two poles of heights 6m and 11m.

AC be the distance between two poles = 12m

$$AB = CE = 6m$$

$$AC = BE = 12m$$

$$DE = 11 - 6 = 5m$$

1 ½Mark

From triangle BDE

$$\begin{aligned}
 BD^2 &= BE^2 + DE^2 \quad (\because \text{Pythagoras theorem}) \\
 &= 12^2 + 5^2 \\
 &= 169 \\
 BD &= 13
 \end{aligned}
 \left. \vphantom{\begin{aligned} BD^2 &= BE^2 + DE^2 \\ &= 12^2 + 5^2 \\ &= 169 \\ BD &= 13 \end{aligned}} \right\} \begin{array}{l} 1\text{Mark} \\ \\ \\ \end{array}$$

\therefore The distance between their tops = 13m. ½ Mark

SECTION – IV

5X8=40

29. a) Let $\sqrt{2} + \sqrt{3}$ is a rational number ½ Mark

So, $\sqrt{2} + \sqrt{3} = \frac{a}{b}$, where a and b are coprimes ½ Mark

$$\sqrt{2} = \frac{a}{b} - \sqrt{3}$$

Squaring on both sides

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

$$2 = \frac{a^2}{b^2} - 2\sqrt{3}\frac{a}{b} + 3$$

$$\frac{2a}{b}\sqrt{3} = \frac{a^2}{b^2} + 1$$

$$\sqrt{3} = \frac{a^2+b^2}{b^2} \times \frac{b}{2a}$$

$$\sqrt{3} = \frac{a^2+b^2}{2ab}$$

Since a and b are coprimes, $\frac{a^2+b^2}{2ab}$ is rational.

So, $\sqrt{3}$ is also rational.

But this contradicts that $\sqrt{3}$ is irrational.

Hence our assumption is wrong.

$\therefore \sqrt{2} + \sqrt{3}$ is an irrational number.

1Mark

4 Marks

2 Marks

29. b) Given series: 5, 11, 17, 23, _____ ½ Mark
- $$a_2 - a_1 = 11 - 5 = 6$$
- $$a_3 - a_2 = 17 - 11 = 6$$
- $$a_4 - a_3 = 23 - 17 = 6$$
- Common difference is same. 1½ Mark
- So, the given numbers are in AP.
- Here, $a = 5, d = 6$ 2 marks
- Let $a_n = 301$
- $$a + (n - 1)d = 301$$
- $$5 + 6n - 6 = 301$$
- $$6n = 302$$
- $$n = \frac{302}{6} = \frac{151}{3} \text{ is not a positive integer}$$
- So, 301 is not a term in the given list of numbers. 1 Mark

30. a) Silver coin (Cylinder) :
- $$d = 1.75 \text{ cm}$$
- So, $r = \frac{d}{2} = \frac{1.75}{2} = \frac{175}{200} = \frac{7}{8} \text{ cm}$ 1 Mark
- $$h = 2 \text{ mm} = \frac{2}{10} \text{ cm} = \frac{1}{5} \text{ cm}$$
- ∴ Volume of cylinder = $\pi r^2 h$
- $$= \frac{22}{7} \times \frac{7}{8} \times \frac{7}{8} \times \frac{1}{5} \text{ cm}^3$$
- 2 Marks
- Cuboid:**
- $$l = 5.5 \text{ cm}$$
- $$b = 10 \text{ cm}$$
- $$h = 3.5 \text{ cm}$$
- ∴ Volume of cuboid = lbh
- $$= 5.5 \times 10 \times 3.5$$
- $$= 55 \times \frac{35}{10} \text{ cm}^3$$
- 2 Marks
- Then no. of silver coins need to be melted = $\frac{\text{Volume fo cuboid}}{\text{Volume of silver coin}}$
- $$= 55 \times \frac{35}{10} \times \frac{7}{22} \times \frac{8}{7} \times \frac{8}{7} \times 5$$
- $$= 400$$
- 2 Marks

(OR)

b) Let the speed of the boat in still water be x kmph } 1 Mark
Speed of the current = 3 kmph

So, speed of the boat in upstream = $x - 3\text{ kmph}$ } 1Mark
In downstream = $x + 3\text{ kmph}$

We know that, $\text{time} = \frac{\text{distance}}{\text{speed}}$ } 1Mark

Given, the trip up and back takes 6 hours

$$\text{So, } \frac{24}{x-3} + \frac{24}{x+3} = 6 \quad \text{1 Mark}$$

$$24 \left[\frac{1}{x-3} + \frac{1}{x+3} \right] = 6$$

$$\frac{x+3+x-3}{x^2-9} = \frac{1}{4}$$

$$x^2 - 9 = 8x$$

$$x^2 - 8x - 9 = 0$$

$$x^2 - 9x + 1x - 9 = 0$$

$$x(x-9) + 1(x-9) = 0$$

$$(x-9)(x+1) = 0$$

$$x-9 = 0 \text{ or } x+1 = 0$$

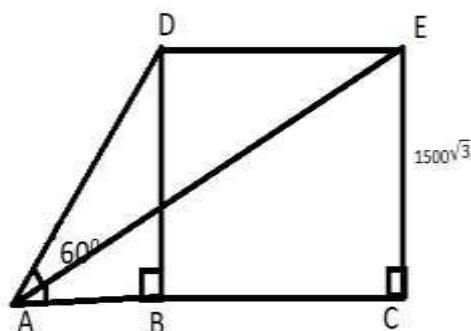
$$x = 9 \quad x = -1$$

But x can not be negative.

So, $x = 9$ } 1 Mark

\therefore speed of the bot in still water = 9 kmph

31. a)



1 Mark

DE be the distance travelled by the jet plane in 15 sec

Height of the plane from the ground $BD = CE = 1500\sqrt{3}$ } 1 Mark

$$\angle BAD = 60^\circ$$

$$\angle BAE = 30^\circ$$

From right angled triangle BAD,

$$\tan 60^\circ = \frac{BD}{AB}$$

$$\sqrt{3} = \frac{1500\sqrt{3}}{AB}$$

$$AB = 1500m$$

2 Marks

From right angled triangle ACE

$$\tan 30^\circ = \frac{CE}{AC}$$

$$\frac{1}{\sqrt{3}} = \frac{1500\sqrt{3}}{AC}$$

$$AC = 1500 \times (\sqrt{3})^2$$

$$AC = 4500 m$$

2 Marks

\therefore Distance travelled in 15 sec = DE

$$= BC$$

$$= AC - AB$$

$$= 4500 - 1500$$

$$= 3000m$$

1 Mark

$$\text{Speed of the jet plane} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{3000}{15}$$

$$= 200m/s$$

1 Mark

(OR)

b) Total no of possible outcomes = 8

1 Mark

$$\text{Probability} = \frac{\text{No of favourable out comes}}{\text{total no of possible out comes}}$$

1 Mark

i) No of favourable outcomes = 6(1, 2, 3, 4, 5, 6)

$$P(\text{a number less than 7}) = \frac{6}{8} = \frac{3}{4}$$

1 ½ Mark

ii) No of favourable outcomes = 3(4, 6, 8)

$$P(\text{a composite number}) = \frac{3}{8}$$

1 ½ Mark

iii) No of favourable outcomes = 4(1, 2, 4, 8)

$$P(\text{a factor of 8}) = \frac{4}{8} = \frac{1}{2}$$

1 ½ Mark

iv) No of favourable outcomes = 2(3, 6)

$$P(\text{a multiple of 3}) = \frac{2}{8} = \frac{1}{4}$$

1½ Marks

32. a)

<i>CI</i>	<i>f</i>	<i>Cf</i>
0-20	6	6
20-40	8	14
40-60	10	24
<i>l</i> 60-80	<i>12f</i>	36
80-100	6	42
100-120	5	47
120-140	3	50
	<i>n = 50</i>	

2 Marks

$$\frac{n}{2} = \frac{50}{2} = 25 \text{ which lies in the class } 60 - 80$$

So, 60–80 is the median class

$$\text{Here, } l = 60, f = 12, cf = 24, h = 20$$

1 Mark

1 Mark

$$\therefore \text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h$$

1 Mark

$$= 60 + \left(\frac{25 - 24}{12} \right) \times 20$$

1 Mark

$$= 60 + 1.67$$

$$= 61.67 \text{ (approx.)}$$

2 Marks

(OR)

b) Given, PQ = 24cm

$$PR = 7cm$$

QR is the diameter of the circle

So, $\angle QPR = 90^\circ$ (\because Angle in a semicircle)

1 Mark

Area of the segment shaded = Area of semi circle – Area of triangle PQR 1 Mark

$$\text{In } \Delta QPR, QR^2 = PQ^2 + PR^2$$

$$= 24^2 + 7^2$$

$$= 625$$

$$QR = 25cm$$

1 Mark

$$\text{So, radius of the circle} = \frac{QR}{2} = \frac{25}{2} cm$$

1 Mark

$$\text{Area of the circle} = \frac{1}{2} \pi r^2$$

$$= \frac{1}{2} \times \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2}$$

$$= 245.53 cm^2$$

1½ Marks

Area of the right angled triangle

$$QPR = \frac{1}{2} \times PQ \times PR$$

1½ Marks

$$= \frac{1}{2} \times 24 \times 7$$

$$= 84\text{cm}^2$$

$$\therefore \text{Area of the shaded segment} = 245.53 - 84$$

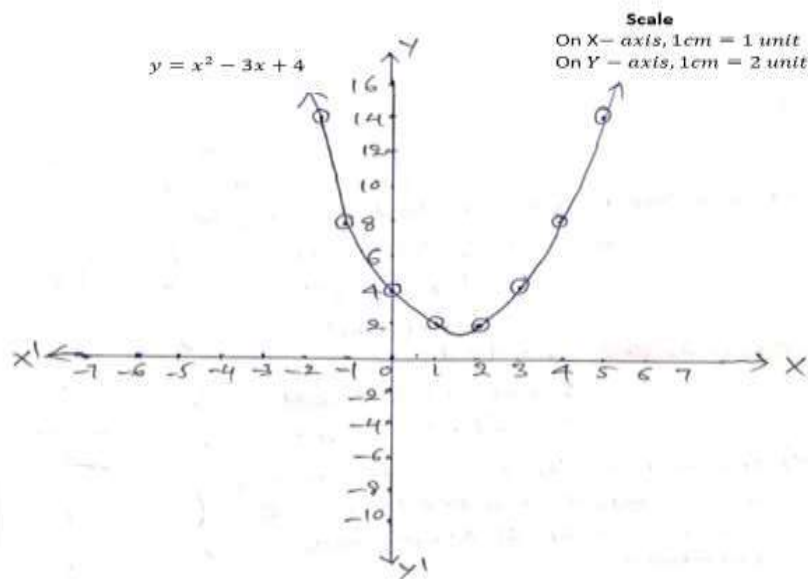
$$= 161.53\text{cm}^2$$

1 Mark

33. a) The zeroes of $x^2 - 3x + 4$ are the x coordinates of the points of intersection of X-axis and parabola. **2 Marks**

x	-2	-1	0	1	2	3	4	5
x^2	4	1	0	1	4	9	16	25
$-3x$	6	3	0	-3	-6	-9	-12	-15
$+4$	+4	+4	+4	+4	+4	+4	+4	+4
y	14	8	4	2	2	4	8	14
(x, y)	(-2, 14)	(-1, 8)	(0, 4)	(1, 2)	(2, 2)	(3, 4)	(4, 8)	(5, 14)

2M



3M

The graph does not intersect X-axis at any point.
So, $x^2 - 3x + 4$ has no real zeroes.

Verification:

$$p(x) = x^2 - 3x + 4$$

Comparing with $ax^2 + bx + c$
We get $a = 1$, $b = -3$, $c = 4$
Discriminant = $b^2 - 4ac$
 $= (-3)^2 - 4 \cdot 1 \cdot 4$
 $= 9 - 16$
 $= -7$

$$\therefore \Delta < 0$$

So, $x^2 - 3x + 4$ has no real zeroes.

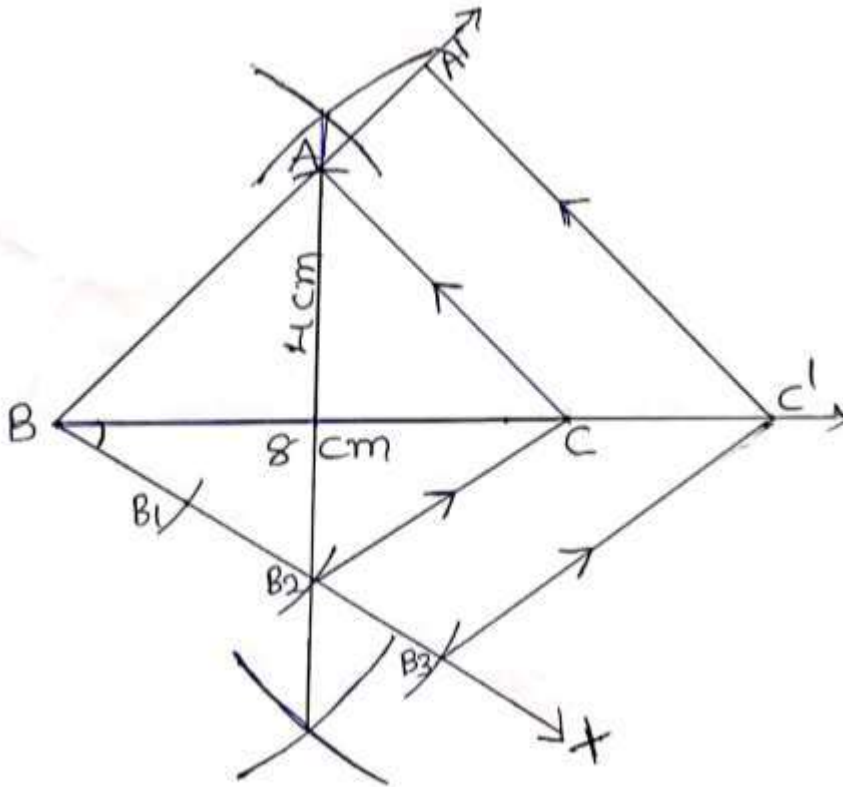
1Mark

1 Mark

(OR)

b) For drawing figure award marks for construction as follows:

- To construct an isosceles triangle ABC with base 8cm and height 4cm —1 Marks
- To draw an acute angle $\angle CBX$ at B 1 Mark
- To locate B_1, B_2 and B_3 on \overrightarrow{BX} such that $BB_1 = B_1B_2 = B_2B_3$ 1 Mark
- To join B_2C 1 Mark
- To draw B_3C' parallel to B_2C and $C'A'$ parallel to AC 1 Mark
- $\Delta ABC \sim \Delta A'B'C'$ 1 Mark
- For writing construction procedure 2 Marks



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SSC PUBLIC EXAMINATIONS: JULY – 2020

DISTRICT COMMON EXAMINATION BOARD, KADAPA – YSR Dist.

MATHEMATICS – PAPER I & II

Time: 3Hrs. 15Mini

Max. Marks: 100Marks

SECTION – I

12X1=12

Q.NO

Marks

1. $\log_{10} 0.001 = \log_{10} \frac{1}{1000}$ }
 $= \log_{10} 10^{-3}$ } $\frac{1}{2}$ Mark
 $= -3\log_{10} 10$ }
 $= -3(1)$ } $\frac{1}{2}$ Mark
 $= -3$ }
2. B [వృత్తం] 1 Mark
3. దత్త వర్గ సమీకరణం $2x^2 - 4x + 3 = 0$
 $ax^2 + bx + c = 0$ తో పోల్చగా
 $a = 2, b = -4, c = 3$
విచక్షని $= b^2 - 4ac$ }
 $= (-4)^2 - 4(2).3$ } $\frac{1}{2}$ Mark
 $= -8$ }
 $\therefore b^2 - 4ac < 0$ }
- కావున $2x^2 - 4x + 3$ మూలాలు వాస్తవాలు కాదు } $\frac{1}{2}$ Mark
4. $A = \{-3, -2, -1, 0, 1, 2\}$ 1 Mark
5. 0 (సున్నా) 1 Mark
6. రేఖా చిత్రం X - అక్షాన్ని ఒక బిందువు వద్ద ఖండిస్తుంది. కావున శూన్యాల సంఖ్య = 1 1 Mark
7. $\tan 2A = \cot(A - 18^\circ)$ }
 $\cot(90^\circ - 2A) = \cot(A - 18^\circ)$ } $\frac{1}{2}$ Mark
 $90^\circ - 2A = A - 18^\circ$ }
 $3A = 108^\circ$ $A = 36^\circ$ } $\frac{1}{2}$ Mark

$$8. \quad \left. \begin{aligned} \frac{AD}{DB} &= \frac{2.4}{7.2} = \frac{1}{3} \\ \frac{AE}{EC} &= \frac{1.8}{5.4} = \frac{1}{3} \\ \therefore \frac{AD}{DB} &= \frac{AE}{EC} \end{aligned} \right\} \frac{1}{2} \text{ Mark}$$

ప్రాథమిక అనుపాత సిద్ధాంత విపర్యం ప్రకారం $DE \parallel BC$ } $\frac{1}{2}$ Mark

9. ii (A సత్యము, B అసత్యము) 1 Mark

$$10. \quad \left. \begin{aligned} \sin 0^\circ &= 0, \tan 0^\circ = 0 \\ \left(\cos 45^\circ = \frac{1}{\sqrt{2}}, \quad \sin 45^\circ = \frac{1}{\sqrt{2}} \right) \end{aligned} \right\} \frac{1}{2} \text{ Mark}$$

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\frac{1}{\sqrt{2}} - 0}{\frac{1}{\sqrt{2}} - 0} = 1 \quad \left. \right\} \frac{1}{2} \text{ Mark}$$

11. C [i-c, ii-a, iii-b] 1 Mark

$$12. \quad \left. \begin{aligned} \text{మొత్తం పర్యవసానాల సంఖ్య} &= 52 \\ \text{అనుకూల పర్యవసానాల సంఖ్య} &= 2 \end{aligned} \right\} \frac{1}{2} \text{ Mark}$$

$$P(\text{ఎరుపు రాణి}) = \frac{2}{52} = \frac{1}{26} \quad \frac{1}{2} \text{ Mark}$$

SECTION – II

8X2=16

$$13. \quad \left. \begin{aligned} 550 &= 300X1 + 250 \\ 300 &= 250X1 + 50 \\ 250 &= 50X5 + 0 \end{aligned} \right\} 1\frac{1}{2} \text{ Mark}$$

\therefore 550 మరియు 300ల గ. సా. భా = 50 $\frac{1}{2}$ Mark

14. $x, x + 2, x + 6$ గుణకశ్రేణి లో మూడు వరుస పదాలు

$$\left. \begin{aligned} \text{కావున, } r &= \frac{a_2}{a_1} = \frac{a_3}{a_2} \\ \Rightarrow \frac{x+2}{x} &= \frac{x+6}{x+2} \end{aligned} \right\} 1 \text{ Mark}$$

అడ్డ గుణకారం చేయగా

$$x^2 + 4x + 4 = x^2 + 6x$$

$$2x = 4$$

$$x = 2$$

1Mark

15. శంఖువు యొక్క వ్యాసార్థం (r) = $6cm$

శంఖువు యొక్క ఎత్తు (h) = $7cm$

½ Mark

∴ శంఖువు ఘనపరిమాణం = $\frac{1}{3}\pi r^2 h$

½ Mark

$$= \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 7$$

½ Mark

$$= 264cm^3$$

½ Mark

16. $F = \{a, b, c\}$

$$n(F) = 3$$

$$\text{ఉపసమితుల సంఖ్య} = 2^n = 2^3 = 8$$

1 Mark

F యొక్క ఉపసమితుల జాబితా

$$\{a\}, \{b\}, \{c\},$$

$$\{a, b\}, \{a, c\}, \{b, c\},$$

$$\{a, b, c\}, \emptyset$$

1 Mark

17. LHS = $2\cos^2\theta + \frac{2}{(1+\cot^2\theta)}$

$$= 2\cos^2\theta + \frac{2}{\operatorname{cosec}^2\theta}$$

1Mark

$$= 2\cos^2\theta + 2\sin^2\theta$$

½ Mark

$$= 2(\cos^2\theta + \sin^2\theta)$$

$$= 2(1)$$

½ Mark

$$= 2$$

$$= RHS$$

∴ LHS = RHS

18. గురుత్వ కేంద్రం: త్రిభుజ మధ్యగత రేఖల మిళిత బిందువును గురుత్వకేంద్రం అంటారు.

1Mark

$$\text{గురుత్వకేంద్రం} = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3} \right)$$

1 Mark

19. $P(-1, 6)$ బిందువు $A(-3, 10)$ మరియు $B(6, -8)$ లను
 $x_1 \quad y_1 \quad x_2 \quad y_2$

½ Mark

కలిపే రేఖా ఖండాన్ని $m:n$ నిష్పత్తిలో విభజిస్తుంది అనుకొనుము.

$$\text{కావున, } \frac{mx_2+nx_1}{m+n} = -1$$

1Mark

$$= \frac{m(6)+n(-3)}{m+n} = -1$$

$$6m - 3n = -m - n$$

$$7m = 2n$$

$$\frac{m}{n} = \frac{2}{7}$$

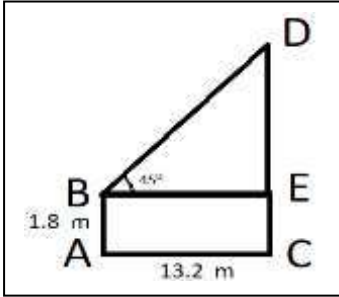
$$m:n = 2 : 7$$

½ Mark

∴ $p(-1, 6)$ బిందువు \overline{AB} రేఖా ఖండాన్ని $2:7$ నిష్పత్తిలో అంతరంగా విభజిస్తుంది.

½ Mark

20.



1Mark

AB పరిశీలకుని ఎత్తు = $1.8m$

CD తాటి చెట్టు ఎత్తు

AC పరిశీలకుడు మరియు తాటిచెట్టు మధ్య దూరం

$$\angle DBE = 45^\circ$$

1Mark

SECTION – III

21. $A = \{1,2,3,4,5\}$
 $B = \{1,3,5,7,9\}$
 $A \cup B = \{1,2,3,4,5, 7, 9\}$ 1 Mark
 $A \cap B = \{1,3,5\}$ 1 Mark
 $A - B = \{2,4\}$ 1 Mark
 $B - A = \{7,9\}$ 1 Mark

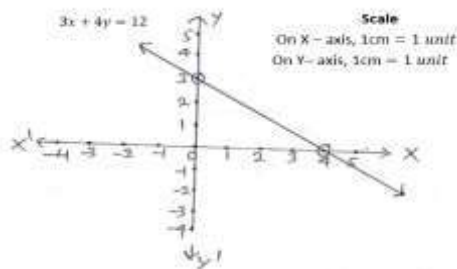
22. దత్త బహుపది $x^2 - 3x - 10$
 $ax^2 + bx + C$ తో పోల్చగా } ½ Mark
 $a = 1, b = -3, c = -10$

$x^2 - 3x - 10 = 0$ అనుకొనుము
 $x^2 - 5x + 2x - 10 = 0$
 $x(x - 5) + 2(x - 5) = 0$
 $(x - 5)(x + 2) = 0$
 $x - 5 = 0$ లేక $x + 2 = 0$
 $x = 5$ $x = -2$ } 1½ Mark

$\alpha = 5, \beta = -2$ అనుకొనుము
 $\alpha + \beta = 5 + (-2) = 3 = \frac{-(-3)}{1} = \frac{-b}{a}$
 $\alpha \beta = 5 \times (-2) = -10 = \frac{-10}{1} = \frac{c}{a}$ } 2 Marks

23. దత్త సమీకరణం $3x + 4y = 12$

x	0	4
y	3	0
(x, y)	(0, 3)	(4, 0)



మార్కులు క్రింది విధంగా ఇవ్వబడతాయి.

- X మరియు Y అక్షాలను గీచినందుకు ½ Mark
- $3x + 4y = 12$ ను తృప్తి పరిచే కనీసం రెండు బిందువులను కనుగొనుటకు 2 Marks
- బిందువులను గుర్తించి, సరళ రేఖను గీయుటకు 1 Mark
- స్కేల్ రాయుటకు ½ Mark

24. ₹ 50 నోట్ల సంఖ్య = x , ₹ 100 నోట్ల సంఖ్య = y అనుకొనుము. ½ Mark

లెక్క ప్రకారం

$$x + y = 25 \quad \text{—————} \quad \textcircled{1}$$

$$50x + 100y = 2000 \quad \text{—————} \quad \textcircled{2}$$

2 Marks

① మరియు ② లను సాధించగా

$$\textcircled{1} \times 100 : 100x + 100y = 2500$$

$$\textcircled{2} \times 1 : 50x + 100y = 2000$$

$$\begin{array}{r} \text{—————} \\ (-) \quad (-) \quad (-) \\ \hline 50x \quad \quad = 500 \end{array}$$

$$x = 10$$

½ Mark

½ Mark

$x = 10$ ని సమీకరణం ①లో ప్రతిక్షేపించగా

$$\textcircled{1} \Rightarrow 10 + y = 25$$

$$y = 25 - 10 = 15$$

½ Mark

$$\therefore \text{₹}50 \text{ నోట్ల సంఖ్య} = 10$$

$$\text{₹}100 \text{ నోట్ల సంఖ్య} = 15$$

25. దత్త బిందువులు A(1, 5), B(5, 8), C(13, 14)

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

½ Mark

$$AB = \sqrt{(5 - 1)^2 + (8 - 5)^2} = \sqrt{16 + 9} = 5 \text{ యూనిట్స్}$$

1 Mark

$$BC = \sqrt{(13 - 5)^2 + (14 - 8)^2} = \sqrt{64 + 36} = 10 \text{ యూనిట్స్}$$

1 Mark

$$AC = \sqrt{(13 - 1)^2 + (14 - 5)^2} = \sqrt{144 + 81} = 15 \text{ యూనిట్స్}$$

1 Mark

$$AB = 5 + 10 = 15 \neq AC$$

½ Mark

కావున ఇచ్చిన బిందువులు శీర్షాలుగా గల త్రిభుజాన్ని గీయలేము.

26.

ఆరోహణ సంచిత పౌనః

పున్య పట్టిక

ఎగువ హద్దులు	ఆరోహణ సంచిత పౌనః పున్య0
10	5
20	20
30	40
40	63
50	80
60	91
70	100

అవరోహణ సంచిత పౌనః

పున్య పట్టిక

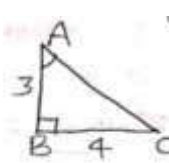
దిగువ హద్దులు	అవరోహణ సంచిత పౌనః పున్య0
0	100
10	95
20	80
30	60
40	37
50	20
60	9

మార్కుల కేటాయింపు

- ఆరోహణ సంచిత పౌనః పున్య పట్టిక కు- 2 marks
- అవరోహణ సంచిత పౌనః పున్య పట్టిక కు- 2 marks

27. , $3\tan A = 4$

$$\tan A = \frac{4}{3} = \frac{BC}{AB}$$



1 Mark

పైథాగరస్ సిద్ధాంతం ప్రకారం $AC^2 = AB^2 + BC^2$

$$= 3^2 + 4^2$$

$$= 9 + 16$$

$$= 25$$

$$AC = \sqrt{25} = 5$$

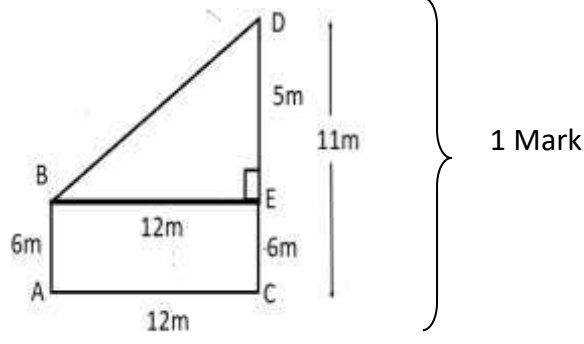
$$\therefore \sin A = \frac{BC}{AC} = \frac{4}{5}$$

$$\cos A = \frac{AB}{AC} = \frac{3}{5}$$

1Mark

2 Marks

28.



1 Mark

AB మరియు CD లు 6m మరియు 11m ఎత్తుగల రెండు స్తంభాలు

AC వాటి మధ్య దూరం = 12m

$$AB = CE = 6m$$

$$AC = BE = 12m$$

$$DE = 11 - 6 = 5m$$

1 ½Mark

BDE లంబకోణ త్రిభుజంలో Type equation here.

$$\begin{aligned} BD^2 &= BE^2 + DE^2 \quad (\because \text{Pythagoras theorem}) \\ &= 12^2 + 5^2 \\ &= 169 \end{aligned}$$

$$BD = 13$$

1Mark

∴ రెండు స్తంభాల కొనల మధ్య దూరం = 13m.

½ Mark

SECTION – IV

5X8=40

29. a) $\sqrt{2} + \sqrt{3}$ ఒక అకరణీయ సంఖ్య అనుకొనుము.

½ Mark

కావున, $\sqrt{2} + \sqrt{3} = \frac{a}{b}$, ఇక్కడ a మరియు b లు పరస్పర ప్రధాన సంఖ్యలు ½ Mark

$$\sqrt{2} = \frac{a}{b} - \sqrt{3}$$

ఇరువైపులా వర్గం చేయగా

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

$$2 = \frac{a^2}{b^2} - 2\sqrt{3}\frac{a}{b} + 3$$

$$\frac{2a}{b}\sqrt{3} = \frac{a^2}{b^2} + 1$$

1Mark

4 Marks

$$\sqrt{3} = \frac{a^2+b^2}{b^2} \times \frac{b}{2a}$$

$$\sqrt{3} = \frac{a^2+b^2}{2ab}$$

a and మరియు b లు పరస్పర ప్రధాన సంఖ్యలు.

కావున, $\frac{a^2+b^2}{2ab}$ ఒక అకరణీయ సంఖ్య.

కావున, $\sqrt{3}$ అనేది కూడా అకరణీయ సంఖ్య అవుతుంది.

కానీ ఇది $\sqrt{3}$ కరణీయ సంఖ్య అను భావనకు విరుద్ధము.

$\therefore \sqrt{2} + \sqrt{3}$ అకరణీయ సంఖ్య అనుకోవడం తప్పు.

కావున $\sqrt{2} + \sqrt{3}$ ఒక కరణీయ సంఖ్య అవుతుంది.

2 Marks

29. b) దత్త శ్రేణి: 5, 11, 17, 23, _____

½ Mark

$$a_2 - a_1 = 11 - 5 = 6$$

$$a_3 - a_2 = 17 - 11 = 6$$

$$a_4 - a_3 = 23 - 17 = 6$$

పదాంతరము సమానం,

కావున ఇవ్వబడిన సంఖ్యలు అంకశ్రేణిలో ఉంటాయి.)

1½ Mark

ఇక్కడ, $a = 5, d = 6$

$$a_n = 301 \text{ అనుకొనుము}$$

2 marks

$$a + (n - 1)d = 301$$

$$5 + 6n - 6 = 301$$

$$6n = 302$$

$$n = \frac{302}{6} = \frac{151}{3} \text{ అనేది ధన పూర్ణ సంఖ్య కాదు.}$$

3 Marks

కావున 301 అనేది ఇవ్వబడిన జాబితాలో ఉండదు.

1 Mark

30. a) వెండి నాణెము (స్థూపము)

$$d = 1.75cm$$

$$\text{కావున, } r = \frac{d}{2} = \frac{1.75}{2} = \frac{175}{200} = \frac{7}{8}cm$$

$$h = 2mm = \frac{2}{10}cm = \frac{1}{5}cm$$

$$\therefore \text{స్థూపం ఘనపరిమాణం} = \pi r^2 h$$

$$= \frac{22}{7} \times \frac{7}{8} \times \frac{7}{8} \times \frac{1}{5} cm^3$$

1 Mark

2 Marks

దీర్ఘ ఘనం:

$$l = 5.5cm$$

$$b = 10 cm$$

$$h = 3.5 cm$$

1 Mark

$$\therefore \text{దీర్ఘ ఘనం ఘనపరిమాణం} = lbh$$

$$= 5.5 \times 10 \times 3.5$$

$$= 55 \times \frac{35}{10} cm^3$$

2 Marks

$$\text{కావలసిన వెండి నాణెముల సంఖ్య} = \frac{\text{దీర్ఘ ఘనం ఘనపరిమాణం}}{\text{స్థూపం ఘనపరిమాణం}}$$

$$= 55 \times \frac{35}{10} \times \frac{7}{22} \times \frac{8}{7} \times \frac{8}{7} \times 5$$

$$= 400$$

2 Marks

(OR)

b) నిలకడ నీటిలో పడవ వేగం = x kmph

ప్రవాహి వేగం = 3 kmph

1 Mark

ప్రవాహం వ్యతిరేఖ దిశలో పడవ వేగం = $x - 3$ kmph

ప్రవాహి దిశలో పడవ వేగం = $x + 3$ kmph

1Mark

$$\text{కాలం} = \frac{\text{దూరం}}{\text{వేగం}}$$

మొత్తం ప్రయాణానికి పట్టిన కాలం = 6 గం

1Mark

$$\text{కావున, } \frac{24}{x-3} + \frac{24}{x+3} = 6$$

1 Mark

$$24 \left[\frac{1}{x-3} + \frac{1}{x+3} \right] = 6$$

$$\frac{x+3+x-3}{x^2-9} = \frac{1}{4}$$

$$x^2 - 9 = 8x$$

1½ Marks

$$x^2 - 8x - 9 = 0$$

$$x^2 - 9x + 1x - 9 = 0$$

$$x(x - 9) + 1(x - 9) = 0$$

$$(x - 9)(x + 1) = 0$$

$$x - 9 = 0 \text{ or } x + 1 = 0$$

$$x = 9 \quad x = -1$$

1½ Marks

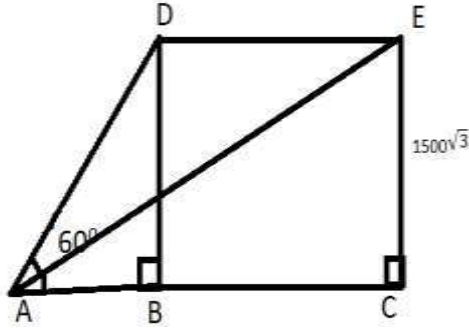
కానీ x ఋణ సంఖ్య కాకూడదు.

కావున, $x = 9$

∴ నిలకడ నీటిలో పడవ వేగం = 9kmph

1 Mark

31. a)



1 Mark

DE జెట్ విమానం 15 సెకన్లలో ప్రయాణించే దూరం
భూమి నుండి విమానం ఎత్తు $BD = CE = 1500\sqrt{3}$

$$\angle BAD = 60^\circ$$

$$\angle BAE = 30^\circ$$

1 Mark

BAD లంబకోణ త్రిభుజం నుండి

$$\tan 60^\circ = \frac{BD}{AB}$$

$$\sqrt{3} = \frac{1500\sqrt{3}}{AB}$$

$$AB = 1500\text{m}$$

2 Marks

ACE లంబకోణ త్రిభుజం నుండి

$$\tan 30^\circ = \frac{CE}{AC}$$

$$\frac{1}{\sqrt{3}} = \frac{1500\sqrt{3}}{AC}$$

$$AC = 1500 \times (\sqrt{3})^2$$

2 Marks

$$AC = 4500 \text{ m}$$

$$\begin{aligned} \therefore 15 \text{ సెకన్లలో విమానం ప్రయాణించిన దూరం} &= DE \\ &= BC \\ &= AC - AB \\ &= 4500 - 1500 \\ &= 3000\text{m} \end{aligned} \quad \left. \vphantom{\begin{aligned} \therefore 15 \text{ సెకన్లలో విమానం ప్రయాణించిన దూరం} \\ &= DE \\ &= BC \\ &= AC - AB \\ &= 4500 - 1500 \\ &= 3000\text{m} \end{aligned}} \right\} 1 \text{ Mark}$$

$$\begin{aligned} \text{విమాన వేగం} &= \frac{\text{దూరం}}{\text{కాలం}} \\ &= \frac{3000}{15} \\ &= 200\text{m/s} \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{విమాన వేగం} \\ &= \frac{\text{దూరం}}{\text{కాలం}} \\ &= \frac{3000}{15} \\ &= 200\text{m/s} \end{aligned}} \right\} 1 \text{ Mark}$$

(OR)

$$\text{b) మొత్తం పర్యవసానాల సంఖ్య} = 8 \quad 1 \text{ Mark}$$

$$\text{సంభావ్యత} = \frac{\text{అనుకూల పర్యవసానాల సంఖ్య}}{\text{మొత్తం పర్యవసానాల సంఖ్య}} \quad 1 \text{ Mark}$$

$$\begin{aligned} \text{i) బాణపు గుర్తు సూచించేది 7 కన్నా చిన్న సంఖ్య} \\ \text{అగుటకు అనుకూల పర్యవసానాల సంఖ్య} &= 6(1, 2, 3, 4, 5, 6) \\ \therefore \text{సంభావ్యత} &= \frac{6}{8} = \frac{3}{4} \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{i) బాణపు గుర్తు సూచించేది 7 కన్నా చిన్న సంఖ్య} \\ \text{అగుటకు అనుకూల పర్యవసానాల సంఖ్య} \\ &= 6(1, 2, 3, 4, 5, 6) \\ \therefore \text{సంభావ్యత} \\ &= \frac{6}{8} = \frac{3}{4} \end{aligned}} \right\} 1 \frac{1}{2} \text{ Mark}$$

$$\begin{aligned} \text{ii) బాణపు గుర్తు సూచించేది ఒక సంయుక్త} \\ \text{అగుటకు అనుకూల పర్యవసానాల సంఖ్య} &= 3(4, 6, 8) \\ \therefore \text{సంభావ్యత} &= \frac{3}{8} \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{ii) బాణపు గుర్తు సూచించేది ఒక సంయుక్త} \\ \text{అగుటకు అనుకూల పర్యవసానాల సంఖ్య} \\ &= 3(4, 6, 8) \\ \therefore \text{సంభావ్యత} \\ &= \frac{3}{8} \end{aligned}} \right\} 1 \frac{1}{2} \text{ Mark}$$

$$\begin{aligned} \text{iii) బాణపు గుర్తు సూచించేది 8 యొక్క కారణాంకం} \\ \text{అగుటకు అనుకూల పర్యవసానాల సంఖ్య} &= 4(1, 2, 4, 8) \\ \therefore \text{సంభావ్యత} &= \frac{4}{8} = \frac{1}{2} \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{iii) బాణపు గుర్తు సూచించేది 8 యొక్క కారణాంకం} \\ \text{అగుటకు అనుకూల పర్యవసానాల సంఖ్య} \\ &= 4(1, 2, 4, 8) \\ \therefore \text{సంభావ్యత} \\ &= \frac{4}{8} = \frac{1}{2} \end{aligned}} \right\} 1 \frac{1}{2} \text{ Mark}$$

$$\begin{aligned} \text{iv) బాణపు గుర్తు సూచించేది 3 యొక్క} \\ \text{గుణిజం అగుటకు అనుకూల పర్యవసానాల సంఖ్య} &= 2(3, 6) \\ \therefore \text{సంభావ్యత} &= \frac{2}{8} = \frac{1}{4} \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{iv) బాణపు గుర్తు సూచించేది 3 యొక్క} \\ \text{గుణిజం అగుటకు అనుకూల పర్యవసానాల సంఖ్య} \\ &= 2(3, 6) \\ \therefore \text{సంభావ్యత} \\ &= \frac{2}{8} = \frac{1}{4} \end{aligned}} \right\} 1 \frac{1}{2} \text{ Marks}$$

32. a)

<i>CI</i>	<i>f</i>	<i>Cf</i>
0-20	6	6
20-40	8	14
40-60	10	24
<i>l</i> 60-80	<i>12f</i>	36
80-100	6	42
100-120	5	47
120-140	3	50
	<i>n</i> = 50	

2 Marks

$\frac{n}{2} = \frac{50}{2} = 25$ అనేది తరగతి 60 – 80 సంచిత పౌనః పుణ్యం లో కలదు కావున 60-80 మధ్యగత తరగతి.

