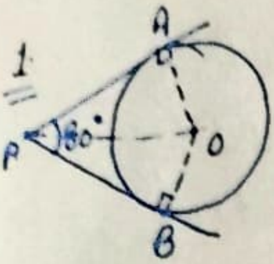
Solution SP-2 (2024-25)

1. 

In ΔOAP & ΔOBP

$\angle OAP = \angle OBP = 90^\circ$

[$\because$ Radius is perpendicular to tangent at point of contact]

$OA = OB$ (radii)

$PA = PB$ (Length of tangents from external pt)

$\therefore$ By SAS congruence criterion

$\Delta OAP \cong \Delta OBP$

$\therefore \angle OPA = \angle OPB = \frac{80^\circ}{2} = 40^\circ$ (cpct)

In ΔPAO, $\angle OPA + \angle OAP + \angle POA = 180^\circ$

$\Rightarrow 90^\circ + 40^\circ + \angle POA = 180^\circ$

$\Rightarrow \angle POA = 50^\circ$ $\boxed{(a)}$

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2. $\boxed{(d)}$ From a point inside a circle only two tangents can be drawn

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3. $\dfrac{4\pi r^2}{3\pi r^2 + 3\pi r^2} = \dfrac{4\pi r^2}{6\pi r^2} = \dfrac{2}{3} = 2:3$ $\boxed{(c)}$

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4. $\bar{x} = \dfrac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}$

$\therefore \sum f_i x_i - \bar{x} \sum f_i = 0$

or $\sum f_i (x_i - \bar{x}) = 0$ $\boxed{(d)}$

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5. Co-ordinates of $D = \left(\frac{6+0}{2}, \frac{4+0}{2}\right)$

$\therefore D(3, 2)$ $\quad A(5, -6)$

$AD = \sqrt{(3-5)^2 + (2+6)^2} = \sqrt{4+64}$

$= \sqrt{68}$ units $\boxed{(a)}$

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6. $x^2 + x - 1 = 0$

$D = b^2 - 4ac$

$= (1)^2 + 4 \times 1 \times 1 = 5$

$\because D = 5 > 0$

$\therefore$ Roots are real & distinct

Also, D is not a perfect square $\therefore$ Roots are Irrational

$\therefore$ $\boxed{(a)}$ Irrational and distinct

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7. $(k-1)x^2 + kx + 1$

$\because$ one zero is (-3)

$(k-1)(-3)^2 + k(-3) + 1 = 0$

$9k - 9 - 3k + 1 = 0$

$6k = 8 \Rightarrow k = \frac{8}{6} = \frac{4}{3}$ $\boxed{(a)}$

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8. $\sin\theta = \frac{3}{5} \Rightarrow \cos\theta = \frac{4}{5}$

$\operatorname{cosec}\theta = \frac{5}{3}$ & $\cot\theta = \frac{\cos\theta}{\sin\theta}$

$= \frac{4}{5} \times \frac{5}{3} = \frac{4}{3}$

$\therefore \dfrac{\operatorname{cosec}\theta - \cot\theta}{2\cot\theta} = \dfrac{\frac{5}{3} - \frac{4}{3}}{2 \times \frac{4}{3}}$

$= \frac{1}{3} \times \frac{3}{8} = \frac{1}{8}$ $\boxed{(c)}$

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9. $3^{x+y} = 81 = 3^4 \Rightarrow x + y = 4$ —(1)

$3^{4(x-y)} = 3^1 \Rightarrow 4x - 4y = 1$ —(2)

Solving (1) & (2) $8x = 17$

$\Rightarrow x = \frac{17}{8} = \boxed{2\frac{1}{8}}$ $\quad y = 4 - \frac{17}{8} = \frac{15}{8} = \boxed{1\frac{7}{8}}$

$\therefore x = 2\frac{1}{8}$ & $y = 1\frac{7}{8}$ $\boxed{(d)}$

10: Total S.A. of tank =

CSA of cylinder + CSA of hemisphere

$= 2\pi rh + 2\pi r^2$

$= 2\pi r(h+r)$

$= 2 \times \frac{22}{7} \times 30(145+30)$

$= 2 \times \frac{22}{7} \times 30 \times \cancel{175}^{25}$

$= 22 \times 1500 = 33000 \text{ cm}^2$

$= \boxed{3.3 m^2}$ $\boxed{(b)}$

11: $d = 5$

$a_{18} - a_{13} = a + 19d - (a + 12d)$

$= 5d = 5 \times 5$

$= \underline{25}$ $\boxed{(c)}$

12: $\sqrt{3} \tan 2\theta = 3$

$\Rightarrow \tan 2\theta = \frac{3}{\sqrt{3}} \Rightarrow \tan 2\theta = \sqrt{3}$

