ICSE BOARD

Class X Mathematics

Board Paper – 2017(Solution)

SECTION A

1.

(a) Cost price of an article = Rs. 3,450

(i) Marked price of the article = Cost price + 16% of Cost price

$$= 3450 + \frac{16}{100} \times 3450$$

$$= 3450 + 552$$

$$= \text{Rs.}4002$$

(ii) Price paid by the customer = Marked price + Sales Tax

$$= 4002 + \frac{10}{100} \times 4002$$

$$= 4002 + 400.2$$

$$= \text{Rs. } 4402.20$$

(b) $13x - 5 < 15x + 4 < 7x + 12, \quad x \in R$

Take $13x - 5 < 15x + 4$ and $15x + 4 < 7x + 12$

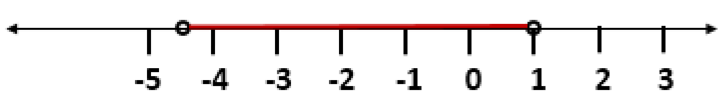
$13x - 5 < 15x + 4$	$15x + 4 < 7x + 12$
$13x < 15x + 9$	$15x < 7x + 8$
$0 < 2x + 9$	$8x < 8$
$-9 < 2x$	$x < 1$
$-\frac{9}{2} < x$	$x < 1$

$\therefore \quad -\frac{9}{2} < x < 1$

i.e. $-4.5 < x < 1$

$\therefore$ Solution set $= \{x : -4.5 < x < 1, \ x \in R\}$

The solution on the number line is as follows:



(c) $\frac{\sin 65°}{\cos 25°}+\frac{\cos 32°}{\sin 58°}-\sin 28°.\sec 62°+\operatorname{cosec}^2 30°$

$=\frac{\sin(90°-25°)}{\cos 25°}+\frac{\cos(90°-58°)}{\sin 58°}-\sin 28°\times\frac{1}{\cos(90°-28°)}+\frac{1}{\sin^2 30}$

$=\frac{\cos 25°}{\cos 25°}+\frac{\sin 58°}{\sin 58°}-\sin 28°\times\frac{1}{\sin 28°}+\left(\frac{1}{\left(\frac{1}{2}\right)^2}\right)$

$=1+1-1+4$

$=5$

2.

(a) Given : $A=\begin{bmatrix}3 & x\\0 & 1\end{bmatrix},\ B=\begin{bmatrix}9 & 16\\0 & -y\end{bmatrix}$ and $A^2=B$

Now, $A^2=A\times A=\begin{bmatrix}3 & x\\0 & 1\end{bmatrix}\times\begin{bmatrix}3 & x\\0 & 1\end{bmatrix}=\begin{bmatrix}9 & 3x+x\\0 & 1\end{bmatrix}=\begin{bmatrix}9 & 4x\\0 & 1\end{bmatrix}$

We have $A^2=B$

Two matrices are equal if each and every corresponding element is equal.

Thus, $\begin{bmatrix}9 & 4x\\0 & 1\end{bmatrix}=\begin{bmatrix}9 & 16\\0 & -y\end{bmatrix}$

$\Rightarrow 4x=16$ and $1=-y$

$\Rightarrow x=4$ and $y=-1$

(b) Population after n years $=$ Present population $\times\left(1+\frac{r}{100}\right)^n$

Present population $=2,00,000$

After first year, population $=2,00,000\times\left(1+\frac{10}{100}\right)^1$

$=2,00,000\times\frac{11}{10}$

$=2,20,000$

Population after two years $=2,20,000\times\left(1+\frac{15}{100}\right)^1$

$=2,53,000$

Thus, the population after two years is 2,53,000.

(c) Three vertices of a parallelogram taken in order are A(3, 6), B(5, 10) and C(3, 2)

(i) We need to find the co-ordinates of D.

We know that the diagonals of a parallelogram bisect each other.

