



Cambridge International Examinations
Cambridge Ordinary Level

MATHEMATICS (SYLLABUS D)

4024/21

Paper 2

May/June 2016

MARK SCHEME

Maximum Mark: 100

Published

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Question	Answers	Mark	Part Marks
1 (a)	7.5(0)	2	M1 for $x + \frac{60x}{100} = 12$ soi or B1 for \div by 160
(b)	45	2	M1 for $\frac{17.40 - 12}{12} \times 100$
(c)	35	2	M1 for $\frac{17.4 - 11.31}{17.4} \times 100$
(d)	25	3	M1 for $60 \times 17.4 + x \times 11.31 (\geq 1320)$ or B1 276 A1 for 24.4(03...)
2 (a)	6	2	M1 for $p - 1 = 5(7 - p)$ soi
(b)	$\frac{3b^2}{a}$	2	M1 for $\frac{9b^4}{a^2}$ oe $\frac{\frac{1}{3}a^2b^3}{\frac{3}{a^2}b}$ oe or B1 for $3b^2$ as numerator or $\frac{k}{a}$
(c)	$\frac{q^2}{3}$	2	B1 for $q^2(1 - q)$ or $3(1 - q)$
(d) (i)	$(4t - 1)(t + 9)$	2	B1 for $(at + c)(bt + d)$ with $ab = 4$ or $cd = -9$
(ii)	$\frac{1}{4} - 9$ or ft	1ft	
3 (a)	Correct graph	2	B1 for correct scales and 4 points or wrong scales and all points.
(b) (i)	-2.3 ± 0.5 1.3 ± 0.5	1	
(ii)	-2.8 ± 0.5 1.8 ± 0.5	2	M1 for $x^2 + x - 3 = 2$ soi
(c)	2.4 to 3.6	2	M1 for tangent at $x = 1$
(d) (i)	$y = 2x - 2$	2	B1 for $2x$ or -2
(ii)	-0.6 1.6	2	Dependent on line drawn B1 for their line having FT gradient or FT intercept

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Question	Answers	Mark	Part Marks
4 (a)	Complete proof	3	B2 for 2 pairs of equal angles 1 pair with reason. B1 for 1 pair of equal angles.
(b) (i)	2 : 5	2	B1 for $NM : BL = 2 : 3$ oe or $NM = LC$
(ii)	4 : 9	1	
(iii)	1 : 3	2	B1 for such as $\frac{\Delta ANM}{\Delta ABC} = \frac{4}{25}$ or $\frac{\Delta NBL}{\Delta ABC} = \frac{9}{25}$
5 (a)	15.1 or 15.08(.....	3	M1 for $\tan \theta = \frac{31}{115}$ or $\tan \theta = \frac{115}{31}$ A1 for $\theta = 15.1$ or $\theta = 74.9$
(b) (i)	18.8 or 18.77(.....	2	M1 for $\sin \theta = \frac{354}{1100}$
(ii)	251 or 251.2(.....	1ft	270 – their $L\hat{J}K$ final ans.
6 (a)	$\begin{pmatrix} 6 & -2 \\ -5 & 11 \end{pmatrix}$	2	B1 for at least 2 elements correct in a 2 x 2 matrix
(b)	$\begin{pmatrix} 15 & -7 \\ 7 & 8 \end{pmatrix}$	2	B1 for at least 2 elements correct or M1 for $\begin{pmatrix} 4 & -1 \\ 1 & 3 \end{pmatrix} \begin{pmatrix} 4 & -1 \\ 1 & 3 \end{pmatrix}$ soi
(c)	$-\frac{1}{10} \begin{pmatrix} -5 & 0 \\ -7 & 2 \end{pmatrix}$ oe isw	2	B1 for $\det B = -10$ soi or $\begin{pmatrix} -5 & 0 \\ -7 & 2 \end{pmatrix}$
(d)	$\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$	1	
(e)	$\begin{pmatrix} 0 & 0 \\ 7 & -7 \end{pmatrix}$	2	B1 for $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ soi