$\Rightarrow \tan 2\theta = \tan 60°$

$\Rightarrow 2\theta = 60° \Rightarrow \theta = \underline{30°}$

$\therefore \sin\theta + \sqrt{3}\cos\theta$

$= \sin 30° + \sqrt{3} \cos 30°$

$= \frac{1}{2} + \left(\sqrt{3} \times \frac{\sqrt{3}}{2}\right)$

$= \frac{1}{2} + \frac{3}{2} = \frac{4}{2} = \underline{2}$ $\boxed{(a)}$

13: P(getting blue card) = $\frac{4}{10} = 0.4$

P(getting green card) = $\frac{3}{10} = 0.3$

P(getting yellow card) = $\frac{2}{10} = 0.2$

P(getting red card) = $\frac{1}{10} = 0.1$

Probability of blue card is highest so it will most likely come - (b)

14: Zeroes = Points where graph touches x-axis

= Value of x of points where $y = 0$

$= \underline{-6, 6}$ $\boxed{(d)}$

15: Coordinates of Chaitanya's house is (6, 5)

Coordinates of Hamida's house is (2, 2)

$\therefore$ Shortest distance between their houses = $\sqrt{(6-2)^2 + (5-2)^2}$

$= \sqrt{16 + 9} = \underline{5 \text{ units}}$ $\boxed{(b)}$

16: $\triangle ABC \sim \triangle EDF$

$\Rightarrow \frac{AB}{ED} = \frac{BC}{DF} = \frac{AC}{EF}$

$\therefore \frac{AB}{ED} = \frac{BC}{DF} \Rightarrow AB \cdot DF = BC \cdot ED$ which is true (c)

$\frac{BC}{DF} = \frac{AC}{EF} \Rightarrow BC \cdot EF = AC \cdot DF$ which is true (a)

$\frac{AB}{EF} = \frac{AC}{EF} \Rightarrow AB \cdot EF = AC \cdot ED$ which is true (b)

$\therefore$ Only option $\boxed{(c)}$ $BC \cdot DE = AB \cdot EF$ is not true

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17.

Marks	No. of students
0-10	3
10-20	9
20-30	15
30-40	30
40-50	18
50-60	5

Highest frequency = 30

$\therefore$ Modal class = 30-40

Upper limit = $\underline{\underline{40}}$ $\boxed{(b)}$

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18. Favourable outcomes

$\{(1,3), (3,1), (2,2), (2,6)$
$(3,5), (4,4), (5,3), (6,2)$
$(6,6)\}$

Total no. of outcomes = 36

No. of favourable outcomes = 9

$\therefore$ Probability $= \frac{9}{36} = \underline{\underline{\frac{1}{4}}}$ $\boxed{(d)}$

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19. Area swept by min. hand in 5 minutes $= \frac{\theta}{360} \times \pi r^2$

$= \frac{30}{360} \times \frac{22}{7} \times 7 \times 7 = \frac{77}{6}$

$= 12\frac{5}{6} cm^2$

Length of arc $= \frac{\theta}{360} \times 2\pi r = \frac{\theta}{180} \times \pi r$

$\therefore$ $\boxed{(b)}$ Both A & R are true but R is not the correct explanation of A

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20. LCM is always divisible by HCF

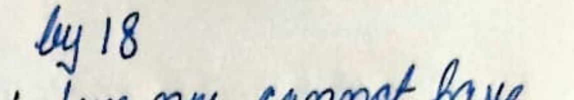
But 380 is not divisible by 18

$\therefore$ two nos. cannot have 18 as their HCF and 380 as their LCM

$\therefore$ (d) Assertion is false but Reason is true

Section-B

21.



