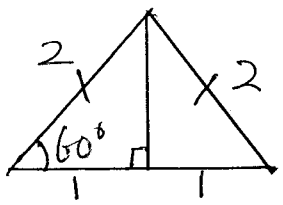
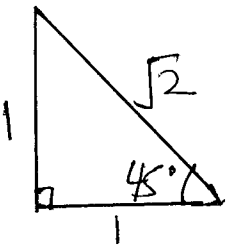
UTEC MOCK 2022 MARKING GUIDE
456/1 MATHEMATICS PAPER ONE

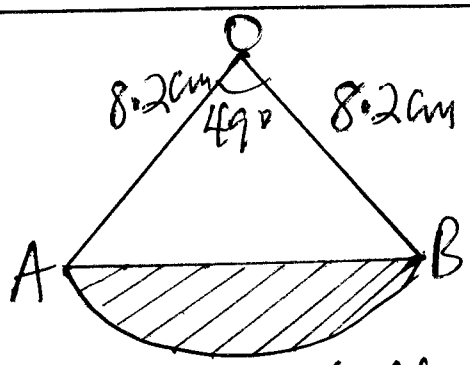
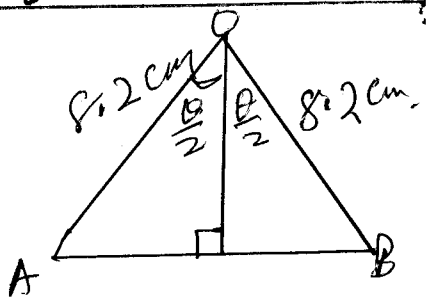
Question	Solution	Marks	Comments
Q.1	Let the numbers be x and $x+2$		
	$9(x+2) - 7x = 46$	M1	M1 for correct equation formed.
	$9x + 18 - 7x = 46$		
	$2x = 46 - 18$	M1	M1 for correct simplification
	$2x = 28$		
	$x = \frac{28}{2}$		
	$x = 14$	A1	A1 for each even number.
	First number is 14 Second number is 16	A1	
		04	
Q.2	~~60,~~ Mode is 62	B1	
	$\text{Mean} = \frac{63+60+64+68+62+69+58+62+54+74+59}{11}$	M1	M1 for correct addition.
	$\text{Mean} = \frac{693}{11}$	M1	M1 for correct simplification of numerator.
	$\text{Mean} = 63$	A1	
		04	

Question	Solution	Marks	Comments
Q.3	(a) $\cos 600^\circ = -\cos(600^\circ - 540^\circ)$	M1	
	$\cos 600^\circ = -\cos 60^\circ$		
	$\cos 600^\circ = -\frac{1}{2}$	A1	Reject 0.5
	(b) $\sin 405^\circ = \sin(405^\circ - 360^\circ)$	M1	
	$\sin 405^\circ = \sin 45^\circ$		
	$\sin 405^\circ = \frac{1}{\sqrt{2}}$ or $\frac{\sqrt{2}}{2}$	A1	Reject 0.7071
		04	
Q.4	$18x^2 - 2(b-3)^2$		
	$2(9x^2 - (b-3)^2)$	M1	M1 for factorising out 2.
	$2[(3x)^2 - (b-3)^2)$	m1	
	$2[(3x+b-3)(3x-b+3)]$	A1A1	A1 for each bracket
		05	

