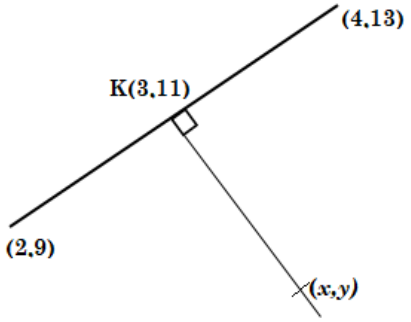
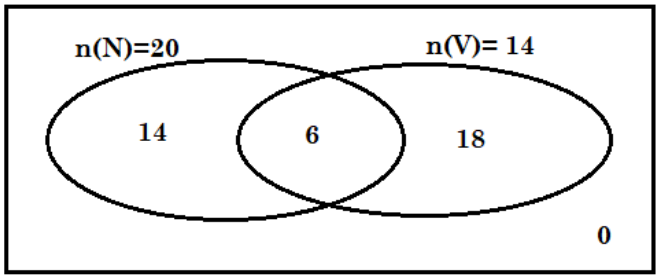
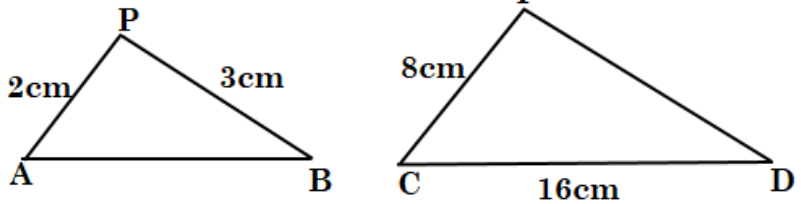
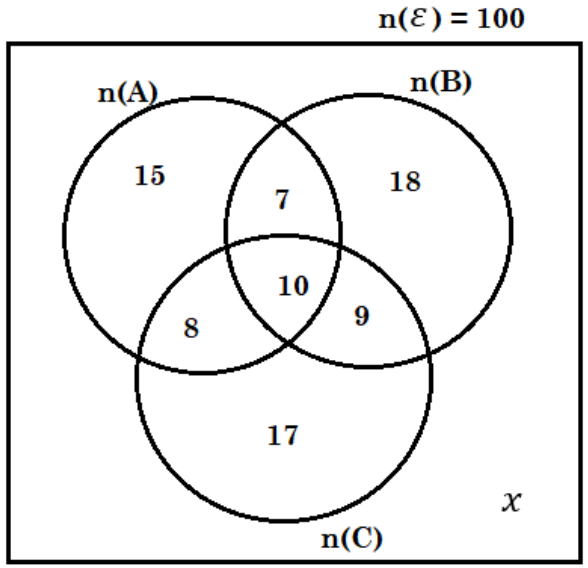
MATIGO EXAMINATIONS BOARD

465/2
MATHEMATICS
MARKING GUIDE 2023
PAPER 2

Qn	Answer	marks	Marking scheme
	SECTION A		
1(a)	$k = \frac{s}{t}$ $= \frac{4.5}{9}$ $= \frac{1}{2}$	M1 A1	For substituting. For correct answer.
(b)	$s = \frac{1}{2}t$ $22 \times 2 = t$ $t = 44$	M1 A1 04	For substituting$k$. For correct answer.
2	$\frac{2\sqrt{5}}{\sqrt{5} \times \sqrt{5}} + \frac{3\sqrt{2}}{\sqrt{2} \times \sqrt{2}}$ $\frac{2\sqrt{5}}{5} + \frac{3\sqrt{2}}{2}$ $a = {}^{2}/_{5}, \quad b = {}^{3}/_{2}$	M1M1 M1 A1	For rationalization of two terms. For simplifying. For correct answers.
		04	
3	$\mathrm{L}(-3,2) \qquad \mathrm{M}(-5,-4)$ $mid\ point, K\left(\frac{-3-5}{2}, \frac{2-4}{2}\right)$ $= K(-4,-1)$	M1M1 M1	Formula for mid-point. Substitution in formula. Coordinate k.