Let (x, y) be the co-ordinates of D.

$$\therefore \text{ Mid-point of diagonal AC} = \left(\frac{3+3}{2}, \frac{6+2}{2}\right) \equiv (3, 4)$$

$$\text{And, mid-point of diagonal BD} = \left(\frac{5+x}{2}, \frac{10+y}{2}\right)$$

Thus, we have

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

$$\Rightarrow 5+x = 6 \quad \text{and} \quad 10+y = 8$$

$$\Rightarrow x = 1 \quad \text{and} \quad y = -2$$

$$\therefore D = (1, -2)$$

(ii) Length of diagonal $BD = \sqrt{(1-5)^2 + (-2-10)^2}$

$$= \sqrt{(-4)^2 + (-12)^2}$$

$$= \sqrt{16+144}$$

$$= \sqrt{160}$$

$$= 4\sqrt{10}$$

(iii) $A(3, 6) = (x_1, y_1)$ and $B(5, 10) = (x_2, y_2)$

$$\text{Slope of line AB} = m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10-6}{5-3} = \frac{4}{2} = 2$$

$\therefore$ Equation of line AB is given by

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

$$\Rightarrow y - 6 = 2(x-3)$$

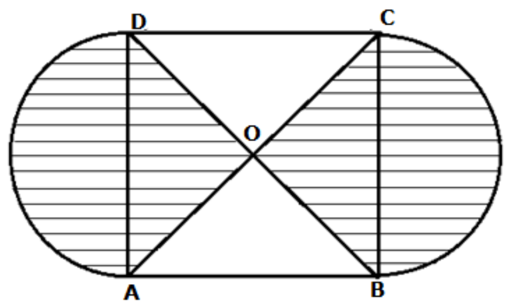
$$\Rightarrow y - 6 = 2x - 6$$

$$\Rightarrow 2x - y = 0$$

$$\Rightarrow 2x = y$$

3.

(a)



Area of one semi-circle = $\frac{1}{2}\times\pi\times\left(\frac{21}{2}\right)^2$

$\Rightarrow$ Area of both semi-circles = $2\times\frac{1}{2}\times\pi\times\left(\frac{21}{2}\right)^2$

Area of one triangle = $\frac{1}{2}\times21\times\frac{21}{2}$

$\Rightarrow$ Area of both triangles = $2\times\frac{1}{2}\times21\times\frac{21}{2}$

Area of shaded portion

$=2\times\frac{1}{2}\times\pi\times\left(\frac{21}{2}\right)^2+2\times\frac{1}{2}\times21\times\frac{21}{2}$

$=\frac{22}{7}\times\frac{441}{4}+\frac{441}{2}$

$=\frac{693}{2}+\frac{441}{2}$

$=\frac{1134}{2}$

$=567\text{ cm}^2$

(b)

Marks (x)	0	1	2	3	4	5	Total
No. of Students (f)	1	3	6	10	5	5	n = 30
fx	0	3	12	30	20	25	Σfx = 90
c.f.	1	4	10	20	25	30	

$$\text{Mean} = \frac{\sum fx}{n} = \frac{90}{30} = 3$$

$$\text{Number of observations} = 30 \text{ (even)}$$

$$\therefore \text{Median} = \frac{\left(\frac{n}{2}\right)^{th} \text{observation} + \left(\frac{n}{2}+1\right)^{th} \text{observation}}{2}$$

$$= \frac{\left(\frac{30}{2}\right)^{th} \text{observation} + \left(\frac{30}{2}+1\right)^{th} \text{observation}}{2}$$

$$= \frac{15^{th} \text{ observation} + 16^{th} \text{observation}}{2}$$

$$= \frac{3+3}{2}$$

$$= 3$$

$$\text{Mode} = \text{The number (marks) with highest frequency} = 3$$

(c) In the given figure, TS ⊥ SP,

m∠TSR = m∠OSP = 90°

In ΔTSR, m∠TSR + m∠TRS +m∠RTS = 180°

⇒ 90° + 65°+ x = 180°

⇒ x = 180° − 90° − 65°

⇒ x = 25°

Now, y = 2x [Angle subtended at the centre is double that of the angle subtended by the arc at the same centre]

⇒ y = 2 × 25°

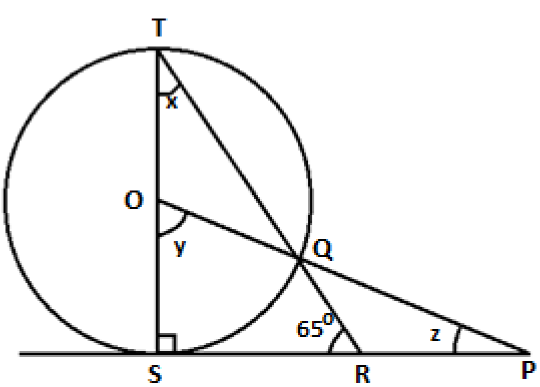
∴ y = 50°

In ΔOSP, m∠OSP + m∠SPO + m∠POS = 180°

⇒ 90° + z + 50° = 180°

⇒ z = 180°−140°

∴ z = 40°



4.

