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

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Question	Answers	Part	Part Marks
1 (a) (i)	3.6	1	
(ii)	109	2	B1 for $756 + 24\times922.25$ soi or SC1 for $\frac{24\times922.25}{21\,000}\times100$ oe
(b)	730.25	3	B1 for $\frac{127\times21\,000}{100}$ soi M1 for $381 + 36x$ = their total amount oe
(c)	1000	3	M1 for $x+\frac{5x}{100}=21\,000$ oe and M1 for $21\,000$ – their 2016 price oe
2 (a)	$\frac{ab}{6}$ Final answer	2	M1 for correct transition to multiplication soi
(b)	$\frac{1}{5}$ oe	2	B1 for $5(h-k)$
(c)	$(3m-2n)(3m+2n)$ Final ans.	1	
(d)	$(p-2)(q-3)$ 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.
(e) (i)	2 $-\frac{8}{5}$ oe	2	B1 for one correct or
(ii)	-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 $x=\frac{1\pm9}{5}\equiv\frac{-B\pm\sqrt{B^2-20C}}{10}$

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

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 **B** = 5 soi or $\begin{pmatrix} 3 & -2 \\ 1 & 1 \end{pmatrix}$ soi
7 (a) (i)	1.98	1	
(ii)	(±) $\sqrt{x^2 - a^2}$ Final answer	2	M1 for $x^2 = a^2 + b^2$ oe
(b) (i)	(*PQ* =) $\frac{17}{x+5}$	1	
(ii)	$3x^2 + 15x - 85$ (=0) oe shown	3	M1 for (*AB* =)their(*PQ*) + 3 and M1 for (their(*PQ* + 3) × *x* = 17 or
(iii)	3.38 –8.38	3	B1 for $\sqrt{15^2 - 4 \times 3 \times (-85)}$ soi and B1 for $\frac{-15 \pm \sqrt{their 1245}}{2 \times 3}$ 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

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 $65^2 = 110^2 + 70^2 - 2\times 110\times 70\times\cos A\hat{C}B$ 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 $A\hat{C}B$ oe SC 2 for 109.1 or 37.0
(b)	92.2	3	M2 for $\frac{AD}{\sin(70+58) or (180-(70+58))} = \frac{110}{\sin 70}$ 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 × by $\frac{60\times 60}{1000}$ oe soi

Question	Answers	Part	Part Marks
10 (a) (i)	6**b** − 3**a** oe isw	**1**	
(ii)	2**b** − **a** oe isw	**1ft**	
(iii)	2 : 3 cao **NB www**	**4**	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 $\overrightarrow{OC}$ = 2**a** + 2**b** ft or $\overrightarrow{CD}$ = 3**a** + 3**b** ft or $\overrightarrow{OD}$ = 5**a** + 5**b**
(b) (i)	Reflection $y = -x$ oe	**2**	B1 for either
(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**	

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 $\frac{2}{5}\times\frac{1}{4}\times\frac{3}{3}$