	$= \begin{pmatrix} -4 \\ -1 \end{pmatrix}$ ALTERNATIVELY $\widetilde{OR} = \widetilde{OL} + \widetilde{LR} = \widetilde{OL} + \frac{1}{2}[\widetilde{OM} - \widetilde{OL}] = \begin{pmatrix} -3 \\ 2 \end{pmatrix} + \frac{1}{2}\left[\begin{pmatrix} -5 \\ -4 \end{pmatrix} - \begin{pmatrix} -3 \\ 2 \end{pmatrix}\right] = \begin{pmatrix} -4 \\ -1 \end{pmatrix}$	A1	Correct answer.
		04	
4	 $m = \frac{13-9}{4-2}$ $= 2$ $2m_2 = -1$ $m_2 = \frac{-1}{2}$ $midpoint, K\left(\frac{2+4}{2}, \frac{9+13}{2}\right)$ $= K(3,11)$ $\frac{-1}{2} = \frac{y-11}{x-3}$ $2y = 25 - x$ $or\ y = \frac{-1}{2}x + \frac{25}{2}$	B1 B1 B1 A1	For numerical substitution for gradient. Correct answer For numerical expression of equation of a line. For correct answer.
		04	
5	 $n(\varepsilon) = 20 + 8$ $= 28\ students$	M1 M1 M1 A1	For 14 For 6 For 8 For correct answer
		04	
6	$V = \frac{22}{7} \times 10 \times \left(\left(\frac{37}{100}\right)^2 + \left(\frac{30}{100}\right)^2\right)$	M1 M1 M1	For big volume For small volume For difference

	$= \frac{22}{7} \times 10 \times \frac{67}{100} \times \frac{7}{100}$ $= 14.74m^3$	A1	For answer
		04	
7	$100 - 20 = 80\%$ $\frac{80}{100} of\ x = 64{,}000$ $x = \frac{64{,}000 \times 100}{80}$ $x = 80{,}000/=$	M1 M1 M1 A1	For Difference. For unknown. For making the subject. For correct answer.
		04	
8	$let\ f^{-1}(x) = y$ $y = \frac{14x + 5}{7x - 6}$ $14x + 5 = 7xy - 6y$ $14x - 7xy = -6y - 5$ $x = \left(\frac{-6y - 5}{14 - 7y}\right)$ $or\ x = \left(\frac{6y + 5}{7y - 14}\right)$ $f(x) = \frac{6x + 5}{7x - 14}$ $7x - 14 = 0$ $x = 2$	M1 M1 M1 A1	For $f^{-1}(x) = y$ For $f(x)$ For $\left(\frac{1}{0}\right)$ For correct answer
		04	
9	 $\frac{AB}{2} = \frac{16}{8}$ $AB = 4cm$	M1	For any expression.

	$\frac{PD}{3} = \frac{8}{2}$ $PD = 12cm$ $BD = 12 - 3$ $= 9cm$	M1 M1 A1	For PD For difference. For answer.
	SECTION B	04	
10	<table><tr><th>*No.*</th><th>*scientific form*</th><th>*log*</th></tr><tr><td>0.81</td><td>8.1×10^{-1}</td><td>$(\bar{1}.9085) \times \frac{2}{3}$</td></tr><tr><td></td><td></td><td>$(-3 + 2.9085) \times \frac{2}{3}$</td></tr><tr><td></td><td></td><td>$-2 + 1.9390$</td></tr><tr><td>0.8689</td><td>8.689×10^{-1}</td><td>$\bar{1}.9390$</td></tr></table> $\therefore \sqrt[3]{0.81^2} = 0.8689$	M1 M1 M1 A1	For $log 0.81 = \bar{1}.9085$ For $\frac{2}{3}$ For 8.689×10^{-1} For correct answer with $(4dp)$
		04	
11(a)		M1 M1 M1 M1 M1 M1	For $n(\varepsilon) = 100$ For 10 For 19 For 17 For 15 For 17 For summation

(b)	$n(A) = 15 + 7 + 10 + 8$ $= 40\ people$	M1 A1	For correct answer
	$B\ and\ C\ only = 9\ people$	A1	For correct answer
(c)	$40 + 18 + 9 + 17 + x = 100$	M1	For adding all
	$x = 100 - 84$		For simplifying
(d)	$x = 16\ people$	M1 A1	For correct answer
		12	

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Allowance	**Calculation**	**Total value**		
Water and Electricity	$48{,}000 \times 1$	48,000	M1	For housing.
Housing	$\frac{240{,}000}{12}$	20,000	M1	For medical.
Medical	$\frac{600{,}000}{12}$	50,000		
Transport	$50{,}000 \times 1$	50,000		For marriage.
Marriage	$\frac{1}{10} \times 700{,}000$	70,000	M1	
Children	$12{,}000 \times 2$	24,000	M1	For child allowance.
	$8{,}000 \times 1$	8,000		

$total\ allowance = 270{,}000/=$ M1 For summation.

