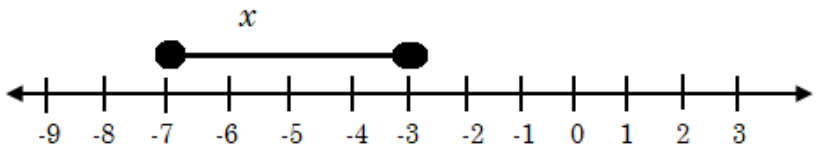
MATIGO EXAMINATIONS BOARD

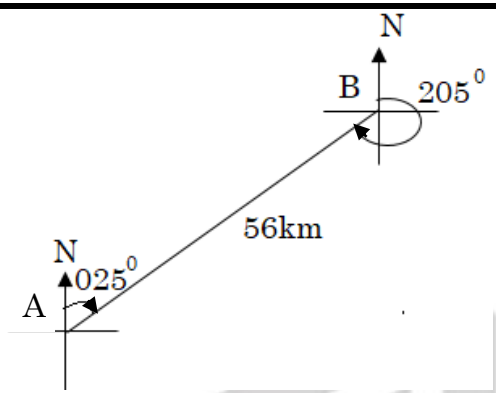
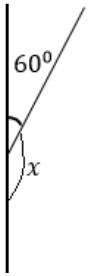
465/1

