

COMMON PRE-BOARD EXAMINATION-2023**MATHEMATICS STANDARD (041)****MARKING SCHEME****CLASS: X****Time Allowed: 3 Hours****Maximum Marks: 80**

Q. No.	SECTION A	Marks
Section A consists of 20 questions of 1 mark each		
1	(a) 4 cm	1
2	(b) 2	1
3	(a) 1	1
4	(d) 30	1
5	(c) 0 and 8	1
6	(b) $-m, m+3$	1
7	(b) 8 cm	1
8	(c) 5 : 1	1
9	(a) 0	1
10	(b) 2	1
11	(c) 8 cm	1
12	(b) 5 units	1
13	(c) 18 cm	1
14	(d) 40	1
15	(c) no solution	1
16	(b) $\frac{3}{11}$	1
17	(b) $\frac{1}{xy}$	1
18	(c) 19.5	1
19	(d) Assertion (A) is false but reason (R) is true.	1
20	(c) Assertion (A) is true but reason (R) is false.	1

SECTION B

Section B consists of 5 questions of 2 marks each

21	<p>We have $(\tan \theta + \cot \theta) = 5$ Squaring both sides, we get: $(\tan \theta + \cot \theta)^2 = 5^2$ $\Rightarrow \tan^2 \theta + \cot^2 \theta + 2 \tan \theta \cot \theta = 25$ $\Rightarrow \tan^2 \theta + \cot^2 \theta + 2 = 25 \quad [\because \tan \theta = \frac{1}{\cot \theta}]$ $\Rightarrow \tan^2 \theta + \cot^2 \theta = 25 - 2 = 23$</p>	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
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OR

$$\begin{aligned}
 LHS &= (\cosec A - \cot A)^2 \\
 &= \left(\frac{1}{\sin A} - \frac{\cos A}{\sin A} \right)^2 \\
 &= \left(\frac{1-\cos A}{\sin A} \right)^2 \\
 &= \frac{(1-\cos A)^2}{\sin^2 A} \\
 &= \frac{(1-\cos A)^2}{1-\cos^2 A} \quad [\because \sin^2 \theta + \cos^2 \theta = 1] \\
 &= \frac{(1-\cos A)(1-\cos A)}{(1-\cos A)(1+\cos A)} \\
 &= \frac{1-\cos A}{1+\cos A} = RHS
 \end{aligned}$$

Hence proved.

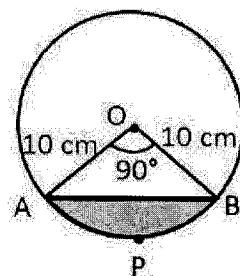
22	<p>$32x + 33y = 34 \dots\dots (i)$ $33x + 32y = 31 \dots\dots (ii)$</p> <p>Subtracting equation (ii) from (i) we get</p> $ \begin{aligned} -x + y &= 3 \\ \text{or } y &= x + 3 \dots\dots (iii) \end{aligned} $ <p>Substituting the value of y in equation (i), we get</p> $ \begin{aligned} 32x + 33(x + 3) &= 34 \\ 32x + 33x + 99 &= 34 \\ 65x &= 34 - 99 \\ 65x &= -65 \\ x &= \frac{-65}{65} = -1 \end{aligned} $ <p>Then from equation (iii)</p> $ \begin{aligned} y &= -1 + 3 = 2 \\ x = -1 \text{ and } y &= 2 \end{aligned} $	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
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23

Given that

$$OA = OB = \text{radius} = 10 \text{ cm}$$

$$\theta = 90^\circ$$



$$\text{Area of segment APB} = \text{Area of sector OAPB} - \text{Area of } \triangle AOB$$

$$\begin{aligned}\text{Area of sector OAPB} &= \frac{\theta}{360} \times \pi r^2 \\ &= \frac{90}{360} \times 3.14 \times (10)^2 \\ &\approx \frac{1}{4} \times 3.14 \times 100 \\ &\approx \frac{1}{4} \times 314 \\ &= 78.5 \text{ cm}^2\end{aligned}$$

