ICSE Board
Class IX Mathematics
Sample Paper 6 - Solution

Time: 2½ hrs **Total Marks: 80**

SECTION – A

Q. 1.

(a)

$$\frac{2\sqrt{5}+3\sqrt{2}}{2\sqrt{5}-3\sqrt{2}}$$

$$=\frac{2\sqrt{5}+3\sqrt{2}}{2\sqrt{5}-3\sqrt{2}}\times\frac{2\sqrt{5}+3\sqrt{2}}{2\sqrt{5}+3\sqrt{2}}$$

$$=\frac{\left(2\sqrt{5}+3\sqrt{2}\right)^2}{\left(2\sqrt{5}\right)^2-\left(3\sqrt{2}\right)^2}$$

$$=\frac{\left(2\sqrt{5}\right)^2+2\left(2\sqrt{5}\right)\left(3\sqrt{2}\right)+\left(3\sqrt{2}\right)^2}{20-18}$$

$$=\frac{20+12\sqrt{10}+18}{2}$$

$$=\frac{38+12\sqrt{10}}{2}$$

$$=\frac{2\left(19+6\sqrt{10}\right)}{2}$$

$$=19+6\sqrt{10}$$

(b)

$$x^2+\frac{1}{x^2}-11$$

$$=x^2+\frac{1}{x^2}-2-9$$

$$=x^2+\frac{1}{x^2}-2\times x\times\frac{1}{x}-9$$

$$=\left(x-\frac{1}{x}\right)^2-(3)^2$$

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

(c)

Let the radii of the two circles be r_1 and r_2, respectively.

Sum of the areas of two circles = 130π sq. cm

$\Rightarrow \pi r_1^2 + \pi r_2^2 = 130\pi$

$\Rightarrow r_1^2 + r_2^2 = 130$ ... (i)

Also, distance between the two radii = 14 cm

$\Rightarrow r_1 + r_2 = 14$

$\Rightarrow r_1 = (14 - r_2)$

Substituting the value of r_1 in (i), we get

$(14 - r_2)^2 + r_2^2 = 130$

$\Rightarrow 196 - 28r_2 + r_2^2 + r_2^2 = 130$

$\Rightarrow 2r_2^2 - 28r_2 + 66 = 0$

$\Rightarrow r_2^2 - 14r_2 + 33 = 0$

$\Rightarrow r_2^2 - 11r_2 - 3r_2 + 33 = 0$

$\Rightarrow r_2(r_2 - 11) - 3(r_2 - 11) = 0$

$\Rightarrow (r_2 - 11)(r_2 - 3) = 0$

$\Rightarrow r_2 = 11$ or $r_2 = 3$

$\Rightarrow r_1 = 14 - 11 = 3$ or $r_1 = 14 - 3 = 11$

Thus, the radii of the two circles are 11 cm and 3 cm, respectively.

Q. 2.

(a)

Let the rate of growth of production = r% per annum.

$\therefore$ Production after 2 years = Present production $\left(1 + \frac{r}{100}\right)^2$

$\therefore 3,11,040 = 2,16,000\left(1 + \frac{r}{100}\right)^2$

$\therefore \frac{3,\,11,\,040}{2,\,16,\,000} = \left(1 + \frac{r}{100}\right)^2$

$\therefore \left(\frac{6}{5}\right)^2 = \left(1 + \frac{r}{100}\right)^2$

Taking Square root on both the sides, we get

$\frac{6}{5} = 1 + \frac{r}{100}$

$\therefore \quad \frac{r}{100} = \frac{6}{5} - 1$

$\therefore \quad r = \frac{1}{5} \times 100 = 20$

Therefore, the annual rate of growth of production = 20%.

(b)

$$\frac{2^n \times 6^{m+1} \times 10^{m-n} \times 15^{m+n-2}}{4^m \times 3^{2m+n} \times 25^{m-1}}$$

$$= \frac{2^n \times 6^m \times 6 \times 10^m \times 10^{-n} \times 15^m \times 15^n \times 15^{-2}}{4^m \times (3^2)^m \times 3^n \times 25^m \times 25^{-1}}$$

$$= \frac{\left(2 \times \frac{1}{10} \times 15\right)^n \times (6 \times 10 \times 15)^m \times 6 \times \frac{1}{15^2}}{3^n \times (4 \times 3^2 \times 25)^m \times \frac{1}{25}}$$

$$= \frac{3^n \times 900^m \times \frac{6}{225}}{3^n \times 900^m \times \frac{1}{25}}$$

$$= \frac{6}{225} \times \frac{25}{1}$$

$$= \frac{6}{9} = \frac{2}{3}$$

(c)

