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**SECTION A**

**1.** (a) Let $f(x) = 2x^3 + 3x^2 - kx + 5$

Using remainder theorem,

$f(2) = 7$

$\therefore 2(2)^3 + 3(2)^2 - k(2) + 5 = 7$

$\therefore 2(8) + 3(4) - k(2) + 5 = 7$

$\therefore 16 + 12 - 2k + 5 = 7$

$\therefore 2k = 16 + 12 + 5 - 7$

$\therefore 2k = 26$

$\therefore k = 13$

(b) $A^2 = 9A + MI$

$\Rightarrow A^2 - 9A = mI$ ...... (1)

$A^2 = AA$

$$= \begin{bmatrix} 2 & 0 \\ -1 & 7 \end{bmatrix} \begin{bmatrix} 2 & 0 \\ -1 & 7 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 0 \\ -9 & 49 \end{bmatrix}$$

Substitute $A^2$ in (1)

$A^2 - 9A = mI$

$$\Rightarrow \begin{bmatrix} 4 & 0 \\ -9 & 49 \end{bmatrix} - 9 \begin{bmatrix} 2 & 0 \\ -1 & 7 \end{bmatrix} = m \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 4 & 0 \\ -9 & 49 \end{bmatrix} - \begin{bmatrix} 18 & 0 \\ -9 & 63 \end{bmatrix} = \begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} -14 & 0 \\ 0 & -14 \end{bmatrix} = \begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix}$$

$\Rightarrow m = -14$

(c) Mean $= \dfrac{\text{Sum of all observations}}{\text{Total number of observations}}$

$\therefore\ 68 = \dfrac{45+52+60+x+69+70+26+81+94}{9}$

$\Rightarrow 68 = \dfrac{497+x}{9}$

$\Rightarrow 612 = 497 + x$

$\Rightarrow x = 612 - 497$

$\Rightarrow x = 115$

Data in ascending order

26, 45, 52, 60, 69, 70, 81, 94, 115

Since the number of observations is odd, the median is the $\left(\dfrac{n+1}{2}\right)^{th}$ observation

$\Rightarrow$ Median $= \left(\dfrac{9+1}{2}\right)^{th}$ observation $= 5^{th}$ observation

Hence, the median is 69.

**2.** (a) (i) Slope of PQ $= \dfrac{3-k}{1-3k-6}$

$\Rightarrow \dfrac{1}{2} = \dfrac{3-k}{-3k-5}$

$\Rightarrow -3k-5 = 2(3-k)$

$\Rightarrow -3k-5 = 6-2k$

$\Rightarrow k = -11$

(ii) Substituting k in P and Q, we get

$P(6,k) = P(6,-11)$ and $Q(1-3k,3) = Q(34,3)$

$\therefore$ Midpoint of PQ $= \left(\dfrac{6+34}{2}, \dfrac{-11+3}{2}\right) = \left(\dfrac{40}{2}, \dfrac{-8}{2}\right) = (20,-4)$

(b) $\operatorname{cosec}^2 57° - \tan^2 33° + \cos 44° \operatorname{cosec} 46° - \sqrt{2}\cos 45° - \tan^2 60°$

$= \operatorname{cosec}^2(90°-33°)° - \tan^2 33° + \cos 44° \operatorname{cosec}(90°-44°) - \sqrt{2}\cos 45° - \tan^2 60°$

$= \sec^2 33° - \tan^2 33° + \cos 44° \sec 44° - \sqrt{2}\cos 45° - \tan^2 60$

$= 1 + 1 - \sqrt{2}\cos 45° - \tan^2 60$

$= 1 + 1 - \sqrt{2}\left(\dfrac{1}{\sqrt{2}}\right) - \left(\sqrt{3}\right)^2$

$= 2 - 1 - 3$

$= -2$

(c) Let the number of cones be n.

Let the radius of sphere be $r_s = 6$ cm

Radius of a cone be $r_c = 2$ cm

And height of the cone be $h = 3$ cm

Volume of sphere = n(Volume of a metallic cone)

$$\Rightarrow \frac{4}{3}\pi r_s^3 = n\left(\frac{1}{3}\pi r_c^2 h\right)$$

$$\Rightarrow \frac{4}{\cancel{3}}\cancel{\pi} r_s^3 = n\left(\frac{1}{\cancel{3}}\cancel{\pi} r_c^2 h\right)$$

$$\Rightarrow \frac{4r_s^3}{r_c^2 h} = n$$

$$\Rightarrow n = \frac{4(6)^3}{(2)^2(3)}$$

$$\Rightarrow n = \frac{\cancel{4} \times 216}{\cancel{4} \times 3}$$

$$\Rightarrow n = 72$$

Hence, the number of cones is 72.

**3.** (a) $-3(x-7) \geq 15-7x > \frac{x+1}{3}$

$$\Rightarrow -3(x-7) \geq 15-7x \quad \text{and} \quad 15-7x > \frac{x+1}{3}$$

$$\Rightarrow -3x + 21 \geq 15-7x \quad \text{and} \quad 45-21x > x+1$$

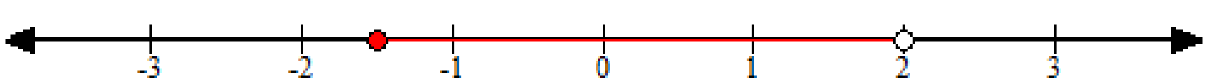
$$\Rightarrow -3x + 7x \geq 15-21 \quad \text{and} \quad 45-1 > x+21x$$

$$\Rightarrow 4x \geq -6 \quad \text{and} \quad 44 > 22x$$

$$\Rightarrow x \geq \frac{-3}{2} \quad \text{and } 2 > x$$

$$\Rightarrow x \geq -1.5 \text{ and } 2 > x$$

The solution set is $\{x : x \in R, -1.5 \leq x < 2\}$.



