SOLUTIONS SET – 1
MATHEMATICS – CLASS X

1. $84 = 2^2 \times 3 \times 7$

   $\therefore$ Prime factors of 84 are 2, 3 and 7.

2. Sum of zeroes = – 5 + 4 = – 1

   Product of zeroes = – 5 × 4 = – 20

   $\therefore$ Required polynomial = $x^2 - (-1)x + (-20)$

   $= x^2 + x - 20$

3. Given equation is $2x + 3y - 13 = 0$

   For x = 2, y = 3

   L.H.S becomes $2(2) + 3(3) - 13$

   $= 4 + 9 = 13$

   $= 13 - 13 = 0$

   = R.H.S

   Hence, x = 2, y = 3 is a solution of the given equation.

4. Here, first term = $\sqrt{2}$

   Second term = $\sqrt{8}$

   $\therefore$ Common difference = $\sqrt{8} - \sqrt{2} = \sqrt{2}$

   $\therefore$ Next term = $\sqrt{18} + \sqrt{2} = 4\sqrt{2}$

5. $\cos A = \frac{3}{5}$

   $\therefore \quad \sin A = \frac{4}{5}$

   Now, $\cot A = \frac{\cos A}{\sin A} = \frac{3}{4}$

   $\therefore \quad 9\cot^2 A - 1 = 9\left(\frac{3}{4}\right)^2 - 1$

   $= \frac{81 - 16}{16}$

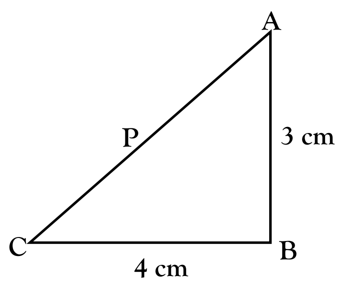
$= \frac{65}{16}$

6. Probability of losing = 1 – probability of winning

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

$= \frac{6}{11}$

7.

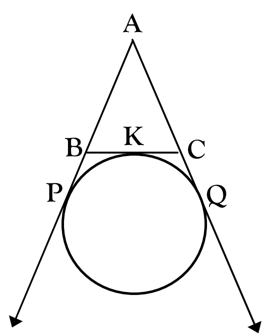


By Pythagoras theorem

$AC = \sqrt{AB^2 + BC^2} = 5$ cm

Now $AP = \frac{1}{2}AC = \frac{5}{2} = 2.5$ cm

8. Let BC touches the circle at point K



Now, AP = AQ = 10 cm

and BP = BK ... (i)

and CQ = CK ... (ii)

AB = AP – BP

AC = AQ – QC

and BC = BK + KC

Perimeter of ΔABC = AB + BC + AC

= AP – BP + BK + KC + AQ – QC

= AP + AQ ... [using (i) and (ii)]

= 10 + 10

= 20 cm

9. Let r_1 = 3 cm, r_2 = 4 cm and R be the radius of the required circle A.T.Q.

$\pi R^2 = \pi r_1^2 + \pi r_2^2$

$= \pi(r_1^2 + r_2^2)$

$\therefore \quad R^2 = r_1^2 + r_2^2$

$= 4^2 + 3^2$

$= 25$

$\therefore \quad R = 5$ cm

10. Median = 20.5

11. For zeros the quadratic polynomial is equated to O.

i.e. $2x^2 - 9 - 3x = 0$

or $2x^2 - 3x - 9 = 0$

$\Rightarrow \quad 2x^2 - 6x + 3x - 9 = 0$

$\Rightarrow \quad (2x + 3)(x - 3) = 0$

Now, either $2x + 3 = 0$ or $x - 3 = 0$

$\Rightarrow \quad 2x = -3 \Rightarrow x = 3$

$\Rightarrow \quad x = -\frac{3}{2}$

So, zeros of the equation are $-\frac{3}{2}$ and 3

Verification of relation

Here in the equation by equating with general equation we get

$a = 2, b = -3, c = -9$

(i) Now sum of zeros $= -\frac{3}{2} + 3 = \frac{-3+6}{2} = \frac{3}{2}$ and $-\frac{b}{a} = -\frac{(-3)}{2} = \frac{3}{2}$