1

Now, $\triangle AOB$ is a right triangle, where $\angle O = 90^\circ$

having Base = OA & Height = OB

$$\begin{aligned}\text{Area of } \triangle AOB &= \frac{1}{2} \times \text{Base} \times \text{Height} \\ &= \frac{1}{2} \times OA \times OB \\ &= \frac{1}{2} \times 10 \times 10 \\ &= 50 \text{ cm}^2\end{aligned}$$

½

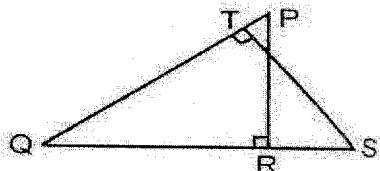
$$\text{Area of segment APB} = \text{Area of sector OAPB} - \text{Area of } \triangle AOB$$

½

$$= 78.5 - 50$$

$$= 28.5 \text{ cm}^2$$

24



Given:

In $\triangle PQR$, $\angle R = 90^\circ$

In $\triangle SQT$, $\angle T = 90^\circ$

To Prove:

$$QR \times QS = QP \times QT$$

Proof:

In $\triangle PQR$ and $\triangle SQT$,

$$\angle PQR = \angle SQT \text{ (Common)}$$

$$\angle PRQ = \angle STQ (90^\circ)$$

$\triangle PQR \sim \triangle SQT$ (By AA Similarity criterion)

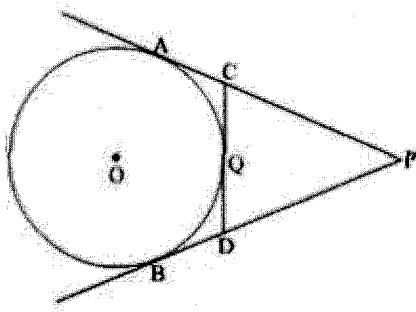
$$\frac{QR}{QT} = \frac{QP}{QS} \text{ (C.P.S.T)}$$

Cross Multiplying we get,

$$QR \times QS = QP \times QT$$

Hence Proved

25



Given: PA and PB are the tangents to the circle.

$$PA = 12 \text{ cm}$$

$$QC = QD = 3 \text{ cm}$$

To find: PC + PD

$$PA = PB = 12 \text{ cm}$$

(The lengths of tangents drawn from an external point to a circle are equal)

$$\text{Similarly, } QC = AC = 3 \text{ cm}$$

$$\text{and } QD = BD = 3 \text{ cm.}$$

$$\text{Now, } PC = PA - AC = 12 - 3 = 9 \text{ cm}$$

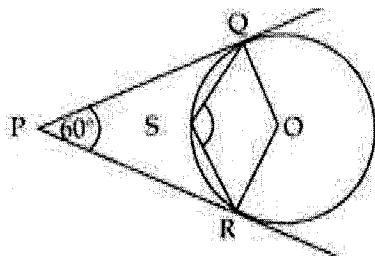
$$\text{Similarly, } PD = PB - BD = 12 - 3 = 9 \text{ cm}$$

$$\text{Hence, } PC + PD = 9 + 9 = 18 \text{ cm.}$$

OR

Given, $\angle QPR = 60^\circ$.