(b) (i) AD is parallel to BC, i.e., OD is parallel to BC and BD is transversal.

$\Rightarrow \angle ODB = \angle CBD = 32°$ ....(Alternate angles)

In $\Delta OBD$,

$OD = OB$ ....(Radii of the same circle)

$\Rightarrow \angle ODB = \angle OBD = 32°$

(ii) AD is parallel to BC, i.e., AO is parallel to BC and OB is transversal.

$\Rightarrow \angle AOB = \angle OBC$ ....(Alternate angles)

$\Rightarrow \angle OBC = \angle OBD + \angle DBC$

$\Rightarrow \angle OBC = 32° + 32°$

$\Rightarrow \angle OBC = 64°$

$\Rightarrow \angle AOB = 64°$

(iii) In $\Delta OAB$,

$OA = OB$ ....(Radii of the same circle)

$\Rightarrow \angle OAB = \angle OBA = x$ (say)

$\angle OAB + \angle OBA + \angle AOB = 180°$

$\Rightarrow x + x + 64° = 180°$

$\Rightarrow 2x = 180° - 64°$

$\Rightarrow 2x = 116°$

$\Rightarrow x = 58°$

$\Rightarrow \angle OAB = 58°$

i.e., $\angle DAB = 58°$

$\Rightarrow \angle DAB = \angle BED = 58°$ ....(Angles inscribed in the same arc are equal.)

(c) $\dfrac{3a + 2b}{5a + 3b} = \dfrac{18}{29}$

$\Rightarrow 29(3a + 2b) = 18(5a + 3b)$

$\Rightarrow 87a + 58b = 90a + 54b$

$\Rightarrow 58b - 54b = 90a - 87a$

$\Rightarrow 4b = 3a$

$\Rightarrow \dfrac{a}{b} = \dfrac{4}{3}$

**4.** (a) Total number of outcomes = 30

(i) The perfect squares lying between 11 and 40 are 16, 25 and 36.

So the number of possible outcomes = 3

$\therefore$ Probability that the number on the card drawn is a perfect square

$$= \frac{\text{Number of possible outcomes}}{\text{Total number of outcomes}} = \frac{3}{30} = \frac{1}{10}$$

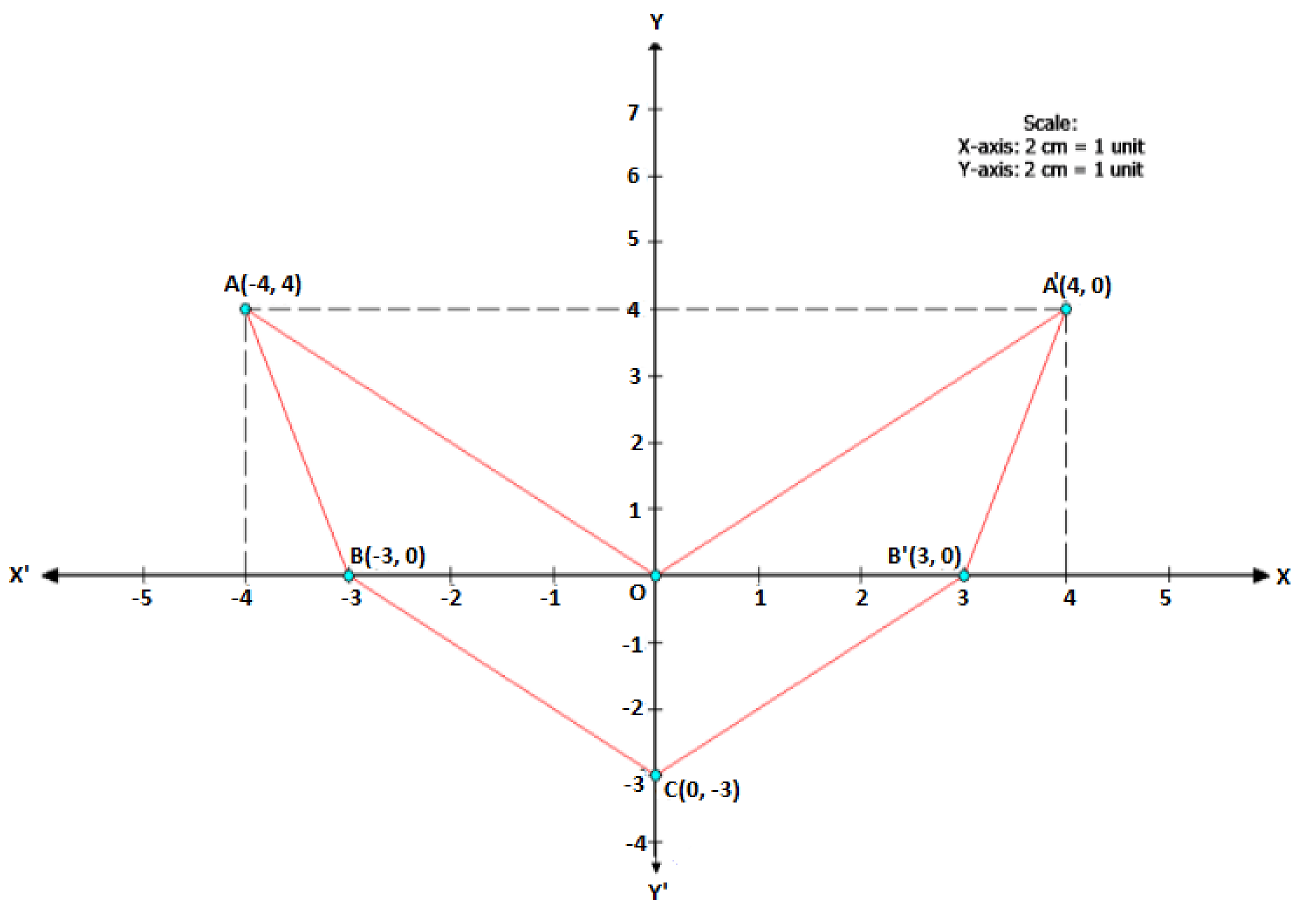
(ii) The numbers from 11 to 40 that are divisible by 7 are 14, 21, 28 and 35.