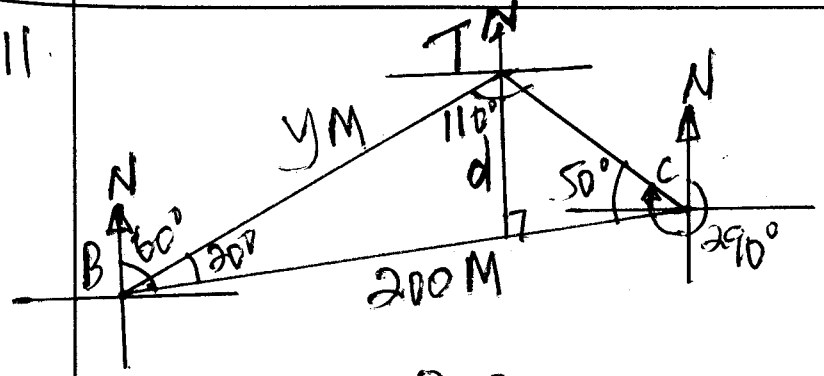
Question	Solution	Marks	Comments
Q.5	$4^x - 256^y = 0$	OR	$4^x - 256^y = 0$
	$4^x = 256^y$	M1	$4^x = 256^y$
	$4^x = 4^{4y}$	M1	$2^{2x} = 2^{8y}$
	$x = 4y$	M1	$2x = 8y$ Accept
	$\frac{x}{y} = \frac{4}{1}$	A1	$\frac{x}{y} = \frac{4}{1}$ $\frac{x}{y} = 4$
		04	
Q.6	$2x + 5y = 12$		
	$x + 2y = 5$		
	$\begin{pmatrix} 2 & 5 \\ 1 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 12 \\ 5 \end{pmatrix}$	M1	M1 for formation of Matrices.
	$\begin{pmatrix} 2 & -5 \\ -1 & 2 \end{pmatrix}\begin{pmatrix} 2 & 5 \\ 1 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 & -5 \\ -1 & 2 \end{pmatrix}\begin{pmatrix} 12 \\ 5 \end{pmatrix}$	M1	M1 for pre-multiplying both sides by $\begin{pmatrix} 2 & -5 \\ -1 & 2 \end{pmatrix}$.
	$\begin{pmatrix} 4-5 & 10-10 \\ -2+2 & -5+4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 24-25 \\ -12+10 \end{pmatrix}$		
	$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$	M1	• Accept alternative methods: • Graphical • Elimination • Substitution
	$\begin{pmatrix} -x \\ -y \end{pmatrix} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$		
	$x = 1,\ y = 2$	A1	A1 for both values correct
		04	

M.G UTEC 2022 45611

Question	Solution	AJAO Marks	Comments
Q.7	$\begin{pmatrix}-1 & -2\\ 3 & a\end{pmatrix}\begin{pmatrix}1\\2\end{pmatrix}=\begin{pmatrix}b\\7\end{pmatrix}$		
	$-1-4=b$	M1	M1 for the equation Accept $\begin{pmatrix}-1+4\\3+2a\end{pmatrix}=\begin{pmatrix}b\\7\end{pmatrix}$ M1
	$-5=b$	A1	
	$3+2a=7$	M1	M1 for equation $\begin{pmatrix}-5\\3+2a\end{pmatrix}=\begin{pmatrix}b\\7\end{pmatrix}$
	$2a=7-3$		
	$2a=4$		$b=-5$
	$a=2,\ b=-5$	A1	$a=2.$
		04	
Q.8	Amega Father	OR	Amega Father
	present age X $3X$	B1	$\frac{1}{3}X$ X B1
	In ten years Time $X+10$ $3X+10$		$\frac{X}{3}+10$ $X+10$
	According to the given condition		
	$X+10=\frac{1}{2}(3X+10)$	M1	$\frac{X}{3}+10=\frac{1}{2}(X+10)$ M1
	$2X+20=3X+10$		$\frac{2X+60}{3}=X+10$
	$3X-2X=20-10$		$2X+60=3X+30$
	$X=10$	A1	$3X-2X=60-30$ M1
			$X=30$ A1
	Father's Age is 3×10 $=30$ Years.	A1	Father's Age is 30 yrs
		04	

Question	Solution	Marks	Comments
Q.9			
	(a) length of a chord AB $= 2r\sin\left(\frac{\theta}{2}\right)$		Accept other methods of the candidate.
	$\overline{AB} = 2\times 8.2\times \sin\left(\frac{49}{2}\right)$	M1	e.g. cosine rule
	$\overline{AB} = 16.4\times 0.4147$		
	$\overline{AB} = 6.8011$	A1	
	$\overline{AB} \simeq 6.80\text{ cm}$		
	(b) Height $= r\cos\left(\frac{\theta}{2}\right)$	M1	
	$= 8.2\times\cos\left(\frac{49}{2}\right)$		
	$= 8.2\times 0.90996$		
	$= 7.4617$		
	$\simeq 7.46\text{ cm}$	A1	
		04	
Q.10	$\begin{pmatrix}x\\y\end{pmatrix} = \frac{1}{k-1}\left(k\mathbf{p}-\mathbf{I}\right)$	OR	$2 = \frac{\begin{pmatrix}2\\-1\end{pmatrix}-\begin{pmatrix}x\\y\end{pmatrix}}{\begin{pmatrix}3\\1\end{pmatrix}-\begin{pmatrix}x\\y\end{pmatrix}}$ M1
	$\begin{pmatrix}x\\y\end{pmatrix} = \frac{1}{2-1}\left(2\begin{pmatrix}3\\1\end{pmatrix}-\begin{pmatrix}2\\-1\end{pmatrix}\right)$	M1	$6-2x = 2-x$ M1
	$\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}6\\2\end{pmatrix}-\begin{pmatrix}2\\-1\end{pmatrix}$	M1	$-x = -4$
			$x = 4$
	$\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}4\\3\end{pmatrix}$	M1	$2-2y = -1-y$ M1
			$-y = -3$
			$y = 3$
	$\therefore$ Centre is $(4,3)$	A1	$\therefore$ Centre is $(4,3)$ A1
		04	