To find: $\angle QSR$



Solution:

$$\angle QPR + \angle QOR = 180^\circ$$

$$60^\circ + \angle QOR = 180^\circ$$

$$\angle QOR = 180^\circ - 60^\circ = 120^\circ$$

$$\text{Reflex } \angle QOR = 360^\circ - 120^\circ = 240^\circ$$

$$\angle QSR = \frac{1}{2} \text{ Reflex } \angle QOR = \frac{1}{2} \times 240^\circ = 120^\circ \text{ (Central angle theorem)}$$

SECTION C

Section C consists of 6 questions of 3 marks each

26

Let $5 - 3\sqrt{2}$ is rational

$$\therefore 5 - 3\sqrt{2} = \frac{a}{b}, \text{ where 'a' and 'b' are co-prime integers and } b \neq 0$$

$$3\sqrt{2} = 5 - \frac{a}{b}$$

$$3\sqrt{2} = \frac{5b-a}{b}$$

$$\text{Or } \sqrt{2} = \frac{5b-a}{3b}$$

Because 'a' and 'b' are integers $\frac{5b-a}{3b}$ is rational

That contradicts the fact that $\sqrt{2}$ is irrational.

The contradiction is because of the incorrect assumption that $5 - 3\sqrt{2}$ is rational.

So, $5 - 3\sqrt{2}$ is irrational.

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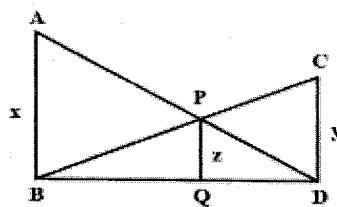
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27

Given :

AB, CD, PQ are perpendicular to BD,

AB = x, CD = y and PQ = z

Proof :Consider $\triangle ABD$ and $\triangle PQD$

$$\angle ABD = \angle PQD = 90^\circ$$

$$\angle ADB = \angle PDQ \text{ (common angle)}$$

 $\triangle ABD \sim \triangle PQD$ (By A.A similarity criterion)

$$\frac{PQ}{AB} = \frac{QD}{BD}$$

$$\Rightarrow \frac{z}{x} = \frac{QD}{BD} \text{ (c.p.s.t)} \quad (1)$$

Consider $\triangle CDB$ and $\triangle PQB$

$$\angle CDB = \angle PQB = 90^\circ$$

$$\angle CBD = \angle PBQ \text{ (common angle)}$$

 $\triangle CDB \sim \triangle PQB$ (By A.A similarity criterion)

$$\text{So, } \frac{z}{y} = \frac{BQ}{BD} \quad (2)$$

From (1) and (2) we get

$$\frac{z}{x} + \frac{z}{y} = \frac{QD}{BD} + \frac{BQ}{BD}$$

$$\Rightarrow z\left(\frac{1}{x} + \frac{1}{y}\right) = \frac{QD + BQ}{BD}$$

$$\Rightarrow z\left(\frac{1}{x} + \frac{1}{y}\right) = \frac{BD}{BD}$$

$$\Rightarrow z\left(\frac{1}{x} + \frac{1}{y}\right) = 1$$

$$\Rightarrow \frac{1}{x} + \frac{1}{y} = \frac{1}{z}$$

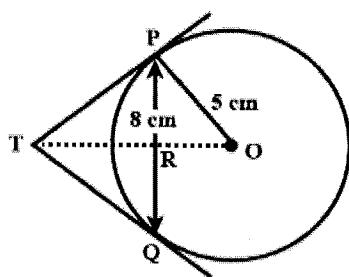
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OR



Join OT. Let it intersect PQ at the point R. Then $\triangle TPQ$ is isosceles and TO is the angle bisector of $\angle PTQ$. So, $OT \perp PQ$ and therefore, OT bisects PQ which gives $PR = RQ = 4\text{ cm}$.

$$\text{Also, } OR = \sqrt{OP^2 - PR^2} = \sqrt{5^2 - 4^2} \text{ cm} = 3 \text{ cm.}$$

In $\triangle ORP$ and $\triangle OPT$,

$$\angle ORP = \angle OPT = 90^\circ$$

\angleROP and \anglePOT (Common angle)

$\triangle ORP \sim \triangle OPT$ (By AA similarity criterion)

