1. (*d*) Let $\alpha = 3$ and $\beta = -2$.

$\alpha + \beta = 1$ and $\alpha\beta = -6$

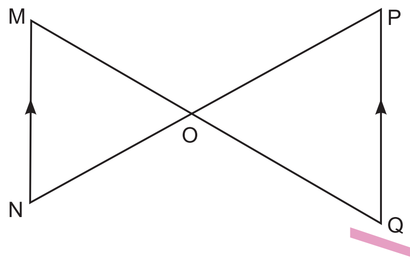
$$\text{Now, } p(x) = k\{x^2 - (\alpha + \beta)x + \alpha\beta\}$$
$$= k\{x^2 - x - 6\}$$

k is any real number.

2. (*a*) Intersecting points of $x = 0$ and $y = 0$ is (0, 0)

one solution

3. (*c*) MN || PQ



$\therefore$ $\angle M = \angle Q$ [Alternate interior angles]

$\angle N = \angle P$ [Alternate interior angles]

Also, $\angle MON = \angle POQ$ [Vertically opposite angles]

$\therefore$ $\Delta MON \sim \Delta QOP$ [AAA similarity rule]

4. (*b*)

$$(\cos A - \sin A)^2 = 1^2$$
$$\Rightarrow \cos^2 A + \sin^2 A - 2 \sin A \cos A = 1$$
$$\Rightarrow 1 - 2 \sin A \cos A = 1$$
$$\Rightarrow 2 \sin A \cos A = 0$$
$$(\cos A + \sin A)^2 = \cos^2 A + \sin^2 A + 2 \sin A \cos A$$
$$= 1 + 0$$
$$= 1$$
$$\Rightarrow \cos A + \sin A = \pm 1$$

5. (*a*)

$$\sec^2 \theta - 2 \tan^2 \theta = 0$$
$$\Rightarrow \sec^2 \theta = 2 \tan^2 \theta$$
$$\Rightarrow 1 + \tan^2 \theta = 2 \tan^2 \theta$$
$$\Rightarrow 1 = \tan^2 \theta$$
$$\Rightarrow \theta = 45°$$

6. (*d*) $(a \times b)^n$ ends with the digit zero for every natural number n, that means it is divisible by 10. Hence, a and b must be multiples of 2 and 5.

7. (*a*) For $0 \le \theta \le 90°$

$$0 \le \sin \theta \le 1$$

i.e. $\sin \theta > 1$ not possible

8. (*c*) MP = PQ [Length of tangents drawn from an external points are equal]

and NP = PQ

Now, MN = MP + NP = 3 cm + 3 cm = 6 cm

9. (*c*) Length of arc $= \pi r \dfrac{\theta}{180°}$

$$= \frac{22}{7} \times 10 \times \frac{45°}{180°}$$

$$= \frac{55}{7} \text{ cm}$$

10. (*d*) Let $\alpha = \dfrac{2}{3}$ and $\beta = \dfrac{-1}{2}$

Now, $\alpha + \beta = \dfrac{2}{3} - \dfrac{1}{2} = \dfrac{1}{6}$

and $\alpha\beta = \dfrac{2}{3} \times \left(\dfrac{-1}{2}\right) = \dfrac{-1}{3}$

Required quadratic equation is,

$$x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

$$\Rightarrow \quad x^2 - \frac{1}{6}x - \frac{1}{3} = 0$$

$$\Rightarrow \quad 6x^2 - x - 2 = 0$$

11. (*d*) PQ || BC, then

$$\frac{AP}{PB} = \frac{AQ}{QC} \text{ (BPT)}$$

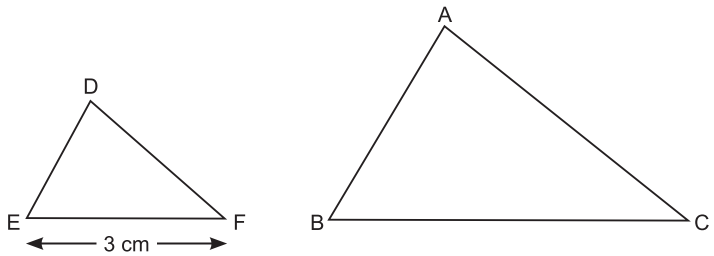
$$\Rightarrow \quad \frac{x}{4x+1} = \frac{x+3}{4x+14}$$

$$\Rightarrow \quad x(4x + 14) = (x + 3)(4x + 1)$$

$$\Rightarrow \quad 4x^2 + 14x = 4x^2 + x + 12x + 3$$

$$\Rightarrow \quad x = 3$$

12. (*c*) We have $\Delta ABC \sim \Delta DEF$; AB = 3DE; EF = 3 cm



Now, $\dfrac{AB}{DE} = \dfrac{BC}{EF}$ [Corresponding sides of similar Δ's]

$$\Rightarrow \quad \frac{3DE}{DE} = \frac{BC}{3} \Rightarrow BC = 9 \text{ cm}$$