1 Mark

ఇక్కడ, $l = 60, f = 12, cf = 24, h = 20$

1 Mark

$$\begin{aligned} \therefore \text{మధ్యగతము} &= l + \left(\frac{\frac{n}{2}-cf}{f}\right) \times h \\ &= 60 + \left(\frac{25-24}{12}\right) \times 20 \\ &= 60 + 1.67 \\ &= 61.67 \text{ (దాదాపుగా)} \end{aligned}$$

1 Mark

1 Mark

2 Marks

(OR)

b) దత్తాంశము, $PQ = 24cm$

$PR = 7cm$

QR వృత్త వ్యాసము

కావున, $\angle QPR = 90^\circ$ (\because అర్థ వృత్తములోని కోణము)

1 Mark

షేడ్ చేయబడిన వృత్త ఖండ వైశాల్యము = అర్థ వృత్త వైశాల్యము – PQR త్రిభుజ వైశాల్యము 1 Mark

పైథాగరస్ సిద్ధాంతము ప్రకారము,

$$\begin{aligned} \Delta QPR, QR^2 &= PQ^2 + PR^2 \\ &= 24^2 + 7^2 \\ &= 625 \\ QR &= 25cm \end{aligned}$$

1 Mark

కావున, వృత్త వ్యాసార్థము = $\frac{QR}{2} = \frac{25}{2} cm$

1 Mark

$$\text{వృత్త వైశాల్యము} = \frac{1}{2} \pi r^2$$

$$\begin{aligned} &= \frac{1}{2} \times \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2} \\ &= 245.53cm^2 \end{aligned}$$

1½ Mark

QPR లంబకోణ త్రిభుజ వైశాల్యము,

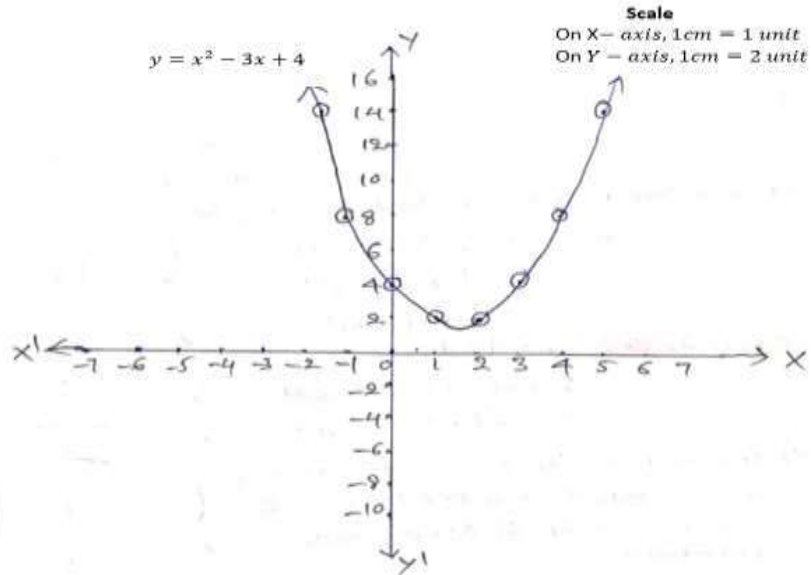
$$\begin{aligned} \text{QPR} &= \frac{1}{2} \times PQ \times PR \\ &= \frac{1}{2} \times 24 \times 7 \\ &= 84\text{cm}^2 \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{QPR} &= \frac{1}{2} \times PQ \times PR \\ &= \frac{1}{2} \times 24 \times 7 \\ &= 84\text{cm}^2 \end{aligned}} \right\} 1\frac{1}{2} \text{ Mark}$$

$$\begin{aligned} \therefore \text{షేడ్ చేయబడిన వృత్త ఖండ వైశాల్యము} &= 245.53 - 84 \\ &= 161.53\text{cm}^2 \end{aligned} \quad \left. \vphantom{\begin{aligned} \therefore \text{షేడ్ చేయబడిన వృత్త ఖండ వైశాల్యము} &= 245.53 - 84 \\ &= 161.53\text{cm}^2 \end{aligned}} \right\} 1 \text{ Mark}$$

33. a) $y = x^2 - 3x + 4$ పరావలయము X - అక్షాన్ని ఖండించిన బిందువుల x నిరూపకాలు $x^2 - 3x + 4$ బహుపదికి శూన్య విలువలు అవుతాయి. } 1Mark

x	-2	-1	0	1	2	3	4	5
x^2	4	1	0	1	4	9	16	25
$-3x$	6	3	0	-3	-6	-9	-12	-15
+4	+4	+4	+4	+4	+4	+4	+4	+4
y	14	8	4	2	2	4	8	14
(x, y)	(-2, 14)	(-1, 8)	(0, 4)	(1, 2)	(2, 2)	(3, 4)	(4, 8)	(5, 14)

2Marks



3Marks

పరావలయము X-అక్షాన్ని ఏ బిందువు వద్ద ఖండించడం లేదు.

కావున, $x^2 - 3x + 4$ బహుపదికి శూన్యాలు (వాస్తవ సంఖ్యలు) వుండవు.

} 1Mark

సరిచూచుట:

$$p(x) = x^2 - 3x + 4$$
$$ax^2 + bx + c \text{ తో పోల్చగా}$$
$$a = 1, b = -3, c = 4$$
$$\therefore \text{విచక్షని} = b^2 - 4ac$$

$$= (-3)^2 - 4 \cdot 1 \cdot 4$$
$$= 9 - 16$$
$$= -7$$

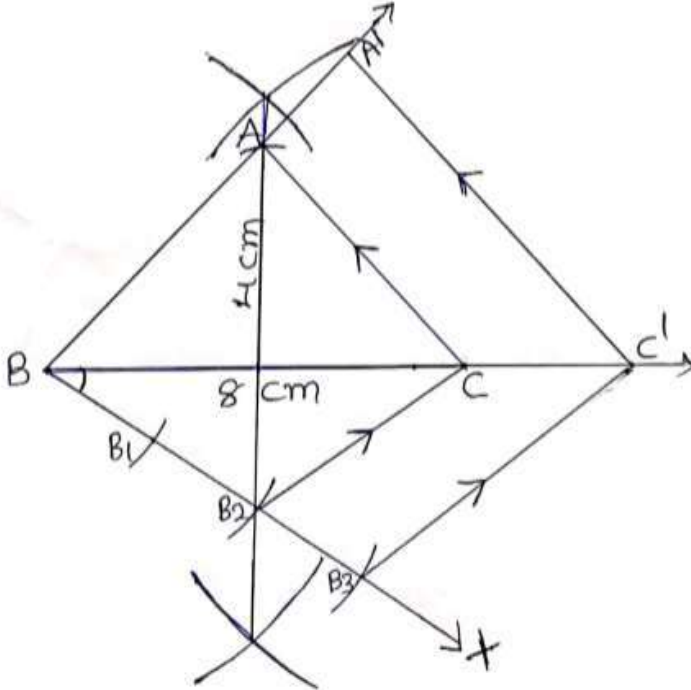
1 Mark

$\therefore \Delta < 0$ $x^2 - 3x + 4$ కావున కి శూన్య విలువలు ఉండవు. (వాస్తవాలు కాదు)

(OR)

b) నిర్మాణానికి క్రింది విధంగా మార్కులు ఇవ్వాలి.

- భూమి 8cm మరియు ఎత్తు 4cm గల సమద్విబాహు త్రిభుజం ABCని నిర్మించినందుకు -1 Marks
- B వద్ద $\angle CBX$ అల్ప కోణాన్ని గీచినందుకు 1 Mark
- $BB_1 = B_1B_2 = B_2B_3$ అయ్యేవిధంగా \rightarrow_{BX} పై B_1, B_2 మరియు B_3 లను గుర్తించినందుకు 1 Mark
- B_2C ని కలిపినందుకు 1 Mark
- B_2C కి సమాంతరంగా B_3C' మరియు CA కి సమాంతరంగా $C'A'$ రేఖలు గీచినందుకు 1 Mark
- $\Delta ABC \sim \Delta A'B'C'$ 1 Mark
- నిర్మాణ క్రమము రాసినందుకు 2 Marks



Prepared by Sri Venkata Ramana, SA Maths, ZPHS- Penagalur, Kadapa-YSR Dist.

SSC PUBLIC EXAMINATIONS: JULY – 2020

DISTRICT COMMON EXAMINATION BOARD, KADAPA – YSR Dist.

03-06-2020

MATHEMATICS – PAPER I & II

Time: 3Hrs. 15Mini

Max. Marks: 100Marks

Instructions:

1. Answer all the questions in a separate answer booklet.
2. The question paper consists of 4 sections and 33 questions.
3. There is internal choice in Section - IV.
4. Write answers neatly and legibly.

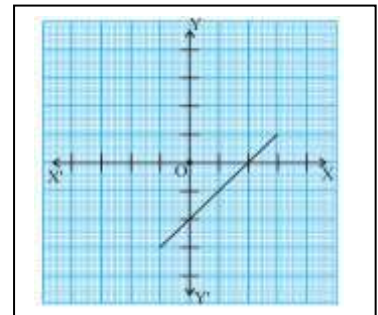
SECTION – I

Note: 1. Answer all the Questions in one WORD or PHRASE.

2. Each Question carries $\frac{1}{2}$ Mark.

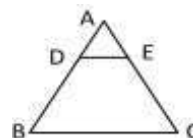
12X1=12

1. Find the value of $\log_{10} 0.001$.
2. Which of the following is not a 3 – D figure.
A) Sphere B) Circle C) Cone D) Cube
3. Find the discriminant of the equation $2x^2 - 4x + 3 = 0$ and write the nature of its roots.
4. Write the roster form of the set $A = \{x / -3 \leq x < 3 \text{ and } x \in Z\}$
5. The number of solutions of a pair of inconsistent equation is _____
6. Write the number of Zeroes of the polynomial represented by the adjacent graph.



7. if $\tan 2A = \cot(A - 18^\circ)$, where $2A$ is an acute angle, Find the value of A .

8. In the adjacent triangle ABC , $AD=2.4\text{cm}$, $DB=7.2\text{cm}$,
 $AE=1.8\text{cm}$ and $EC=5.4\text{cm}$



Then verify whether $DE \parallel BC$ or not.

9. Choosing the correct answer satisfying the following statements.

Statement (A): Any two congruent figures are similar.

Statement (B): Any two similar figures are congruent.

- | | |
|----------------------------|-----------------------------|
| i) both A and B are true | ii) A is true, B is false |
| iii) A is false, B is true | iv) Both A and B are false. |

10. Find the slope of the line joining the two points $(\sin 0^\circ, \tan 0^\circ)$ and $(\cos 45^\circ, \sin 45^\circ)$

11. Match the following

Group –A

i) $\sin^2 \theta \cdot \operatorname{cosec}^2 \theta$

ii) $\tan^2 \theta - \sec^2 \theta$

iii) $\cos 27^\circ - \sin 63^\circ$

A) i-b, ii-a, iii-c

B) i-b, ii-c, iii-a

Group- B

a) -1

b) 0

c) 1

C) i-c, ii-a, iii-b

D) i-c, ii-b, iii-a

12. Find the probability of drawing out a red queen from a well shuffled deck of 52 cards.

SECTION – II

Note: 1. Answer all the Questions.

2. Each Question carries 12 Marks.

8X2=16

13. Find the HCF of 300 and 550 by using Euclid's division algorithm.

14. Find x so that $x, x + 2, x + 6$ are consecutive terms of a G.P.

15. Find the volume of right circular cone with radius 6cm and height 7cm.

16. Find the number of subsets of the set $F = \{a, b, c\}$ and list all the subsets of F.

17. Prove that $2\cos^2 \theta + \frac{2}{(1+\cot^2 \theta)} = 2$.

18. Define centroid and write the formula to find centroid.

19. In what ratio does the point P(-1, 6) divide the line segment joining the points (-3, 10) and (6, -8)

20. An observer of height 1.8m is 13.2m away from a palm tree the angle of elevation of the top of the tree from his eyes is 45° . Draw diagram for these data.

SECTION – III

Note: 1. Answer all the Questions.

2. Each Question carries 4 Marks.

8X4=32

21. If $A = \{1, 2, 3, 4, 5\}$ and $B = \{1, 3, 5, 7, 9\}$ then find $A \cup B, A \cap B, A - B$ and $B - A$.

22. Find the zeroes of the quadratic polynomial $x^2 - 3x - 10$ and verify the relationship between zeroes and coefficients.

23. Draw the graph of $3x + 4y = 12$ in a plane paper.

24. Rubina went to a bank to withdraw ₹2000. She asked the cashier to give the cash in ₹50 and ₹100 notes only. Rubina got 25 notes in all. Can you tell how many notes of ₹50 and ₹100 she received?

25. Can you draw a triangle with vertices (1, 5), (5, 8) and (13, 14)? Give reason.

26. Prepare less than cumulative frequency and more than cumulative frequency distributions.

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	5	15	20	23	17	11	9

27. If $3\tan A = 4$ then find $\sin A$ and $\cos A$.

28. Two poles of heights 6m and 11m stand on a plane ground. If the distance between the feet of the poles is 12m. Find the distance between their tops.

SECTION – IV

Note: 1. Answer all the Questions.

2. Each Question carries 8 Marks.

3. There is an internal choice for each question.

5X8=40

29. a) Prove that $\sqrt{2} + \sqrt{3}$ is irrational.

(OR)

b) Check whether 301 is a term of the list of numbers 5, 11, 17, 23,

30. a) How many silver coins, 1.75cm in diameter and thickness 2mm., need to be melted to form a cuboid of dimensions 5.5 cm X 10 cm X 3.5 cm?

(OR)

b) A motor boat heads upstream a distance of 24Km on a river whose current is running at 3Km per hour. The trip up and back takes 6 hours. Assuming that the motor boat maintained a constant speed, what was its speed?

31. a) The angle of elevation of a jet plane from a point A on the ground is 60° . After a flight of 15 seconds, the angle of elevation changes to 30° . If the jet plane is flying at a constant height of $1500\sqrt{3}$ meter, find the speed of the jet plane. ($\sqrt{3} = 1.732$)

(OR)

b) A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 (see figure), and these are equally likely out comes.

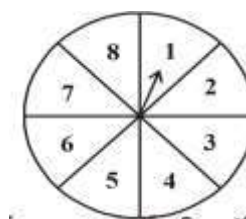
What is the probability that it will point at

i) a number less than 7?

ii) a composite number?

iii) a factor of 8?

iv) a multiple of 3?

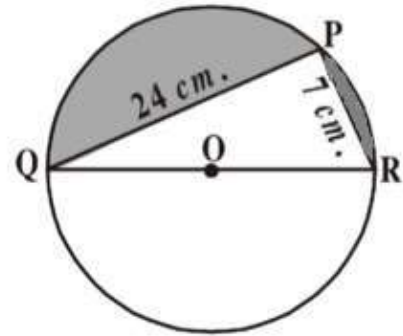


32. a) Find Median of the following data.

Class Interval	0-20	20-40	40-60	60-80	80-100	100-120	120-140
Frequency	6	8	10	12	6	5	3

(OR)

- b) Find the area of the segments shaded in the figure, if $PQ = 24$ cm, $PR = 7$ cm and QR is the diameter of the circle with centre O (Take $\pi = \frac{22}{7}$)



33. a) Draw the graph of $P(x) = x^2 - 3x + 4$ and find the zeroes. Justify the answer.
(OR)
b) Construct an isosceles triangle whose base is 8cm and altitude is 4cm. Then, draw another triangle whose sides are $1\frac{1}{2}$ times the corresponding sides of the isosceles triangle.

Prepared by **Sri D. Venkata Ramana**, SA Maths, ZPHS- Penagalur, Kadapa-YSR Dist.

SSC PUBLIC EXAMINATIONS: JULY – 2020

DISTRICT COMMON EXAMINATION BOARD, KADAPA – YSR Dist.

03-06-2020

MATHEMATICS – PAPER I & II

Time: 3Hrs. 15Mini

Max. Marks: 100Marks

Instructions:

1. అన్ని ప్రశ్నలకు సమాధానములు ప్రత్యేక బుక్లెట్లో మాత్రమే రాయాలి.
2. ప్రశ్న పత్రంలో నాలుగు విభాగాలు మరియు 33 ప్రశ్నలు ఉండును.
3. విభాగం - IV లో అంతర్గత ఎంపిక కలదు.
4. సమాధానములు స్పష్టంగా రాయాలి.

SECTION – I

సూచనలు: 1. క్రింద ఇవ్వబడిన అన్ని ప్రశ్నలకు ఒక పదం లేదా మాటలో జవాబులు రాయండి.

2. ప్రతి ప్రశ్నకు 1 మార్కు

3. ఏదైనా ప్రశ్నకు జవాబు ఒకటి కంటే ఎక్కువసార్లు రాసినచో, మొదటిసారి రాసిన జవాబును మాత్రమే పరిగణలోకి తీసుకొనబడును. 12X1=12

1. $\log_{10} 0.001$ విలువను కనుగొనండి.

2. క్రింది వానిలో త్రి పరిమాణ పటం కానిది.

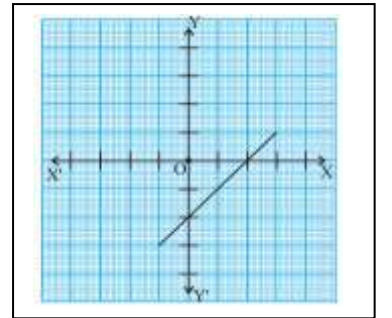
- A) గోళము B) వృత్తము C) శంఖువు D) సమఘనము

3. $2x^2 - 4x + 3 = 0$ వర్గ సమీకరణం యొక్క విచక్షణి కనుగొనండి. మూలాల స్వభావం రాయండి.

4. సమితి $A = \{x/-3 \leq x < 3 \text{ మరియు } x \in Z\}$ యొక్క రోస్టర్ రూపం ను రాయండి.

5. అసంగత సమీకరణాల జతకి గల సాధనల సంఖ్య _____

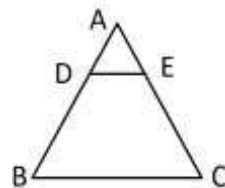
6. ప్రక్క రేఖా చిత్రం సూచించే బహుపది యొక్క శూన్యాల సంఖ్యను రాయండి.



7. $\tan 2A = \cot(A - 18^\circ)$, $2A$ లఘుకోణం అయిన, A విలువ కనుక్కోండి.

8. ప్రక్క త్రిభుజం ABC లో $AD=2.4\text{cm}$, $DB=7.2\text{cm}$, $AE=1.8\text{cm}$ మరియు $EC=5.4\text{cm}$

అయిన, $DE \parallel BC$ అవుతుందో, కాదో సరిచూడండి.



9. క్రింది ప్రవచనాలను తృప్తి పరచు జవాబును ఎన్నుకొనుము.

ప్రవచనం(A): ఏ రెండు సర్వ సమాన పటాలు అయిన సరూపాలు.

ప్రవచనం(B): ఏ రెండు సరూప పటాలు అయిన సర్వ సమానాలు.

i) A మరియు B రెండూ సత్యము

ii) A సత్యము, B అసత్యము

iii) A అసత్యము, B సత్యము

iv) A మరియు B రెండూ అసత్యము

10. $(\sin 0^\circ, \tan 0^\circ)$ మరియు $(\cos 45^\circ, \sin 45^\circ)$ బిందువులను కలిపే రేఖ వాలును కనుగొనుము.

11. జతపరుచుము.

Group - A

Group - B

i) $\sin^2 \theta \cdot \operatorname{cosec}^2 \theta$

a) -1

ii) $\tan^2 \theta - \sec^2 \theta$

b) 0

iii) $\cos 27^\circ - \sin 63^\circ$

c) 1

A) i-b, ii-a, iii-c

B) i-b, ii-c, iii-a

C) i-c, ii-a, iii-b

D) i-c, ii-b, iii-a

12. ఒక పేక ముక్కల కట్ట (52) నుండి ఎరుపు రంగు రాణిని తీయు సంభావ్యత ఎంత?

SECTION - II

సూచనలు: 1. అన్ని ప్రశ్నలకు జవాబులు రాయండి.

2. ప్రతి ప్రశ్నకు 2 మార్కులు.

8X2=16

13. యూక్లిడ్ భాగహార న్యాయాన్ని ఉపయోగించి 300 మరియు 550 ల గ.సా.భా ను కనుగొనుము.

14. x , $x + 2$, $x + 6$ లు ఒక గుణ శ్రేణిలో మూడు వరుస పదాలైన x విలువను కనుగొనుము?

15. 6cm భూవ్యాసార్థము, 7cm ఎత్తు కలిగిన క్రమ వృత్తాకార శంఖువు యొక్క ఘనపరిమాణమును కనుక్కోండి?

16. $F = \{a, b, c\}$ సమితి యొక్క ఉపసమితుల సంఖ్యను కనుగొనుము మరియు F యొక్క ఉపసమితులన్నింటి జాబితాను రాయండి.

17. నిరూపించుము. $2\cos^2 \theta + \frac{2}{(1+\cot^2 \theta)} = 2$.

18. గురుత్వ కేంద్రాన్ని నిర్వచించుము మరియు గురుత్వకేంద్రను కనుగొను సూత్రం రాయుము.

19. P(-1, 6) బిందువు (-3, 10) మరియు (6, -8) బిందువులను కలిపే రేఖా ఖండాన్ని ఏ నిష్పత్తిలో విభజిస్తుంది.

20. 1.8 మీ ఎత్తు ఉన్న ఒక పరిశీలకుడు ఒక తాటి చెట్టు నుండి 13.2 మీటర్ల దూరంలో ఉన్నాడు. ఆ చెట్టు పై కొన పరిశీలకుడి కంటి నుండి 45° ఊర్ధ్వ కోణం చేస్తుంది. ఈ దత్తాంశానికి సరిపడు పటాన్ని గీయండి.

SECTION - III

సూచనలు: 1. అన్ని ప్రశ్నలకు జవాబులు రాయండి.

2. ప్రతి ప్రశ్నకు 4 మార్కులు.

8X4=32

21. $A = \{1, 2, 3, 4, 5\}$ మరియు $B = \{1, 3, 5, 7, 9\}$ అయిన,

$A \cup B$, $A \cap B$, $A - B$ మరియు $B - A$ లను కనుగొనుము.

22. $x^2 - 3x - 10$ వర్గ బహుపది యొక్క శూన్యాలను కనుగొనండి మరియు శూన్యాలకు, గుణకాలకు మధ్య గల సంబంధాన్ని సరిచూడండి.
23. తెల్ల కాగితం పై X మరియు Y అక్షాలను తీసుకోవడం ద్వారా $3x + 4y = 12$ యొక్క రేఖా చిత్రాన్ని గీయుము.
24. రుబీనా బ్యాంకు నుండి ₹2000 తీసుకొనదలచినది. ఆ క్యాషియర్ను ఆ మొత్తానికి ₹ 50 మరియు ₹ 100 నోట్లు మాత్రమే ఈయమని కోరినది. మొత్తము ఆమెకు 25 నోట్లు వచ్చిన, ఆమెకు ఎన్ని ₹ 50 నోట్లు, ఎన్ని ₹ 100 నోట్లు వచ్చినవో చెప్పగలరా?
25. బిందువులు (1, 5), (5, 8) మరియు (13,14) లతో త్రిభుజమును గీయగలమా? కారణం తెలపండి.
26. క్రింద ఇవ్వబడిన దత్తాంశానికి ఆరోహణ సంచిత మరియు అవరోహణ సంచిత పౌనః పున్య పట్టికలను తయారు చేయండి.

తరగతి అంతరం	0-10	10-20	20-30	30-40	40-50	50-60	60-70
పౌనః పున్యం	5	15	20	23	17	11	9

27. $3\tan A = 4$ అయిన $\sin A$ మరియు $\cos A$ లను కనుగొనుము.
28. 6మీ మరియు 11 మీటర్ల పొడవు గల స్థంబాలు ఒక చదునైన నేలపై కలవు. నేలపై ఆ రెండు స్థంబాల అడుగు భాగాల మధ్య దూరము 12మీ అయిన, ఆ రెండు స్థంబాల పై భాగముల మధ్య దూరమెంత?

SECTION – IV

సూచనలు: 1. అన్ని ప్రశ్నలకు జవాబులు రాయండి.

2. ప్రతి ప్రశ్నకు 8మార్కులు.

3. ప్రతి ప్రశ్నకు అంతర్గత ఎంపిక కలదు.

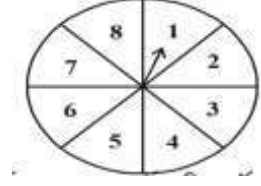
5X8=40

29. a) $\sqrt{2} + \sqrt{3}$ అనేది ఒక కరణీయ సంఖ్య అని నిరూపించండి.
- (OR)
- b) 5, 11, 17, 23, జాబితా లో 301 ఉంటుందో లేదో కనుగొనుము?
30. a) 5.5 సెం.మీ X 10 సెం.మీ X 3.5 సెం.మీ కొలతలు కలిగిన దీర్ఘ ఘనముగా మార్చడానికి 1.75 సెం.మీ వ్యాసము, 2మి.మీ మందము కలిగిన ఎన్ని వెండి నాణెములు అవసరమవుతాయి?
- (OR)
- b) గంటకు 3కి. మీ వేగంతో ప్రయాణిస్తున్న ఒక నదిలో ఒక మోటారు బోటు 24కి.మీ దూరమును ప్రయాణించి తిరిగి బయలుదేరిన స్థానానికి రావడానికి పట్టిన కాలం 6 గంటలైన బోటు స్థిర వేగంతో ప్రయాణించినదని భావించి దాని వేగమును కనుగొనుము?
31. a) భూమి పై నున్న A బిందువు నుండి ఒక జెట్ విమానాన్ని పరిశీలిస్తే 60° ఊర్ధ్వకోణం చేస్తుంది. 15 సెకన్ల తర్వాత దాని ఊర్ధ్వకోణం 30° గా మారుతుంది. ఆ జెట్ విమానం $1500\sqrt{3}$ మీటర్ల స్థిర ఎత్తులో ఎగురుతూ ఉంటే దాని వేగాన్ని కనుక్కోండి. ($\sqrt{3} = 1.732$)

(OR)

b) ఒక ఆట నందు వేగంగా త్రిప్పబడిన బాణపు గుర్తు పటములో చూపబడినట్లు 1, 2, 3, 4, 5, 6, 7 లేక 8 ని సూచిస్తూ ఆగుతుంది. అన్ని పర్యవసానములు సమ సంభవములైతే క్రింది ఘటనల సంభావ్యతలు లెక్కించండి. బాణపు గుర్తు సూచించేది,

- i) 7 కన్నా చిన్న సంఖ్య? ii) సంయుక్త సంఖ్య
iii) 8యొక్క కారణాంకము? iv) 3యొక్క గుణిజము?



32. a) క్రింది దత్తాంశము యొక్క మధ్య గతాన్ని కనుక్కోండి.

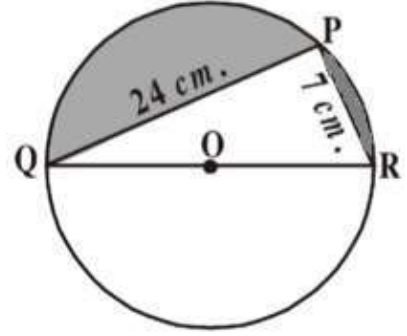
తరగతి అంతరం	0-20	20-40	40-60	60-80	80-100	100-120	120-140
పౌనః పున్యం	6	8	10	12	6	5	3

(OR)

b) ప్రక్క పటంలో O కేంద్రంగా వృత్తములో
PQ = 24 సెం.మీ, PR = 7 సెం.మీ
మరియు వ్యాసము QR అని ఇవ్వబడినది.

షేడ్ చేయబడిన వృత్త ఖండము

వైశాల్యము కనుగొనుము. ($\pi = \frac{22}{7}$ తీసుకోండి)



33. a) $P(x) = x^2 - 3x + 4$ రేఖాచిత్రాన్ని గీచి, శూన్యాలను కనుగొనండి. ఫలితాన్ని సమర్థించండి.

(OR)

b) భూమి 8 సెం.మీ మరియు దానికి గీచిన లంబము 4 సెం.మీ ఉండునట్లు ఒక సమద్విబాహు త్రిభుజంను గీయండి. ఆ త్రిభుజ భుజాలకు $1\frac{1}{2}$ రెట్లు అనురూప భుజాల పొడవులు కలిగి ఇచ్చిన త్రిభుజానికి సరూపంగా ఉండేట్లు వేరొక త్రిభుజాన్ని నిర్మించండి.

Prepared by Sri D. Venkata Ramana, SA Maths, ZPHS- Penagaluru, Kadapa-YSR Dist.

S.R. RAPID TEST - 2

CLASS - 10 (EM)

MATHEMATICS

TEST - 2

Time : 3.15 Hrs.

PAPER - I & II

Max. Marks : 100

Instructions :

1. Answer all the questions.
2. The question paper consists of 4 sections and 33 questions.
3. There is an internal choice in section - IV.
4. Write answers neatly and legibly.

SECTION - I

Note: i) Answer all the questions in one word or phrase.

ii) Each question carries 1 mark.

12 × 1 = 12 M

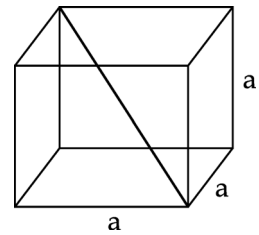
1. If α, β are the zeroes of polynomial $ax^2 + bx + c$ then find $\frac{1}{\alpha} + \frac{1}{\beta}$.

2. **Statement (A)** : To calculate the quantity of milk inside a bottle we need to find out its area.

Statement (B) : Length of the dark line (diagonal of a cube) given in the diagram is $\sqrt{3}a$

- i) Both A and B are true ii) A is true, B is false
iii) A is false, B is true iv) Both A and B are false

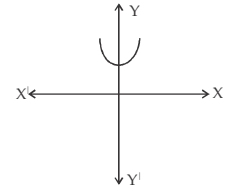
3. Find the 10th term of the series $\frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \dots$



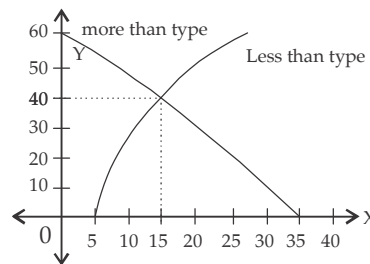
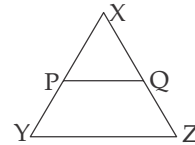
4. Match the following.

- | | |
|--|---------------------------|
| A) $\{x : x \text{ is a multiple of } 2\}$ | i) Empty set |
| B) $\{x : x \in \mathbb{N} \text{ and } x < 1\}$ | ii) Singleton set |
| C) $\{x : x \text{ is a even prime}\}$ | iii) Infinite set |
| a) A - i, B - ii, C - iii | b) A - iii, B - i, C - ii |
| c) A - ii, B - i, C - iii | d) A - iii, B - ii, C - i |

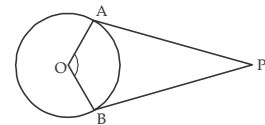
5. If $x + y = 6$, $x - y = 10$ then find 'y'.
6. Write the number of zeroes that can be identified from adjacent figure ?



7. In the given figure, P, Q are the mid points of sides XY and XZ, what is the relation between PQ and YZ.
8. From the Ogive curve what is the value of median ?



9. Find the angle made by the minute hand in a clock during a period of 20 minutes.
10. Define an angle of depression. Draw an angle of depression.
11. In the given figure $\angle APB = 80^\circ$ then find $\angle AOB$.



12. Which of the following is the modal class for the following data ?

C.I	0 - 10	10-20	20-30	30-40	40-50
f	7	13	25	3	2

SECTION - II

Note : i) Answer all the questions.

ii) Each question carries 2 marks.

8 × 2 = 16 M

13. If $A = \left\{ 1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25} \right\}$, then write 'A' in set - builder form.
14. For what value of 'k', the pair of linear equations $2x - ky + 3 = 0$, $4x + 6y - 5 = 0$ represent parallel lines ?
15. Find the sum and product of roots of the quadratic equation $x^2 - 4\sqrt{3}x + 9 = 0$.
16. Find the maximum length of a pencil that can be kept in a rectangular box of dimensions 8 cm × 6 cm × 2 cm.

17. Find the value of $\sin^2 30^\circ + \cos^2 60^\circ$.
18. A three digit number is formed by the digits 2, 3 and 5 without repetition. What is the probability that the number is divisible by 5 ?
19. Calculate the length of tangent from a point 15 cm away from the centre of a circle of radius 9 cm.
20. If a die is rolled once, what is the probability of getting a prime number?

SECTION - III

Note: i) Answer all the questions.

ii) Each question carries 4 marks.

8 × 4 = 32 M

21. Find the roots of the quadratic equation $(3x - 2)^2 - 4(3x - 2) + 3 = 0$.
22. Is the pair of linear equations $3x - y = 40$, $4x - 2y = 50$ consistent or inconsistent? Why?
23. Find the 20th term from the end of the A.P : 3, 8, 13,253.
24. Find the volume and surface area of a sphere of radius 2.1 cm.
25. Verify whether the following points are collinear or not. (1, -1), (4, 1), (-2, -3).
26. A box contains 100 red cards, 200 yellow cards and 50 blue cards. If a card is drawn at random from the box, then find the probability that it will be
(i) a blue card, (ii) not a yellow card.
27. If a circle touches all the four sides of a quadrilateral ABCD at points PQRS, then prove that $AB + CD = BC + DA$.
28. PQR is a triangle right angled at P and M is a point on QR such that $PM \perp QR$. Show that $PM^2 = QM \cdot MR$.

SECTION - IV

Note: i) Answer all the questions.

ii) Each question carries 8 marks.

iii) There is an internal choice for each question.

5 × 8 = 40 M

29. Solve the equations $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$ and $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$.

(OR)

Two cubes each of volume 216 cm^3 are joined end to end together. Find the total surface area of the resulting cuboid.

30. An A.P. has 21 terms. The sum of 10th, 11th, 12th terms is 129. The sum of the last 3 terms is 237, then find the A.P.

(OR)

Solve the quadratic equation $9x^2 - 9x + 2 = 0$ by the method of completing the square.

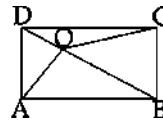
31. i) Show that $\sec^2 \theta + \operatorname{cosec}^2 \theta = \sec^2 \theta \cdot \operatorname{cosec}^2 \theta$.

ii) Prove that $\sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} = \operatorname{cosec} \theta + \cot \theta$.

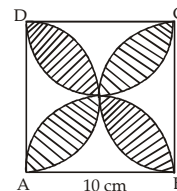
(OR)

If 'O' is any point inside the rectangle ABCD,

prove that $OB^2 + OD^2 = OA^2 + OC^2$.



32. Find the area of the shaded region in figure, where ABCD is a square of side 10 cm. and semicircles are drawn with each side of the square as diameter (use $\pi = 3.14$)



(OR)

Prove that the points $(-7, -3)$, $(5, 10)$, $(15, 8)$ and $(3, -5)$ taken in order are the corners of a parallelogram.

33. Draw the graph of polynomial $p(x) = x^2 - 3x + 2$ and find its zeroes from the graph.

(OR)

Draw two tangents to a circle of radius 2.5 cm, from a point 'P' at a distance of 7 cm from its centre.



MODEL PAPER



MATHEMATICS (E.M.)

Time : 3.15 Hrs

PAPER I & II

Max. Marks : 100

- Instructions :**
- 15 minutes are allotted for reading the question paper in addition to 3.00 hours for writing the answers.
 - All answers should be written in the separate answer booklet.
 - There are four sections in the questions.
 - There is internal choice in Section-IV.
 - Write answers should be visible and legibly.

Section I

Note: 1. Answer all the questions.

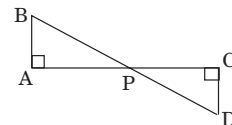
2. Each question carries 1 mark.