$Taxable\ income\ (TI) =$

$$\begin{array}{r} 700{,}000 \\ -\ 270{,}000 \\ \hline 430{,}000/= \end{array}$$

M1 For correct answer of taxable income.

TI	Calculation	Tax	Balance
30,000	–	0	400,000
60,000	$\frac{10}{100} \times 60{,}000$	6,000	340,000
90,000	$\frac{20}{100} \times 90{,}000$	18,000	250,000
70,000	$\frac{30}{100} \times 70{,}000$	21,000	180,000
150,000	$\frac{40}{100} \times 150{,}000$	60,000	30,000
30,000	$\frac{50}{100} \times 30{,}000$	15,000	0

M1 For (TI).

M1 For TI column.

M1 Tax column

$$Total\ TAX = 120{,}000/=$$

M1 Tax (120,000).

$$= \frac{120{,}000}{700{,}000} \times 100\%$$

M1 For computation of percentage.

$$= 17.143\%$$

$$\approx 17\%$$

A1 For correct answer.

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13 (a) (i)

$let\ y = f(x)$

$y = 3x + 2$

$x = \frac{y-2}{3}$

M1 For $y = f(x)$.

$f^{-1}(x) = \frac{x-2}{3}$

M1 For $f^{-1}(x)$.

$f^{-1}(2) = \frac{2-2}{3}$

M1 For working out.

$f^{-1}(2) = 0$

A1 For correct answer.

(ii)

$ff(x) = fg(x)$

M1M1 For $ff(x)$ & $fg(x)$

$3(3x + 2) + 2 = 3(5x - 4) + 2$

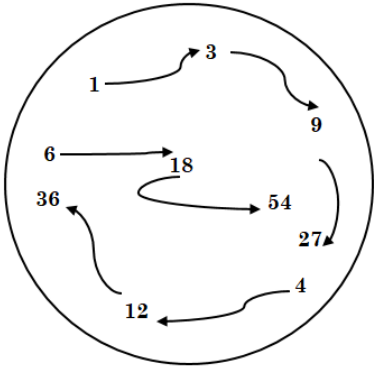
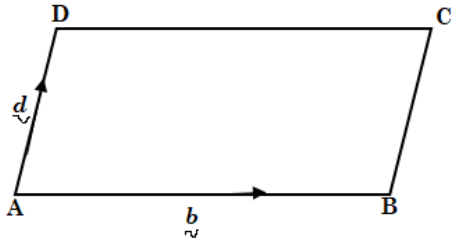
$9x + 8 = 15x - 10$

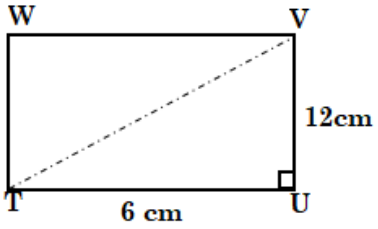
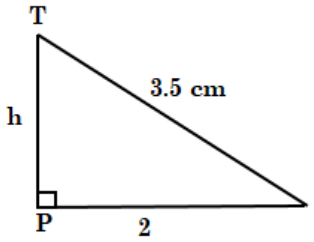
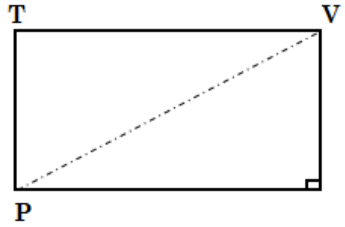
M1 For equating.

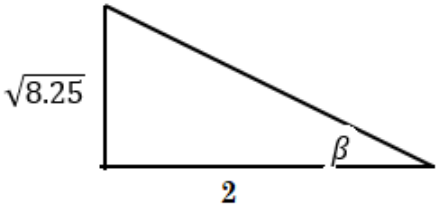
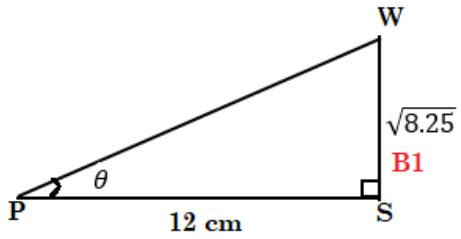
$18 = 6x$