(a) Given,

$P = \text{Rs. } 1000$

$n = 2 \text{ years} = 24 \text{ months}$

$r = 6\%$

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

$= 1000 \times \frac{24 \times 25}{2} \times \frac{6}{12 \times 100}$

$= 1500$

Thus, the interest earned in 2 years is Rs. 1500.

(ii) Sum deposited in two years $= 24 \times 1000 = 24{,}000$

Maturity value = Total sum deposited in two years + Interest

= 24,000 + 1,500

= 25,500

Thus, the maturity value is Rs. 25,500.

(b) $(K + 2)x^2 - Kx + 6 = 0$ ....(1)

Substituting $x = 3$ in equation (1), we get

$(K + 2)(3)^2 - K(3) + 6 = 0$

$\therefore\ 9(K + 2) - 3K + 6 = 0$

$\therefore\ 9k + 18 - 3k + 6 = 0$

$\therefore\ 6k + 24 = 0$

$\therefore\ K = -4$

Now, substituting $K = -4$ in equation (1), we get

$(-4 + 2)x^2 - (-4)x + 6 = 0$

$\therefore\ -2x^2 + 4x + 6 = 0$

$\therefore\ x^2 - 2x - 3 = 0$

$\therefore\ x^2 - 3x + x - 3 = 0$

$\therefore\ x(x - 3) + 1(x - 3) = 0$

$\therefore\ (x + 1)(x - 3) = 0$

So, the roots are $x = -1$ and $x = 3$.

Thus, the other root of the equation is $x = -1$.

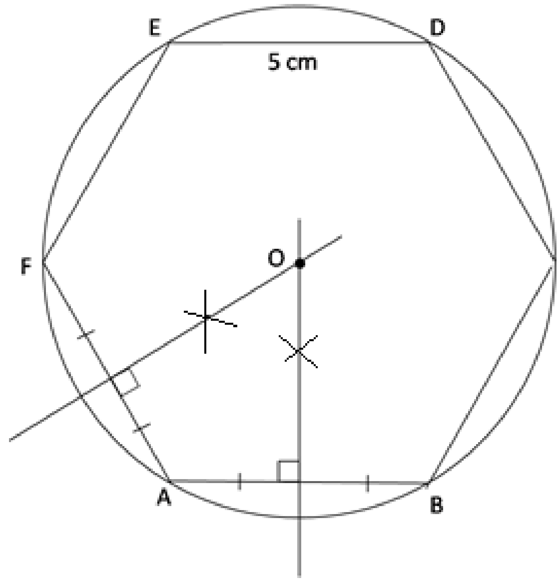
(c) Each interior angle of the regular hexagon $= \frac{(2n-4)}{n} \times 90° = \frac{(2 \times 6 - 4)}{6} \times 90° = 120°$

Steps of construction:

i. Construct the regular hexagon ABCDEF with each side equal to 5 cm.

ii. Draw the perpendicular bisectors of sides AB and AF and make them intersect each other at point O.

iii. With O as the centre and OA as the radius draw a circle which will pass through all the vertices of the regular hexagon ABCDEF.



SECTION B

5.

(a)

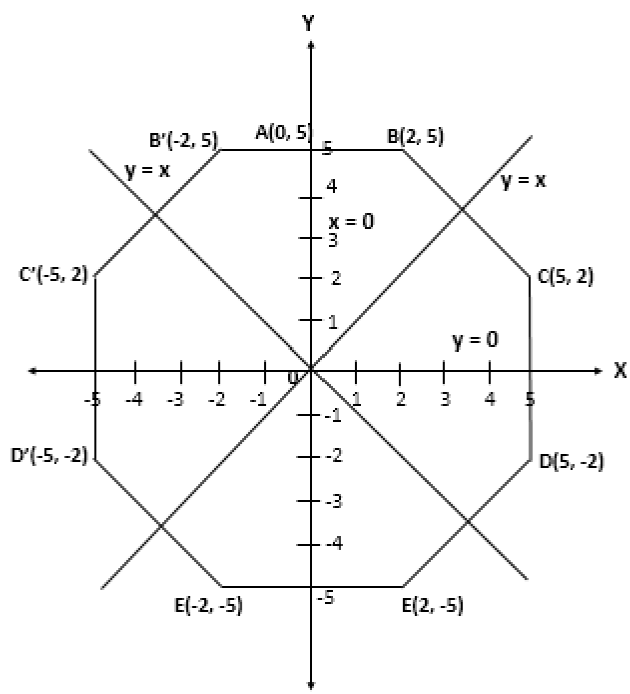
(i) See the figure.