(12 × 1 = 12)

- What is the nature of the roots of $x^2 - 4x + 5 = 0$.
- Write the short form of $8^{-1/3}$.
- In a pair of linear equations in two variables, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ then what type of lines do you get ?
- Statement : A linear equation is given by $\frac{x+y}{xy} = 6$.

Write an equivalent linear equation in two variables x and y from the above data.

- If $a_1 = 3$ and $a_3 = 27$ are in G.P. then what is the common ratio ?
- If the discriminant of the equation $2x^2 - kx - 4 = 0$ is 64, then find k .
- From the adjacent figure $\triangle ABP$, $\triangle CPD$ are formed at the intersection point of the line segments AC and BD. How do they represent each other ?
- What is the value of $\sin 17^\circ \cos 13^\circ + \cos 17^\circ \sin 13^\circ$?
- Find the slope of (2, 3) and (4, 5).
- Find the Mean of 144, 145, 147, 148, 149, 151, 152, 154, 155, 160.
- Which of the following is true ?
(A) $0 \leq P(E) \leq 1$ (B) $P(E) > 1$ (C) $P(E) < 0$ (D) $P(E) < 1$
- Draw a figure of two internally touching circles and a tangent.



Section II

Note: 1. Answer all the questions.

2. Each question carries 2 marks.

(8 × 2 = 16)

13. If $a_1 = -4$, $a_6 = 6$, find d .
14. A right circular cylinder has base radius 14 cm and height 21 cm. Find curved surface area.
15. Cost of mathematics text book is Rs. 10 less than twice of cost of English text book. Write this in linear equation.
16. Surface area of sphere and cube are equal. Then find the ratio of their volumes.
17. Find the area of sector whose radius is 7 cm and angle be 60° .
18. Find the distance between the points (0, 0) and (36, 15).
19. If $\tan 2A = \cot (A - 18^\circ)$, where $2A$ is an acute angle, find the value of A .
20. A boat crosses the river by making 60° angle with the bank of river and travels a distance of 600 m to reach another side of river. Find the width of river.

Section III

Note: 1. Answer all the questions.

2. Each question carries 4 marks.

(8 × 4 = 32)

21. Find the volume and surface area of a sphere of radius 2.1 cm.
22. Expand $\log \frac{p^2q^3}{r}$
23. The sum of the numerator and denominator of a fraction is 12. If the denominator is increased by 3, the fraction becomes $\frac{1}{2}$. Find the fraction.
24. A cone of height 24 cm and radius of base 6 cm is made up of modeling clay. A child reshapes it into a sphere. Find the radius of the sphere.
25. If $\cos A = \frac{12}{13}$, find $\sin A$ and $\tan A$.
26. Prove that $\sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sec A + \tan A$.
27. Find a point on Y-axis which is equidistant from both the points A (6, 5), B (-4, 3).
28. In a circle with centre 'O', $OD \perp BC$ where BC is a chord. Then show that $AC = 2 OD$.

Section IV

Note: 1. Answer all the questions.

2. Each question carries 8 marks.

3. There is internal choice for each question.

(5 × 8 = 40)

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

(Or)

- (b) A hemispherical bowl of internal radius 15 cm contains a liquid. The liquid is to be filled into cylindrical bottles of diameter 5 cm and height 6 cm. How many bottles are necessary to empty the bowl ?

30.(a) State which of the following sets are finite and which are infinite. Give reasons.

(i) $A = \{x : x \in \mathbb{N} \text{ and } x < 100\}$, $B = \{x : x \in \mathbb{N} \text{ and } x \leq 5\}$

(ii) $C = \{1^2, 2^2, 3^2, \dots\}$, $D = \{1, 2, 3, 4\}$

(Or)

- (b) The difference of squares of two numbers is 180. The square of the smaller number is 8 times the larger number. Find the two numbers.

31.(a) The given distribution shows the number of runs scored by some top batsmen of the world in one-day international cricket matches.

Runs	3000 - 4000	4000 - 5000	5000 - 6000	6000 - 7000	7000 - 8000	8000 - 9000	9000 - 10000	10000 - 11000
Number of batsmen	4	18	9	7	6	3	1	1

Find the mode of the data.

(Or)

- (b) Two concentric circles with radii 5 cm and 3 cm are drawn. Find the length of the chord of the larger circle which touches the smaller circle.

32.(a) Find the area of triangle formed by the points $(8, -5)$, $(-2, -7)$ and $(5, 1)$ by using Herone's formula.

(Or)

- (b) State and prove Basic Proportionality Theorem.

33.(a) Draw the graph of $P(x) = x^2 - x - 12$ and find zeroes. Justify your answer.

(Or)

- (b) The following distribution gives the daily income of 50 workers of a factory.

Daily income (in Rupees)	250-300	300-350	350-400	400-450	450-500
Number of workers	12	14	8	6	10

Convert the above Distribution to a more than type cumulative frequency distribution and draw its ogive.

ANSWERS

Section I

1. What is the nature of the roots of $x^2 - 4x + 5 = 0$.

Solution :

Imaginary

2. Write the short form of $8^{-1/3}$.

Solution :

$$\frac{1}{2}$$

3. In a pair of linear equations in two variables, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ then what type of lines do you get ?

Solution :

coincident

4. Statement : A linear equation is given by $\frac{x+y}{xy} = 6$.

Write an equivalent linear equation in two variables x and y from the above data.

Solution :

$$\frac{1}{x} + \frac{1}{y} = 6$$

5. If $a_1 = 3$ and $a_3 = 27$ are in G.P. then what is the common ratio ?

Solution :

$$\pm 3$$

6. If the discriminant of the equation $2x^2 - kx - 4 = 0$ is 64, then find k .

Solution :

$$\text{Discriminant } \Delta = b^2 - 4ac.$$

$$a = 2, b = -k, c = -4.$$

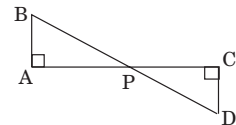
$$(-k)^2 - 4(2)(-4) = 64 \text{ (given)}$$

$$k^2 + 32 = 64$$

$$k^2 = 64 - 32 = 32$$

$$k = \sqrt{32} = \sqrt{16 \times 2} = \pm 4\sqrt{2}.$$

7. From the adjacent figure ΔABP , ΔCPD are formed at the intersection point of the line segments AC and BD . How do they represent each other ?



Solution :

Similar.

8. What is the value of $\sin 17^\circ \cos 13^\circ + \cos 17^\circ \sin 13^\circ$?

Solution :

$$\frac{1}{2} \quad (\because \sin A \cos B + \cos A \sin B = \sin (A + B))$$

9. Find the slope of (2, 3) and (4, 5).

Solution :

$$1 \quad \left(\because \frac{5-3}{4-2} = \frac{2}{2} \right)$$

10. Find the Mean of 144, 145, 147, 148, 149, 151, 152, 154, 155, 160.

Solution :

$$150.5 \quad \left(\because \frac{144 + 145 + 147 + 148 + 149 + 151 + 152 + 154 + 155 + 160}{10} \right)$$

11. Which of the following is true ?

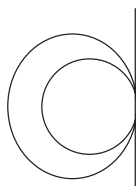
(A) $0 \leq P(E) \leq 1$ (B) $P(E) > 1$ (C) $P(E) < 0$ (D) $P(E) < 1$

Solution :

(A) $0 \leq P(E) \leq 1$.

12. Draw a figure of two internally touching circles and a tangent.

Solution :



Section II

13. If $a_1 = -4$, $a_6 = 6$, find d .

Solution :

$$\begin{aligned} a_1 &= -4 \\ a_6 &= a + 5d = 6 \\ -4 + 5d &= 6 \\ 5d &= 6 + 4 = 10 \\ d &= \frac{10}{5} = 2 \\ \therefore d &= 2 \end{aligned}$$

14. A right circular cylinder has base radius 14 cm and height 21 cm. Find curved surface area.

Solution :

Radius = $r = 14$ cm

Height = $h = 21$ cm

C.S.A of right circular cylinder = $2\pi rh$

$$\begin{aligned} &= 2 \times \frac{22}{7} \times 14 \times 21 \\ &= 44 \times 2 \times 21 = 1848 \text{ cm}^2 \end{aligned}$$

- 15. Cost of mathematics text book is Rs. 10 less than twice of cost of English text book. Write this in linear equation.**

Solution :

Let the cost of English text book = Rs. x

Twice of it = $2x$.

Rs. 10/- less to above = $2x - 10$

Then cost of Maths text book : $y = 2x - 10$ is the required linear equation.

- 16. Surface area of sphere and cube are equal. Then find the ratio of their volumes.**

Solution :

Surface area of sphere = TSA of cube.

So, $4\pi r^2 = 6a^2$

$$4 \times \frac{22}{7} \times r^2 = 6a^2$$

$$\frac{r^2}{a^2} = \frac{21}{44}$$

$$\frac{r}{a} = \sqrt{\frac{21}{44}}$$

$$r = \sqrt{\frac{21}{44}} a$$

$$a = r \cdot \sqrt{\frac{44}{21}}$$

Volume of the cube = a^3 .

Volume of the sphere = $\frac{4}{3} \pi r^3$.

$$\begin{aligned} &= \frac{4}{3} \times \frac{22}{7} \times \left(\sqrt{\frac{21}{44}} a \right)^3 \\ &= \frac{4}{3} \times \frac{22^2}{7} \times \frac{21}{44} \times \sqrt{\frac{21}{44}} a^3 = 2 \times \sqrt{\frac{21}{44}} a^3 \end{aligned}$$

Ratio of volumes of sphere and cube = $\frac{4}{3} \pi r^3 : a^3$

$$= 2 \sqrt{\frac{21}{44}} a^3 : a^3 = 2\sqrt{21} : \sqrt{44}$$

$$= 2\sqrt{21} : 2\sqrt{11} = \sqrt{21} : \sqrt{11}$$

- 17. Find the area of sector whose radius is 7 cm and angle be 60° .**

Solution :

Radius of the sector (r) = 7 cm

Angle of the sector (θ) = 60°

Area of the sector = $\frac{\theta}{360^\circ} \times \pi r^2$

$$\begin{aligned} &= \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 7 \times 7 = \frac{77}{3} = 25.6 \text{ cm}^2 \\ &\quad \frac{6}{3} \end{aligned}$$

- 18. Find the distance between the points (0, 0) and (36, 15).**

Solution :

The distance between any point from the origin

$$= \sqrt{x^2 + y^2}$$

$$\begin{aligned}
 &= \sqrt{(36)^2 + (15)^2} \\
 &= \sqrt{1296 + 225} = \sqrt{1521} \\
 &= \sqrt{39 \times 39} = 39
 \end{aligned}$$

19. If $\tan 2A = \cot (A - 18^\circ)$, where $2A$ is an acute angle, find the value of A .

Solution :

$$\begin{aligned}
 \tan 2A &= \cot (A - 18^\circ) \\
 \cot (90^\circ - 2A) &= \cot (A - 18^\circ) \quad [\because \tan 2A = \cot (90^\circ - 2A)] \\
 90^\circ - 2A &= A - 18 \\
 -2A - A &= -18^\circ - 90^\circ \\
 -3A &= -108^\circ \\
 3A &= 108^\circ \\
 A &= \frac{108^\circ}{3} = 36^\circ \\
 A &= 36^\circ
 \end{aligned}$$

20. A boat crosses the river by making 60° angle with the bank of river and travels a distance of 600 m to reach another side of river. Find the width of river.

Solution :

Width of river AB.

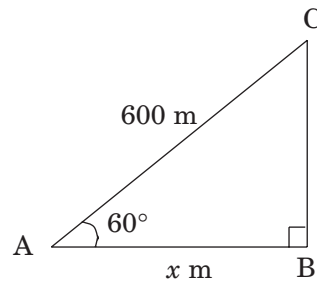
Making angle with river $\angle CAB = 60^\circ$.

Travel of boat from A to C, AC = 600 m

$$\text{From } \triangle ABC, \cos 60^\circ = \frac{x}{600}$$

$$\Rightarrow \frac{1}{2} = \frac{x}{600} \Rightarrow x = 300 \text{ m}$$

\therefore The width of river = 300 m.



Section III

21. Find the volume and surface area of sphere of radius 2.1 cm.

Solution :

Radius of sphere (r) = 2.1 cm

Surface area of sphere = $4\pi r^2$

$$\begin{aligned}
 &= 4 \times \frac{22}{7} \times (2.1)^2 \\
 &= 4 \times \frac{22}{7} \times \frac{21}{10} \times \frac{21}{10} = \frac{1386}{25} = 55.44 \text{ cm}^2
 \end{aligned}$$

Volume of sphere = $\frac{4}{3} \pi r^3$

$$= \frac{4}{3} \times \frac{22}{7} \times (2.1)^3 = \frac{4}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 2.1 = 38.808 \text{ cm}^3.$$

22. Expand $\log \frac{p^2 q^3}{r}$

Solution :

$$\log \frac{p^2 q^3}{r} \quad (\text{Recall : } \log \frac{xy}{z} = \log x + \log y - \log z)$$

$$\therefore \log \frac{p^2 q^3}{r} = \log p^2 + \log q^3 - \log r \quad (\text{Recall : } \log_a x^m = m \log_a x)$$

$$\therefore \log p^2 + \log q^3 - \log r = 2 \log p + 3 \log q - \log r$$

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

Solution :

Let the required fraction be $\frac{x}{y}$.

Then $x + y = 12$ and $\frac{x}{y + 3} = \frac{1}{2}$ (given)

$$2x - y = 3$$

By solving $x + y = 12$ and $2x - y = 3$

We get $3x = 15 \Rightarrow x = 5$

Substituting $x = 5$ in $x + y = 12$

We get $y = 7$

\therefore The required fraction = $\frac{5}{7}$.

- 24. A cone of height 24 cm and radius of base 6 cm is made up modeling clay. A child reshapes it into a sphere. Find the radius of the sphere.**

Solution :

Given the height of a cone (h) = 24 cm

Radius of a cone (r) = 6 cm

Volume of a cone $V = \frac{1}{3} \pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 24 = \frac{22}{7} \times 6 \times 6 \times 8 \text{ cubic cm.}$$

Volume of the sphere = volume of the cone.

$$\frac{4}{3} \pi r^3 = \frac{22}{7} \times 6 \times 6 \times 8$$

$$\frac{4}{3} \times \frac{22}{7} r^3 = \frac{22}{7} \times 6 \times 6 \times 8$$

$$r^3 = \frac{22 \times 6 \times 6 \times 8 \times 3 \times 7}{4 \times 22 \times 7}$$

$$r^3 = 6 \times 6 \times 6$$

$$r = \sqrt[3]{6^3} = 6 \text{ cm}$$

\therefore Radius of the sphere = 6 cm.

- 25. If $\cos A = \frac{12}{13}$, find $\sin A$ and $\tan A$.**

Solution :

$$\cos A = \frac{12}{13}$$

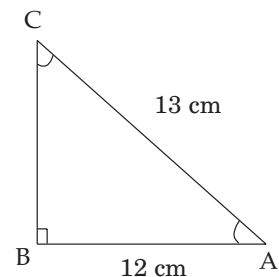
In $\triangle ABC$, $AC^2 = AB^2 + BC^2$

$$\Rightarrow BC^2 = AC^2 - AB^2$$

$$= 13^2 - 12^2 = 169 - 144$$

$$BC^2 = 25$$

$$BC = \sqrt{25} = 5$$



$$\sin A = \frac{\text{opp}}{\text{hyp}} = \frac{BC}{AC} = \frac{5}{13}$$

$$\tan A = \frac{\text{opp}}{\text{adj}} = \frac{BC}{AB} = \frac{5}{12}$$

26. Prove that $\sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sec A + \tan A$.

Solution :

$$\text{LHS : } \sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sqrt{\frac{(1 + \sin A)(1 + \sin A)}{(1 - \sin A)(1 + \sin A)}}$$

Multiplying both numerator and denominator by $(1 + \sin A)$

$$\begin{aligned} &= \sqrt{\frac{(1 + \sin A)^2}{1 - \sin^2 A}} = \sqrt{\frac{(1 + \sin A)^2}{\cos^2 A}} \\ &= \frac{1 + \sin A}{\cos A} = \frac{1}{\cos A} + \frac{\sin A}{\cos A} = \sec A + \tan A \text{ (proved)} \\ &= \text{RHS.} \end{aligned}$$

27. Find a point on Y-axis which is equidistant from both the points A (6, 5), B (-4, 3).

Solution :

We know that a point on the Y-axis is of the form $(0, y)$. So, let the point P $(0, y)$ be equidistant from A and B. Then

$$PA = \sqrt{(6 - 0)^2 + (5 - y)^2}$$

$$PB = \sqrt{(-4 - 0)^2 + (3 - y)^2}$$

$$PA^2 = PB^2 \quad [\because PA = PB \text{ (given)}]$$

$$\text{So, } (6 - 0)^2 + (5 - y)^2 = (-4 - 0)^2 + (3 - y)^2$$

$$\text{i.e., } 36 + 25 + y^2 - 10y = 16 + 9 + y^2 - 6y$$

$$\text{i.e., } 4y = 36$$

$$\text{i.e., } y = 9$$

So, the required point is $(0, 9)$

$$\text{Let us check our solution : } AP = \sqrt{(6 - 0)^2 + (5 - 9)^2}$$

$$= \sqrt{36 + 16} = \sqrt{52}$$

$$BP = \sqrt{(-4 - 0)^2 + (3 - 9)^2}$$

$$= \sqrt{16 + 36} = \sqrt{52}$$

So, $(0, 9)$ is equidistant from $(6, 5)$ and $(-4, 3)$.

28. In a circle with centre 'O', $OD \perp BC$ where BC is a chord. Then show that $AC = 2 OD$

Solution :

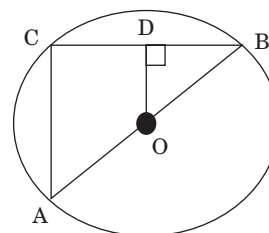
'O' is the centre of the circle BC is a chord and $OD \perp BC$

$\therefore D$ bisects BC (A perpendicular from the centre 'O' on any chord bisects it).

'O' is the midpoint of the diagonal AB

In $\triangle ABC$, $OD \perp BC$

$\therefore AC = 2 OD$



Section IV

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

Solution :

Let the tap of smaller diameter fill the tank in x hr.

In one hour it can fill $\frac{1}{x}$ part of tank

The tap of larger diameter takes 10 hours less, that is $(x - 10)$ hours to fill the tank.

So, in one hour it can fill $\frac{1}{(x - 10)}$ part of tank

If the two taps are opened at the same time they can fill $\frac{1}{x} + \frac{1}{(x - 10)}$ part of tank in 1 hour.

Also the two taps together can fill $\frac{1}{9\frac{3}{8}}$ part of tank in 1 hour (given).

$$\therefore \frac{1}{x} + \frac{1}{(x - 10)} = \frac{1}{9\frac{3}{8}} = \frac{1}{\frac{75}{8}} = \frac{8}{75}$$

$$\Rightarrow \frac{x - 10 + x}{x(x - 10)} = \frac{8}{75}$$

$$\Rightarrow \frac{2x - 10}{(x^2 - 10x)} = \frac{8}{75}$$

Cross multiplying, $75(2x - 10) = 8(x^2 - 10x)$

$$\Rightarrow 150x - 750 = 8x^2 - 80x$$

That is $8x^2 - 80x - 150x + 750 = 0$

$$\Rightarrow 8x^2 - 230x + 750 = 0$$

$$\Rightarrow 2(4x^2 - 115x + 375) = 0$$

$$\Rightarrow 4x^2 - 115x + 375 = 0$$

$$a = 4; b = -115; c = 375$$

$$b^2 - 4ac = (-115)^2 - 4 \times 4 \times 375 \\ = 13225 - 6000 = 7225$$

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

$$= \frac{-(-115) \pm \sqrt{7225}}{2 \times 4} = \frac{115 \pm 85}{8}$$

$$\Rightarrow x = \frac{115 + 85}{8} \text{ or } \frac{115 - 85}{8}$$

$$\Rightarrow x = \frac{200}{8} \text{ or } \frac{30}{8}$$

$$\Rightarrow x = 25 \text{ or } \frac{15}{4}$$

25 and $\frac{15}{4}$ are the roots.

But $\frac{15}{4}$ is not admissible. The smaller diameter tap takes 25 hours and the larger diameter tap takes $(25 - 10)$ or 15 hours to fill up the tank.

(Or)

- (b) **A hemispherical bowl of internal radius 15 cm contains a liquid. The liquid is to be filled into cylindrical bottles of diameter 5 cm and height 6 cm. How many bottles are necessary to empty the bowl ?**

Solution :

$$\text{Volume of hemisphere} = \frac{2}{3} \pi r^3$$

Internal radius of hemisphere $r = 15$ cm.

\therefore Volume of liquid contained in hemispherical bowl

$$\begin{aligned} &= \frac{2}{3} \pi (15)^3 \text{ cm}^3 \\ &= 2250 \pi \text{ cm}^3 \end{aligned}$$

This liquid is to be filled in cylindrical bottles and the height of each bottle (h) = 6 cm

Radius of cylindrical bottle (R) = $\frac{5}{2}$ cm

\therefore Volume of 1 cylindrical bottle = $\pi R^2 h$

$$\begin{aligned} &= \pi \times \left(\frac{5}{2}\right)^2 \times 6 \\ &= \pi \times \frac{25}{4} \times 6 \text{ cm}^3 = \frac{75}{2} \pi \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Number of cylindrical bottles required} &= \frac{\text{Volume of hemispherical bowl}}{\text{Volume of 1 cylindrical bottle}} \\ &= \frac{2250 \pi}{\frac{75}{2} \pi} \\ &= \frac{2 \times 2250}{75} = 60 \text{ bottles.} \end{aligned}$$

- 30.(a) State which of the following sets are finite and which are infinite. Give reasons.**

(i) $A = \{x : x \in N \text{ and } x < 100\}$, $B = \{x : x \in N \text{ and } x \leq 5\}$

(ii) $C = \{1^2, 2^2, 3^2, \dots\}$, $D = \{1, 2, 3, 4\}$

Solution :

(i) A is a finite set. It consists of 99 elements only.

B is a finite set. It consists of 5 elements only.

(ii) C is an infinite set. It consists of squares of all natural numbers.

D is a finite set because it consists of 4 elements only.

(Or)

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

Solution :

Let the smaller number be y and larger number be x .

(smaller number)² = 8 \times larger number

$$y^2 = 8x$$

Difference of squares of the numbers : $x^2 - y^2 = 180$

That is $x^2 - 8x = 180$

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

$$a = 1 ; b = -8 ; c = -180$$

$$b^2 - 4ac = (-8)^2 - 4 \times 1 \times (-180)$$

$$= 64 + 720 = 784$$

$$\sqrt{b^2 - 4ac} = \sqrt{784} = \pm 28$$

$$\Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-8) \pm 28}{2 \times 1}$$

$$\Rightarrow x = \frac{8 + 28}{2} \text{ or } \frac{8 - 28}{2} = \frac{8 \pm 28}{2}$$

$$\Rightarrow x = \frac{36}{2} \text{ or } \frac{-20}{2}$$

$$\Rightarrow x = 18 \text{ or } -10$$

If x = greater number = 18.

$$\Rightarrow y^2 = 8 \times 18 = 144$$

$$y = \sqrt{144} = \pm 12$$

Larger number = 18 ; Smaller number = 12 (or) Larger number = 10 ;

Smaller number = - 12, which is impossible.

\therefore Larger number 18, smaller number = 12.

31. (a) The given distribution shows the number of runs scored by some top batsmen of the world in one-day international cricket matches.

Runs	3000 - 4000	4000 - 5000	5000 - 6000	6000 - 7000	7000 - 8000	8000 - 9000	9000 - 10000	10000 - 11000
Number of batsmen	4	18	9	7	6	3	1	1

Find the mode of the data.

Solution :

Runs (C.I)	Number of batsmen (f)
3000 - 4000	(4) f_0
l (4000) - 5000	(18) f_1
5000 - 6000	(9) f_2
6000 - 7000	7
7000 - 8000	6
8000 - 9000	3
9000 - 10,000	1
10,000 - 11,000	1

Highest frequency is $f_1 = 18$

The frequency of class preceding the model class $f_0 = 4$

The frequency of class succeeding the model class $f_2 = 9$

Class interval (h) = 1000

Lower limit $l = 4000$

$$\begin{aligned}
 \text{Mode} &= l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h \\
 &= 4000 + \left[\frac{18 - 4}{2 \times 18 - 4 - 9} \right] \times 1000 \\
 &= 4000 + \left[\frac{14}{36 - 13} \right] \times 1000 \\
 &= 4000 + \frac{14}{23} \times 1000 = 4000 + \frac{14000}{23} \\
 &= 4000 + 608.69 = 4608.69
 \end{aligned}$$

(Or)

- (b) **Two concentric circles with radii 5 cm and 3 cm are drawn. Find the length of the chord of the larger circle which touches the smaller circle.**

Solution :

OA is the radius of larger circle

OB is the radius of the smaller circle

Two concentric circles with centre 'O' are drawn

'PQ' is the chord of the larger circle which touches the smaller circle at 'B'.

Join O, Q.

In $\triangle OBQ$, $OQ = 5$ cm ; $OB = 3$ cm

BQ is the tangent. $\angle OBQ = 90^\circ$

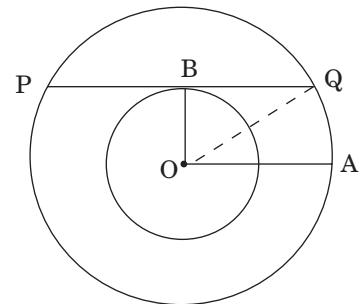
$$\begin{aligned}
 BQ^2 &= OQ^2 - OB^2 \\
 &= 5^2 - 3^2 = 25 - 9 = 16
 \end{aligned}$$

$$BQ = \sqrt{16} = 4$$

OB bisects PQ .

$$\therefore PQ = 2BQ = 2 \times 4 \text{ cm}$$

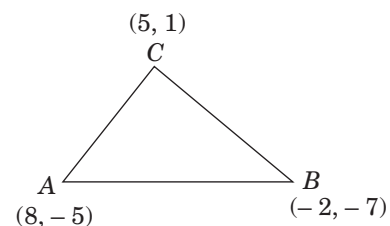
$$\therefore PQ = 8 \text{ cm}$$



32. (a) **Find the area of triangle formed by the points (8, -5), (-2, -7) and (5, 1) by using Herone's formula.**

Solution :

$$\begin{aligned}
 AB &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 &= \sqrt{(-2 - 8)^2 + [-7 - (-5)]^2} \\
 &= \sqrt{(-10)^2 + (-7 + 5)^2} \\
 &= \sqrt{100 + (-2)^2} \\
 &= \sqrt{100 + 4} = \sqrt{104} \\
 &= 10 \text{ (nearly)} \\
 BC &= \sqrt{[5 - (-2)]^2 + [1 - (-7)]^2} \\
 &= \sqrt{(5 + 2)^2 + (1 + 7)^2} \\
 &= \sqrt{7^2 + 8^2} \\
 &= \sqrt{49 + 64} \\
 &= \sqrt{113} = 10.6
 \end{aligned}$$



$$\begin{aligned}
CA &= \sqrt{(5-8)^2 + [1-(-5)]^2} \\
&= \sqrt{(-3)^2 + (1+5)^2} \\
&= \sqrt{9+36} = \sqrt{45} = 6.7 \\
S &= \frac{AB+BC+CA}{2} \\
&= \frac{10+10.6+6.7}{2} = \frac{27.3}{2} = 13.65
\end{aligned}$$

$$\therefore S = 13.65$$

$$\therefore S = 13.7 \text{ (Nearly)}$$

$$\begin{aligned}
\Delta &= \sqrt{S(S-a)(S-b)(S-c)} \\
&= \sqrt{13.7(13.7-10)(13.7-10.6)(13.7-6.7)} \\
&= \sqrt{13.7 \times 3.7 \times 3.1 \times 7} \\
&= \sqrt{1099.973} = 33 \text{ sq. units (nearly)}
\end{aligned}$$

(Or)

(b) State and prove Basic Proportionality Theorem.

Solution :

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.

Given : In $\triangle ABC$, $DE \parallel BC$ which intersects sides AB and AC at D and E respectively.

$$\text{RTP : } \frac{AD}{DB} = \frac{AE}{EC}$$

Construction : Join B, E and C, D and then draw.

$DM \perp AC$ and $EN \perp AB$.

Proof :

$$\text{Area of } \triangle ADE = \frac{1}{2} \times AD \times EN$$

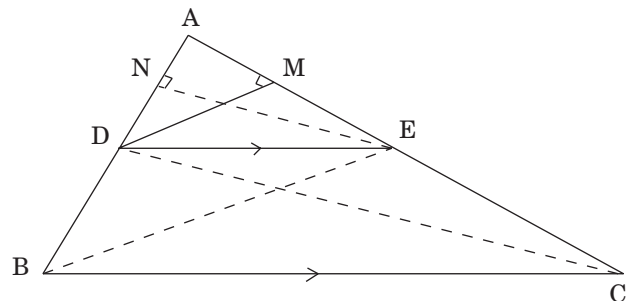
$$\text{Area of } \triangle BDE = \frac{1}{2} \times BD \times EN$$

$$\text{So } \frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle BDE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times BD \times EN} = \frac{AD}{BD} \quad \dots (1)$$

$$\text{Again area of } \triangle ADE = \frac{1}{2} \times AE \times DM$$

$$\text{Area of } \triangle CDE = \frac{1}{2} \times EC \times DM$$

$$\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle CDE)} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC} \quad \dots (2)$$



Observe that ΔBDE and ΔCDE are on the same base DE and between same parallels BC and DE .

So ar (ΔBDE) = ar (ΔCDE) --- (3)

From (1), (2) and (3), we have

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

Hence proved.

33.(a) Draw the graph of $P(x) = x^2 - x - 12$ and find zeroes. Justify your answer.

Solution :

$$p(x) = x^2 - x - 12$$

Table : $x^2 - x - 12$

x	-3	-2	-1	0	1	2	3	4
$y = x^2 - x - 12$	0	-6	-10	-12	-12	-10	-6	0
(x, y)	(-3, 0)	(-2, -6)	(-1, -10)	(0, -12)	(1, -12)	(2, -10)	(3, -6)	(4, 0)

Verification :

Let $p(x) = 0$

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

$$x^2 - 4x + 3x - 12 = 0$$

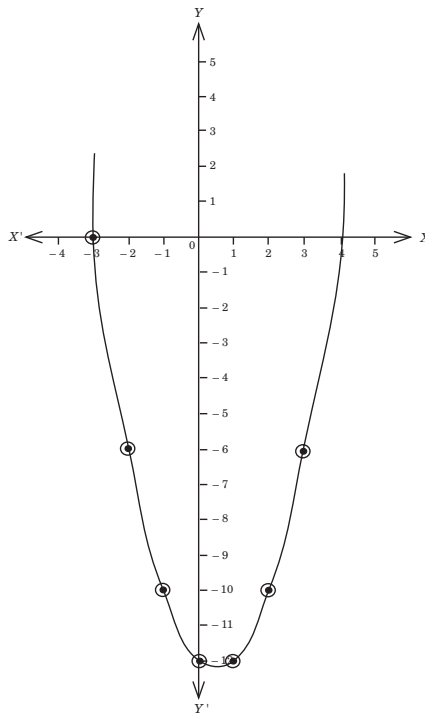
$$x(x - 4) + 3(x - 4) = 0$$

$$(x - 4)(x + 3) = 0$$

$$x - 4 = 0 \Rightarrow x = 4 \text{ and } x + 3 = 0 \Rightarrow x = -3$$

$$\therefore x = \{4, -3\}.$$

The zeroes of $x^2 - x - 12 = 4, -3$.



(Or)

33. (b) The following distribution gives the daily income of 50 workers of a factory.

Daily income (in Rupees)	250-300	300-350	350-400	400-450	450-500
Number of workers	12	14	8	6	10

Convert the above Distribution to a more than type cumulative frequency distribution and draw its ogive.

Solution :

(C.I)	(f)	Lower Boundaries	More than cumulative frequency (GCF)
250 – 300	12	250	50
300 – 350	14	300	38
350 – 400	8	350	24
400 – 450	6	400	16
450 – 500	10	450	10

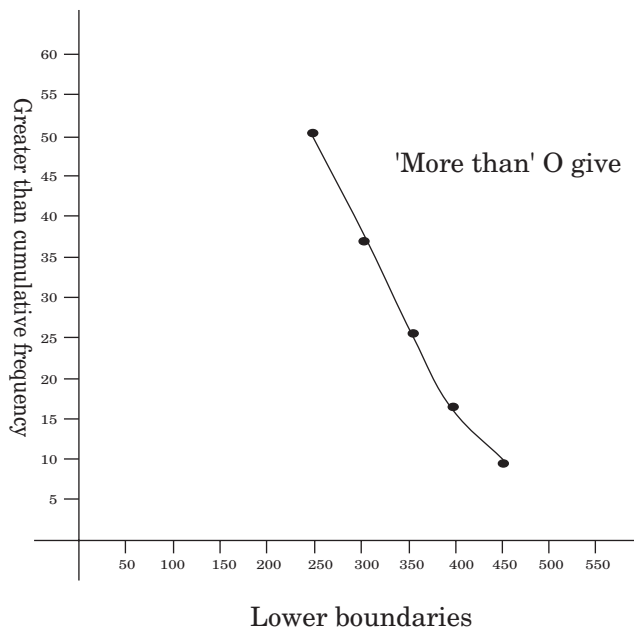
Scale : On X- axis 1 cm = 50 units

On Y- axis 1 cm = 5 units

Plot the following points in graph sheet and join them by a smooth hand curve.

(250, 50) (300, 38) (350, 24) (400, 16) (450, 10)

The curve we get is called a GCF curve, or an ogive (of the more than type)



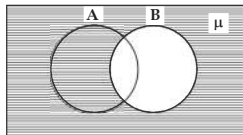
MATHEMATICS

RAPID TEST - 3 : ANSWERS

SECTION - I

1. What does the shaded region show ?

Sol. $\mu - B$



2. Statement (A) : Let the age of Mary and his daughter be 'x' and 'y' years and Mary told her daughter "Seven years ago I was seven times as old as you were" then linear equation form is $x - 7y + 42 = 0$.

Statement (B) : The solutions of $2x - y = 5$ and $3x + 2y = 11$ is $x = 3$ and $y = -1$.

Which of the above statements are true?

- i) Both A and B are true
- ii) A is true, B is false
- iii) A is false, B is true
- iv) Both A and B are false

Sol. (ii)

3. If total surface area of a cube is 96 cm^2 then find its volume.

Sol. T.S.A. of a cube = 96 cm^2

$$\text{T.S.A. of a cube} = 6a^2$$

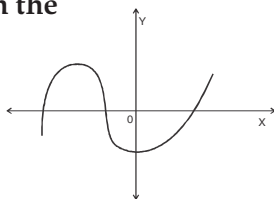
$$6a^2 = 96$$

$$a^2 = \frac{96}{6} = 16$$

$$a^2 = 16 \Rightarrow a = 4$$

$$\text{Volume of a cube} = a^3 = 4^3 = 64 \text{ cm}^3$$

4. Find the numbers of zeros of the polynomial from the adjacent graph.



Sol. Three zeroes.

5. Find the discriminant of $6x^2 - 5x + 1 = 0$.

Sol. Given quadratic equation

$$6x^2 - 5x + 1 = 0$$

$$\text{where } a = 6, b = -5, c = 1$$

$$\text{Discriminant} = b^2 - 4ac$$

$$= (-5)^2 - 4 \times 6 \times 1$$

$$= 25 - 24 = 1$$

6. If $n(A) = 8$, $n(B) = 3$, $n(A \cap B) = 2$ then find $n(A \cup B)$.

Sol. $n(A) = 8$, $n(B) = 3$, $n(A \cap B) = 2$,

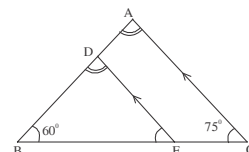
$$n(A \cup B) = ?$$

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$= 8 + 3 - 2$$

$$= 9$$

7. Find $\angle BDE$ from the adjacent figure.



Sol. In $\triangle ABC$, $DE \parallel AC$

$$\angle BED = \angle BCA = 75^\circ$$

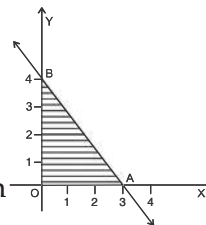
$$\text{In } \triangle BDE, \angle B + \angle BDE + \angle BED = 180^\circ$$

$$60^\circ + \angle BDE + 75^\circ = 180^\circ$$

$$\angle BDE = 180 - 135^\circ$$

$$\angle BDE = 45^\circ$$

8. Find the area of shaded region from the given figure.



Sol. Area of shaded region

$$= \text{Area of right angled triangle AOB}$$

$$= \frac{1}{2} |OA \times OB|$$

$$= \frac{1}{2} \times |3 \times 4| = \frac{1}{2} \times 12 = 6 \text{ sq. units}$$

9. If the length of a shadow of a pole is equal to the length of the pole then find the angle of elevation.

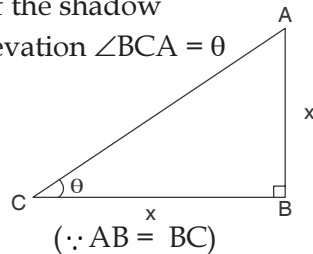
Sol. AB = Length of the pole
BC = Length of the shadow
Let angle of elevation $\angle BCA = \theta$

$$\tan \theta = \frac{AB}{BC}$$

$$\tan \theta = \frac{AB}{BC} = 1$$

$$\tan \theta = 1 \quad (\because \tan 45^\circ = 1)$$

$$\tan \theta = \tan 45^\circ \quad \boxed{\theta = 45^\circ}$$



10. Which of the following situations have equally likely events ?

i) Getting 1 or 2 or 3 or 4 or 5 or 6 when a dice is rolled

ii) Winning or loosing a game

iii) Head or tail when a coin is tossed

A) i or ii B) ii and iii

C) i and iii D) i and ii and iii

Sol. D (i and ii and iii)

11. Find the centroid of a triangle whose vertices are $(-a, 0)$, $(0, b)$ and $(a, 0)$

Sol. Centroid = $\left[\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right]$

$$= \left[\frac{-a + 0 + a}{3}, \frac{0 + b + 0}{3} \right] = \left[\frac{0}{3}, \frac{b}{3} \right] = \left[0, \frac{b}{3} \right]$$

12. What is the probability of getting a vowel from the word 'MATHEMATICS'?

Sol. No. of total a possible outcomes = 11
No. of favourable outcomes to get a vowel = 4

$$\text{Probability} = \frac{4}{11}$$

SECTION - II

13. Find the value of $\log_5 \sqrt{625}$.

Sol. $\log_5 \sqrt{625} = \log_5 25$
 $= \log_5 5^2$
 $= 2 \log_5 5$
 $= 2 \times 1 = 2$

14. Find the curved surface area of cylinder, whose radius is 7 cm. and height is 10 cm.

Sol. Radius of cylinder (r) = 7 cm
Height (h) = 10 cm

$$\begin{aligned} \text{Curved surface area of cylinder} &= 2\pi rh \\ &= 2 \times \frac{22}{7} \times 7 \times 10 \\ &= 440 \text{ cm}^2 \end{aligned}$$

15. Check whether $(x-2)(x+1) = (x-1)(x+3)$ is a quadratic equation or not

Sol. No, LHS: $(x-2)(x+1) = x^2 + x - 2x - 2$
 $= x^2 - x - 2$

$$\begin{aligned} \text{RHS: } (x-1)(x+3) &= x^2 + 3x - x - 3 \\ &= x^2 + 2x - 3 \end{aligned}$$

Therefore, $x^2 - x - 2 = x^2 + 2x - 3$

$$\begin{aligned} \therefore x^2 - x - 2 - x^2 - 2x + 3 &= 0 \\ -3x + 1 &= 0 \end{aligned}$$

It is not in the form of $ax^2 + bx + c = 0$.

