Date: 04/03/2025

Question Paper Code

T25 511

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar, Gurugram, Haryana-122015

Time: 3 Hrs.

MATHEMATICS

Max. Marks: 80

ICSE Board Class X Exam (2025)

Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions very carefully and follow them:

(i) You will not be allowed to write during first 15 minutes.

(ii) Attempt all questions from Section A and any four questions from Section B.

(iii) Omission of essential working will result in loss of marks.

(iv) The intended marks for questions or parts of questions are given in brackets [ ].

(v) Mathematical tables and graph papers are provided.

SECTION-A (40 Marks)

*(Attempt **all** questions from this Section.)*

1. Choose the correct answers to the questions from the given options. **[15]**

(Do not copy the questions, write the correct answers only.)

(i) The given quadratic equation $3x^2 + \sqrt{7}x + 2 = 0$ has

(a) Two equal real roots (b) Two distinct real roots

(c) More than two real roots (d) No real roots

Answer (d) **[1]**

Sol. No real roots

(ii) Mr. Anuj deposits ₹500 per month for 18 months in a recurring deposit account at a certain rate. If he earns ₹570 as interest at the time of maturity, then his matured amount is

(a) ₹(500 × 18 + 570) (b) ₹(500 × 19 + 570)

(c) ₹(500 × 18 × 19 + 570) (d) ₹(500 × 9 × 19 + 570)

Answer (a) **[1]**

Sol. ₹(500 × 18 + 570)

(iii) Which of the following **cannot** be the probability of any event?

(a) $\frac{5}{4}$ (b) 0.25

(c) $\frac{1}{33}$ (d) 67%

Answer (a) **[1]**

Sol. $\frac{5}{4}$

(iv) The equation of the line passing through origin and parallel to the line $3x + 4y + 7 = 0$ is

(a) $3x + 4y + 5 = 0$ (b) $4x - 3y - 5 = 0$

(c) $4x - 3y = 0$ (d) $3x + 4y = 0$

Answer (d) **[1]**

Sol. $3x + 4y = 0$

(v) If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, then A^2 is equal to

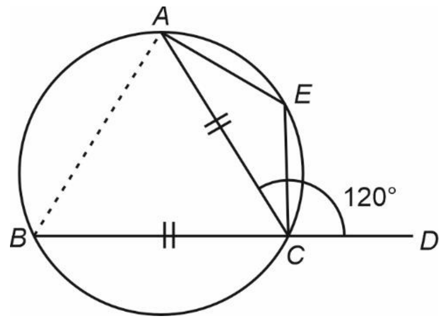
(a) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

Answer (c) **[1]**

Sol. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(vi) In the given diagram, chords AC and BC are equal. If $\angle ACD = 120^\circ$, then $\angle AEC$ is



(a) 30° (b) 60°

(c) 90° (d) 120°

Answer (d) **[1]**

Sol. 120°

(vii) The factor **common** to the two polynomials $x^2 - 4$ and $x^3 - x^2 - 4x + 4$ is

(a) $(x + 1)$ (b) $(x - 1)$

(c) $(x + 2)$ (d) $(x - 2)$

Answer (c, d)* **[1]**

Sol. $(x + 2)$ and $(x - 2)$ both are factor of given polynomial.

(viii) A man invested in a company paying 12% dividend on its share. If the percentage return on his investment is 10%, then the shares are

(a) at par (b) below par

(c) above par (d) cannot be determined

Answer (c) **[1]**

(ix) **Statement 1 :** The point which is equidistant from three non-collinear points D, E and F is the circumcentre of the ΔDEF.

Statement 2 : The incentre of a triangle is the point where the bisector of the angles intersects.

(a) Both the statements are true

(b) Both the statements are false

(c) Statement 1 is true and Statement 2 is false

(d) Statement 1 is false and Statement 2 is true

Answer (a) **[1]**

(x) **Assertion (A) :** If $\sin^2 A + \sin A = 1$ then $\cos^4 A + \cos^2 A = 1$

Reason (R) : $1 - \sin^2 A = \cos^2 A$

(a) (A) is true, (R) is false

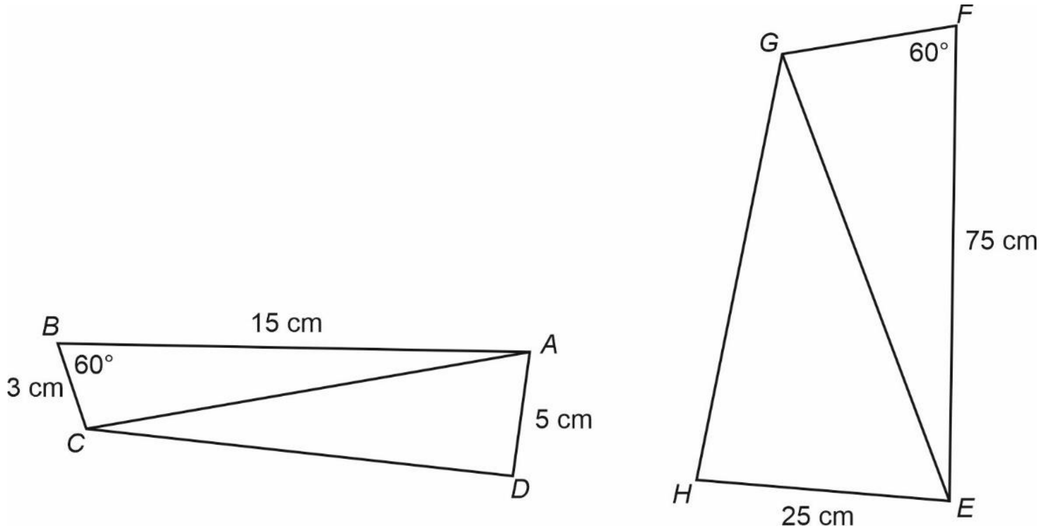
(b) (A) is false, (R) is true

(c) Both (A) and (R) are true, and (R) is the correct reason for (A)

(d) Both (A) and (R) are true, and (R) is the incorrect reason for (A)

Answer (c) **[1]**

(xi) In the given diagram $\Delta ABC \sim \Delta EFG$. If $\angle ABC = \angle EFG = 60°$, then the length of the side FG is



(a) 15 cm (b) 20 cm

(c) 25 cm (d) 30 cm

Answer (a) **[1]**

(xii) If the volume of two spheres is in the ratio 27 : 64, then the ratio of their radii is

(a) 3 : 4 (b) 4 : 3

(c) 9 : 16 (d) 16 : 9

Answer (a) **[1]**

(xiii) The marked price of an article is ₹1375. If the CGST is charged at a rate of 4%, then the price of the article including GST is

(a) ₹55 (b) ₹110

(c) ₹1430 (d) ₹1485

Answer (d) **[1]**

Sol. Price of article including GST $= \frac{1375 \times 108}{100} = ₹1485$

(xiv) The solution set for $0 < -\frac{x}{3} < 2,\ x \in Z$ is

(a) {–5, –4, –3, –2, –1} (b) {–6, –5, –4, –3, –2, –1}

(c) {–5, –4, –3, –2, –1, 0} (d) {–6, –5, –4, –3, –2, –1, 0}

Answer (a) **[1]**

Sol. $0 < -\frac{x}{3} < 2,\ x \in Z$

$0 < -x < 6$

$-6 < x < 0$

$x \in \{-5, -4, -3, -2, -1\}$

(xv) **Assertion (A) :** The mean of first 9 natural numbers is 4.5.