So the number of possible outcomes = 4

Probability that the number on the card drawn is divisible by 7

$$= \frac{\text{Number of possible outcomes}}{\text{Total number of outcomes}} = \frac{4}{30} = \frac{2}{15}$$

(b) (i)




A' = (4, 4) AND B' = (3, 0)

(ii) The figure is an arrow head.

(iii) The y-axis is the line of symmetry of figure OABCB'A'.

(c) (i) $P = Rs.5000, T = 1 \text{ year}, A = Rs.5325$

$I = A - P$

$\Rightarrow I = 5325 - 5000$

$\Rightarrow I = 325$

So, the interest at the end of first year is Rs. 325.

$I = \frac{PRT}{100}$

$\Rightarrow R = \frac{I \times 100}{P \times T}$

$\Rightarrow R = \frac{325 \times 100}{5000 \times 1}$

$\Rightarrow R = \frac{32500}{5000} = 6.5\%$

So,the rate of interest at the end of the first year is 6.5%.

(ii) The amount at the end of the first year will be the principal for the second year.

$P = Rs.5325, T = 1 \text{ year}, R = 6.5\%$

$I = \frac{PRT}{100}$

$\Rightarrow I = \frac{5325 \times 6.5 \times 1}{100}$

$\Rightarrow I = 346.125$

$A = P + I$

$\Rightarrow A = 5325 + 346.125$

$\Rightarrow A = 5671.125$

$\Rightarrow A \approx Rs.5671$

So,the amount at the end of the second year is Rs. 5671.

## SECTION B (40 Marks)

Attempt any four questions from this section

**5.** (a) $x^2 - 3(x + 3) = 0$

$\Rightarrow x^2 - 3x - 9 = 0$

Comparing with $ax^2 + bx + c$, we get

$a = 1, b = -3, c = -9$

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

$$\Rightarrow x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)}$$

$$\Rightarrow x = \frac{3 \pm \sqrt{9 + 36}}{2}$$

$$\Rightarrow x = \frac{3 \pm \sqrt{45}}{2}$$

$$\Rightarrow x = \frac{3 \pm \sqrt{9 \times 5}}{2}$$

$$\Rightarrow x = \frac{3 \pm 3\sqrt{5}}{2}$$

$$\Rightarrow x = \frac{3 + 3\sqrt{5}}{2} \text{ or } x = \frac{3 - 3\sqrt{5}}{2}$$

$$\Rightarrow x = \frac{3 + 3 \times 2.236}{2} \text{ or } x = \frac{3 - 3 \times 2.236}{2}$$

$$\Rightarrow x = \frac{3 + 6.708}{2} \text{ or } x = \frac{3 - 6.708}{2}$$

$$\Rightarrow x = \frac{9.708}{2} \text{ or } x = \frac{-3.708}{2}$$

$\Rightarrow x = 4.85$ or $x = -1.85$

(b) Since the interest is earned on the minimum balance between 10th day and the last day of the month as per entries, we have

Minimum balance for April = Rs. 8300

Minimum balance for May = Rs. 7600

Minimum balance for June = Rs. 10300

Minimum balance for July = Rs. 10300

Minimum balance for August = Rs. 3900

Minimum balance for September = Rs. 0

Total balance = Rs. 40400

$\Rightarrow$ Total amount qualifying for interest = Rs. 40400

$\Rightarrow \text{Principle for 1 month} \left(\frac{1}{12}\text{ year}\right) = \text{Rs. } 40400,$

$\text{Rate of interest} = 4.5\% \text{ per annum}$

$$\Rightarrow \text{Interest} = \text{Rs.} \frac{40400 \times 4.5 \times \frac{1}{12}}{100} = \text{Rs. } 151.50$$

$$\begin{aligned}\text{Amount} &= \text{Balance in the account in last month} + \text{Interest}\\ &= 5900 + 151.5\\ &= \text{Rs. } 6051.50\end{aligned}$$

Thus, Mrs. Ravi receives Rs. 6051.50 on closing the account.