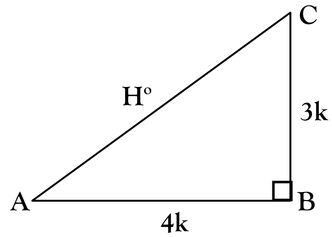
i.e. sum of zeros $= -\frac{b}{a}$

(ii) Product of zeros $= x_1.x_2 = -\frac{3}{2} \times 3 = -\frac{9}{2}$

Also $\frac{c}{a} = -\frac{9}{2}$

i.e. product of zeros $= \frac{c}{a} = \frac{\text{coefficient constt}}{\text{coefficient of } x^2}$

12. Given: $3 \cot \theta = A \Rightarrow \cot \theta = \frac{4}{3} = \frac{\text{Base}}{\text{perpendicular}}$



So in ΔABC, using Pythagoras

$AC^2 = AB^2 + BC^2 = (4k)^2 + (3k)^2$

$= (16 + 9)k^2 = 25k^2$

$AC = \sqrt{25k^2} = 5k$ (Neglecting – Negative as length can't be less than zero)

So $\sin \theta = \frac{3k}{5k}$ and $\cos \theta = \frac{4k}{5k}$

$$\frac{5\sin\theta - 3\cos\theta}{5\sin\theta + 3\cos\theta} = \frac{5 \times \frac{3}{5} - 3 \times \frac{4}{5}}{5 \times \frac{3}{5} + 3 \times \frac{4}{5}}$$

$$= \frac{15 - 12}{15 + 12} = \frac{3}{27} = \frac{1}{9}$$

OR

$$\left(\frac{\tan 20^\circ}{\operatorname{cosec} 70^\circ}\right)^2 + \left(\frac{\cot 20^\circ}{\sec 70^\circ}\right)^2 + 2 \tan 15^\circ \,.\, \tan 45^\circ \,.\, \tan 75^\circ$$

$$\Rightarrow \left(\frac{\sin 20^\circ}{\cos 20^\circ} \times \sin 70^\circ\right)^2 + \left(\frac{\cos 20^\circ}{\sin 20^\circ} \times \cos 70^\circ\right)^2 + 2 \tan 15^\circ \,.\, 1 \times \tan (90^\circ - 15^\circ)$$

$$= \left(\frac{\sin 20^\circ}{\cos 20^\circ} \times \cos 20^\circ\right)^2 + \left(\frac{\cos 20^\circ}{\sin 20^\circ} \times \sin 20^\circ\right) + 2 \tan 15^\circ \,.\, \cot 15^\circ$$

$$\left\{\begin{array}{l} \text{using formula} \\ \sin (90^\circ - \theta) - \cos \theta \\ \cos (90^\circ - \theta) = \sin \theta \\ \tan (90^\circ - \theta) = \cot \theta \end{array}\right\}$$

$= (\sin^2 20^\circ + \cos^2 20^\circ) + 2 \,.\, \tan 15 \times \frac{1}{\tan 15^\circ}$ {using $\cot \theta = \frac{1}{\tan \theta}$}

$= 1 + 2 = 3$ {using $\sin^2\theta + \cos^2\theta = 1$}

13. Given: $A(x_1, y_1) = (1, k)$, $B(x_2\ y_2) = (4, -3)$

$C(x_3, y_3) = (-9, 7)$

And Area(ΔABC)= 15 square units

We know Area of a triangle with coordinates (x_1, y_1), $(x_2\ y_2)$ $(x_3\ y_3)$ is

$$\text{Area} = \frac{1}{2} \left| x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) \right|$$

