Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **May/June 2017**

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

Question	Answers	Marks	Part marks
1(a)	9370	**3**	**M1** for (1199×5) or **B1** for 5995 or 2398 and 3597 and **M1** for 14(55×2 +40×3)oe or **B1** for 3220 or 1540 and 1680
1(b)	Bonus [cars] and 67	**3**	**B2** for 67 or answer Bonus with 588 and 655 seen as total charged or **M1** for 42×14 or 20×14+750×0.5[0]
2(a)	138 404 000 or 1.38404×10^8 isw	**1**	
2(b)	Thailand	**1**	
2(c)	$4.95[12] \times 10^7$ final answer	**1**	
2(d)	1.639 to 1.64	**2**	**M1** for $\frac{188169[000]-185133[000]}{185133[000]}[\times100]$ oe or $\frac{188169[000]}{185133[000]}\times100$
2(e)	15 400 000 oe final answer nfww	**3**	**M2** for $15677000 \div \frac{100+1.68}{100}$ oe or **M1** for seeing 15 677 000 as 101.68[%]
3(a)	- - - - - - 6 8 3 6 9 12 4 8 12 16	**2**	**B1** for at least 6 correct
3(b)	$\frac{5}{16}$ or 0.3125 or 31.25%	**1**	FT *their* complete table (decimals or percentages correct to at least 3sf)

Question	Answers	Marks	Part marks
3(c)	$\frac{3}{4}$ cao	**2**	**B1** for $\frac{12}{16}$ or $\frac{6}{8}$ or $\frac{their\,12}{16}$ oe
3(d)	No with square 6 **and** factors 7 seen or square $\frac{6}{16}$ **and** factors $\frac{7}{16}$ seen or 1 4 4 4 9 16 **and** 1 2 2 3 3 6 6 seen or $1^2\,2^2\,2^2\,2^2\,3^2\,4^2$ **and** 1 2 2 3 3 6 6 seen	**2**	**B1** for square $\frac{6}{16}$ or factors $\frac{7}{16}$ or 1 4 4 4 9 16 seen or $1^2\,2^2\,2^2\,2^2\,3^2\,4^2$ seen or 1 2 2 3 3 6 6 seen or square 6 **and** factors 7
4(a)	$\begin{pmatrix}1 & 0\\ 8 & 8\end{pmatrix}$	**2**	**B1** for 2 or 3 elements correct
4(b)	$\begin{pmatrix}-7\\ 5\end{pmatrix}$	**2**	**B1** for $\left(\frac{-7}{5}\right)$ or $\begin{matrix}-7\\5\end{matrix}$ or $\begin{pmatrix}-7\\k\end{pmatrix}$ or $\begin{pmatrix}k\\5\end{pmatrix}$ or (–7 [,] 5)
4(c)	$\begin{pmatrix}2 & 1\\ -2 & -\frac{1}{2}\end{pmatrix}$ or $\frac{1}{2}\begin{pmatrix}4 & 2\\ -4 & -1\end{pmatrix}$ oe isw	**3**	**B2** for $\frac{1}{2}\begin{pmatrix}-2 & -2\\ 4 & 3\end{pmatrix}$ oe or **B1** for determinant = 2 soi or $k\begin{pmatrix}-2 & -2\\ 4 & 3\end{pmatrix}$
5(a)	$\frac{9}{10x}$ final answer	**1**	
5(b)	$7x - 5y + 3$ final answer	**2**	**B1** for $7x - 5y + 3$ seen or two of $7x$, $-5y$, 3 in final answer
5(c)	–1.14, 1.47 final answers	**3**	**B2** for $\frac{-(-1)\pm\sqrt{(-1)^2-4\times3\times-5}}{2\times3}$ oe or **B1** for $\frac{-(-1)\pm\sqrt{p}}{2\times3}$ oe or $\frac{q\pm\sqrt{(-1)^2-4\times3\times-5}}{r}$ oe