(ii) Reflection of points on the y-axis will result in the change of the x-coordinate

(iii) Points will be B’(−2, 5), C’(−5, 2), D’(−5, −2), E’(−2, −5).

(iv) The figure BCDEE’D’C’B’ is a hexagon.

(v) The lines of symmetry is x-axis or y-axis.



(b) Principal for the month of April = Rs. 0

Principal for the month of May = Rs. 4650

Principal for the month of June = Rs. 4750

Principal for the month of July = Rs. 8950

Total Principal for one month = Rs. 18,350

Time = $\frac{1}{12}$ year, Rate = 4%

Interest earned = $\frac{18350\times1\times4}{100\times12}=61.17$

Money received on closing the account on 1st August, 2010

= Last Balance + Interest earned

= Rs. (8950 + 61.17)

= Rs. 9011.17

6.

(a) Given that a, b and c are in continued proportion.

$$\Rightarrow \frac{a}{b}=\frac{b}{c}\Rightarrow b^2=ac$$

$$\begin{aligned} \text{L.H.S.} &= (a+b+c)(a-b+c) \\ &= a(a-b+c)+b(a-b+c)+c(a-b+c) \\ &= a^2-ab+ac+ab-b^2+bc+ac-bc+c^2 \\ &= a^2+ac-b^2+ac+c^2 \\ &= a^2+b^2-b^2+b^2+c^2 \qquad [\because b^2=ac] \\ &= a^2+b^2+c^2 \\ &= \text{R.H.S.} \end{aligned}$$

(b)

i. The line intersects the x–axis where, y = 0. Thus, the co-ordinates of A are (4, 0).

ii. Length of AB=$\sqrt{\left(4-(-2)\right)^2+\left(0-3\right)^2}=\sqrt{36+9}=\sqrt{45}=3\sqrt{5}$ units

Length of AC $=\sqrt{\left(4-(-2)\right)^2+\left(0+4\right)^2}=\sqrt{36+16}=\sqrt{52}=2\sqrt{13}$ units

iii. Let Q divides AC in the ratio $m_1 : m_2$. Thus, the co-ordinates of Q are (0, y)

Since $x=\frac{m_1x_2+m_2x_1}{m_1+m_2}$

$$\Rightarrow 0=\frac{m_1(-2)+m_2(4)}{m_1+m_2}\Rightarrow 2m_1=4m_2\Rightarrow m_1=2m_2$$

$$\Rightarrow \frac{m_1}{m_2}=\frac{2}{1}$$

$\therefore$ Required ratio is 2 : 1.

iv. A(4, 0) = A(x_1, y_1) and B(−2, −4) = b(x_2, y_2)

$$\text{Slope of AC} = \frac{-4-0}{-2-4} = \frac{-4}{-6} = \frac{2}{3}$$

$\therefore$ Equation of line AC is given by $y - y_1 = m(x - x_1)$

$$\Rightarrow y - 0 = \frac{2}{3}(x-4)$$

$$\Rightarrow 3y = 2x - 8$$

$$\Rightarrow 2x - 3y = 8$$

(c) Consider the following distribution:

Class Interval	Frequency (f)	Class mark (x)	fx
0 – 10	8	5	40
10 – 20	5	15	75
20 – 30	12	25	300
30 – 40	35	35	1225
40 – 50	24	45	1080
50 – 60	16	55	880
Total	$n = \sum f = 100$		$\sum fx = 3600$

$$\text{Mean} = \frac{\sum fx}{n} = \frac{3600}{100} = 36$$

7.

(a) Radius of small sphere = r = 2 cm

Radius of big sphere = R = 4 cm

$$\text{Volume of small sphere} = \frac{4}{3}\pi r^3 = \frac{4\pi}{3}\times(2)^3 = \frac{32\pi}{3}\text{cm}^3$$

$$\text{Volume of big sphere} = \frac{4}{3}\pi R^3 = \frac{4\pi}{3}\times(4)^3 = \frac{256\pi}{3}\text{cm}^3$$

$$\text{Volume of both the spheres} = \frac{32\pi}{3} + \frac{256\pi}{3} = \frac{288\pi}{3}\text{cm}^3$$