Reason (R) : Mean = $\dfrac{\text{Sum of all the observations}}{\text{Total number of observations}}$

(a) (A) is true, (R) is false

(b) (A) is false, (R) is true

(c) Both (A) and (R) are true, and (R) is the correct reason for (A)

(d) Both (A) and (R) are true, and (R) is the incorrect reason for (A)

Answer (b) **[1]**

Sol. Assertion (A)

$$\text{Mean} = \frac{1+2+3+4+5+6+7+8+9}{9} = 5$$

Reason (R)

$$\text{Mean} = \frac{\text{Sum of all the observations}}{\text{Total number of observations}}$$

∴ (b) (A) is false, (R) is true

2. (i) Solve the following quadratic equation $2x^2 - 5x - 4 = 0$ **[4]**

Give your answer correct to three significant figures.

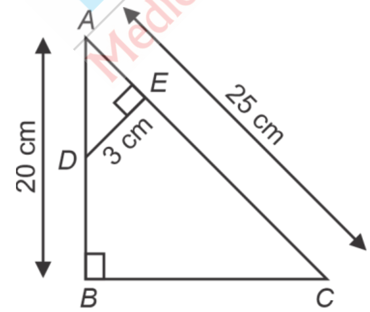
(*Use mathematical tables for this question*)

(ii) Mrs. Rao deposited ₹250 per month in a recurring deposit account for a period of 3 years. She received ₹10,110 at the time of maturity. Find: **[4]**

(a) the rate of interest.

(b) how much more interest Mrs. Rao will receive if she had deposited ₹50 more per month at the same rate of interest and for the same time.

(iii) In ΔABC, $\angle ABC = 90°$, $AB = 20$ cm, $AC = 25$ cm, DE is perpendicular to AC such that $\angle DEA = 90°$ and $DE = 3$ cm as shown in the given figure. **[4]**



(a) Prove that $\Delta ABC \sim \Delta AED$.

(b) Find the lengths of BC, AD and AE.

(c) If $BCED$ represents a plot of land on a map whose actual area on ground is 576 m^2, then find the scale factor of the map.

Sol. (i) $2x^2 - 5x - 4 = 0$

$a = 2 \quad b = -5 \quad c = -4$ **[½]**

$D = b^2 - 4ac$ **[½]**

$= (-5)^2 - 4(2)(-4)$

$= 25 + 32$

$= 57$ **[½]**

$\sqrt{D} = \sqrt{57}$ **[½]**

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

$$x = \frac{5 \pm \sqrt{57}}{2 \times 2}$$ **[½]**

$$x = \frac{5 \pm \sqrt{57}}{4}$$ **[½]**

$x = 3.137$ or $x = -0.637$ **[½]**

$\therefore$ $\boxed{x = 3.14, -0.637}$ **[½]**

(ii) (a) Mrs. Rao deposits ₹250 per month for 3 years,

Total amount deposited = ₹250 × 36

= ₹9000 **[½]**

Let the rate of interest be r% per annum, then

$$\text{SI} = \frac{P \times n(n+1) \times r}{2 \times 12 \times 100}$$

$$= \frac{₹250 \times 36 \times 37 \times r}{2 \times 12 \times 100}$$ **[½]**

$$\therefore \text{SI} = \frac{9000 \times 37 \times r}{2400}$$

$$\text{SI} = \frac{90 \times 37 \times r}{24}$$

$$= \frac{555}{4} r$$ **[½]**

It is given that amount on maturity = ₹10,110

$$9000 + \frac{555r}{4} = 10{,}110$$

$$\frac{555r}{4} = 10{,}110 - 9000$$

$$\frac{555r}{4} = 1{,}110$$

$r = 8$ **[½]**

(b) $$\text{SI} = \frac{P \times n(n+1) \times r}{2 \times 12 \times 100}$$ **[½]**

$$= \frac{₹300 \times 36 \times 37 \times 8}{2400}$$ **[½]**

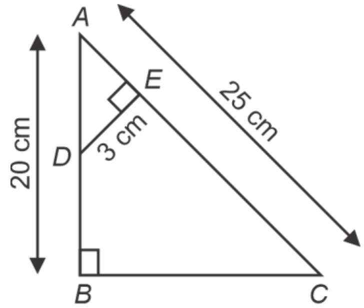
= ₹36 × 37

= ₹1332 **[½]**

Difference = 1332 – 1110

= ₹222 **[½]**

(iii)



(a) In ΔABC and ΔAED

$\angle A = \angle A$ [Common angle]

$\angle DEA = \angle ABC = 90°$

$\Delta ABC \sim \Delta AED$ [By AA similarity] **[1]**

(b) $BC^2 = AC^2 - AB^2$

$= 25^2 - 20^2$

$= 15^2$

$BC = 15$ cm **[½]**

Now, $\dfrac{DE}{AD} = \dfrac{BC}{AC}$ [$\because \Delta ABC \sim \Delta AED$]

$\Rightarrow \dfrac{3}{AD} = \dfrac{15}{25}$

$\Rightarrow AD = 5$ cm **[½]**

$\dfrac{DE}{AE} = \dfrac{BC}{AB}$ [$\because \Delta ABC \sim \Delta AED$]

$\Rightarrow \dfrac{3}{AE} = \dfrac{15}{20}$

$\Rightarrow AE = 4$ cm **[½]**

(c) ar($BCED$) = ar(ΔABC) – ar(ΔAED)

$= \frac{1}{2} \times 20 \times 15 - \frac{1}{2} \times 3 \times 4$

$= 150 - 6 = 144$ cm^2 **[½]**

Actual area = 576 m^2 = 576 × 10^4 cm^2

Let scale factor be 'k'

$$k^2 = \frac{\text{Area of the map}}{\text{Area of actual figure}} = \frac{144}{576 \times 10^4}$$

$$= \frac{1}{40000}$$

$k = 1 : 200$ **[1]**

3. (i) Use ruler and compass for the following construction. Construct a ΔABC, where AB = 6 cm, AC = 4.5 cm and $\angle BAC$ = 120°. Construct a circle circumscribing the ΔABC. Measure and write down the length of the radius of the circle. **[4]**