13. (*c*) Volume of water displaced = volume of sphere

$$= \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \frac{22}{7} \times 5.25 \times 5.25 \times 5.25$$

$$= 606.38 \text{ cm}^3$$

14. (*d*) Diameter of sphere $(2r)$ = Diameter of cylinder $(2r)$ = Height of cylinder (h)

$$\therefore \quad 2r = h$$

$$\frac{\text{CSA of cylinder}}{\text{TSA of sphere}} = \frac{2\pi rh}{4\pi r^2} = \frac{2r}{2r} = \frac{1}{1}$$

$$\text{Ratio} = 1 : 1.$$

15. (*a*) If P(E) is probability of Rahul win the match, then $P(\overline{E})$ is the probability of Rahul not winning the match.

$\therefore$ P(E) + $P(\overline{E}) = 1 \Rightarrow 0.62 + P(\overline{E}) = 1 \Rightarrow P(\overline{E}) = 0.38$

16. (*c*) Mode = 3 Median – 2 Mean.

17. (*d*)

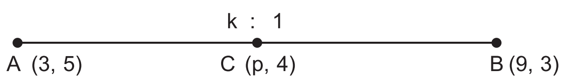
Class interval	*f*	*cf*
0 – 5	12	12
5 – 10	11	23
10 – 15	15	38
15 – 20	9	47
20 – 25	10	57

Now, $\dfrac{n}{2} = \dfrac{57}{2} = 28.5$

So, median class = 10 – 15

$\therefore$ Upper limit = 15

18. (*d*)



Let AC : BC = $k : 1$

Now, $$(x, y) = \left(\frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1}\right)$$

$$\Rightarrow \quad (p, 4) = \left(\frac{9k+3}{k+1}, \frac{3k+5}{k+1}\right)$$

$$\therefore \quad \frac{3k+5}{k+1} = 4$$

$$\Rightarrow \quad 3k + 5 = 4k + 4 \Rightarrow k = 1$$

Now, $$p = \frac{9k+3}{k+1} = \frac{12}{2} = 6$$

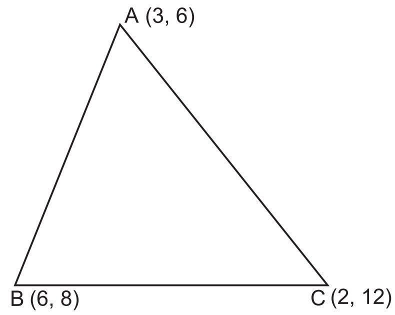
19. (*a*) The given number is $\sqrt{3} + \sqrt{5}$.

$\sqrt{3}$ and $\sqrt{5}$ both are irrational numbers because 3 and 5 are prime natural numbers and also $\sqrt{3}$ and $\sqrt{5}$ cannot be written in the form of $\dfrac{p}{q}$, where p is any integer and $q \neq 0$.

$\therefore$ $\sqrt{3} + \sqrt{5}$ is an irrational number

Hence, both assertion(A) and reason(R) are true and reason(R) is correct explanation of assertion(A).

20. (*d*) Distance formula $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$



$$\text{AB} = \sqrt{(6-3)^2 + (8-6)^2}$$
$$= \sqrt{9+4}$$
$$= \sqrt{13} \text{ units}$$
$$\text{AC} = \sqrt{(3-2)^2 + (6-12)^2}$$
$$= \sqrt{1+36}$$
$$= \sqrt{37} \text{ units}$$
$$\text{BC} = \sqrt{(6-2)^2 + (8-12)^2}$$
$$= \sqrt{16+16} = \sqrt{32} \text{ units.}$$

$\therefore$ AB $\neq$ AC $\neq$ BC

ΔABC is not an isosceles triangle because in isosceles triangle two sides are equal in lengths.