$\Rightarrow \quad 15 = \frac{1}{2} |1(-3 -7) + 4(7 - k) - 9 (k + 3)|$

$30 = |-10 + 28 - 4k - 9k - 27|$

or $\quad |-13k - 9| = 30$

$\Rightarrow$ either

$- 13k - 9 = 30$ or $-(-13k - 9) = 30$

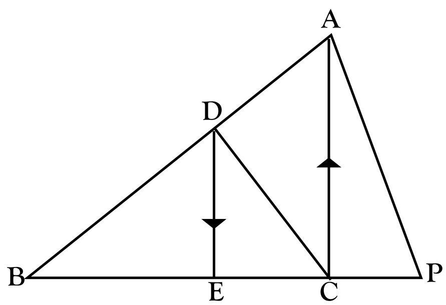
$-13k = 39$ $\quad 13k + 9 = 30$

$k = -\frac{39}{13} = 3$ $\quad 13k = 21$

$k = 3$ $\quad k = \frac{21}{13}$

$\Rightarrow \quad k = 3$ or $\frac{21}{13}$

14.



Given: DE || AC and $\frac{BE}{EC} = \frac{BC}{CP}$ ... (i)

To proof: DC || AP

Proofs: In ΔABC, DE || AC (Given)

$\Rightarrow \quad \frac{BE}{CE} = \frac{BD}{DA}$ ... (ii)

A line parallel to one side of a triangle divide the other two sides in the same ratio

Also $\frac{BE}{CE} = \frac{BC}{CP}$ (Given)

So we have $\frac{BD}{AD} = \frac{BC}{CP}$ ... (iii)

Now in ΔABP; $\frac{BD}{AD} = \frac{BC}{CD}$ (just proved)

$\Rightarrow$ DC || AP

(A line dividing two sides of a triangle in the same ratio is parallel to the third side)

15. Total number of cards in the box = 65

(i) Number of cards of one digit = (6, 7, 8, 9) = 4

Probability of 1 digit number = $\frac{4}{65}$

(ii) Total numbers divisible by 5 = (10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65 and 70) = 13

Probability of number divisible by 5 = $\frac{13}{65} = \frac{1}{5}$

16. $72 = 2^3 \times 3^2$

$126 = 2 \times 3^2 \times 7$

$168 = 2^3 \times 3 \times 7$

HCF = $2 \times 3 = 6$

LCM = $2^3 \times 3^2 \times 7 = 504$

HCF × LCM = $2 \times 3 \times 2^3 \times 3^2 \times 7 = 2^4 \times 3^3 \times 7$

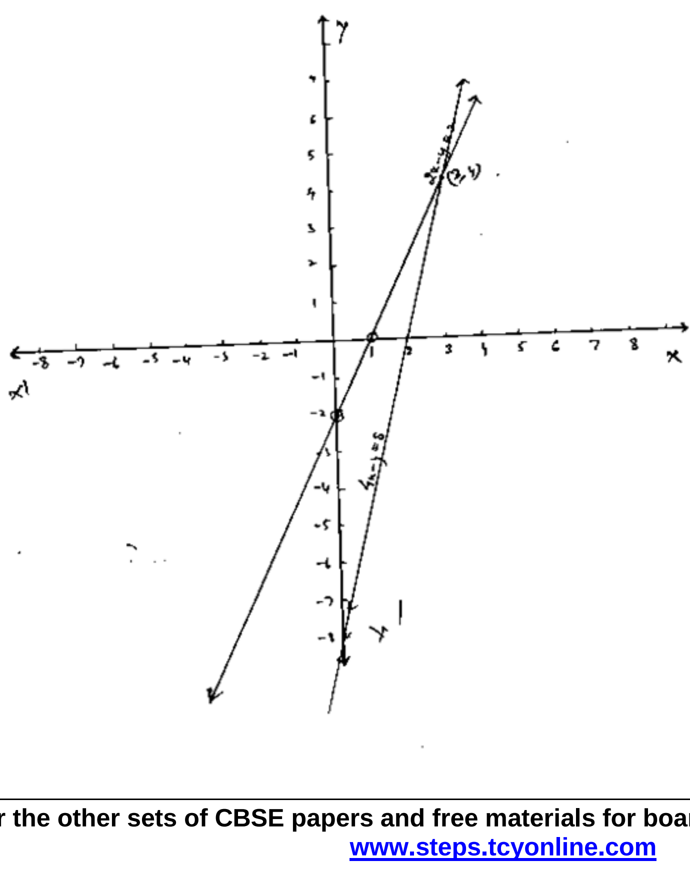
Product of numbers = $2^3 \times 3^2 \times 2 \times 3^2 \times 7 \times 2^3 \times 7 = 2^7 \times 3^5 \times 7^2$