(c) Given P = Rs. 1500, I = 496.50, R = 10%

$$A = P + I$$

$$\Rightarrow A = \text{Rs. } 1500 + \text{Rs. } 496.50 = \text{Rs. } 1996.50$$

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$\Rightarrow 1996.50 = 1500\left(1 + \frac{10}{100}\right)^n$$

$$\Rightarrow \frac{1996.50}{1500} = \left(1 + \frac{1}{10}\right)^n$$

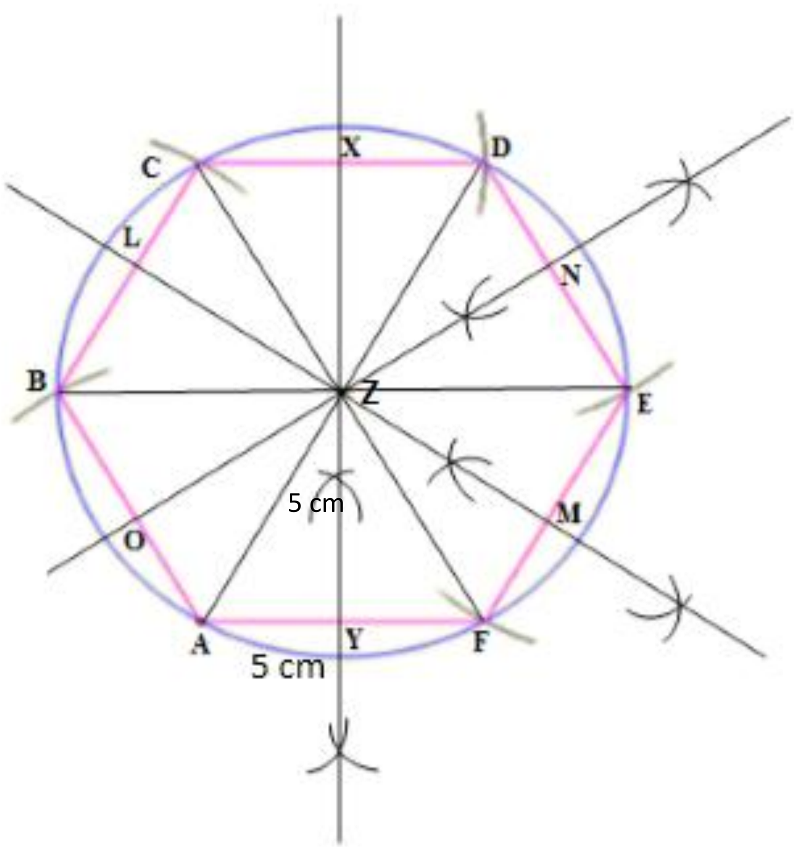
$$\Rightarrow 1.331 = (1.1)^n$$

$$\Rightarrow (1.1)^3 = (1.1)^n$$

$$\Rightarrow n = 3$$

**6.** (a) Steps of construction:

1. Draw AF measuring 5 cm using a ruler.
2. With A as the centre and radius equal to AF, draw an arc above AF.
3. With F as the centre, and same radius cut the previous arc at Z
4. With Z as the centre, and same radius draw a circle passing through A and F.
5. With A as the centre and same radius, draw an arc to cut the circle above AF at B.
6. With B as the centre and same radius, draw ar arc to cut the circle at C.
7. Repeat this process to get remaining vertices of the hexagon at D and E.
8. Join consecutive arcs on the circle to form the hexagon.
9. Draw the perpendicular bisectors of AF, FE and DE.
10. Extend the bisectors of AF, FE and DE to meet CD, BC and AB at X, L and O respectively.
11. Join AD, CF and EB.
12. These are the 6 lines of symmetry of the regular hexagon.



(b) (i) Since $\square PQRS$ is a cyclic quadrilateral,

$\angle QRT = \angle SPT$ ....(1)(exterior angle is equal to interior opposite angle)

In $\Delta TPS$ and $\Delta TRQ$,

$\angle PTS = \angle RTQ$ ....(common angle)

$\angle QRT = \angle SPT$ ....(from 1)

$\Rightarrow \Delta TPS \sim \Delta TRQ$ ....(AA similarity criterion)

(ii) Since $\Delta TPS \sim \Delta TRQ$, implies that corresponding sides are proportional

i.e., $\frac{SP}{QR} = \frac{TP}{TR}$

$\Rightarrow \frac{SP}{4} = \frac{18}{6}$

$\Rightarrow SP = \frac{18 \times 4}{6}$

$\Rightarrow SP = 12\,\text{cm}$

(iii) Since $\Delta TPS \sim \Delta TRQ$,

$$\frac{Ar(\Delta TPS)}{Ar(\Delta TRQ)} = \frac{SP^2}{RQ^2}$$

$$\Rightarrow \frac{27}{Ar(\Delta TRQ)} = \frac{12^2}{4^2}$$

$$\Rightarrow Ar(\Delta TRQ) = \frac{27 \times 4 \times 4}{12 \times 12}$$

$$\Rightarrow Ar(\Delta TRQ) = 3\,\text{cm}^2$$

Now, $Ar(\square PQRS) = Ar(\Delta TPS) - Ar(\Delta TRQ) = 27 - 3 = 24\,\text{cm}^2$

(c) $A = \begin{bmatrix} 4\sin 30^\circ & \cos 0^\circ \\ \cos 0^\circ & 4\sin 30^\circ \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$

(i) Let the order of matrix $X = m \times n$

Order of matrix $A = 2 \times 2$

Order of matrix $B = 2 \times 1$

Now, $AX = B$

$$\Rightarrow A_{2\times 2} \bullet X_{m\times n} = B_{2\times 1}$$

$\Rightarrow$ Order of matrix $X = m \times n = 2 \times 2$

(ii) Let the matrix $X = \begin{bmatrix} x \\ y \end{bmatrix}$

$AX = B$

$\Rightarrow \begin{bmatrix} 4\sin 30^o & \cos 0^o \\ \cos 0^o & 4\sin 30^o \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$

$\Rightarrow \begin{bmatrix} 4\left(\frac{1}{2}\right) & 1 \\ 1 & 4\left(\frac{1}{2}\right) \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$

