

MID TERM EXAMINATION

MATHEMATICS

SECTION - A

1. At a point on y -axis, $x = 0$

$0-y=8 \Rightarrow y=-8$, The line $x-y=8$ will intersect y axis at the point $(0, -8)$.

2. For unique soln, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$$\frac{4}{3} \neq -\frac{2}{k} \Rightarrow 4k \neq -6 \\ \Rightarrow k \neq -\frac{6}{4} \Rightarrow k \neq -\frac{3}{2}.$$

3. $a+2d=5$, $a+6d=9$, $a=3$, $d=1$ AP: 3, 4, 5 ...

4. $a=-40$, $d = -(14+17) = 3$. 5th term = -28

5. In $\triangle PQR$ $PQ = 10$; In $\triangle PQR$, $PQ^2 = 576$, $PQ^2 = 100$
 $QR^2 = 676$: $PQ^2 + PR^2 = 676 = QR^2$

6. By converse of Pythagoras $\angle QPR = 90^\circ$

It is given that $\frac{PS}{SQ} = \frac{PT}{TR}$, so $ST \parallel QR$

$\angle PST = \angle PQR$ (C.A) gives $\angle PST = \angle PQR$.

$\therefore \angle PRO = \angle PQR \quad \therefore PQ = PR \therefore \triangle PQR$ is isosceles.

SECTION - B

7. Let the age of son = x years; Father = y years

$$y = 3x$$

$$\text{After 5 years } y+5 = 2(x+5) \Rightarrow 5x - 2y + 15 = 0$$

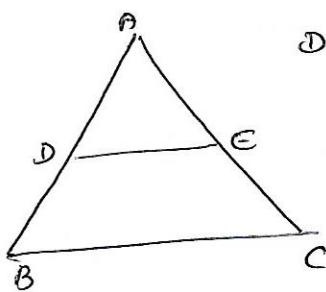
8. Money saved in 12 months = $\frac{12}{2} [2 \times 150 + 11 \times 50]$
 $= \text{₹ } 5100$.

She will be able to arrange money after 12 months.

Value: Importance of girls Education, Regular Savings.

There are 10 rows.

10.



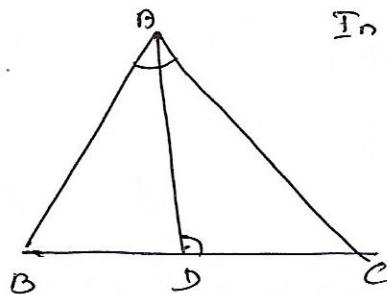
D is the mid point of AB
and DE || BC.
 $\therefore \frac{BD}{DB} = \frac{BE}{EC}$

$$\frac{AD}{DB} = 1 \Rightarrow AD = DB; \quad \frac{BE}{EC} = 1 \Rightarrow BE = EC.$$

E is mid point of AC.

11.

Given $\angle ADC = \angle BDC$.



In $\triangle BDC$ and $\triangle ADC$

$$\angle BDC = \angle ADC$$

$$\angle BCA = \angle DCD.$$

$$\triangle BDC \sim \triangle ADC$$

$$\therefore \frac{CD}{CD} = \frac{CB}{CA} \Rightarrow CA^2 = CB \cdot CD$$

12.

$$\triangle ABC \sim \triangle DEF. \quad \text{or } \frac{\text{Area of } \triangle ABC}{\text{Area of } \triangle DEF} = \left(\frac{BC}{EF}\right)^2$$

$$\frac{64}{121} = \left(\frac{BC}{15.4}\right)^2 \Rightarrow \left(\frac{8}{11}\right)^2 = \left(\frac{BC}{15.4}\right)^2.$$

$$\Rightarrow \frac{8}{11} = \frac{BC}{15.4} \Rightarrow BC = 11.2 \text{ cm.}$$

Section C.

13.