∴ HCF × LCM ≠ Product of numbers.

17. $2x - y = 2$

$4x - y = 8$

The point of intersection is (3, 4).



18. $(a - b)x + (a + b)y = a^2 - 2ab - b^2$ ....(1)

$(a + b)x + (a + b)y = a^2 + b^2$ ....(2)

Subtracting (1) from (2), we get

$2bx = 2b^2 + 2ab$

$\Rightarrow x = a + b$

Substituting in (1)

$(a - b)(a + b) + (a + b)y = a^2 - 2ab - b^2$

$\Rightarrow (a + b)y = -2ab$

$\Rightarrow y = \dfrac{-2ab}{a + b}$

OR

For real and distinct roots, D > 0

$\therefore \quad 4(1 + 2m)^2 - 8m(3 + 2m) > 0$

$4 + 16m^2 + 16m - 24m - 16m^2 > 0$

$4 - 8m > 0$

$\Rightarrow \quad m < \dfrac{1}{2}$

For equal roots, D = 0

$\Rightarrow \quad m = \dfrac{1}{2}$

19. L.H.S. = $\dfrac{\cos\theta - \sin\theta + 1}{\cos\theta + \sin\theta - 1}$

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

$$= \dfrac{\cot\theta - 1 + \operatorname{cosec}\theta}{\cot\theta + 1 - \operatorname{cosec}\theta}$$

$$= \dfrac{\cot\theta - (\operatorname{cosec}^2\theta - \cot^2\theta) + \operatorname{cosec}\theta}{\cot\theta + 1 - \operatorname{cosec}\theta}$$

$$= \dfrac{\cot\theta + \operatorname{cosec} - (\operatorname{cosec}\theta - \cot\theta)(\operatorname{cosec}\theta + \cot\theta)}{\cot\theta + 1 - \operatorname{cosec}\theta}$$

$$= \dfrac{(\cot\theta + \operatorname{cosec}\theta)[1 - \operatorname{cosec}\theta + \cot\theta]}{[1 - \operatorname{cosec}\theta + \cot\theta]}$$

= cot θ + cosec θ

= R.H.S.

OR

R.H.S. = $\dfrac{1}{\tan\theta + \cot\theta}$

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

= $\dfrac{1}{\dfrac{\sin^2\theta + \cos^2\theta}{\cos\theta\sin\theta}}$

Also, R.H.S. = (cosec θ – sin θ) (sec θ – cos θ)

= $\left(\dfrac{1}{\sin\theta} - \sin\theta\right)\left(\dfrac{1}{\cos\theta} - \cos\theta\right)$

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

= $\dfrac{\cos^2\theta\sin^2\theta}{\sin\theta\cos\theta}$

= cos θ sin θ

Hence, R.H.S. = L.H.S.