Therefore, the given equation is not a quadratic equation.

16. Find the 30th term of the A.P. : 10, 7, 4,

Sol. We have, 10, 7, 4,

Here, $a = 10$; $d = a_2 - a_1 = 7 - 10 = -3$ and $n = 30$

$$\begin{aligned} \text{We have } a_n &= a + (n-1)d \\ a_{30} &= 10 + (30-1)(-3) \\ &= 10 + 29(-3) \\ &= 10 - 87 \\ a_{30} &= -77 \end{aligned}$$

17. In $\triangle ABC$, $LM \parallel BC$ and $\frac{AL}{LB} = \frac{2}{3}$,

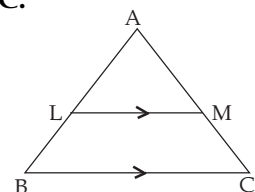
AM = 5cm, find AC.

Sol. $\frac{AL}{LB} = \frac{AM}{MC}$

$$\frac{2}{3} = \frac{5}{MC}$$

$$MC = \frac{15}{2} = 7.5 \text{ cm}$$

$$AC = AM + MC = 5 + 7.5 = 12.5 \text{ cm}$$



18. A box contains 3 blue and 4 red balls. What is the probability that the ball taken out randomly will be red ?

Sol. Total number of balls = 3 + 4 = 7
Total number of possible outcomes = 7

Favourable outcomes that the ball be a red ball = 4

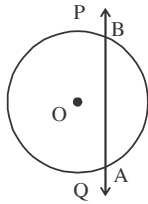
Probability for the ball drawn

to be the red. = $\frac{4}{7}$

19. Define 'Secant' of a circle and draw the figure.

Sol. Secant of a circle :

If a line intersects a circle at two distinct points that line is called secant of a circle.



From the figure PQ is a secant of a circle.

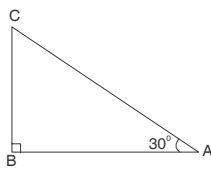
20. Find the length of AB from adjacent figure.

Sol. From the figure

$\angle ABC = 90^\circ$, $\angle BAC = 30^\circ$

$$\tan 30^\circ = \frac{BC}{AB} \quad \left| \quad AB = 10\sqrt{3} \text{ mt} \right.$$

$$\frac{1}{\sqrt{3}} = \frac{10}{AB} \quad \left| \quad \begin{array}{l} \text{Length of side} \\ AB = 10\sqrt{3} \text{ mt} \end{array} \right.$$



SECTION - III

21. Find the zeroes of the quadratic polynomial $x^2 - x - 30$ and verify the relation between the zeroes and its coefficients.

Sol. Given polynomial is $x^2 - x - 30 = 0$

To find zeroes $x^2 - x - 30 = 0$ say

$$\Rightarrow x^2 - 6x + 5x - 30 = 0$$

$$\Rightarrow (x - 6)(x + 5) = 0$$

$$\Rightarrow x = 6 \text{ or } x = -5$$

Sum of the zeroes

$$= 6 + (-5) = 1$$

$$= \frac{-(-1)}{1} = \frac{-(\text{Coefficient of } x)}{\text{Coefficient of } x^2}$$

Product of the zeroes

$$= 6(-5) = -30$$

$$= \frac{-30}{1} = \frac{-\text{Constant term}}{\text{Coefficient of } x^2}$$

22. Find the HCF of 1260 and 1440 by using Euclid's division lemma.

Sol. Given numbers are 1260, 1440

$$1440 = 1260 \times 1 + 180$$

$$1260 = 180 \times 7 + 0$$

H.C.F. of 1260, 1440 is 180

23. Solve $3^x = 5^{x-2}$.

Sol. $3^x = 5^{x-2}$

Taking "logarithm" both sides

$$\log_{10} 3^x = \log_{10} 5^{x-2}$$

We know that $\log_a x^n = n \log_a x$

$$x \log_{10} 3 = (x - 2) \log_{10} 5$$

$$x \log_{10} 3 = x \log_{10} 5 - 2 \log_{10} 5$$

$$x \log_{10} 5 - x \log_{10} 3 = 2 \log_{10} 5$$

$$x (\log_{10} 5 - \log_{10} 3) = 2 \log_{10} 5$$

$$\therefore x = \frac{2 \log_{10} 5}{\log_{10} 5 - \log_{10} 3}$$

24. Find the value of 'k' for which the pair of equations $2x - ky + 3 = 0$, $4x + 6y - 5 = 0$ represent parallel lines.

Sol. Given pair of equations

$$2x - ky + 3 = 0 \text{ and } 4x + 6y - 5 = 0$$

$$a_1 = 2; b_1 = -k; c_1 = 3;$$

$$a_2 = 4; b_2 = 6; c_2 = -5$$

Given the pair of lines are parallel

$$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \Rightarrow \frac{2}{4} = \frac{-k}{6}$$

$$\Rightarrow -4k = 2 \times 6 \Rightarrow -4k = 12$$

$$\Rightarrow k = \frac{12}{-4} = -3$$

25. If the distance between two points $(x, 1)$ and $(-1, 5)$ is '5' find the value of 'x'.

Sol. Distance between two points

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

$$\text{Distance between } (x, 1), (-1, 5) = 5$$

$$\sqrt{[x - (-1)]^2 + (1 - 5)^2} = 5$$

$$\sqrt{(x + 1)^2 + (-4)^2} = 5$$

$$x^2 + 1 + 2x + 16 = 25$$

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

$$(x + 4)(x - 2) = 0$$

$$x = -4 \text{ or } x = 2$$

26. If $\cos A = \frac{7}{25}$, then find $\sin A$ and $\operatorname{cosec} A$. What do you observe?

Sol. In a right angled triangle $\triangle ABC$

$$\cos A = \frac{7}{25} = \frac{AB}{AC}$$

$$x^2 + 7^2 = 25^2$$

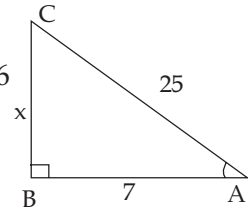
$$x^2 = 25^2 - 7^2 = 576$$

$$x = 24$$

$$\sin A = \frac{24}{25}$$

$$\operatorname{cosec} A = \frac{25}{24}$$

$$\text{Observed that } \operatorname{cosec} A = \frac{1}{\sin A}$$



27. Write mid - values of the following frequency distribution.

Class interval	8-11	12-15	16-19	20-23	24-27	28-31	32-35
Frequency	4	4	5	13	20	14	8

Sol.

Class interval	Frequency	Mid value of the class
8 - 11	4	9.5
12 - 15	4	13.5
16 - 19	5	17.5
20 - 23	13	21.5
24 - 27	20	25.5
28 - 31	14	29.5
32 - 35	8	33.5

28. A contractor wants to set up a slide for the children to play in the park. He wants to set it up at the height of 2 m and by making an angle of 30° with the ground. What should be the length of the slide?

Sol.: Let the length of slide = AC

The slide set up at the height BC = 2m.

In $\triangle ABC$, $\angle B = 90^\circ$, $\angle A = 30^\circ$

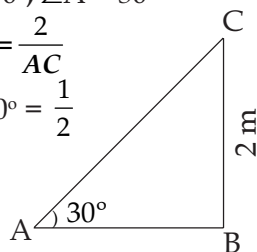
$$\sin A = \frac{BC}{AC} = \frac{2}{AC}$$

$$\sin A = \sin 30^\circ = \frac{1}{2}$$

$$\frac{2}{AC} = \frac{1}{2}$$

$$AC = 4$$

\therefore Length of slide = 4m



SECTION - IV

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

Sol. Let us assume, the contrary,

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

i.e., we can find co - primes 'a' and 'b', $b \neq 0$

$$\text{such that } 2 + 5\sqrt{3} = \frac{a}{b}$$

$$\Rightarrow 5\sqrt{3} = \frac{a}{b} - 2$$

$$\Rightarrow \sqrt{3} = \frac{a}{5b} - \frac{2}{5}$$

$$\text{Since } \frac{a}{5b} \text{ and } \frac{2}{5} \in \mathbb{Q}$$

$$\Rightarrow \frac{a}{5b} - \frac{2}{5} \in \mathbb{Q}$$

and so $\sqrt{3}$ is rational
 But this contradicts the fact that
 $\sqrt{3}$ is irrational
 So, our assumption that $2 + 5\sqrt{3}$
 is rational is wrong.
 So, we can conclude that $2 + 5\sqrt{3}$
 is irrational.

(Or)

Check whether -321 is a term of the
 A.P. : 22, 15, 8, 1,

Sol. From the given A.P. : 22, 15, 8, 1, ...
 $a = 22, d = -7$
 n^{th} term of an A.P.

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

In this A.P. let n^{th} term be - 321

$$\begin{aligned} \Rightarrow a + (n - 1) d &= -321 \\ \Rightarrow 22 + (n - 1) (-7) &= -321 \\ \Rightarrow (n - 1) (-7) &= -321 - 22 = -343 \\ \Rightarrow n - 1 &= \frac{-343}{-7} = 49 \\ \Rightarrow n &= 49 + 1 = 50 \end{aligned}$$

\therefore - 321 will be the 50th term in the
 given A.P.

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

Sol. Given that the sum of Moulika's marks
 in Mathematics and English is 30.
 Let the marks of Moulika in
 Mathematics = x
 and that in English = $30 - x$
 If she got 2 marks more in Mathematics
 then marks in Maths
 = $x + 2$
 and she got 3 marks less in English then
 the marks in English
 = $30 - x - 3 = 27 - x$

Product of these two

$$\begin{aligned} &= (x + 2) (27 - x) = 210 \\ &\Rightarrow x^2 - 25x + 156 = 0 \\ &\Rightarrow (x - 12) (x - 13) = 0 \\ &\Rightarrow x = 12, x = 13 \end{aligned}$$

Case : (1)

If $x = 12$, the marks of Moulika
 in Mathematics = 12
 in English = $30 - 12 = 18$

Case : (2)

If $x = 13$, the marks of Moulika
 in Mathematics = 13
 in English = $30 - 13 = 17$

(Or)

An oil drum is in the shape of cylinder,
 whose diameter is 2 m. and height is
 7m. The painter charges ₹ 5 per m² to
 paint the drum. Find the total charges
 to be paid to the painter for 10 drums.

Sol. The diameter of the oil drum
 which is in the shape of cylinder
 $= d = 2\text{m}$
 Radius of the drum = $r = \frac{d}{2} = 1\text{ m}$
 height = $h = 7\text{m}$

Total Surface Area of the drum which
 is in the shape of a cylinder

$$\begin{aligned} &= 2\pi r (r + h) \\ &= 2 \times \frac{22}{7} \times 1 \times (1 + 7) \\ &= 2 \times \frac{22}{7} \times 8 \\ &= \frac{352}{7} \\ &= 50.28 \text{ sq.m.} \end{aligned}$$

Charges to paint the drum per sq.m.
 = ₹ 5

Total cost of painting 10 such type of
 drums = $50.28 \times 5 \times 10$
 = ₹ 2514

31. Two dice are thrown at the same time. What is the probability that the sum of two numbers appearing on the top of the dice is (a) 10, (b) less than or equal to 12, (c) a prime number, (d) multiple of '3' ?

Sol. Possible outcomes when two dice are thrown simultaneously.

$$S = \left[\begin{array}{l} (1,1), (1,2), (1,3), (1,4), (1,5), (1,6) \\ (2,1), (2,2), (2,3), (2,4), (2,5), (2,6) \\ (3,1), (3,2), (3,3), (3,4), (3,5), (3,6) \\ (4,1), (4,2), (4,3), (4,4), (4,5), (4,6) \\ (5,1), (5,2), (5,3), (5,4), (5,5), (5,6) \\ (6,1), (6,2), (6,3), (6,4), (6,5), (6,6) \end{array} \right]$$

$$\begin{aligned} \text{Total number of possible outcomes} \\ = 6 \times 6 = 36 \end{aligned}$$

$$\begin{aligned} \text{Favourable outcomes for the sum is 10} \\ = (4, 6), (5, 5), (6, 4) \end{aligned}$$

- a) $\left[\begin{array}{l} \text{Number of favourable} \\ \text{outcomes for sum 10} = 3 \end{array} \right]$

$$P(E) =$$

$$\frac{\text{Number of favourable outcomes to E}}{\text{Total number of possible outcomes}}$$

$$P(\text{sum 10}) = \frac{3}{36} = \frac{1}{12}$$

- b) $\left[\begin{array}{l} \text{Number of favourable} \\ \text{outcomes of sum} \leq 12 = 36 \end{array} \right]$

$$P(\text{sum} \leq 12) = \frac{36}{36} = 1$$

- c) $\left[\begin{array}{l} \text{Favourable outcomes for the} \\ \text{sum is prime} = (1, 1), (1, 2), (1, 4), \\ (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, \\ 4), (4, 1), (4, 3), (5, 2), (5, 6), (6, 1), \\ (6, 5) \end{array} \right]$

Number of favourable outcomes for the sum is prime = 15

$$P(\text{sum prime}) = \frac{15}{36} = \frac{5}{12}$$

- d) $\left[\begin{array}{l} \text{Favourable outcomes for the sum} \\ \text{is a multiple of 3} = (1, 2), (1, 5), (2, \\ 1), (2, 4), (3, 3), (3, 6), (4, 2), (4, 5), \\ (5, 1), (5, 4), (6, 3), (6, 6) \end{array} \right]$

Number of favourable outcomes for the sum is a multiple of

$$3 = 12$$

$$P(\text{sum is multiple of 3})$$

$$= \frac{12}{36} = \frac{1}{3}$$

(Or)

A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground by making 30° angle with the ground. The distance between the foot of the tree and the top of the tree on the ground is 6m. Find the height of the tree before falling down.

Sol. Let the height of the tree before

$$\text{fall be } AB = (x + y) \text{ m}$$

$$BD = 6\text{m}$$

Tree is broken at C

Its top A touches the ground at D

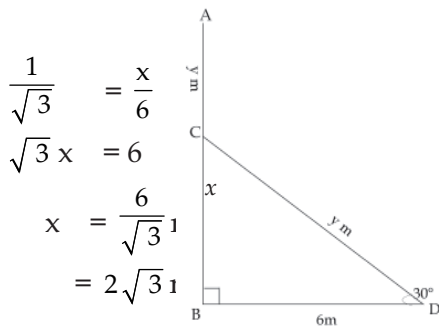
$$AC = CD = y\text{m}$$

Angle of elevation $\angle BDC = 30^\circ$

$$BC = x\text{m}$$

In a right angled triangle $\triangle CBD$

$$\tan 30^\circ = \frac{BC}{BD}$$



$$\frac{1}{\sqrt{3}} = \frac{x}{6}$$

$$\sqrt{3} x = 6$$

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

$$= 2\sqrt{3} \text{ m}$$

$$\cos 30^\circ = \frac{BD}{AD} \Rightarrow \frac{\sqrt{3}}{2} = \frac{6}{y}$$

$$\sqrt{3} y = 12 \Rightarrow y = \frac{12}{\sqrt{3}} = 4\sqrt{3} \text{ m}$$

Height of the tree before falling down = $2\sqrt{3} + 4\sqrt{3} = 6\sqrt{3} \text{ m}$

32. A chord of a circle of radius 10 cm. subtends a right angle at the centre. Find the area of the corresponding: (use $\pi = 3.14$)

i. Minor segment

ii. Major segment

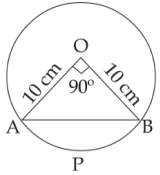
Sol. Radius of the circle (r) = 10 cm

$$\angle AOB = 90^\circ$$

$$\text{Area of } \triangle OAB = \frac{1}{2} \times OA \times OB$$

$$= \frac{1}{2} \times 10 \text{ cm} \times 10 \text{ cm} = 50 \text{ cm}^2$$

Area of the sector

$$OAPB = \frac{x^\circ}{360^\circ} \times \pi r^2$$


$$= \frac{90^\circ}{360^\circ} \times 3.14 \times 10 \text{ cm} \times 10 \text{ cm}$$

$$= \frac{1}{4} \times 314 \text{ cm}^2 = 78.5 \text{ cm}^2$$

- i) Area of the minor segment =
Area of the sector OAPB -
Area of $\triangle OAB$
 $= 78.5 \text{ cm}^2 - 50 \text{ cm}^2 = 28.5 \text{ cm}^2$

ii) Area of the circle = πr^2
 $= 3.14 \times 10 \text{ cm} \times 10 \text{ cm}$
 $= 314 \text{ cm}^2$

\therefore Area of the major segment
 $=$ Area of the circle -
Area of minor segment
 $= 314 \text{ cm}^2 - 28.5 \text{ cm}^2$
 $= 285.5 \text{ cm}^2$

(Or)

Find a point on the Y - axis which is equidistant from both the points A (6,5) and B (-4,3)

Sol. We know that a point on the Y - axis is of the form (0, y). So, let the point P (0, y) be equidistant from A and B. Then

$$PA = \sqrt{(6-0)^2 + (5-y)^2}$$

$$PB = \sqrt{(-4-0)^2 + (3-y)^2}$$

$$PA^2 = PB^2$$

So,

$$(6-0)^2 + (5-y)^2 = (-4-0)^2 + (3-y)^2$$

$$\text{i.e., } 36 + 25 + y^2 - 10y$$

$$= 16 + 9 + y^2 - 6y$$

$$\text{i.e., } 4y = 36 \quad ; \quad \text{i.e., } y = 9$$

So, the required point is (0, 9).

Let us check our solution :

$$AP = \sqrt{(6-0)^2 + (5-9)^2}$$

$$= \sqrt{36 + 16} = \sqrt{52}$$

$$BP = \sqrt{(-4-0)^2 + (3-9)^2}$$

$$= \sqrt{16 + 36} = \sqrt{52}$$

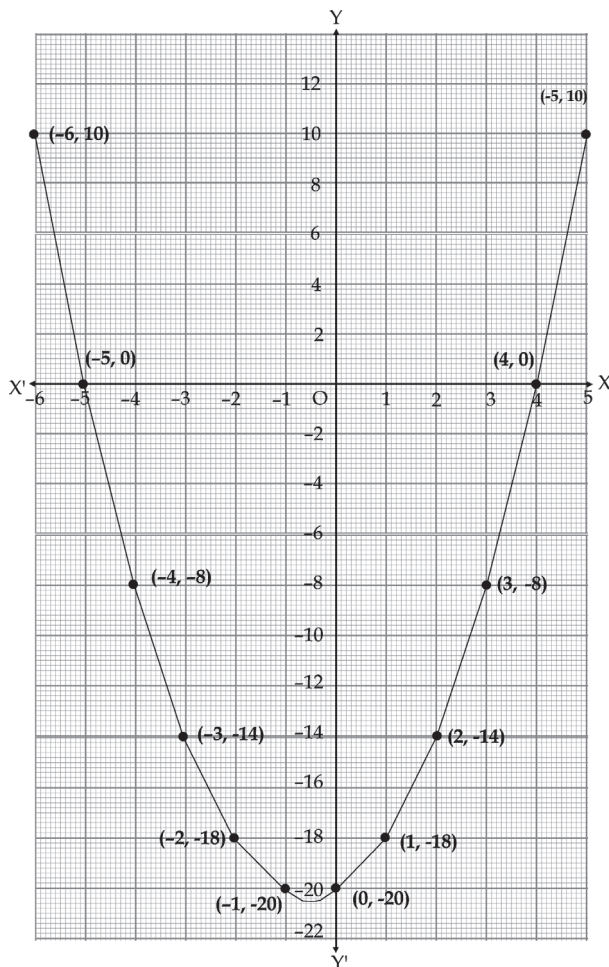
So (0, 9) is equidistant from (0, 5) and (4, 3)

33. Find the zeroes of the quadratic polynomial $p(x) = x^2 + x - 20$ using graph.

Sol. Let $y = x^2 + x - 20$

x	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5
x^2	36	25	16	9	4	1	0	1	4	9	16	25
x	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5
-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
y	10	0	-8	-14	-18	-20	-20	-18	-14	-8	0	10
(x,y)	(-6,10)	(-5,0)	(-4,-8)	(-3,-14)	(-2,-18)	(-1,-20)	(0,-20)	(1,-18)	(2,-14)	(3,-8)	(4,0)	(5,10)

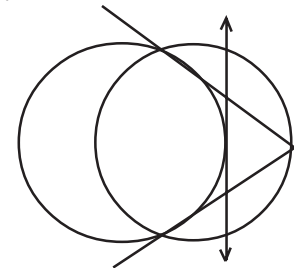
Scale : X - axis : 1 cm = 1 unit
Y - axis : 1 cm = 2 units



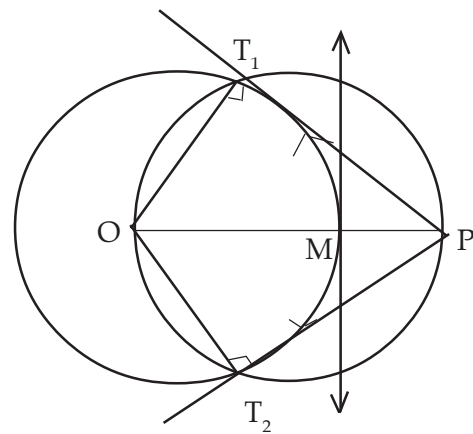
(Or)

Draw a circle of radius 4 cm and draw a pair of tangents to the circle, which are intersecting each other 6 cm away from the centre.

Sol.



Rough Sketch



Steps of construction :

- Draw a circle with radius 4 cm with centre O
- Plot a point P such that $OP = 6$ cm
- Bisect OP at M and draw circle with radius OM or MP
- Draw tangents from intersecting points of two circles.

SR RAPID TEST - 3

CLASS - 10 (EM)

MATHEMATICS

TEST - 3

Time : 3.15 Hrs.

PAPER - I & II

Max. Marks : 100

Instructions :

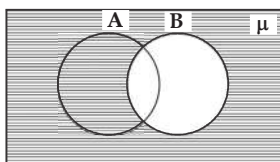
1. Answer all the questions.
2. The question paper consists of 4 sections and 33 questions.
3. There is an internal choice in section - IV.
4. Write answers neatly and legibly.

SECTION - I

*Note: i) Answer all the questions in one word or phrase.
ii) Each question carries 1 mark.*

12 × 1 = 12 M

1. What does the shaded region show ?

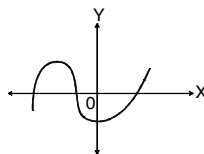


2. **Statement (A):** Let the age of Mary and his daughter be 'x' and 'y' years and Mary told her daughter "Seven years ago I was seven times as old as you were" then linear equation form is $x - 7y + 42 = 0$.

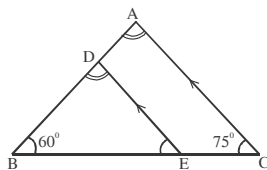
Statement (B): The solutions of $2x - y = 5$ and $3x + 2y = 11$ is $x = 3$ and $y = -1$.

Which of the above statements are true ?

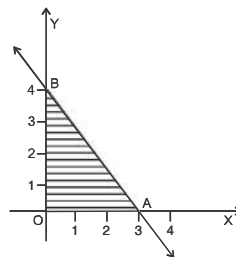
- i) Both A and B are true
 - ii) A is true, B is false
 - iii) A is false, B is true
 - iv) Both A and B are false
3. If total surface area of a cube is 96 cm^2 then find its volume.
4. Find the number of zeros of the polynomial from the adjacent graph.



5. Find the discriminant of $6x^2 - 5x + 1 = 0$.
6. If $n(A) = 8$, $n(B) = 3$, $n(A \cap B) = 2$ then find $n(A \cup B)$.
7. Find $\angle BDE$ from the adjacent figure.



8. Find the area of shaded region from the given figure.



9. If the length of a shadow of a pole is equal to the length of the pole then find the angle of elevation.
10. Which of the following situations have equally likely events ?
- Getting 1 or 2 or 3 or 4 or 5 or 6 when a dice is rolled
 - Winning or loosing a game
 - Head or tail when a coin is tossed
- A) i or ii B) ii and iii C) i and iii D) i and ii and iii
11. Find the centroid of a triangle whose vertices are $(-a, 0)$, $(0, b)$ and $(a, 0)$.
12. What is the probability of getting a vowel from the word 'MATHEMATICS'?

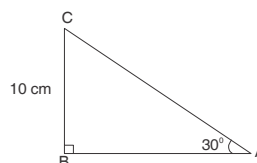
SECTION - II

Note: i) Answer all the questions.

ii) Each question carries 2 marks.

8 × 2 = 16 M

13. Find the value of $\log_5 \sqrt{625}$.
14. Find the curved surface area of cylinder, whose radius is 7 cm. and height is 10 cm.
15. Check whether $(x-2)(x+1) = (x-1)(x+3)$ is a quadratic equation or not.
16. Find the 30th term of the A.P. : 10, 7, 4
17. In ΔABC , $LM \parallel BC$ and $\frac{AL}{LB} = \frac{2}{3}$, $AM = 5\text{cm}$, find AC .
18. A box contains 3 blue and 4 red balls. What is the probability that the ball taken out randomly will be red ?
19. Define 'Secant' of a circle and draw the figure.
20. Find the length of AB from adjacent figure.



SECTION - III

Note: i) Answer all the questions.

ii) Each question carries 4 marks.

8 × 4 = 32 M

21. Find the zeroes of the quadratic polynomial $x^2 - x - 30$ and verify the relation between the zeroes and its co - efficient.
22. Find the HCF of 1260 and 1440 by using Euclid's division lemma.
23. Solve $3^x = 5^{x-2}$.
24. Find the value of 'k' for which the pair of equations $2x - ky + 3 = 0$, $4x + 6y - 5 = 0$ represent parallel lines.
25. If the distance between two points $(x, 1)$ and $(-1, 5)$ is '5' find the value of 'x'.
26. If $\cos A = \frac{7}{25}$, then find $\sin A$ and $\operatorname{cosec} A$. What do you observe ?
27. Write mid - values of the following frequency distribution.

Class interval	8-11	12-15	16-19	20-23	24-27	28-31	32-35
Frequency	4	4	5	13	20	14	8

28. A contractor wants to set up a slide for the children to play in the park. He wants to set it up at the height of 2 m and by making an angle of 30° with the ground. What should be the length of the slide ?

SECTION - IV

Note: i) Answer all the questions.

ii) Each question carries 8 marks.

iii) There is an internal choice for each question.

5 × 8 = 40 M

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

(OR)

Check whether -321 is a term of the A.P. : 22, 15, 8, 1,

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

(OR)

An oil drum is in the shape of cylinder, whose diameter is 2 m. and height is 7m. The painter charges ₹ 5 per m^2 to paint the drum. Find the total charges to be paid to the painter for 10 drums.

31. Two dice are thrown at the same time. What is the probability that the sum of two numbers appearing on the top of the dice is (a) 10, (b) less than or equal to 12, (c) a prime number, (d) multiple of '3' ?

(OR)

A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground by making 30° angle with the ground. The distance between the foot of the tree and the top of the tree on the ground is 6m. Find the height of the tree before falling down.

32. A chord of a circle of radius 10 cm. subtends a right angle at the centre. Find the area of the corresponding: (use $\pi = 3.14$) i. Minor segment ii. Major segment

(OR)

Find a point on the Y - axis which is equidistant from both the points A (6,5) and B (-4,3)

33. Find the zeroes of the quadratic polynomial $p(x) = x^2 + x - 20$ using graph.

(OR)

Draw a circle of radius 4 cm and draw a pair of tangents to the circle, which are intersecting each other 6 cm away from the centre.

DCCB KRISHNA
KEY FOR Mathematics paper I & II
(English Medium)

1. Ans : $\log_3 81^x = x \Rightarrow (81)^x = 3$
 $\Rightarrow (3^4)^x = 3$
 $\Rightarrow 3^{4x} = 3^1$
 $\Rightarrow 3^{4x} = 3^1$
 $4x = 1$
 $x = \frac{1}{4}$

2. Ans : $n(A - B) = 0$

3. Ans : C $\left[\frac{c}{a} = \frac{10}{1} = 10 \right]$

4. Ans : C $\left[\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}, \frac{4}{8} = \frac{5}{K} = \frac{10}{18} \Rightarrow K = 10 \right]$

5. Ans : A $\left[b^2 - 4ac = 5^2 - 4(2)(3) = 25 - 24 = 1 \right]$

6. Ans : A $\left[\frac{a_2}{a_1} = \frac{-b}{a} = -2 \right] \Rightarrow x = -2$

7. Ans : C $\left[\frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 6}{-2 - 4} = \frac{-1}{-6} = \frac{1}{6} \right]$

8. Ans : 7.5 $\left[\frac{6}{PQ} = \frac{4}{QR} = \frac{3}{6} \Rightarrow \begin{aligned} PQ &= 4.5 \\ QR &= 3 \\ PQ + QR &= 7.5 \end{aligned} \right]$

9. Ans : A $\left[\begin{aligned} \sqrt{d^2 - x^2} &= \sqrt{17^2 - 8^2} \\ &= \sqrt{289 - 64} \\ &= \sqrt{225} \\ &= 15 \text{ cm.} \end{aligned} \right]$

10. Ans : D $\left[2 \sin^2 60^\circ \times \cos 60^\circ = 2 \times \frac{3}{4} \times \frac{1}{2} = \frac{3}{4} \right]$

11) Ans : D

12. ~~Mean~~ Mean = $\frac{3+5+9+x+11}{5}$

$$7 = \frac{28+x}{5}$$

$$35 = 28+x$$

$$x = 35 - 28$$

$$x = 7$$

13) $72 = 2 \times 36$

$$= 2 \times 2 \times 18$$

$$= 2 \times 2 \times 2 \times 9$$

$$= 2 \times 2 \times 2 \times 3 \times 3$$

$$108 = 2 \times 54$$

$$= 2 \times 2 \times 27$$

$$= 2 \times 2 \times 3 \times 9$$

$$= 2 \times 2 \times 3 \times 3 \times 3$$

$$\text{L.C.M} = 2 \times 2 \times 2 \times 3 \times 3 \times 3$$
$$= 216$$

$$\text{H.C.F} = 2 \times 2 \times 3 \times 3$$
$$= 36$$

14. Subsets of C:

$$\phi, C, \{x\}, \{y\}, \{z\}, \{x, y\}, \{y, z\}, \{x, z\}$$

15. $\alpha = 2, \beta = -1$

$$K [x^2 - (\alpha + \beta)x + \alpha\beta]$$

$$K [x^2 - (2 + (-1))x + 2(-1)]$$

$$K [x^2 - x - 2]$$

$K = 1$ then quadratic polynomial $x^2 - x - 2$

16. Ans : $2x^2 - 3x + 5 = 0$ compare with $ax^2 + bx + c = 0$

$$a = 2, b = -3, c = 5$$

$$\text{Discriminant } D = b^2 - 4ac$$

$$= (-3)^2 - 4(2)(5)$$

$$= 9 - 40$$

$$= -31$$

$\therefore D < 0$ then the roots are imaginary.

17. $(3, -5), (-7, 4), (10, -2)$
 $x_1, y_1, x_2, y_2, x_3, y_3$

centroid $G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$
 $= \left(\frac{3 + (-7) + 10}{3}, \frac{-5 + 4 + (-2)}{3} \right)$
 $= \left(\frac{6}{3}, -\frac{3}{3} \right) = (2, -1)$

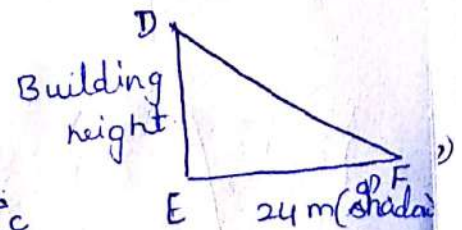
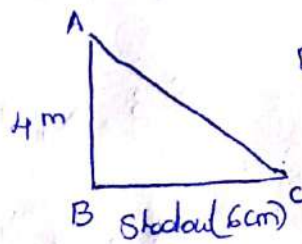
18. $\Delta ABC \sim \Delta DEF$

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

$$\frac{4}{x} = \frac{6}{24} \cdot 4$$

$$x = 16 \text{ m}$$

Building height = 16 m.



$$19. \text{ Ans : } (\sec^2\theta - 1) (\operatorname{cosec}^2\theta - 1)$$

$$= \tan^2\theta \times \cot^2\theta$$

$$= \cancel{\tan^2\theta} \times \frac{1}{\cancel{\tan^2\theta}}$$

$$= 1.$$

20. All possible outcomes when two coins are tossed at a time = $\{(H, H), (H, T), (T, H), (T, T)\}$

$$21. A \cup B = \{2, 4, 6, 8, 10\} \cup \{3, 6, 9, 12, 15\}$$

$$= \{2, 3, 4, 6, 8, 9, 10, 12, 15\}$$

$$A \cap B = \{2, 4, 6, 8, 10\} \cap \{3, 6, 9, 12, 15\}$$

$$= \{6\}$$

$$A - B = \{2, 4, \cancel{6}, 8, 10\} - \{3, \cancel{6}, 9, 12, 15\}$$

$$= \{2, 4, 8, 10\}$$

$$B - A = \{3, \cancel{6}, 9, 12, 15\} - \{2, 4, \cancel{6}, 8, 10\}$$

$$= \{3, 9, 12, 15\}$$

22.

one number = x

second number = $27 - x$

sum of two number = 27

product of two number = 182

$$x(27 - x) = 182$$

$$27x - x^2 = 182$$

$$x^2 - 27x + 182 = 0$$

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

$$\begin{array}{r} 182 \\ \wedge \\ -13 \quad -14 \end{array}$$

$$x(x-13) - 14(x-13) = 0$$

$$(x-13)(x-14) = 0$$

$$x-13 = 0 \quad \text{or} \quad x-14 = 0$$

$$x = 13 \quad \text{or} \quad x = 14$$

$$\begin{aligned} x = 13 \quad \text{So} \quad \text{Second number} &= 27 - x \\ &= 27 - 13 \\ &= 14 \end{aligned}$$

Two numbers are : 13, 14.

23. Sum of 4th term and 8th term in A.P = 24

$$a_4 + a_8 = 24$$

$$a + 3d + a + 7d = 24$$

$$\Rightarrow 2a + 10d = 24$$

$$\Rightarrow 2(a + 5d) = 24$$

$$\Rightarrow a + 5d = 12$$

Sum of 6th and 10th terms in A.P = 44

$$a_6 + a_{10} = 44$$

$$a + 5d + a + 9d = 44$$

$$2a + 14d = 44$$

$$2(a + 7d) = 44$$

$$a + 7d = 22$$

$$\begin{aligned} a + 7d &= 22 \\ (-) a + 5d &= 12 \end{aligned}$$

$$2d = 10$$

$$d = \frac{10}{2}$$

$$d = 5$$

$$a + 5d = 12$$

$$a + 5(5) = 12$$

$$a + 25 = 12$$

$$a = 12 - 25$$

$$a = -13$$

first three term : $a_1 = a = -13$

$$a_2 = a + d = -13 + 5 = -8$$

$$a_3 = a + 2d = -13 + 2(5)$$

$$= -13 + 10 = -3$$

24. Ans : Volume of cone = $\frac{1}{3} \pi \times 6 \times 6 \times 24 \text{ cm}^3$

If r is the radius of the sphere, then its volume is
 $= \frac{4}{3} \pi r^3$

Since the volume of clay in the form of the cone and the sphere remains the same, we have

$$\frac{4}{3} \pi r^3 = \frac{1}{3} \pi \times 6 \times 6 \times 24$$

$$r^3 = 3 \times 3 \times 24 = 3 \times 3 \times 3 \times 8$$

$$r^3 = 3^3 \times 2^3$$

$$r = 3 \times 2 = 6$$

Therefore the radius of the sphere is 6 cm.

