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)	3.6	**1**	
(ii)	109	**2**	B1 for $756 + 24 \times 922.25$ soi or SC1 for $\dfrac{24 \times 922.25}{21\,000} \times 100$ oe
(b)	730.25	**3**	B1 for $\dfrac{127 \times 21\,000}{100}$ soi M1 for $381 + 36x =$ their total amount oe
(c)	1000	**3**	M1 for $x + \dfrac{5x}{100} = 21\,000$ oe and M1 for $21\,000 -$ their 2016 price oe
2 (a)	$\dfrac{ab}{6}$ Final answer	**2**	M1 for correct transition to multiplication soi
(b)	$\dfrac{1}{5}$ 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)	$2 \quad -\dfrac{8}{5}$ oe	**2**	B1 for one correct or
(ii)	$-2 \quad -16$ cao	**2**	B1 for either or M1 for $(5x-1)^2 = 9^2$ or $\quad\quad (x-2)(x+\dfrac{8}{5}) = 0$ oe ft or Uses e(i) to form simultaneous equations or $x = \dfrac{1 \pm 9}{5} \equiv \dfrac{-B \pm \sqrt{B^2 - 20C}}{10}$

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 $x^3 + 10x - 80 = 0 \equiv \dfrac{x}{20}(x^2 - 10) = ax + b$ 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 $\dfrac{AD}{3} = \cos 27$ oe
(ii)	4.57	**3**	M2 for $CD = \dfrac{3}{\sin 41}$ oe or $\quad$ M1 for $\dfrac{3}{CD} = \sin 41$ oe
(b)	53.1 $\quad$ 126.9	**3**	M1 for $\dfrac{1}{2} \times 3 \times 5 \times \sin P\hat{Q}R = 6$ oe and $\quad$ A1 for 53.1 or $\quad$ 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 $\dfrac{AC}{AB} = \dfrac{CD}{BT}$ oe soi and $\quad$ M1 for $\dfrac{7}{10} = \dfrac{CD}{3}$ oe OR $\quad$ B1 for ($AB =$) 10

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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)	$(\pm)\sqrt{x^2 - a^2}$ Final answer	**2**	M1 for $x^2 = a^2 + b^2$ oe
(b) **(i)**	$(PQ =) \ \dfrac{17}{x+5}$	**1**	
(ii)	$3x^2 + 15x - 85 \ (=0)$ oe shown	**3**	M1 for $(AB =)$their$(PQ) + 3$ and M1 for (their$(PQ + 3) \times x = 17$ or
(iii)	3.38 −8.38	**3**	B1 for $\sqrt{15^2 - 4\times 3\times(-85)}$ soi and B1 for $\dfrac{-15\pm\sqrt{their\,1245}}{2\times 3}$ soi and M1 for both real values of $\dfrac{p\pm\sqrt{q}}{r}$
(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 $\dfrac{48}{360} \times 2\pi R$ soi and M1 for $R = 20 \times \dfrac{360}{48} \times \dfrac{1}{2\pi}$ oe
(ii)	239	**2**	M1 for $\dfrac{48}{360} \times \pi R^2$
(iii)	20.7	**2**	M1 for $2\pi r = \dfrac{312}{360} \times 2\pi R$ 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 $\dfrac{AD}{\sin(70+58) \, or \, (180-(70+58))} = \dfrac{110}{\sin 70}$ oe soi or M1 for $70 + 58$ or $180 - (70 + 58)$
(c) **(i)**	13.6 or 13.7	**2**	M1 for $\tan YBC = \dfrac{17}{70}$ or $\tan BYC = \dfrac{70}{17}$
(ii)	16.5	**3**	M1 for Figs $\dfrac{110}{24}$ soi and B1 for × by $\dfrac{60 \times 60}{1000}$ oe soi

Question	Answers	Part	Part Marks
10 (a) (i)	$6\mathbf{b} - 3\mathbf{a}$ oe isw	1	
(ii)	$2\mathbf{b} - \mathbf{a}$ 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 $\overrightarrow{OC} = 2\mathbf{a} + 2\mathbf{b}$ ft or $\overrightarrow{CD} = 3\mathbf{a} + 3\mathbf{b}$ ft or $\overrightarrow{OD} = 5\mathbf{a} + 5\mathbf{b}$
(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)**	$\dfrac{2}{4}$ oe	**1**	
(ii)	$\dfrac{2}{20}$ oe	**1**	
(iii)	$\dfrac{12}{20}$ oe	**2**	B1 for $\dfrac{3}{5}\times\dfrac{2}{4}$ or $\dfrac{2}{5}\times\dfrac{3}{4}$ seen
(iv)	$\dfrac{18}{60}$ oe	**2**	B1 for any correct sequence of three coins, $\dfrac{3}{5}\times\dfrac{2}{4}\times\dfrac{1}{3}$ or $\dfrac{2}{5}\times\dfrac{3}{4}\times\dfrac{1}{3}$ or $\dfrac{2}{5}\times\dfrac{1}{4}\times\dfrac{3}{3}$