Cambridge
O Level

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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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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 ÷ 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 $60 \times 17.4 + x \times 11.31 (\geqslant 1320)$ 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 $\frac{3a^{\frac{1}{2}}b^3}{a^{\frac{3}{2}}b}$ 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

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

Question	Answers	Mark	Part Marks
7 (a)	4.53 to 4.54	4	B2 for BOC = 52 or after B0 B1 for $A\hat{B}C = 90$ or triangle OBC isosceles or $B\hat{A}C = 26$ 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 $\frac{-1 \pm \sqrt{their\,425}}{2 \times 2}$ soi

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 $BC^2=BE^2+$ (their CE)^2 or any complete alternative method A1 for 1.932 and M1 for $\tan F\hat{A}E = \frac{5}{2\cos 15}$ oe or $\frac{5}{their(AF)}$
(b) (i)	80.9(4…. Or 81	3	B1 for $10^2 = 6^2 + 9^2 - 2\times6\times9\times\cos\theta$ or B2 for $\cos\theta = \frac{9^2 + 6^2 - 10^2}{2\times9\times6}$
(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 ⩽ 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

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 √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 *F* (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.