



Cambridge International Examinations
Cambridge Ordinary Level

MATHEMATICS (SYLLABUS D)

4024/22

Paper 2

October/November 2016

MARK SCHEME

Maximum Mark: 100

Published

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Question	Answers	Part	Part Marks
1 (a) (i) (ii) (b) (c)	3.6	1	
	109	2	B1 for $756 + 24 \times 922.25$ soi or SC1 for $\frac{24 \times 922.25}{21\,000} \times 100$ oe
	730.25	3	B1 for $\frac{127 \times 21\,000}{100}$ soi M1 for $381 + 36x =$ their total amount oe
	1000	3	M1 for $x + \frac{5x}{100} = 21\,000$ oe and M1 for $21\,000 -$ their 2016 price oe
2 (a) (b) (c) (d) (e) (i) (ii)	$\frac{ab}{6}$ Final answer	2	M1 for correct transition to multiplication soi
	$\frac{1}{5}$ oe	2	B1 for $5(h - k)$
	$(3m - 2n)(3m + 2n)$ Final ans.	1	
	$(p - 2)(q - 3)$ oe	2	B1 for $-q(2 - p)$ or $-3(p - 2)$ seen or M1 if brackets removed and rearranged and extraction of p or 2 or for a correct extraction of a common factor after a sign error.
	$2 - \frac{8}{5}$ oe	2	B1 for one correct or
	$-2 - 16$ cao	2	B1 for either or M1 for $(5x - 1)^2 = 9^2$ or $(x - 2)(x + \frac{8}{5}) = 0$ oe ft or Uses e(i) to form simultaneous equations or $x = \frac{1 \pm 9}{5} \equiv \frac{-B \pm \sqrt{B^2 - 20C}}{10}$

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Question	Answers	Part	Part Marks
3 (a)	3.75	1	
	(b) Correct curve ft	2ft	B1 for 4 correct plots ft
	(c) (0.3 to 0.5) ft	2ft	M1 for a reasonable tangent at $x = 2.5$
	(d) 0 cao (3.05 to 3.25) ft	2ft	B1 for either
	(e) (i) $y = 4 - x$	2	M1 for $x^3 + 10x - 80 = 0 \equiv \frac{x}{20}(x^2 - 10) = ax + b$ oe
	(ii) L drawn on the grid ft	1ft	Dependent on at least 1 mark in (e)(i).
	(iii) (3.55) ft	1ft	Dependent on at least 1 mark in (e)(i).
4 (a) (i)	2.67	2	M1 $\frac{AD}{3} = \cos 27$ oe
	(ii) 4.57	3	M2 for $CD = \frac{3}{\sin 41}$ oe or M1 for $\frac{3}{CD} = \sin 41$ oe
	(b) 53.1 126.9	3	M1 for $\frac{1}{2} \times 3 \times 5 \times \sin P\hat{Q}R = 6$ oe and A1 for 53.1 or SC1 for supplementary angles from $\sin P\hat{Q}R = k$.
5 (a)	TAB ATB Statement mentions tangent and radius ABT	2	B1 for 2 pairs of equal angles.
	(b) 2.1	3	M1 for $\frac{AC}{AB} = \frac{CD}{BT}$ oe soi and M1 for $\frac{7}{10} = \frac{CD}{3}$ oe OR B1 for $(AB =) 10$

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Question	Answers	Part	Part Marks
6 (a)	$\begin{pmatrix} 4 & 4 \\ 1 & 7 \end{pmatrix}$	2	B1 for 3 entries correct.
(b)	$\begin{pmatrix} 2 & 4 \\ 2 & 9 \end{pmatrix}$	2	B1 for 3 entries correct.
(c)	4 7	2	B1 for one correct or $\begin{pmatrix} 2x \\ 3x+2 \end{pmatrix}$ seen
(d)	$\frac{1}{5}\begin{pmatrix} 3 & -2 \\ 1 & 1 \end{pmatrix}$ oe isw	2	B1 for $\det \mathbf{B} = 5$ soi or $\begin{pmatrix} 3 & -2 \\ 1 & 1 \end{pmatrix}$ soi
7 (a) (i)	1.98	1	
(ii)	$(\pm)\sqrt{x^2 - a^2}$ Final answer	2	M1 for $x^2 = a^2 + b^2$ oe
(b) (i)	$(PQ \Rightarrow) \frac{17}{x+5}$	1	
(ii)	$3x^2 + 15x - 85 (=0)$ oe shown	3	M1 for $(AB \Rightarrow)$ their $(PQ) + 3$ and M1 for $(\text{their}(PQ) + 3) \times x = 17$ or
(iii)	3.38 -8.38	3	B1 for $\sqrt{15^2 - 4 \times 3 \times (-85)}$ soi and B1 for $\frac{-15 \pm \sqrt{\text{their} 1245}}{2 \times 3}$ soi and M1 for both real values of $\frac{p \pm \sqrt{q}}{r}$
(iv)	20.8	2ft	M1 for their (PQ) and $x + 5$ evaluated using $x =$ the positive root from (b)(iii). or for their perimeter in algebraic form