(ii) If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} -5 & 1 \\ 7 & -4 \end{bmatrix}$ **[4]**

Find :

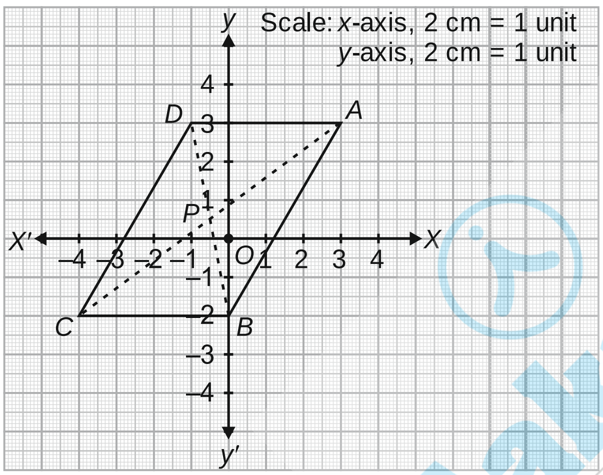
(a) $A + C$

(b) $B(A + C)$

(c) $5B$

(d) $B(A + C) - 5B$

(iii) in the given graph $ABCD$ is a parallelogram. **[5]**



Using the graph, answer the following:

(a) Write down the coordinates of A, B, C and D.

(b) Calculate the coordinates of 'P', the point of intersection of the diagonals AC and BD.

(c) Find the slope of sides CB and DA and verify that they represent parallel lines.

(d) Find the equation of the diagonal AC.

Sol. (i) Steps of construction : **[2]**

(1) Draw a line segment AB = 6 cm.

(2) At point A, construct an $\angle BAX$ of 120° using ruler and compass.

(3) Taking A as centre, draw an arc of length 4.5 cm which cuts $\overrightarrow{AX}$ at C.

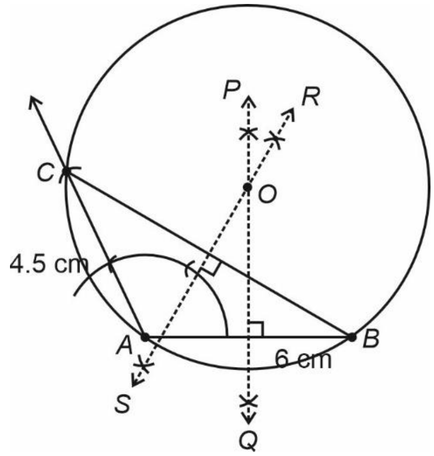
(4) Join BC.

(5) Draw perpendicular bisectors of sides BC and AB. Which are represented by PQ and RS respectively.

(6) PQ and RS are intersect at O which circumcentre.

(7) Taking OA as radius draw a circle which passes through A, B and C.

(8) Measure *OA*, *OB* or *OC* which is radius.



[2]

(ii) (a) $A + C = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} -5 & 1 \\ 7 & -4 \end{bmatrix}$

$= \begin{bmatrix} 1-5 & 2+1 \\ 3+7 & 4-4 \end{bmatrix}$ **[½]**

$= \begin{bmatrix} -4 & 3 \\ 10 & 0 \end{bmatrix}$ **[½]**

(b) $B(A+C) = \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix} \left(\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} -5 & 1 \\ 7 & -4 \end{bmatrix} \right)$

$= \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} -4 & 3 \\ 10 & 0 \end{bmatrix}$

$= \begin{bmatrix} (2\times -4)+(1\times 10) & (2\times 3)+(1\times 0) \\ (4\times -4)+(2\times 10) & (4\times 3)+(2\times 0) \end{bmatrix}$ **[½]**

$= \begin{bmatrix} 2 & 6 \\ 4 & 12 \end{bmatrix}$ **[½]**

(c) $5B = 5\begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}$

$= \begin{bmatrix} 5\times 2 & 5\times 1 \\ 5\times 4 & 5\times 2 \end{bmatrix}$ **[½]**

$= \begin{bmatrix} 10 & 5 \\ 20 & 10 \end{bmatrix}$ **[½]**

(d) $B(A+C) - 5B = \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix} \left(\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} -5 & 1 \\ 7 & -4 \end{bmatrix} \right) - 5\begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}$

$= \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} -4 & 3 \\ 10 & 0 \end{bmatrix} - \begin{bmatrix} 5\times 2 & 5\times 1 \\ 5\times 4 & 5\times 2 \end{bmatrix}$

$= \begin{bmatrix} -8+10 & 6+0 \\ -16+20 & 12+0 \end{bmatrix} - \begin{bmatrix} 10 & 5 \\ 20 & 10 \end{bmatrix}$

$= \begin{bmatrix} 2 & 6 \\ 4 & 12 \end{bmatrix} - \begin{bmatrix} 10 & 5 \\ 20 & 10 \end{bmatrix}$ **[½]**

$= \begin{bmatrix} -8 & 1 \\ -16 & 2 \end{bmatrix}$ **[½]**

(iii) (a) $A(3, 3)$

$B(0, -2)$

$C(-4, -2)$

$D(-1, 3)$ **[1]**

(b) $\because$ In any parallelogram, diagonal bisects each other

$\therefore$ $P\left(\frac{0+(-1)}{2}, \frac{-2+3}{2}\right)$ [By mid point formula]

$P\left(\frac{-1}{2}, \frac{-1}{2}\right)$ **[1]**

(c) Slope of side $CB = \frac{-2-(-2)}{-4-0} = 0$

Slope of side $DA = \frac{3-3}{-1-3} = 0$ **[½]**

$\because$ Slope of side CB = Slope of side DA

$\therefore$ Both side CB and DA are parallel to each other **[½]**

(d) Equation of diagonal AC

$y-3 = \frac{-2-3}{-4-3}(x-3)$ [By two point form] **[1]**

$y-3 = \frac{-5}{-7}(x-3)$

$7y - 21 = 5x - 15$

$5x - 7y + 6 = 0$ **[1]**

SECTION-B (40 Marks)

*(Attempt **any four** questions from this Section.)*

4. (i) Solve the following inequation, write the solution set and represent it on the real number line **[3]**

$2x - \frac{5}{3} < \frac{3x}{5} + 10 \le \frac{4x}{5} + 11; \ x \in R$

(ii) The first term of an Arithmetic Progression (A.P.) is 5, the last term is 50 and their sum is 440. Find: **[3]**

(a) the number of terms

(b) common difference

(iii) Prove that: **[4]**

$$\frac{(\cot A + \tan A - 1)(\sin A + \cos A)}{\sin^3 A + \cos^3 A} = \sec A.\text{cosec}A$$

