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O Level

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

Paper 2 **May/June 2017**

MARK SCHEME

Maximum Mark: 100

Published

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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)

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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

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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**	

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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 $\cos[A] = \frac{9^2 + 11^2 - 15.1^2}{2 \times 9 \times 11}$ oe or **B1** for $15.1^2 = 9^2 + 11^2 - 2 \times 9 \times 11 \times \cos[A]$ oe

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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

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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**	

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