$\therefore\ x = 3$

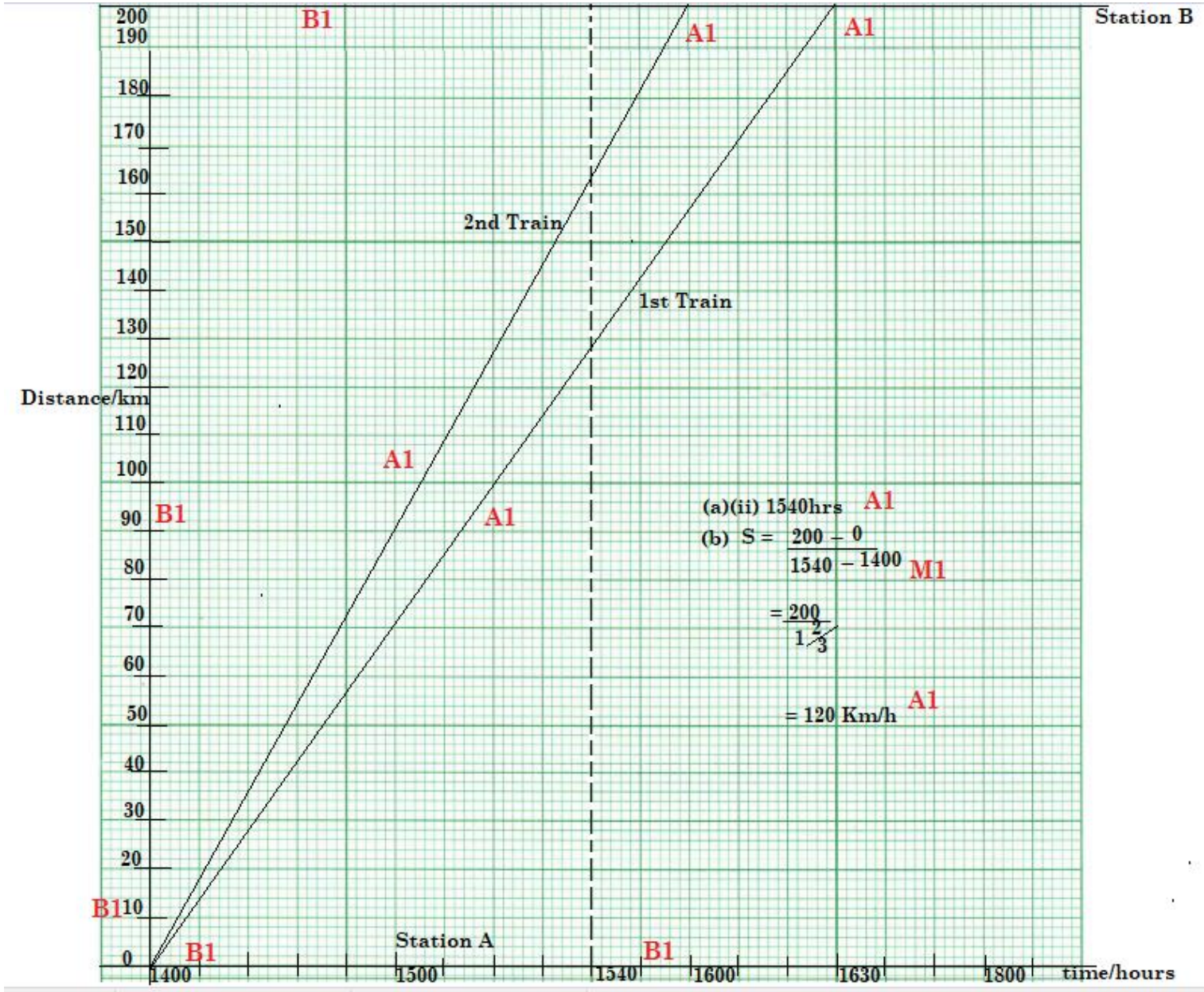
A1 For correct answer.