Sol. (i) $2x - \frac{5}{3} < \frac{3x}{5} + 10 \le \frac{4x}{5} + 11$

Now, $2x - \frac{5}{3} < \frac{3x}{5} + 10$

$\Rightarrow$ $30x - 25 < 9x + 150$ [multiply both side by 15] **[½]**

$\Rightarrow \quad 21x < 175$

$\Rightarrow \quad x < \dfrac{175}{21} \quad \ldots\text{(i)}$ **[½]**

Again, $\dfrac{3x}{5} + 10 \le \dfrac{4x}{5} + 11$

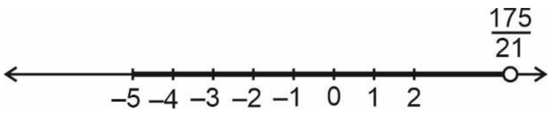
$\Rightarrow \quad 3x + 50 \le 4x + 55$ [multiplying both side by 5]

$\Rightarrow \quad -5 \le x \quad \ldots\text{(ii)}$ **[½]**

From (i) and (ii), we get

$-5 \le x < \dfrac{175}{21}$ **[½]**

Solution on number line



[1]

(ii) Consider, first term of A.P. be a = 5

Last term of A.P. be l = 50

Sum of A.P. be s = 440

(a) $440 = \dfrac{n}{2}(a + l)$ **[½]**

$440 = \dfrac{n}{2}(5 + 50)$ **[½]**

$880 = 55n$

$\therefore \quad n = \dfrac{880}{55}$ **[½]**

$\boxed{n = 16}$

(b) $\because l = 50$

$\Rightarrow \quad a + (n - 1)d = 50$ [where 'd' is common difference of A.P.] **[½]**

$\Rightarrow \quad 5 + (16 - 1)d = 50$ **[½]**

$\Rightarrow \quad 15d = 45$ **[½]**

$\therefore \quad \boxed{d = 3}$

(iii) L.H.S $= \dfrac{(\cot A + \tan A - 1)(\sin A + \cos A)}{\sin^3 A + \cos^3 A}$ **[1]**

Using $\cot A = \dfrac{\cos A}{\sin A}, \quad \tan A = \dfrac{\sin A}{\cos A}$ **[1]**

We get

L.H.S $= \dfrac{\left(\dfrac{\cos A}{\sin A} + \dfrac{\sin A}{\cos A} - 1\right)(\sin A + \cos A)}{\sin^3 A + \cos^3 A}$ **[1]**

Using $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$

$= \dfrac{1}{\sin A \cos A} = \text{cosec}A \sec A \left[\text{using } \dfrac{1}{\sin A} = \text{cosec}A \text{ and } \dfrac{1}{\cos A} = \sec A\right]$ **[1]**

= RHS hence proved.

5. (i) Using properties of proportion, find the value of ‘x’: **[3]**

$$\frac{6x^2+3x-5}{3x-5}=\frac{9x^2+2x+5}{2x+5}\ ;\ x\neq 0$$

(ii) It is given that $(x-2)$ is a factor of polynomial $2x^3-7x^2+kx-2$. **[3]**

(a) Find the value of ‘k’.

(b) hence, factorise the resulting polynomial completely.

(iii) A solid wooden capsule is shown in Figure 1. The capsule is formed of a cylindrical block and two hemispheres. **[4]**

Find the sum of total surface area of the three parts as shown in Figure 2. Given, the radius of the capsule is 3.5 cm and the length of the cylindrical block is 14 cm. $\left(\text{Use } \pi=\frac{22}{7}\right)$

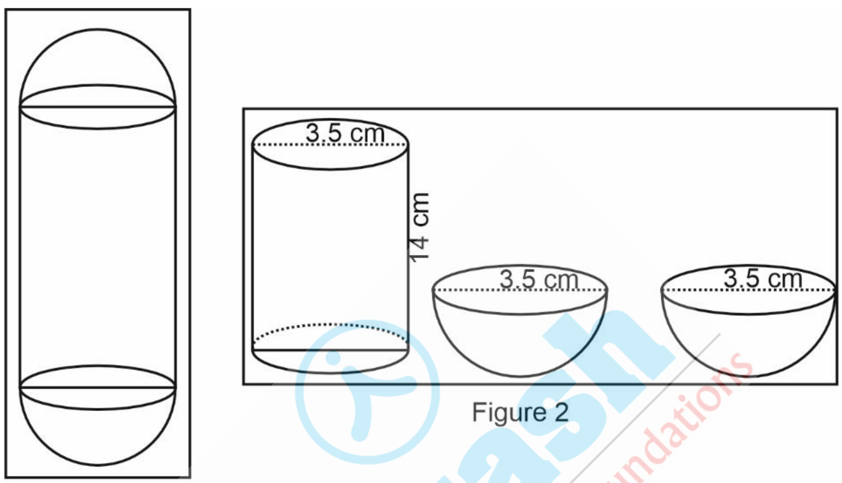


Figure 1 Figure 2

Sol. (i) $\frac{6x^2+3x-5}{3x-5}=\frac{9x^2+2x+5}{2x+5}$

$\Rightarrow \frac{6x^2+3x-5+3x-5}{6x^2+3x-5-3x+5}=\frac{9x^2+2x+5+2x+5}{9x^2+2x+5-2x-5}$ [Applying Componendo and Dividendo] **[½]**

$\Rightarrow \frac{6x^2+6x-10}{6x^2}=\frac{9x^2+4x+10}{9x^2}$ **[½]**

$\Rightarrow$ $9(6x^2+6x-10)=6(9x^2+4x+10)$ [$\because x\neq 0$] **[½]**

$\Rightarrow$ $6(3x^2+3x-5)=2(9x^2+4x+10)$ **[½]**

$\Rightarrow$ $18x^2+18x-30=18x^2+8x+20$ **[½]**

$\Rightarrow$ $10x=50$

$\Rightarrow$ $x=5$ **[½]**

(ii) (a) $(x-2)$ is a factor of polynomial $2x^3-7x^2+kx-2$

$\therefore$ Let $f(x)=2x^3-7x^2+kx-2=0$

$\Rightarrow$ $2(2)^3-7(2)^2+k(2)-2=0$ **[½]**

$\Rightarrow$ $16-28+2k-2=0$

$\Rightarrow$ $2k-14=0$

$\Rightarrow$ $2k=14$ **[½]**

$\Rightarrow$ $k=7$

(b) Since (x – 2) is a factor of the given polynomial

Now, we will apply long division

$$x-2\,\big)\,2x^3-7x^2+7x-2\,\big(\,2x^2-3x+1$$
$$2x^3-4x^2$$
$$-\quad +$$
$$-3x^2-7x-2$$
$$-3x^2+6x$$
$$+\quad -$$
$$x-2$$
$$x-2$$
$$-\quad +$$
$$0$$

[1]