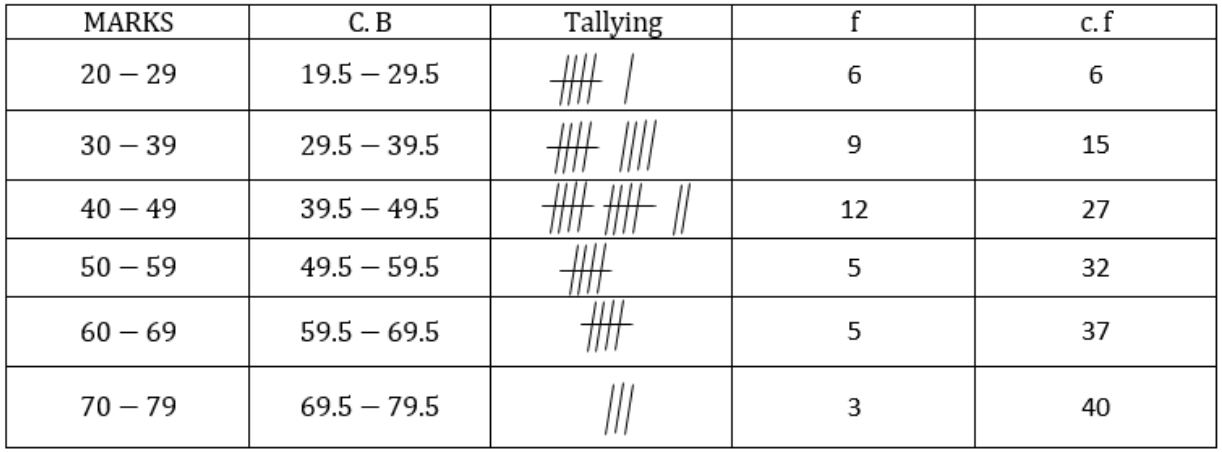
MATHEMATICS
MARKING GUIDE 2023
PAPER 1

Qn	Answers	Marks	comment
	SECTION A		
1	$MM^{-1} = \begin{pmatrix}1 & 2\\ c & d\end{pmatrix}\begin{pmatrix}-3 & 2\\ 2 & -1\end{pmatrix} = \begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}$ $-3c + 2d = 1 \ldots\ldots\ldots\ldots\ldots (i) 2c - b = 0 \ldots\ldots\ldots\ldots\ldots\ldots (ii),$ $d = 2c - 1, -3c + 4c - 2 = 0$ $c - 2 = 0, c = 2$ $d = (2)(c) - 1 = 4 - 1 = 3$	B1 M1 M1 A1	For $MM^{-1} = I$ Solving equation (i) and (ii) simultaneously simultaneously Correct values of *c and d*
		04	
2	$\frac{2X - Y}{X - 2Y} = \frac{4}{3}$ $3(2X - Y) = 4(X - 2Y)$ $6X - 3Y = 4X - 8Y$ $2X = -5Y$ $\frac{Y}{X} = \frac{-2}{5}$	 M1 M1 M1 A1	 Cross multiplying Opening brackets Collecting like terms Correct answer
		04	
3	1170,1200,1220,1230,1290,1390,1410,1430,1440,1460,1500,1600,1680,1730,1810	B1	Arrangement