ABCD is a rhombus $\Rightarrow$ AD = CD and $\angle ADC = \angle ABC = 56°$

DCFE is a square $\Rightarrow$ ED = CD and $\angle FED = \angle EDC = \angle DCF = \angle CFE = 90°$

$\Rightarrow$ AD = CD = ED

In ΔADE,

AD = ED $\Rightarrow \angle DAE = \angle AED$...(i)

$\angle DAE + \angle AED + \angle ADE = 180°$

$\Rightarrow 2\angle DAE + 146° = 180°$ ...(Since $\angle ADE = \angle EDC + \angle ADC = 90° + 56° = 146°$)

$\Rightarrow 2\angle DAE = 34°$

$\Rightarrow \angle DAE = 17°$

$\Rightarrow \angle DEA = 17°$...(ii)

In $\square ABCD$,

$\angle ABC + \angle BCD + \angle ADC + \angle DAB = 360°$

$\Rightarrow 56° + 56° + 2\angle DAB = 360°$ ($\because$ opposite angles of a rhombus are equal)

$\Rightarrow 2\angle DAB = 248°$

$\Rightarrow \angle DAB = 124°$

We know that diagonals of a rhombus, bisect its angles.

$\Rightarrow \angle DAC = \frac{124°}{2} = 62°$

$\Rightarrow \angle EAC = \angle DAC - \angle DAE = 62° - 17° = 45°$

Now, $\angle FEA = \angle FED - \angle DEA$

$= 90° - 17°$ ...(from (ii) and each angle of a square is 90°)

$= 73°$

We know that diagonals of a square bisect its angles.

$\Rightarrow \angle CED = \frac{90°}{2} = 45°$

So, $\angle AEC = \angle CED - \angle DEA$

$= 45° - 17°$

$= 28°$

Hence, $\angle DAE = 17°$, $\angle FEA = 73°$, $\angle EAC = 45°$ and $\angle AEC = 28°$.

Q. 3.

(a)

Given equations are $4x+3y=17$ and $3x-4y+6=0$

Comparing with $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$, we have

$a_1=4, b_1=3, c_1=-17$ and $a_2=3, b_2=-4, c_2=6$

Now, $x=\frac{b_1c_2-b_2c_1}{a_1b_2-a_2b_1}$ and $y=\frac{c_1a_2-c_2a_1}{a_1b_2-a_2b_1}$

$\Rightarrow x=\frac{3\times6-(-4)\times(-17)}{4\times(-4)-3\times3}$ and $y=\frac{-17\times3-6\times4}{4\times(-4)-3\times3}$

$\Rightarrow x=\frac{18-68}{-16-9}$ and $y=\frac{-51-24}{-16-9}$

$\Rightarrow x=\frac{-50}{-25}$ and $y=\frac{-75}{-25}$

$\Rightarrow x=2$ and $y=3$

(b)

$2\cos^2\theta+\sin\theta-2=0$

$2\cos^2\theta+\sin\theta=2$

$\sin\theta=2-2\cos^2\theta$

$\sin\theta=2(1-\cos^2\theta)$

$\sin\theta=2\times\sin^2\theta$

$\frac{\sin^2\theta}{\sin\theta}=\frac{1}{2}$

$\sin\theta=\frac{1}{2}$

$\sin\theta=\sin30°$

$\theta=30°$

(c) Steps:

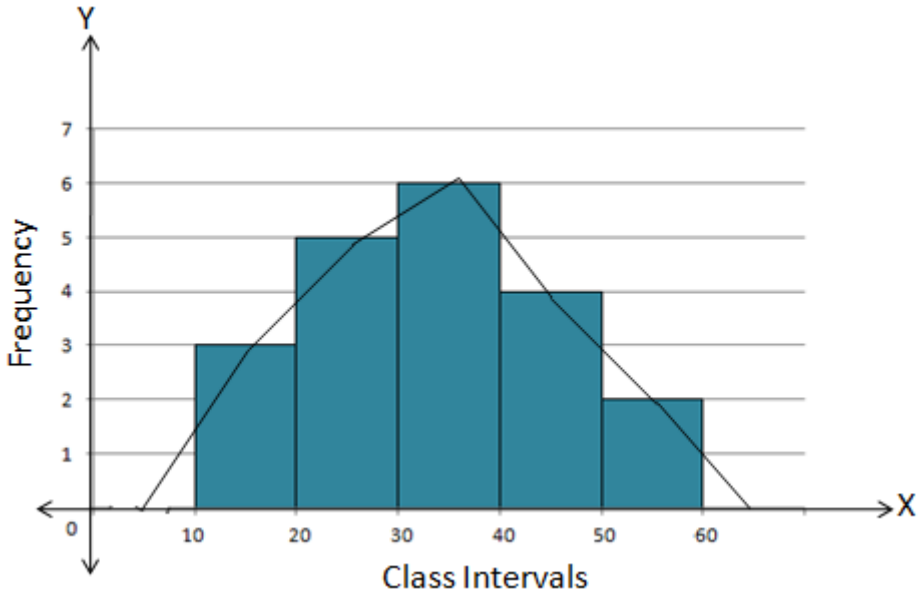
(i) Draw a histogram for the given data.