If unit digit is x and tens place is y

$$\text{The number} = 10y + x. \quad \text{gives } x + y = 9$$

$$\text{After reversing} = 10x + y$$

$$\text{As per condition } 9(10y + x) = 2(10x + y)$$

$$\Rightarrow x - 8y = 0$$

$$\text{On solving } x = 8, y = 1$$

Required number is 18

$$x = -2, y = 11 \quad y = mx + 3 \Rightarrow 11 = -2m + 3$$

$$-2m = 8$$

$$m = -4$$

14. $4x - y = 8 \Rightarrow \frac{4x}{8} - \frac{y}{8} = 1$
 $\frac{x}{2} - \frac{y}{8} = 1$ point $(2, 0)$ and $(0, -8)$

$2x - 3y = -6 \Rightarrow \frac{2x}{6} - \frac{3y}{6} = 1 \Rightarrow \frac{x}{3} + \frac{y}{2} = 1$
 $(-3, 0)$ and $(0, 2)$

Intersect at $(3, 4)$

Identifying vertices $(2, 0), (-3, 0), (3, 4)$

15. put $u = \frac{1}{2x-1}, v = \frac{1}{y+2} \Rightarrow 5u+v=2$
 $6u-3v=1$

Solving $u = \frac{1}{3}, v = \frac{1}{3}$ $x = 4, y = 5$

16. $a_n = 3 + 2n$. $a_1 = 5, a_2 = 7, a_3 = 9$

List of numbers $5, 7, 9, 11, \dots$

$d = 2, a = 5, n = 24$

$\therefore S_{24} = \frac{24}{2} [2 \times 5 + 23 \times 2] = 622.$

17. Given A.P $3, 15, 27, 39, \dots$

$a = 3, d = 12, a_n = a_5 + 132.$

$n = 65$. Hence 65^{th} term will be 132 more than 54^{th} term

OR

$a = 17, l = 350 = a_n, d = 9$

$350 = 17 + (n-1)9 \Rightarrow n = 38. S_n = \frac{n}{2}(a+a_n)$

$S_{38} = \frac{38}{2}(17+350) = 6993.$

12, 16, 20, 24 ... 96.

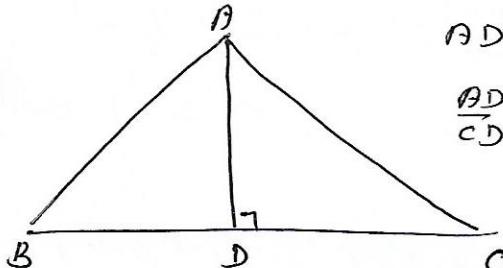
$$a = 12, d = 4, a_n = 96$$

$$\therefore a_n = a + (n-1)d \Rightarrow 96 = 12 + (n-1)4$$

$$\Rightarrow n = 22.$$

$$S_n = \frac{n}{2}(12+96) = 11 \times 108 = 1188.$$

19.



$$AD^2 = BD \times CD$$

$$\frac{AD}{CD} = \frac{BD}{AD}$$

$$\therefore \triangle ABD \sim \triangle BDC \therefore \angle A = 90^\circ$$

$$\therefore \angle BAD = \angle BCD$$

$$\angle BDC = \angle DBA$$

$$\therefore \angle BAD + \angle BCD + \angle BDC + \angle DBA = 180^\circ$$

$$2\angle BAD + 2\angle BDC = 180^\circ$$

$$\angle BAD + \angle BDC = 90^\circ \Rightarrow \angle A = 90^\circ$$

20.

$$LN \parallel CD$$

$$\frac{AL}{AC} = \frac{BN}{BD} \quad \text{by BPT}$$

$$LM \parallel CB$$

$$\frac{BL}{BC} = \frac{BM}{BD} \quad \text{by BPT}$$

$$\frac{BM}{BC} = \frac{BN}{BD}.$$

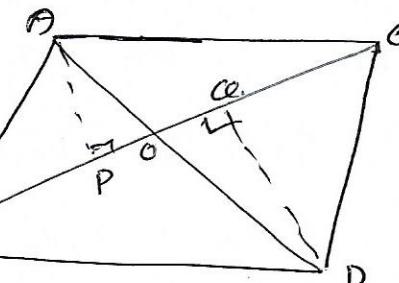
21.