$\therefore$ $2x^2 - 3x + 1 = 2x^2 - 2x - x + 1$

$= 2x(x - 1) - 1(x - 1)$

$= (2x - 1)(x - 1)$

$\therefore$ factors of polynomial $2x^3 - 7x^2 + 7x - 2$ are $(x - 2)(2x - 1)(x - 1)$ **[1]**

(iii) Total surface area of cylindrical block $= 2\pi rh + 2\pi r^2$ **[½]**

Total surface area of hemispherical part $= 2\pi r^2 + \pi r^2$

Total surface area of another hemispherical part $= 2\pi r^2 + \pi r^2$ **[½]**

Sum of total surface area of all three parts

$= 2\pi rh + 2\pi r^2 + 2\pi r^2 + \pi r^2 + 2\pi r^2 + \pi r^2$ **[½]**

$= 2\pi rh + 8\pi r^2$ **[½]**

It is given that

$r = 3.5$, $h = 14$

Total surface area of all parts $= 2\pi rh + 8\pi r^2$

$$= 2\times\frac{22}{7}\times3.5\times14+8\times\frac{22}{7}\times(3.5)^2$$ **[½]**

$$= 22\times14+\left(8\times\frac{22}{7}\times3.5\times3.5\right)$$ **[½]**

$= 308 + (88 \times 3.5)$

$= 308 + 308$ **[½]**

$= 616\ \text{cm}^2$ **[½]**

6. (i) Use a graph paper for this question taking 2 cm = 1 unit along both axes. **[5]**

(a) Plot $A(1, 3)$, $B(1, 2)$ and $C(3, 0)$.

(b) Reflect A and B on the x-axis and name their images as E and D respectively. Write down their coordinates.

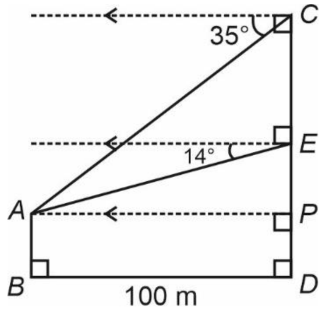
(c) Reflect A and B through the origin and name their images as F and G respectively.

(d) Reflect A, B and C on the y-axis and name their images as J, I and H respectively.

(e) Join all the points A, B, C, D, E, F, G, H, I and J in order and name the closed figure so formed.

(ii) In the given diagram, *AB* is a vertical tower 100 m away from the foot of a 30 storied building *CD*. The angles of depression from the point *C* and *E*. (*E* being the mid-point of *CD*), are 35° and 14° respectively. (Use mathematical table for the required values rounded off correct to two places of decimals only) **[5]**

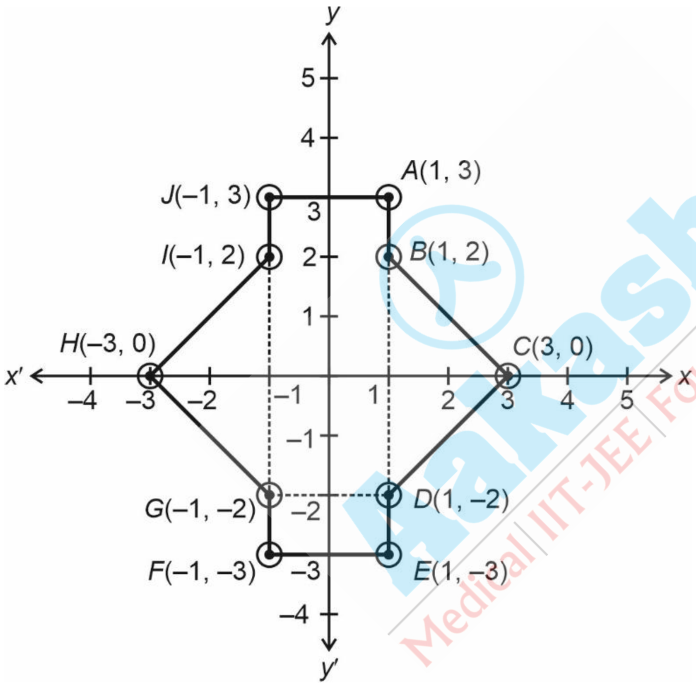
Find the height of the:



(a) tower *AB*

(b) building *CD*

Sol. (i) (a) **[1]**



(b) *E*(1, –3) and *D*(1, –2) **[1]**

(c) *F*(–1, –3) and *G*(–1, –2) **[1]**

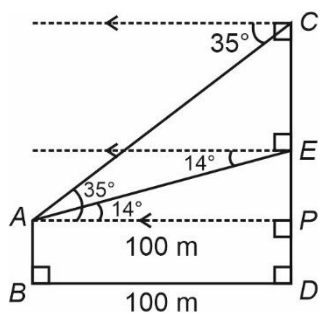
(d) *J*(–1, 3), I(–1, 2) and *H*(–3, 0) **[1]**

(e) 10-side polygon or Decagon **[1]**

(ii) (a) Let *CD* = *H* meters and *AB* = *PD* = *h* meters

then, $CE = ED = \frac{H}{2}$ [*E* is mid-point of *CD*]

$$PE = \frac{H}{2} - h = \frac{H-2h}{2}$$ **[½]**



Now, in ΔEPA

$$\tan 14° = \frac{PE}{AP}$$ **[½]**

$\Rightarrow \quad 0.25 = \dfrac{H - 2h}{2 \times 100}$

$\Rightarrow \quad H - 2h = 50$ …(i) **[½]**

Again, in ΔCAP

$\tan 35° = \dfrac{PC}{AP} = \dfrac{H - h}{100}$ **[½]**

$\Rightarrow \quad 0.7 = \dfrac{H - h}{100}$

$\Rightarrow \quad H - h = 70$ …(ii) **[½]**

Subtracting equation (i) from equation (ii), we get

$h = 70 - 50$

$h = 20$ …(iii) **[½]**

AB = 20 meters

(b) Putting the value of h in equation (ii), we get

$H = 70 + 20$ **[1]**

$H = 90$ **[½]**

CD = 90 meters **[½]**

7. (i) Use a graph paper for this question. **[3]**

(Take 2 cm = 10 Marks along one axis and 2 cm = 10 students along another axis).

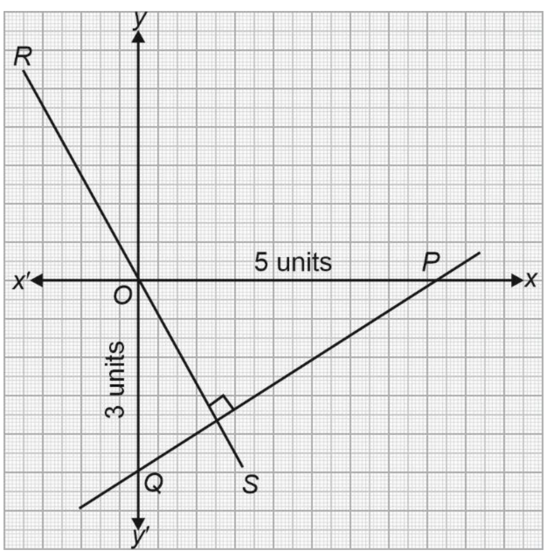
Draw a Histogram for the following distribution which gives the marks obtained by 164 students in a particular class and hence find the **Mode**.