(ii) Mark the mid-point at the top of each rectangle of the histogram drawn.

(iii) Also, mark the mid-point of the immediately lower class interval and the mid-point of the immediately higher class interval.

(iv) Join the consecutive mid-points marked by straight lines to obtain the required frequency polygon.

The required combined histogram and frequency polygon is shown in the following figure:



Q. 4.

(a)

$$3(\log 5 - \log 3) - (\log 5 - 2\log 6) = 2 - \log x$$

$$\Rightarrow 3\log 5 - 3\log 3 - \log 5 + 2\log(2 \times 3) = 2 - \log x$$
$$\Rightarrow 3\log 5 - 3\log 3 - \log 5 + 2\log 2 + 2\log 3 = 2 - \log x$$
$$\Rightarrow 2\log 5 - \log 3 + 2\log 2 = 2 - \log x$$
$$\Rightarrow 2\log 5 - \log 3 + 2\log 2 + \log x = 2$$
$$\Rightarrow \log 5^2 - \log 3 + \log 2^2 + \log x = 2$$
$$\Rightarrow \log\left(\frac{25 \times 4 \times x}{3}\right) = 2$$
$$\Rightarrow \log\left(\frac{100x}{3}\right) = 2$$
$$\Rightarrow \frac{100x}{3} = 10^2$$
$$\Rightarrow \frac{x}{3} = 1$$
$$\Rightarrow x = 3$$

(b)

$$\left(3a + \frac{2}{b}\right)\left(2a - \frac{3}{b}\right) = (3a)(2a) + \left(\frac{2}{b}\right)(2a) - \left(\frac{3}{b}\right)(3a) - \left(\frac{2}{b}\right)\left(\frac{3}{b}\right)$$
$$= 6a^2 + \left(\frac{4}{b} - \frac{9}{b}\right)a - \frac{6}{b^2}$$
$$= 6a^2 + \left(-\frac{5}{b}\right)a - \frac{6}{b^2}$$
$$= 6a^2 - \frac{5a}{b} - \frac{6}{b^2}$$

(c)

Given:

AB and AC are the chords of a circle of radius R such that AB = 2AC. p and q are the distances of AB and AC from O, i.e.

OM = p, ON = q

To prove:

$4q^2 = p^2 + 3r^2$

Construction: Join OA

Proof:

OM and ON are the perpendicular distances of chord AB and AC from O.

$\therefore AM = \frac{1}{2}AB$ and $AN = \frac{1}{2}AC$ (since the perpendicular from the centre bisects the chord)

$AM = \frac{1}{2}AB = \frac{2AC}{2} = AC = 2AN$

$\therefore AM = 2AN$ ... (1)

In right-angled ΔAMO,

$AO^2 = AM^2 + OM^2$

$\therefore r^2 = AM^2 + p^2$

In right-angled ΔAMO,

$AO^2 = AM^2 + OM^2$

$\therefore r^2 = AM^2 + p^2$

$\therefore AM^2 = r^2 - p^2$

$\therefore (2AN)^2 = r^2 - p^2$ ... from (1)

$\therefore 4AN^2 = r^2 - p^2$

$\therefore AN^2 = \frac{1}{4}(r^2 - p^2)$ ... (2)

In the right-angled ΔANO,

$AO^2 = AN^2 + ON^2$

$\therefore r^2 = AN^2 + q^2$

$\therefore AN^2 = r^2 - q^2$ ... (3)

From (2) and (3), we get

$$\frac{1}{4}\left(r^2 - p^2\right) = r^2 - p^2$$

$$\therefore r^2 - p^2 = 4\left(r^2 - p^2\right)$$

$$\therefore r^2 - p^2 = 4r^2 - 4p^2$$

$$\therefore 4q^2 = 4r^2 - r^2 + p^2$$

$$\Rightarrow 4q^2 = 3r^2 + p^2$$

Hence proved.

SECTION – B

Q. 5.

(a)

Let the point on the x - axis be P(x, 0).