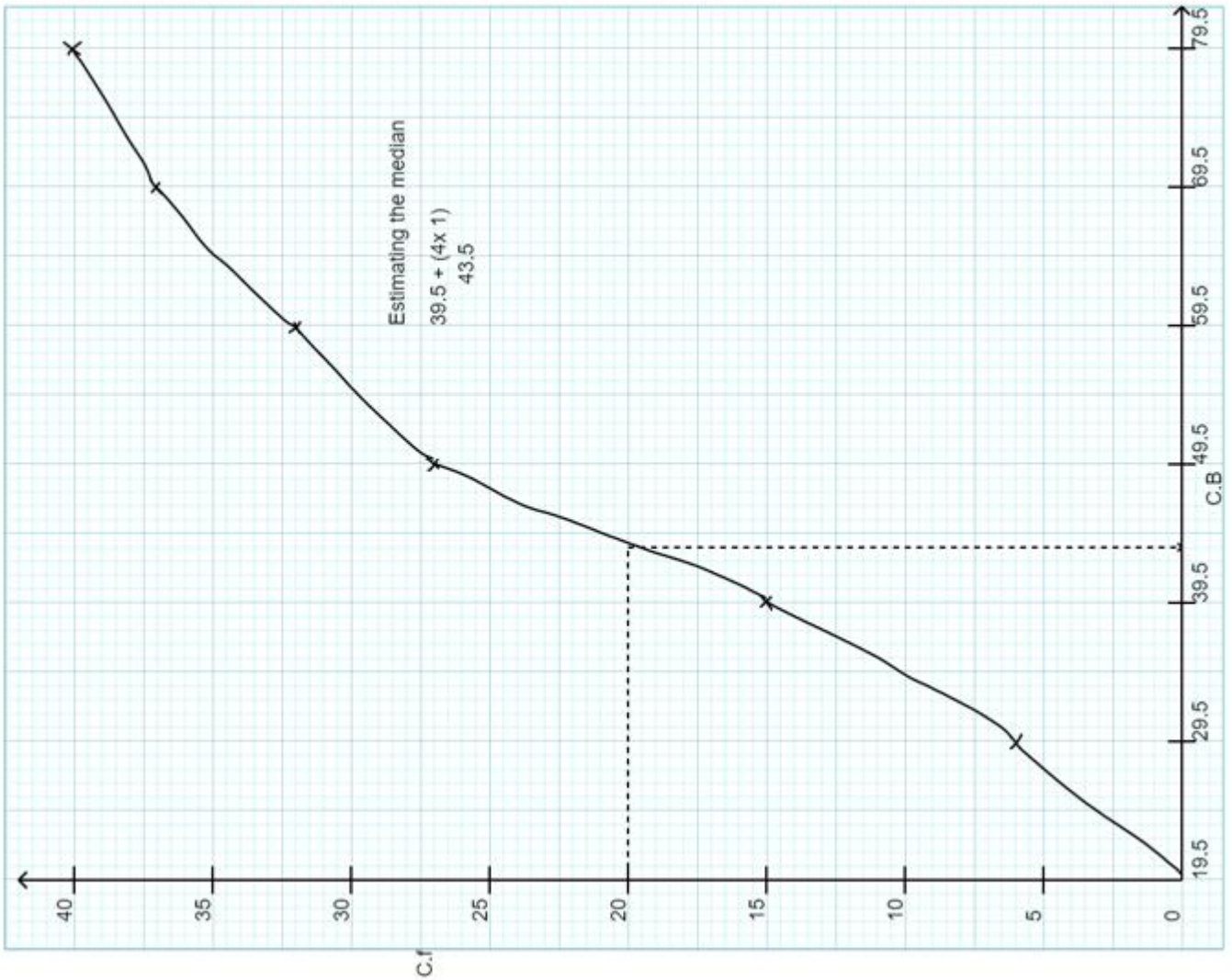
	$(i) median = 1430$ $(ii) mean = \frac{1170 + 1200 + 1220 + 1230 + 1290 + 1390 + 1410 + 1430 + 1440 + 1460 + 1500 + 1600 + 1680 + 1730 + 1810}{15}$ $= \frac{21560}{15}$ $= 1437\frac{1}{3}$	A1 M1 A1	Median Summation Accept 1437.3333
		04	
4	$-9 \leq 2X + 5 \leq 1$ $-9 - 5 \leq 2X \leq 1 - 5$ $-14 \leq 2X \leq -6$ $-7 \leq X \leq -3$  	M1 M1 A1 B1	Collecting like terms Simplifying Inequality Number line
		04	
5	$(2x^2) - 3^2 = 0$ $(2x - 3)(2x + 3)$ $\therefore (2x - 3)(2x + 3) = 0$ *either* $(2x - 3) = 0$ *or* $(2x + 3) = 0$ $\frac{2x}{2} = \frac{3}{2}$ *or* $\frac{2x}{2} = \frac{-3}{2}$ $x = \frac{3}{2}$ *or* $x = \frac{-3}{2}$	M1 B1 M1 A1	Difference of two squares Factorizing Either & or Answer
		04	
6	$6t^2 + 5y^2 + 6ty + 5ty$ $= 6t^2 + 6ty + 5ty + 5y^2$ $= 6t(t + y) + 5y(t + y)$ $= (t + y)(6t + 5y)$	M1 M1M1 A1	Correct arrangement Answer