$\therefore$ Assertion(A) is false but reason(R) is true.

21.
$$2x + 5y = 10 \quad ...(i)$$
$$3x + 6y = 20 \quad ...(ii)$$

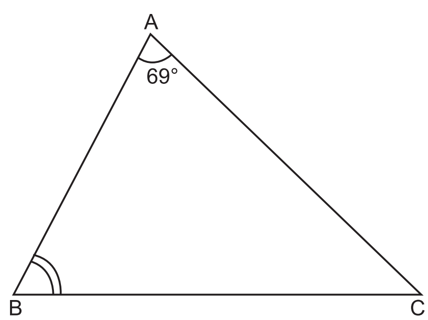
Now multiplying equation (*i*) by 3 and equation (*ii*) by 2 and subtracting equation (*ii*), from (*i*), we get

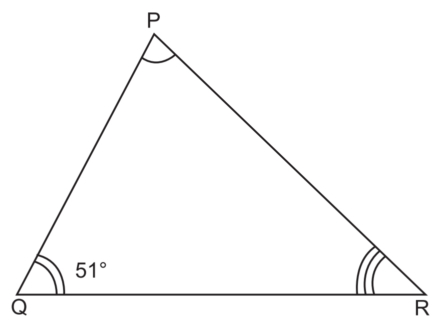
$$6x + 15y = 30$$
$$\underline{\overset{}{-}6x \; \overset{}{-} \; 12y = \overset{}{-}40}$$
$$3y = -10$$
$$y = \frac{-10}{3}$$

Putting the value of *y* in equation (*ii*), we get

$$3x + 6\left(\frac{-10}{3}\right) = 20 \;\Rightarrow\; 3x = 40 \;\Rightarrow\; x = \frac{40}{3}$$

22.





ΔABC $\sim$ ΔPQR [Given]

$\therefore$ $\angle$A = $\angle$P [Corresponding angles of similar triangles]

In ΔPQR

$\therefore$ $\angle P + \angle Q + \angle R = 180°$

$\Rightarrow$ $69° + 51° + \angle R = 180° \;\Rightarrow\; \angle R = 180° - 120°$

$\Rightarrow$ $\angle R = 60°$

23.
$$\text{LHS} = \frac{1 + \operatorname{cosec}\theta}{\operatorname{cosec}\theta}$$
$$= \frac{1 + \frac{1}{\sin\theta}}{\frac{1}{\sin\theta}}$$

$$= \frac{\sin\theta + 1}{\sin\theta} \times \frac{\sin\theta}{1}$$

$$= \sin\theta + 1$$

$$\text{RHS} = \frac{\cos^2\theta}{1 - \sin\theta}$$

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

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

$$= 1 + \sin\theta$$

$\therefore$ LHS = RHS

OR

$$\text{LHS} = (1 - \sin\theta)(\sec\theta + \tan\theta)$$

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

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

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

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

$$= \cos\theta = \text{RHS}$$

$\therefore$ LHS = RHS

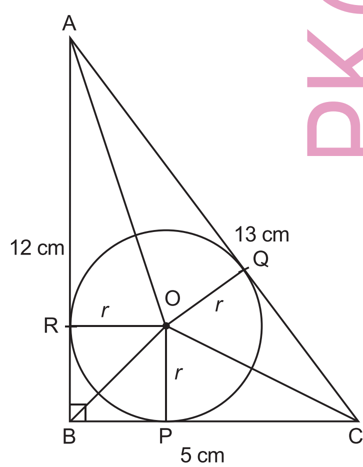
24. In ΔABC, $\angle ABC = 90^\circ$ [Given]

Now, $AB = 12$ cm; $BC = 5$ cm

Now, $AC^2 = AB^2 + BC^2$ [Pythagoras Theorem]

$= 12^2 + 5^2 = 169$

$\therefore$ $AC = 13$ cm



Area of $\Delta ABC = \frac{1}{2} \times BC \times AB = \frac{1}{2} \times 12 \times 5 = 30 \text{ cm}^2$

Also area of $(\Delta ABC) = ar(\Delta AOB) + ar(\Delta BOC) + ar(\Delta AOC)$

$= \frac{1}{2} \times r \times AB + \frac{1}{2} \times r \times BC + \frac{1}{2} \times r \times AC$