Let $A = (1,-2)$ & $B(-3,4)$

Let P and Q trisect the line segment AB $\frac{AP}{PB} = \frac{1}{2}$ & $\frac{AQ}{QB} = \frac{2}{1}$

$\because$ P divides AB internally in the ratio 1 : 2

$$P\left(\frac{1\times(-3)+2\times 1}{1+2}, \frac{1\times 4+2\times(-2)}{1+2}\right)$$

$= P\left(-\frac{1}{3}, 0\right)$

$\because$ Q divides AB in the ratio 2 : 1

$\therefore Q\left(\frac{2\times(-3)+1\times 1}{2+1}, \frac{2\times 4+1\times(-2)}{2+1}\right)$

$\therefore Q\left(\frac{-5}{3}, 2\right)$

$\therefore$ two points of trisection are $\left(\frac{-1}{3}, 0\right)$ & $\left(\frac{-5}{3}, 2\right)$

22: No. of possible outcomes
$= (123-11)+1 = 113$

Favourable outcomes (Square nos) = 16, 25, 36, 49, 64, 81, 100, 121

No. of fav. outcomes = 8

$\therefore$ P(getting a square no.) $= \frac{8}{113}$

Or

Total no. of cards = 52 − 1 = 51
Queen of heart = 1
P(getting queen of heart)

$= \frac{\text{No. of favourable outcomes}}{\text{Total possible outcomes}}$

$= \frac{1}{51}$

23: LCM of two nos = 14 × HCF of two nos. (Given) −(1)

Also, LCM + HCF = 600
14 × HCF + HCF = 600 [From (1)]
15 HCF = 600 ⇒ HCF $= \frac{600}{15} = 40$

$\therefore$ LCM = 14 × HCF = 14 × 40
⇒ LCM = 560

One no = 280 (Given)

280 × other no = LCM × HCF

⇒ Other no $= \frac{\overset{2}{\cancel{560}} \times 40}{\cancel{280}}$

$\therefore$ Other no = 80

Or

2	450
3	225
3	75
5	25
5	5
	1

2	216
2	108
2	54
3	27
3	9
3	3
	1

$450 = 2^1 \times 3^2 \times 5^2$
$216 = 2^3 \times 3^3$
HCF $= 2^1 \times 3^2 = 18$
HCF = 23m − 51
⇒ 23m − 51 = 18
⇒ 23m = 51 + 18 = 69
⇒ $m = \frac{69}{23} = 3$
$\therefore m = 3$

24: Let P(x, 0) be the point on x-axis having $2\sqrt{5}$ unit distance from the pt.
Q(7, −4)

$PQ = 2\sqrt{5}$ (Given)

$\Rightarrow PQ^2 = 4 \times 5$

$\Rightarrow (x-7)^2 + (0+4)^2 = 20$

$\Rightarrow x^2 - 14x + 49 + 16 = 20$

$\Rightarrow x^2 - 14x + 45 = 0$

$\Rightarrow (x-9)(x-5) = 0$

$\Rightarrow x = 5, 9$

Hence, the pts. on x-axis which have distance $2\sqrt{5}$ units from pt. $(7,-4)$ are $(5,0)$ & $(9,0)$

25. $4\cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$

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

$\Rightarrow \cancel{4} - \cancel{4} + \frac{3}{4} + p = \frac{3}{4}$

$\Rightarrow p = 0$

Section-C

26. $\frac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} = 2 + \frac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta}$

or $\frac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} - \frac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta} = 2$

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

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

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

$= \sin^2\theta\left(\frac{1}{\cos\theta+1} - \frac{1}{\cos\theta-1}\right)$

$= \sin^2\theta\left(\frac{\cancel{\cos\theta} - 1 - \cancel{\cos\theta} - 1}{(\cos\theta+1)(\cos\theta-1)}\right)$

$= \sin^2\theta\left(\frac{-2}{\cos^2\theta - 1}\right)$

$= \frac{-2\sin^2\theta}{-\sin^2\theta}$ $\left[\because 1-\cos^2\theta = \sin^2\theta \text{ or } \cos^2\theta - 1 = -\sin^2\theta\right]$

$= 2 =$ RHS

Hence Proved

27. To Prove $\rightarrow \sqrt{5}$ is Irrational no.

Let $\sqrt{5}$ be a Rational no.