20. The required A.P. is 10, 13, 16, ...,97

It is an A.P with a = 10, d = 3 and n = 30

$\therefore$ S = $\dfrac{n}{2}[2a + (n-1)d] = \dfrac{30}{2}[2 \times 10 + 29 \times 3] = 1605$

21. P is the mid-point of the line segment joining (2, –1) and (5, –6)

$\therefore$ Co-ordinates of P are $\left(\dfrac{7}{2}, \dfrac{-7}{2}\right)$

P lies on 2x + 3y + k = 0

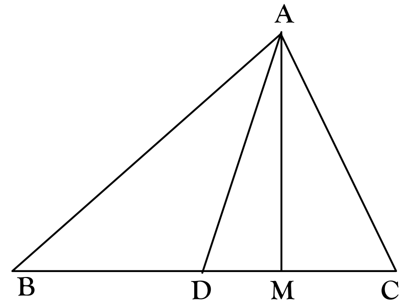
$\therefore\ 2 \times \dfrac{7}{2} + 4\left(-\dfrac{7}{2}\right) + k = 0$

7 – 14 + k = 0

$\Rightarrow$ k = 7

22. Given: A triangle ABC with AD as median

Construction : Draw AM perpendicular to BC.



In ΔABM, $AB^2 = AM^2 + BM^2$

$=(AD^2 - DM^2) + (BD + DM)^2$

$AB^2 = AD^2 + BD^2 + 2BD.DM$ .... (i)

In ΔAMC,

$AC^2 = AM^2 + MC^2$

$AC^2 = (AD^2 - DM)^2 + (CD - DM)^2$

$AC^2 = AD^2 + CD^2 - 2CD.DM$ ... (ii)

Adding (i) and(ii)

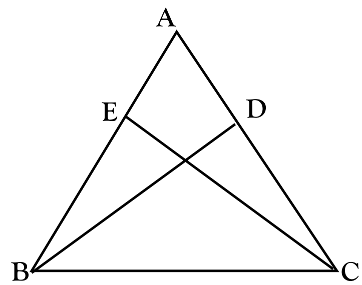
$AB^2 + AC^2 = AD^2 + BD^2 + 2BD.DM + AD^2 + CD^2 - 2CD.DM$

Since, BD = CD

$\Rightarrow \quad AB^2 + AC^2 = 2(AD^2 + BD^2)$

OR

Given: A triangle ABC with an acute angle ∠A and lines BD and CE perpendicular on lines AC and AB respectively.



To prove: AB × AE = AC × AD

In ΔABD and ΔACE

$\angle A = \angle A$

$\angle ADB = \angle AEC = 90^o$ [given]

Hence, $\Delta ABD \sim \Delta ACE$

So $\frac{AC}{AB} = \frac{AE}{AD}$

AC × AD = AE × AB

Hence proved

23. Let A(5, 6), B(1, 5), C(2, 1) and D(6, 2) be the vertices of the square. To show that it is a square we should use the property that all its sides should be equal and both its diagonals should also be equal.

Now,

$AB = \sqrt{(5-1)^2 + (6-5)^2} = \sqrt{(4)^2 + (1)^2} = \sqrt{17}$

$BC = \sqrt{(1-2)^2 + (5-1)^2} = \sqrt{1+16} = \sqrt{17}$

$CD = \sqrt{(2-6)^2 + (1-2)^2} = \sqrt{16+1} = \sqrt{17}$

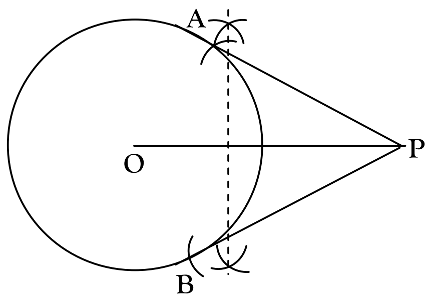
$DA = \sqrt{(6-5)^2 + (2-6)^2} = \sqrt{1+16} = \sqrt{17}$

AC = $\sqrt{(5-2)^2 + (6-1)^2} = \sqrt{9+25} = \sqrt{34}$

BD = $\sqrt{(1-6)^2 - (5-2)^2} = \sqrt{25+9} = \sqrt{34}$

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

24.