25. $\Delta ABC \sim \Delta DEF$

$$\frac{\text{ar}(\Delta ABC)}{\text{ar}(\Delta DEF)} = \left(\frac{BC}{EF}\right)^2$$

$$\frac{54}{\text{ar}(\Delta DEF)} = \left(\frac{3}{4}\right)^2$$

$$\frac{54}{\text{ar}(\Delta DEF)} = \frac{9}{16}$$

$$9 \times \text{ar}(\Delta DEF) = 54 \times 16$$

$$\text{ar}(\Delta DEF) = \frac{54 \times 16}{9}$$

$$\text{ar}(\Delta DEF) = 96 \text{ sq. cm.}$$

26. Ans. $A + B + C = 180^\circ$

$$\frac{A + B + C}{2} = \frac{180^\circ}{2}$$

$$\frac{A + B}{2} + \frac{C}{2} = 90^\circ$$

$$\frac{A + B}{2} = 90^\circ - \frac{C}{2}$$

$$\tan\left(\frac{A + B}{2}\right) = \tan\left(90^\circ - \frac{C}{2}\right)$$
$$= \cot \frac{C}{2}$$

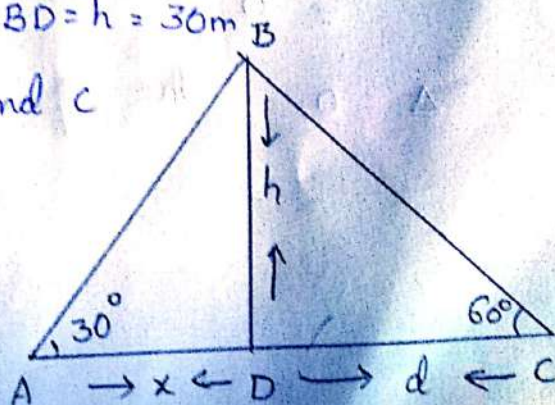
27: Ans: height of temple $BD = h = 30\text{m}$

Two men respectively A and C

$$\angle BAD = 30^\circ$$

$$\angle BCD = 60^\circ$$

$$AD = x, CD = d$$



$$\text{From } \triangle ABC \quad \tan 30^\circ = \frac{BD}{AD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{30}{x}$$

$$\Rightarrow x = 30\sqrt{3}$$

$$\text{From } \triangle BCD \quad \tan 60^\circ = \frac{BD}{DC} \Rightarrow \sqrt{3} = \frac{30}{d}$$

$$\Rightarrow d = \frac{30}{\sqrt{3}}$$

$$AC = AD + DC = 30\sqrt{3} + \frac{30}{\sqrt{3}}$$

$$= \frac{30 \times 3 + 30}{\sqrt{3}} = \frac{120}{\sqrt{3}} = 40\sqrt{3} \text{ m}$$

28. Ans : $(3, -2)$ $(-2, 8)$ $(0, 4)$
 x_1, y_1 x_2, y_2 x_3, y_3

$$\Delta = \frac{1}{2} \cdot |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

$$= \frac{1}{2} |3(8 - 4) + (-2)(4 - (-2)) + 0(-2 - 8)|$$

$$\Delta = \frac{1}{2} |3(4) + (-2)(4 + 2) + 0|$$

$$= \frac{1}{2} |12 - 12|$$

$$= \frac{1}{2} |0|$$

$$= 0$$

$$\Delta = 0$$

The given points are collinear.

29) a) Since we are using proof by contradiction, let us assume the contrary i.e., $\sqrt{5}$ is rational

If it is rational, then there must exist two integers x and s ($s \neq 0$) such that $\sqrt{5} = \frac{x}{s}$.

Suppose x and s have a common factor other than 1. Then, we divide by the common factor to get $\sqrt{5} = \frac{a}{b}$, where a and b are co-prime.

$$\text{So, } b\sqrt{5} = a.$$

On squaring both sides and regarding, we get $5b^2 = a^2$. Therefore, 5 divides a^2 .

Now, by statement 1, it follows that if 5 divides a^2 it also divides a .

So, we can write $a = 5c$ for some integer c .

Substituting for a , we get $5b^2 = 5c^2$ that is $b^2 = c^2$.

This means that 5 divides b^2 and so divides b . Therefore, both a and b have 5 as a common factor.

But this contradicts the fact that a and b are co-prime and have no common factors other than 1.

This contradiction has arisen because of our assumption that $\sqrt{5}$ is rational. So, we conclude that $\sqrt{5}$ is irrational.

29) b)

$$\begin{aligned}
 P(x) &= 3x^3 - 5x^2 - 11x - 3 \\
 P(3) &= 3(3)^3 - 5(3)^2 - 11(3) - 3 \\
 &= 3(27) - 5(9) - 33 - 3 \\
 &= 81 - 45 - 36 \\
 &= 81 - 81
 \end{aligned}$$

$$P(-1) = 3(-1)^3 - 5(-1)^2 - 11(-1) - 3$$

$$= 3(-1) - 5(1) + 11 - 3$$

$$= -3 - 5 + 11 - 3 = -8 + 8$$

$$= 0$$

$$P\left(-\frac{1}{3}\right) = 3\left(-\frac{1}{3}\right)^3 - 5\left(-\frac{1}{3}\right)^2 - 11\left(-\frac{1}{3}\right) - 3$$

$$= 3 \times \frac{-1}{3^3} - 5\left(\frac{1}{9}\right) + \frac{11}{3} - 3$$

$$= -\frac{1}{9} - \frac{5}{9} + \frac{11}{3} - 3$$

$$= \frac{-1 - 5 + 33 - 27}{9}$$

$$= \frac{27 - 27}{9} = \frac{0}{9} = 0$$

$P(3) = 0$, $P(-1) = 0$, $P\left(-\frac{1}{3}\right) = 0$ then $3, -1, -\frac{1}{3}$ are zeros of $P(x)$.

$$\alpha = 3, \beta = -1, \gamma = -\frac{1}{3}$$

$$\alpha + \beta + \gamma = 3 + (-1) + \left(-\frac{1}{3}\right)$$

$$= \frac{9 - 3 - 1}{3} = \frac{5}{3} = -\frac{(-5)}{3} = -\frac{\alpha}{\alpha^3} = -\frac{b}{a}$$

$$\alpha\beta\gamma = 3 \times -1 \times -\frac{1}{3}$$

$$= 1 = -\frac{(-3)}{3} = -\frac{d}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = 3(-1) + (-1)\left(-\frac{1}{3}\right) + \left(-\frac{1}{3}\right) \times 3$$

$$= -3 + \frac{1}{3} - 1$$

$$= \frac{-9 + 1 - 3}{3} = -\frac{11}{3} = -\frac{c}{a}$$

$$30) \quad \frac{5}{x-1} + \frac{1}{y-2} = 2 \quad , \quad \frac{6}{x-1} + \frac{5}{y-2} = 1$$

$$\text{Let } \frac{1}{x-1} = a \quad , \quad \frac{1}{y-2} = b$$

$$5a + b = 2 \rightarrow (1) \quad , \quad 6a - 3b = 1 \rightarrow (2)$$

$$(1) \times 3 + (2) \Rightarrow \quad \begin{array}{r} 15a + 3b = 6 \\ 6a - 3b = 1 \\ \hline 21a = 7 \end{array}$$

$$21a = 7$$

$$a = \frac{7}{21} = \frac{1}{3}$$

$$a = \frac{1}{3}$$

$$6a - 3b = 1 \Rightarrow 6\left(\frac{1}{3}\right) - 3b = 1$$

$$2 - 3b = 1$$

$$3b = 2 - 1$$

$$3b = 1$$

$$b = \frac{1}{3}$$

$$a = \frac{1}{3} \quad , \quad b = \frac{1}{3}$$

$$\frac{1}{x-1} = \frac{1}{3} \quad , \quad \frac{1}{y-2} = \frac{1}{3}$$

$$x-1 = 3 \quad , \quad y-2 = 3$$

$$x = 3+1 \quad , \quad y = 3+2$$

$$x = 4 \quad , \quad y = 5$$

30) b. Ans: $\text{Volume of Hemisphere} = \frac{2}{3} \pi r^3$

Internal radius of hemisphere $r = 15 \text{ cm}$

\therefore volume of liquid contained in hemispherical

$$\text{bowl} = \frac{2}{3} \pi (15)^3 \text{ cm}^3$$

$$= 2250 \pi \text{ cm}^3$$

This liquid is to be filled in cylindrical bottle and the height of each bottle (h) = 6 cm

Radius of cylindrical bottle (R) = $\frac{5}{2}$ cm

\therefore Volume of 1 cylindrical bottle = $\pi R^2 h$

$$= \pi \times \left(\frac{5}{2}\right)^2 \times 6$$

$$= \pi \times \frac{25}{4} \times 6 \text{ cm}^3 = \frac{75}{2} \pi \text{ cm}^3$$

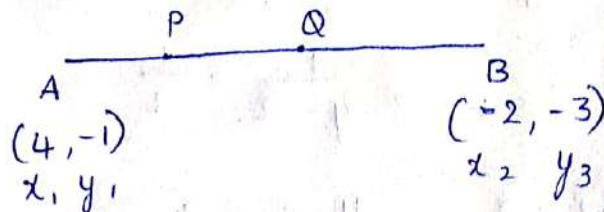
Number of cylindrical bottles required =

$$= \frac{\text{Volume of hemispherical bowl}}{\text{Volume of 1 cylindrical bottle}}$$

$$= \frac{2250\pi}{\frac{75}{2}\pi} = \frac{2 \times 2250}{75} = 60.$$

31) a. \overrightarrow{AB}

P, Q divides the AB line segment in the ratios 1:2, 2:1. Then P, Q are trisection points of AB.



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

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

$$= \left(\frac{-2+8}{3}, \frac{-3-2}{3} \right) = \left(\frac{6}{3}, \frac{-5}{3} \right)$$

$$= \left(2, \frac{-5}{3} \right)$$

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

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

$$= \left(\frac{-4+4}{3}, \frac{-6-1}{3} \right) = \left(0, -\frac{7}{3} \right)$$

31 b) i, Let E be the event of getting a red face card.

Then, the outcomes favourable to E are

1 diamond king, 1 heart king, 1 diamond queen, 1 heart queen, 1 diamond jack and 1 heart jack

\therefore The number of outcomes favourable to $E = 6$

$$\text{So, } P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Number of all possible outcomes}} = \frac{6}{52} = \frac{3}{26}$$

ii, Let E be the event of getting the jack of hearts
Then, the number of outcomes favourable to $E = 1$

$$\text{So, } P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Number of all possible outcomes}} = \frac{1}{52}$$

iii Let E be the event of getting a spade.

Then, the outcomes favourable to E are 13 spades.
Then the number of outcomes favourable to E is 13.

$$\text{So, } P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Number of all possible outcomes}} = \frac{13}{52} = \frac{1}{4}$$

iv, Let E be the event of getting the queen of diamond
Then, the number of outcomes favourable to $E = 1$

$$\text{So, } P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Number of all possible outcomes}} = \frac{1}{52}$$

$$\text{cosec } \theta + \cot \theta = k \rightarrow (1)$$

$$\text{cosec}^2 \theta - \cot^2 \theta = 1$$

$$(\text{cosec } \theta + \cot \theta) (\text{cosec } \theta - \cot \theta) = 1$$

$$k (\text{cosec } \theta - \cot \theta) = 1$$

$$\text{cosec } \theta - \cot \theta = \frac{1}{k} \rightarrow (2)$$

$$(1) + (2) \Rightarrow \text{cosec } \theta + \cancel{\cot \theta} = k$$

$$\text{cosec } \theta - \cancel{\cot \theta} = \frac{1}{k}$$

$$2 \text{ cosec } \theta = k + \frac{1}{k}$$

$$\text{cosec } \theta = \frac{k^2 + 1}{2k}$$

$$(1) - (2) \Rightarrow \text{cosec } \theta + \cancel{\cot \theta} = k$$

$$\text{cosec } \theta - \cancel{\cot \theta} = \frac{1}{k}$$

(-)

$$2 \cot \theta = k - \frac{1}{k}$$

$$\cot \theta = \frac{k^2 - 1}{2k}$$

$$\cos \theta = \frac{\cot \theta}{\text{cosec } \theta} = \frac{\left(\frac{\cos \theta}{\sin \theta} \right)}{\left(\frac{1}{\sin \theta} \right)} = \frac{\left(\frac{k^2 - 1}{2k} \right)}{\left(\frac{k^2 + 1}{2k} \right)}$$

$$= \frac{k^2 - 1}{k^2 + 1}$$

32 b)

<u>class interval</u>	<u>No. of obsd</u> f_i	<u>Mid value</u>	<u>U_i</u>	<u>$f_i U_i$</u>
10 - 25	2	17.5	-2	-4
25 - 40	3	32.5	-1	-3
40 - 55	7	<u>47.5</u>	0	0
55 - 70	6	62.5	1	6
70 - 85	6	77.5	2	12
85 - 100	6	92.5	3	18
	<u>$\Sigma f_i = 30$</u>			<u>$\Sigma f_i U_i = 29$</u>

$$\begin{aligned} \text{Mean (A.M)} &= a + \frac{\Sigma f_i U_i}{\Sigma f_i} \times h \\ &= 47.5 + \frac{29}{30} \times 15 \\ &= 47.5 + 14.5 \\ &= 62. \end{aligned}$$

33 a) $P(x) = x^2 - x - 6$

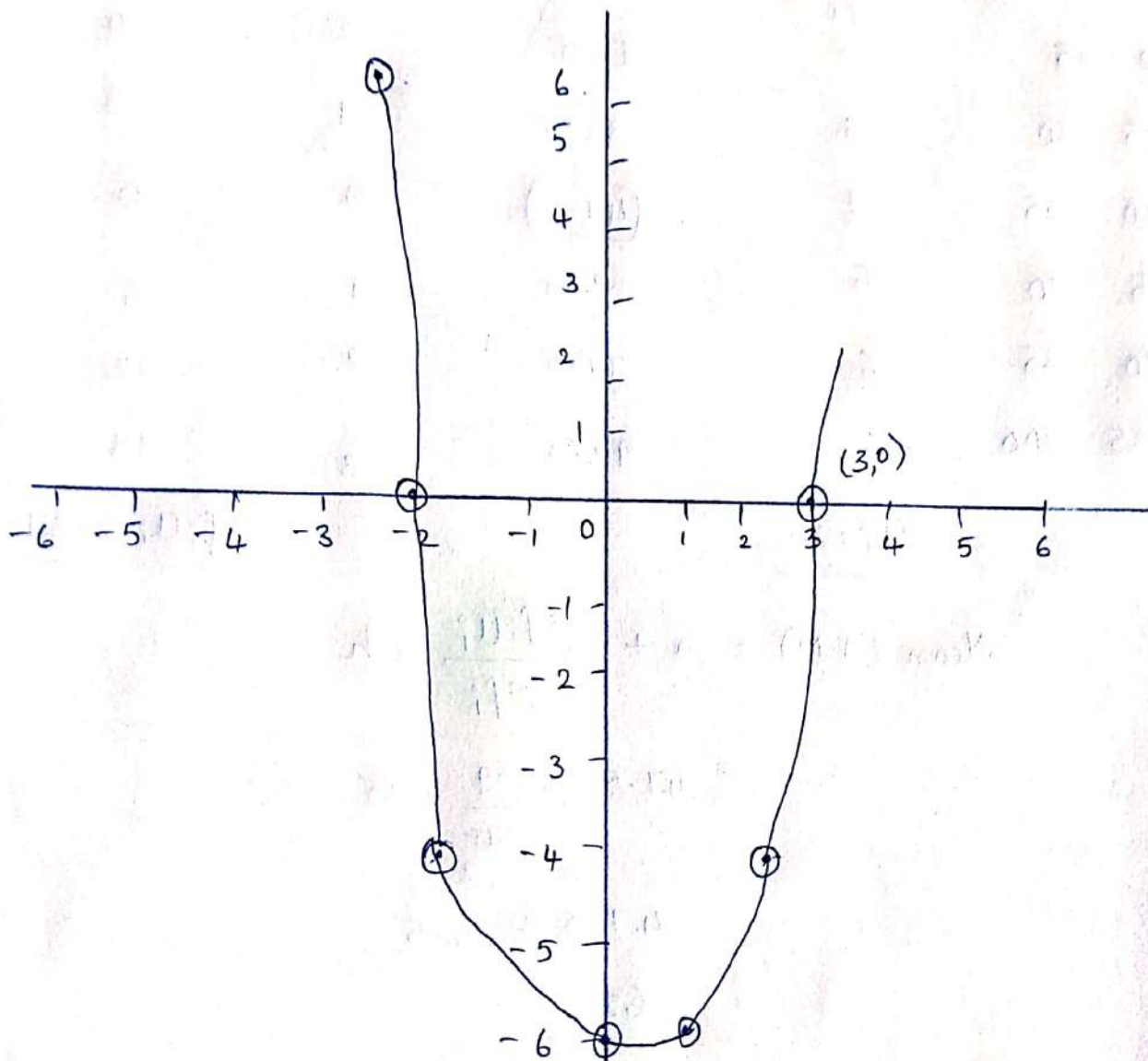
					-1	-2	-3
x	0	1	2	3			
x^2	0	1	4	9	1	4	9
$-x$	0	-1	-2	-3	1	2	
-6	-6	-6	-6	-6	-6	-6	-6
$P(x)$	-6	-6	-4	0	-4	0	6

$(0, -6) (1, -6) (2, -4) (3, 0) (-1, -4) (-2, 0) (-3, 6)$

33 b)

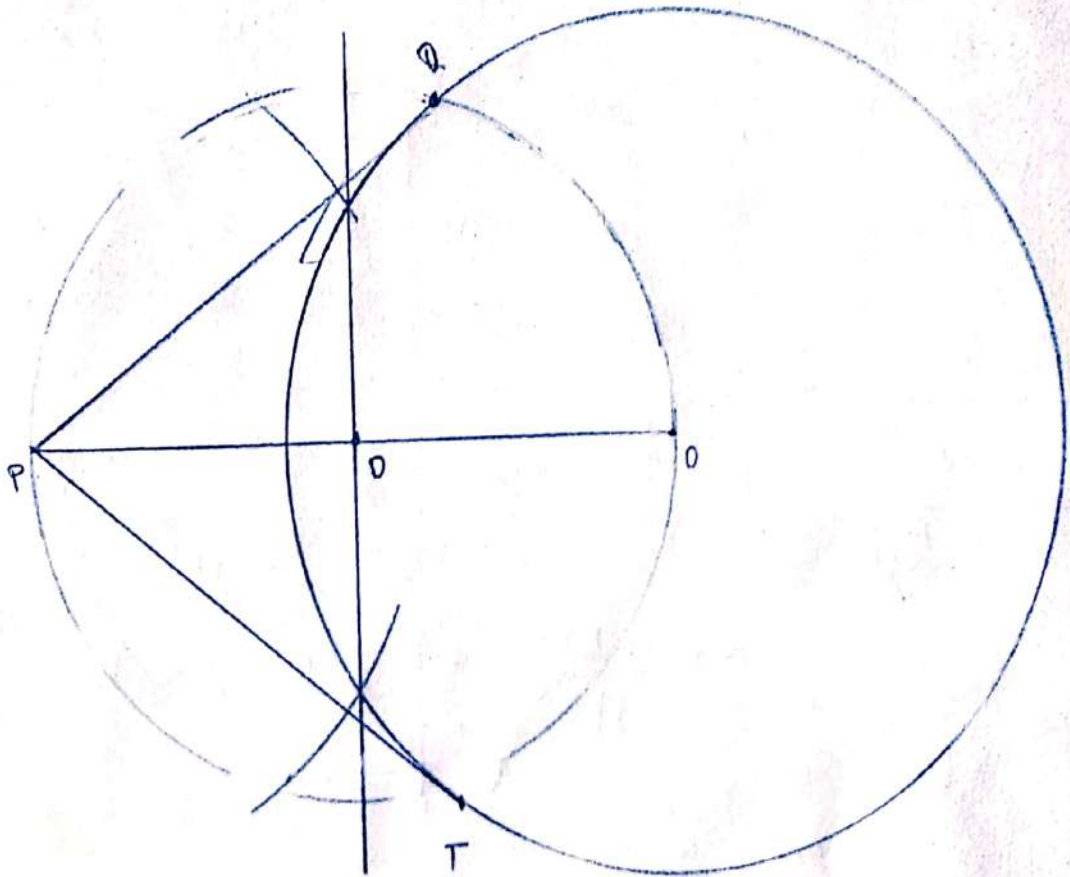
Scale : x axis 1 cm = 1 unit

1 cm = 1 unit.



The graph of $p(x) = x^2 - x - 6$ cuts the x-axis in the points $(3, 0)$ & $(-2, 0)$. From graph the zeroes of $p(x) = x^2 - x - 6$ are 3, -2.

33 b).



Constructions:-

- 1) Draw a circle with 6 cm radius.
- 2) Draw a line segment of 10 cm OP
- 3) Draw perpendicular bisector for line segment OP
- 4) Draw a circle with radius OD. The circle intersects the original circle at Q, T.
- 5) Join PQ and PT, PQ and PT are tangents of circle.

$$PQ = PT = 8 \text{ cm}$$

$$PQ = \sqrt{OP^2 - OQ^2} = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} \\ = \sqrt{64} = 8 \text{ cm}$$

$$PT = \sqrt{OP^2 - OT^2} = \sqrt{10^2 - 6^2} \\ = \sqrt{100 - 36} = \sqrt{64} = 8 \text{ cm}$$

DCEB KRISHNA

KEY FOR Mathematics Paper I & II
(Telugu Medium)

1. Ans : $\log_{81} 3 = x \Rightarrow (81)^x = 3$
 $\Rightarrow (3^4)^x = 3$
 $\Rightarrow 3^{4x} = 3^1$
 $\Rightarrow 3^{4x} = 3^1$
 $4x = 1$
 $x = \frac{1}{4}$

2. Ans : $n(A-B) = 0$

3. Ans : C $\left[\frac{c}{a} = \frac{10}{1} = 10 \right]$

4. Ans : C $\left[\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \cdot \frac{4}{8} = \frac{5}{k} = \frac{9}{18} \Rightarrow k = 10 \right]$

5. Ans : A $\left[b^2 - 4ac = 5^2 - 4(2)(3) = 25 - 24 = 1 \right]$

6. Ans : A $\left[\frac{a_2}{a_1} = \frac{-5}{-8} = \frac{-2}{-1} \right] \quad r = -2$
: A

7. Ans : 7.5 $\left[\frac{6}{PQ} = \frac{4}{QR} = \frac{8}{6} \Rightarrow \begin{aligned} PQ &= 4.5 \\ QR &= 3 \\ PQ + QR &= 7.5 \end{aligned} \right]$

8. Ans : C $\left[\frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 6}{-2 - 4} = \frac{-1}{-6} = \frac{1}{6} \right]$

9. Ans : A $\left[\sqrt{d^2 - r^2} = \sqrt{17^2 - 8^2} \right]$
 $= \sqrt{289 - 64}$
 $= \sqrt{225} = 15 \text{ cm}$

10) Ans : D $\left[2 \sin^2 60^\circ \cdot \cos 60^\circ = 2 \times \frac{3}{4} \times \frac{1}{2} = \frac{3}{4} \right]$

11) Ans : D

12)
$$\text{S.A.O} = \frac{3+5+9+x+11}{5}$$

$$7 = \frac{28+x}{5}$$

$$35 = 28+x$$

$$x = 35 - 28$$

$$x = 7.$$

13)

$$72 = 2 \times 36$$

$$= 2 \times 2 \times 18$$

$$= 2 \times 2 \times 2 \times 9$$

$$= 2 \times 2 \times 2 \times 3 \times 3$$

$$108 = 2 \times 54$$

$$= 2 \times 2 \times 27$$

$$= 2 \times 2 \times 3 \times 9$$

$$= 2 \times 2 \times 3 \times 3 \times 3$$

$$\text{S.F.O} = 2 \times 2 \times 2 \times 3 \times 3 \times 3$$

$$= 216$$

$$\text{P.F.O} = 2 \times 2 \times 3 \times 3$$

$$= 36.$$

14. C అక్షరాల సంఖ్యలు :

$\phi, C, \{x\}, \{y\}, \{z\}, \{x, y\}, \{y, z\}, \{x, z\}$

15. $\alpha = 2, \beta = -1$

$$K [x^2 - (\alpha + \beta)x + \alpha\beta]$$

$$K [x^2 - (2 + (-1))x + 2(-1)]$$

$$k[x^2 - x - 2]$$

$$k = 1 \text{ గా } x^2 - x - 2$$

16. Ans: $2x^2 - 3x + 5 = 0$ ను $ax^2 + bx + c = 0$ గా తీసుకుంటే $a = 2, b = -3, c = 5$.

ఇక్కడ $D = b^2 - 4ac$

$$= (-3)^2 - 4(2)(5)$$

$$= 9 - 40$$

$$= -31$$

$\therefore D < 0$ కాబట్టి మూలలు కల్పనలు

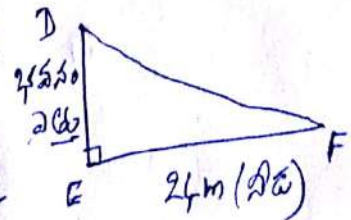
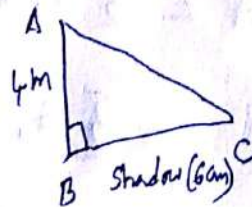
17. $(3, -5), (-7, 4), (10, -2)$
 $x_1, y_1, x_2, y_2, x_3, y_3$

మూలకేంద్రం $G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$

$$= \left(\frac{3 + (-7) + 10}{3}, \frac{-5 + 4 + (-2)}{3} \right)$$

$$= \left(\frac{6}{3}, \frac{-3}{3} \right) = (2, -1)$$

18. $\triangle ABC \sim \triangle DEF$



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

$$\frac{4}{x} = \frac{6}{24}$$

$$x = 16 \text{ m}$$

$$\text{భవన ఎత్తు} = 16 \text{ m}$$

$$27x - x^2 = 182$$

19. Ans: $(\sec^2 \theta - 1) (\csc^2 \theta - 1)$

$$= \tan^2 \theta \times \cot^2 \theta$$

$$= \cancel{\tan^2 \theta} \times \frac{1}{\cancel{\cot^2 \theta}}$$

$$= 1.$$

20. రెండు వాళ్ళిండు ఒకే సారి ఎగుతే పోలిక

$$\text{వచ్చే సరికొలుపు} = \sum (H, H), (H, T), (T, H), (T, T)$$

21. $A \cup B = \{2, 4, 6, 8, 10\} \cup \{3, 6, 9, 12, 15\}$

$$= \{2, 4, 6, 8, 9, 10, 12, 15\}$$

$$A \cap B = \{2, 4, 6, 8, 10\} \cap \{3, 6, 9, 12, 15\}$$

$$= \{6\}$$

$$A - B = \{2, 4, 8, 10\} - \{3, 6, 9, 12, 15\}$$

$$= \{2, 4, 8, 10\}$$

$$B - A = \{3, 6, 9, 12, 15\} - \{2, 4, 8, 10\}$$

$$= \{3, 9, 12, 15\}$$

22

$$\text{ఏక సంఖ్య} = x, \quad \text{రెండు సంఖ్యల మొత్తం} = 27$$

$$\text{రెండో సంఖ్య} = 27 - x$$

$$\text{వటలబ్ధం} = 182$$

$$27x - x^2 = 182$$

$$27x - x^2 = 182$$

$$x^2 - 27x + 182 = 0$$

$$x^2 - 13x - 14x + 182 = 0 \quad \begin{array}{l} 182 \\ \wedge \\ -13 \quad -14 \end{array}$$

$$x(x-13) - 14(x-13) = 0$$

$$(x-13)(x-14) = 0$$

$$x-13=0 \text{ గా } x-14=0$$

$$x=13 \text{ గా } x=14$$

$$x=13 \text{ గా } \text{రెండో సంఖ్య} = 27 - x \\ = 27 - 13$$

$$= 14.$$

సంఖ్యలు : 13, 14

23. తొమ్మిది వా 4వ మరియు 8వ పదాల మొత్తం = 24

$$a_4 + a_8 = 24$$

$$a + 3d + a + 7d = 24$$

$$\cancel{2a + 10d = 24} \Rightarrow 2a + 10d = 24$$

$$2(a + 5d) = 24 \Rightarrow 2(a + 5d) = 24$$

$$a + 5d = 12 \Rightarrow a + 5d = 12$$

6వ మరియు 10వ పదాల మొత్తం = 44

$$a_6 + a_{10} = 44$$

$$a + 5d + a + 9d = 44$$

$$2a + 14d = 44$$

$$2(a + 7d) = 44$$

$$a + 7d = 22$$

$$\begin{array}{r} a+7d = 22 \\ a+5d = 12 \\ \hline \end{array}$$

$$2d = 10$$

$$d = \frac{10}{2} = 5$$

$$d = 5$$

$$a+5d = 12$$

$$a+5(5) = 12$$

$$a+25 = 12$$

$$a = 12-25$$

$$a = -13$$

మొదటి పాదం పదాలు: $a_1 = a = -13$

$$a_2 = a+d = -13+5 = -8$$

$$\begin{aligned} a_3 &= a+2d = -13+2(5) \\ &= -13+10 = -3 \end{aligned}$$

24. Ans: చుట్టూ గుచ్చుకోవడం $r = 6 \text{ cm}$

చుట్టూ వెళ్లడం $h = 24 \text{ cm}$.

గోళం యొక్క గుచ్చుకోవడం = R

చుట్టూ గుచ్చుకోవడం = గోళం గుచ్చుకోవడం

$$\frac{1}{3} \pi r^2 h = \frac{4}{3} \pi R^3$$

$$r^2 h = 4R^3$$

$$6^2 \times 24 = 4R^3$$

$$36 \times 24 = 4R^3$$

$$R^3 = 36 \times 6$$

$$R^3 = 6 \times 6 \times 6$$

$$R = 6 \text{ cm.}$$

25. $\triangle ABC \sim \triangle DEF$

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle DEF)} = \left(\frac{BC}{EF}\right)^2$$

$$\frac{54}{\text{ar}(\triangle DEF)} = \left(\frac{3}{4}\right)^2$$

$$\frac{54}{\text{ar}(\triangle DEF)} = \frac{9}{16}$$

$$9 \times \text{ar}(\triangle DEF) = 54 \times 16$$

$$\text{ar}(\triangle DEF) = \frac{54 \times 16}{9}$$

$$\text{ar}(\triangle DEF) = 96 \text{ cm}^2$$

26. Any. $A + B + C = 180^\circ$

$$\frac{A + B + C}{2} = \frac{180^\circ}{2}$$

$$\frac{A + B}{2} + \frac{C}{2} = 90^\circ$$

$$\frac{A + B}{2} = 90^\circ - \frac{C}{2}$$

$$\tan\left(\frac{A+B}{2}\right) = \tan\left(90^\circ - \frac{C}{2}\right)$$

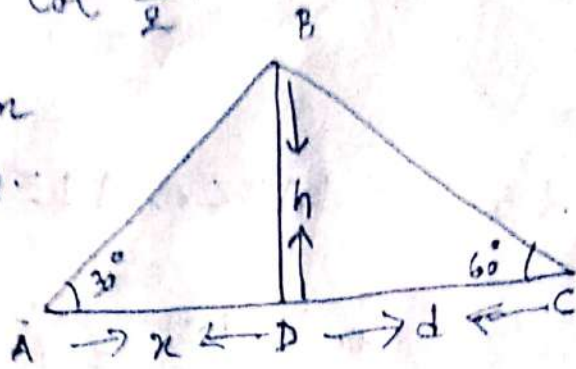
$$= \cot \frac{C}{2}$$

Q7. క్షేత్రం $BD = h = 30 \text{ m}$

A, C లో 2 బొటం సునుభ్రం.

$$\angle BAD = 30^\circ$$

$$\angle BCD = 60^\circ$$



$$AD = x, \quad DC = d$$

$$\Delta ABD \text{ నుండి } \tan 30^\circ = \frac{BD}{AD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{30}{x}$$

$$\Rightarrow x = 30\sqrt{3}$$

$$\Delta BCD \text{ నుండి } \tan 60^\circ = \frac{BD}{DC} \Rightarrow \sqrt{3} = \frac{30}{d}$$

$$\Rightarrow d = \frac{30}{\sqrt{3}}$$

$$AC = AD + DC = 30\sqrt{3} + \frac{30}{\sqrt{3}}$$

$$= \frac{30 \times 3 + 30}{\sqrt{3}} = \frac{120}{\sqrt{3}} = 40\sqrt{3} \text{ m}$$

28. Any: $(x_1, y_1) = (3, -2)$, $(x_2, y_2) = (-2, 8)$, $(x_3, y_3) = (0, 4)$

$$\Delta = \frac{1}{2} \left| x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) \right|$$

$$= \frac{1}{2} \left| 3(8 - 4) + (-2)(4 - (-2)) + 0(-2 - 8) \right|$$

$$\Delta = \frac{1}{2} | 3(4) + (-2)(4+2) + 0 |$$

$$= \frac{1}{2} | 12 - 12 |$$

$$= \frac{1}{2} | 0 |$$

$$= 0.$$

$\Delta = 0$ క్రమ ఇచ్చిన బిందువులు సరిఖామాల.

29 a) $\sqrt{5}$ కరణీయ సంఖ్య కాదు $\sqrt{5}$ అకరణీయ సంఖ్య ప్రమాణం
 $\sqrt{5} = \frac{a}{b}$ ($b \neq 0$) అయ్యేటట్లుగా a, b ల
 రెండు సహజ సంఖ్యలు అనుకోండి.

$$a = b\sqrt{5}$$

రెండు వైపుల వర్గం చేయగా

$$a^2 = b^2 \times 5$$

$a^2, 5$ చే భాగించబడుతుంది.

a లో 5 చే భాగించబడుతుంది.

కాబట్టి $a = 5c$, c ఒక సంఖ్య

$a = 5c$ ని $a^2 = 5b^2$ లో ప్రతిక్షేపించగా

$$(5c)^2 = 5b^2$$

$$25c^2 = 5b^2$$

$$5c^2 = b^2$$

b^2 ని 5 భాగిస్తుంది.

b ని లోప 5 భాగిస్తుంది.

∴ a, b లు రెండు '5' చే భాగించబడతాయి.

∴ కాని ఇది a, b లు పరస్పర ప్రధానాంకాలు అని దానికి విరుద్ధం.

∴ ఈ విరుద్ధత రావడానికి కారణం మనం $\sqrt{5}$ కరణీయ సంఖ్య అని అనుకున్నాము కచ్చితమైన మనం దీనిని బహుళిత్వం ∴ $\sqrt{5}$ కరణీయ సంఖ్య.

29 b) $P(x) = 3x^3 - 5x^2 - 11x - 3$

$$P(3) = 3(3)^3 - 5(3)^2 - 11(3) - 3$$

$$= 3(27) - 5(9) - 33 - 3$$

$$= 81 - 45 - 36$$

$$= 81 - 81$$

$$= 0.$$

$$P(-1) = 3(-1)^3 - 5(-1)^2 - 11(-1) - 3$$

$$= 3(-1) - 5(1) + 11 - 3$$

$$= -3 - 5 + 11 - 3 = -8 + 8$$

$$= 0.$$

$$P\left(-\frac{1}{3}\right) = 3\left(-\frac{1}{3}\right)^3 - 5\left(-\frac{1}{3}\right)^2 - 11\left(-\frac{1}{3}\right) - 3$$

$$= 3 \times \frac{-1}{3^3} - 5\left(\frac{1}{9}\right) + \frac{11}{3} - 3$$

$$= \frac{-1}{9} - \frac{5}{9} + \frac{11}{3} - 3$$

$$= \frac{-1 - 5 + 33 - 27}{9}$$

$$= \frac{27 - 27}{9} = \frac{0}{9} = 0$$

$P(3) = 0, P(-1) = 0, P\left(-\frac{1}{3}\right) = 0$ కావున $P(x)$ ని $3, -1, -\frac{1}{3}$ లు సూక్ష్మ అంశాలు.

$$\alpha = 3, \beta = -1, \gamma = -\frac{1}{3}$$

$$\alpha + \beta + \gamma = 3 + (-1) + \left(-\frac{1}{3}\right)$$

$$= \frac{9 - 3 - 1}{3} = \frac{5}{3} = \frac{-(-5)}{3} = \frac{x_0}{a}$$

$$\alpha\beta\gamma = 3 \times (-1) \times \left(-\frac{1}{3}\right)$$

$$= 1 = \frac{-(-3)}{3} = \frac{-d}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = 3(-1) + (-1)\left(-\frac{1}{3}\right) + \left(-\frac{1}{3}\right)(3)$$

$$= -3 + \frac{1}{3} - 1$$

$$= \frac{-9 + 1 - 3}{3} = \frac{-11}{3} = \frac{x_0 + y_0 + z_0}{a}$$

30 a) $\frac{5}{x-1} + \frac{1}{y-2} = 2, \quad \frac{6}{x-1} - \frac{3}{y-2} = 1$

$$\frac{1}{x-1} = a, \quad \frac{1}{y-2} = b$$

$$5a + b = 2 \quad \text{--- (1)}$$

$$6a - 3b = 1 \quad \text{--- (2)}$$

$$\text{(1)} \times 3 + \text{(2)} \Rightarrow 15a + 3b = 6$$

$$6a - 3b = 1$$

$$\text{--- (+)}$$

$$21a = 7$$

$$a = \frac{7}{21} = \frac{1}{3}$$

$$a = \frac{1}{3}$$

$$6a - 3b = 1 \Rightarrow 6\left(\frac{1}{3}\right) - 3b = 1$$

$$2 - 3b = 1$$

$$3b = 2 - 1$$

$$3b = 1$$

$$b = \frac{1}{3}$$

$$a = \frac{1}{3}, \quad b = \frac{1}{3}$$

$$\frac{1}{x-1} = \frac{1}{3}, \quad \frac{1}{y-2} = \frac{1}{3}$$

$$x-1 = 3 \quad \therefore, \quad y-2 = 3$$

$$x = 3+1, \quad y = 3+2$$

$$x = 4, \quad y = 5.$$

30 b) Ans.

$$\text{ఊళ్ళం గోళం ఘన పరిమాణం} = \frac{2}{3} \pi r^3$$

$$\text{ఊళ్ళం తీరరేఖ వ్యాసం } r = 15 \text{ cm}$$

$$\text{ఊళ్ళం గోళం ఘన పరిమాణం} = \frac{2}{3} \pi (15)^3$$

$$= 2250 \pi \text{ cm}^3$$

$$\text{ఊళ్ళం గోళం ఎత్తు } h = 6 \text{ cm}$$

$$\text{ఊళ్ళం గోళం వ్యాసం } (R) = \frac{5}{2} \text{ cm}$$

$$\text{ఊళ్ళం గోళం ఘన పరిమాణం} = \pi R^2 h$$
$$= \pi \times \left(\frac{5}{2}\right)^2 \times 6.$$

$$= \pi \times \frac{25}{1} \times 6 = \frac{75}{2} \pi \text{ cm}^3$$

$$\text{అవసరమగు సుపరికర బడల్యే సంఖ్య} = \frac{\text{అక్షరాల సంఖ్య}}{\text{ఒక సుపరికర బడల్యే సంఖ్య}}$$

$$= \frac{2250\pi}{\frac{75 \times \pi}{2}} = \frac{2 \times 2250}{75} = 60$$

31 ఎ) \vec{AB} తీరే రేఖా భుజాన్ని P Q

P, Q ల వరుసగా $1:2, 2:1$ $A(4, -1)$ $B(-2, -3)$
 నిష్పత్తి తీరే తీరంగా విభజించాలి. x_1, y_1 x_2, y_2

P, Q ల అధికరించు బిందువుల క్రమం.