Distance between the points P(x, 0) and A(–2, 5)

= Distance between the points P(x, 0) and B(2, –3)

$\sqrt{(x-(-2))^2+(0-5)^2} = \sqrt{(x-2)^2+(0-(-3))^2}$

$\Rightarrow (x-(-2))^2+(0-5)^2 = (x-2)^2+(0-(-3))^2$ ....(Squaring both sides)

$\Rightarrow x^2+4x+4+25 = x^2-4x+4+9$

$\Rightarrow 4x+25 = -4x+9$

$\Rightarrow 8x = -16$

$\Rightarrow x = -2$

So, the point is (-2, 0).

(b)

Given that:

AB = 8 cm

AD = 12 cm

As ABCD is a rectangle so,

AB = DC

Now area of parallelogram DEFC

= Base × Height

= CD × AD

= 8 × 12

= 96 cm^2

As ΔEFG and parallelogram DEFC are on the same base EF and between the same parallels CD || EF, so area of the triangle EFGis half of the area of parallelogram DEFC

Hence Area of $\Delta EFG = \frac{96}{2} = 48cm^2$

(c)

For 1st year:

$P = \text{Rs. } 8,000; \quad R = 15\% \text{ and } T = 1 \text{ year}$

$\therefore \text{Interest} = \text{Rs. } \frac{8,000 \times 15 \times 1}{100} = \text{Rs. } 1200$

And, amount $= \text{Rs. } (8,000 + 1200) = \text{Rs. } 9,200$

For 2nd year:

$P = \text{Rs. } 9,200; \quad R = 15\% \text{ and } T = 1 \text{ year}$

$\therefore \text{Interest} = \text{Rs. } \frac{9,200 \times 15 \times 1}{100} = \text{Rs. } 1,380$

And, amount $= \text{Rs. } (9,200 + 1,380) = \text{Rs. } 10,580$

For the last $\frac{1}{2}$ year:

$P = \text{Rs. } 10,580; \quad R = 15\% \text{ and } T = \frac{1}{2} \text{ year}$

$\therefore \text{Interest} = \text{Rs. } \frac{10,580 \times 15 \times 1}{100 \times 2} = \text{Rs. } 793.50$

And, amount $= \text{Rs. } (10,580 + 793.50) = \text{Rs. } 11373.50$

$\therefore$ C.I. accrued = Final amount − Intitial Principal

$= \text{Rs. } (11373.50 - 8,000)$

$= \text{Rs. } 3373.50$

Q. 6.

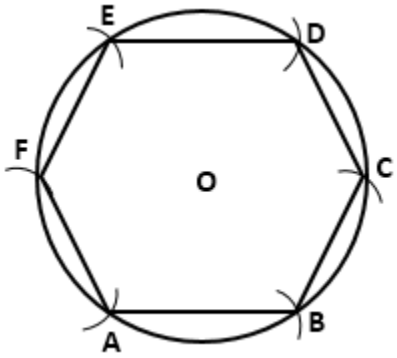
(a) The length of the side of a regular hexagon is equal to the radius of its circumcircle.

Steps of construction:

1) Draw a circle of radius 2.5 cm
2) Taking any point A on the circumference of the circle as centre, draw arcs of same radii (i.e. 2.5 cm) which cut the circumference at B and F.
3) With B and F as centres, again draw two arcs of the same radii which cut the circumference at C and E, respectively.
4) With C or E as centre, draw one more arc of the same radius which cuts the circumference at point D.

   In this way, the circumference of the circle is divided into six equal parts.
5) Join AB, BC, CD, DE, EF and FA.

ABCDEF is the required regular hexagon.



(b)

$x + y - z = 4$ and $x^2 + y^2 + z^2 = 30$

Since $(x + y - z)^2 = x^2 + y^2 + z^2 + 2(xy - yz - zx)$, we have

$(4)^2 = 30 + 2(xy - yz - zx)$

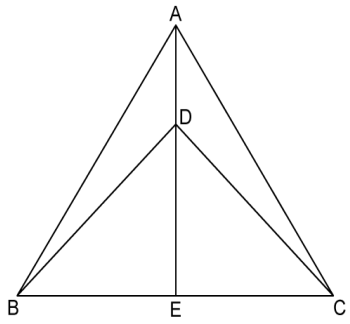
$\Rightarrow 16 = 30 + 2(xy - yz - zx)$

$\Rightarrow 2(xy - yz - zx) = -14$

$\Rightarrow xy - yz - zx = \frac{-14}{2} = -7$

$\therefore xy - yz - zx = -7$

(c)



(i) In ΔABD and ΔACD,

$AB = AC$ (equal sides of isosceles ΔABC)

$DB = DC$ (equal sides of isosceles ΔDBC)

$AD = AD$ (common)

$\therefore \Delta ABD \cong ACD$ (by SSS congruence criterion)

(ii) Since $\Delta ABD \cong \Delta ACD$,

$\angle BAD = \angle CAD$ (c.p.c.t.)