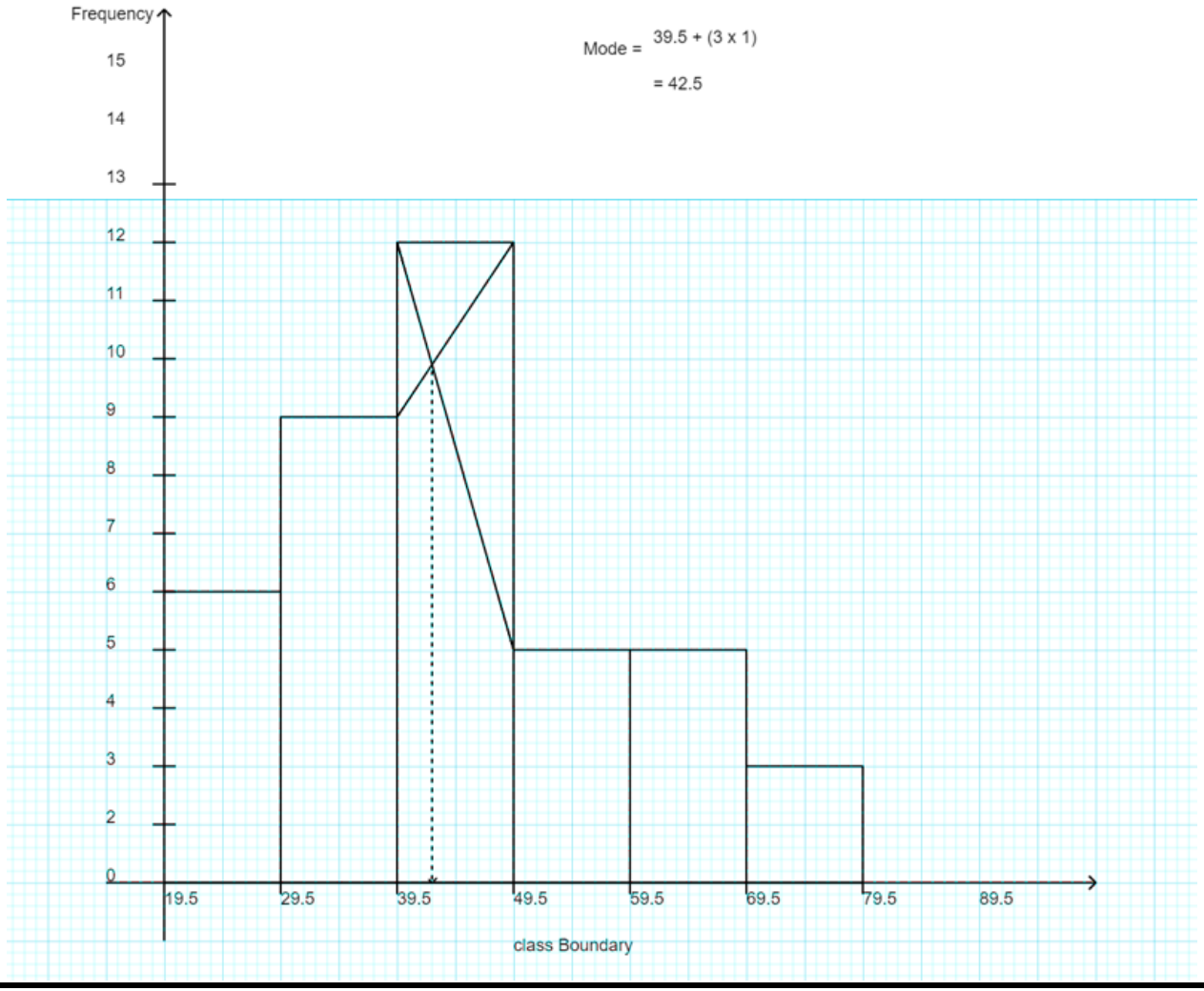
		04	
7	$k=-2, A(4,3), A^1(4,-5), O(x,y)$ $\frac{OA^1}{OA}=K$ $\frac{A^1-O}{A-O}=K$ $\frac{\binom{4}{-5}-\binom{x}{y}}{\binom{4}{3}-\binom{x}{y}}=-2$ $\frac{\binom{4-x}{-5-y}}{\binom{4-x}{3-y}}=-2$ $\binom{4-x}{-5-y}=-2\binom{4-x}{3-y}$ $4-x=-8+2x$ $-3x=-12$ $x=-4$ $-5-y=-6+2y$ $-3y=-1$ $y=\frac{1}{3}$ $O(x,y)=(4,\frac{1}{3})$	M1 M1M1 A1	Correct substitution
		04	
	ALTERNATIVELY $\boldsymbol{C.E}=\frac{1}{K-1}(KO-I)$ $=\frac{1}{-2-1}\left(-2\binom{4}{3}-\binom{4}{-5}\right)$ $=\frac{1}{-3}\binom{-12}{-1}$ $\boldsymbol{C.E}=\binom{4}{1/3}$	M1 M1 M1	Proper substitution