$\Rightarrow \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$

$\Rightarrow \begin{bmatrix} 2x + y \\ x + 2y \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$

$\Rightarrow 2x + y = 4 \quad \ldots.(1)$

$x + 2y = 5 \quad \ldots.(2)$

Multiplying (1) by 2, we get

$4x + 2y = 8 \quad \ldots.(3)$

Subtracting (2) from (3), we have

$3x = 3$

$\Rightarrow x = 1$

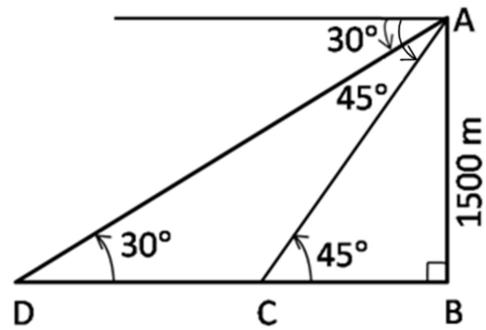
Substitute x in (1), we get

$2 \times 1 + y = 4$

$\Rightarrow y = 2$

Hence, the matrix $X = \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$

**7.** (a)




A is the aeroplane, D and C are the ships sailing towards A.
Ships are sailing towards the aeroplane in the same direction.
In the figure, height AB=1500 m

To find: Distance between the ships, that is CD.

Solution:
In the right-angled ΔABC,

$\tan 45° = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{1500}{BC}$

$\Rightarrow BC = 1500$ m

In the right-angled ΔABD,

$\tan 30° = \frac{AB}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{1500}{BD}$

$\Rightarrow BD = 1500\sqrt{3}$ m

$\Rightarrow BD = 1500(1.732) = 2598$ m

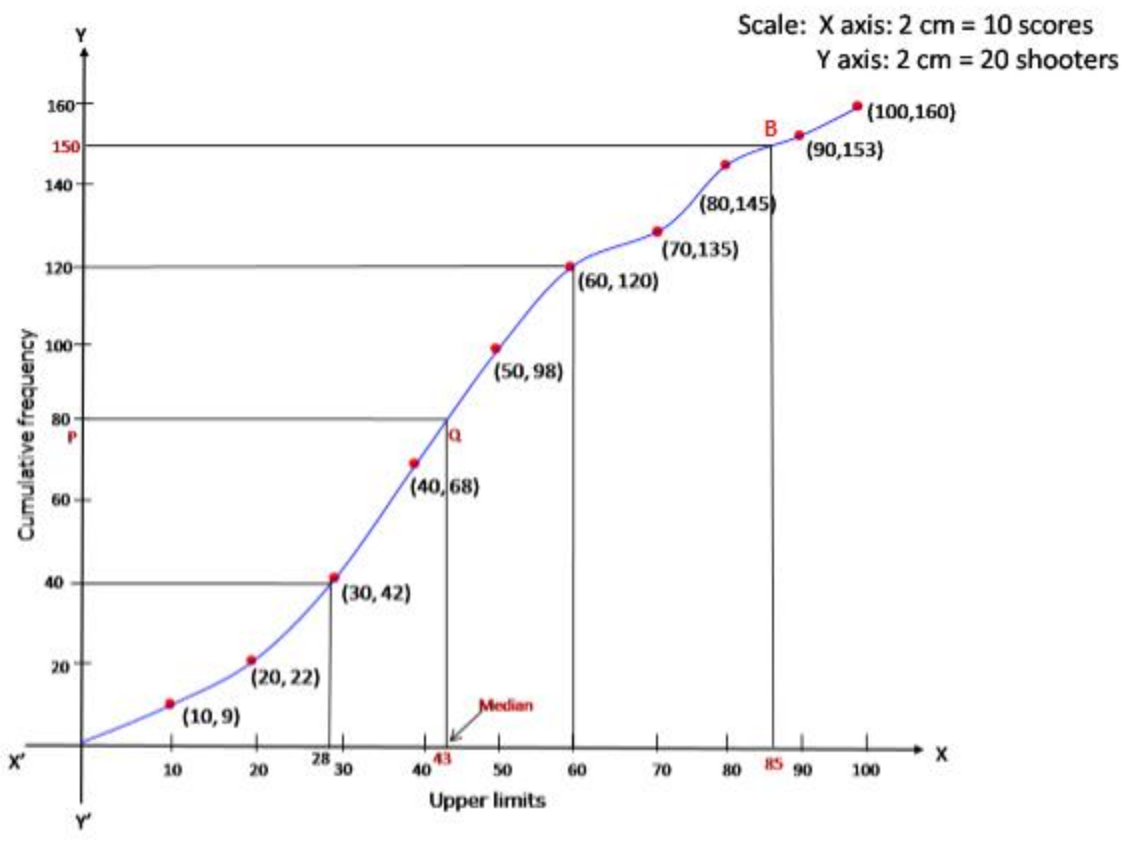
$\therefore$ Distance between the ships = CD = BD − BC

= 2598 − 1500

= 1098 m

(b)

| Scores | f | c.f. |
|---|---|---|
| 0 – 10 | 9 | 9 |
| 10 – 20 | 13 | 22 |
| 20 – 30 | 20 | 42 |
| 30 – 40 | 26 | 68 |
| 40 – 50 | 30 | 98 |
| 50 – 60 | 22 | 120 |
| 60 – 70 | 15 | 135 |
| 70 – 80 | 10 | 145 |
| 80 – 90 | 8 | 153 |
| 90 – 100 | 7 | 160 |
| | n = 160 | |




(i) Median= $\left(\frac{n}{2}\right)^{th}$ term = $\left(\frac{160}{2}\right)^{th}$ term $=80^{th}$ term

Through mark 80 on y-axis, draw a horizontal line which meets the ogive drawn at point Q.