We need to find R_1. $h = 8$ cm (Given)

$$\text{Volume of the cone} = \frac{1}{3}\pi R_1^{\,2}\times(8)$$

Volume of the cone = Volume of both the sphere

$$\Rightarrow \frac{1}{3}\pi R_1^{\,2}\times(8) = \frac{288\pi}{3}$$

$$\Rightarrow R_1^{\,2}\times(8) = 288$$

$$\Rightarrow R_1^{\,2} = \frac{288}{8} \Rightarrow R_1^{\,2} = 36$$

$$\Rightarrow R_1 = 6\text{ cm}$$

(b) The given polynomials are $ax^3 + 3x^2 - 9$ and $2x^3 + 4x + a$.

Let $p(x) = ax^3 + 3x^2 - 9$ and $q(x) = 2x^3 + 4x + a$

Given that p(x) and q(x) leave the same remainder when divided by (x + 3),

Thus by Remainder Theorem, we have

$p(-3) = q(-3)$

$\Rightarrow a(-3)^3 + 3(-3)^2 - 9 = 2(-3)^3 + 4(-3) + a$

$\Rightarrow -27a + 27 - 9 = -54 - 12 + a$

$\Rightarrow -27a + 18 = -66 + a$

$\Rightarrow -27a - a = -66 - 18$

$\Rightarrow -28a = -84$

$\Rightarrow a = \dfrac{84}{28}$

$\therefore a = 3$

(c) $$\text{L.H.S.} = \frac{\sin\theta}{1-\cot\theta} + \frac{\cos\theta}{1-\tan\theta}$$

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

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

$$= \frac{\sin^2\theta}{\sin\theta-\cos\theta} - \frac{\cos^2\theta}{\sin\theta-\cos\theta}$$

$$= \frac{\sin^2\theta-\cos^2\theta}{\sin\theta-\cos\theta}$$

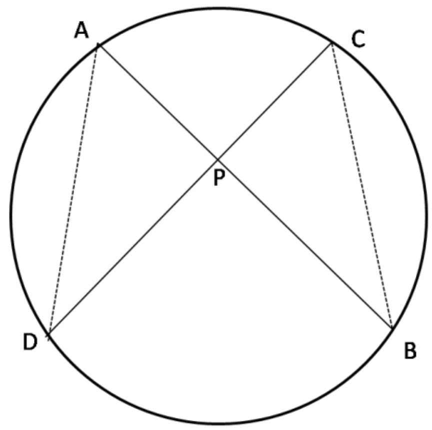
$$= \frac{(\sin\theta-\cos\theta)(\sin\theta+\cos\theta)}{\sin\theta-\cos\theta}$$

$$= \sin\theta+\cos\theta$$

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

8.

(a) Construction: Join AD and CB.



In ΔAPD and ΔCPB

$\angle A = \angle C$ .....(Angles in the same segment)

$\angle D = \angle B$ .....(Angles in the same segment)

$\Rightarrow \Delta APD \sim \Delta CPB$ ....(By AA Postulate)

$\Rightarrow \frac{AP}{CP} = \frac{PD}{PB}$ ....(Corresponding sides of similar triangles)

$\Rightarrow AP \times PB = CP \times PD$

(b) Total number of balls = 5 + 6 + 9 = 20

(i) Number of green balls $= 9 =$ Numberof favourable cases

$$\therefore \text{P(Green ball)} = \frac{\text{Number of favourable cases}}{\text{Total number of balls}} = \frac{9}{20}$$

(ii) Number of white balls $= 5$, Number of red balls $= 6$

Number of favourable cases $= 5 + 6 = 11$

$$\therefore \text{ P(White ball or Red ball)} = \frac{\text{Number of favourable cases}}{\text{Total number of balls}} = \frac{11}{20}$$

(iii) P(Neither green ball nor white ball) $=$ P(Red ball)

$$= \frac{\text{Number of Red balls}}{\text{Total number of balls}}$$

$$= \frac{6}{20}$$

(c)

(i) 100 shares at Rs. 20 premium means:

Nominal value of the share is Rs. 100

Market value of each share = 100 + 20 = Rs. 120

Investment = Rs. 9600

$$\therefore \text{ Number of shares} = \frac{\text{Investment}}{\text{Market Value of each Share}} = \frac{9600}{120} = 80$$