$\therefore \sqrt{5} = \frac{p}{q}$; p & q are coprime nos. & $q \neq 0$

or $p = \sqrt{5}q$

Squaring both sides

$p^2 = 5q^2$ — (1)

$\therefore$ 5 divides $p^2 \Rightarrow p$ is a multiple of 5 — (2)

[$\because$ If a prime no. 'p' divides a^2, then p divides 'a' also]

$\Rightarrow p = 5m$, m is any integer

Squaring both sides

$p^2 = 25m^2$

Putting p^2 in eq^n (1)

$25m^2 = 5q^2$

$q^2 = 5m^2$

$\therefore$ 5 divides q^2

$\Rightarrow$ q is a multiple of 5 -(3)

From (2) & (3)

p & q have a common factor 5

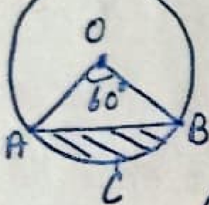
This contradicts our assumption that 'p' & 'q' are coprime.

$\therefore$ our assumption is wrong

$\sqrt{5}$ is not a Rational no.

Hence, $\sqrt{5}$ is an Irrational no.

28.



Let ACB be the given arc, subtending angle of 60° at the centre

$\theta = 60°$ & $OA = OB = r = 14cm$

$\therefore$ ΔOAB is an equilateral triangle

Area of minor segment = (Area of sector OACB) - (Area of equilateral ΔOAB)

$$= \frac{\theta}{360}\pi r^2 - \frac{\sqrt{3}}{4}r^2$$

$$= r^2\left[\frac{\theta}{360}\pi - \frac{\sqrt{3}}{4}\right]$$

$$= 14 \times 14\left[\frac{60}{360} \times \frac{22}{7} - \frac{1.73}{4}\right]$$

$$= 196\left[\frac{11}{21} - \frac{1.73}{4}\right]$$

$$= 196\left[\frac{44 - 36.33}{84}\right]$$

$$= \frac{196 \times 7.67}{84} = \frac{53.69}{3}$$

$$= 17.89 \text{ cm}^2$$

Or

Area of remaining part of park = (Area of square park) - (Area of 4 flower beds)

$$= (\text{side} \times \text{side}) - 4 \times \left(\frac{1}{4} \times \pi r^2\right)$$

$$= (100 \times 100) - \left(\frac{22}{7} \times 14 \times 14\right)$$

$$= 10000 - 616$$

$$= 9384 \text{ m}^2$$

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29. Let α and β be the zeros of the polynomial $2x^2 - 5x - 3$

$\Rightarrow \alpha + \beta = -\frac{b}{a} = \frac{5}{2}$

& $\alpha\beta = \frac{c}{a} = -\frac{3}{2}$

$\because$ zeros of polynomial $x^2 + px + q$ is double the zeros of $2x^2 - 5x - 3$

$\therefore$ Zeros of $x^2 + px + q = 2\alpha$ & 2β

$2\alpha + 2\beta = \frac{-p}{1} \Rightarrow 2(\alpha + \beta) = -p \Rightarrow 2 \times \frac{5}{2} = 5$

$-p = 5 \Rightarrow p = -5$

$$2\alpha \times 2\beta = \frac{c}{a} = q$$

$$4(\alpha\beta) = q$$

$$4\left(-\frac{3}{2}\right) = q$$

$$q = -6$$

$$\therefore p = -5 \ \& \ q = -6$$

30. Let present age of Rehman be 'x' yrs.

∴ Rehman's age 3 years ago $= (x-3)$ yrs

& Rehman's age 5 years hence $= (x+5)$ yrs

Acc to ques

$$\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$$

$$\Rightarrow \frac{x+5+x-3}{(x-3)(x+5)} = \frac{1}{3}$$

$$\Rightarrow 3(2x+2) = (x-3)(x+5)$$

$$\Rightarrow 6x+6 = x^2+2x-15$$

$$\Rightarrow x^2-4x-21=0$$

$$\Rightarrow x^2-7x+3x-21=0$$

$$\Rightarrow x(x-7)+3(x-7)=0$$

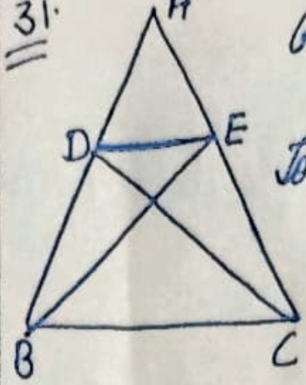
$$\Rightarrow (x-7)(x+3)=0$$

$$\Rightarrow x = 7, -3$$

∴ the age of a person can't be negative

Hence, Rehman's present age is 7 years

31.