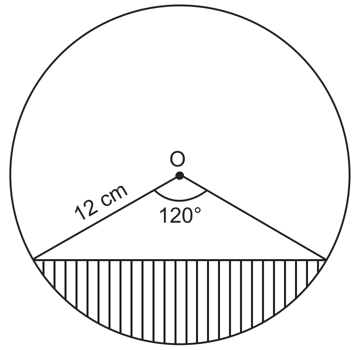
$= \frac{1}{2} r(AB + BC + AC)$

$= \frac{1}{2} r(30)$

$= 15r \text{ cm}^2$

$\therefore$ $15r = 30 \Rightarrow r = 2$ cm

25. Area of segment $= \pi r^2 \dfrac{\theta}{360°} - r^2 \sin\dfrac{\theta}{2}\cos\dfrac{\theta}{2}$



$$= r^2\left[3.14 \times \frac{120°}{360°} - \sin 60° \cos 60°\right]$$

$$= 12 \times 12\left[\frac{3.14}{3} - \frac{\sqrt{3}}{4}\right]$$

$$= 12 \times 12\left[\frac{12.56 - 5.19}{12}\right]$$

$$= 12 \times 7.37 = 88.44 \text{ cm}^2$$

OR

Angle swept by minute hand in 10 minutes, $\theta = \dfrac{360°}{60°} \times 10 = 60°$

Area swept by minute hand in 10 minutes $= \pi r^2 \dfrac{\theta}{360°}$

$$= 3.14 \times 10 \times 10 \times \frac{60°}{360°}$$

$$= \frac{314}{6} = 52.33 \text{ cm}^2$$

26. Let $\sqrt{5}$ is a rational number

$\sqrt{5} = \dfrac{a}{b}$, where a and b are co-prime integers and $q \neq o$.

$\Rightarrow \quad a = \sqrt{5}b$

$\Rightarrow \quad a^2 = 5b^2$ ...(*i*)

$\therefore \quad a^2$ is divisible by 5.

So. a is also divisible by 5, Then

$a = 5c$, where c is any integer.

$\Rightarrow \quad a^2 = 25c^2$

$\therefore \quad b^2 = 5c^2$ (Using (*i*))

$\therefore$ b^2 is divisible by 5.

So, b is also divisible by 5.

That means, both a and b are divisible by 5, but a and b are co-prime. This contradiction arises due to our wrong assumption that $\sqrt{5}$ is a rational number.

$\therefore$ Hence, $\sqrt{5}$ is an irrational number.

27.

$$\sin\theta = \frac{1}{\operatorname{cosec}\theta} = \frac{1}{\sqrt{1+\cot^2\theta}}$$

$$\cos\theta = \frac{1}{\sec\theta} = \frac{1}{\sqrt{1+\tan^2\theta}} = \frac{\cot\theta}{\sqrt{1+\cot^2\theta}}$$

$$\tan\theta = \frac{1}{\cot\theta}$$

$$\sec\theta = \sqrt{1+\tan^2\theta} = \sqrt{\frac{\cot^2\theta + 1}{\cot^2\theta}}$$

$$= \sqrt{\frac{1+\cot^2\theta}{\cot\theta}}$$

$$\operatorname{cosec}\theta = \sqrt{1+\cot^2\theta}$$

28. $199x - 201y = 197$ ...(*i*)

$-201x + 199y = -203$ ...(*ii*)

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

$$-2x - 2y = -6$$

$\Rightarrow$ $x + y = 3$ ...(*iii*)

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

$$400x - 400y = 400$$

$\Rightarrow$ $x - y = 1$ ...(*iv*)

On solving (*iii*) and (*iv*), we get

$$x = 2, y = 1$$

OR

Let unit's place be x and ten's place be y.

According to first condition

$x + y = 12$ ...(*i*)

$$\text{2-digit number} = 10y + x$$

According to second condition

$$(10y + x) - (10x + y) = 18$$

$\Rightarrow$ $10y + x - 10x - y = 18$

$\Rightarrow$ $9y - 9x = 18$

$\Rightarrow$ $y - x = 2$

$\therefore$ $x - y = -2$ ...(*ii*)

On Adding (*i*) and (*ii*), we get

$x + y = 12$ ...(*i*)

$x - y = -2$ ...(*ii*)