$\Rightarrow \angle BAE = \angle CAE$ ... (1)

Now, in ΔABE and ΔACE,

$AB = AC$ (equal sides of isosceles ΔABC)

$\angle BAE = \angle CAE$ [From (1)]

$AE = AE$ (common)

$\therefore \Delta ABE \cong \Delta ACE$ (by SAS congruence criterion)

(iii) Since $\Delta ABD \cong \Delta ACD$,

$\angle BAD = \angle CAD$ (c.p.c.t.)

$\Rightarrow \angle BAE = \angle CAE$

Thus, AE bisects $\angle A$.

In ΔBDE and ΔCDE,

$BD = CD$ (equal sides of isosceles ΔABC)

$BE = CE$ (c.p.c.t. since $\Delta ABE \cong ACE$)

$DE = DE$ (common)

$\therefore \Delta BDE \cong CDE$ (by SSS congruence criterion)

$\Rightarrow \angle BDE = \angle CDE$ (c.p.c.t.)

Thus, DE bisects $\angle D$, i.e. AE bisects $\angle D$.

Hence, AE bisects $\angle A$ as well as $\angle D$.

(iv) Since $\Delta BDE \cong \Delta CDE$,

$BE = CE$ and $\angle BED = \angle CED$ (c.p.c.t.)

$\Rightarrow$ BE = CE and $\angle BED = \angle CED = 90°$ (since $\angle BED$ and $\angle CED$ form a linear pair)

$\Rightarrow$DE is the perpendicular bisector of BC.

$\Rightarrow$ AE is the perpendicular bisector of BC.

Q. 7.

(a)

$$\frac{\tan^2 60^\circ + 4\cos^2 45^\circ + 3\sec^2 30^\circ + 5\cos 90^\circ}{\operatorname{cosec} 30^\circ + \sec 60^\circ - \cot^2 30^\circ}$$

$$= \frac{\left(\sqrt{3}\right)^2 + 4 \times \left(\frac{1}{\sqrt{2}}\right)^2 + 3 \times \left(\frac{2}{\sqrt{3}}\right)^2 + 5 \times 0}{2 + 2 - \left(\sqrt{3}\right)^2}$$

$$= \frac{3 + 4 \times \frac{1}{2} + 3 \times \frac{4}{3} + 0}{2 + 2 - 3}$$

$$= \frac{3 + 2 + 4}{4 - 3}$$

$$= 9$$

(b)

$$\frac{4}{(216)^{-\frac{2}{3}}} + \frac{1}{(256)^{-\frac{3}{4}}} + \frac{2}{(243)^{-\frac{1}{5}}}$$

$$= \frac{4}{\left(6^3\right)^{-\frac{2}{3}}} + \frac{1}{\left(4^4\right)^{-\frac{3}{4}}} + \frac{2}{\left(3^5\right)^{-\frac{1}{5}}}$$

$$= \frac{4}{6^{-2}} + \frac{1}{4^{-3}} + \frac{2}{3^{-1}}$$

$$= 4 \times 6^2 + 1 \times 4^3 + 2 \times 3$$

$$= 4 \times 36 + 1 \times 64 + 6$$

$$= 144 + 64 + 6$$

$$= 214$$

(c)

(i) BC, if AB = 8.6 cm

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

$\because CD = DE$

$$\frac{BC}{AB} = 1$$

$BC = AB = 8.6cm$

(ii) GE, if FE = 6 cm

$$\frac{GF}{FE} = \frac{DE}{CD}$$

$\because DE = CD$

$$\frac{GF}{FE} = 1$$

$GF = FE = 6cm$

$GE = GF + FE$

$GE = 6 + 6 = 12cm$

(iii) AE, if BD = 3.6 cm

$$BD = \frac{1}{2}AE$$

$\therefore AE = 2BD$

$AE = 2 \times 3.6cm$

$AE = 7.2cm$

(iv) DF, if CG = 15 cm

$$DF = \frac{1}{2}CG$$

$$DF = \frac{15}{2}cm$$

$DF = 7.5cm$

Q. 8.

(a)

Given: $\triangle ABC$ in which AD, BE and CF are its medians.

To prove: Perimeter of a triangle, i.e. AB + BC + AC > AD + BE + CF

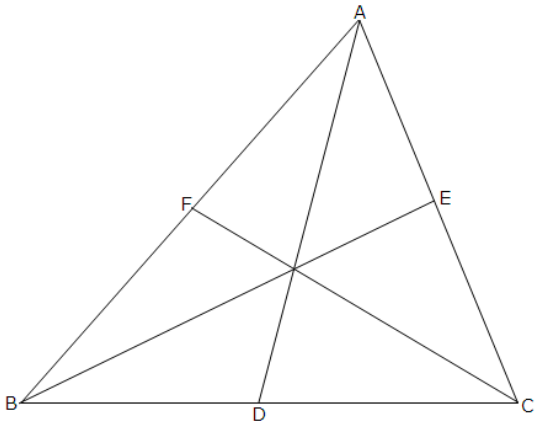
We know that the sum of any two sides of a triangle is greater than twice the median bisecting the third side. Therefore,

AD is the median bisecting BC.