So, their corresponding sides are proportional

$$\text{I.e. } \frac{RP}{PT} = \frac{OR}{OP}$$

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

$$PT = \frac{20}{3}$$

28	(i) $P(\text{getting a red face card}) = \frac{6}{52} = \frac{3}{26}$ (ii) $P(\text{not getting a diamond card}) = \frac{52-13}{52} = \frac{39}{52} = \frac{3}{4}$ (iii) $P(\text{getting either king or black card}) = \frac{26+2}{52} = \frac{28}{52} = \frac{7}{13}$	1 1 1
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29	Let the zeros of the given equation be α and β . Now, $7y^2 - \frac{11}{3}y - \frac{2}{3} = 0$ (Here, $a = 7$, $b = \frac{-11}{3}$, $c = \frac{-2}{3}$) On multiplying both sides by 3, we get, $21y^2 - 11y - 2 = 0$ $21y^2 - 14y + 3y - 2 = 0$ $7y(3y - 2) + 1(3y - 2) = 0$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
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	$(7y + 1)(3y - 2) = 0$ $\Rightarrow (7y + 1) = 0 \text{ or } (3y - 2) = 0$ $\therefore y = -\frac{1}{7} \text{ or } y = \frac{2}{3}$ $\therefore \alpha = -\frac{1}{7} \text{ & } \beta = \frac{2}{3}$ $\text{Sum of the roots } (\alpha + \beta) = -\frac{b}{a}$ $\text{LHS} = \alpha + \beta = -\frac{1}{7} + \frac{2}{3} = \frac{11}{21}$ $\text{RHS} = -\frac{b}{a} = \frac{11}{21}$ $\therefore \text{LHS} = \text{RHS}$ $\text{Product of the roots } (\alpha\beta) = \frac{c}{a}$ $\text{LHS} = \alpha\beta = -\frac{1}{7} \times \frac{2}{3} = -\frac{2}{21}$ $\text{RHS} = \frac{c}{a} = -\frac{2}{21}$ $\therefore \text{LHS} = \text{RHS}$ <p>Hence, verified.</p>	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
30	<p>Let the number of tigers be x and that of peacocks be y,</p> <p>Then head count :</p> $x + y = 47 \quad \dots \quad (1)$ <p>Leg count :</p> $4x + 2y = 152 \quad \dots \quad (2)$ $(1) \times 2 \Rightarrow 2x + 2y = 94 \quad \dots \quad (3)$ <p>Subtracting (3) from (2), we get,</p> $2x = 58$ $\therefore x = 58/2 = 29$ <p>Substituting $x = 29$ in equation (1), we get</p> $29 + y = 47.$ $\therefore y = 47 - 29 = 18$ <p>Therefore, the number of tigers is 29 and the number of peacocks is 18.</p> <p style="text-align: center;">OR</p> <p>Let the ten's digit be x and one's digit be y</p> <p>So, the two digit number = $10x + y$</p> <p>If we interchange the digit, New number = $10y + x$</p>	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

	Case 1: 10x + y + 10y + x = 99 11x + 11y = 99 Dividing by 11 x + y = 9 x = 9 - y ----- (1)	½
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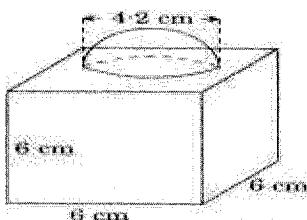
	Case 2: 10x + y + 5 = 6(x + y) - 4 10x + y + 5 = 6x + 6y - 4 4x - 5y = -9 ----- (2) Substitute (1) in (2) 4(9 - y) - 5y = -9 36 - 4y - 5y = -9 9y = 45 y = 5 Substitute y = 5 in (1) x = 9 - 5 = 4 The number is 45.	½
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31	$\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1}{(\sec \theta - \tan \theta)}$ $LHS = \frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1}$ Dividing the numerator and the denominator by $\cos \theta$, we get $= \frac{\frac{\sin \theta}{\cos \theta} - \frac{\cos \theta}{\cos \theta} + 1}{\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\cos \theta} - 1} = \frac{\tan \theta - 1 + \sec \theta}{\tan \theta + 1 - \sec \theta}$ $= \frac{(\tan \theta + \sec \theta) - 1}{(\tan \theta - \sec \theta) + 1}$ $= \frac{((\tan \theta + \sec \theta) - 1)(\tan \theta - \sec \theta)}{((\tan \theta - \sec \theta) + 1)(\tan \theta - \sec \theta)}$ $= \frac{(\tan^2 \theta - \sec^2 \theta) - (\tan \theta - \sec \theta)}{(\tan \theta - \sec \theta + 1)(\tan \theta - \sec \theta)}$ $= \frac{-1 - \tan \theta + \sec \theta}{(\tan \theta - \sec \theta + 1)(\tan \theta - \sec \theta)}$ $= \frac{-1}{\tan \theta - \sec \theta}$ $= \frac{1}{\sec \theta - \tan \theta}$ = RHS	1 ½ ½ ½ ½ ½ ½ ½ ½ ½
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SECTION D