Const.: Draw

$$DP \perp BC \text{ and } DQ \perp BC.$$

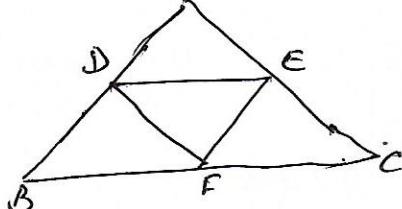
$$\angle DPO = \angle DQO = 90^\circ$$

$$\angle DOP = \angle DOQ$$



$$\triangle DOP \sim \triangle DOQ \Rightarrow \frac{DP}{DQ} = \frac{DO}{DO}$$

OR



$$\frac{DE}{AC} = \frac{1}{2} \quad \frac{DF}{FB} = \frac{1}{2} \Rightarrow \frac{DE}{AC} = \frac{DF}{FB}$$

$$\therefore DE \parallel BC.$$

$$\frac{\text{ar } \triangle ABC}{\text{ar } \triangle DBC} = \frac{\frac{1}{2} BC \cdot DP}{\frac{1}{2} BC \cdot DQ}$$

$$= \frac{DP}{DQ}$$

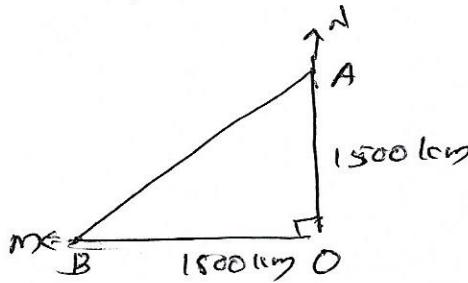
$$= \frac{AO}{DO}$$

$\therefore \triangle ABC \sim \triangle DEF$.

$$\frac{\text{ar } \triangle DCF}{\text{ar } \triangle ABC} = \left(\frac{DC}{BC}\right)^2 = \left(\frac{\frac{1}{2}BC}{BC}\right)^2 = \frac{1}{4}$$

Ratio = 1 : 4

22.



$$OA = 1000 \times \frac{1}{2} \\ = 1500 \text{ km}$$

$$OB = 1200 \times \frac{1}{2} = 1800 \text{ km}$$

$$AB^2 = OA^2 + OB^2 = 5490000 \Rightarrow AB = 300\sqrt{61} \text{ km}$$

Hence the two planes will be $300\sqrt{61}$ km apart after $1\frac{1}{2}$ hrs.

23.

Section-D

Let the speed of the boat in still water = $x \text{ km/hr}$.
= $y \text{ km/hr}$

Speed of stream

Speed in up stream = $(x-y) \text{ km/hr}$
down stream = $(x+y) \text{ km/hr}$.

$$t_1 = \frac{30}{x-y}, \quad t_2 = \frac{44}{x+y}.$$

$$\frac{30}{x-y} + \frac{44}{x+y} = 10; \quad \frac{40}{x-y} + \frac{55}{x+y} = 13$$

$$\text{put } \frac{1}{x-y} = u \text{ and } \frac{1}{x+y} = v. \quad u = \frac{1}{5}, \quad v = \frac{1}{11}$$

$$x-y = 5 \quad x+y = 11. \quad x = 8, \quad y = 3.$$

24. Fixed charge Rs. x and tem charge Rs. y .

$$x+10y = 105, \quad x+15y = 155 \quad x = 5, \quad y = 10$$

\therefore Fixed charge Rs. 5 and charge per km Rs 10

$3x+y$

$$A+B = \frac{3}{4} \quad \text{and} \quad A-B = -\frac{1}{2},$$

$$\therefore A = \frac{1}{2}, \quad B = \frac{1}{2}.$$

$$3x+y = 4 \quad \text{and} \quad 3x-y = 2 \quad \therefore x=1, y=1$$

OR

x litres of 90% pure acid

y litres of 97% pure acid soln.