(ii) Sale price of each share = Rs. 160

$\therefore$ The sale proceeds = 80 × 160 = Rs. 12,800

(iii) New investment = Rs. 12,800

Market Value of each share = Rs. 40

$$\therefore \text{ Number of shares} = \frac{\text{Investment}}{\text{Market Value of each share}} = \frac{12800}{40} = 320$$

(iv) Dividend in the 1^{st} investment:

$= \text{Number of shares} \times \text{Rate of dividend} \times \text{N.V. of each share}$

$= 80 \times 8\% \times 100$

$= 80 \times \frac{8}{100} \times 100$

$= \text{Rs. } 640$

Dividend in the 2^{nd} investment

$= \text{Number of shares} \times \text{Rate of dividend} \times \text{N.V. of each share}$

$= 320 \times 10\% \times 50$

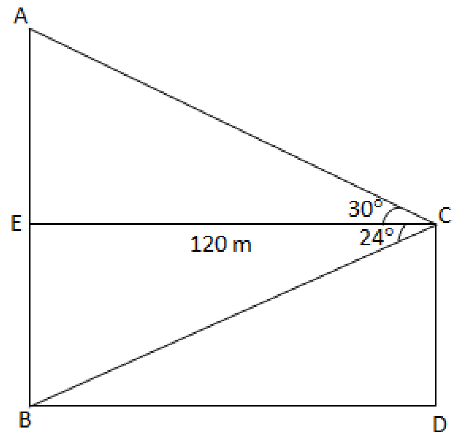
$= 320 \times \frac{10}{100} \times 50$

$= \text{Rs. } 1600$

Thus, change in two dividends = 1600 – 640 = Rs. 960

9.

(a) Consider the following figure:



In ΔAEC,

$$\tan 30° = \frac{AE}{EC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AE}{120}$$

$$\Rightarrow \frac{120}{\sqrt{3}} = AE$$

$\therefore$ AE = 69.28 m

In ΔBEC,

$$\tan 24° = \frac{EB}{EC}$$

$$\Rightarrow 0.445 = \frac{EB}{120}$$

$\therefore$ EB = 53.427 m

Thus, height of first tower, AB = AE + EB

$= 69.282 + 53.427$

$= 122.709$ m

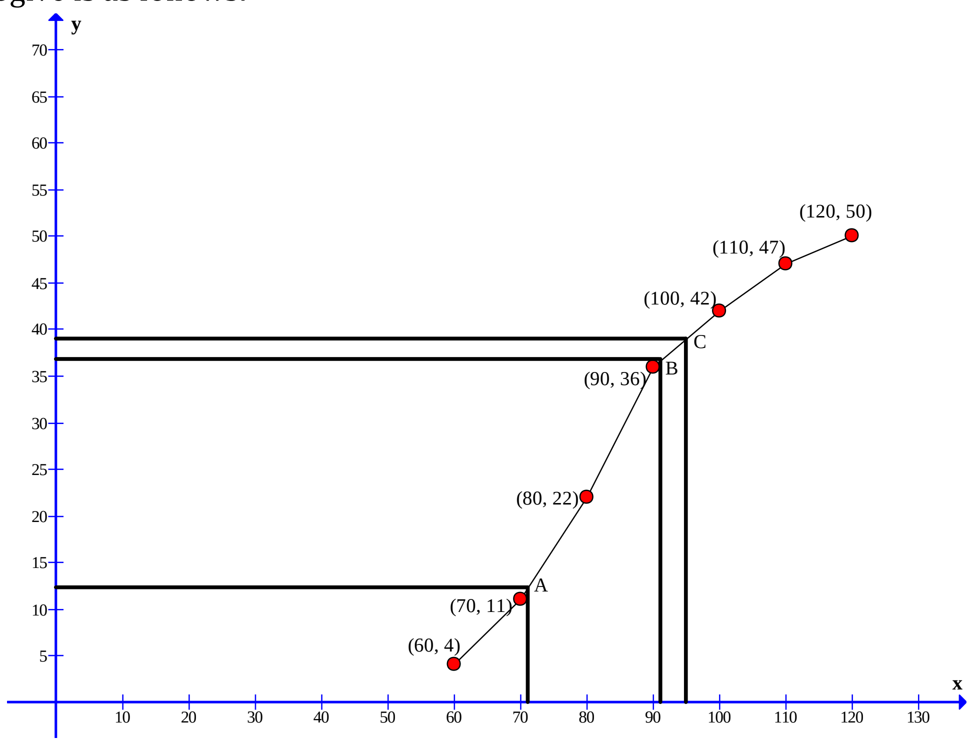
$= 122$ m (correct to 3 significant figures)