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Question	Answers	Part	Part Marks
8 (a) (i)	Dependent on 4 fig. term calculated using any version of π .	3	M1 for arc length $\frac{48}{360} \times 2\pi R$ soi and M1 for $R = 20 \times \frac{360}{48} \times \frac{1}{2\pi}$ oe
(ii)	239	2	M1 for $\frac{48}{360} \times \pi R^2$
(iii)	20.7	2	M1 for $2\pi r = \frac{312}{360} \times 2\pi R$ oe
(b) (i)	200	3	M1 for $l^2 = 4^2 + 7.5^2$ oe soi and A1 for ($l =$) 8.5
(ii)	2.5	2	B1 for 8 : 5 soi
9 (a)	326 ft	4ft	M2 for $65^2 = 110^2 + 70^2 - 2 \times 110 \times 70 \times \cos \hat{ACB}$ soi or M1 for the cosine rule with one error. and A1 for 33.9 or 146.1 or 59.2 and B1 ft for 360 – their $\hat{ACB}$ oe SC 2 for 109.1 or 37.0
(b)	92.2	3	M2 for $\frac{AD}{\sin(70 + 58) \text{ or } (180 - (70 + 58))} = \frac{110}{\sin 70}$ oe soi or M1 for $70 + 58$ or $180 - (70 + 58)$
(c) (i)	13.6 or 13.7	2	M1 for $\tan YBC = \frac{17}{70}$ or $\tan BYC = \frac{70}{17}$
(ii)	16.5	3	M1 for Figs $\frac{110}{24}$ soi and B1 for $\times$ by $\frac{60 \times 60}{1000}$ oe soi

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Question	Answers	Part	Part Marks
10 (a) (i)	$6b - 3a$ oe isw	1	M1+ M1 for two of $\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$ $\overrightarrow{CD} = \overrightarrow{CB} + \overrightarrow{BD}$ $\overrightarrow{OD} = \overrightarrow{OB} + \overrightarrow{BD}$ A1 for $\overrightarrow{OC} = 2a + 2b$ ft or $\overrightarrow{CD} = 3a + 3b$ ft or $\overrightarrow{OD} = 5a + 5b$
(ii)	$2b - a$ oe isw	1ft	
(iii)	$2 : 3$ cao NB www	4	
(b) (i)	Reflection $y = -x$ oe	2	
(ii) (a)	Triangle C with vertices (2, 3), (2, 2), (5, 5)	2	B1 for two vertices correct or M1 for a correct construction line involving H(2, 1) or H(2, 0)
(b)	1	1	
(c)	$\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$	1ft	

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Question	Answers	Part	Part Marks
11 (a) (i) (a)	40 to 41	1	
(b)	23 to 27	2	B1 for 52 ± 1 or 27 ± 1
(c)	225 to 245	1	
(ii)	79 to 80	1	
(iii)	Paper1 e.g. Paper 2 has median 54 oe Using (i)(a), (i)(c) or (ii) with numerical justification – accept reasonable attempts to read the graphs correctly.	1	
(b) (i)	$\frac{2}{4}$ oe	1	
(ii)	$\frac{2}{20}$ oe	1	
(iii)	$\frac{12}{20}$ oe	2	B1 for $\frac{3}{5} \times \frac{2}{4}$ or $\frac{2}{5} \times \frac{3}{4}$ seen
(iv)	$\frac{18}{60}$ oe	2	B1 for any correct sequence of three coins, $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3}$ or $\frac{2}{5} \times \frac{3}{4} \times \frac{1}{3}$ or $\frac{2}{5} \times \frac{1}{4} \times \frac{3}{3}$