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

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

$$= \left(\frac{-2+8}{3}, \frac{-3-2}{3} \right) = \left(\frac{6}{3}, \frac{-5}{3} \right)$$

$$= \left(2, -\frac{5}{3} \right)$$

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

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

$$= \left(\frac{-4+4}{3}, \frac{-6-1}{3} \right) = \left(0, -\frac{7}{3} \right)$$

31 b) వేక కట్టలలో 52 ముక్కలు క్రిందివి. కచ్చిన మొత్తం
 ఫలితాల సంఖ్య = 52.

i) వేక కట్టలనుండి ఒక ముక్కను తీస్తే, అది ఎరుపు ముఖ
 కార్డు - తయ్యకమున E కు ముఖం వచ్చే E కి కుమార్తెల సంఖ్య = 26
 ఎరుపు ముఖ కార్డు తయ్యకమున సంఖ్యల P(E) = $\frac{E \text{ కి కుమార్తెల సంఖ్య}}{\text{మొత్తం ఫలితం}}$

$$P(E) = \frac{26}{52} = \frac{1}{2}$$

ii) వేక కట్టలనుండి ఒక ముక్కను తీస్తే, అది వ్యవస్థాపక
 గల బిల్ కార్డు తయ్యకమున E కు ముఖం వచ్చే E కి
 కుమార్తెల సంఖ్య = 1

వ్యవస్థాపక గల బిల్ కార్డు తయ్యకమున సంఖ్యల

$$P(E) = \frac{E \text{ కి కుమార్తెల సంఖ్య}}{\text{మొత్తం ఫలితం}} = \frac{1}{52}$$

iii) వేక కట్టలనుండి ఒక ముక్కను తీస్తే, అది కచ్చిన ముఖ
 - తయ్యకమున E కు ముఖం వచ్చే E కి కుమార్తెల సంఖ్య = 13

కచ్చిన ముఖ కార్డు తయ్యకమున సంఖ్యల P(E) = $\frac{E \text{ కి కుమార్తెల సంఖ్య}}{\text{మొత్తం ఫలితం}}$

$$= \frac{13}{52} = \frac{1}{4}$$

iv) వేక కట్టలనుండి ఒక ముక్కను తీస్తే, అది సైమండ్ రాయి
 తయ్యకమున E కు ముఖం వచ్చే E కి కుమార్తెల సంఖ్య = 1

సైమండ్ రాయి కార్డు తయ్యకమున సంఖ్యల P(E) = $\frac{E \text{ కి కుమార్తెల సంఖ్య}}{\text{మొత్తం ఫలితం}}$
 $P(E) = \frac{1}{52}$

$$12. a) \quad \operatorname{cosec} \theta + \cot \theta = k \rightarrow (1)$$

$$\operatorname{cosec} \theta = \cot \theta + 1$$

$$(\cot \theta + 1)(\operatorname{cosec} \theta - \cot \theta) = 1$$

$$k(\operatorname{cosec} \theta - \cot \theta) = 1$$

$$\operatorname{cosec} \theta - \cot \theta = \frac{1}{k} \rightarrow (2)$$

$$(1) + (2) \Rightarrow \begin{array}{l} \operatorname{cosec} \theta + \cot \theta = k \\ \operatorname{cosec} \theta - \cot \theta = \frac{1}{k} \end{array}$$

$$2 \operatorname{cosec} \theta = k + \frac{1}{k}$$

$$\operatorname{cosec} \theta = \frac{k^2 + 1}{2k}$$

$$(1) - (2) \Rightarrow \begin{array}{l} \operatorname{cosec} \theta + \cot \theta = k \\ \operatorname{cosec} \theta - \cot \theta = \frac{1}{k} \end{array}$$

$$2 \cot \theta = k - \frac{1}{k}$$

$$\cot \theta = \frac{k^2 - 1}{2k}$$

$$\cos \theta = \frac{\cot \theta}{\operatorname{cosec} \theta} = \frac{\left(\frac{k^2 - 1}{2k}\right)}{\left(\frac{k^2 + 1}{2k}\right)}$$

$$= \frac{k^2 - 1}{k^2 + 1}$$

32 b)

<u>ଶନିତ୍ଵ</u>	<u>ଆବୃତ୍ତି</u> f_i	<u>ଶନିତ୍ଵ</u> <u>ମଧ୍ୟ</u>	<u>ଅନ୍ତର</u> U_i	$f_i U_i$
10-25	2	17.5	-2	-4
25-40	3	32.5	-1	-3
40-55	7	(47.5)	0	0
55-70	6	62.5	1	6
70-85	6	77.5	2	12
85-100	6	92.5	3	18
	$\Sigma f_i = 30$			$\Sigma f_i U_i = 29$

$$\begin{aligned} \text{ମଧ୍ୟ (A.M)} &= a + \frac{\Sigma f_i U_i}{\Sigma f_i} \times h \\ &= 47.5 + \frac{29}{30} \times 15 \\ &= 47.5 + 14.5 \\ &= 62. \end{aligned}$$

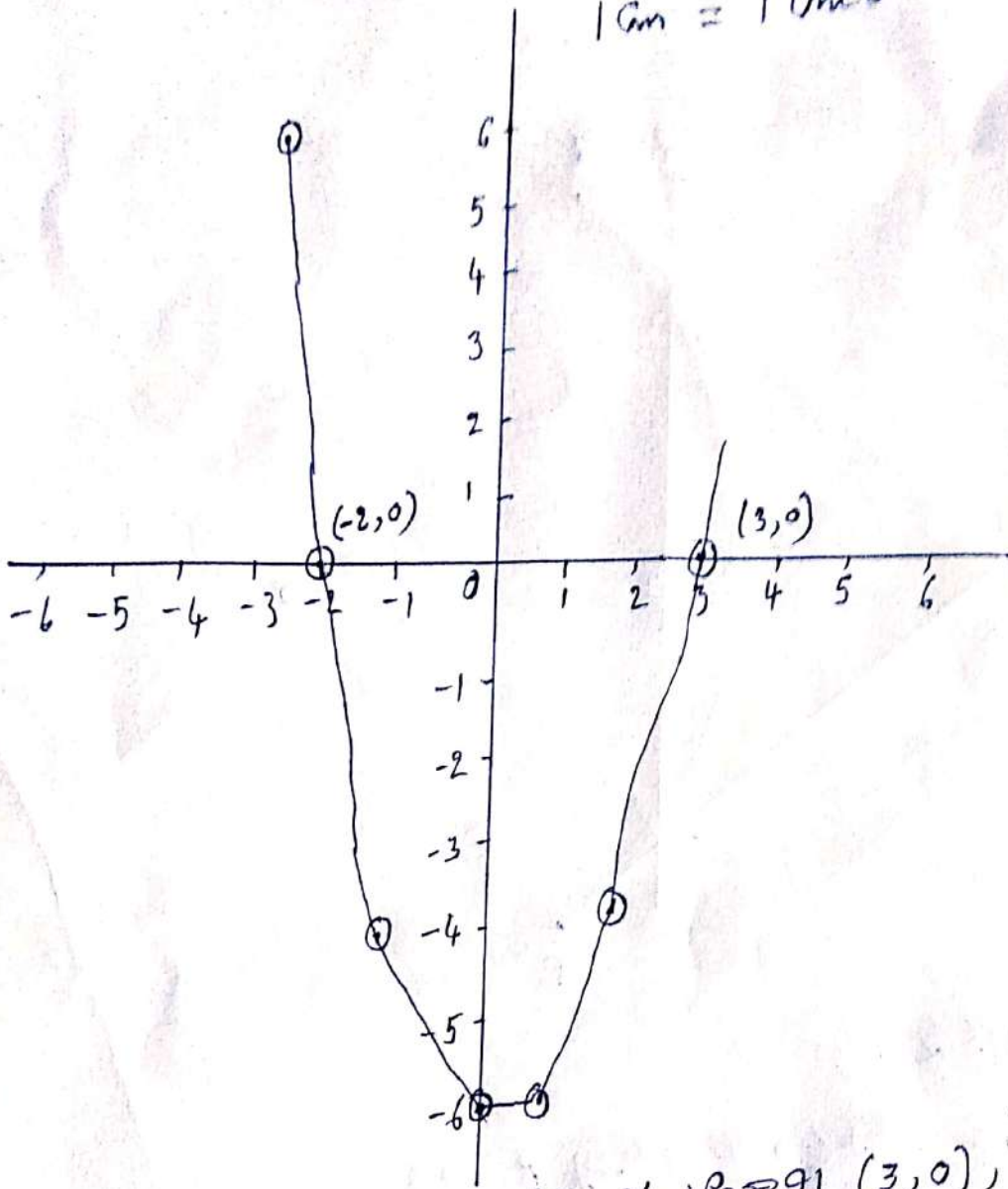
33 a) $P(x) = x^2 - x - 6.$

x	0	1	2	3	-1	-2	-3
x^2	0	1	4	9	1	4	9
$-x$	0	-1	-2	-3	1	2	3
-6	-6	-6	-6	-6	-6	-6	-6
$P(x)$	-6	-6	-4	0	-4	0	6

$$P(x) = -6 \quad -6 \quad -4 \quad 0 \quad -4 \quad 0 \quad 6$$

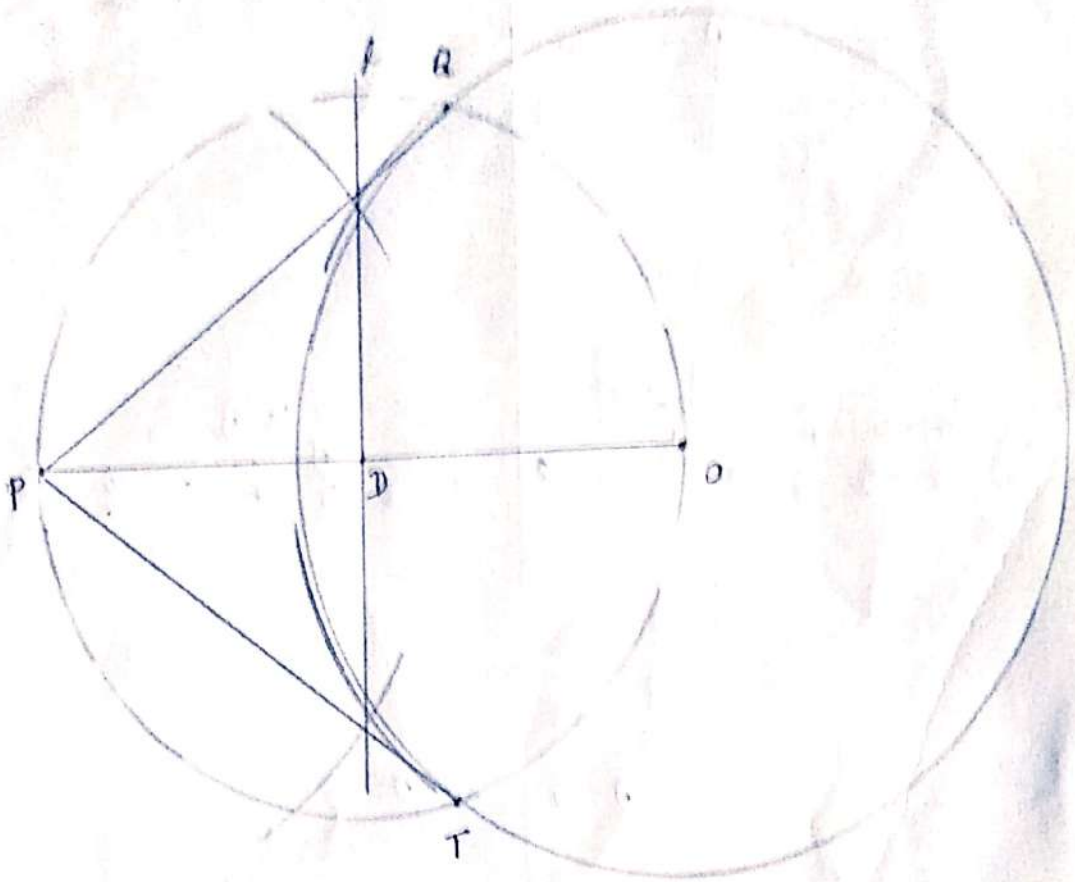
$$(0, -6) \quad (1, -6) \quad (2, -4) \quad (3, 0) \quad (-1, -4) \quad (-2, 0) \quad (-3, 6)$$

$\text{Ex: } x^2 - x - 6 \quad 1 \text{ cm} = 1 \text{ Unit}$
 $1 \text{ cm} = 1 \text{ Unit}$



$P(x) = x^2 - x - 6$ గా ఇచ్చిన x -అక్షాన్ని $(3, 0)$, $(-2, 0)$ బిందువులలో ఖండించును. కావున $P(x) = x^2 - x - 6$ యొక్క బిందువులు $3, -2$ అవుతాయి.

33 b)



నివ్వబడినవి :

- 1) 6cm వ్యాసార్థం లో వృత్తాన్ని గీసినది.
 - 2) $OP = 10\text{cm}$ లో రేఖ ఖండాన్ని గీసినది.
 - 3) OP మధ్య లంబ సమవత్సరఖండన రేఖ 'L'ని గీసినది.
 - 4) OP వ్యాసార్థం వృత్తాన్ని గీసినది. ఈ రేఖ వృత్తాన్ని Q, T బిందువులలో ఖండించింది.
 - 5) P, Q లను, P, T లను కలిపింది.
 - 6) PQ, PT ల వృత్తానికి రెండు సమకోణాలు.
- $PQ = PT = 8\text{cm}$.

సరిచూడండి :

$$PQ = \sqrt{OP^2 - OQ^2} = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8\text{cm}$$

$$PT = \sqrt{OP^2 - OT^2} = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8\text{cm}$$

DCEB KRISHNA
SSC PUBLIC EXAMINATIONS - JULY - 2020
MATHEMATICS - Paper - I & II
MODEL PAPER
(English Medium)

Time : 3-15 Hrs.]

[Max. Marks : 100

Instructions :

- 1) Answer ALL the questions in a separate answer Booklet.
 - 2) The question paper consists of 4 sections and 33 questions.
 - 3) There is an internal choice in Section - IV
 - 4) Write answers neatly and legibly.
-

SECTION – I

Note : 1) Answer ALL the questions in ONE WORD or PHRASE.

2) Each question carries 1 mark.

3) If any question is answered more than once, the first answer only will be considered. **12 x 1 = 12**

1. Determine the value of $\log_{81} 3$.
2. If $A \subset B$, $n(A) = 4$, $n(B) = 7$ the $n(A - B) =$
3. The product of the zeros of the polynomial $x^2 + 7x + 10$ is
A) -7 B) 7 C) 10 D) - 10
4. If the system of equations $4x + 5y = 9$, $8x + ky = 18$ has infinitely many solutions then $k =$
A) 8 B) 9 C) 10 D) 1
5. The discriminant of $2x^2 + 5x + 3 = 0$ is
A) 1 B) -1 C) 25 D) 24

[Turn Over

6. The common ratio of the G.P. 3, -6, 12, -24, 48, is
 A) - 2 B) $-\frac{1}{2}$ C) - 3 D) 2
7. The slope of line joining (4, 6) and (-2, 5) is
 A) $\frac{6}{5}$ B) $-\frac{2}{4}$ C) $\frac{1}{6}$ D) $\frac{11}{2}$
8. $\Delta ABC \sim \Delta PQR$ if $AB = 6$, $BC = 4$, $AC = 8$, $PR = 6$ then $PQ + QR =$
9. The length of tangent drawn from a point 17 cm away from the centre of a circle of radius 8 cm is
 A) 25 cm B) 9 cm C) 15 cm D) 8.5 cm
10. The value of $2 \sin^2 60^\circ \times \cos 60^\circ$
 A) $\frac{1}{3}$ B) $\frac{5}{2}$ C) $\frac{4}{3}$ D) $\frac{3}{4}$
11. Which of the following cannot be the probability of an event.
 A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) 25% D) $\frac{4}{3}$
12. The mean of 3, 5, 9, x , 11 is 7, then $x =$

SECTION – II

Note : 1) Answer ALL the questions.

2) Each question carries 2 marks.

8 x 2 = 16

13. Find the LCM and HCF of 72 and 108.
14. List all the subsets of $c = \{x, y, z\}$
15. Find the quadratic polynomial whose zeroes are 2, -1.
16. Find the nature of the roots of $2x^2 - 3x + 5 = 0$
17. Find the centroid of the triangle whose vertices are (3, -5), (-7, 4), (10, -2) respectively.
18. A flag pole 4 m tall casts a 6 m shadow at the same time, a nearby building casts a shadow of 24 m. How tall is the building.

[Contd... 3rd

19. Evaluate $(\sec^2\theta - 1)(\operatorname{cosec}^2\theta - 1)$.
20. Write all possible out comes when two coins are tossed at a time.

SECTION – III

Note : 1) Answer ALL the questions.

2) Each question carries 4 marks.

8 x 4 = 32

21. If $A = \{ 2, 4, 6, 8, 10 \}$, $B = \{ 3, 6, 9, 12, 15 \}$ Find
 $A \cup B$, $A \cap B$, $A - B$, $B - A$.
22. Find the two numbers whose sum is 27 and product is 182.
23. The sum of the 4th and 8th term of an A.P is 24 and sum of the 6th and 10th terms is 44. Find the first three terms of the A.P.
24. A cone of height 24 cm and radius of base 6 cm is made up of modelling clay. A child reshapes it in the form of a sphere find the radius of the sphere.
25. $\Delta ABC \sim \Delta DEF$ $BC = 3$ cm, $EF = 4$ cm and area of $\Delta ABC = 54 \text{ cm}^2$. Determine the area of ΔDEF .
26. If A, B, C are interior angles of a triangle ABC, then show that

$$\tan\left(\frac{A+B}{2}\right) = \cot\frac{C}{2}$$
27. Two men on either side of a temple of 30 meter height observe its top at the angles of elevation 30° and 60° respectively. Find the distance between the two men.
28. The points (3, -2), (-2, 8) and (0, 4) are three points in a plane. Show that three points are collinear.

SECTION – IV

Note : 1) Answer ALL the questions.

2) Each question carries 8 marks.

3) There is internal choice for each question.

5 x 8 = 40

29. a) Prove that $\sqrt{5}$ is irrational

(OR)

[Turn Over

DCEB KRISHNA
SSC PUBLIC EXAMINATIONS - JULY - 2020
MATHEMATICS - Paper - I & II
MODEL PAPER
(Telugu Medium)

Time : 3-15 Hrs.]

[Max. Marks : 100

విద్యార్థులకు సూచనలు :

1. అన్ని ప్రశ్నలకు సమాధానములు ప్రత్యేక బుక్‌లెట్‌లో మాత్రమే రాయాలి.
2. ప్రశ్నాపత్రంలో నాలుగు విభాగాలు మరియు 33 ప్రశ్నలు ఉండును.
3. విభాగం - 4 లో అంతర్గత ఎంపిక కలదు.
4. సమాధానములు స్పష్టంగా రాయాలి.

విభాగం - 1

- సూచనలు : 1) క్రింది ఇవ్వబడిన అన్ని ప్రశ్నలకు ఒక పదం లేదా మాటలో జవాబులు రాయండి.
- 2) ప్రతి ప్రశ్నకు 1 మార్కు.
 - 3) ఏదైనా ప్రశ్నకు జవాబు ఒకటి కంటే ఎక్కువసార్లు రాసినచో, మొదటిసారి రాసిన జవాబును మాత్రమే పరిగణనలోనికి తీసుకొనబడును.

12 × 1 = 12

1. $\log_{81} 3$ విలువను కనుగొనండి.
2. $A \subset B$ అయిన $n(A) = 4$, $n(B) = 7$ అయిన $n(A - B)$ విలువ ఎంత ?
3. $x^2 + 7x + 10$ అనే బహుపది యొక్క శూన్యాల లబ్ధం
A) -7 B) 7 C) 10 D) - 10
4. $4x + 5y = 9$, $8x + ky = 18$ అనే సమీకరణాల వ్యవస్థకు అనంత సాధనలు ఉంటే k విలువ
A) 8 B) 9 C) 10 D) 1
5. $2x^2 + 5x + 3 = 0$ అనే వర్గ సమీకరణం యొక్క విచక్షణి విలువ
A) 1 B) - 1 C) 25 D) 24

[Turn Over

6. 3, -6, 12, -24, 48, అనే గుణశ్రేణి యొక్క సామాన్య నిష్పత్తి ఎంత ?
A) - 2 B) $-\frac{1}{2}$ C) - 3 D) 2
7. $\Delta ABC \sim \Delta PQR$ అయిన $AB = 6, BC = 4, AC = 8, PR = 6$ అయిన $PQ + QR =$
8. (4, 6) మరియు (-2, 5) బిందువులను కలిపే రేఖవాలు
A) $\frac{6}{5}$ B) $-\frac{2}{4}$ C) $\frac{1}{6}$ D) $\frac{11}{2}$
9. 8 సెం.మీ. గల వ్యాసార్థం గల వృత్తానికి దాని కేంద్రం నుంచి 17 సెం.మీ. దూరంలో గల బాహ్య బిందువు నుంచి వృత్తానికి గీసిన స్పర్శ రేఖ పొడవు.
A) 25 సెం.మీ. B) 9 సెం.మీ. C) 15 సెం.మీ. D) 8.5 సెం.మీ.
10. $2 \sin^2 60^\circ \times \cos 60^\circ$ విలువ
A) $\frac{1}{3}$ B) $\frac{5}{2}$ C) $\frac{4}{3}$ D) $\frac{3}{4}$
11. క్రింది వానిలో సంభావ్యత విలువ కానిది
A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) 25% D) $\frac{4}{3}$
12. 3, 5, 9, x , 11 విలువల యొక్క సగటు (7) ఏడు అయిన x విలువ ఎంత ?

విభాగం - 2

సూచనలు : 1) అన్ని ప్రశ్నలకు సమాధానములు రాయండి.

2) ప్రతి ప్రశ్నకు 2 మార్కులు.

8 × 2 = 16

13. 72 మరియు 108 ల యొక్క క.సా.గు మరియు గ.సా.భా ను కనుగొనండి.
14. $c = \{x, y, z\}$ c యొక్క అన్ని ఉపసమితులను రాయండి.
15. 2, -1 శూన్యాలుగా గల వర్గ బహుపదిని కనుగొనండి.
16. $2x^2 - 3x + 5 = 0$ అనే వర్గ సమీకరణం యొక్క మూలాల స్వభావాన్ని కనుగొనండి.
17. (3, -5), (-7, 4), (10, -2) లు శీర్షాలుగా గల త్రిభుజం యొక్క గురుత్వ కేంద్రం కనుగొనండి.
18. 4 మీ. పొడవు గల స్థంభం యొక్క నీడ పొడవు 6 మీ. అదే సమయంలో ఒక భవనం యొక్క నీడ పొడవు 24 మీ. అయిన ఆ భవనం యొక్క ఎత్తును కనుగొనండి.

[Contd... 3rd

19. $(\sec^2\theta - 1)(\operatorname{cosec}^2\theta - 1)$ విలువను కనుగొనండి.
20. రెండు నాణేలను ఒకేసారి ఎగరవేసినప్పుడు వచ్చే మొత్తం ఫలితాలను వ్రాయండి.

విభాగం - 3

సూచనలు : 1) అన్ని ప్రశ్నలకు సమాధానములు రాయండి.

2) ప్రతి ప్రశ్నకు 4 మార్కులు.

8 × 4 = 32

21. $A = \{ 2, 4, 6, 8, 10 \}$, $B = \{ 3, 6, 9, 12, 15 \}$ అయిన
 $A \cup B$, $A \cap B$, $A - B$, $B - A$ లను కనుగొనండి.
22. రెండు సంఖ్యల మొత్తం 27, వాటి లబ్ధము 182 అయిన ఆ రెండు సంఖ్యలను కనుగొనండి.
23. ఒక అంకశ్రేణిలో 4 మరియు 8 వ పదాల మొత్తము 24 మరియు 6 వ, 10 వ పదాల మొత్తము 44 అయిన ఆ అంకశ్రేణిలో మొదటి మూడు పదాలను కనుగొనండి.
24. 6 సెం.మీ. భూ వ్యాసార్థం మరియు 24 సెం.మీ. ఎత్తు గల శంఖువు మట్టితో చేయబడింది. ఒక బాలుడు ఆ శంఖువుని గోళంగా మారిస్తే ఆ గోళం యొక్క వ్యాసార్థాన్ని కనుగొనండి.
25. $\Delta ABC \sim \Delta DEF$ $BC = 3$ సెం.మీ, $EF = 4$ సెం.మీ మరియు ΔABC వైశాల్యము 54 చ.సెం.మీ అయిన ΔDEF వైశాల్యమును కనుగొనండి.
26. A, B, C లు త్రిభుజం యొక్క అంతర కోణాలయిన $\tan\left(\frac{A+B}{2}\right) = \cot\frac{C}{2}$ అని చూపండి.
27. 30 మీ. ఎత్తు గల గుడికి యిరువైపుల గల ఇద్దరు మనుష్యులు గుడి పైభాగాన్ని వరుసగా 30° , 60° ల ఊర్ధ్వ కోణాలతో చూశారు. అయిన ఇద్దరు మనుష్యుల మధ్య దూరాన్ని కనుగొనండి.
28. $(3, -2)$, $(-2, 8)$ మరియు $(0, 4)$ బిందువులు సరేఖీయాలని నిరూపించండి.

విభాగం - 4

సూచనలు : 1) అన్ని ప్రశ్నలకు సమాధానములు రాయండి.

2) ప్రతి ప్రశ్నకు 8 మార్కులు.

3) ప్రతి ప్రశ్నకు అంతర్గత ఎంపిక కలదు.

5 × 8 = 40

29. a) $\sqrt{5}$ కరణీయ సంఖ్య అని నిరూపించుము.

(లేదా)

[Turn Over

- b) $P(x) = 3x^3 - 5x^2 - 11x - 3$ అనే బహుపదికి 3, -1, $-\frac{1}{3}$ లు శూన్యాలని నిరూపించండి మరియు శూన్యాలకు గుణకాలకు మధ్య సంబంధాన్ని సరిచూడండి.

30. a) $\frac{5}{x-1} + \frac{1}{y-2} = 2, \frac{6}{x-1} - \frac{3}{y-2} = 1$ సాధించండి.

(లేదా)

- b) 15 సెం.మీ.ల అంతరవ్యాసార్థం గల అర్థగోళాకార పాత్ర ద్రవంతో నింపబడివుంది. అయితే ఆ పాత్రలో గల ద్రవాన్ని 5 సెం.మీ. వ్యాసం మరియు 6 సెం.మీ. ఎత్తు గల స్థూపాకార బాటిల్స్ లో నింపితే, ఆ పాత్రలో గల ద్రవాన్ని ఖాళీ చేయుటకు ఎన్ని బాటిల్స్ అవసరమౌతాయి.

31. a) (4, -1) మరియు (-2, -3) బిందువులను కలుపు రేఖాఖండం యొక్క త్రిధాకరించు బిందు నిరూపకాలను కనుగొనండి.

(లేదా)

- b) బాగా కలపబడిన ఒక పేక కట్ట నుండి ఒక ముక్కను తీస్తే అది
 i) ఎరుపు ముఖ కార్డు ii) హృదయపు గుర్తు గల జాకీ కార్డు
 iii) ఈసేపుడు కార్డు iv) డైమండ్ రాణి కార్డు
 అయ్యే సంభావ్యతను కనుగొనండి.

32. a) $\operatorname{cosec} \theta + \cot \theta = k$ అయిన $\cos \theta = \frac{k^2 - 1}{k^2 + 1}$ అని చూపండి.

(లేదా)

- b) క్రింది దత్తాంశానికి అంకమధ్యమమును కనుగొనండి.

తరగతి అంతరము	10-25	25-40	40-55	55-70	70-85	85-100
విద్యార్థుల సంఖ్య	2	3	7	6	6	6

33. a) $P(x) = x^2 - x - 6$ అనే వర్గ బహుపది యొక్క రేఖా చిత్రాన్ని గీయండి. ఆ రేఖా చిత్రం నుండి ఇచ్చిన వర్గ బహుపది యొక్క శూన్యాలను కనుగొనండి.

(లేదా)

- b) 6 సెం.మీ. వ్యాసార్థం గల వృత్తానికి దాని కేంద్రం నుండి 10 సెం.మీ. ల దూరంలో గల బాహ్య బిందువు నుంచి రెండు స్పర్శ రేఖలను గీయండి మరియు వాటి పొడవులను కొలవండి. పైథాగరస్ సిద్ధాంతం ఉపయోగించి స్పర్శ రేఖల పొడవును సరి చూడండి.



ANSWERS



SECTION - I

1. "The set of lines which are parallel to the x-axis is a infinite set". Is this statement true or false ?

A. Yes, it is a infinite set, because there is an infinite lines which are parallel to the x-axis.

2. If $\log_3 27$ is a root of quadratic equation $x^2 + 5x + p = 0$, then find the value of p.

A. $\log_3 27 = \log_3 3^3 = 3 \log_3 3$
 $= 3.1 = 3$

'3' is a root of $x^2 + 5x + p = 0$,

So,

$$3^2 + 5(3) + p = 0$$

$$\Rightarrow 9 + 15 + p = 0$$

$$\Rightarrow p = -24$$

\therefore The value of p is -24 .

3. Which of the following matching is correct ? Choose the correct option.

- a) The shape of vertical cutout of a cylinder **i)** triangle
- b) The shape of vertical cutout of a cone **ii)** rectangle
- c) The shape of horizontal cutout of a cylinder **iii)** circle

A) a - i, b - ii, c - iii

B) a - iii, b - i, c - ii

C) a - ii, b - iii, c - i

D) a - ii, b - i, c - iii

A. (D)

4. LCM of two numbers is 108 and their HCF is 9 and one of them is 54. Find the second one.

A. Second number

$$= \frac{\text{LCM} \times \text{HCF}}{\text{first number}} = \frac{108 \times 9}{54} = 18$$

5. Choose the correct answer.

A : For quadratic equation $ax^2 + bx + c = 0$ is,

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

B : The values of x are $-\frac{a}{2}$, a for a quadratic equation.

i) Both A and B are true

ii) A is true, B is false

iii) A is false, B is true

iv) Both A and B are false

A. (ii) is correct

6. Write the common difference of the A.P.

$$\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}, \dots$$

A. Given, A.P. = $\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}, \dots$

$$\Rightarrow \sqrt{3}, 2\sqrt{3}, 3\sqrt{3}, 4\sqrt{3}, \dots$$

\therefore Common difference (d)

$$= 2\sqrt{3} - \sqrt{3} = \sqrt{3}$$

7. Find the mid point of AB, where $A(\log_2 8, \log_5 25)$ and $B(\log_{10} 10, \log_{10} 100)$.

A. $A(\log_2 8, \log_5 25) = A(3, 2)$

$B(\log_{10} 10, \log_{10} 10^2) = B(1, 2)$

\therefore Mid point of AB

$$= \left(\frac{3+1}{2}, \frac{2+2}{2} \right) = (2, 2)$$

8. Write the value of $\tan \theta$ in terms of $\operatorname{cosec} \theta$.

A. $\tan \theta = \frac{1}{\sqrt{\operatorname{cosec}^2 \theta - 1}}$

9. If a circle is inscribed in a quadrilateral, then write the relation between sides of a quadrilateral.

A. $AB + CD = BC + DA$

10. Which measure of central tendency is given by the x-coordinate of the point of intersection of the two ogives of grouped data ?

A. Median of the data.

11. What is the value of probability of getting 7, when a dice is rolled ?

A. Zero is the probability.

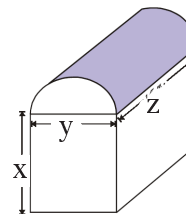
12. Name the theorem applied to divide the line segment in the given ratio.

A. Thale's theorem.

SECTION - II

13. Draw a rough diagram of a solid showing the combination of cuboid and a half cylinder.

Sol.



14. Cost of mathematics textbook is ₹10 less than twice of cost of maths textbook. Write this in linear equation.

Sol. Let the cost of maths textbook = ₹ x

Twice of it = ₹ 2x

₹ 10 less to above = $2x - 10$

Then cost of Mathematics textbook = $y = 2x - 10$ is the required linear equation.

15. R and T are two sets defined as $R = \{x/x \text{ is divisible by } 2, x \in \mathbf{N}\}$ $T = \{x/x \text{ is divisible by } 6, x \in \mathbf{N}\}$ is $T \subset R$. Justify your answer.

Sol. From given data

$R = \{2, 4, 6, 8, \dots\} \rightarrow$ (i)

$T = \{6, 12, 18, \dots\} \rightarrow$ (ii)

By observing (i) and (ii) $T \subset R$.

16. If a cylinder and cone are of the same radius and height, then how many cones full of milk can fill the cylinder ? Answer with reasons.

Sol. Volume of the cylinder is three times to the volume of the cone, if they have same radius and height.

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

Sol. Given, $\sin \alpha = \frac{1}{2} = \sin 30^\circ$
 $\Rightarrow \alpha = 30^\circ$

$$\cos \beta = \frac{1}{2} = \cos 60^\circ \Rightarrow \beta = 60^\circ$$

$$\therefore \alpha + \beta = 30^\circ + 60^\circ = 90^\circ$$

18. Give two different examples of pair of

- i) Similar figures
- ii) Non-similar figures

Sol. i) Similar figures :

- a) Any two circles
- b) Any two squares
- c) Any two equilateral triangles

ii) Non-similar figures :

- a) A square and a rhombus
- b) A square and a rectangle

19. Write the formula for the median of a grouped data. Explain symbol with their used meaning.

Sol. Median (M) = $l + \left(\frac{\frac{n}{2} - \text{c.f}}{f} \right) \times h$

l = lower limit of the median class.

n = sum of the frequency

c.f = cumulative frequency of the class preceding the median class

f = frequency of the median class

h = length of the class

20. Someone is asked to choose a number from 1 to 100. What is the probability of it being a prime number ?

Sol. Total prime numbers between 1 to 100 = 25

\therefore Probability (Prime number)

$$= \frac{25}{100} = \frac{1}{4}$$

SECTION - III

21. Show that

$$\log \frac{162}{343} + 2 \log \frac{7}{9} - \log \frac{1}{7} = \log 2.$$

Sol. LHS = $\log \frac{162}{343} + 2 \log \frac{7}{9} - \log \frac{1}{7}$

$$= \log \left(\frac{3^4 \times 2}{7^3} \right) + 2 \log \left(\frac{7}{3^2} \right) - \log \left(\frac{1}{7} \right)$$

$$= \log 3^4 + \log 2 - \log 7^3$$

$$+ 2[\log 7 - \log 3^2] - [\log 1 - \log 7]$$

$$= 4 \log 3 + \log 2 - 3 \log 7 + 2 \log 7$$

$$- 4 \log 3 - \log 1 + \log 7$$

$$= \log 2 (\because \log 1 = 0) = \text{RHS}$$

Hence proved.

22. $A = \{x : x \in \mathbb{N}, \text{ and } x \text{ is a multiple of } 4\};$

$B = \{x : x \in \mathbb{N}, \text{ and } x \text{ is a multiple of } 6\};$

$C = \{x : x \in \mathbb{N}, \text{ and } x \text{ is a multiple of L.C.M. of } 4 \text{ and } 6\};$

Find $A \cap B$. How can you relate the sets $A \cap B$ and C ?

Sol. $A = \{4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, \dots\}$

$B = \{6, 12, 18, 24, 30, 36, 42, 48, \dots\}$

$A \cap B = \{12, 24, 36, \dots\}$

L.C.M. of 4 and 6 = 12

$C = \{12, 24, 36, \dots\}$

$\therefore A \cap B = C$

23. Is it possible to design a rectangular garden, whose length is twice of its breadth and area is 200 m^2 ? If so, find its length and breadth.

Sol. Let breadth be "x" m then length be "2x" m

Area = $2x^2 \text{ m}^2$

$2x^2 = 200$

$x^2 = 100$

$x = \sqrt{100} = 10$

\therefore breadth = 10 m

length = 20 m

\therefore It is possible to design such a rectangular garden.

24. Measures of sides of a triangle are in Arithmetic Progression. Its perimeter is 30cm, and the difference between the longest

and shortest side is 4cm; then find the measures of the sides.

Sol. Let the 3 sides of given triangle = $a - d, a, a + d$

Then its perimeter

= $a - d + a + a + d = 30 \text{ cm.}$

$3a = 30 \text{ cm} \Rightarrow a = \frac{30}{3} = 10 \text{ cm.}$

The larger side = $a + d$

The shorter side = $a - d$

The difference between the above two = $(a + d) - (a - d)$

= 4 cm.

$a + d - a + d = 4 \text{ cm.}$

$2d = 4 \Rightarrow d = \frac{4}{2} = 2 \text{ cm.}$

So the sides $a - d = 10 - 2 = 8 \text{ cm}$

$a = 10 \text{ cm}$

and $a + d = 10 + 2 = 12 \text{ cm.}$

So 8, 10, 12 cm are the sides of the triangle.

25. Find the coordinates of the point which divide the line segment joining the points $(a + b, a - b)$ and $(a - b, a + b)$ in the ratio 3 : 2 internally.

