



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 <u>and</u> 3597 <u>and</u> M1 for $14(55 \times 2 + 40 \times 3)$ oe or B1 for 3220 or 1540 <u>and</u> 1680
1(b)	Bonus [cars] and 67	3	B2 for 67 or answer Bonus <u>with</u> 588 <u>and</u> 655 seen as total charged or M1 for 42×14 or $20 \times 14 + 750 \times 0.5$ [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 $\frac{188169[000] - 185133[000]}{185133[000]} [\times 100]$ oe or $\frac{188169[000]}{185133[000]} \times 100$
2(e)	15 400 000 oe final answer nfw	3	M2 for $15\,677\,000 \div \frac{100 + 1.68}{100}$ 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 <i>their</i> 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 $\begin{pmatrix} -7 \\ 5 \end{pmatrix}$ or $\frac{-7}{5}$ or $\begin{pmatrix} -7 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 5 \end{pmatrix}$ or $(-7 \text{ [] } 5)$
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 $\frac{-(-1) \pm \sqrt{(-1)^2 - 4 \times 3 \times -5}}{2 \times 3}$ oe or B1 for $\frac{-(-1) \pm \sqrt{p}}{2 \times 3}$ oe or $\frac{q \pm \sqrt{(-1)^2 - 4 \times 3 \times -5}}{r}$ 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 <i>their</i> 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) nfw	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=] $\sqrt{12^2 - (\text{their}(a))^2}$ 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. $(\frac{1}{2}n^2 + \frac{1}{2}n) + (\frac{1}{2}n^2 - \frac{1}{2}n)$
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 $m^2 - 9m = 0$ or $m^2 = 9m$ or $m - 9 = 0$ or $m + 1 = 10$ or B2 for $[m = 9] 5m = 45$ and crosses = 45 or B1 for values for $5m$ 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 $15.1^2 - \text{their } 2^2$ 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 nfw	4	M3 for $\frac{1}{2} \times 9 \times 11 \times \sin(b) + \frac{1}{2} \times (4+6) \times (a)$ oe with $(a) \neq 15.1$ 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 $(a) \neq 15.1$ soi
8(d)	495.5 to 497	2	FT (c) $\times 4$ B1 for $(\text{figs } 5)^2$ 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 <i>their</i> $(5x+2) = 20 + 8x - x^2$ 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 $\frac{3 \pm \sqrt{3^2 - 4 \times 1 \times -18}}{2 \times 1}$ 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 $ADB = 90^\circ$	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 $0.5 \leq n < 1$ if <i>their</i> $CD >$ <i>their</i> DB or answer $1 < n \leq 2$ if <i>their</i> $CD <$ <i>their</i> 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 <i>their</i> (a)(iv) $\neq 1$ 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)	$55 \leq t < 60$	1	
11(a)(ii)	60.8 nfw	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 <u>and</u> 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 <i>their</i> '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 <i>their</i> (b)(i) – (58.76 to 58.8) provided answer not negative M2 for <i>their</i> (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	