Given → $\Delta BEA \cong \Delta CDA$

To Prove → $\Delta DEA \sim \Delta BCA$

Proof ∵ $\Delta BEA \cong \Delta CDA$ (Given)

∴ $BA = CA$ [cpct] −(1)

& $DA = EA$ [cpct] −(2)

In ΔDEA & ΔBCA

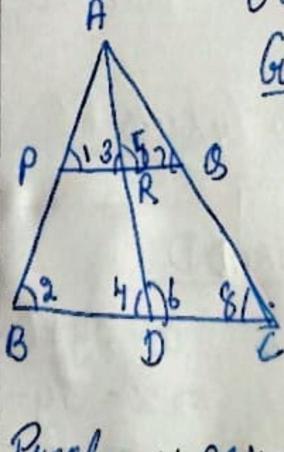
$$\frac{DA}{BA} = \frac{EA}{CA} \quad [\text{Dividing eq}^n \ (2) \text{ by } (1)]$$

$\angle A = \angle A$ [common]

∴ By SAS similarity criterion

$\Delta DEA \sim \Delta BCA$

Or



Given → A ΔABC with $PQ \parallel BC$ & AD is median to side BC

To Prove → AD bisects PQ, i.e. $PR = RQ$

Proof → ∵ $PQ \parallel BC$ [Given]

∴ $PR \parallel BD$ & AB & AD are transversals

$\angle 1 = \angle 2$ (corresponding angles) −(1)

& $\angle 3 = \angle 4$ −(2)

From (1) & (2)

$\Delta APR \sim \Delta ABD$ (by AA similarity criterion)

$\therefore \frac{PR}{BD} = \frac{AR}{AD}$ —(3) [corresponding sides of similar triangles]

Similarly, $\because PQ \parallel BC$

$\therefore RQ \parallel DC$ & AD & AC are transversals

$\therefore \angle 5 = \angle 6$ —(4) [corresponding angles]

$\angle 7 = \angle 8$ —(5)

From (4) & (5)

$\triangle ARQ \sim \triangle ADC$ [By AA similarity]

$\therefore \frac{RQ}{DC} = \frac{AR}{AD}$ —(6)

From (3) & (6)

$\frac{PR}{BD} = \frac{RQ}{DC}$

But $BD = DC$ as AD is median to side BC

$\Rightarrow PR = RQ$

i.e. Median AD bisects PQ

Section E

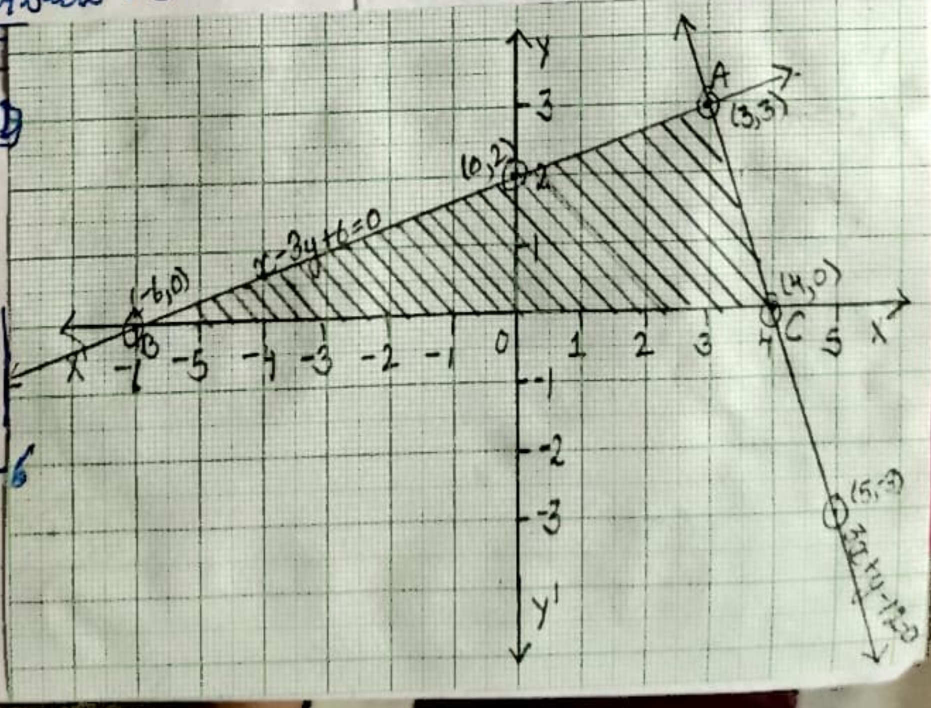
39. $3x+y-12=0$

$\Rightarrow y = 12-3x$

x	3	4	5
y	3	0	−3
(x,y)	(3,3)	(4,0)	(5,−3)