Section B consists of 4 questions of 5 marks each

32



For the Cube:

$$a = 6 \text{ cm}$$

For the hemisphere:

$$r = \frac{4.2}{2} = 2.1 \text{ cm}$$

The total surface area of the block = TSA of the Cube + CSA of the

Hemisphere - Base area of the hemisphere

$$= 6 \times a^2 + 2 \times \pi \times r^2 - \pi \times r^2$$

$$= 6 \times a^2 + \pi \times r^2$$

$$= 6 \times 6^2 + \frac{22}{7} \times 2.1 \times 2.1$$

$$= 229.86 \text{ cm}^2$$

Volume of the block = Volume of the cube + Volume of the hemisphere

$$= a^3 + \frac{2}{3} \times \pi \times r^3$$

$$= 6^3 + \frac{2}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 2.1$$

$$= 216 + 2 \times 22 \times 0.3 \times 0.7 \times 2.1$$

$$= 235.404 \text{ cm}^3$$

OR

Given inner diameter of the glass = 5 cm

$$\text{So, radius } r = \frac{\text{Diameter}}{2} = \frac{5}{2} = 2.5 \text{ cm}$$

Height = 10 cm

Volume of the cylindrical glass = $\pi r^2 h$

$$= 3.14 \times (2.5)^2 \times 10$$

$$= 3.14 \times 2.5 \times 2.5 \times 10$$

$$= 3.14 \times 6.25 \times 10$$

$$= 196.25 \text{ cm}^3$$

Volume of the hemisphereRadius of hemisphere = $r = 2.5 \text{ cm}$

$$\text{Volume of the hemisphere} = \frac{2}{3}\pi r^3$$

$$= \frac{2}{3} \times 3.14 \times (2.5)^3$$

$$= \frac{2}{3} \times 3.14 \times 2.5 \times 2.5 \times 2.5$$

$$= \frac{2}{3} \times 3.14 \times 15.625$$

$$= 32.7 \text{ cm}^3$$

Apparent capacity of the glass = Volume of cylinder = 196.25 cm^3 **Actual capacity of the glass**

$$= \text{Total volume of cylinder} - \text{volume of hemisphere}$$

$$= 196.25 - 32.7$$

$$= 163.54 \text{ cm}^3$$

Hence, apparent capacity = 196.25 cm^3 Actual capacity of the glass = 163.54 cm^3

33

Class intervals	Frequency (f)	Cumulative frequency (c.f.)
20-30	4	4
30-40	12	16
40-50	14	30
50-60	16	46
60-70	20	66
70-80	16	82
80-90	10	92
90-100	8	100

$$N = \sum f_i = 100$$

½

1

½

1

2½

Here, $N = \sum f_i = 100 \therefore \frac{N}{2} = 50$

We observe that the cumulative frequency just greater than $\frac{N}{2} = 50$ is 66 and the corresponding class is 60 – 70.