Total = $(x+y)$ litres.

$$\begin{aligned} \therefore x+y &= 21 \quad \text{and} \quad 90\% \text{ of } x + 97\% \text{ of } y = 95\% \text{ of } 21 \\ &\quad \rightarrow ① \qquad \qquad \qquad \rightarrow ② \\ &\quad \Rightarrow 90x + 97y = 1995 \end{aligned}$$

$$\text{Solving } ① \text{ and } ②: \quad x = 6 \quad \text{and} \quad y = 15.$$

26.

$$1 \text{ woman's 1 day work} = \frac{1}{x} \quad ; \quad \text{put} \quad \frac{1}{x} = u$$

$$1 \text{ man's 1 day work} = \frac{1}{y} \quad ; \quad \frac{1}{y} = v$$

2 Women and 5 men

$$\frac{2}{x} + \frac{5}{y} = \frac{1}{4}$$

$$6u + 15v = \frac{3}{4}$$

$$6u + 12v = \frac{2}{3}$$

3 Women and 6 men

$$\frac{3}{x} + \frac{6}{y} = \frac{1}{3}$$

$$4u + 18v = \frac{1}{18}$$

$$\Rightarrow u = \frac{1}{18}, v = \frac{1}{36}$$

$$\Rightarrow x = 18, y = 36$$

1 Women alone $\Rightarrow 18$ days. 1 men alone in 36 days.

27.

$$S_n = 4n - n^2, \quad S_1 = 3, \quad a_1 = 3$$

$$10^{th} \text{ term} = -15$$

$$S_2 = 4, \quad a_2 = 1 \quad a_3 = -1$$

$$n^{th} \text{ term} = S_n - S_{n-1}$$

$$S_9 = -45 \quad S_{10} = -60$$

$$\begin{aligned} &= (4n - n^2)^2 - 60 - n^2 - 5 \\ &= -5 - 2n \end{aligned}$$

28.

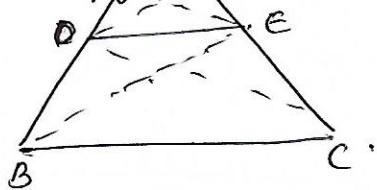
$$\text{Ans} \quad d = 7, \quad a_{22} = 149 \quad a_n = a + (n-1)d$$

$$a_{22} = a + 21d \quad \Rightarrow \quad a = 2.$$

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

$$S_{22} = \frac{22}{2} [4 + 21 \times 7]$$

$$= 11 \times 151 = 1661$$



$$\text{ar } \triangle BDE = \frac{1}{2} BD \times EP$$

$$\text{ar } \triangle BDE = \frac{1}{2} BE \times DQ$$

$$\text{ar } \triangle DCE = \frac{1}{2} DC \times EP$$

$$\text{ar } \triangle DEC = \frac{1}{2} EC \times DQ$$

Using $\text{ar } \triangle BDE = \text{ar } \triangle DEC$ and confirming.

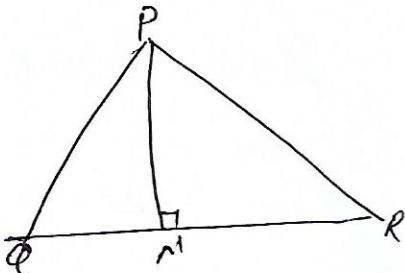
These ratios are equal; Conclusion.