PA and PB are the required tangents.

25. Radius of circle is OA = R = 14 cm.

Radius of circle with diameter OD = r = 7 cm

So area of this circle is πr^2.

$= \frac{22}{7} \times 7 \times 7 = 154\ cm^2$.

Area of the semicircle = $\frac{1}{2}(\pi R^2)$

$= \frac{1}{2} \times \frac{22}{7} \times 14 \times 14 = 308\ cm^2$

Area of the shaded portion = (area of circle with radius r) + (area of semicircle with radius R) – (area of the triangle)

$= 154 + 308 - \frac{1}{2} \times 28 \times 14$

$= 154 + 308 - 196 = 266\ cm^2$

26. Let the number of persons be = n

If Rs. 6500 is divided equals than each willg et = Rs. $\frac{6500}{n}$

If number of person are increased by 15 i.e. n + 15 than each person will get Rs. 30 less.

So according to question.

$$\frac{6500}{n+15} = \frac{6500}{n} - 30$$

$$30 = \frac{6500}{n} - \frac{6500}{n+15}$$

$$30 = 6500\left(\frac{1}{n} - \frac{1}{n+15}\right)$$

$$\therefore \quad 30 = 6500\left(\frac{15}{(n)\,(n+15)}\right)$$

$$(n)\,(n+15) = \frac{6500 \times 15}{30}$$

$n^2 + 15n - 32\sqrt{0} = 0$

$n^2 + 65n - 50n - 3250 = 0$

$n(n + 65) - 50(n + 65) = 0$

$n = 50, - 65$

So number of person are 50.

OR

Let the speed of train b = v km/h

So time taken by train to cover 360 km = $\frac{360}{v}$ hours

Now if the speed is increased by 5 km/h i.e. v + 5 km/h then time reduces by one hour.

So according to question

$$\frac{360}{v} - 1 = \frac{360}{v+5}$$

$$\frac{360}{v} - \frac{360}{v+5} = 1$$

$$360\left(\frac{1}{v} - \frac{1}{v+5}\right) = 1$$

$$\frac{360 \times 5}{(v)\,(v+5)} = 1$$

$\Rightarrow \quad (v)\,(v + 5) = 1800$

$v^2 + 5v - 1800 = 0$

$v^2 + 45v - 40v - 1800 = 0$

$v(v + 45) - 40(v + 45) = 0$

$(v - 40)\,(v + 45) = 0$

$v = 40, - 45$

So original speed of train is 40 km/h

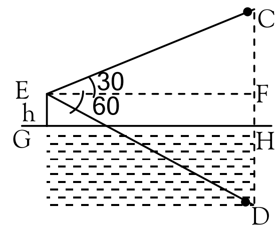
27. Let GH be the upper surface of the lake, C be the position of the cloud,

D be its reflection in the lake and E be the eye of the observer.

Draw EF ⊥ CD and EG ⊥ GH. Then,

GE = 60, ∠FEC = 30° and ∠FED = 60°.

Clearly, FH = GE = h. Let height of the cloud = HC = HD = x.



∴ FC = x – 60 and FD = x + 60.

Now, $\frac{EF}{FD}$ = cot 60°

⇒ EF = (x + 60) cot 60 = (x + 60)$\frac{1}{\sqrt{3}}$

Also $\frac{EF}{FC}$ = cot 30°

⇒ EF = (x – 60) $\sqrt{3}$

∴ EF = (x – 60) $\sqrt{3}$ = (x + 60)$\frac{1}{\sqrt{3}}$ 3(x – 60) = (x + 60)

3x – 180 = x + 60

2x = 240

x= 120

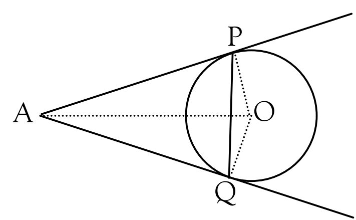
Height of the cloud = 120 m

28. The length of two tangents drawn from an external point to a circle are equal.

Given: Two tangents AP and AQ drawn from a point A to a circle C(O, r).