$\Rightarrow$ AB + AC > 2 AD ... (i)

BE is the median bisecting AC ... (ii)

And CF is the median bisecting AB.



$\Rightarrow$ BC + AC > 2EF ... (iii)

Adding (i), (ii) and (iii), we get

(AB + AC) + (AB + BC) + (BC + AC) > 2. AD + 2. BE + 2.CF

$\Rightarrow$ 2 (AB + BC + AC) > 2 (AD + BE + CF)

$\Rightarrow$ AB + BC + AC > AD + BE + CF

(b)

Let the fraction be $\frac{x}{y}$.

According to given information, we have

$\frac{x+2}{y+2} = \frac{9}{10}$ and $\frac{x-3}{y-3} = \frac{4}{5}$

$\Rightarrow 10x + 20 = 9y + 18$ and $5x - 15 = 4y - 12$

$\Rightarrow 10x - 9y = -2$ ....(i) and $5x - 4y = 3$ ....(ii)

Multiplying eqn. (ii) by 2, we get

$10x - 8y = 6$ ....(iii)

Subtracting eqn. (iii) from eqn. (i), we get

$-y = -8$

$\Rightarrow y = 8$

$\Rightarrow 10x - 8(8) = 6$

$\Rightarrow 10x - 64 = 6$

$\Rightarrow 10x = 70$

$\Rightarrow x = 7$

$\therefore$ Required fraction $= \frac{7}{8}$

(c)

(i)

Total numbers of observations = 5

Given,

Mean = 13

$\Rightarrow \frac{x + (x+2) + (x+4) + (x+6) + (x+8)}{5} = 13$

$\Rightarrow 5x + 20 = 13 \times 5$

$\Rightarrow 5x + 20 = 65$

$\Rightarrow 5x = 45$

$\Rightarrow x = 9$

Thus, the last three observations are (9 + 4), (9 + 6) and (9 + 8),

i.e. 13, 15 and 17.

$\therefore$ Mean of last three observations $= \frac{13+15+17}{3} = \frac{45}{3} = 15$

(ii)

Mean height of 30 boys = 150 cm

$\Rightarrow$Total height of 30 boys = 150 × 30 = 4500 cm

Correct sum = 4500 – incorrect value + correct value

= 4500 – 135 + 165

= 4530

$\therefore$ Correct Mean $= \frac{\text{Correct sum}}{30} = \frac{4530}{30} = 151$ cm

Q. 9.

(a) For a cuboidal water tank,

Length = 6 m

Breadth = 5 m

Height = 4.5 m

Now,

Volume of a cuboidal water tank = Length × Breadth × Height

= (6 × 5 × 4.5) m^3

= 135 m^3

= 135 × 1000 litres

= 135000 litres

Thus, a tank can hold 135000 litres of water.

(b)

Radius of the circle is 6.7 cm.

d(P, R) = 5.7 cm $\therefore$ 5.7 cm < 6.7 cm

$\therefore$ Distance between P and R is less than the radius of the circle.

$\therefore$ Point R lies in the interior of the circle.

d(P, Q) = 7.6 cm

$\therefore$ 7.6 cm > 6.7 cm

$\therefore$ The distance between P and Q is greater than the radius of the circle.

$\therefore$ Point Q lies in the exterior circle.

(c) First we find three solutions for each equation to make tables.

When the simultaneous equations are satisfied by the same pair of values of x and y, such a pair of variables is called the solution of the given simultaneous equations.

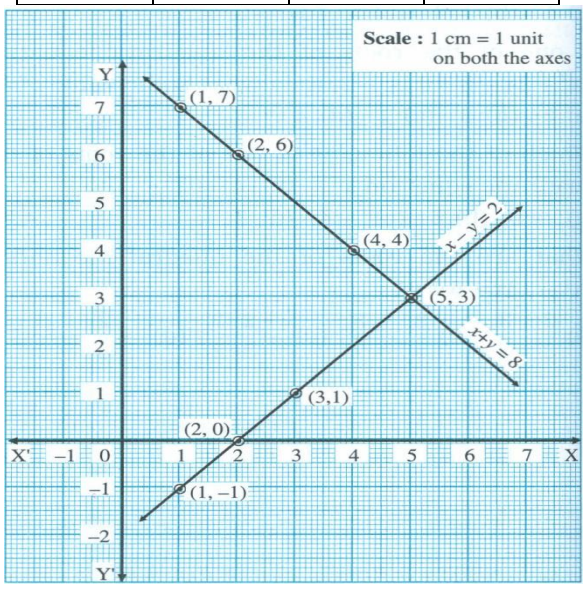
The first given equation is x + y = 8.