AJAO

Question	Solution	Marks	Comments
Qn. 11		B1	B1 for locating B
		B1	B1 for locating C
		B1	B1 for locating T
	(a) $\frac{y}{\sin 50^\circ} = \frac{200}{\sin 110^\circ}$	M1	M1 for correct use of sine formula.
	$y = \frac{200 \times \sin 50^\circ}{\sin 110^\circ}$		
	$y = \frac{200 \times 0.7660}{0.9397}$	M1	
	$y = \frac{153.2}{0.9397}$	M1	
	$y = 163.03$		Accept 163.048M
	$y \simeq 163\,M$	A1	Reject Scale drawings without calculations.
	(b) $\sin 20^\circ = \frac{d}{163}$	M1	M1 for correct use of sine ratio
	$d = 163 \times \sin 20^\circ$	M1	
	$d = 163 \times 0.3420$	M1	Without $d = 163 \times 0.3420$ M1 M1
	$d = 55.746$	M1	
	$d \simeq 55.75$	A1	Without 55.75 M1 M1 A1 Reject 55.8M
	∴ Shortest distance from the road is 55.75 Metres.		
		12	

Question	Solution	Marks	Comments
Qn. 12	(a) (i) Sector B Represents 41-50 Marks.		
	Number of Students $= \frac{90}{360} \times 200$	M1	
	$= 50$ Students	A1	
	(ii) Sector D, E and F Represents above 60 Marks.	B1	
	Number of Students $= \frac{72+27+18}{360} \times 200$	M1	M1
	$= \frac{117}{360} \times 200$		
	$= 65$ students.	A1	
	(b) Sector A and B Represents at most 50 Marks.	B1	
	Fraction $= \frac{45+90}{360}$	M1	M1 Accept $\frac{25+50}{200} = \frac{75}{200} = \frac{3}{8}$
	$= \frac{135}{360}$ or $\frac{3}{8}$	A1	
	(c) The modal Class is 51-60 Since it has the biggest angle.	B2	
		12	

Qu	Solution	Marks	Comments
Q13.	(a) $B = A^{-1} \times AB$	M1	M1 for det. = 11
	$A^{-1} = \frac{1}{3-^-8}\begin{pmatrix}1 & -4\\ -2 & 3\end{pmatrix} = \frac{1}{11}\begin{pmatrix}1 & 4\\ -2 & 3\end{pmatrix}$	M1M1	M1 for R.H.S M1 for L.H.S
	So $B = \frac{1}{11}\begin{pmatrix}1 & 4\\ -2 & 3\end{pmatrix}\begin{pmatrix}-10 & -12\\ -3 & 3\end{pmatrix}$	M1	
	$B = \frac{1}{11}\begin{pmatrix}-22 & 0\\ 11 & 33\end{pmatrix}$	M1	Accept other methods of candidate.
	$B = \begin{pmatrix}-2 & 0\\ 1 & 3\end{pmatrix}$	A1	
	(b) (i) $\begin{pmatrix}1 & 1 & 2\\ 1 & 3 & 2\\ 1 & 3 & 6\end{pmatrix}$	B1	Accept $\begin{pmatrix}1 & 1 & 1\\ 1 & 3 & 3\\ 2 & 2 & 6\end{pmatrix}$
	(ii) $\begin{pmatrix}1 & 1 & 2\\ 1 & 3 & 2\\ 1 & 3 & 6\end{pmatrix}\begin{pmatrix}12000\\ 15000\\ 25000\end{pmatrix}$	M1	M1 for R.H.S
	$= \begin{pmatrix}12000+15000+50000\\ 12000+45000+50000\\ 12000+45000+150000\end{pmatrix}$	M1	M1 for L.H.S
	$= \begin{pmatrix}77,000\\ 107,000\\ 207,000\end{pmatrix}$	A1	
	Amega spent shs 77,000 Nalera spent shs 107,000. Kuluse spent shs 207,000.	A1	A1 for all three values correct
	Total Expenditure is $= 77000 + 107,000 + 207000$ $=$ shs 391,000.	A1	Accept Amega $\begin{pmatrix}77000\\ 107000\\ 207000\end{pmatrix}$ A1 A1 Nalera Kuluse 391,000 A1
		12	