$\therefore$ $2x = 10$

$\Rightarrow$ $x = 5$

Putting the value of x in equation (*i*) we get

$$y = 7$$

$$\text{Original number} = 10y + x$$

$$= 10 \times 7 + 5 = 75$$

29. $p(x) = 2x^2 - 5x + 3$

Since α and β are zeroes of the polynomial then

Sum of zeroes, $(\alpha + \beta) = \frac{5}{2}$, product of zeroes, $(\alpha\beta) = \frac{3}{2}$

$$\text{Sum of zeroes} = \frac{1}{\alpha^2} + \frac{1}{\beta^2}$$

$$= \frac{(\alpha + \beta)^2 - 2\alpha\beta}{(\alpha\beta)^2}$$

$$= \frac{\frac{25}{4} - 3}{\frac{9}{4}}$$

$$= \frac{25 - 12}{4} \times \frac{4}{9} = \frac{13}{9}$$

$$\text{Product of zeroes} = \frac{1}{\alpha^2} \times \frac{1}{\beta^2} = \frac{1}{(\alpha\beta)^2} = \frac{4}{9}$$

$$\text{Polynomial is } f(x) = k\left\{x^2 - \frac{13x}{9} + \frac{4}{9}\right\} = 9x^2 - 13x + 4 \quad (\text{taking } k = 9)$$

30. Let S be the sample space.

S = {HHH, HHT, HTH, THH, TTT, TTH, THT, HTT}

(*i*) Number of outcomes having at least two tails = 4

E_1 : At least two tails

$$\therefore \quad P(E_1) = \frac{\text{Number of outcomes having at least two tails}}{\text{Total number of outcomes}}$$

$$= \frac{4}{8} = \frac{1}{2}$$

(*ii*) E_2 : At most two heads

Number of outcomes having at most two heads = 7

$$\therefore \quad P(E_2) = \frac{\text{Number of outcomes having at most two heads}}{\text{Total number of outcomes}}$$

$$= \frac{7}{8}$$

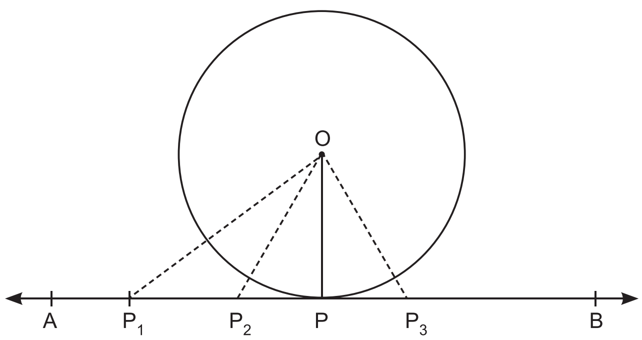
(*iii*) E_3 : Two heads

Number of outcomes having two heads = 3

$$\therefore \quad P(E_3) = \frac{\text{Number of outcomes having two heads}}{\text{Total number of outcomes}}$$

$$= \frac{3}{8}$$

31.



Given: A circle with centre O. AB is a tangent with point of contact P.

To prove: OP ⊥ AB.

Construction: Mark points P_1, P_2, P_3 ... on AB other than P and join with centre O.

Proof: $OP_1 > \text{Radius}$

$OP_2 > \text{Radius}$

$OP_3 > \text{Radius}$

.

.

.

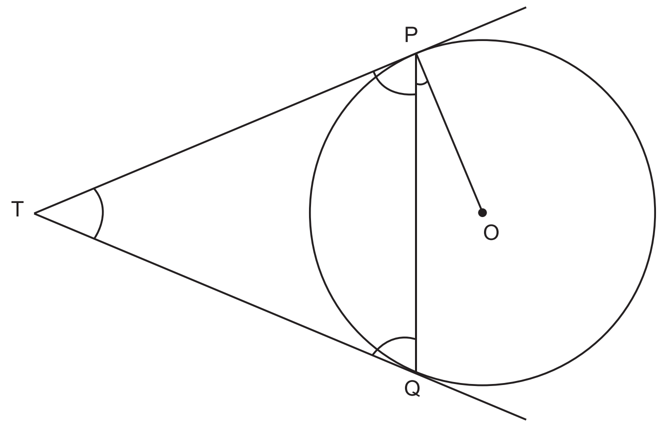
$OP = \text{Radius}$

i.e. $OP_1, OP_2, OP_3, \ldots > OP$

$\therefore$ OP is the shortest path from O to AB and shortest path is always perpendicular.