So, 60 – 70 is the median class.

$\therefore l = 60, f = 20, F = 46$ and $h = 10$

Now,

$$\text{Median} = l + \frac{\frac{N}{2} - F}{f} \times h$$

$$\Rightarrow \text{Median} = 60 + \frac{50-46}{20} \times 10 = 62$$

34

Let the usual speed of plane be x km/hr

Increased speed = $(250 + x)$ km/hr

Time taken to cover 1500 km at usual speed = $\frac{1500}{x}$

Time taken to cover 1500 km at increased speed = $\frac{1500}{x+250}$

From the given information, we have:

$$\frac{1500}{x} - \frac{1500}{x+250} = \frac{30}{60}$$

$$\frac{1500x + 1500 \times 250 - 1500x}{x(x+250)} = \frac{1}{2}$$

$$\frac{1500 \times 250}{x^2 + 250x} = \frac{1}{2}$$

$$x^2 + 250x - 750000 = 0$$

$$x^2 + 1000x - 750x - 750000 = 0$$

$$x(x + 1000) - 750(x + 1000) = 0$$

$$(x + 1000)(x - 750) = 0$$

$$X = -1000, 750$$

Since, speed cannot be negative. So, $x = 750$

Hence, the usual speed of plane is 750 km/hr.

OR

Let x be the number of students who planned a picnic.

Original cost of food for each member = Rs. $2000/x$

Five students failed to attend the picnic. So, $(x-5)$ students attended the picnic.

New cost of food for each member = Rs. $2000/(x-5)$

According to the given condition,

$$\frac{\text{₹} \frac{2000}{x-5}}{\text{₹} \frac{2000}{x}} = \text{₹} 20$$

$$\Rightarrow \frac{2000x - 2000x + 10000}{x(x-5)} = 20$$

$$\Rightarrow \frac{10000}{x^2 - 5x} = 20$$

$$\Rightarrow x^2 - 5x = 500$$

$$\Rightarrow x^2 - 25x + 20x - 500 = 0$$

$$\Rightarrow x(x-25) + 20(x-25) = 0$$

$$\Rightarrow (x-25)(x+20) = 0$$

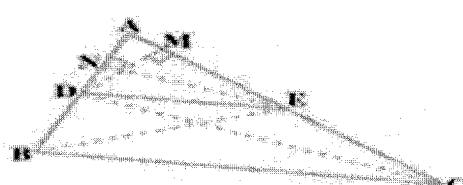
$$\Rightarrow x-25 = 0 \text{ or } x+20 = 0$$

$$\Rightarrow x = 25 \text{ or } x = -20$$

Number of students who attended the picnic = $x - 5 = 25 - 5 = 20$

$$\text{Amount paid by each student for the food} = \frac{2000}{20} = \text{₹} 100$$

35



We need to prove that $\frac{AD}{DB} = \frac{AE}{EC}$

Let us join BE and CD and then draw
DM \perp AC and EN \perp AB

$$\text{Now, area of } \triangle ADE = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times AD \times EN$$

area of $\triangle ADE$ is denoted as $\text{ar}(ADE)$.

$$\text{So, } \text{ar}(ADE) = \frac{1}{2} \times AD \times EN$$

$$\text{Similarly, } \text{ar}(BDE) = \frac{1}{2} \times DB \times EN$$

$$\text{ar}(ADE) = \frac{1}{2} \times AE \times DM \text{ and}$$

$$\text{ar}(DEC) = \frac{1}{2} \times EC \times DM$$

$$\text{Therefore, } \frac{\text{ar}(ADE)}{\text{ar}(BDE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN}$$

$$= \frac{AD}{DB} \dots (1)$$

$$\text{and } \frac{\text{ar}(ADE)}{\text{ar}(DEC)} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM}$$