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Question	Answers	Mark	Part Marks
7 (a)	4.53 to 4.54	4	B2 for $BOC = 52$ or after B0 B1 for $\hat{A}BC = 90$ or triangle OBC isosceles or $\hat{B}AC = 26$ M1 for $\frac{52}{360} \times 2\pi 5$ ft
(b) (i)	101 or 32π or 100 to 100.6	2	M1 for $\pi(16.52)$ or 15.5^2
(ii)	0.87 to 0.871	3	B1 for $\pi 15.5^2$ or $44\pi r^2$ and M1 for $r^2 = \frac{\pi 15.5^2 - 650}{44\pi}$
(iii)	7	3	M1 for $\pi 15.5^2 d = 500$ A1 for 0.66 to 0.663
8 (a) (i)	-1.92 (3.....	1	
(ii)	$\frac{8}{p+5}$	2	M1 for $\frac{8}{q} = p+5$ or $pq = 8-5q$ or $p = \frac{8}{q} - 5$
(b) (i)	H and h correctly derived	2	M1 for correct substitution in the formula for the area of a trapezium.
(ii)	$\frac{75}{(x-1)(2x+3)}$ correctly derived	3	M1 for $\frac{15(2x+3) - 30(x-1)}{(x-1)(2x+3)}$ soi B1 for $30x + 45 - 30x + 30$ soi
(iii) (a)	Equation correctly derived.	2	B1 for $\frac{75}{(x-1)(2x+3)} = 1.5$
(b)	4.90	2	B1 for $\sqrt{1^2 - 4 \times 2 \times (-53)}$ soi or B1 for $\frac{-1 \pm \sqrt{\text{their } 425}}{2 \times 2}$ soi

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Question	Answers	Mark	Part Marks	
9	(a) (i)	5.38 to 5.39 or $\sqrt{29}$	2	M1 for $(AC^2) = 2^2 + 5^2$
	(ii)	0.517 to 0.518	2	M1 for $\frac{CE}{2} = \sin 15$ oe
	(iii)	68.8 to 68.9	4	M1 for $\frac{AF}{2} = \cos 15$ oe or $BC^2 = BE^2 + (\text{their } CE)^2$ or any complete alternative method A1 for 1.932 and M1 for $\tan \hat{FAE} = \frac{5}{2 \cos 15}$ oe or $\frac{5}{\text{their}(AF)}$
	(b) (i)	80.9(4.... Or 81	3	B1 for $10^2 = 6^2 + 9^2 - 2 \times 6 \times 9 \times \cos \theta$ or B2 for $\cos \theta = \frac{9^2 + 6^2 - 10^2}{2 \times 9 \times 6}$
	(ii)	>	1	
10	(a)	(2) (4) 14 54 84 98 (100)	1	
	(b)	Correct curve	2	P1 for at least 5 correct plots
	(c) (i)	195 ft $190 \leq$ and < 200	1	
	(ii)	50 – 75	2	B1 for one quartile correct in ranges 225 to 235 or 160 to 175
	(d)	Correct curve	4	P3 for at least 4 correct plots or B1 + B1 for any two correct points soi.
	(e)	92 ft	1	
	(f)	B 15 ft A	1ft	Their 90 – 75

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Question	Answers	Mark	Part Marks
11 (a)	$\begin{pmatrix} -6 \\ 2 \end{pmatrix}$	1	
(b) (i)	$\begin{pmatrix} 8 \\ 4 \end{pmatrix}$	2	B1 for $\begin{pmatrix} 8 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 4 \end{pmatrix}$
(ii)	$\begin{pmatrix} -8 \\ -4 \end{pmatrix}$ ft	1	
(iii)	8.94 or 8.94 to 8.95 or $\sqrt{80}$ oe	2	M1 for $\sqrt{(-8)^2 + (-4)^2}$ oe ft
(c) (i)	Triangle vertices (5,4), (13,0), (9,8)	2	B1 for 2 correct
(ii)	Triangle <i>F</i> (5,4), (7,3), (6,5)	1	
(iii)	Rotation 180 Centre (5,4)	3	B2 for Rotation with either centre or angle. B1 for Rotation.