Hence, $OP \perp AB$

OR



Given: TP and TQ are two tangents to a circle with centre O with points of contact P and Q respectively.

To prove: $\angle PTQ = 2\angle OPQ$

Proof: In ΔPTQ,

$TP = TQ$ [Length of tangents from an external point]

$\therefore \quad \angle TQP = \angle TPQ$ [Angles opposite to equal sides of a triangle]

Now, $\angle TPQ + \angle TQP + \angle PTQ = 180°$ [Angle sum property of triangle]

$\Rightarrow \quad \angle TPQ + \angle TPQ + \angle PTQ = 180°$ [$\because \angle TPQ = \angle TQP$]

$\Rightarrow \quad 2\angle TPQ + \angle PTQ = 180°$ ...(*i*)

Now, $\angle OPT = 90°$ [Tangent is perpendicular to radius drawn through point of contact]

$\therefore \quad \angle OPQ + \angle TPQ = 90°$

$\therefore \quad \angle TPQ = 90° - \angle OPQ$ ...(*ii*)

Putting value of $\angle TPQ$ in equation (*i*), we get

$2(90° - \angle OPQ) + \angle PTQ = 180°$

$\Rightarrow \quad 180° - 2\angle OPQ + \angle PTQ = 180°$

$\therefore \quad \angle PTQ = 2\angle OPQ$ Hence proved.

32.

Class interval	Frequency
0–10	5
10–20	13
20–30	*x*
30–40	22
40–50	30
50–60	*y*
Total	100

$$x + y + 70 = 100$$

$$\Rightarrow \quad x + y = 30 \quad \ldots(i)$$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \quad 44 = 40 + \left(\frac{30 - 22}{2 \times 30 - 22 - y}\right) \times 10$$

$$\Rightarrow \quad 4 = \frac{8}{38 - y} \times 10$$

$$\Rightarrow \quad 152 - 4y = 80 \quad \Rightarrow \quad y = 18$$

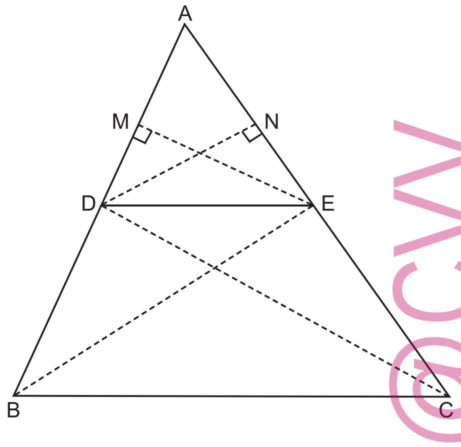
Now, $x + 18 = 30$ [Using (i)]

$$\Rightarrow \quad x = 12$$

$$\therefore \quad x = 12, y = 18$$

33. **Statement:** If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

Given: ΔABC in which DE || BC, where D and E are the points on AB and AC respectively.



To prove: $\frac{AD}{DB} = \frac{AE}{EC}$

Construction: Join BE and CD and Draw EM ⊥ AB and DN ⊥ AC.

Proof:

$$\frac{\text{Area of } \Delta ADE}{\text{Area of } \Delta DEB} = \frac{\frac{1}{2} \times AD \times EM}{\frac{1}{2} \times DB \times EM}$$

$$\therefore \quad \frac{ar(\Delta ADE)}{ar(\Delta DEB)} = \frac{AD}{DB} \quad \ldots(i)$$

Similarly

$$\therefore \quad \frac{ar(\Delta ADE)}{ar(\Delta DEC)} = \frac{AE}{EC} \quad \ldots(ii)$$

Now, $ar(\Delta DEB) = ar(\Delta DEC)$ ...(iii) [Triangles on same base and between same || lines]