Question	Answers	Marks	Part marks
5(d)(i)	Ruled line through (0,2.5) and (5, 0)	**2**	**B1** for 'correct' freehand line or line with a gradient of –0.5 or line through (0, 2.5) with negative gradient or line through (5, 0) with negative gradient
5(d)(ii)	Correct region unambiguously identified	**1**	FT provided *their* straight line with negative gradient and the 3 given lines form a quadrilateral below $y = 4$
6(a)	7.387 to 7.392	**2**	**M1** for $\sin 38 = \frac{PQ}{12}$ soi or $\frac{PQ}{\sin 38} = \frac{12}{\sin 90}$ soi
6(b)	71(.0) to 71.02, 108.98 to 109(.0) nfww	**4**	**B3** for one correct or **M2** for $\sin S = \frac{12\sin 52}{10}$ or $\frac{12\cos 38}{10}$ or **M1** for $\frac{\sin S}{12} = \frac{\sin 52}{10}$ oe or [*PR*=]12cos38 or [*PR*=]12sin52 or [*PR*=] $\sqrt{12^2 - (their(a))^2}$ and **SC1** for two answers that add to 180
7(a)	Correct pattern drawn	**1**	
7(b)	15 21 10 15	**2**	**B1** for 2 or 3 correct
7(c)	n^2 oe final answer	**1**	e.g. $\left(\frac{1}{2}n^2 + \frac{1}{2}n\right) + \left(\frac{1}{2}n^2 - \frac{1}{2}n\right)$
7(d)	465	**1**	

Question	Answers	Marks	Part marks
7(e)	$n^2 - \left(\frac{1}{2}n^2 + \frac{1}{2}n\right)$ or $\left(\frac{1}{2}(n-1)^2 + \frac{1}{2}(n-1)\right)$ or $\left(\frac{1}{2}n^2 + \frac{1}{2}n\right) - n$ leading to $\left(\frac{1}{2}n^2 - \frac{1}{2}n\right)$ without error **AG**	**1**	
7(f)	$m = 9$ cao	**3**	**M1** for $\frac{1}{2}m^2 + \frac{1}{2}m = 5m$ **A1** for $m^2 - 9\,m = 0$ or $m^2 = 9\,m$ or $m - 9 = 0$ or $m + 1 = 10$ or **B2** for [$m = 9$] $5\,m = 45$ and crosses = 45 or **B1** for values for $5\,m$ and the number of crosses seen for at least $m = 7$ and 8 After 0, **SC1** for answer 11
SECTION B			
8(a)	14.96 to 15[.0] nfww	**3**	**M2** for $15.1^2 - 2^2$ (= 224.01) or **M1** for $DC^2 + 2^2 = 15.1^2$ or 15.1^2 – *their* 2^2 with horizontal line seen or **B1** for horizontal line and 2 soi
8(b)	97.46 to 97.55	**3**	**M2** for $\cos[A] = \dfrac{9^2 + 11^2 - 15.1^2}{2 \times 9 \times 11}$ oe or **B1** for $15.1^2 = 9^2 + 11^2 - 2 \times 9 \times 11 \times \cos[A]$ oe

Question	Answers	Marks	Part marks
8(c)	123.8 to 124.1 nfww	**4**	**M3** for $\frac{1}{2}\times9\times11\times\sin(b)+\frac{1}{2}\times(4+6)\times(a)$ oe with (a) ≠15.1 soi or **M1** for $\frac{1}{2}\times 9\times 11\times\sin$ **(b)** oe soi and **M1** for $\frac{1}{2}\times(4+6)\times(a)$ oe with **(a)** ≠ 15.1 soi
8(d)	495.5 to 497	**2**	FT **(c)** × 4 **B1** for (figs 5)^2 soi
9(a)	$(x + 2)(10 – x)$ $=10x + 20 – x^2 – 2x$ $y = 20 + 8x – x^2$ **AG**	**2**	**B1** for $(x + 2)$ and $(10 – x)$ seen
9(b)	Smooth curve through 11 correct integer points	**4**	**B3** for 6 or 7 correct integer points plotted or **B2** for 4 or 5 correct integer points plotted or **B1** for 2 or 3 correct integer points plotted
9(c)	9.1 to 9.4 with $y = x$ drawn	**2**	**B1** for $y = x$ drawn or 9.1 to 9.4 with no line drawn/wrong line drawn
9(d)	–3, 6	**4**	**B1** for $5x$ +2 soi **M1** for *their*$(5x + 2) = 20 + 8x – x^2$ leading to $x^2 – 3x – k$ [=0] or $x^2 – kx – 18$[= 0] or equivalent 3 term quadratic **A1** for $(x + 3)(x – 6)$ [= 0] or $\frac{3\pm\sqrt{3^2-4\times1\times-18}}{2\times1}$ oe or $\frac{3}{2}\pm\sqrt{\frac{81}{4}}$ oe After A0, **SC1** for answer 6 or –3