Marks	30-40	40-50	50-60	60-70	70-80
Number of Students	10	26	40	54	34

(ii) In the given graph. P and Q are points such that PQ cuts off intercepts of 5 units and 3 units along the x-axis and y-axis respectively. Line RS is perpendicular to PQ and passes through the origin. Find the

(a) coordinates of P and Q

(b) equation of line RS



(iii) Refer to the given bill. **[4]**

A customer paid ₹2000 (rounded off to the nearest ₹10) to clear the bill.

Note: 5% discount is applicable on an article if 10 or more such articles are purchased.

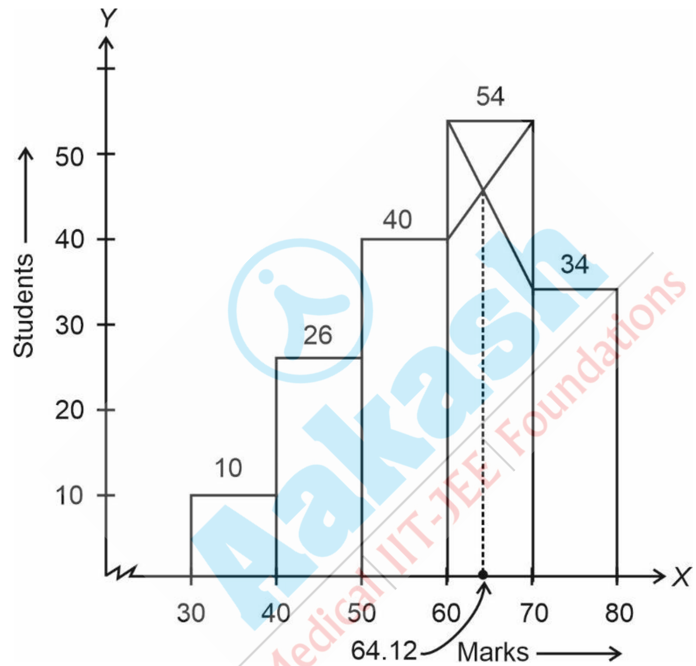
BILL			
Article	**M.P. (₹)**	**Quantity**	**G.S.T.**
A	190	06	12%
B	50	12	18%

Check whether the total amount paid by the customer is correct or not. Justify your answer with necessary working.

Sol. (i) Scale : **[3]**

On x-axis : 2 cm = 10 Marks

On y-axis : 2 cm = 10 students



∴ Mode = 64.12

(ii) (a) According to given question, from the given graph

Coordinates of P and Q are (5, 0), (0, –3) respectively. **[1]**

(b) RS is perpendicular to PQ (Given)

Slope of $PQ = \frac{-3-0}{0-5} = \frac{3}{5}$ **[½]**

∴ Slope of $RS = \frac{-1}{(3/5)} = \frac{-5}{3}$ **[½]**

Also, RS line is passing through origin (0, 0)

∴ Equation of line RS is

$y - 0 = \frac{-5}{3}(x - 0)$ [By point slope form] **[½]**

$3y = -5x$

or $5x + 3y = 0$ **[½]**

(iii) For article A

M.P = ₹ 190 × 6

= ₹ 1140 **[½]**

Discount is not applicable because number of articles less than 10 are purchased.

GST = 12%

Amount paid by customer for article $A = ₹\left(1140 + \frac{1140 \times 12}{100}\right)$ **[½]**

= ₹1140 + 136.8 **[½]**

= ₹1276.8 **[½]**

For article B

M.P = ₹ 50 × 12

= ₹ 600 **[½]**

Discount is applicable because number of articles is more than 10 are purchased.

S.P = M.P – Discount

$= ₹600 - \frac{₹600 \times 5}{100}$

= ₹ 570 **[½]**

GST = 18%

Amount paid by customer for articles B

$= ₹570 + \frac{570 \times 18}{100}$

= ₹ 570 + 102.6

= ₹ 672.6 **[½]**

Total amount paid by customer

= ₹ 1276.8 + ₹ 672.6

= ₹ 1949.4 **[½]**

Total amount paid by customer is not correct.

8. (i) A man bought ₹200 shares of a company at 25% premium. If he received a return of 5% on his investment. Find the : **[3]**

(a) market value

(b) dividend percent declared

(c) number of shares purchased, if annual dividend is ₹1000.

(ii) For the given frequency distribution, find the : **[3]**

(a) mean, to the nearest whole number

(b) median

x	10	11	12	13	14	15	16
f	3	2	2	6	3	5	3

(iii) Mr. and Mrs. Das were travelling by car from Delhi to Kasauli for a holiday. Distance between Delhi and Kasauli is approximately 350 km (via NH 152D). Due to heavy rain they had to slow down. The average speed of the car was reduced by 20 km/hr and time of the journey increased by 2 hours. Find : **[4]**

(a) the original speed of the car.

(b) with the reduced speed, the number of hours they took to reach their destination.

Sol. (i) Nominal value of shares = ₹200

Premium = 25%

(a) Market value = $200 + \frac{25}{100} \times 200$ **[½]**

= ₹250 **[½]**

(b) Return on investment $= \frac{\text{Dividend} \times \text{N.V.}}{100}$

$\Rightarrow$ 5% of 250 $= \frac{\text{Dividend} \times 200}{100}$

$\Rightarrow \frac{5}{100} \times 250 = \frac{\text{Dividend} \times 200}{100}$ **[½]**

$\Rightarrow$ Dividend $= \frac{5 \times 250 \times 100}{100 \times 200}$

$\therefore$ Dividend declared = 6.25% **[½]**

(c) If dividend = ₹1000 = 6.25% of ₹200 × Number of shares

$\Rightarrow 1000 = \frac{625}{10000} \times 200 \times \text{Number of shares}$ **[½]**

$\Rightarrow$ Number of shares $= \frac{1000 \times 10000}{625 \times 200}$

= 80 **[½]**

(ii) (a)

x	***f***	***fx***
10	3	30
11	2	22
12	2	24
13	6	78
14	3	42
15	5	75
16	3	48
	$\Sigma f = 24$	$\Sigma fx = 319$

Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{319}{24}$ **[½]**

= 13.29 **[½]**

= 13 (to the nearest whole number) **[½]**

(b)

x	f	Cf
10	3	3
11	2	5
12	2	7
13	6	13
14	3	16
15	5	21
16	3	24

$$\text{Median} = \frac{\left(\frac{N}{2}\right)^{th}\text{ term} + \left(\frac{N}{2}+1\right)^{th}\text{ term}}{2}$$ [½]

$$= \frac{12^{th}\text{ term} + 13^{th}\text{ term}}{2}$$ [½]

$$= \frac{13+13}{2} = 13$$ [½]

(iii) (a) Let the original speed of car be x km/hr

Usual time = $\frac{350}{x}$ hrs

According to question,

$$(x-20)\left(\frac{350}{x}+2\right) = 350$$ [½]

$$350 + 2x - \frac{7000}{x} - 40 = 350$$ [½]

$2x^2 - 7000 - 40x = 0$

OR

$x^2 - 20x - 3500 = 0$ [½]

$D = (-20)^2 - 4(1)(-3500)$

$D = 400 + 4 \times 3500$

$D = 4[100 + 3500]$

$D = 4 \times 3600$

$\sqrt{D} = 2 \times 60 = 120$

$$x = \frac{20 \pm 120}{2}$$ [½]

$\boxed{x = 70 \text{ km/hr}}$ as $x > 0$

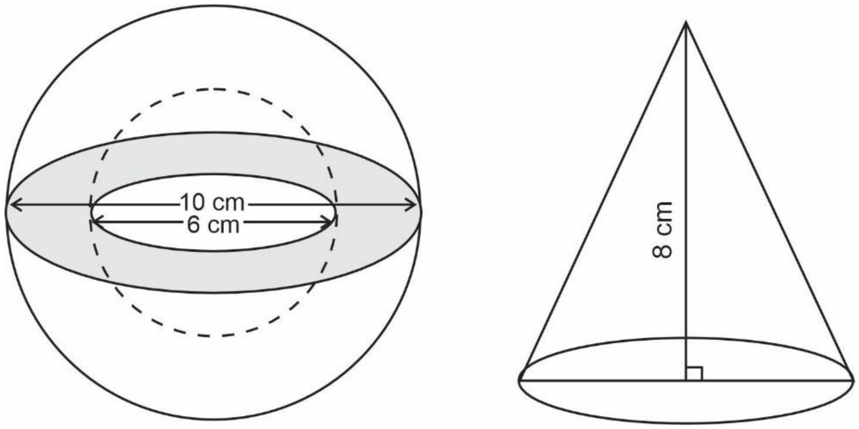
∴ Original speed of car is 70 km/hr.

(b) Required number of hours = $\frac{350}{x} + 2$ [1]

$= \frac{350}{70} + 2$ [½]

= 7 hrs. [½]

9. (i) A hollow sphere of external diameter 10 cm and internal diameter 6 cm is melted and made into a solid right circular cone of height 8 cm. Find the radius of the cone so formed. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[3]**



(ii) Ms. Sushmita went to a fair and participated in a game. The game consisted of a box having number cards with numbers from 01 to 30. The three prizes were as per the given table: **[3]**

Prize	Number on the card drawn at random is a
Wall Clock	perfect square
Water Bottle	even number which is also a multiple of 3
Purse	Prime number

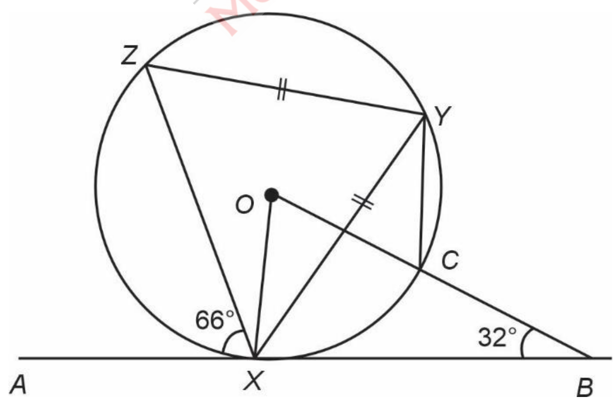
Find the probability of winning a :

(a) Wall Clock

(b) Water Bottle

(c) Purse

(iii) X, Y, Z and C are the points on the circumference of a circle with centre 'O'. AB is a tangent to the circle at 'X' and $ZY = XY$. Given $\angle OBX = 32°$ and $\angle AXZ = 66°$. Find : **[4]**



(a) $\angle BOX$

(b) $\angle CYX$

(c) $\angle ZYX$

(d) $\angle OXY$

Sol. (i) Volume of hollow sphere (V_1) = $\frac{4}{3}\pi(R)^3 - \frac{4}{3}\pi(r)^3$

$$= \frac{4}{3}\pi(R^3 - r^3)$$ **[½]**

$$= \frac{4}{3}\times\frac{22}{7}\left(5^3 - 3^3\right)$$

$$= \frac{4}{3}\times\frac{22}{7}\times 98$$

$$= \frac{4}{3}\times 22\times 14$$

$$= \frac{1232}{3}\ \text{cm}^3$$ **[½]**

Volume of cone formed from hollow sphere (V_2)

$$= \frac{1}{3}\pi r'^2 h$$

$$= \frac{1}{3}\pi r'^2 \times 8$$ **[½]**

According to given condition in question

$V_1 = V_2$

$\Rightarrow \quad \frac{1232}{3} = \frac{1}{3}\times\frac{22}{7}\times r'^2\times 8$ **[½]**

$\Rightarrow \quad 56 = \frac{1}{7}\times r'^2\times 8$ **[½]**

$\Rightarrow \quad r'^2 = 49$

$\Rightarrow \quad r' = 7$ cm **[½]**

$\therefore$ Radius of cone = 7 cm

(ii) Probability of an event E is given by

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{n(E)}{n(S)}$$

(a) If event E denotes occurrence of perfect square number, then

E = {01, 04, 09, 16, 25} $\quad\therefore n(E) = 5$

$\therefore \quad P(E) = \frac{n(E)}{n(S)}$

$$= \frac{5}{30}$$

$$= \frac{1}{6}$$ **[1]**

$\therefore$ Probability of winning wall clock is $\frac{1}{6}$

(b) If event E denotes occurrence of even number which is also a multiple of 3, is

E = {06, 12, 18, 24, 30} $\quad \therefore n(E) = 5$

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

$$= \frac{5}{30}$$

$$= \frac{1}{6}$$ **[1]**

$\therefore$ Probability of winning water bottle is $\frac{1}{6}$

(c) If event E denotes occurrence of prime number, then

E = {02, 03, 05, 07, 11, 13, 17, 19, 23, 29} $\quad \therefore n(E) = 10$

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

$$= \frac{10}{30}$$

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

$\therefore$ Probability of winning purse is $\frac{1}{3}$. **[1]**

(iii) $\angle OXB = 32°$

(a) In ΔOBX

$\angle OBX = 90°$ [$\because$ A tangent to the circle is perpendicular to the radius at the point of contact] **[½]**