From equations (i), (ii) and (iii), we get

$$\frac{AD}{DB} = \frac{AE}{EC}$$

34. Volume of wood = Volume of cuboid – 4 × Volume of a conical depression

$$= LBH - 4 \times \frac{1}{3}\pi r^2 h$$

$$= 10 \times 6 \times 4 - 4 \times \frac{1}{3} \times \frac{22}{7} \times 0.7 \times 0.7 \times 2$$

$$= 235.89 \text{ cm}^3$$

OR

Volume of water rise in cylinder = Volume of sphere

$$\Rightarrow \quad \pi r^2 \times \text{increase in water level} = \frac{4}{3}\pi R^3 \qquad \left\{\begin{array}{l} r = \text{radius of sphere} \\ R = \text{radius of cylinder} \end{array}\right\}$$

$$\Rightarrow \quad r^2 \times 4\frac{4}{27} = \frac{4}{3} \times 7 \times 7 \times 7$$

$$\Rightarrow \quad r^2 \times \frac{112}{27} = \frac{4 \times 7 \times 7 \times 7}{3}$$

$$\Rightarrow \quad r^2 = \frac{4}{3} \times \frac{7 \times 7 \times 7 \times 27}{112}$$

$$\Rightarrow \quad r^2 = 110.25$$

$$\Rightarrow \quad r = 10.5 \text{ cm}$$

35. Let number of persons be x.

According to question,

$$\frac{12000}{x} - \frac{12000}{x+40} = 80$$

$$\Rightarrow \quad \frac{12000(x+40-x)}{x(x+40)} = 80$$

$$\Rightarrow \quad 12000 \times 40 = 80(x^2 + 40x)$$

$$x^2 + 40x = \frac{12000 \times 40}{80}$$

$$\Rightarrow \quad x^2 + 40x - 6000 = 0$$

$$\Rightarrow \quad x^2 + 100x - 60x - 6000 = 0$$

$$\Rightarrow \quad (x + 100)(x - 60) = 0$$

$$\Rightarrow \quad x = -100 \text{ (not possible)}, x = 60$$

Hence, initially number of persons = 60

OR

$$4x^2 - 4a^3x + (a^6 - b^6) = 0$$

$$\Rightarrow \quad 4x^2 - 2(a^3 - b^3)x - 2(a^3 + b^3)x + (a^3 - b^3)(a^3 + b^3) = 0$$

$$\Rightarrow \quad 2x[2x - (a^3 - b^3)] - (a^3 + b^3)[2x - (a^3 - b^3)] = 0$$

$$\Rightarrow \quad [2x - (a^3 - b^3)][2x - (a^3 + b^3)] = 0$$

$$\Rightarrow \quad x = \frac{a^3 - b^3}{2} \text{ or } x = \frac{a^3 + b^3}{2}$$

36. (*i*) Here, $a = 20$, $d = -1$

$$a_6 = a + 5d$$
$$= 20 + 5(-1)$$
$$= 20 - 5 = 15$$

Number of logs in 6th row = 15

(*ii*)

$$S_n = 200$$

$$\Rightarrow \quad \frac{n}{2}[2a + (n-1)d] = 200$$

$$\Rightarrow \quad \frac{n}{2}[2 \times 20 + (n-1)(-1)] = 200$$

$$\Rightarrow \quad \frac{n}{2}[40 - n + 1] = 200$$

$$\Rightarrow \quad n(41 - n) = 400$$

$$\therefore \Rightarrow \quad n^2 - 41n + 400 = 0$$

$$\Rightarrow \quad n^2 - 25n - 16n + 400 = 0$$

$$\Rightarrow \quad (n - 15)(n - 16) = 0$$

$$\Rightarrow \qquad n = 25, n = 16$$

If $n = 25$, then $a_{25} = a + 24d$

$= 20 + 24(-1)$

$= -4$ (not possible)

If $n = 16$, then $a_{16} = 20 + 15d$

$= 20 - 15$

$a_{16} = 5$

Hence, number of rows $= 16$

(*iii*) $a_1 - a_{16} = 20 - 5$

$= 15$

OR

$a_{10} - a_{14} = (a + 9d) - (a + 13d)$

$= 9d - 13d$

$= -4d = -4 \times (-1)$

$= 4$

37. Coordinates of 4 friends are: A (3, 4), B(6, 7), C(9, 4), D(6, 1).

(*i*) $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(6-3)^2 + (7-4)^2}$

$= \sqrt{9+9}$

$= \sqrt{18}$ units

$= 3\sqrt{2}$ units

$AD = \sqrt{(6-3)^2 + (1-4)^2} = \sqrt{9+9}$

$= 3\sqrt{2}$ units

(*ii*) $BC = \sqrt{(9-6)^2 + (4-7)^2} = \sqrt{9+9} = 3\sqrt{2}$ units

$DC = \sqrt{(9-6)^2 + (4-1)^2} = \sqrt{9+9}$

$= 3\sqrt{2}$ units

(*iii*) $AB = BC = CD = AD = 3\sqrt{2}$ units

Diagonal $AC = \sqrt{(9-3)^2 + (4-4)^2} = \sqrt{36+0}$

$= 6$ units

$BD = \sqrt{(6-6)^2 + (1-7)^2} = \sqrt{0+36}$

$= 6$ units

$AC = BD$

So, in □ ABCD, we have

$AB = BC = CD = DA = 3\sqrt{2}$ units and $AC = BD = 6$ units.