Question	Solution	Marks	Comments
Q.14	(a) See the graph.		
	(b) $\begin{pmatrix} -3 & 0 \\ 0 & -3 \end{pmatrix}\begin{pmatrix} A & B' & C' & D' \\ -1 & -1 & -3 & -2 \\ 1 & 4 & 4 & 3 \end{pmatrix} = \begin{pmatrix} A'' & B'' & C'' & D'' \\ 3 & 3 & 9 & 6 \\ -3 & -12 & -12 & -9 \end{pmatrix}$	M1 A1	M1 for L-H-S A1 for R-H-S
	$A''(3,-3), B''(3,-12), C''(9,-12), D''(6,-9)$	A1 A1	A1 for any two correct coordinates
		12	
Q.15	(a)		

+	1	2	3	4	5	6
1	2	(3)	4	5	(6)	7
2	(3)	4	5	(6)	7	8
3	4	5	(6)	7	8	(9)
4	5	(6)	7	8	(9)	10
5	(6)	7	8	(9)	10	11
6	7	8	(9)	10	11	(12)

	B6	All Correct
	B5	30-35 Correct
	B4	20-29 Correct
	B3	15-19 Correct
	B2	10-14 Correct
	B1	5-9 Correct

(b) (ii) $P(M) = \frac{12}{36}$ or $\frac{1}{3}$ — M1 A1 — Accept Method of Listing possible outcomes.