Question	Answers	Marks	Part marks
10(a)(i)	*B* and *C* correctly placed	**3**	**B2** for *B* or *C* correctly placed or **B1** for a point on a bearing of 062° or a point on a bearing of 194°
10(a)(ii)	*D* on *BC* with *ADB* = 90°	**1**	FT
10(a)(iii)	2.7 to 3.1	**1**	dep on **(a)(ii)** and *B* or *C* correct
10(a)(iv)	1.2 to 1.4 oe	**2**	dep on **(a)(ii)** and *B* or *C* correct **B1** for [*CD*] 5.5 to 6 and [*DB*] 7.3 to 7.7 or **SC1** for answer $0.5 \leqslant n < 1$ if *their CD* > *their DB* or answer $1 < n \leqslant 2$ if *their CD* < *their DB*
10(a)(v)	$0.714w$ to $0.834w$ oe or $k - w$ where k is 18 to 20.5	**1**	FT $\frac{w}{\text{their (a)(iv)}}$ if *their* **(a)(iv)** ≠ 1 **and** dep on **(a)(ii)**
10(b)	Correct region shaded	**4**	**B1** for arc 6 cm from *E* **B1** for angle bisector of *EAF* **B1** for perpendicular bisector of *AF* After B2, **SC1** for 'correct' region shaded provided only slight inaccuracy with the other line/curve
11(a)(i)	$55 \leqslant t < 60$	**1**	
11(a)(ii)	60.8 nfww	**3**	**M2** for $\frac{\sum \text{frequency} \times \text{midvalue}}{50}$ oe or **M1** for $\sum ft$

Question	Answers	Marks	Part marks
11(a)(iii)	$\frac{23}{50}$ or 0.46 or 46%	**2**	**B1** for 23 seen or 16 + 7 seen
11(b)(i)	34	**1**	
11(b)(ii)	4.5	**2**	**B1** for 31.5 to 32.5 and 36 to 37 seen
11(b)(iii)	(28, 0) (32, 15) (36, 45) (40, 60) plotted and points joined	**3**	**B2** for at least 3 correct points plotted or **B1** for 2 correct points plotted or (28, 0) (32, 15) (36, 45) and (40, 60) seen
12(a)	32.56 to 32.58 or 32.6	**3**	**M2** for $\frac{72}{360}\times\pi\times 20+20$ oe or **M1** for $\frac{72}{360}\times\pi\times 20$ **A1** for 12.56 to 12.58 or 12.6 After 0 or 1, **SC1** for *their* 'arc length' + 10 + 10 soi
12(b)(i)	62.83 to 62.84 or 62.8	**2**	**M1** for $\frac{72}{360}\times\pi\times 10^2$
12(b)(ii)	4(.00) to 4.08 nfww	**3**	FT from *their* **(b)(i)** – (58.76 to 58.8) provided answer not negative **M2** for *their* **(b)(i)** – $2\times\frac{1}{2}\times 10\times 10\times\sin\left(\frac{72}{2}\right)$ oe or **M1** for [2×] $\frac{1}{2}\times 10\times 10\times\sin\left(\frac{72}{2}\right)$ oe soi
12(c)	Add totals from **(a)** and **(b)** then divide by 2 Any half values are to be rounded down	**4**	