Hence, ABCD is a square.

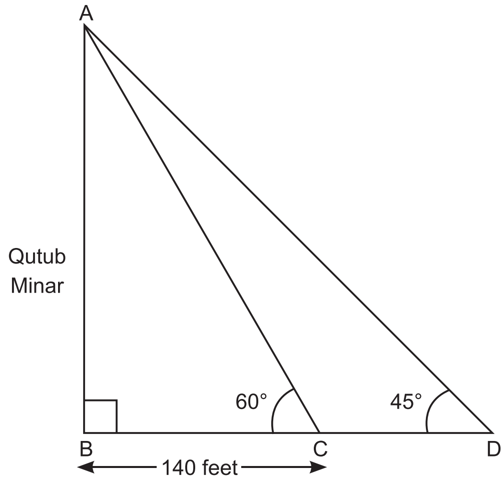
OR

Diagonals of a square bisect each other.

$$O(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$
$$= \left(\frac{3 + 9}{2}, \frac{4 + 4}{2}\right)$$
$$= (6, 4)$$

Hence, coordinates of point where diagonals of square intersect are (6, 4).

38.



(*i*) $\frac{AB}{BC} = \tan 60°$

$\Rightarrow$ $\frac{AB}{140} = \sqrt{3}$

$\Rightarrow$ $AB = 140 \times 1.7 = 238$ feet

(*ii*) $\frac{AB}{BD} = \tan 45°$

$\Rightarrow$ $AB = BD$ $(\because \tan 45° = 1)$

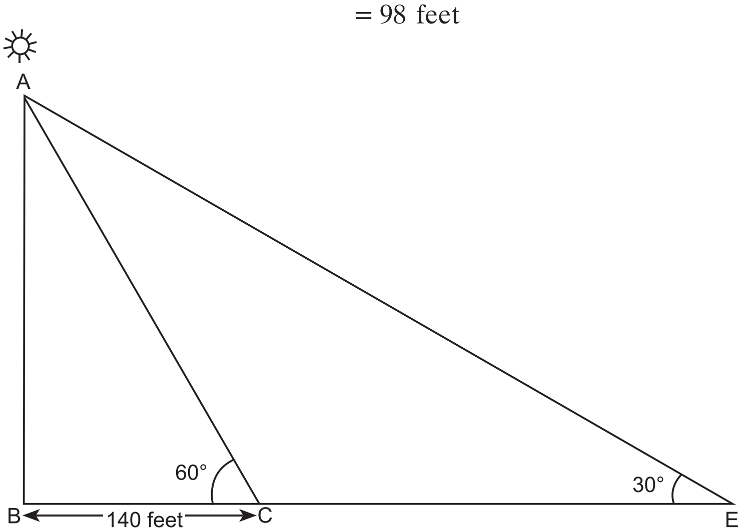
$\therefore$ $BD = 238$ feet

Now, $DC = BD - BC$

$= 238$ feet $- 140$ feet

$= 98$ feet

(*iii*)



In ΔABC, $\frac{AB}{BC} = \tan 60°$

$\Rightarrow$ $AB = BC\sqrt{3}$ ...(*i*)

In ΔABE, $\frac{AB}{BE} = \tan 30°$

$\Rightarrow$ $AB = \frac{BE}{\sqrt{3}}$ ...(*ii*)

$\therefore$ $\frac{BE}{\sqrt{3}} = BC\sqrt{3}$ [Using (*i*) and (*ii*)]

$\Rightarrow$ $BE = 3BC$

$\Rightarrow$ $BC + CE = 3BC$

$CE = 2BC = 2 \times 140 \text{ feet} = 280 \text{ feet}$

Hence, length of shadow is increased by 280 feet.

OR

(*a*) Height of a mountain can be determined with the help of trigonometry.

(*b*) Width of a river can also be determined with the help of trigonometry.