(iii) $P(N) = \frac{18}{36}$ or $\frac{1}{2}$ — M1 A1

(iii) $P(M \text{ and } N) = P(M) \times P(N)$

$= \frac{12}{36} \times \frac{18}{36}$ — M1

$= \frac{216}{1296}$ or $\frac{1}{6}$ — A1

12

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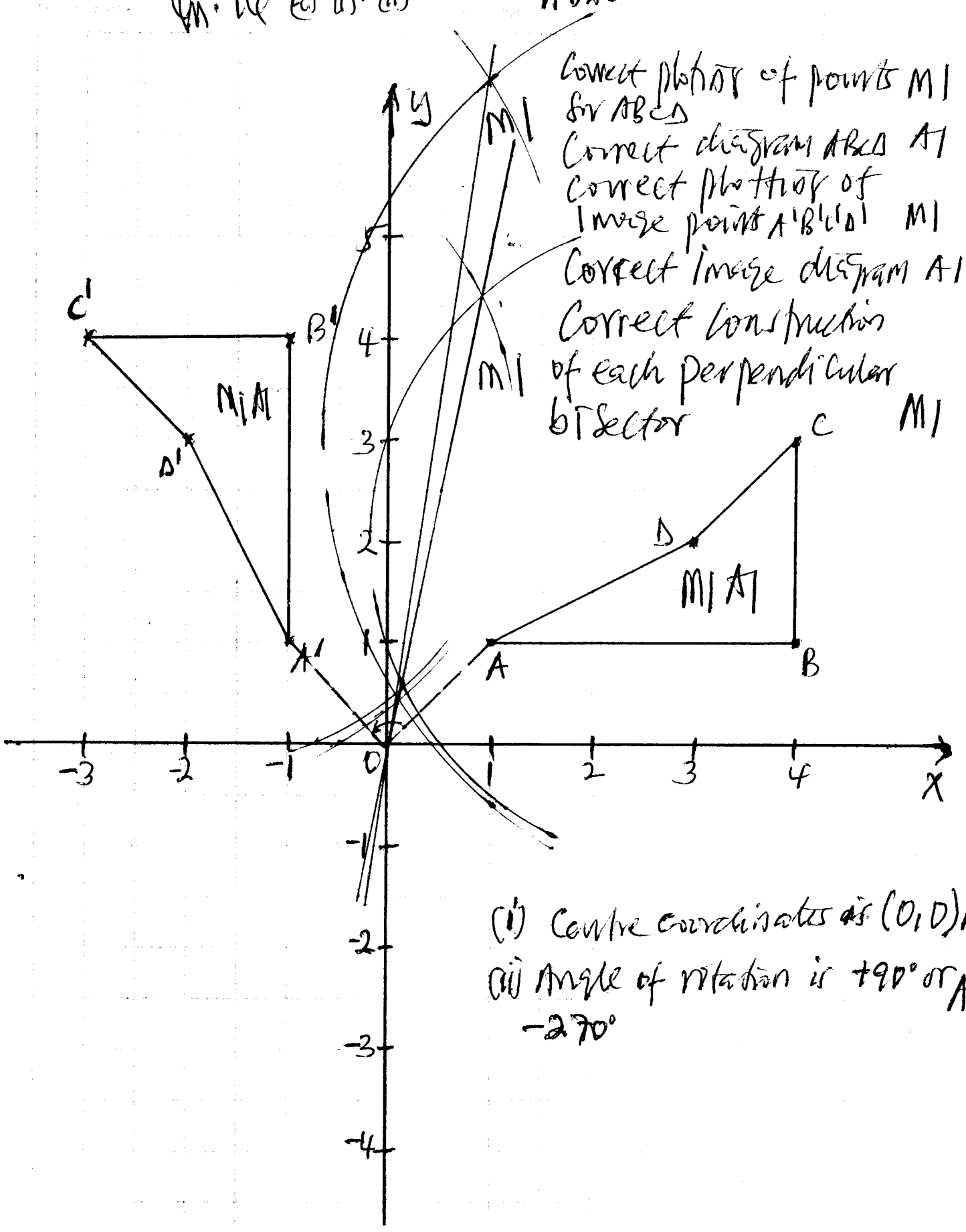
Qn. 14 (a) (i)-(ii) AJAO



Correct plotting of points for ABCD M1

Correct diagram ABCD A1

Correct plotting of image points A'B'C'D' M1

Correct image diagram A1

Correct construction of each perpendicular bisector M1

(i) Centre coordinates is (0,0) A1

(ii) Angle of rotation is +90° or −270° A1

NO	SOLUTION							ASTD Mark	Comments
Q.4 (a)	x	-3	-2	-1	0	1	2		
	$3x^2$	~~27~~	12	3	0	3	12	B1	B1 for all $3x^2$ row correct
	$5x$	-15	-10	-5	0	5	10	B1	B1 for all $5x$ row correct
	-7	-7	-7	-7	-7	-7	-7		
	y	5	-5	-9	-9	1	15	B1	B1 for all y row correct.

(b) Correct use of a scale on both axes — B1

Plotting all points correctly — M1

Joining the points using a smooth curve — M1

Stating two ~~points~~ Pairs of points on the line $y = 2x + 3$ — B1 (0,3), (2,7)

Drawing the line $y = 2x + 3$ correctly. — M1 Correct line drawn without any two points stated score B1 M1

(c) $y = 3x^2 + 5x - 7$ ------ (i)

$y = 2x + 3$ ------ (ii)

Subtracting equation (ii) from equation (i) or equating the two equations $3x^2 + 3x - 7 = 0$ ~~M1~~