To prove: AP = AQ.

Construction: Join OP, OQ, and OA.



Proof: Since a tangent at any point of a circle is perpendicular to the radius through the point of contact, we have OP ⊥ AP and OQ ⊥ AQ.

Now, in right triangles OPA and OQA, we have

OP = OQ (radii)

and OA = OA (common)

∴ ΔOPA ≅ ΔOQA

Hence, AP = AQ.

Part II

In ΔAPQ

$AP = AQ$ (Proved)

$\therefore \quad \angle 1 = \angle 2$ (Angles opposite to equal sides)

$\angle 1 + \angle 2 + \angle 3 = 180^o$ (Sum of angles of Δ's) ...(i)

$\therefore \quad \angle 4 = \angle 5$ (Angles opposite to radii)

$\angle 4 + \angle 5 + \angle 6 = 180^o$ ... (ii)

Adding (i) and (ii)

$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 360^o$

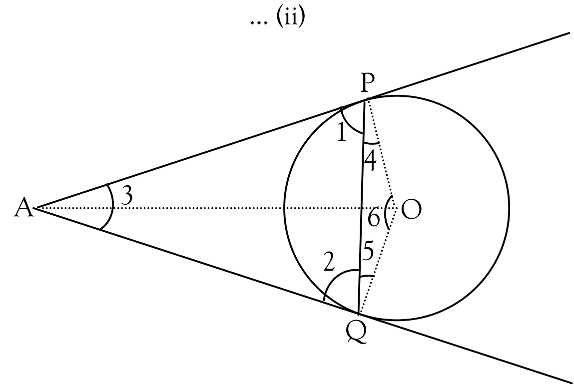
$2\angle 1 + 2\angle 4 + \angle 3 + \angle 6 = 360^o$

$2(\angle 1 + \angle 4) + \angle 3 + \angle 6 = 360^o$

$2 \times 90^o + \angle 3 + \angle 6 = 360^o$ (as $OQ \perp AQ$)

$\angle 3 + \angle 6 = 360^o - 180^o = 180^o$

$\angle 3$ and $\angle 6$ are supplementary



OR

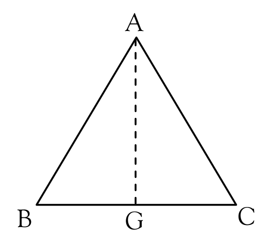
The ratio of the areas of two similar triangles is equal to the ratio of the squares of the corresponding sides.

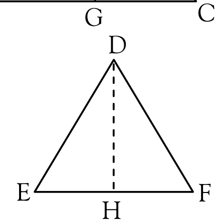
Given: ΔABC and ΔDEF are two similar triangles.

To prove:

(i) $$\frac{ar\ (\Delta ABC)}{ar\ (\Delta DEF)} = \frac{BC^2}{EF^2} = \frac{AB^2}{DE^2} = \frac{AC^2}{DF^2}$$

Construction: Draw $AG \perp BC$ and $DH \perp EF$.





Proof: (i) $$\frac{ar\ (\Delta ABC)}{ar\ (\Delta DEF)} = \frac{\frac{1}{2} \times BC \times AG}{\frac{1}{2} \times EF \times DH} = \frac{BC}{EF} \times \frac{AG}{DH} \quad ...(i)$$

($\because$ area of $\Delta = \frac{1}{2}$ base × height)

Now, in Δ s ABG and DEH, we have

$\angle B = \angle E$ ($\because \Delta ABC \sim \Delta DEF$)

$\angle AGB = \angle DHE$ (each equal to 90^o)