Sol. Given : A $(a + b, a - b)$ and B $(a - b, a + b)$.

Let P (x, y) divides \overline{AB} in the ratio 3 : 2 internally.

Section formula

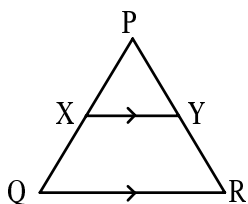
$$= \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$$

$$= \left(\frac{3(a - b) + 2(a + b)}{3 + 2}, \frac{3(a + b) + 2(a - b)}{3 + 2} \right)$$

$$= \left(\frac{3a - 3b + 2a + 2b}{5}, \frac{3a + 3b + 2a - 2b}{5} \right)$$

$$= \left(\frac{5a - b}{5}, \frac{5a + b}{5} \right)$$

26. Observe the below figure.



In a ΔPQR , if $XY \parallel QR$ and $PX = x - 2$, $XQ = x + 5$, $PY = x - 3$ and $YR = x + 3$, then find the value of 'x'.

Sol. Given : In ΔPQR , $XY \parallel QR$ and $PX = x - 2$, $XQ = x + 5$, $PY = x - 3$ and $YR = x + 3$.

By Basic Proportionality theorem,

If $XY \parallel QR$, then we should have

$$\frac{PX}{XQ} = \frac{PY}{YR}$$

$$\therefore \frac{x - 2}{x + 5} = \frac{x - 3}{x + 3}$$

$$\Rightarrow (x - 2)(x + 3) = (x - 3)(x + 5)$$

$$\Rightarrow x^2 + 3x - 2x - 6 = x^2 + 5x - 3x - 15$$

$$\Rightarrow x^2 + x - 6 = x^2 + 2x - 15$$

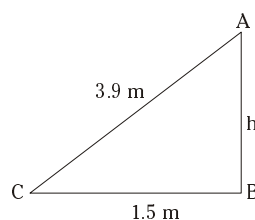
$$\Rightarrow x - 6 = 2x - 15$$

$$\Rightarrow 2x - x = 15 - 6 \Rightarrow x = 9$$

\therefore The value of $x = 9$ will make $XY \parallel QR$.

27. A ladder of 3.9 m length is laid against a wall. The distance between the foot of the wall and the ladder is 1.5 m. Find the height at which the ladder touches the wall.

Sol.



$$h^2 = (3.9)^2 - (1.5)^2$$

$$= (3.9 + 1.5)(3.9 - 1.5)$$

$$= 5.4 \times 2.4$$

$$= 0.6 \times 9 \times 0.6 \times 4$$

$$= (0.6)^2 \times 6^2$$

$$\therefore h = 6 \times 0.6 = 3.6 \text{ m}$$

28. One card is selected from a well - shuffled deck of 52 cards. Find the probability of getting a red card with prime number.

Sol. Number of cards in a deck = 52
Number of red card with prime number = 8

Probability of getting red card with prime number

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of total outcomes}}$$

$$= \frac{8}{52} = \frac{2}{13}$$

SECTION - IV

29. a) 2 women and 5 men can together finish an embroidery work in 4 days while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone and 1 man alone to finish the work.

Sol. Let the time taken by 1 woman to complete the work = x days and time taken by 1 man to complete the work = y days
 \therefore Work done by 1 woman in 1 day = $\frac{1}{x}$
 Work done by 1 man in 1 day = $\frac{1}{y}$

By problem,

$$4\left(\frac{2}{x} + \frac{5}{y}\right) = 1 \text{ and } \left(\frac{3}{x} + \frac{6}{y}\right)3 = 1$$

$$\Rightarrow \frac{2}{x} + \frac{5}{y} = \frac{1}{4} \text{ and } \frac{3}{x} + \frac{6}{y} = \frac{1}{3}$$

Take $\frac{1}{x} = a$ and $\frac{1}{y} = b$

then the above equations reduce to

$$2a + 5b = \frac{1}{4} \text{ and } 3a + 6b = \frac{1}{3}$$

$$\Rightarrow 8a + 20b = 1 \quad \dots\dots\dots (1)$$

and

$$9a + 18b = 1 \quad \dots\dots\dots (2)$$

equation (1) \times 9 and

equation (2) \times 8

$$\Rightarrow 72a + 180b = 9$$

$$\Rightarrow 72a + 144b = 8$$

$$\begin{array}{r} \\ (-) \quad 36b = 1 \end{array}$$

$$\Rightarrow b = \frac{1}{36}$$

Substituting $b = \frac{1}{36}$ in equation (1) we get

$$8a + 20\left(\frac{1}{36}\right) = 1$$

$$\Rightarrow 8a = 1 - \frac{5}{9} \Rightarrow 8a = \frac{4}{9}$$

$$\Rightarrow a = \frac{4}{9 \times 8} = \frac{1}{18}$$

$$\text{but } a = \frac{1}{x} = \frac{1}{18} \Rightarrow x = 18 \text{ and}$$

$$b = \frac{1}{y} = \frac{1}{36} \Rightarrow y = 36$$

\therefore Time taken by 1 woman = 18 days
 1 man = 36 days

(OR)

b) How many silver coins of diameter 5 cm and thickness 4 mm have to be melted to prepare a cuboid of 12 cm \times 11 cm \times 5 cm dimension ?

Sol. Diameter of silver coin = 5 cm

$$\begin{aligned} \text{Radius of silver coin} &= \frac{5}{2} \\ &= 2.5 \text{ cm} = r \end{aligned}$$

$$\begin{aligned} \text{Thickness of silver coin} &= 4 \text{ mm} \\ &= 0.4 \text{ cm} = h \end{aligned}$$

$$\begin{aligned} \text{Volume of each silver coin} &= \pi r^2 h \end{aligned}$$

$$= \frac{22}{7} \times (2.5)^2 \times 0.4$$

$$= \frac{22}{7} \times \frac{5}{2} \times \frac{5}{2} \times \frac{4}{10} = \frac{11 \times 5}{7}$$

$$\begin{aligned} \text{Cuboid dimensions} &= 12 \text{ cm} \times 11 \text{ cm} \times 5 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Volume of cuboid} &= l b h \\ &= 12 \times 11 \times 5 \end{aligned}$$

$$\begin{aligned} \therefore \text{Number of silver coins} &= \frac{\text{Volume of cuboid}}{\text{Volume of each silver coin}} \end{aligned}$$

$$= \frac{12 \times 11 \times 5}{\left(\frac{11 \times 5}{7}\right)}$$

$$= 12 \times 7 = 84$$

30.a) A sum of Rs. 1,000 is invested at 8% simple interest per year. Calculate the interest at the end of each year. Do these interests for 1st, 2nd and 3rd years form an A.P. ? If so, find the total interest to be paid for 30 years making the use of this fact.

Sol. Sum invested = P = Rs. 1000

Rate of interest = R = 8%

Time of investment = 1 year

∴ Amount of interest (simple)

$$I = \frac{PTR}{100} = \frac{1000 \times 1 \times 8}{100}$$

$$= \text{Rs. } 80$$

Amount of interest for 2 years

$$= \frac{PTR}{100} = \frac{1000 \times 2 \times 8}{100}$$

$$= \text{Rs. } 160$$

Amount of interest for 3 years

$$= \frac{PTR}{100} = \frac{1000 \times 3 \times 8}{100}$$

$$= \text{Rs. } 240$$

So the amount of interest for the years 1, 2, 3, are

80, 160, 240, are in an A.P.

In which the first term (a) = 80

Common difference (d) = $a_2 - a_1$
 $= 160 - 80 = 80$

∴ The amount of interest to be paid in 30 years of time = S_{30}

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

$$= \frac{30}{2} [2(80) + (30 - 1) 80]$$

$$= 15[160 + 29(80)]$$

$$= 15[160 + 2320]$$

$$= 2480 \times 15 = \text{Rs. } 37200$$

∴ Rs. 37200 will be paid towards interest for 30 years.

(OR)

b) Show that cube of any positive integer will be in the form of $8m$ or $8m + 1$ or $8m + 3$ or $8m + 5$ or $8m + 7$, where m is a whole number.

Sol. $a = bq + r, 0 \leq r < b$

$a = 8k + t$ for $t = 0, 1, 2, 3, 4, 5, 6, 7.$

$$a^3 = (8k + t)^3$$

$$= (8k)^3 + 3(8k)(t)(8k + t) + (t)^3$$

$$= 8[64k^3 + 3kt(8k + t)] + t^3$$

$$= 8n + t^3$$

If $t = 0, 2, 4, 6$ then $t^3 = 8p$

$$a^3 = (8k + t)^3 = 8n + 8p$$

$$= 8(n + p) = 8m$$

If $t = 1$, then $a^3 = 8n + 1$
 $= 8m + 1$

If $t = 3$, then $a^3 = 8n + 27$
 $= 8(n + 3) + 3 = 8m + 3$

If $t = 5$, then $a^3 = 8n + 125$
 $= 8(n + 15) + 5 = 8m + 5$

If $t = 7$, then $a^3 = 8n + 343$
 $= 8(n + 42) + 7 = 8m + 7$

∴ The cube of any positive integer will be of the form $8m$ or $8m + 1$ or $8m + 3$ or $8m + 5$ or $8m + 7.$

31. a) The following distribution gives the daily profits (in rupees) earned by 50 shops in a locality.

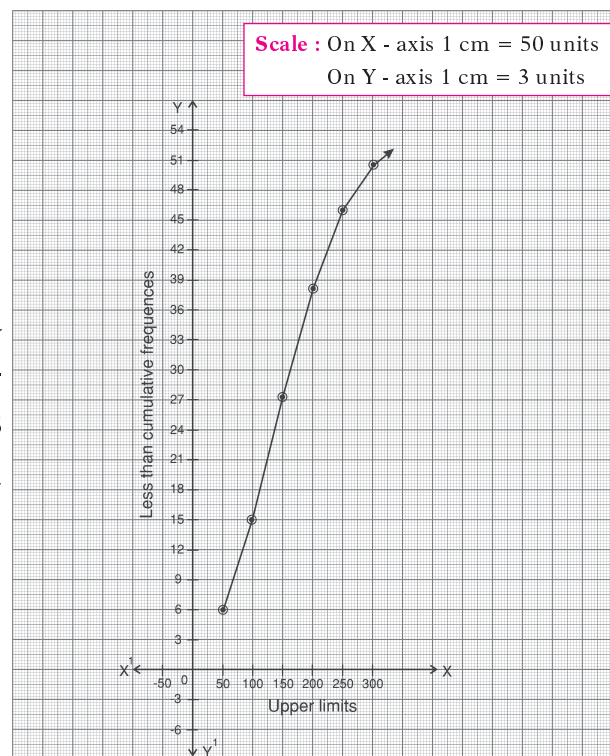
Daily profits (in rupees)	0 – 50	50 – 100	100 – 150	150 – 200	200 – 250	250 – 300
No. of shops	6	9	13	10	8	4

Convert the above distribution to a 'less than type' cumulative frequency distribution and draw its Ogive.

Daily Profits	No. of Shops	Upper limits	L.C.F.
0 - 50	6	50	6
50 - 100	9	100	6 + 9 = 15
100 - 150	13	150	15 + 13 = 28
150 - 200	10	200	28 + 10 = 38
200 - 250	8	250	38 + 8 = 46
250 - 300	4	300	46 + 4 = 50

To draw the less than type ogive, we plot the points (50, 6), (100, 15), (150, 28), (200, 38), (250, 46), (300, 50).

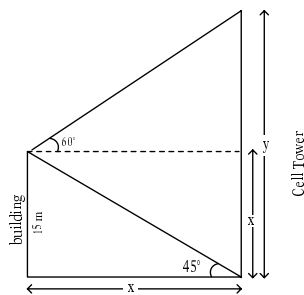
To represent the data graphically, we mark the upper limits of the class intervals on the horizontal axis and their corresponding L.C.F. on the vertical axis and join them.



(OR)

- b) A person from the top of a building of height 15 meters observes the top and the bottom (foot) of a cell tower with the angle of elevation as 60° and the angle of depression as 45° respectively. Then find the height of that cell tower.

Sol.



Angle of elevation of the top of the tower = 60° .

Angle of depression to the foot of the tower = 45° .

Height of the building = 15 m.

Distance between tower and building = x m

Let, height of the tower = y m

From the figure

$$\tan 45^\circ = \frac{15}{x}$$

$$1 = \frac{15}{x} \Rightarrow x = 15 \text{ m}$$

$$\text{Also } \tan 60^\circ = \frac{y-15}{15}$$

$$\Rightarrow \sqrt{3} = \frac{y-15}{15}$$

$$\Rightarrow 15\sqrt{3} = y - 15$$

$$\Rightarrow y = 15 + 15\sqrt{3}$$

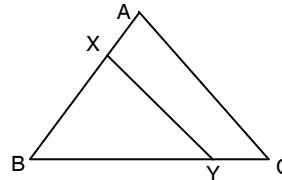
$$= 15(\sqrt{3} + 1)$$

$$= 15(1.732 + 1)$$

$$= 15 \times 2.732 = 40.98 \text{ m.}$$

32. a) In $\triangle ABC$, $XY \parallel AC$ and XY divides the triangle into two parts of equal area. Find the ratio of $\frac{AX}{XB}$.

Sol.



Given : In $\triangle ABC$; $XY \parallel AC$.

XY divides $\triangle ABC$ into two parts of equal area.

In $\triangle ABC$, $\triangle XBY$

$$\angle B = \angle B$$

$$\angle A = \angle X$$

$$\angle C = \angle Y$$

[$\because XY \parallel AC$; ($\angle A$, $\angle X$) and $\angle C$, $\angle Y$ are the pairs of corresponding angles]

Thus $\triangle ABC \sim \triangle XBY$ by A.A.A. similarity condition.

$$\text{Hence, } \frac{\Delta ABC}{\Delta XBY} = \frac{AB^2}{XB^2}$$

[\because The ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides]

$$\frac{2}{1} = \frac{AB^2}{XB^2}$$

[Given, $\Delta BXY = \Delta BAC$

$$\therefore \Delta ABC = 2 \cdot \Delta XBY]$$

$$2 = \left(\frac{AB}{XB}\right)^2$$

$$2 = \left(\frac{AX + XB}{XB}\right)^2$$

$$2 = \left(\frac{AX}{XB} + \frac{XB}{XB} \right)^2$$

$$\Rightarrow 2 = \left(\frac{AX}{XB} + 1 \right)^2$$

$$\Rightarrow \frac{AX}{XB} + 1 = \sqrt{2}$$

$$\Rightarrow \frac{AX}{XB} = \sqrt{2} - 1$$

Hence the ratio $\frac{AX}{XB} = \frac{\sqrt{2} - 1}{1}$.

(OR)

b) From a deck of 52 playing cards, King, Ace and 10 of Clubs were removed and remaining cards were well shuffled. If a card is drawn at random from the remaining, find the probability of getting a card of

i) Club

ii) Ace

iii) Diamond king iv) Club 5.

Sol. Total number of possible outcomes = $52 - 3 = 49$

(i) Probability of getting a card of club

$$\begin{aligned} & \frac{\text{Number of favourable outcomes for getting a card of club}}{\text{Total No. of possible outcomes}} \\ &= \frac{10}{49} \end{aligned}$$

(ii) Probability of getting a card of ace = $\frac{3}{49}$

(iii) Probability of getting a card of diamond king = $\frac{1}{49}$

(iv) Probability of getting a card of club 5 = $\frac{1}{49}$

33.a) Draw the graph of polynomial $p(x) = x^2 - 3x + 2$ and find the zeros from the graph.

Sol. Let $y = p(x) = x^2 - 3x + 2$

If $x = 0$, then $p(0) = 0 - 0 + 2 = 2$ So $(0, 2)$

$x = 1$, then $p(1) = 1^2 - 3(1) + 2 = 1 - 3 + 2 = 0$ So $(1, 0)$

$x = 2$, then $p(2) = 2^2 - 3(2) + 2 = 4 - 6 + 2 = 0$ So $(2, 0)$

$x = 3$, then $p(3) = 3^2 - 3(3) + 2 = 9 - 9 + 2 = 2$ So $(3, 2)$

and if $x = -1$, then $p(-1)$

$= (-1)^2 - 3(-1) + 2 = 1 + 3 + 2 = 6$ So $(-1, 6)$

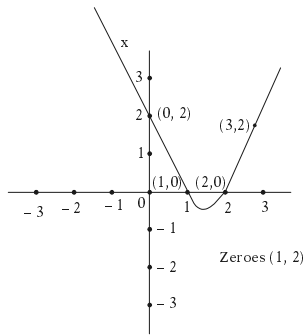
$x = -2$, then $p(-2)$

$= (-2)^2 - 3(-2) + 2 = 4 + 6 + 2 = 12$ So $(-2, 12)$

that means the graph of the polynomial

$p(x) = x^2 - 3x + 2$ passes through the points.

$(0, 2), (1, 0), (2, 0), (3, 2), (-1, 6)$ and $(-2, 12)$

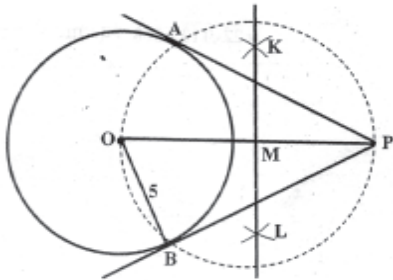


So 1 and 2 are zeroes of the given polynomial.

(OR)

b) Draw a circle with 5 cm radius and construct a pair of tangents to the circle.

Sol.



Steps of construction :

- 1) Construct a circle from the centre 'O' with a radius of 5 cm.
- 2) Trace a point 'P' in the exterior of circle and then join \overline{OP} . Now construct its perpendicular bisector of \overline{OP} which meets at the point 'M'.
- 3) Construct another circle from the centre 'M' with a radius of $\overline{OM} = \overline{MP}$.
- 4) Name the intersection points of two circles (A, B).
- 5) Now join \overline{PA} and \overline{PB} which are required tangents.





CLASS X

PRE-PUBLIC PAPER MATHEMATICS

2

Time : 3.15 Hrs.]

[Max. Marks : 100

Instructions :

1. Answer **all** the questions in a separate answer Booklet.
2. The question paper consists of **IV** Sections and **33** questions.
3. There is an internal choice in **Section – IV**.
4. Write answers neatly and legibly.

SECTION - I

12 × 1 = 12

Note : 1. Answer **all** the Questions in **ONE WORD** or **PHRASE**.

2. Each question carries **1** Mark.

3. If any question is answered more than once, the answer only will be considered.

1. "The set of lines which are parallel to the x-axis is a infinite set". Is this statement true or false ?
2. If $\log_3 27$ is a root of quadratic equation $x^2 + 5x + p = 0$, then find the value of p.
3. Which of the following matching is correct ? Choose the correct option.

a) The shape of vertical cutout of a cylinder	i) triangle
b) The shape of vertical cutout of a cone	ii) rectangle
c) The shape of horizontal cutout of a cylinder	iii) circle

A) a - i, b - ii, c - iii B) a - iii, b - i, c - ii
C) a - ii, b - iii, c - i D) a - ii, b - i, c - iii
4. LCM of two numbers is 108 and their HCF is 9 and one of them is 54. Find the second one.

5. Choose the correct answer.

A : For quadratic equation $ax^2 + bx + c = 0$ is,

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

B : The values of x are $-\frac{a}{2}$, a for a quadratic equation.

- i) Both A and B are true ii) A is true, B is false
iii) A is false, B is true iv) Both A and B are false

6. Write the common difference of the A.P.

$$\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}, \dots$$

7. Find the mid point of AB, where $A(\log_2 8, \log_5 25)$ and $B(\log_{10} 10, \log_{10} 100)$.

8. Write the value of $\tan \theta$ in terms of $\operatorname{cosec} \theta$.

9. If a circle is inscribed in a quadrilateral, then write the relation between sides of a quadrilateral.

10. Which measure of central tendency is given by the x-coordinate of the point of intersection of the two ogives of grouped data ?

11. What is the value of probability of getting 7, when a dice is rolled ?

12. Name the theorem applied to divide the line segment in the given ratio.

SECTION - II

$8 \times 2 = 16$

Note : 1. Answer all the questions.

2. Each question carries 2 Marks.

13. Draw a rough diagram of a solid showing the combination of cuboid and a half cylinder.

14. Cost of mathematics textbook is ₹10 less than twice of cost of maths textbook. Write this in linear equation.

15. R and T are two sets defined as

$$R = \{x/x \text{ is divisible by } 2, x \in \mathbb{N}\}$$

$$T = \{x/x \text{ is divisible by } 6, x \in \mathbb{N}\} \text{ is } T \subset R.$$

Justify your answer.

-
16. If a cylinder and cone are of the same radius and height, then how many cones full of milk can fill the cylinder ? Answer with reasons.
17. If $\sin \alpha = \frac{1}{2}$ and $\cos \beta = \frac{1}{2}$, then find the value of $(\alpha + \beta)$.
18. Give two different examples of pair of
- Similar figures
 - Non-similar figures
19. Write the formula for the median of a grouped data. Explain symbol with their used meaning.
20. Someone is asked to choose a number from 1 to 100. What is the probability of it being a prime number ?

SECTION - III

$8 \times 4 = 32$

Note : 1. Answer all the questions.
2. Each question carries 4 Marks.

21. Show that

$$\log \frac{162}{343} + 2 \log \frac{7}{9} - \log \frac{1}{7} = \log 2.$$

22. $A = \{x : x \in \mathbb{N}, \text{ and } x \text{ is a multiple of } 4\};$

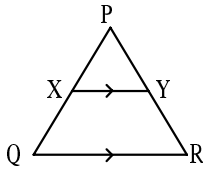
$$B = \{x : x \in \mathbb{N}, \text{ and } x \text{ is a multiple of } 6\};$$

$$C = \{x : x \in \mathbb{N}, \text{ and } x \text{ is a multiple of L.C.M. of } 4 \text{ and } 6\};$$

Find $A \cap B$. How can you relate the sets $A \cap B$ and C ?

23. Is it possible to design a rectangular garden, whose length is twice of its breadth and area is 200 m^2 ? If so, find its length and breadth.
24. Measures of sides of a triangle are in Arithmetic Progression. Its perimeter is 30cm, and the difference between the longest and shortest side is 4cm; then find the measures of the sides.
25. Find the coordinates of the point which divide the line segment joining the points $(a + b, a - b)$ and $(a - b, a + b)$ in the ratio 3 : 2 internally.

26. Observe the below figure.



In a ΔPQR , if $XY \parallel QR$ and $PX = x - 2$, $XQ = x + 5$, $PY = x - 3$ and $YR = x + 3$, then find the value of 'x'.

27. A ladder of 3.9 m length is laid against a wall. The distance between the foot of the wall and the ladder is 1.5 m. Find the height at which the ladder touches the wall.
28. One card is selected from a well-shuffled deck of 52 cards. Find the probability of getting a red card with prime number.

SECTION - IV

$5 \times 8 = 40$

Note : 1. Answer all the questions.

2. Each Question carries 8 Marks.

3. There is an internal choice for each question.

29. a) 2 women and 5 men can together finish an embroidery work in 4 days while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone and 1 man alone to finish the work.

(OR)

- b) How many silver coins of diameter 5 cm and thickness 4 mm have to be melted to prepare a cuboid of $12 \text{ cm} \times 11 \text{ cm} \times 5 \text{ cm}$ dimension ?

30. a) A sum of Rs. 1,000 is invested at 8% simple interest per year. Calculate the interest at the end of each year. Do these interests for 1st, 2nd and 3rd years form an A.P. ? If so, find the total interest to be paid for 30 years making the use of this fact.

(OR)

- b) Show that cube of any positive integer will be in the form of $8m$ or $8m + 1$ or $8m + 3$ or $8m + 5$ or $8m + 7$, where m is a whole number.

31. a) The following distribution gives the daily profits (in rupees) earned by 50 shops in a locality.

Daily profits (in rupees)	0 – 50	50 – 100	100 – 150	150 – 200	200 – 250	250 – 300
No. of shops	6	9	13	10	8	4

Convert the above distribution to a 'less than type' cumulative frequency distribution and draw its Ogive.

(OR)

- b) A person from the top of a building of height 15 meters observes the top and the bottom (foot) of a cell tower with the angle of elevation as 60° and the angle of depression as 45° respectively. Then find the height of that cell tower.
32. a) In $\triangle ABC$, $XY \parallel AC$ and XY divides the triangle into two parts of equal area. Find the ratio of $\frac{AX}{XB}$.

(OR)

- b) From a deck of 52 playing cards, King, Ace and 10 of Clubs were removed and remaining cards were well shuffled. If a card is drawn at random from the remaining, find the probability of getting a card of
- i) Club
 - ii) Ace
 - iii) Diamond king
 - iv) Club 5.
33. a) Draw the graph of polynomial $p(x) = x^2 - 3x + 2$ and find the zeros from the graph.

(OR)

- b) Draw a circle with 5 cm radius and construct a pair of tangents to the circle.



ANSWERS



విభాగం - I

1. "X- అక్షంకు సమాంతరంగా వున్న రేఖల సమితి అపరిమిత సమితి" ఇది సరైనదేనా ? నీ సమాధానాన్ని సమర్థించుము.

జ. అవును. X-అక్షంకు సమాంతరంగా వుండు రేఖలు అనంతము కనుక ఇది ఒక అపరిమిత సమితి అగును.

2. $x^2 + 5x + p = 0$ వర్గ సమీకరణము మూలము $\log_3 27$ అయిన 'p' విలువ ఎంత ?

జ. $\log_3 27 = \log_3 3^3 = 3 \log_3 3$
 $= 3.1 = 3$

$x^2 + 5x + p = 0$ కు 3 ఒక మూలము కనుక,

$$3^2 + 5(3) + p = 0$$

$$\Rightarrow 9 + 15 + p = 0$$

$$\Rightarrow p = -24$$

$\therefore p$ విలువ - 24.

3. కింది వాటిలో సరైన జతను చూపు ఎంపికను ఎన్నుకొనుము.

- a) స్థూపపు నిలువు కోత ఆకారము i) త్రిభుజము
 - b) శంఖువు నిలువుకోత ఆకారము ii) దీర్ఘచతురస్రం
 - c) స్థూపపు అడ్డుకోత iii) వృత్తము
- A) a - i, b - ii, c - iii
 B) a - iii, b - i, c - ii

C) a - ii, b - iii, c - i

D) a - ii, b - i, c - iii

జ. (D) సరైన సమాధానము.

4. రెండు సంఖ్యల క.సా.గు 108 మరియు వాటి గ.సా.భా 9 మరియు అందులో ఒక సంఖ్య 54 అయిన రెండవ సంఖ్యను కనుగొనుము.

జ. రెండవ సంఖ్య = $\frac{\text{క.సా.గు} \times \text{గ.సా.భా}}{\text{మొదటి సంఖ్య}}$
 $= \frac{108 \times 9}{54} = 18$

5. క్రింది ప్రవచనాలలో సరైన సమాధానాన్ని ఎన్నుకొనుము.

A : వర్గ సమీకరణం $ax^2 + bx + c = 0$ కు

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

B : వర్గ సమీకరణం x కు మూలాలు $-\frac{a}{2}$, a అగును.

i) A మరియు B లు సత్యాలు

ii) A సత్యం B అసత్యం

iii) A అసత్యం, B సత్యం

iv) A మరియు B లు అసత్యాలు

జ. (ii) సరైన సమాధానము.

6. అంకశ్రేణి

$$\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}, \dots$$

పదాంతరంను వ్రాయుము.

జ. $\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}, \dots$ అంకశ్రేణిలో కలదు.

$$\Rightarrow \sqrt{3}, 2\sqrt{3}, 3\sqrt{3}, 4\sqrt{3}, \dots$$

\therefore సామాన్య బేధము (d)

$$= 2\sqrt{3} - \sqrt{3} = \sqrt{3}$$

7. \overline{AB} మధ్య బిందువును కనుగొనుము. ఇక్కడ $A(\log_2 8, \log_5 25)$ మరియు $B(\log_{10} 10, \log_{10} 100)$.

జ. $A(\log_2 8, \log_5 25) = A(3, 2)$
 $B(\log_{10} 10, \log_{10} 10^2) = B(1, 2)$
 $\therefore AB$ మధ్య బిందువు

$$= \left(\frac{3+1}{2}, \frac{2+2}{2} \right) = (2, 2)$$

8. $\tan \theta$ ను $\operatorname{cosec} \theta$ లలో వ్రాయుము.

$$\text{జ. } \tan \theta = \frac{1}{\sqrt{\operatorname{cosec}^2 \theta - 1}}$$

9. ఒక చతుర్భుజంలో వృత్తం ఇమిడి వున్నది అయిన చతుర్భుజ భుజాల మధ్య సంబంధంను వ్రాయుము.

$$\text{జ. } AB + CD = BC + DA$$

10. వర్గీకృత దత్తాంశము యొక్క రెండు ఓజీవ్ వక్రాలు ఖండన బిందువులో x -నిరూపకము తెలియజేయు కేంద్రీయ కొలత ఏది ?

జ. దత్తాంశపు మధ్యగతమును తెలుపును.

11. ఒక పాచికను దొర్లించినపుడు '7'ను పొందు సంభావ్యత విలువ ఎంత ?

జ. శూన్య విలువ కావలసిన సంభావ్యత

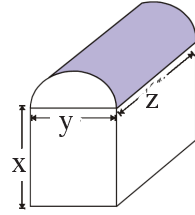
12. ఒక రేఖా ఖండంను ఇచ్చిన నిష్పత్తిలో విభజించుటకు అవసరమైన సిద్ధాంతము ఏది ?

జ. థేల్స్ సిద్ధాంతము

విభాగం - II

13. దీర్ఘఘనం మరియు స్థూపం సగభాగముల సమ్మేళనముగా వుండు పెట్టె నమూనాను గీయుము.

సాధన.



14. 'గణిత టెక్స్ బుక్ విలువ, గణిత నోటు పుస్తకము కన్నా రెట్టింపుకు 10 తక్కువ'. దీనికి రేఖీయ సమీకరణమును వ్రాయుము.

సాధన. గణిత నోట్ బుక్ ఖరీదు = ₹ x అ||కొ||

$$\text{దాని రెట్టింపు} = ₹ 2x$$

$$\text{పై దానికి ₹ 10 తక్కువ} = 2x - 10$$

$$\therefore \text{గణిత టెక్స్ బుక్ ఖరీదు}$$

$$= y = 2x - 10$$

15. R మరియు T అను రెండు సమితులు ఈ విధంగా నిర్వచించబడినవి.

$$R = \{x/x, 2 \text{ చే భాగించబడినది}, x \in \mathbf{N}\}$$

మరియు

$$T = \{x/x, 6 \text{ చే భాగించబడినది}, x \in \mathbf{N}\}$$

అయిన $T \subset R$ అగునా ?

నీ సమాధానాన్ని సమర్థించుము.

సాధన. దత్తాంశం నుండి

$$R = \{2, 4, 6, 8, \dots\} \rightarrow \text{(i)}$$

$$T = \{6, 12, 18, \dots\} \rightarrow \text{(ii)}$$

(i) మరియు (ii) లను గమనించగా

$$T \subset R.$$

16. ఒకే వ్యాసార్థం మరియు ఎత్తులు గల శంఖువు మరియు స్థూపాకార పాత్రలలో, ఎన్ని శంఖువాకార పాత్రల పాలు, స్థూపాకార పాత్రను నింపునో తెల్చి నీ సమాధానాన్ని సమర్థించుము.

సాధన. స్థూపము ఘనపరిమాణము, శంఖువు ఘనపరిమాణముకు మూడు రెట్లు కనుక. మూడు శంఖాకార పాత్రల పాలు, స్థూపాకార పాత్రను నింపును.

$$17. \sin \alpha = \frac{1}{2} \text{ మరియు } \cos \beta = \frac{1}{2}$$

అయిన $(\alpha + \beta)$ విలువను కనుగొనుము.

$$\text{సాధన. } \sin \alpha = \frac{1}{2} = \sin 30^\circ$$

$$\Rightarrow \alpha = 30^\circ$$

$$\cos \beta = \frac{1}{2} = \cos 60^\circ \Rightarrow \beta = 60^\circ$$

$$\therefore \alpha + \beta = 30^\circ + 60^\circ = 90^\circ$$

18 ఈ క్రింది వాటికి రెండు వేరువేరు ఉదాహరణలివ్వండి.

i) సరూప పటాలు,

ii) సరూప పటాలు కానివి

సాధన. i) సరూప పటాలు

a) ఏవైనా రెండు వృత్తాలు

b) ఏవైనా రెండు చతురస్రాలు

c) ఏవైనా రెండు సమబాహు త్రిభుజాలు

ii) సరూప పటాలు కానివి

a) ఒక చతురస్రము మరియు ఒక రాంబస్

b) ఒక చతురస్రము మరియు ఒక దీర్ఘచతురస్రము

19. వర్గీకృత దత్తాంశము యొక్క మధ్యగతము కనుగొనుటకు సూత్రము వ్రాసి దానిలోని అక్షరాలను వివరించండి.

సాధన. వర్గీకృత దత్తాంశానికి మధ్యగతం

$$= l + \left(\frac{\frac{n}{2} - c.f}{f} \right) \times h$$

l = మధ్యగత తరగతి దిగువ హద్దు

n = దత్తాంశంలోని రాశుల సంఖ్య

cf = మధ్యగత తరగతి ముందు తరగతి యొక్క సంచిత పౌనఃపున్యము

f = మధ్యగత తరగతి యొక్క పౌనఃపున్యము

h = మధ్యగత తరగతి పొడవు

20. 1 నుండి 100 వరకు గల సంఖ్యలలో ఒక సంఖ్యను ఎన్నుకొనమని ఒకరు అడిగిన, ఆ సంఖ్య ప్రధాన సంఖ్య అగు సంభావ్యత ఎంత ? కనుగొనుము.

సాధన. 1 నుండి 100 వరకు గల మొత్తం ప్రధాన సంఖ్యలు = 25

\therefore కావలసిన సంభావ్యత (ప్రధాన సంఖ్య)

$$= \frac{25}{100} = \frac{1}{4}$$

విభాగం - III

21. $\log \frac{162}{343} + 2 \log \frac{7}{9} - \log \frac{1}{7} = \log 2$ అని చూపండి.

Sol. LHS = $\log \frac{162}{343} + 2 \log \frac{7}{9} - \log \frac{1}{7}$
 $= \log \left(\frac{3^4 \times 2}{7^3} \right) + 2 \log \left(\frac{7}{3^2} \right) - \log \left(\frac{1}{7} \right)$
 $= \log 3^4 + \log 2 - \log 7^3$
 $+ 2[\log 7 - \log 3^2] - [\log 1 - \log 7]$

$$= 4\log 3 + \log 2 - 3\log 7 + 2\log 7 - 4\log 3 - \log 1 + \log 7$$

$$= \log 2 (\because \log 1 = 0) = \text{RHS}$$

22. $A = \{x : x \in \mathbb{N} \text{ మరియు } x \text{ అనేది } 4 \text{ గుణిజాల సమితి} \}$;

$B = \{x : x \in \mathbb{N} \text{ మరియు } x \text{ అనేది } 6 \text{ గుణిజాల సమితి} \}$;

$C = \{x : x \in \mathbb{N} \text{ మరియు } x \text{ అనేది } 4, 6 \text{ ల క.సా.గు. యొక్క గుణిజాల సమితి} \}$;

అయిన $A \cap B$ ని కనుగొనండి.

$A \cap B$ మరియు C సమితుల మధ్య గల సంబంధాన్ని తెలపండి.

సాధన. $A = \{4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, \dots\}$

$B = \{6, 12, 18, 24, 30, 36, 42, 48, \dots\}$

$A \cap B = \{12, 24, 36, \dots\}$

4 మరియు 6 ల క.సా.గు. = 12

$C = \{12, 24, 36, \dots\}$

$\therefore A \cap B = C$

23. ఒక దీర్ఘచతురస్రాకార స్థలం పొడవు వెడల్పునకు రెండు రెట్లు ఉండి 200 చ.మీ. వైశాల్యం గల ఒక దీర్ఘచతురస్రాన్ని చిత్రీకరించగలమా? చేయగలిగితే దాని పొడవు, వెడల్పులను కనుగొనుము.

సాధన. వెడల్పు = x మీ. అనుకొందుము

పొడవు = $2x$ మీ.

వైశాల్యం = $2x^2$ మీ²

$2x^2 = 200$

$x^2 = 100$

$x = \sqrt{100} = 10$

\therefore వెడల్పు = 10 మీ.

పొడవు = 20 మీ.

\therefore కావున ఇలాంటి దీర్ఘచతురస్రాన్ని చిత్రీకరించగలము.

24. ఒక త్రిభుజం యొక్క భుజాల పొడవులు అంకశ్రేణిలో కలవు. ఆ త్రిభుజం చుట్టు కొలత 30 సెం.మీ. మరియు అతి పెద్ద, అతి చిన్న భుజాల పొడవుల భేదం 4 సెం.మీ. అయిన ఆ త్రిభుజ భుజాల పొడవులను కనుగొనుము.

సాధన. A.P. లో గల త్రిభుజ భుజాల పొడవులు = $a + d$,

$a, a - d$ అనుకుందాం.

\therefore త్రిభుజ చుట్టుకొలత = $(a + d) + a + (a - d) = 30$

$a + d + a + a - d = 30$ సెం.మీ.

$3a = 30 \Rightarrow a = \frac{30}{3} = 10$ సెం.మీ.

$a = 10$

అతిపెద్ద, అతిచిన్న భుజాలు

= $a + d, a - d$

వాటి భేదం = $(a + d) - (a - d) = 4$ సెం.మీ.

$d + d - d + d = 4$ సెం.మీ.

$2d = 4$ సెం.మీ. $d = \frac{4}{2}$

= 2 సెం.మీ.

$d = 2$

\therefore ఆ భుజాల పొడవులు = $a + d$

= $10 + 2 = 12$

$a = 10$

$a - d = 10 - 2 = 8$

\therefore 12 సెం.మీ., 10 సెం.మీ., 8 సెం.మీ.

ఆ త్రిభుజ భుజాల పొడవులు.