	$C.E = (4, {}^{1}/_{3})$	A1	
		04	
8	 B is 56km from A on a bearing of 025^0 $or N25°E$	B1B1 M1A1	For correct diagram
		04	
9 (a) (b)	$S = \{452, 425, 542, 524, 245, 254\}$ $E = \{425, 245\}$ $P(E) = \frac{2}{6}$ $= \frac{1}{3}$ *no Event* $P(prime) = 0$	M1 M1 A1 A1	Sample space Elements
		04	
10	 $60° + x = 180°$ $x = 120°$		

	$number\ of\ sides = \frac{360°}{120°}$ $= 3\ sides$ $it\ is\ a\ triangle$ ALTERNATIVELY $One\ interior\ angle = \frac{180(n-2)}{n}$ $60 = \frac{180(n-2)}{n}$ $60n = 180n - 360$ $\frac{120n}{120} = \frac{360°}{120}$ $n = 3\ sides$ $its\ atriangle$	M1 M1 A1 A1 M1 M1 A1 A1	Formula Sides Answer
		04	40MARKS
	SECTION B		
11(a)		M1 M1 A1 M1 M1 M1 M1 M1 M1M1 M1M1 A1	Correct O-give Location of the media Correct median(44-45) For correct marks For correct tallying For $C.B$, f, $c.f$ correct For labelling graph correctly For correct bars For location of the mode Correct mode(42-43)

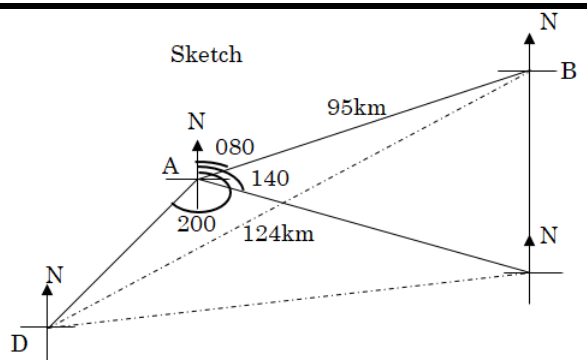
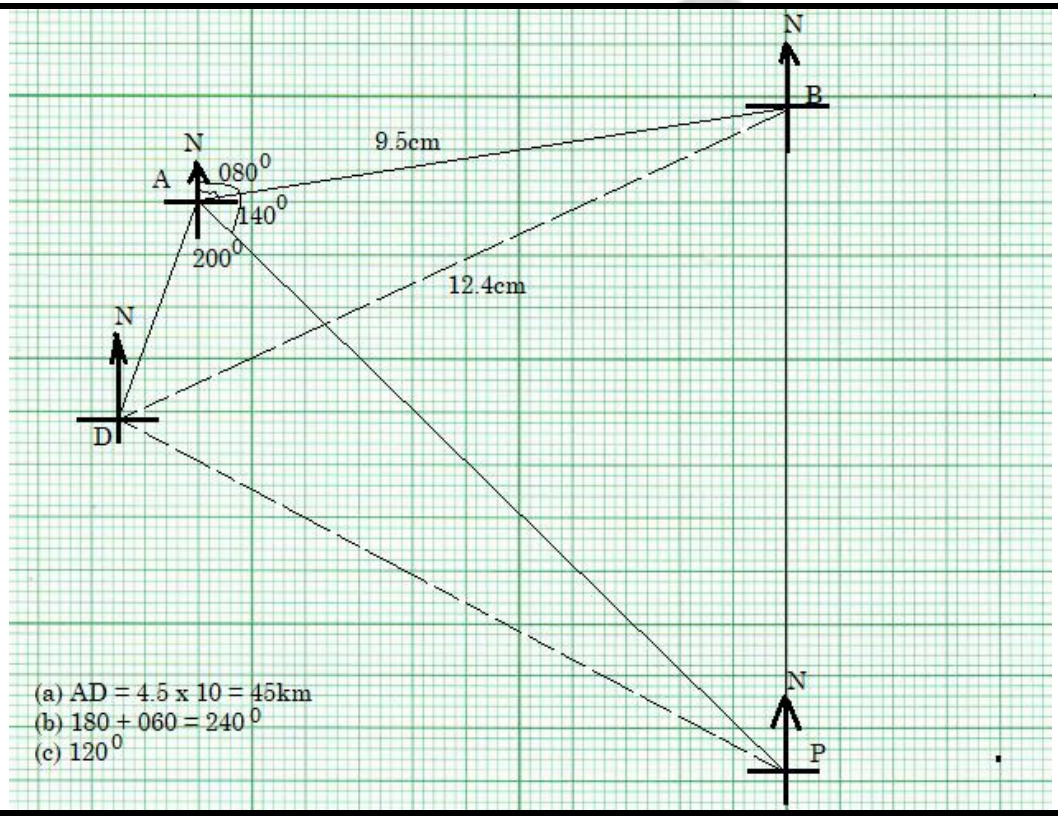
MARKS	C. B	Tallying	f	c. f
$20-29$	$19.5-29.5$	𝍸 |	6	6
$30-39$	$29.5-39.5$	𝍸 𝍸	9	15
$40-49$	$39.5-49.5$	𝍸 𝍸 ||	12	27
$50-59$	$49.5-59.5$	𝍸	5	32
$60-69$	$59.5-69.5$	𝍸	5	37
$70-79$	$69.5-79.5$	|||	3	40