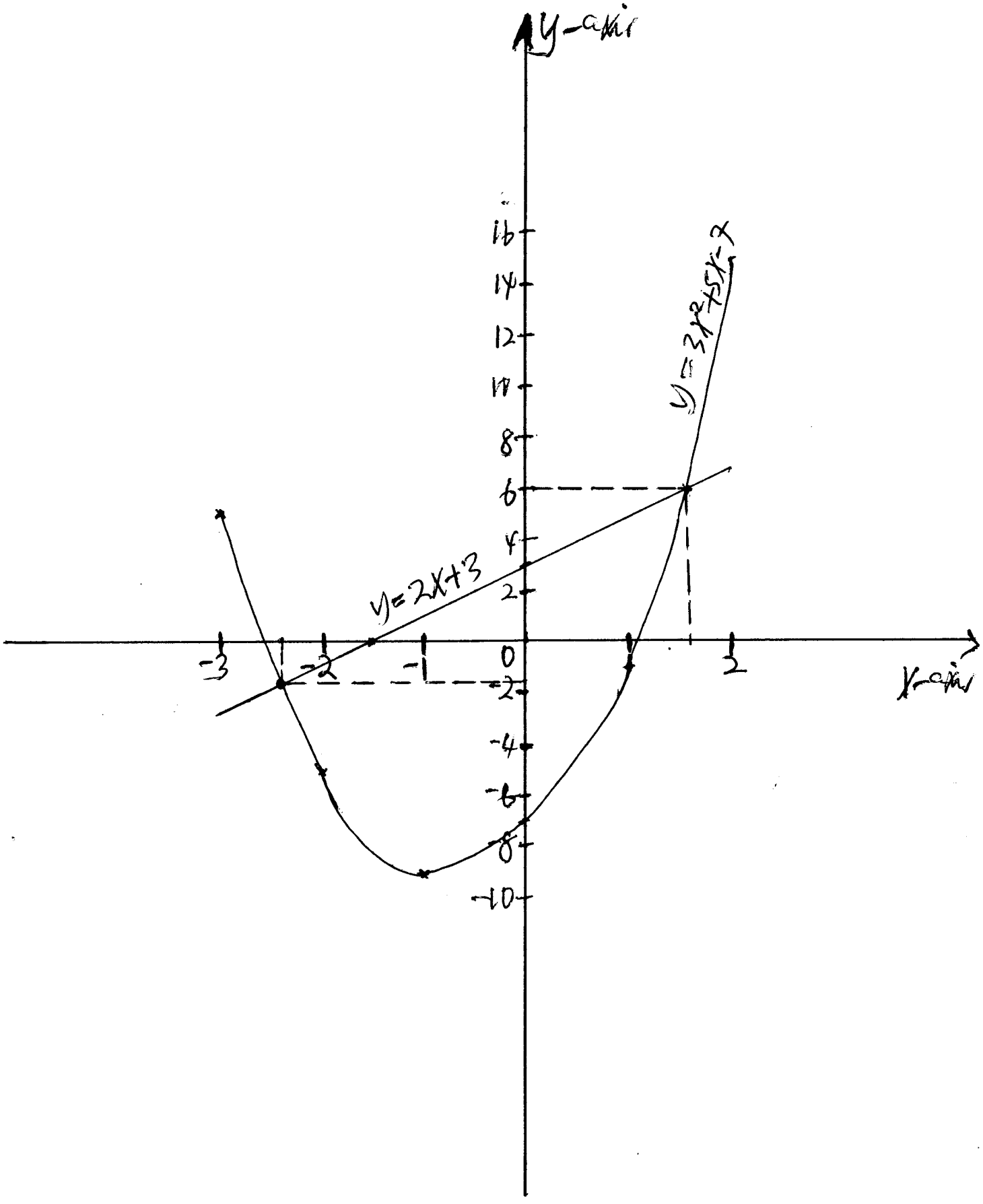
$x = 1.4 \pm 0.1$, $y = 5.8 \pm 0.1$ — A1A1 ($x = 1.3$ to 1.5, $y = 5.7$ to 5.9)

or $x = -2.4 \pm 0.1$, $y = -1.8 \pm 0.1$ — A1A1 ($x = -2.5$ to -2.3, $y = -1.9$ to -1.7)

12

M·G UTEC 2022 48611

Qn. 16 (b)



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Question	Solution	Marks	Comments
Q.17	(a) $25000x + 75000y \geq 1500000$ OR $25x + 75y \geq 1500$ OR $x + 3y \geq 60$	M1	M1 for any of the equivalent inequalities.
	$x + y \leq 50$	M1	
	$x \geq 15$	M1	
	$y \geq 0$	M1	
	(b) Drawing line $x + 3y = 60$ with the correct shading	M1	(0,20), (60,0)
	Drawing the line $x + y = 50$ and shading the unwanted region.	M1	(10,40), (30,20)
	Drawing the line $x = 15$ and shading the unwanted region.	M1	
	Correct unshaded region	A1	
	(c) (15,15), Cost $375,000 + 1,125,000 = 1,500,000$	M1	M1 for each correct value obtained.
	(15,35), Cost $375,000 + 2,625,000 = 3,000,000$		
	(45,5), Cost $1,125,000 + 375,000 = 1,500,000$		
	(15,35) is the best solution or maximum amount the club receives annually is shs 3,000,000.	A1 A1	For 15 and 35 each
		A1	
		12	