∴ y = 8 – x

x	3	2	4
y	5	6	4
(x, y)	(3, 5)	(2,6)	(4,4)

The second equation is x – y = 2.
∴ y = x – 2
Let us draw two lines corresponding to the two equations, and the co-ordinates of the point of intersection of these lines is the solution of the given simultaneous equations.

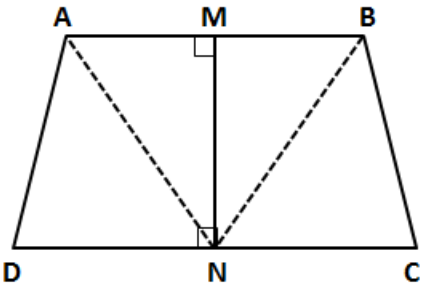
x	1	4	3
y	–1	2	1
(x, y)	(1, –1)	(4, 2)	(3, 1)



The co-ordinates of the point of intersection are (5, 3).
The solution of the given simultaneous equations
is x = 5 and y = 3.

Q. 10.

(a) Construction: Join AN and BN.



In ΔANM and ΔBNM,

AM = BM (M is the mid-point of AB)

∠AMN = ∠BMN (Each 90°)

MN = MN (common)

∴ ΔANM ≅ ΔBNM (by SAS congruence criterion)

⇒ AN = BN (c.p.c.t.) ... (i)

And ∠ANM = ∠BNM (c.p.c.t.)

⇒ 90° – ∠ANM = 90° – ∠BNM

⇒ ∠AND = ∠BNC ... (ii)

In ΔAND and ΔBNC,

AN = BN [From (i)]

∠AND = ∠BNC [From (ii)]

DN = CN (N is the mid-point of DC)

∴ ΔAND ≅ ΔBNC (by SAS congruence criterion)

⇒ AD = BC (c.p.c.t.)

(b)

Given $\log x = 2m - n$, $\log y = n - 2m$ and $\log z = 3m - 2n$

$$\log \frac{x^2y^3}{z^4} = \log x^2y^3 - \log z^4$$

$$= \log x^2 + \log y^3 - \log z^4$$

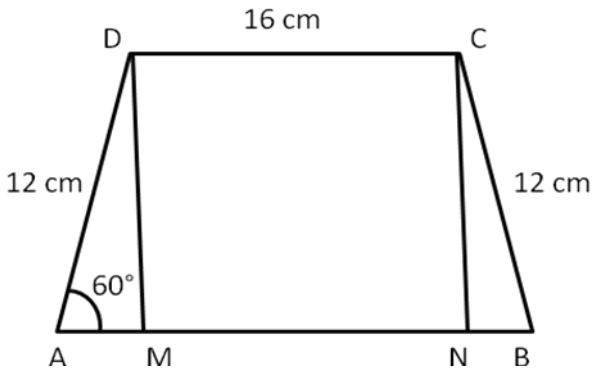
$$= 2\log x + 3\log y - 4\log z$$

$$= 2(2m - n) + 3(n - 2m) - 4(3m - 2n)$$

$$= 4m - 2n + 3n - 6m - 12m - 8n$$

$$= -14m - 7n$$

(c)