$x-3y+6=0 \Rightarrow x=3y-6$

x	0	−6	3
y	2	0	3
(x,y)	(0,2)	(−6,0)	(3,3)



From Graph,

The two lines intersect at (3,3)

$\therefore x=3$ & $y=3$ is the solution of given pair of lines

Shaded Region is the Required Region i.e. Region bounded by triangle ABC

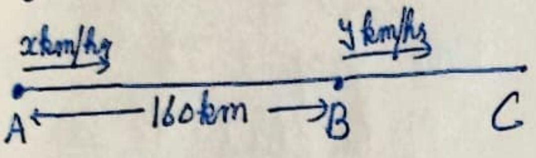
32 OR

Let the speeds of the car A & B be x km/hr & y km/hr resp.

Let $x > y$

Case 1 When they travel in same direction

Let the cars meet at pt. C in 8 hrs.



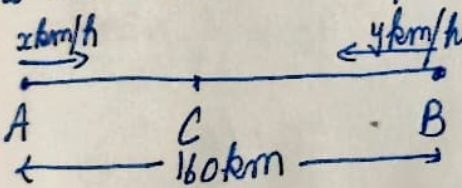
$AC - BC = 160$

$\Rightarrow (x \times 8) - (y \times 8) = 160$ [Distance = Speed × Time]

or $x - y = 20$ —(1)

Case 2 When they travel in opposite directions

Let the cars meet at pt C in 2 hrs



$AC + BC = 160$

$\Rightarrow (x \times 2) + (y \times 2) = 160$

$\Rightarrow x + y = 80$ —(2)

Adding (1) & (2)

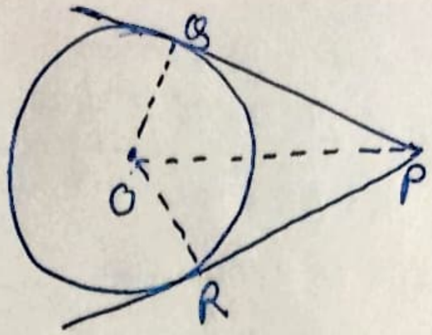
$2x = 100 \Rightarrow x = 50$

From (1)

$50 - y = 20 \Rightarrow y = 30$

∴ Speeds of the cars are 50 km/hr & 30 km/hr

33.



Given → A circle with centre 'O' and two tangents PQ & PR from external pt. P

To Prove → $PQ = PR$

Construction → Join OQ, OR & OP

Proof → In $\triangle OQP$ and $\triangle ORP$

$OQ = OR$ (radii of a circle)

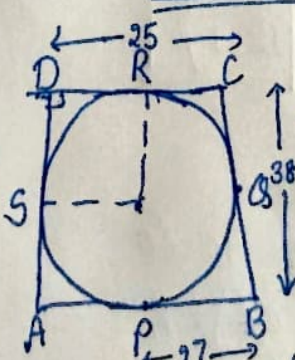
$\angle Q = \angle R$ [Each 90°; Radius is ⊥ tangent at pt. of contact]

$OP = OP$ (common)

∴ By RHS congruence criterion

$\triangle OQP \cong \triangle ORP$

∴ $PQ = PR$ (cpct)



Given → A quad ABCD with $\angle D = 90°$: A circle touching sides AB, BC, CD & DA at P, Q, R & S such that BC = 38 cm CD = 25 cm & BP = 27 cm

To find → Radius of the circle

Soln → $\angle D = 90^\circ$ [Given]

$\angle ORD = \angle OSD = 90^\circ$ [Radius is $\perp$ tangent at pt of contact]

Also, $OR = OS = r$

$\therefore$ ORDS is a square

$\because$ tangents from exterior point to a circle are equal in length

$\therefore BP = BQ = 27cm$

$BQ + CQ = BC$

$27 + CQ = 38 \Rightarrow CQ = 11cm$

$CR = CQ = 11cm$ [Length of tangent segments from external pt]

$DR = CD - CR = 25 - 11 = 14cm$

$\because$ ORDS is a square

$\therefore OR = DR = 14cm$

Hence, radius = 14cm

34.