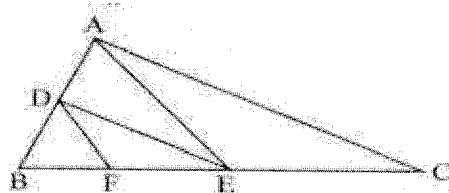
$$= \frac{AE}{EC} \dots (2)$$

Note that $\triangle BDE$ and $\triangle DEC$ are on the same base DE and between the same parallels BC and DE .

$$\text{So, } \text{ar}(BDE) = \text{ar}(DEC) \dots (3)$$

Therefore, from (1), (2) and (3), we have:

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



In $\triangle ABC$, $DE \parallel AC$ (Given)

$$\therefore \frac{BD}{DA} = \frac{BE}{EC} \quad (\text{BPT}) \dots (i)$$

In $\triangle ABE$, $DF \parallel AE$ (Given)

$$\therefore \frac{BD}{DA} = \frac{BF}{FE} \quad (\text{BPT}) \dots (ii)$$

From (i) and (ii), we have

$$\frac{BF}{FE} = \frac{BE}{EC}$$

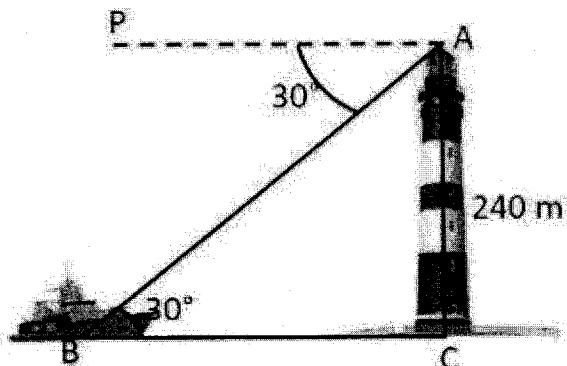
Hence proved.

SECTION E

Case study based questions are compulsory

36

(i)



Given that height of the lighthouse is 240 m

Hence, $AC = 240 \text{ m}$

And angle of depression of boat is 30°

So, $\angle PAB = 30^\circ$

Since Angle of depression = Angle of elevation

$\therefore \angle ABC = 30^\circ$

(ii)

In right angled triangle ΔABC ,

$$\tan B = \frac{\text{Side opposite to angle } B}{\text{Side adjacent to angle } B}$$

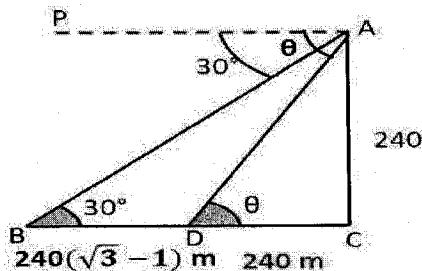
$$\tan 30^\circ = \frac{AC}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{240}{BC}$$

$$BC = 240\sqrt{3} \text{ m}$$

The distance of the boat from the foot of the lighthouse = $240\sqrt{3} \text{ m}$

(iii)



$$\text{Given } BD = 240(\sqrt{3} - 1) \text{ m}$$

1

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

So, $CD = BC - BD = 240\sqrt{3} - 240(\sqrt{3} - 1) = 240$ m

$$\tan \theta = \frac{AC}{CD}$$

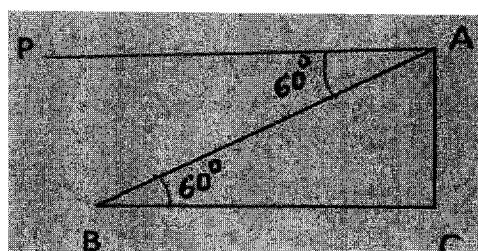
$$\tan \theta = \frac{240}{240}$$

$$\tan \theta = 1$$

$$\therefore \theta = 45^\circ$$

the new angle of depression of the boat from the top of the light house = 45°

OR



When the angle of depression (θ) is 60°

$\angle ABC = \angle PAB = 60^\circ$ (A; alternate interior angles)

$$\tan B = \frac{AC}{BC}$$

$$\tan 60^\circ = \frac{240}{BC}$$

$$\sqrt{3} = \frac{240}{BC}$$

$$BC = \frac{240}{\sqrt{3}} = \frac{240 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{240\sqrt{3}}{3} = 80\sqrt{3}$$

$$= 80 \times 1.73 = 138.4 \text{ m}$$

The distance of the boat from the lighthouse, when the angle of depression is 60° = 138.4 m