(b)			
		12	



Mode = $39.5 + (3 \times 1)$

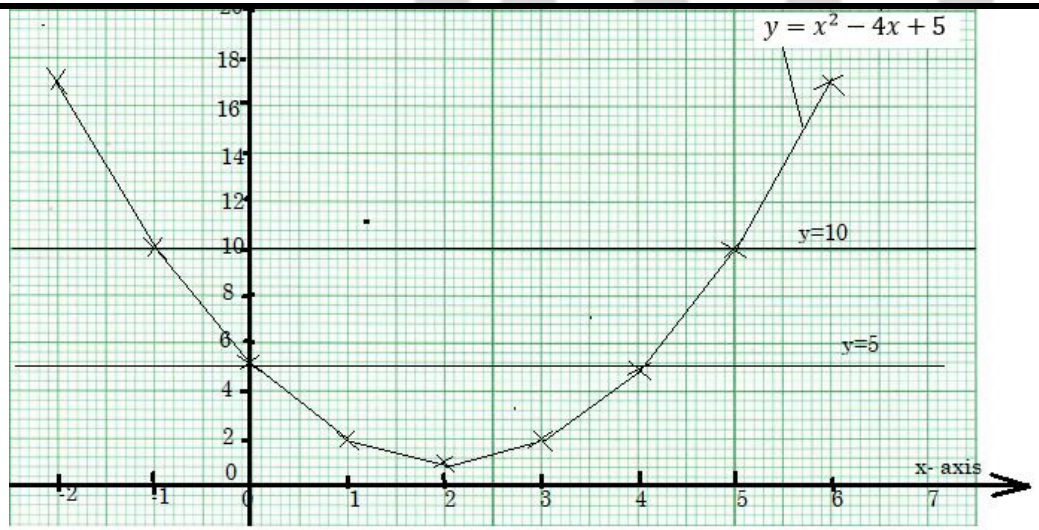
$= 42.5$

12	Sketch  $Scale: 1cm : 10km$, $9.5cm : 95km$, $24.4cm : 124km$		
	 	B1 B1 B2 A1 A1 A1 B1 B4	Correct sketch indicating all the information North line indicated and all the angles. For angles, 080°, 140°, 200°. For $\overline{AD} = 45km$ For 240° For 120° North lines drawn properly For location of points, A, B, D, P
		12	