Since $MN = DC = 16$ cm,

In ΔAMD,

$$\sin 60° = \frac{DM}{AD}$$

$$\Rightarrow DM = AD \times \frac{\sqrt{3}}{2}$$

$$\Rightarrow DM = 12 \times \frac{\sqrt{3}}{2}$$

$$\Rightarrow DM = 6\sqrt{3} \text{ cm}$$

Since $DC \parallel AB, DM = CN = 6\sqrt{3}$ cm

In ΔAMD,

$$AD^2 = AM^2 + DM^2$$

$$\Rightarrow AM^2 = AD^2 - DM^2$$

$$\Rightarrow AM^2 = 12^2 - (6\sqrt{3})^2$$

$$\Rightarrow AM^2 = 144 - 108$$

$$\Rightarrow AM^2 = 36 \Rightarrow AM = 6 \text{ cm}$$

Since ABCD is an isosceles trapezium, $AM = NB = 6$ cm

(i) $AB = AM + MN + NB = 6 + 16 + 6 = 28$ cm

(ii) area of trapezium $ABCD = \frac{1}{2}(AB + DC) \times \text{height}$

$$= \frac{1}{2}(28 + 16) \times 6\sqrt{3}$$

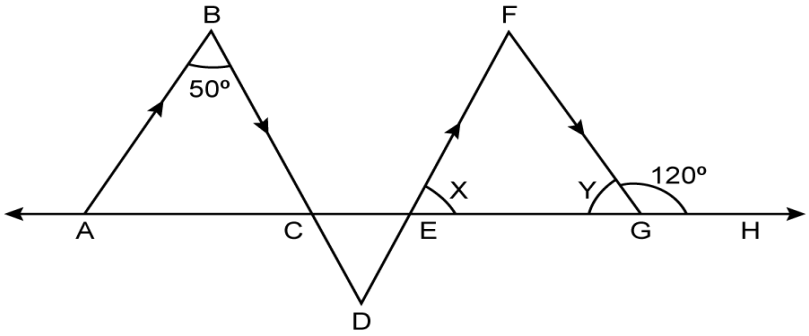
$$= \frac{1}{2} \times 44 \times 6\sqrt{3}$$

$$= \frac{1}{2} \times 44 \times 6 \times 1.732$$

$$= 228.63 \text{ cm}^2$$

Q. 11.

(a)



$\angle FGH + \angle FGE = 180°$ (linear pair)

$\Rightarrow 120° + y = 180°$

$\Rightarrow y = 60°$

AB ∥ DF and BD is the transversal.

$\Rightarrow \angle ABC = \angle CDE$ (alternate angles)

$\Rightarrow \angle CDE = 50°$

BD ∥ FG and DF is the transversal.

$\Rightarrow \angle EFG = \angle CDE$ (alternate angles)

$\Rightarrow \angle EFG = 50°$

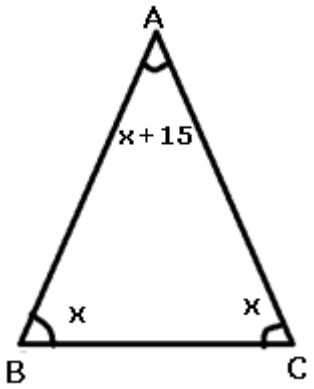
In ΔEFG, by the angle sum property,

$\angle FEG + \angle FGE + \angle EFG = 180°$

$\Rightarrow x + y + 50° = 180°$

$\Rightarrow x + 60° + 50° = 180° \Rightarrow x = 70°$

(b)



Let equal angles of the isosceles triangle be x each. Therefore, non-equal angle = x + 15^o

Angles of a triangle = 180°

∴ x + x + (x + 15^o) = 180°

∴ 3x + 15° = 180°

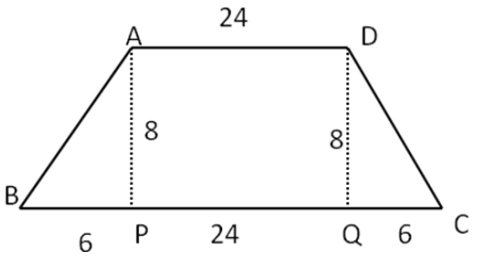
∴ 3x = 165°

∴ x = 55°

∴ x + 15 = 70°

Therefore, the angles are 55°, 55° and 70°.

(c)



Let the unequal sides of the isosceles trapezium be
2x and 3x respeectively.

Area of trapezium = $\frac{1}{2}(\text{Sum of parallel sides}) \times (\text{Distance between them})$

$\Rightarrow \frac{1}{2} \times (2x + 3x) \times 8$

$\Rightarrow \frac{1}{2} \times (2x + 3x) \times 8 = 240$

$\Rightarrow \frac{1}{2} \times 5x \times 8 = 240$

$\Rightarrow \frac{1}{2} \times 40x = 240 \Rightarrow x = 12$

The parallel sides of isosceles trapezium are 24 cm and 36 cm.
In the figure we can see that
ΔDCQ and ΔAPB are right angled triangle.
Hence from the figure we can see that
AD = PQ = 24 cm and
BC = PB + PQ +QC
$\Rightarrow$ 36 = 24 + 2BP (As, BP = QC)
$\Rightarrow$ BP = QC = 6 cm
In the right angled trangle ΔDCQ
$DQ^2 + QC^2 = DC^2$
$8^2 + 6^2 = 10^2$ (height of trapezium)
DC = 10 cm
Similarly,
For the ΔAPB
$AP^2 + BP^2 = AB^2$
$8^2 + 6^2 = AB^2$ (height of trapezium)
AB = 10 cm
Perimeter of trapezium is
AB + BC + CD + AD = 24 + 36 + 10 + 10
= 80 cm