37	(i) The distance of the point B from y-axis = 2 units	1
	(ii) The coordinates of F is (12, 7)	
	The coordinates of F is (15, 11)	½
	the coordinates of the mid-point of the line segment joining the points	
	$F \text{ and } G = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right)$	
	$= \left(\frac{12+15}{2}, \frac{7+11}{2} \right) = \left(\frac{27}{2}, \frac{18}{2} \right) = (13.5, 9)$	½

(iii) $m_1 = 1$ & $m_2 = 2$

the coordinates of the point which divides the line segment joining the points F (12, 7) and G(15, 11) in the ratio 1 : 2 is

$$\begin{aligned} &= \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right) \\ &= \left(\frac{1 \times 15 + 2 \times 12}{1+2}, \frac{1 \times 11 + 2 \times 7}{1+2} \right) = \left(\frac{39}{3}, \frac{25}{3} \right) \\ &= \left(13, \frac{25}{3} \right) \end{aligned}$$

OR

Let P(x, y) is equidistant from the points A(1, 2) and C(5, 5)

ie. PA = PC

Therefore $PA^2 = PC^2$

$$(x - 1)^2 + (y - 2)^2 = (x - 5)^2 + (y - 5)^2$$

$$x^2 - 2x + 1 + y^2 - 4y + 4 = x^2 - 10x + 25 + y^2 - 10y + 25$$

$$-2x + 10x - 4y + 10y = 25 + 25 - 1 - 4$$

$$8x + 6y = 45$$

$$8x + 6y - 45 = 0$$

- 38 (i) since the production increases uniformly by a fixed number every year, the number of cars manufactured in 1st, 2nd, 3rd Years will form an AP.

$$a_4 = 1800$$

$$a + 3d = 1800 \quad \dots \quad (1)$$

$$a_8 = 2600$$

$$a + 7d = 2600 \quad \dots \quad (2)$$

$$(2) - (1) \Rightarrow 4d = 800$$

$$d = 200$$

$$\text{substitue } d = 200 \text{ in (1)} \Rightarrow a + 3 \times 200 = 1800$$

$$a = 1800 - 600 = 1200$$

The production in the 1st year = 1200

(ii) $a_{12} = a + 11d$

$$a_{12} = 1200 + 11 \times 200 = 1200 + 2200 = 3400$$

The production in the 12th year = 3400

(iii)	$S_n = n/2 (2a + (n-1)d)$	$\frac{1}{2}$
	$S_{10} = 10/2 (2 \times 1200 + 9 \times 200)$	$\frac{1}{2}$
	$= 5 \times (2400 + 1800)$	$\frac{1}{2}$
	$= 5 \times 4200 = 21000$	$\frac{1}{2}$
	The total production in first 10 years 21000	
	OR	
	$S_n = n/2 (2a + (n - 1)d) = 31200$	$\frac{1}{2}$
	$n/2 (2 \times 1200 + (n - 1) \times 200) = 31200$	
	$n/2 (2400 + 200n - 200) = 31200$	
	$n/2 \times 200 (11 + n) = 31200$	
	$n \times 100 (11 + n) = 31200$	1
	$n^2 + 11n - 312 = 0$	
	$(n + 24)(n - 13) = 0$	
	$n = 13 \text{ or } n = -24$	
	As n can't be negative. So n = 13	$\frac{1}{2}$
	In 13 th year the total production will reach to 31200 cars	