And, height of second tower, CD = EB = 53.427 m = 53.4 (correct to 3 significant figures)

(b) The cumulative frequency table of the given distribution table is as follows:

Weight in Kg	Number of workers	Cumulative frequency
50-60	4	4
60-70	7	11
70-80	11	22
80-90	14	36
90-100	6	42
100-110	5	47
110-120	3	50

The ogive is as follows:



Number of workers = 50

(i) Upper quartile (Q3) $=\left(\frac{3\times 50}{4}\right)^{th}$ term $=(37.5)^{th}$ term $=92$

Lower quartile $(Q_1)=\left(\frac{50}{4}\right)^{th}$ term $=(12.5)^{th}$ term $=71.1$

(ii) Through mark of 95 on the x – axis, draw a vertical line which meets the graph at point C.

Then through point C, draw a horizontal line which meets the y-axis at the mark of 39.

Thus, number of workers weighing 95 kg and above = $50-39=11$

10.

(a) (i) Selling price of the manufacturer = Rs. 25000

Marked price of the wholesaler

$$= 25000 + \frac{20}{100} \times 25000$$
$$= 25000 + 5000$$
$$= \text{Rs. } 30{,}000$$

(ii) For retailer,

$$\text{C.P.} = \text{Marked price} - \text{Discount}$$
$$= \text{Rs. } 30000 - 10\% \text{ of Rs. } 30000$$
$$= \text{Rs. } 30000 - \frac{10}{100} \times \text{Rs. } 30000$$
$$= \text{Rs. } 30000 - \text{Rs. } 3000$$
$$= \text{Rs. } 27{,}000$$

$$\text{Now, C.P. inclusive of tax} = \text{Rs. } 27000 + 8\% \text{ of Rs. } 27000$$
$$= \text{Rs. } 27000 + \frac{8}{100} \times \text{Rs. } 27000$$
$$= \text{Rs. } 27000 + \text{Rs. } 2160$$
$$= \text{Rs. } 29{,}160$$

(iii) For wholesaler,

$$\text{C.P.} = \text{Rs. } 25000$$
$$\text{S.P.} = \text{Rs. } 27000$$
$$\text{Profit} = \text{S.P.} - \text{C.P.} = \text{Rs. } (27000 - 25000) = \text{Rs. } 2000$$
$$\text{VAT paid by wholesaler} = \frac{8}{100} \times \text{Rs. } 2000 = \text{Rs. } 160$$

(b) $$AB = \begin{bmatrix} 3 & 7 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} 0 & 2 \\ 5 & 3 \end{bmatrix}$$
$$= \begin{bmatrix} 3\times0+7\times5 & 3\times2+7\times3 \\ 2\times0+4\times5 & 2\times2+4\times3 \end{bmatrix}$$
$$= \begin{bmatrix} 0+35 & 6+21 \\ 0+20 & 4+12 \end{bmatrix}$$
$$= \begin{bmatrix} 35 & 27 \\ 20 & 16 \end{bmatrix}$$
$$5C = 5\begin{bmatrix} 1 & -5 \\ -4 & 6 \end{bmatrix} = \begin{bmatrix} 5 & -25 \\ -20 & 30 \end{bmatrix}$$
$$AB - 5C = \begin{bmatrix} 35 & 27 \\ 20 & 16 \end{bmatrix} - \begin{bmatrix} 5 & -25 \\ -20 & 30 \end{bmatrix} = \begin{bmatrix} 30 & 52 \\ 40 & -14 \end{bmatrix}$$

(c)

(i)Consider ΔADE and ΔACB.

$\angle A = \angle A \quad [\text{Common}]$

$m\angle B = m\angle E = 90^\circ$

Thus by Angle-Angle similarity, triangles, $\Delta ACB \sim \Delta ADE$.

(ii)Since $\Delta ADE \sim \Delta ACB$, their sides are proportional.