$\angle OXB + \angle XOB + \angle OBX = 180°$

$\Rightarrow \quad \angle BOX + 90° + 32° = 180°$

$\Rightarrow \quad \angle BOX = 180° - 122°$

$\Rightarrow \quad \angle BOX = 58°$ **[½]**

(b) $2\angle CYX = \angle COX$

[$\because$ The angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle] **[½]**

$\Rightarrow \quad \angle CYX = \frac{58°}{2}$

$\Rightarrow \quad \angle CYX = 29°$ **[½]**

(c) $\angle AXZ = \angle ZYX = 66°$ [$\because$ Alternate Segment Theorem] **[1]**

(d) In ΔZXY

$\angle ZXY + \angle ZYX + \angle XZY = 180°$ [$\because \angle XZY = \angle YXZ$]

$\Rightarrow \quad 2\angle XZY + 66° = 180°$

⇒ $2\angle XZY = 114°$

⇒ $\angle XZY = \angle ZXY = 57°$

$\angle AXO = 90°$ [∵ A tangent to the circle is perpendicular to the radius at the point of contact] **[½]**

⇒ $\angle ZXO = 90° – 66°$

$= 66°$

∴ $\angle ZXY = 57°$

⇒ $\angle OXY = \angle ZXY – \angle ZXO$

$= 57 – 24°$

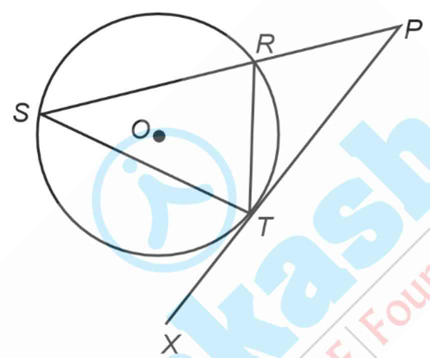
$= 33°$ **[½]**

10. (i) If 1701 is the n^{th} term of the Geometric Progression (G.P.) 7, 21, 63 …, find: **[3]**

(a) The value of 'n'

(b) Hence find the sum of the 'n' terms of the G.P.

(ii) In the given diagram 'O' is the centre of the circle. Chord SR produced meets the tangent XTP at P. **[3]**

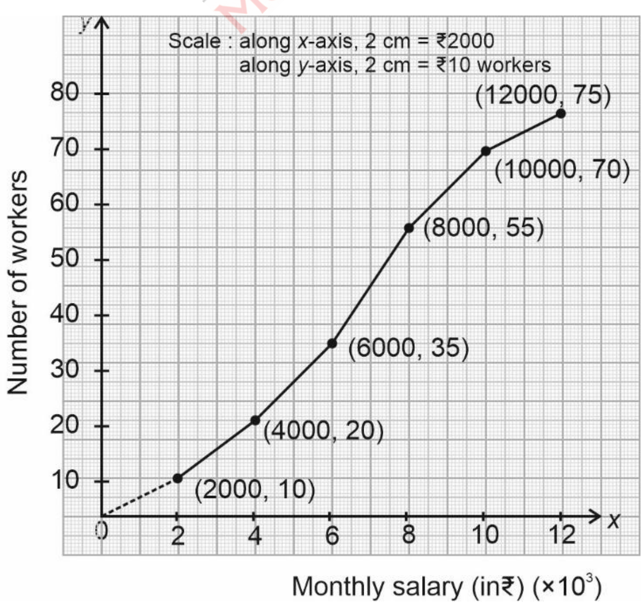


(a) Prove that $\Delta PTR \sim \Delta PST$

(b) Prove that $PT^2 = PR \times PS$

(c) If $PR = 4$ cm and $PS = 16$ cm, find the length of the tangent PT.

(iii) The given graph represents the monthly salaries (in ₹) of workers of a factory. **[4]**



Using graph answer the following:

(a) The total number of workers.

(b) The median class.

(c) The lower-quartile class.

(d) Number of workers having monthly salary more than or equal to ₹6,000 but less than ₹10,000.

Sol. (i) (a) Here, first term = $a = 7$

Common ration $r = \frac{21}{7} = 3$ **[½]**

n^{th} term of G.P $a_n = ar^{n-1}$ **[½]**

$1701 = 7(3)^{n-1}$

$\Rightarrow \quad 243 = (3)^{n-1}$

$\Rightarrow \quad (3)^5 = (3)^{n-1}$

$\Rightarrow \quad n - 1 = 5$

$\Rightarrow \quad n = 6$ **[½]**

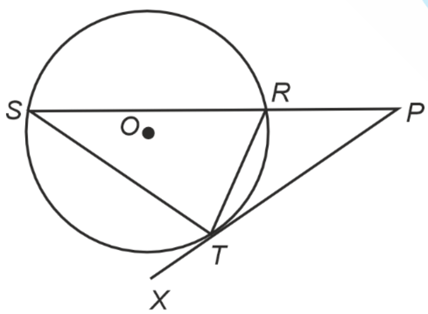
(b) Sum of n^{th} term $S_n = \frac{a\left(r^n - 1\right)}{r - 1}$ **[½]**

$S_n = \frac{7\left(3^6 - 1\right)}{3 - 1}$ **[½]**

$= \frac{7(729 - 1)}{2}$

$= \frac{7 \times 728}{2}$

$= 2548$ **[½]**

(ii) 

(a) In ΔPTR and ΔPST

$\angle RPT = \angle TPS$ (Common) **[½]**

$\angle RTP = \angle TSP$ (Alternate segment theorem) **[½]**

$\therefore \quad \Delta PTR \sim \Delta PST$ (AA similarity)

(b) As $\Delta PTR \sim \Delta PST$

$\therefore \quad \frac{PT}{PS} = \frac{PR}{PT}$ **[½]**

Or $PT^2 = PS \times PR$ **[½]**

(c) $PR = 4$ cm $PS = 16$ cm

$PT^2 = PR \times PS$ (Tangent secant theorem) [½]

$PT^2 = 4 \times 16$

$PT^2 = 64$

$PT = \sqrt{64}$

$\boxed{PT = 8 \text{ cm}}$ [1]

(iii) (a) Total number of workers = 75 [1]

(b) Total number of workers (N) = 75

$\Rightarrow \quad \frac{N+1}{2} = \frac{75+1}{2} = 38$ [½]

$\therefore$ The median class is 6000 – 8000

(c) $\frac{N+1}{4} = \frac{75+1}{4} = 19$ [½]

$\therefore$ Lower quartile class is 2000 – 4000 [½]

(d) Number of workers having monthly salary more than or equal to ₹6000 but less than ₹10000

= 70 – 35 [½]

= 35 [½]

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