(b)	 *"is a third of"*	A1 A1 A1 A1	$1 \rightarrow 3 \rightarrow 9$ $6 \rightarrow 18 \rightarrow 54$ $4 \rightarrow 12 \rightarrow 36$ $9 \rightarrow 27$
		12	
14 (a)			
	$AE = AD + DE$ $= AD + DC + CE$ $= \tilde{d} + \tilde{b} + \frac{1}{2}\tilde{b}$ $= \tilde{d} + \frac{3}{2}\tilde{b}$	M1 M1 M1	$AE = AB + BF$ $BF = \frac{2}{3}BC$
	$AE = \frac{1}{2}(2\tilde{d} + 3\tilde{b})$	A1	
	$AF = AB + BF$ $= AB + \frac{2}{3}BC$ $= \tilde{b} + \frac{2}{3}\tilde{d}$ $= \frac{\mathbf{3}\tilde{b} + 2\tilde{d}}{\mathbf{3}}$	M1 M1 M1	$\frac{AF}{AE}$ *or* $\frac{AF}{FE}$ *or* $\frac{AE}{FE}$ Follow student work.
	$AF = \frac{1}{3}(2\tilde{d} + 3\tilde{b})$	A1	
(b)	$AF : AE$	M1	For ratio

	$\frac{AF}{AE} = \frac{\frac{1}{3}(2\tilde{d} + 3\tilde{b})}{\frac{1}{2}(2\tilde{d} + 3\tilde{b})}$ $\frac{AF}{AE} = \frac{2}{3}$ $AF : AE = 2 : 3$ *common point* (A), *Ratio* $2:3$	M1 A1	For simplifying For correct answer.
		12	
15 (a)	 $TV^2 = 6^2 + 12^2$ $TV^2 = 180$ $TV = \sqrt{180}$ OR $TV = 13.416cm$	M1	For Pythagoras theorem.
	 $h^2 = 3.5^2 - 2^2$ $h^2 = 8.25$ $h = \sqrt{8.25}$ OR $h = 2.872cm$	M1	For Pythagoras theorem and correct answer of h.
(b)	 $PV^2 = \left(\sqrt{180}\right)^2 + \left(\sqrt{8.25}\right)^2$ $PV^2 = 188.25$ $PV = \sqrt{188.25}$ OR $PV = 13.72cm$	M1 A1	For manipulation. For correct answer.

(c)	 $tan\beta = \frac{\sqrt{8.25}}{2}$ $\beta = tan^{-1}\left(\frac{\sqrt{8.25}}{2}\right)$ $\beta = 55.2°$  $tan\theta = \frac{\sqrt{8.25}}{12}$ $\theta = tan^{-1}\left(\frac{\sqrt{8.25}}{12}\right)$ $\theta = 13.5°$	B1M1 A1 M1 A1	For correct expression of $tan\ \beta$ For correct answer. For $\tan\theta$ expression. For correct answer.
(d)	$V = \frac{1}{2} \times \sqrt{8.25} \times 12 \times (6 + 8)$ $= 6 \times \sqrt{8.25} \times 14$ $= 241.272cm^3$	M1 A1	For formula. For correct answer.
		12	
16	$D_1 = 80\left(t + \frac{5}{6}\right)$ $D_2 = 100\left(t + \frac{2}{6}\right)$ $80\left(t + \frac{5}{6}\right) = 100\left(t + \frac{2}{6}\right)$ $80t + \frac{200}{3} = 100t + \frac{100}{3}$ $100t - 80t = \frac{200}{3} - \frac{100}{3}$ $20t = \frac{100}{3}$		

	$t = \frac{100}{60}, t = 1\frac{2}{3} hours$ OR $1{:}40\ minutes$ $D = 80\left(\frac{5}{3} + \frac{5}{6}\right)$ $= 80 \times \frac{5}{2}$ $D = 200km$		
		12	
17 **(a)**	$S = aN + b$ $600{,}000 = 1000a + b \ldots\ldots\ldots\ldots.1$ $720{,}000 = 14000a + b \ldots\ldots\ldots\ldots\ldots 2$ $equation\ 2 - equation\ 1$ $720{,}000 = 1400a + b$ $-\ 600{,}000 = 1000a + b$ $120{,}000 = 400a$ $a = \frac{120{,}000}{400}$ $= 300$ $600{,}000 = 300 \times 1000 + b$ $b = 300{,}000$ $Equation$ $S = 300N + 300{,}000$	M1 M1 M1 B1 B1 A1	*For Equation* $S = aN + b$. For the two equations. Solving simultaneously. Correct answer $a = 300$. Correct answer. $b = 300{,}000$. For correct equation. $S = 300N + 300{,}000$.
(b)	$1{,}200{,}000 = 300N + 300{,}000$ $300N = 900{,}000$ $N = 3000\ Students$	M1 M1 A1	For substitution. For simplifying. For correct answer.
(c)	$S = 300 \times 2000 + 300{,}000$ $= 600{,}000 + 300{,}000$ $S = 900{,}000/=$	M1 M1 A1	For substitution. For simplifying. For correct answer.



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