Class	Freq(f)	C.f.
0-20	17	17
20-40	p	17+p
40-60	32	49+p
60-80	24	73+p
80-100	19	92+p

$n = 92 + p$

$\because$ Median = 50

$\therefore$ Median class = 40-60

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

$$\Rightarrow 50 = 40 + \left[\frac{\frac{92+p}{2} - (17+p)}{32}\right] \times 20$$

$$\Rightarrow \frac{10}{20} = \frac{92+p-34-2p}{64}$$

$$\Rightarrow \frac{58-p}{64} = \frac{1}{2}$$

$$\Rightarrow 58 - p = 32$$

$$p = 26$$

Max. freq = 32

$\therefore$ Modal class = 40-60

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

$$= 40 + \left(\frac{32-26}{2 \times 32 - 26 - 24}\right) \times 20$$

$$= 40 + \frac{6}{64-50} \times 20$$

$$= 40 + \frac{6}{\cancel{14}_{7}} \times \cancel{20}^{10}$$

$$= 40 + \frac{60}{7}$$

$$= 40 + 8.57$$

$\therefore$ Mode = 48.57

Mode = 3 Median − 2 Mean

$48.57 = 3(50) - 2\,\text{Mean}$

$\Rightarrow 2\,\text{Mean} = 150 - 48.57$

$\Rightarrow \text{Mean} = \frac{101.43}{2}$

$\Rightarrow \text{Mean} = 50.715$

34. OR

CI	f	c.f
0-10	2	2
10-20	5	7
20-30	x	$7+x$
30-40	12	$19+x$
40-50	17	$36+x$
50-60	20	$56+x$
60-70	y	$56+x+y$
70-80	9	$65+x+y$
80-90	7	$72+x+y$
90-100	4	$76+x+y$

$76+x+y = 100$

$\Rightarrow x+y = 24 \quad -(1)$

$\because$ Median $= 52.5$

Median class $= 50-60$

Median $= l + \dfrac{\frac{n}{2}-cf}{f} \times h$

$\Rightarrow 52.5 = 50 + \dfrac{\frac{100}{2}-(36+x)}{2\cancel{0}} \times 1\cancel{0}$

$\Rightarrow 52.5-50 = \dfrac{50-36-x}{2}$

$\Rightarrow 2.5\times 2 = 14-x$

$\Rightarrow 5-14 = -x$

$\Rightarrow x = 9$

From (1)

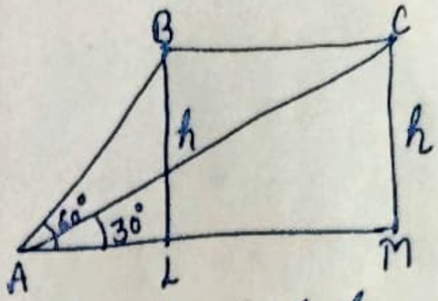
$x+y = 24$

$\Rightarrow 9+y = 24$

$y = 24-9 = 15$

$\therefore x = 9 \ \& \ y = 15$

35.



Let A be the point of observation on the ground and B & C be the two positions of the jet

Let the constant height at which jet is flying is 'h' m

$\therefore BL = CM = h$ m

Speed of jet $= 720$ km/hrs. $\dfrac{\overset{40}{\cancel{720}} \times \overset{5}{\cancel{1000}}}{\underset{18}{\cancel{3600}}}$

$= 200$ m/sec

Time take to cover distance BC is 15 seconds

Distance $BC = S \times T = 200 \times 15 = 3000$ m

In rt $\triangle ALB$, $\tan 60° = \dfrac{BL}{AL}$

$\Rightarrow \sqrt{3} = \dfrac{h}{AL} \Rightarrow AL = \dfrac{h}{\sqrt{3}}$ m

$BC = LM = 3000$ m

$AM = AL + LM = \left(\dfrac{h}{\sqrt{3}} + 3000\right)$ m

In $\triangle AMC$

$\tan 30° = \dfrac{CM}{AM}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{h}{\frac{h}{\sqrt{3}} + 3000}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{\sqrt{3}h}{h + 3000\sqrt{3}}$