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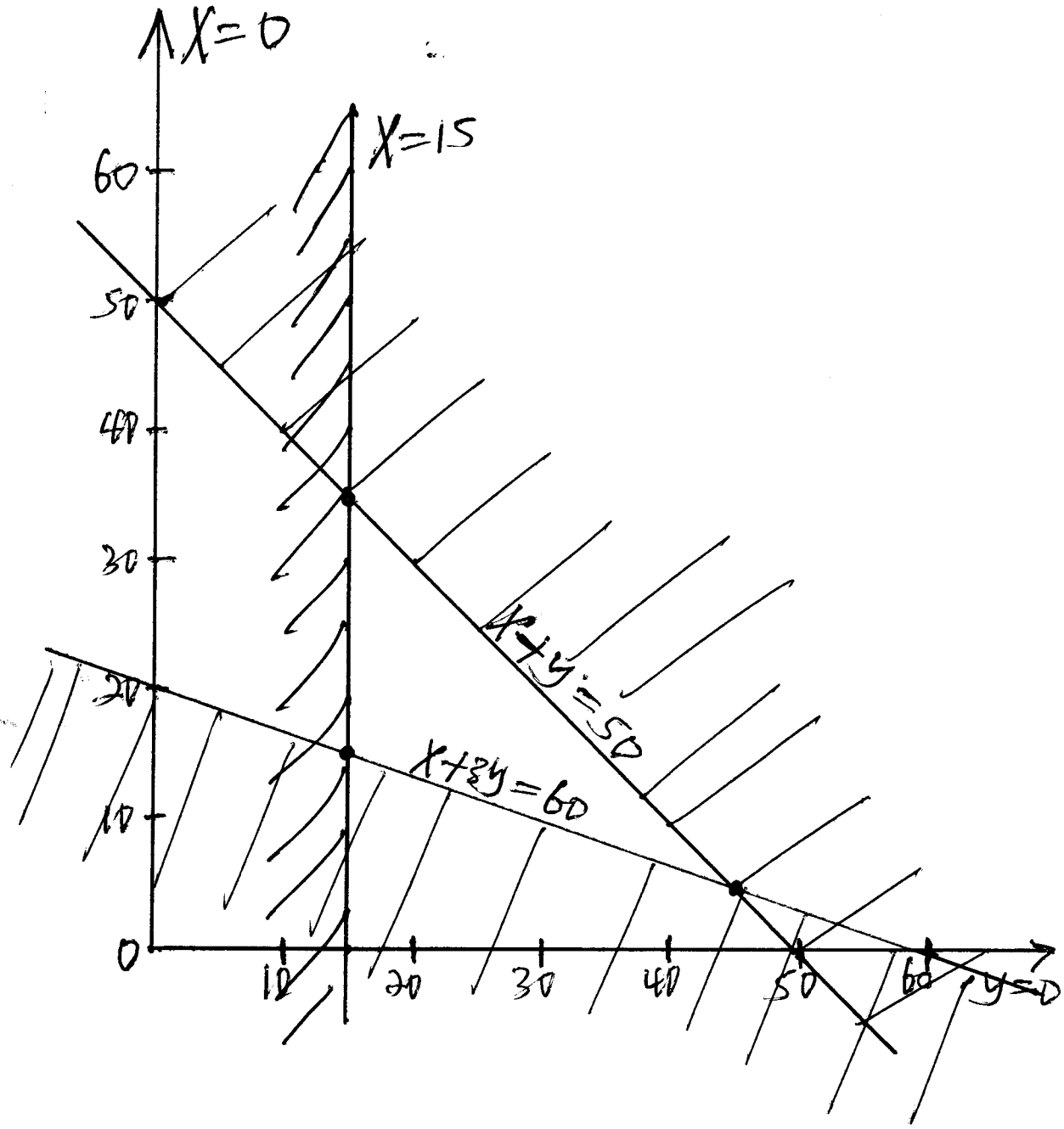
Qn. 17(b) AJAO