Hypothesis,

Construction:

BM and PN perpendicular to BC

Or



and QM

$$\frac{\text{ar } \triangle ABC}{\text{ar } \triangle PQR} = \frac{BC \times BM}{PQ \times PN}$$

$$\angle B = \angle Q \quad \triangle ABC \sim \triangle PQR$$

$$\angle M = \angle N \quad \frac{BM}{PN} = \frac{AB}{PQ}$$

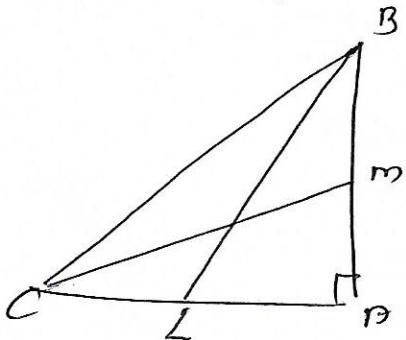
$$\triangle ABC \sim \triangle PQR$$

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$$

$$\frac{\text{ar } \triangle ABC}{\text{ar } \triangle PQR} = \frac{AB}{PQ} \times \frac{BC}{QR} = \frac{AB}{PQ} \times \frac{AB}{PR} = \left(\frac{AB}{PQ} \right)^2$$

Conclusion:

So,



$$\text{In } \triangle ABC, BC^2 = AB^2 + AC^2$$

$$\text{In } \triangle ABL, BL^2 = AL^2 + AB^2$$

$$BL^2 = \left(\frac{AC}{2}\right)^2 + AB^2$$

$$4BL^2 = AC^2 + 4AB^2$$

From $\triangle ACM$

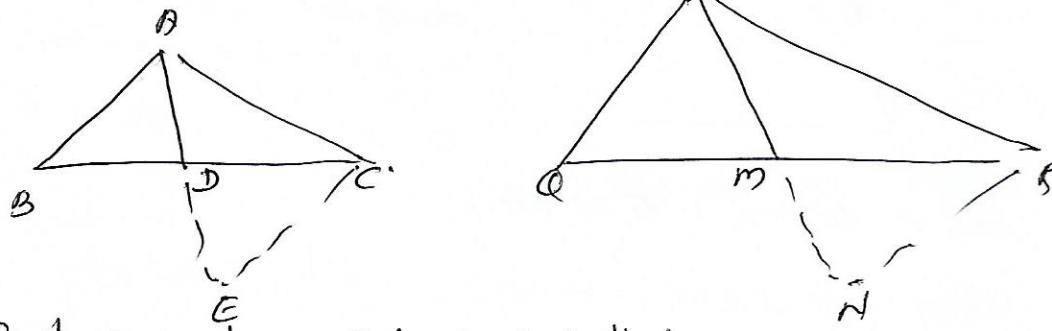
$$CM^2 = AC^2 + AM^2$$

$$= AC^2 + \left(\frac{AB}{2}\right)^2$$

$$ACM^2 = 4AC^2 + AB^2$$

$$\therefore 4(BL^2 + CM^2) = 5AC^2 + 5AB^2$$

$$= 5(AC^2 + AB^2)$$



Const : produce BD to E such that $BD = DE$
 produce PN such that $PN = MN$

$$\begin{array}{l|l} \Delta ABD \cong \Delta ECD & \Delta PQM \cong \Delta NRM \\ BD = ED & PQ = NR \\ \angle BOD = \angle CED & \angle QPM = \angle RNM \end{array}$$

Given $\frac{DB}{PQ} = \frac{DC}{PR} = \frac{BD}{PM} \therefore \frac{CE}{RN} = \frac{DC}{PR} = \frac{DE}{PN}$

$\therefore \Delta DCE \sim \Delta PRN \therefore \angle CED = \angle RNM$
 $\angle BOD = \angle QPM$

$\therefore \Delta ABD \sim \Delta PQM$

$\therefore \frac{DB}{PQ} = \frac{BD}{QM}$

$\therefore \frac{DB}{PQ} = \frac{DC}{PR} = \frac{BC}{QR}$

$\therefore \Delta ABC \sim \Delta PQR$.