13		B1	For all x^2correct
		B1	For all $-4x$ correct
		B1	For all y correct

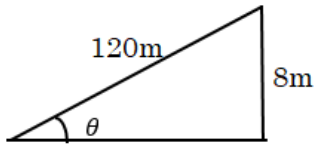
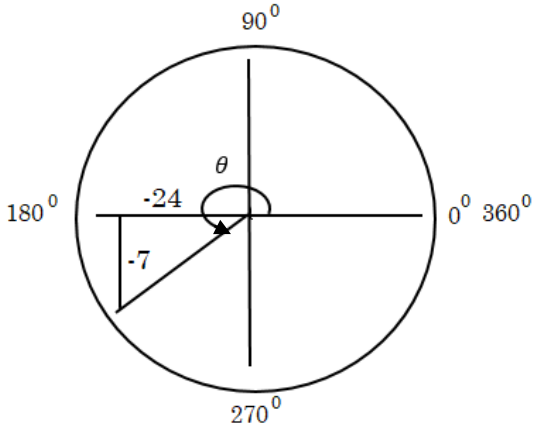
x	-2	-1	0	1	2	3	4	5	6
x^2	4	1	0	1	4	9	16	25	36
$-4x$	8	4	0	-4	-8	-12	-16	-20	-24
5	5	5	5	5	5	5	5	5	5
y	17	10	5	2	1	1	5	10	17

(a)	$y = x^2 - 4x + 5$ $-\ 0 = x^2 - 4x - 5$ $y = 10$	M1M1	Plotting all points correctly
(b)	The solution occurs where the line $y = 10$ meets the curve $y = x^2 - 4x + 5\ i.e\ x = -1, x = 5$	M1 A1	For the line $y = 10$
	$y = x^2 - 4x + 5$ $-\ 0 = x^2 - 4x + 5$ $y = 5$	M1 M1	No solution shown
	The solution occurs where the line $y = 5$ meets the curve $y = x^2 - 4x + 5\ i.e\ x = 0, x = 4$	M1 A1 A1	Labelling axes For drawing the line $y = 5$
(c)	The minimum point is (2,1)		For $x = 0, x = 4$ For minimum point



		12	

14(a)	$Let\ P = \begin{pmatrix} a & c \\ b & d \end{pmatrix}$ $MO = I$ $\begin{pmatrix} a & c \\ b & d \end{pmatrix}\begin{pmatrix} 1 & -2 \\ 3 & -3 \end{pmatrix} = \begin{pmatrix} 2 & -3 \\ 4 & -11 \end{pmatrix}$ $a + 3c = 2 \ldots\ldots\ldots\ldots\ldots\ldots 1$ $-2a - 3c = -3 \ldots\ldots\ldots\ldots\ldots\ldots 2$ $b + 3d = 4 \ldots\ldots\ldots\ldots\ldots\ldots 3$ $-2b - 3d = -11 \ldots\ldots\ldots\ldots\ldots\ldots 4$ $a + 3c = 2$ $+\ -2a - 3c = -3$ $a = 1$ $put\ a = 1\ in\ equation\ 1$ $a + 3c = 2$ $1 + 3c = 2$ $c = {}^{1}/_{3}$ $b + 3d = 4$ $+\ -2b - 3d = -11$ $-b = -7$ $b = 7$ $put\ b = 7\ in\ equation\ 3$ $b + 3d = 4$ $7 + 3d = 4$ $3b = -3$ $d = -1$ $P = \begin{pmatrix} 1 & 1/3 \\ 7 & -1 \end{pmatrix}$	M1 M1M1 M1 M1 A1	For the equation For the two sets of equations
(b)	$P(2,4)$ $M = \begin{pmatrix} Cos\theta & -Sin\theta \\ Sin\theta & Cos\theta \end{pmatrix}$ $= \begin{pmatrix} Cos60 & -Sin60 \\ Sin60 & Cos60 \end{pmatrix}$	M1	