$\Rightarrow \frac{AE}{AB} = \frac{AD}{AC} = \frac{DE}{BC} ...(1)$

In ΔABC, by Pythagoras Theorem, we have

$AB^2 + BC^2 = AC^2$

$\Rightarrow AB^2 + 5^2 = 13^2$

$\Rightarrow AB = 12 \text{ cm}$

From equation (1), we have,

$\frac{4}{12} = \frac{AD}{13} = \frac{DE}{5}$

$\Rightarrow \frac{1}{3} = \frac{AD}{13}$

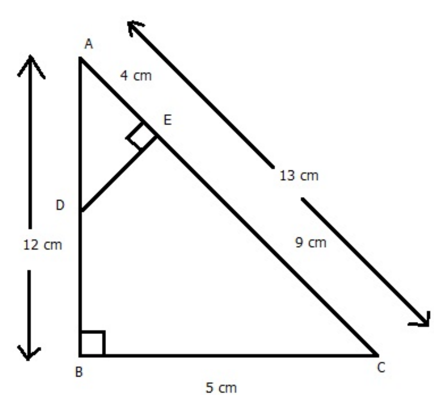
$\Rightarrow AD = \frac{13}{3} \text{ cm}$

Also $\frac{4}{12} = \frac{DE}{5}$

$\Rightarrow DE = \frac{20}{12} = \frac{5}{3} \text{ cm}$

(iii) We need to find the area of ΔADE and quadrilateral BCED.

Area of ΔADE = $\frac{1}{2} \times AE \times DE = \frac{1}{2} \times 4 \times \frac{5}{3} = \frac{10}{3} \text{ cm}^2$



Area of quad.BCED = Area of ΔABC – Area of ΔADE

$= \frac{1}{2} \times BC \times AB - \frac{10}{3}$

$= \frac{1}{2} \times 5 \times 12 - \frac{10}{3}$

$= 30 - \frac{10}{3}$

$= \frac{80}{3} \text{ cm}^2$

Thus ratio of areas of ΔADE to quadrilateral BCED= $\frac{\frac{10}{3}}{\frac{80}{3}} = \frac{1}{8}$

11.

(a) Let the two natural numbers be x and (8 – x). Then, we have

$$\frac{1}{x}-\frac{1}{8-x}=\frac{2}{15}$$

$$\Rightarrow \frac{8-x-x}{x(8-x)}=\frac{2}{15}$$

$$\Rightarrow \frac{8-2x}{x(8-x)}=\frac{2}{15}$$

$$\Rightarrow \frac{4-x}{x(8-x)}=\frac{1}{15}$$

$$\Rightarrow 15(4-x)=x(8-x)$$

$$\Rightarrow 60-15x=8x-x^2$$

$$\Rightarrow x^2-15x-8x+60=0$$

$$\Rightarrow x^2-23x+60=0$$

$$\Rightarrow x^2-20x-3x+60=0$$

$$\Rightarrow (x-3)(x-20)=0$$

$$\Rightarrow (x-3)=0 \text{ or } (x-20)=0$$

$$\Rightarrow x=3 \text{ or } x=20$$

Since sum of two natural numbers is 8, x cannot be equal to 20

$\Rightarrow$ x = 3 and $8-x=8-3=5$

Hence, required natural numbers are 3 and 5.

(b) $$\frac{x^3+12x}{6x^2+8}=\frac{y^3+27y}{9y^2+27}$$

$$\Rightarrow \frac{x^3+12x+6x^2+8}{x^3+12x-6x^2-8}=\frac{y^3+27y+9y^2+27}{y^3+27y-9y^2-27} \quad \text{(Using componendo-dividendo)}$$

$$\Rightarrow \frac{(x+2)^3}{(x-2)^3}=\frac{(y+3)^3}{(y-3)^3}$$

$$\Rightarrow \left(\frac{x+2}{x-2}\right)^3=\left(\frac{y+3}{y-3}\right)^3$$

$$\Rightarrow \frac{x+2}{x-2}=\frac{y+3}{y-3}$$

$$\Rightarrow \frac{2x}{4}=\frac{2y}{6} \quad \text{(Using componendo-dividendo)}$$

$$\Rightarrow \frac{x}{2}=\frac{y}{3}$$

$$\Rightarrow \frac{x}{y}=\frac{2}{3}\Rightarrow x:y=2:3$$

(c)

1. Draw a line segment AB of length 5.5 cm.
2. Make an angle m∠BAX = 105° using a protractor.
3. Draw an arc AC with radius AC = 6 cm on AX with centre at A.
4. Join BC.

Thus ΔABC is the required triangle.

(i) Draw BR, the bisector of ∠ABC, which is the locus of points equidistant from BA and BC.

(ii) Draw MN, the perpendicular bisector of BC, which is the locus of points equidistant from B and C.

(iii) The angle bisector of ∠ABC and perpendicular bisector of BC meet at point P. Thus, P satisfies the above two loci.
Length of PC = 4.8 cm