Through Q, draw a vertical line which meets the x-axis at the mark of 43.

$\Rightarrow$ Median = 43

(ii) Since the number of terms = 160

Lower quartile $(Q_1) = \left(\frac{160}{4}\right)^{th}$ term $= 40^{th}$ term $= 28$

Upper quartile $(Q_3) = \left(\frac{3 \times 160}{4}\right)^{th}$ term $= 120^{th}$ term $= 60$

$\therefore$ Inter-quartile range $= Q_3 - Q_1 = 60 - 28 = 32$

(iii) Since 85% scores = 85% of 100 = 85

Through mark for 85 on x-axis, draw a vertical line which meets the ogive drawn at point B.

Through the point B, draw a horizontal line which meets the y-axis at the mark of 150.

$\Rightarrow$ Number of shooters who obtained more than 85% score=160 − 150=10

**8.** (a) Let $\frac{x}{a} = \frac{y}{b} = \frac{z}{c} = k$

$\Rightarrow x = ak, y = bk, z = ck$

$$\text{L.H.S.} = \frac{x^3}{a^3} + \frac{y^3}{b^3} + \frac{z^3}{c^3}$$

$$= \frac{(ak)^3}{a^3} + \frac{(bk)^3}{b^3} + \frac{(ck)^3}{c^3}$$

$$= \frac{a^3k^3}{a^3} + \frac{b^3k^3}{b^3} + \frac{c^3k^3}{c^3}$$

$$= k^3 + k^3 + k^3$$

$$= 3k^3$$

$$\text{R.H.S.} = \frac{3xyz}{abc}$$

$$= \frac{3(ak)(bk)(ck)}{abc}$$

$$= 3k^3$$

$$= \text{L.H.S.}$$

$\Rightarrow$ L.H.S. = R.H.S.

$$\Rightarrow \frac{x^3}{a^3} + \frac{y^3}{b^3} + \frac{z^3}{c^3} = \frac{3xyz}{abc}$$

(b) Steps for construction:

(i) Draw AB = 5 cm using a ruler.

(ii) With A as the centre cut an arc of 3 cm on AB to obtain C.

(iii) With A as the centre and radius 2.5 cm, draw an arc above AB.

(iv) With same radius, and C as the centre draw an arc to cut the previous arc and mark the intersection as O.

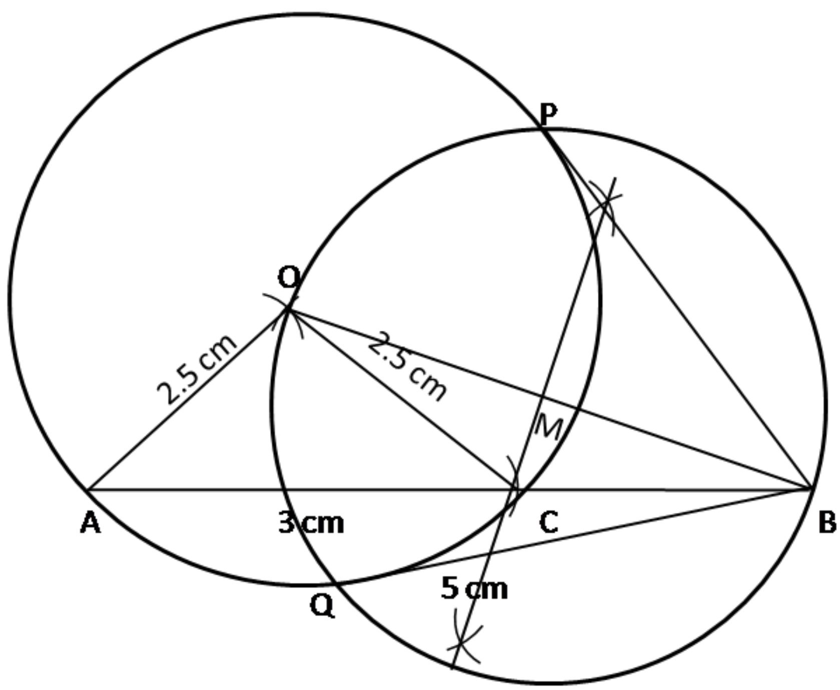
(v) With O as the centre and radius 2.5 cm, draw a circle so that points A and C lie on the circle formed.

(vi) Join OB.

(vii) Draw the perpendicular bisector of OB to obtain the mid-point of OB, M.

(viii) With the M as the centre and radius equal to OM, draw a circle to cut the previous circle at points P and Q.

(ix) Join PB and QB. PB and QB are the required tangents to the given circle from exterior point B.




QB = PB = 3 cm
That is, length of the tangents is 3 cm.

(c) (i) Since, A lies on the x-axis, let the coordinates of A be (x, 0).

Since B lies on the y - axis, let the coordinates of B be (0, y).

Let m = 1 and n = 2.

Using section formula,

Coordinates of P = $\left(\frac{1(0) + 2(x)}{1 + 2}, \frac{1y + 2(0)}{1 + 2}\right)$

$\Rightarrow (4, -1) = \left(\frac{2x}{3}, \frac{y}{3}\right)$

$\Rightarrow \frac{2x}{3} = 4$ and $\frac{y}{3} = -1$

$\Rightarrow x = 6$ and $y = -3$

So, the coordinates of A are (6, 0) and that of B are (0, –3).