$\therefore \Delta ABG \sim \Delta DEH$ (AA Similarity)

$$\therefore \frac{AB}{DE} = \frac{AG}{DH}$$

($\because$ If Δs are similar, the ratio of their corresponding sides is same)

But $\frac{AB}{DE} = \frac{BC}{EF}$ ($\because \Delta$ ABC ~ Δ DEF)

$\Rightarrow \frac{AG}{DH} = \frac{BC}{EF}$ ...(ii)

Now, from (i) and (ii), we have: $\frac{ar\ (\Delta ABC)}{ar\ (\Delta DEF)} = \frac{BC}{EF} \times \frac{BC}{EF} = \frac{BC^2}{EF^2}$

Similarly we can prove $\frac{ar\ (\Delta ABC)}{ar\ (\Delta DEF)} = \frac{BC^2}{EF^2} = \frac{AB^2}{DE^2} = \frac{AC^2}{DF^2}$ ---- (1)

If the area of two similar triangle are equal i.e ar(ΔABG) = ar(ΔDEH)

Using the above relation:

$$\frac{ar\ (\Delta ABC)}{ar\ (\Delta DEF)} = \frac{BC^2}{EF^2} = \frac{AB^2}{DE^2} = \frac{AC^2}{DF^2}$$

$$1 = \frac{BC^2}{EF^2} = \frac{AB^2}{DE^2} = \frac{AC^2}{DF^2}$$

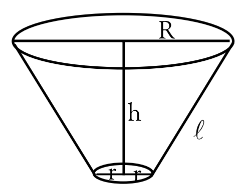
We get BC = EF , AB = DE and DF = AC

Now, in Δ s ABG and DEH, we have BC = EF , AB = DE and DF = AC

$\therefore$ ΔABG ≅ ΔDEH (using SSS)

29. Radius of top R = 28 cm

Radius of bottom r = 7 cm



Let height of the bucket = h

Capacity of the bucket =21560 cm^3

As capacity= $\frac{\pi h}{3}[R^2 + r^2 + Rr]$

21560 = $\frac{\pi h}{3}[R^2 + r^2 + Rr]$ = (22/7) (h/3) ($28^2 + 7^2$ + 28 x 7)

21560 = 1078 h

h= 20

Slant height of Frustum = $\sqrt{h^2 + (R - r)^2} = \sqrt{20^2 + (28 - 7)^2} = \sqrt{400 + 441} = \sqrt{841}$ = 29

Total surface area = $\pi[\ell(R + r) + r^2]$ = 3344 cm^2

Classes	Frequency (f_i)	Class mark x_1	$f_i x_i$	Cumulative frequency
10 – 20	4	15	60	4
20 – 30	8	25	200	12
30 – 40	10	35	350	22
40 – 50	12	45	540	34
50 – 60	10	55	550	44
60 – 70	4	65	260	48
70 – 80	2	75	150	50
	$\sum f_i = 50$		$\sum f_i x_i = 2110$	

Mean = $\frac{\sum f_i x_i}{\sum f_i} = \frac{2110}{50} = 42.20$

Calculation of median

Since n = 50.

So, $\frac{n}{2} = \frac{50}{2} = 25$ This observation lies in 40 – 50.

$\therefore \ \ell = 40, f = 12, cf = 22, h = 10$

We know, median = $\ell + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h = 40 + \left(\frac{\frac{50}{2} - 22}{12}\right) \times 10 = 40 + 2.5 = 42.5$

Calculation of mode

Here the maximum class frequency is 12 and the class corresponding to this frequency is 40 – 50

So, modal class is 40 – 50

Lower limit (ℓ) of modal class = 40

Frequency (f_1) of modal class = 12

Frequency (f_0) of class preceding modal class = 10

Frequency (f_2) of class succeeding modal class = 10

We know, Mode = $\ell + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 40 + \left[\frac{(12-10)}{2 \times 12 - 10 - 10}\right] \times 10 = 40 + \frac{2 \times 10}{4} = 40 + 5 = 45.$