$3h = h + 3000\sqrt{3}$

34:/ / OR

$2h = 3000\sqrt{3}$

$\Rightarrow h = 1500\sqrt{3}$

$\Rightarrow h = 1500 \times 1.732$

$\Rightarrow h = 2598000$

$\Rightarrow h = 2598$

$\therefore$ constant height at which the jet is flying is 2598m

Section-E

36 (i) First term $a = 2$

2, 5, 8, 11, 14, ------

common difference, $d = 5-2 = 3$

(ii) $a_n = a+(n-1)d$

$34 = 2+(n-1)3$

$n-1 = \frac{34-2}{3} = \frac{32}{3} = \cancel{10\frac{2}{3}}$

$n = \frac{32}{3}+1 = \frac{35}{3} = 11\frac{2}{3}$

which is not a positive integer it is not possible to have 34 pots in a row.

(iii)(A) $S_n = \frac{n}{2}[2a+(n-1)d]$

$S_n = \frac{n}{2}[(2\times2)+(n-1)(3)]$

$S_n = \frac{n}{2}[3n+1]$

$\therefore S_8 = \frac{8}{2}[(3\times8)+1]$

$4 \times 25 = 100$

(iii)(B) A.P. will be

5, 8, 11, 14, 17, ----

$a = 5, d = 3$

$a_{11} = a+10d$

$= 5+10(3) = 35$

37.(i) In ΔCAB & ΔCLO

$\angle CAB = \angle CLO = 90°$

$\angle C = \angle C$ (common)

$\therefore$ By AA similarity criterion

$\Delta CAB \sim \Delta CLO$

(ii) In ΔDCA and ΔBAC

$DC = BA$ [$\because x = y$ (Given)]

$\angle DCA = \angle BAC$ [Each 90°]

$CA = AC$ [common]

$\therefore$ By SAS similarity criterion

$\Delta DCA \sim \Delta BAC$

$\therefore \frac{DA}{BC} = \frac{DC}{BA} = \frac{y}{x}$

$\Rightarrow \frac{BC}{DA} = \frac{x}{y} = \frac{x}{x} = \frac{1}{1}$

$\therefore BC : DA = 1:1$

(iii)(A) $\because \Delta CAB \sim \Delta CLO$ (Proved in i)

$\frac{CA}{CL} = \frac{AB}{LO}$

$\Rightarrow \frac{z}{a} = \frac{x}{d} \Rightarrow a = \frac{zd}{x}$

(iii)(B) In ΔALO & ΔACD

$\angle ALO = \angle ACD = 90^\circ$

$\angle A = \angle A$ (common)

$\therefore$ By AA similarity criterion

$\Delta ALO \sim \Delta ACD$

$$\frac{AL}{AC} = \frac{OL}{DC} \Rightarrow \frac{b}{z} = \frac{d}{y}$$

$$\Rightarrow b = \frac{zd}{y}$$

38(i) Cone: Radius $r = \frac{3.5}{2}$ cm

$h = 3.5 - \frac{3.5}{2} = \frac{3.5}{2}$ m

Volume of cone $= \frac{1}{3}\pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times \frac{3.5}{2}$$

$$= \frac{12.25 \times 5.5}{12} = \frac{67.35}{12} = 5.614 m^3$$

(ii) Volume of cylinder that circumscribes cone & hemisphere

$$= \pi r^2 H = \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times 3.5$$

$$= \frac{67.35}{2} = 33.68 m^3$$

(iii)(A) Additional space enclosed by cylinder =

(Vol. of cylinder) − (Volume of cone + Volume of hemisphere)

$$= 33.68 - (5.614 + \frac{2}{3}\pi r^3)$$

$$= 33.68 - \left[(5.614) + \left(\frac{2}{3} \times \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times \frac{3.5}{2}\right)\right]$$

$$= 33.68 - \left[(5.614 + \frac{67.35}{6})\right]$$

$$= 33.68 - [5.614 + 11.23]$$

$$= 33.68 - [16.844] = 16.836 m^3$$

(iii)(B) Reqd. Ratio =

$$\frac{\text{CSA of cone}}{\text{CSA of hemisphere}} = \frac{\pi rl}{2\pi r^2}$$

$$= \frac{\sqrt{r^2+h^2}}{2r} = \frac{\sqrt{r^2+r^2}}{2r} \quad [\because r = h \text{ of cone}]$$

$$= \frac{\sqrt{2}r}{2r} = \frac{1}{\sqrt{2}}$$

$$= 1 : \sqrt{2}$$