(ii) Slope of AB = $\frac{-3-0}{0-6} = \frac{-3}{-6} = \frac{1}{2}$

$\Rightarrow$ Slope of line perpendicular to AB = m = –2

P = (4, –1)

$\Rightarrow$ Required equation is

$y - y_1 = m(x - x_1)$

$\Rightarrow y - (-1) = -2(x - 4)$

$\Rightarrow y + 1 = -2x + 8$

$\Rightarrow 2x + y = 7$

**9.** (a) Marked price of the article = Rs. 6,000.

A dealer buys an article at a discount of 30% from the wholesaler.

$\therefore$ Price of the article which the dealer paid to the wholesaler

$= 6000 - 30\%$ of $6000$

$= 6000 - \frac{30}{100} \times 6000$

$= \text{Rs.}4200$

Sales tax paid by dealer $= 6\%$ of $4200 = \frac{6}{100} \times 4200 = \text{Rs.}252$

$\therefore$ Amount of the article inclusive of sales tax at which the dealer bought it

$= \text{Rs.}4200 + \text{Rs.}252 = \text{Rs.}4452$

Dealer sells the article at a discount of 10% to the shopkeeper.

$\therefore$ Price of the article which the shopkeeper paid to the dealer

$= 6000 - 10\%$ of $6000$

$= 6000 - \frac{10}{100} \times 6000$

$= \text{Rs.}5400$

Sales tax paid by shopkeeper $= 6\%$ of $5400 = \frac{6}{100} \times 5400 = \text{Rs.}324$

$\therefore$ Amount of the article inclusive of sales tax at which the shopkeeper bought it

$= \text{Rs.}5400 + \text{Rs.}324 = \text{Rs.}5724$

The value added by dealer $= \text{Rs.}5400 - \text{Rs.}4200 = \text{Rs.}1200$

Amount of VAT paid by dealer

$= 6\%$ of $1200$

$= \frac{6}{100} \times 1200$

$= \text{Rs. } 72$

$\therefore$ Price paid by shopkeeper including tax is Rs 5724.

$\therefore$ VAT paid by dealer is Rs.72.

(b) (i) Area of the shaded part = Area of the circle + area of the semicircle

$$= \pi(2.5)^2 + \frac{\pi(2)^2}{2}$$
$$= \pi[6.25 + 2]$$
$$= \frac{22}{7}[8.25]$$
$$\approx 26\,\text{cm}^2$$

(ii) Area of kite $= \frac{\text{product of the diagonals}}{2} = \frac{AC \times BD}{2} = \frac{12 \times 8}{2} = 48\ \text{cm}^2$

Area of the unshaded part = Area of the kite − Area of the shaded part

$$= 48 - 26$$
$$= 22\,\text{cm}^2$$

(c) (i) Scale factor $k = \frac{1}{300}$

Length of the model of the ship = $k \times$ Length of the ship

$\Rightarrow 2 = \frac{1}{300} \times$ Length of the ship

$\Rightarrow$ Length of the ship = 600 m

(ii) Area of the deck of the model = $k^2 \times$ Area of the deck of the ship

$\Rightarrow$ Area of the deck of the model $= \left(\frac{1}{300}\right)^2 \times 180{,}000$

$$= \frac{1}{90000} \times 180{,}000$$
$$= 2\ \text{m}^2$$

(iii) Volume of the model = $k^3 \times$ Volume of the ship

$\Rightarrow 6.5 = \left(\frac{1}{300}\right)^3 \times$ Volume of the ship

$\Rightarrow$ Volume of the ship = $6.5 \times 27000000 = 175500000\ \text{m}^3$

**10.** (a) (i) $I = Rs. 1200, n = 2 \times 12 = 24$ months, $r = 6\%$

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

$$\Rightarrow 1200 = P \times \frac{24 \times 25}{24} \times \frac{6}{100}$$

$$\Rightarrow 1200 = P \times \frac{3}{2}$$

$$\Rightarrow P = \frac{1200 \times 2}{3}$$

$$\Rightarrow P = Rs.\ 800$$

So the monthly instalment is Rs. 800.

(ii) Total sum deposited = $P \times n$ = Rs. $800 \times 24$ = Rs. 19200

$\therefore$ Amount of maturity = Total sum deposited + Interest on it

= Rs. 19200 + Rs. 1200

= Rs. 20400

(b) (i)

| Class interval | Frequency |
|---|---|
| 0-10 | 2 |
| 10- 20 | 5 |
| 20-30 | 8 |
| 30-40 | 4 |
| 40-50 | 6 |

(ii)

| Class interval | Frequency (f) | Mean value (x) | fx |
|---|---|---|---|
| 0-10 | 2 | 5 | 10 |
| 10- 20 | 5 | 15 | 75 |
| 20-30 | 8 | 25 | 200 |
| 30-40 | 4 | 35 | 140 |
| 40-50 | 6 | 45 | 270 |
| | $\Sigma f = 25$ | | $\Sigma f = 695$ |

$$\therefore \text{Mean} = \frac{\sum fx}{\sum f} = \frac{695}{25} = 27.8$$

(iii) Here the maximum frequency is 8 which is corresponding to class 20 – 30.
Hence, the modal class is 20 – 30.