	$= \begin{pmatrix} \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}$ $MO = I$ $\begin{pmatrix} \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}\begin{pmatrix} 2 \\ 4 \end{pmatrix} = \begin{pmatrix} 1-2\sqrt{3} \\ \sqrt{3}+2 \end{pmatrix}$ $\therefore P^1(1-2\sqrt{3}, \sqrt{3}+2)$	M1 M1 A1 12	
15(a)	 $Sin\theta = \frac{8}{120}$ $\theta = Sin^{-1}(8/120$ $= 3.82°$ $Tan\theta = \frac{7}{24}, 180° \leq \theta \leq 360°$	B1 M1M1	For correct diagram
(b)	 $(-7)^2 + (-24)^2 = c^2$ $c^2 = \sqrt{625}$	A1	

	$= 25$	B1	For correct diagram
	$Sin\theta = {}^{-7}/_{25}$	M1	
	$Cos\theta = {}^{-24}/_{25}$		
	$\dfrac{Sin\theta - Cos\theta}{2} = \dfrac{1}{2}\left(\dfrac{-7}{25} + \dfrac{24}{25}\right)$	A1	
	$= \dfrac{1}{2}\left(\dfrac{17}{25}\right)$	A1	
	$= {}^{17}/_{50}$		
	$13^2 - 5^2 = b^2$	M1	
	$169 - 25 = b^2$		
	$b = 12$	A1	
	$P = 2(L + W)$	M1	
	$P = 2(12 + 5)$		
(c)	$P = 34m$	A1	
		12	
16(a)	$A = \begin{pmatrix} 2 & -1 \\ 4 & -1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 1 \\ -4 & k \end{pmatrix}$		
	$\det B = 0$	M1	
	$k + 4 = 0$	M1	
	$k = -4$	M1	
(b)	$\det A = (2 \times -1) - (4 \times -1)$	A1	
	$= -2 + 4$		
	$= 2$	M1	
	$A^{-1} = \dfrac{1}{2}\begin{pmatrix} -1 & 1 \\ -4 & 2 \end{pmatrix}$	A1	
	$= \begin{pmatrix} {}^{-1}/_{2} & {}^{1}/_{2} \\ -2 & 1 \end{pmatrix}$		
	$A^{-1}B = \begin{pmatrix} {}^{-1}/_{2} & {}^{1}/_{2} \\ -2 & 1 \end{pmatrix}\begin{pmatrix} 1 & 1 \\ -4 & -4 \end{pmatrix}$	A1	
		A1	
	$= \begin{pmatrix} {}^{-5}/_{2} & {}^{-5}/_{2} \\ -6 & -6 \end{pmatrix}$		
		M1	
(c)	$A - 2I = \begin{pmatrix} 2 & -1 \\ 4 & -1 \end{pmatrix} - 2\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$	M1	
		M1	

	$= \begin{pmatrix} 2 & -1 \\ 4 & -1 \end{pmatrix} - \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ $= \begin{pmatrix} 0 & -1 \\ 4 & -3 \end{pmatrix}$	A1	
17(a)	$x + y \leq 11 \ldots\ldots\ldots\ldots\ldots\ldots .1$ $x \leq 9 \ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$ $y \leq 5 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$ $4 \times 90 \times x + 3 \times 150 \times y \geq 3600$ $360x + 450y \geq 3600$ $4x + 5y \geq 40 \ldots\ldots\ldots\ldots\ldots\ldots 4$ $4x + 5y = 40$ $(0,8), (10,0)$ $x + y = 11$ $x = 0, \quad y = 11$ $(0,11)$ $y = 0, x = 11$ $(11,0)$ *Objective equation* $150000x + 240000y$ $(9,1) \quad 1,590000$ $(9,2) \quad 1,830000$ $(5,4) \quad 1,740000$ $(4,5) \quad 1,800000$ $(5,5) \quad 1,950000$ $(6,5) \quad 2,100000$	M1 M1 M1 M1 M1 M1M1	
(b)	*9type A lories and 1 type B lories for minimum cost*		
(c)	6 type A lories and 5 type B lories for minimum number of bags each day Either 4 type A lories and 5 type B lories or 5 type A lories and 4 type B lories for a minimum number of drivers		
		12	

x	0	10
y	8	0