25. బిందువులు $(a + b, a - b)$ మరియు $(a - b, a + b)$ లచే ఏర్పడు రేఖా ఖండమును అంతరంగా 3 : 2 నిష్పత్తిలో విభజించు బిందువు నిరూపకాలను కనుగొనండి.

సాధన. ఇచ్చిన బిందువులు

$(a + b, a - b)$ మరియు $(a - b, a + b)$ ల రేఖాఖండాన్ని అంతరంగా $P(x, y)$ 3 : 2 నిష్పత్తిలో విభజిస్తుంది అనుకొనుము.

$\therefore P(x, y)$

$$= \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$$

$$P = \left(\frac{3(a - b) + 2(a + b)}{3 + 2}, \frac{3(a + b) + 2(a - b)}{3 + 2} \right)$$

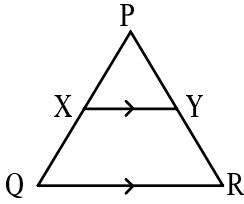
$$= \left(\frac{3a - 3b + 2a + 2b}{5}, \frac{3a + 3b + 2a - 2b}{5} \right)$$

$$= \left(\frac{5a - b}{5}, \frac{5a + b}{5} \right)$$

\therefore కావలసిన బిందువులు

$$= \left(\frac{5a - b}{5}, \frac{5a + b}{5} \right)$$

26. కింది పటం పరిశీలించుము.



ΔPQR లో $XY \parallel QR$ మరియు

$PX = x - 2$, $XQ = x + 5$,

$PY = x - 3$ మరియు $YR = x + 3$

అయితే, 'x' విలువను కనుగొనుము.

సాధన. దత్తాంశము : ΔPQR లో $XY \parallel QR$

మరియు $PX = x - 2$, $XQ = x + 5$,

$PY = x - 3$ మరియు $YR = x + 3$.

ప్రాథమిక అనుపాత సిద్ధాంతము ప్రకారం $XY \parallel QR$ అయిన

$$\frac{PX}{XQ} = \frac{PY}{YR}$$

$$\therefore \frac{x - 2}{x + 5} = \frac{x - 3}{x + 3}$$

$$\Rightarrow (x - 2)(x + 3) = (x - 3)(x + 5)$$

$$\Rightarrow x^2 + 3x - 2x - 6$$

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

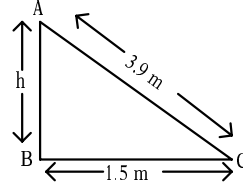
$$\Rightarrow x^2 + x - 6 = x^2 + 2x - 15$$

$$\Rightarrow x - 6 = 2x - 15$$

$$\Rightarrow 2x - x = 15 - 6 \Rightarrow x = 9$$

$\therefore x = 9$ అయినపుడు $XY \parallel QR$ అగును.

27. 3.9 మీ. పొడవు గల ఒక నిచ్చైన ఒక గోడకు వేయబడినది. నిచ్చైన అడుగు భాగం మరియు గోడ అడుగు భాగంల మధ్య దూరం 1.5 మీ. అయిన, ఆ నిచ్చైన గోడను ఎంత ఎత్తులో తాకును? సాధన.



పటములో

$AC =$ నిచ్చైన పొడవు = 3.9 మీ.

$AB =$ నేలపై నిచ్చైన అడుగు భాగము తాకిన స్థానమునకు, గోడకు గల దూరము = h మీ.

$BC =$ నిచ్చైన అడుగు భాగము మరియు గోడ అడుగు భాగముల మధ్య దూరము = 1.5 మీ.

పైథాగరస్ సిద్ధాంతం ప్రకారం

$$AC^2 = AB^2 + BC^2$$

$$(3.9)^2 = h^2 + (1.5)^2$$

$$h^2 = (3.9)^2 - (1.5)^2$$

$$h^2 = 15.21 - 2.25$$

$$h^2 = 12.96$$

$$h = \sqrt{12.96} = 3.6$$

\therefore నిచ్చైన గోడను తాకు ఎత్తు = 3.6 మీ.

28. బాగుగా కలుపబడిన పేకాట 52 కార్డుల కట్ట నుండి ఒక కార్డు తీయుటలో అది ప్రధాన సంఖ్య కలిగిన ఎరుపు రంగు కార్డు అయ్యే సంభావ్యతను కనుగొనుము.

సాధన. మొత్తం పేక ముక్కలు = 52
52 పేక ముక్కలలో ప్రధాన సంఖ్య కలిగి ఎరుపు రంగు గల పేక ముక్కల సంఖ్య = 8
ఎన్నుకొన్న పేకముక్క ప్రధానసంఖ్యను కలిగి అది ఎరుపు రంగు గల పేక ముక్క అగు ఘటన సంభావ్యత

$$= \frac{\text{అనుకూల పర్యవసానాల సంఖ్య}}{\text{మొత్తం ఫలితాల సంఖ్య}}$$

$$= \frac{8}{52} = \frac{2}{13}$$

విభాగం - IV

29. a) ఇద్దరు స్త్రీలు మరియు 5 గురు పురుషులు ఒక కుట్టువనిని 4 రోజులలో చేయగా, ముగ్గురు స్త్రీలు మరియు 6 గురు పురుషులు దానిని 3 రోజులలో చేసెదరు. స్త్రీ ఒక్కరే లేదా పురుషుడు ఒక్కడే ఆ పనిని పూర్తి చేయుటకు పట్టు కాలమును కనుగొనుము.

సాధన. స్త్రీ ఒక్కరే ఆ పనిని పూర్తి చేయుటకు పట్టు కాలం = x రోజులు
పురుషుడు ఒక్కడే ఆ పనిని పూర్తి చేయుటకు పట్టు కాలం = y రోజులు అనుకుందాం.

$$\text{స్త్రీ ఒక్కరే 1 రోజు చేయు పని} = \frac{1}{x}$$

$$\text{పురుషుడు ఒక్కడే 1 రోజు చేయు పని} = \frac{1}{y}$$

సందర్భం - 1 :

ఇద్దరు స్త్రీలు మరియు 5 గురు పురుషులు ఆ పనిని 4 రోజులలో చేయుదురు.

$$\text{కావున, ఇద్దరు స్త్రీలు మరియు 5 గురు పురుషులు ఒక రోజులో చేయు పని} = \frac{1}{4}$$

$$\therefore \text{ఇద్దరు స్త్రీలు ఒకరోజులో చేయు పని} = 2 \times \frac{1}{x} = \frac{2}{x}$$

$$\therefore \frac{2}{x} + \frac{5}{y} = \frac{1}{4}$$

$$\text{5 గురు పురుషులు ఒక రోజులో చేయు పని} = 5 \times \frac{1}{y} = \frac{5}{y}$$

$$\therefore \frac{8}{x} + \frac{20}{y} = 1 \quad \dots\dots\dots (1)$$

సందర్భం - 2 :

ముగ్గురు స్త్రీలు మరియు 6 గురు పురుషులు ఆ పనిని 3 రోజులలో చేసెదరు.

$$\therefore \text{ముగ్గురు స్త్రీలు మరియు 6 గురు పురుషులు ఒక రోజు చేయు పని} = \frac{1}{3}$$

$$\frac{3}{x} + \frac{6}{y} = \frac{1}{3}$$

$$\frac{9}{x} + \frac{18}{y} = 1 \quad \dots\dots\dots (2)$$

$$p = \frac{1}{x}, q = \frac{1}{y} \text{ అనుకుంటే,}$$

$$(1) \Rightarrow 8p + 20q = 1 \quad \dots\dots\dots (3)$$

$$(2) \Rightarrow 9p + 18q = 1 \quad \dots\dots\dots (4)$$

$$(3) \times 9 \Rightarrow 72p + 180q = 9$$

$$(4) \times 8 \Rightarrow 72p + 144q = 8$$

$$\begin{array}{r} - \quad - \quad - \\ \hline 36q = 1 \end{array}$$

$$q = \frac{1}{36}$$

$q = \frac{1}{36}$ ను (4) లో రాయగా,

$$9p + 18 \left(\frac{1}{36} \right) = 1$$

$$\Rightarrow 9p + \frac{1}{2} = 1$$

$$\Rightarrow 9p = 1 - \frac{1}{2} = \frac{1}{2} \Rightarrow p = \frac{1}{18}$$

$$\Rightarrow p = \frac{1}{18}, q = \frac{1}{36}$$

$$\text{కానీ } \frac{1}{x} = p = \frac{1}{18} \Rightarrow x = 18$$

$$\frac{1}{y} = q = \frac{1}{36} \Rightarrow y = 36$$

స్త్రీ ఒక్కరే ఆ పని పూర్తి చేయుటకు పట్టు

కాలం = 18 రోజులు

పురుషుడు ఒక్కరే ఆ పనిని పూర్తి

చేయుటకు పట్టు కాలం = 36 రోజులు.

సరిచూచుట :

$x = 18, y = 36$ ని (2) లో రాయగా,

$$\frac{9}{18} + \frac{18}{36} = 1 \Rightarrow \frac{1}{2} + \frac{1}{2} = 1$$

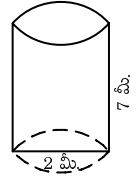
$$\Rightarrow \frac{2}{2} = 1 \Rightarrow 1 = 1$$

(లేదా)

b) స్థూపాకృతిలో ఉన్న నూనె పీపా 2 మీ. భూవ్యాసం మరియు 7 మీ. ఎత్తును కలియున్నది. పీపాకు రంగు వేయడానికి పెయింటర్ 1 చ.మీ. కు ₹ 5 అను తీసుకుంటుంటే, 10 నూనె పీపాలకు రంగు వేయడానికి ఎంత ఖర్చు అవుతుంది ?

సాధన. స్థూపాకృతిలో ఉన్న నూనె పీపా

$$\begin{aligned} \text{భూ వ్యాసం} &= d \\ &= 2 \text{ మీ.} \end{aligned}$$



$$\begin{aligned} \text{పీపా వ్యాసార్ధం} &= r = \frac{d}{2} \\ &= 1 \text{ మీ.} \end{aligned}$$

$$\text{ఎత్తు} = h = 7 \text{ మీ.}$$

స్థూపాకార నూనె పీపా యొక్క సంపూర్ణతల వైశాల్యం

$$= 2\pi r(r + h)$$

$$= 2 \times \frac{22}{7} \times 1 \times (1 + 7)$$

$$= 2 \times \frac{22}{7} \times 8$$

$$= \frac{352}{7} = 50.28 \text{ చ.మీ.}$$

1 చ.మీ.కు రంగు వేయుటకు ఖర్చు = రూ. 5

అటువంటి 10 పీపాలకు రంగు వేయడానికి అయ్యే ఖర్చు

$$= 50.28 \times 5 \times 10$$

$$= \text{రూ. } 2514$$

30.a) ₹ 1000 అకు సంవత్సరానికి 8% బారు వడ్డీ ప్రకారము ప్రతి సంవత్సరానికి అయ్యే వడ్డీని కనుగొనుము. ఈ వడ్డీల జాబితా ఒక అంకశ్రేణి అవుతుందా? ఒకవేళ అంకశ్రేణి అయితే 30వ సం॥ము చివర అయ్యే వడ్డీని కనుగొనుము.

సాధన. అసలు = ₹ 1000, R = 8 %

$$\text{బారువడ్డీ } I = \frac{\text{PTR}}{100}$$

$$\therefore \text{1వ సం॥ము చివర అయ్యే వడ్డీ} \\ = \frac{1000 \times 1 \times 8}{100} = ₹ 80$$

$$\text{2వ సం॥ము చివర అయ్యే వడ్డీ} \\ = \frac{1000 \times 8 \times 2}{100} = ₹ 160$$

$$\text{3వ సం॥ము చివర అయ్యే వడ్డీ} \\ = \frac{1000 \times 8 \times 3}{100} = ₹ 240$$

$$\text{4వ సం॥ము చివర అయ్యే వడ్డీ} \\ = \frac{1000 \times 8 \times 4}{100} = ₹ 320$$

.....
.....

∴ 1వ, 2వ, 3వ, 4వ సం॥ల చివర అయ్యే వడ్డీల విలువలు వరుసగా 80, 160, 240, 320,

పై జాబితాలో ఏ రెండు వరుస పదాల భేదము (80) స్థిరము.

కావున ఇది ఒక అంకశ్రేణి అవుతుంది.

30 సం॥ల చివర అయ్యే వడ్డీని a_{30} అవుతుంది.

$$\therefore a_{30} = a + (30 - 1) d \\ = 80 + 29 \times 80 \\ = 80 + 2320$$

$$a_{30} = 2400$$

$$30 \text{ సం॥ముల చివర అయ్యే వడ్డీ} \\ = ₹ 2400.$$

(లేదా)

b) ఏదయిన ధన పూర్ణసంఖ్య యొక్క ఘనం $8m$ లేదా $8m + 1$ లేదా $8m + 3$ లేదా $8m + 5$ లేదా $8m + 7$ రూపంలో ఉంటుందని చూపుము.

సాధన. $a = bq + r, 0 \leq r < b$

$$a = 8k + t, t = 0, 1, 2, 3, 4, 5, 6, 7.$$

$$a^3 = (8k + t)^3 \\ = (8k)^3 + 3(8k)(t)(8k + t) + t^3 \\ = 8[64k^3 + 3kt(8k + t)] + t^3 \\ = 8n + t^3$$

$$t = 0, 2, 4, 6 \text{ అయిన } t^3 = 8p$$

$$a^3 = (8k + t)^3 = 8n + 8p \\ = 8(n + p) = 8m$$

$$t = 1 \text{ అయిన } a^3 = 8n + 1 \\ = 8m + 1$$

$$t = 3 \text{ అయిన } a^3 = 8n + 27 \\ = 8(n + 3) + 3 = 8m + 3$$

$$t = 5 \text{ అయిన } a^3 = 8n + 125 \\ = 8(n + 15) + 5 \\ = 8m + 5$$

$$t = 7 \text{ అయిన } a^3 = 8n + 343 \\ = 8(n + 42) + 7 = 8m + 7$$

∴ ఏదైనా ధన పూర్ణసంఖ్య యొక్క గణము $8m$ లేదా $8m + 1$ లేదా $8m + 3$ లేదా $8m + 5$ లేదా $8m + 7$ రూపంలో ఉంటుంది.

31. a) ఒక బస్టిలోని 50 దుకాణాల యొక్క దినసరి లాభాలు (రూపాయలలో) కింది పట్టికలో ఇవ్వబడ్డాయి.

దినసరి లాభాలు (రూపాయలలో)	0 - 50	50 - 100	100 - 150	150 - 200	200 - 250	250 - 300
దుకాణాల సంఖ్య	6	9	13	10	8	4

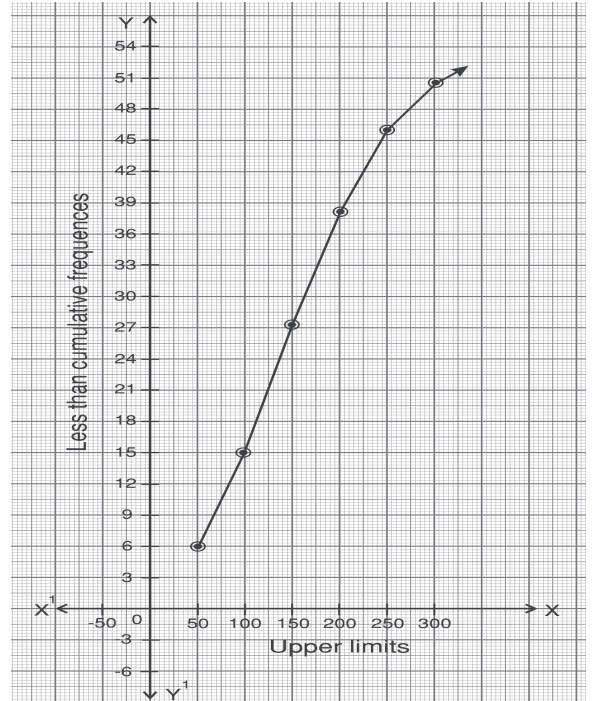
ఈ దత్తాంశమునకు ఆరోహణ సంచిత పౌనఃపున్యములను తయారుచేసి, ఓజివ్ వక్రము గీయండి.

సాధన.	దినసరి లాభాలు (రూపాయలలో)	దుకాణాల సంఖ్య	ఎగువ హద్దులు	ఆరోహణ సంచిత పౌనఃపున్యం
	0 - 50	6	50	6
	50 - 100	9	100	6 + 9 = 15
	100 - 150	13	150	15 + 13 = 28
	150 - 200	10	200	28 + 10 = 38
	200 - 250	8	250	38 + 8 = 46
	250 - 300	4	300	46 + 4 = 50

ఓజివ్ వక్రం కొరకు X - అక్షంపై ఎగువ హద్దులు, Y - అక్షంపై ఆరోహణ సంచిత పౌనఃపున్యాలు తీసుకొనవలెను. కావలసిన క్రమయుగ్మాల సమితి

= {(50, 6), (100, 15), (150, 28), (200, 38), (250, 46), (300, 50)}.

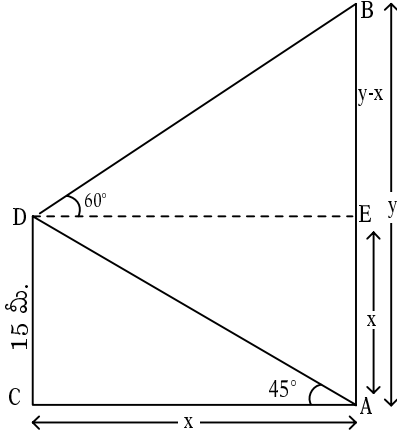
ఈ క్రమయుగ్మాలను గ్రాఫు కాగితంపై గుర్తించవలెను.



(లేదా)

- b) 15 మీ. ఎత్తుగల ఒక భవనంపై నుండి ఒక వ్యక్తి ఒక సెల్ టవరు పై భాగాన్ని, కింది భాగాన్ని (పాదమును) పరిశీలించిన అవి వరుసగా 60° ల ఊర్ధ్వకోణం మరియు 45° ల నిమ్నకోణం చేయుచున్న, ఆ సెల్ టవరు ఎత్తును కనుగొనండి.

సాధన.



పటం నుండి $AB =$ సెల్ టవర్ ఎత్తు $= y$ అనుకొనుము.

$CD = AE =$ భవనం ఎత్తు $= 15$ మీ. భవనం నుండి టవర్ కు గల మధ్య దూరం $= x$ మీ.

ఊర్ధ్వకోణము $\angle BDE = 60^\circ$ మరియు $\angle EDA = \angle DAC = 45^\circ$.

$$\Delta ADC \text{ నుండి } \tan 45^\circ = \frac{CD}{AC}$$

$$1 = \frac{15}{AC}$$

$$AC = 15 \text{ మీ.}$$

$$\Delta BDE \text{ నుండి } \tan 60^\circ = \frac{BE}{DE}$$

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

$$\sqrt{3} = \frac{BE}{15} \quad \{ \because x = 15 \text{ మీ.} \}$$

$$BE = 15\sqrt{3} \text{ మీ.}$$

$$BE = y - x = 15\sqrt{3}$$

$$\Rightarrow y - 15 = 15\sqrt{3}$$

$$\Rightarrow y = 15 + 15\sqrt{3}$$

$$\Rightarrow y = 15(\sqrt{3} + 1)$$

$$\Rightarrow y = 15(1.732 + 1)$$

$$\Rightarrow y = 15 \times 2.732$$

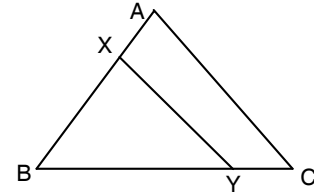
$$\therefore y = 40.98 \text{ మీ.}$$

$$\therefore \text{సెల్ టవరు ఎత్తు} = y$$

$$= 40.98 \text{ మీ.}$$

32. a) ΔABC లో, $XY \parallel AC$ మరియు XY ఆ త్రిభుజాన్ని రెండు సమాన వైశాల్యాలు గల భాగాలుగా విభజించును. అయిన $\frac{AX}{XB}$ నిష్పత్తిని కనుగొనండి.

సాధన.



దత్తాంశము : ΔABC లో $XY \parallel AC$.

సారాంశము : $\frac{AX}{XB}$ నిష్పత్తి, XY ,

ΔABC ను సమాన వైశాల్యాలు గల భాగాలుగా విభజించును.

$\Delta ABC, \Delta XBY$ లలో

$$\angle B = \angle B$$

$$\angle A = \angle X$$

$[\because XY \parallel AC; \angle A, \angle X$ మరియు

$\angle C, \angle Y$ లు ఆసన్నకోణాల జత]

$$\Delta ABC \sim \Delta XBY$$

(కో.కో.కో సరూపకత ధర్మము ప్రకారము)

$$\text{ఆ విధముగా } \frac{\Delta ABC}{\Delta XBY} = \frac{AB^2}{XB^2}$$

[∵ రెండు సరూప త్రిభుజాల వైశాల్యాల నిష్పత్తి వాటి అనురూప భుజాల నిష్పత్తి వర్గమునకు సమానము]

$$\frac{2}{1} = \frac{AB^2}{XB^2}$$

[దత్తాంశంలో $\Delta BXY = \Delta BAC$ కావున
∴ $\Delta ABC = 2 \cdot \Delta XBY$]

$$2 = \left(\frac{AB}{XB}\right)^2$$

$$2 = \left(\frac{AX + XB}{XB}\right)^2$$

$$2 = \left(\frac{AX}{XB} + \frac{XB}{XB}\right)^2$$

$$2 = \left(\frac{AX}{XB} + 1\right)^2$$

$$\Rightarrow \frac{AX}{XB} + 1 = \sqrt{2}$$

$$\Rightarrow \frac{AX}{XB} = \sqrt{2} - 1$$

$$\text{కావున ఆ నిష్పత్తి } \frac{AX}{XB} = \frac{\sqrt{2} - 1}{1}.$$

(లేదా)

b) ఒక పేక ముక్కల కట్ట నుండి ఏస్, రాజు మరియు 10 సంఖ్య గల 3 కళావరు ముక్కలను బయటకు తీసి, మిగిలిన వాటిని బాగా కలిపి, వాటి నుండి ఒక పేక ముక్కను తీసినచో అది

i) కళావరు అగుటకు,

ii) ఏస్ అగుటకు,

iii) డైమండ్ రాజు అగుటకు,

iv) కళావరు 5 అగుటకు సంభావ్యత కనుగొనండి.

సాధన. మొత్తం పర్యవసానాల సంఖ్య
 $52 - 3 = 49$

(i) తీసిన ముక్క కళావరు అగుటకు సంభావ్యత

$$= \frac{\text{కళావరు అగుటకు అనుకూల పర్యవసానాల సంఖ్య}}{\text{మొత్తం పర్యవసానముల సంఖ్య}}$$

$$= \frac{10}{49}$$

(ii) తీసిన ముక్క ఆసు అగుటకు సంభావ్యత

$$= \frac{3}{49}$$

(iii) తీసిన ముక్క డైమండ్ రాజు అగుటకు

$$\text{సంభావ్యత} = \frac{1}{49}$$

(iv) తీసిన ముక్క కళావరు 5 అగుటకు

$$\text{సంభావ్యత} = \frac{1}{49}$$

33.a) $p(x) = x^2 - 3x + 2$ బహుపది రేఖా చిత్రాన్ని గీసి దాని నుండి శూన్యాలను కనుగొనుము.

సాధన. $y = p(x) = x^2 - 3x + 2$

$$x = 0 \text{ అయిన } y = 0^2 - 3(0) + 2 = 2 \text{ (0, 2)}$$

$$x = 1 \text{ అయిన } y = 1^2 - 3(1) + 2 = 0 \text{ (1, 0)}$$

$$x = 2 \text{ అయిన } y = 2^2 - 3(2) + 2 = 0 \text{ (2, 0)}$$

$$x = 3 \text{ అయిన } y = 3^2 - 3(3) + 2 = 2 \text{ (3, 2)}$$

$$x = -1 \text{ అయిన}$$

$$y = (-1)^2 - 3(-1) + 2$$

$$= 1 + 3 + 2 = 6 \text{ అయిన } (-1, 6)$$

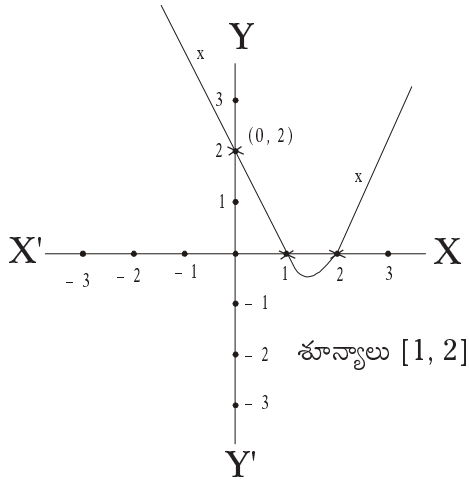
$x = -2$ అయిన

$$y = (-2)^2 - 3(-2) + 2$$

$$= 4 + 6 + 2 = 12 \text{ అయిన}$$

$(-2, 12)$

అనగా పై వర్గ బహుపది $(0, 2)$,
 $(1, 0)$, $(2, 0)$, $(3, 2)$, $(-1, 6)$,
 $(-2, 12)$ బిందువుల నుండి పోతుంది.



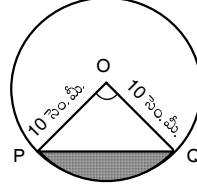
(లేదా)

b) 10 సెం.మీ వ్యాసార్థముగా గల వృత్తములో ఒక జ్యా కేంద్రము వద్ద లంబకోణాన్ని ఏర్పరిస్తే, కింది ఇవ్వబడిన వృత్తఖండాల వైశాల్యాలు కనుగొనండి.
 $(\pi = 3.14$ అని తీసుకోండి.)

i) అల్ప వృత్తఖండము

ii) అధిక వృత్త ఖండము

సాధన.



PQ జ్యా కేంద్రం వద్ద చేయు కోణం
 $(x^\circ) = 90^\circ$

వృత్త వ్యాసార్థం $(r) = 10$ సెం.మీ.

i) అల్ప వృత్త ఖండ వైశాల్యము = POQ సెక్టార్ వైశాల్యము - Δ POQ వైశాల్యము

$$\text{POQ సెక్టార్ వైశాల్యము} = \frac{x}{360} \times \pi r^2$$

$$\Delta \text{POQ వైశాల్యము} = \frac{1}{2}bh$$

$$\therefore \text{అల్ప వృత్త ఖండ వైశాల్యము}$$

$$= \frac{90}{360} \times 3.14 \times 10 \times 10 - \frac{1}{2} \times 10 \times 10$$

$$= 78.5 - 50 = 28.5 \text{ సెం.మీ}^2$$

ii) అధిక వృత్తఖండ వైశాల్యము

$$= \text{వృత్త వైశాల్యము}$$

$$- \text{అల్పవృత్త ఖండ వైశాల్యము.}$$

$$= \pi r^2 - 28.5$$

$$= \frac{22}{7} \times 10 \times 10 - 28.5$$

$$= 314 - 28.5$$

$$\therefore \text{అధిక వృత్త ఖండ వైశాల్యము}$$

$$= 285.5 \text{ సెం.మీ.}$$





CLASS X

PRE-PUBLIC PAPER

2

గణిత-శాస్త్రం

Time : 3.15 Hrs.]

[Max. Marks : 100

విద్యార్థులకు సూచనలు :

1. అన్ని ప్రశ్నలకు సమాధానములు ప్రత్యేక బుక్‌లెట్‌లో మాత్రమే రాయాలి.
2. ప్రశ్నాపత్రంలో నాలుగు విభాగాలు మరియు 33 ప్రశ్నలు ఉండును.
3. విభాగం - IV లో అంతర్గత ఎంపిక ఉంటుంది.
4. సమాధానాలు స్పష్టంగా రాయాలి.

విభాగం - I

12 × 1 = 12

సూచనలు: 1. క్రింద ఇవ్వబడిన అన్ని ప్రశ్నలకు ఒక పదం లేదా ఒక వాక్యంలో జవాబు రాయండి.

2. ప్రతి ప్రశ్నకు 1 మార్కు.

3. ఏదైన ప్రశ్నకు జవాబు ఒకటి కంటే ఎక్కువసార్లు రాసినచో, మొదటిసారి రాసిన జవాబును మాత్రమే పరిగణనలోనికి తీసుకొనబడును.

1. "X - అక్షంకు సమాంతరంగా వున్న రేఖల సమితి అపరిమిత సమితి" ఇది సరైనదేనా ? నీ సమాధానాన్ని సమర్థించుము.
2. $x^2 + 5x + p = 0$ వర్గ సమీకరణము మూలము $\log_3 27$ అయిన 'p' విలువ ఎంత ?
3. కింది వాటిలో సరైన జతను చూపు ఎంపికను ఎన్నుకొనుము.

a) స్థూపపు నిలువుకోత ఆకారము	i) త్రిభుజము
b) శంఖువు నిలువుకోత ఆకారము	ii) దీర్ఘచతురస్రం
c) స్థూపపు అడ్డుకోత	iii) వృత్తము
- A) a - i, b - ii, c - iii B) a - iii, b - i, c - ii
- C) a - ii, b - iii, c - i D) a - ii, b - i, c - iii
4. రెండు సంఖ్యల క.సా.గు 108 మరియు వాటి గ.సా.భా 9 మరియు అందులో ఒక సంఖ్య 54 అయిన రెండవ సంఖ్యను కనుగొనుము.

5. క్రింది ప్రవచనాలలో సరైన సమాధానాన్ని ఎన్నుకొనుము.

A : వర్గ సమీకరణం $ax^2 + bx + c = 0$ కు మూలాలు $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

B : వర్గ సమీకరణం x కు మూలాలు $-\frac{a}{2}$, a అగును.

i) A మరియు B లు సత్యాలు

ii) A సత్యం, B అసత్యం

iii) A అసత్యం, B సత్యం

iv) A మరియు B లు అసత్యాలు

6. అంకశ్రేణి $\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}, \dots$ ల పదాంతరంను వ్రాయుము.

7. \overline{AB} మధ్య బిందువును కనుగొనుము. ఇక్కడ $A(\log_2 8, \log_5 25)$ మరియు $B(\log_{10} 10, \log_{10} 100)$.

8. $\tan \theta$ ను $\operatorname{cosec} \theta$ లలో వ్రాయుము.

9. ఒక చతుర్భుజంలో వృత్తం ఇమిడి వున్నది అయిన చతుర్భుజ భుజాల మధ్య సంబంధంను వ్రాయుము.

10. వర్గీకృత దత్తాంశము యొక్క రెండు ఓజీవ్ వక్రాలు ఖండన బిందువులో x - నిరూపకము తెలియజేయు కేంద్రీయ కొలత ఏది ?

11. ఒక పాచికను దొర్లించినపుడు '7'ను పొందు సంభావ్యత విలువ ఎంత ?

12. ఒక రేఖా ఖండంను ఇచ్చిన నిష్పత్తిలో విభజించుటకు అవసరమైన సిద్ధాంతము ఏది ?

విభాగం - II

8 × 2 = 16

సూచనలు: 1. అన్ని ప్రశ్నలకు సమాధానములు రాయుము.

2. ప్రతి ప్రశ్నకు 2 మార్కులు.

13. దీర్ఘఘనం మరియు స్థూపం సగభాగముల సమ్మేళనముగా వుండు పెట్టె నమూనాను గీయుము.

14. 'గణిత టెక్స్ బుక్ విలువ, గణిత నోటు పుస్తకము కన్నా రెట్టింపుకు 10 తక్కువ'. దీనికి రేఖీయ సమీకరణమును వ్రాయుము.

15. R మరియు T అను రెండు సమితులు ఈ విధంగా నిర్వచించబడినవి.

$R = \{x/x, 2 \text{ చే భాగించబడినది}, x \in \mathbb{N}\}$ మరియు

$T = \{x/x, 6 \text{ చే భాగించబడినది}, x \in \mathbb{N}\}$ అయిన $T \subset R$ అగునా ? నీ సమాధానాన్ని సమర్థించుము.

16. ఒకే వ్యాసార్థం మరియు ఎత్తులు గల శంఖువు మరియు స్థూపాకార పాత్రలలో, ఎన్ని శంఖువాకార పాత్రల పాలు, స్థూపాకార పాత్రను నింపునో తెల్పి నీ సమాధానాన్ని సమర్థించుము.

17. $\sin \alpha = \frac{1}{2}$ మరియు $\cos \beta = \frac{1}{2}$ అయిన $(\alpha + \beta)$ విలువను కనుగొనుము.
18. ఈ క్రింది వాటికి రెండు వేరువేరు ఉదాహరణలివ్వండి.
i) సరూప పటాలు, ii) సరూప పటాలు కానివి
19. వర్గీకృత దత్తాంశము యొక్క మధ్యగతము కనుగొనుటకు సూత్రము వ్రాసి దానిలోని అక్షరాలను వివరించండి.
20. 1 నుండి 100 వరకు గల సంఖ్యలలో ఒక సంఖ్యను ఎన్నుకొనమని ఒకరు అడిగిన, ఆ సంఖ్య ప్రధాన సంఖ్య అగు సంభావ్యత ఎంత ? కనుగొనుము.

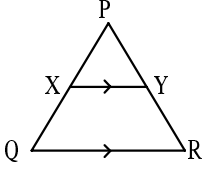
విభాగం - III

8 × 4 = 32

- సూచనలు:** 1. అన్ని ప్రశ్నలకు సమాధానములు రాయుము.
2. ప్రతి ప్రశ్నకు 4 మార్కులు.

21. $\log \frac{162}{343} + 2 \log \frac{7}{9} - \log \frac{1}{7} = \log 2$ అని చూపండి.
22. $A = \{x : x \in \mathbb{N} \text{ మరియు } x \text{ అనేది } 4 \text{ గుణిజాల సమితి}\};$
 $B = \{x : x \in \mathbb{N} \text{ మరియు } x \text{ అనేది } 6 \text{ గుణిజాల సమితి}\};$
 $C = \{x : x \in \mathbb{N} \text{ మరియు } x \text{ అనేది } 4, 6 \text{ ల క.సా.గు. యొక్క గుణిజాల సమితి}\};$
 అయిన $A \cap B$ ని కనుగొనండి. $A \cap B$ మరియు C సమితుల మధ్య గల సంబంధాన్ని తెలపండి.
23. ఒక దీర్ఘచతురస్రాకార స్థలం పొడవు వెడల్పునకు రెండు రెట్లు ఉండి 200 చ.మీ. వైశాల్యం గల ఒక దీర్ఘ చతురస్రాన్ని చిత్రీకరించగలమా ? చేయగలిగితే దాని పొడవు, వెడల్పులను కనుగొనుము.
24. ఒక త్రిభుజం యొక్క భుజాల పొడవులు అంకశ్రేణిలో కలవు. ఆ త్రిభుజం చుట్టు కొలత 30 సెం.మీ. మరియు అతి పెద్ద, అతి చిన్న భుజాల పొడవుల భేదం 4 సెం.మీ. అయిన ఆ త్రిభుజ భుజాల పొడవులను కనుగొనుము.
25. బిందువులు $(a + b, a - b)$ మరియు $(a - b, a + b)$ లచే ఏర్పడు రేఖా ఖండమును అంతరంగా 3 : 2 నిష్పత్తిలో విభజించు బిందువు నిరూపకాలను కనుగొనండి.

26. కింది పటం పరిశీలించుము.



ΔPQR లో $XY \parallel QR$ మరియు $PX = x - 2$, $XQ = x + 5$, $PY = x - 3$ మరియు $YR = x + 3$ అయితే, 'x' విలువను కనుగొనుము.

27. 3.9 మీ. పొడవు గల ఒక నిచ్చెన ఒక గోడకు వేయబడినది. నిచ్చెన అడుగు భాగం మరియు గోడ అడుగు భాగంల మధ్య దూరం 1.5 మీ. అయిన, ఆ నిచ్చెన గోడను ఎంత ఎత్తులో తాకును?

28. బాగుగా కలుపబడిన పేకాట 52 కార్డుల కట్ట నుండి ఒక కార్డు తీయుటలో అది ప్రధాన సంఖ్య కలిగిన ఎరుపు రంగు కార్డు అయ్యే సంభావ్యతను కనుగొనుము.

విభాగం - IV

5 × 8 = 40

సూచనలు: 1. అన్ని ప్రశ్నలకు సమాధానములు రాయుము.

2. ప్రతి ప్రశ్నకు 8 మార్కులు.

3. ప్రతి ప్రశ్నకు అంతర్గత ఎంపిక కలదు.

29. a) ఇద్దరు స్త్రీలు మరియు 5 గురు పురుషులు ఒక కుట్టుపనిని 4 రోజులలో చేయగా, ముగ్గురు స్త్రీలు మరియు 6 గురు పురుషులు దానిని 3 రోజులలో చేసెదరు. స్త్రీ ఒక్కరే లేదా పురుషుడు ఒక్కడే ఆ పనిని పూర్తి చేయుటకు పట్టు కాలమును కనుగొనుము.

(లేదా)

b) స్థాపాకృతిలో ఉన్న నూనె పీపా 2 మీ. భూవ్యాసం మరియు 7 మీ. ఎత్తును కల్గియున్నది. పీపాకు రంగు వేయడానికి పెయింటర్ 1 చ.మీ. కు ₹ 5 లను తీసుకుంటుంటే, 10 నూనె పీపాలకు రంగు వేయడానికి ఎంత ఖర్చు అవుతుంది ?

30. a) ₹ 1000 లకు సంవత్సరానికి 8% బారు వడ్డీ ప్రకారము ప్రతి సంవత్సరానికి అయ్యే వడ్డీని కనుగొనుము. ఈ వడ్డీల జాబితా ఒక అంకశ్రేణి అవుతుందా ? ఒకవేళ అంకశ్రేణి అయితే 30వ సం॥ము చివర అయ్యే వడ్డీని కనుగొనుము.

(లేదా)

b) ఏదయిన ధన పూర్ణసంఖ్య యొక్క ఘనం 8m లేదా 8m + 1 లేదా 8m + 3 లేదా 8m + 5 లేదా 8m + 7 రూపంలో ఉంటుందని చూపుము.