(c) Time taken by bus to cover total distance with speed x km/h $= \frac{240}{x}$

Time taken by bus to cover total distance with speed (x − 10) km/h $= \frac{240}{x-10}$

According to the given condition,

$$\frac{240}{x-10} - \frac{240}{x} = 2$$

$$\Rightarrow 240\left(\frac{1}{x-10} - \frac{1}{x}\right) = 2$$

$$\Rightarrow \frac{1}{x-10} - \frac{1}{x} = \frac{1}{120}$$

$$\Rightarrow \frac{x-x+10}{x(x-10)} = \frac{1}{120}$$

$$\Rightarrow \frac{10}{x^2-10x} = \frac{1}{120}$$

$$\Rightarrow x^2 - 10x = 1200$$

$$\Rightarrow x^2 - 10x - 1200 = 0$$

$$\Rightarrow (x-40)(x+30) = 0$$

$$\Rightarrow x - 40 = 0 \text{ or } x + 30 = 0$$

$$\Rightarrow x = 40 \text{ or } x = -30$$

Since, the speed cannot be negative, the uniform speed is 40 km/h.

**11.** (a) L.H.S. $= \frac{\cos A}{1 + \sin A} + \tan A$

$$= \frac{\cos A(1 - \sin A)}{(1 + \sin A)(1 - \sin A)} + \frac{\sin A}{\cos A}$$

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

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

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

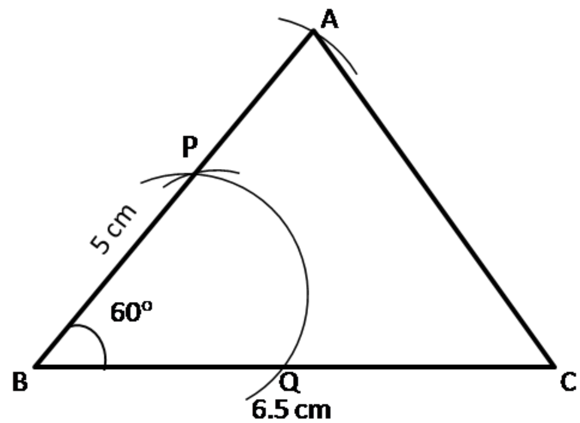
$$= \frac{1}{\cos A}$$

$= \sec A$

= R.H.S

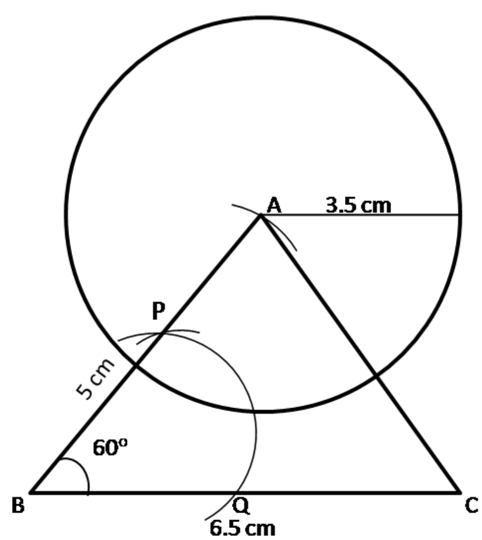
(b) (i) Steps of construction:

1. Draw BC = 6.5 cm using a ruler.
2. With B as the centre and radius equal to approximately half of BC, draw an arc that cuts the segment BC at Q.
3. With Q as the centre, and same radius, cut the previous arc at P.
4. Join BP and extend it.
5. With B as the centre and radius 5 cm, draw an arc that cuts the arm PB to obtain point A.
6. Join AC to obtain ΔABC.



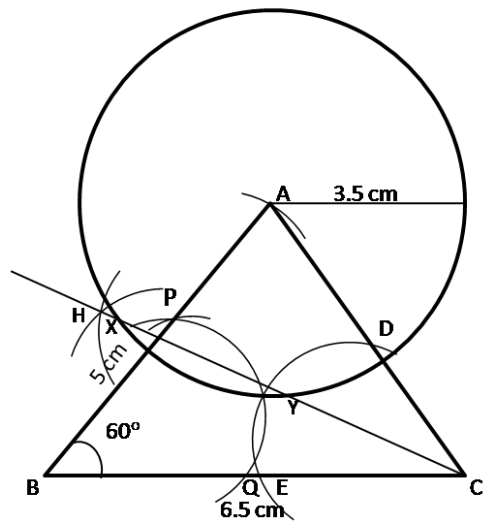

(ii) Steps for construction :

1. With A as the centre and radius 3.5 cm, draw a circle.
2. The circumference of a circle is the required locus.



(iii) Steps for construction :

1. With C as the centre and with radius of a length less than CA or BC, draw an arc to cut the line segments AC and BC at D and E respectively.
2. With the same radius or a suitable radius and with D as the centre, draw an arc of a circle.
3. With the same radius and with E as the centre draw an arc such that the two arcs intersect at H.
4. Join C and H.
5. CH is the bisector of ÐACB and is the required locus.




(iv) Steps for construction :

1. We known that the points at a distance of 3.5 cm from A will surely lie on the circle with centre A.
2. Also, the points on the angle bisector CH are the points equidistant from AC and BC.
3. Mark X and Y which are at the intersection of the circle and the angle bisector CH.
4. Measure XY. XY = 5 cm

(c)

(i) Total dividend = Rs.2,475

Dividend on each share = 12% of Rs. 25 $= \frac{12}{100} \times 25 =$ Rs. 3

$\therefore$ Number of shares bought $= \frac{\text{Total dividend}}{\text{Dividend on 1 share}} = \frac{2475}{3} = 825$

(ii) Market value of each share $= \frac{\text{Total Investment}}{\text{Number of shares bought}} = \frac{26400}{825} =$ Rs. 32