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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2017**

MARK SCHEME

Maximum Mark: 130

Published

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Part marks
1(a)(i)	275.31	**2**	**M1** for $90 \times 23.15 + 1885 \times 13.5$ oe
1(a)(ii)	3202	**3**	**M2** for $\frac{198.16 - 90 \times 0.245}{0.055}$ oe **M1** for 90×0.245 or 90×24.5 oe
1(b)	17.[0] or 17.00 to 17.01	**2**	**M1** for $13.5 \times \left(1 + \frac{8}{100}\right)^3$
1(c)(i)	40	**3**	**M2** for $\frac{7.7 - 5.5}{5.5}$ [$\times 100$] oe or $\frac{7.7}{5.5} \times 100$ or **M1** for $\frac{7.7}{5.5}$ oe
1(c)(ii)	11.9 or 11.86 to 11.87	**3**	**M2** for $\sqrt[3]{\frac{7.7}{5.5}}$ oe or **M1** for $5.5 \times x^3 = 7.7$ oe
1(d)	150 [million] oe	**2**	**M1** for 390 [million] ÷ (5 + 2 + 6)
1(e)	250 nfww	**3**	**M2** for 258.25 ÷ ((100 + 3.3) ÷ 100) or **M1** for 258.25 associated with 103.3[%]
2(a)	$71 < t \leqslant 72$	**1**	
2(b)	72.3 or 72.27 to 72.28 nfww	**4**	**M1** for midpoints soi (condone 1 error or omission) **M1** for use of $\sum fx$ with x in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\sum fx \div 90$
2(c)(i)	41, 62, 80, 90	**2**	**B1** for 2 correct values

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Question	Answer	Marks	Part marks
2(c)(ii)	Correct curve	**3**	**B1FT** *their* **(c)(i)** for 5 correct heights **B1** for 5 points plotted at upper ends of intervals **B1FT** (dep on at least **B1**) for increasing curve or increasing polygon through 5 points If zero scored, **SC1FT** for 4 correct points plotted
2(c)(iii)	72.1 to 72.4	**1**	
2(c)(iv)	1.9 to 2.2	**2**	**M1** for UQ = 73.2 to 73.4 or LQ = 71.2 to 71.3
2(d)	180 cao nfww	**4**	**B3** for 50 [m/s] nfww OR **M3** for $\frac{3725 \div 1000}{74.5 \div 3600}$ OR **M2** for 3725 ÷ 74.5 or **M1** for 3725 or 74.5 seen or for (3715 to 3725) ÷ (74.5 to 75.5) **M1** indep for multiply by 3.6 oe
3(a)(i)	Image at (5, 1), (7, 1), (7, 4)	**2**	**B1** reflection in $y = 4$ or $x = k$
3(a)(ii)	Image at (–1, 1), (–4, 1), (–1, 3)	**2**	**B1** correct size and correct orientation wrong position or for rotation 90° clockwise around (0, 0)
3(a)(iii)	Image at (2, – 4), (4, – 4), (2, – 1)	**2**	**B1** for translation by $\begin{pmatrix}1\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-5\end{pmatrix}$
3(b)	Enlargement	**1**	
	[sf] – 0.5 oe	**1**	
	(5, 5)	**1**	
3(c)	$\begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}$	**2**	**B1** for one correct column or row
3(d)(i)	(4, 2)	**2**	**M1** for $\begin{pmatrix}1 & 0\\0 & 2\end{pmatrix}\begin{pmatrix}4\\1\end{pmatrix}$ oe

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Question	Answer	Marks	Part marks
3(d)(ii)	(– 4, 2)	**3**	**M2** for $\begin{pmatrix}-1 & 0\\ 0 & 2\end{pmatrix}$ or $\begin{pmatrix}1 & 0\\ 0 & 2\end{pmatrix}\begin{pmatrix}-4\\ 1\end{pmatrix}$ or **M1** for $\begin{pmatrix}1 & 0\\ 0 & 2\end{pmatrix}\begin{pmatrix}-1 & 0\\ 0 & 1\end{pmatrix}\left[\begin{pmatrix}4\\ 1\end{pmatrix}\right]$ or $\begin{pmatrix}-4\\ 1\end{pmatrix}$
3(d)(iii)	$\frac{1}{2}\begin{pmatrix}2 & 0\\ 0 & 1\end{pmatrix}$ oe isw	**3**	**M2** for det = 2 soi or $k\begin{pmatrix}2 & 0\\ 0 & 1\end{pmatrix}$ soi or **M1** for recognition that **Q** is inverse matrix of **G** or **GQ = I** or **QG = I**
4(a)	–1.6 to –1.4	**1**	
4(b)	–0.5	**1**	
4(c)	$k > -4$	**2**	**B1** for identifying the –4 or for horizontal line drawn $y = -4$
4(d)	$y = x - 5$ ruled and –2.3 to –2.1 –1.2 to –1.1 1.3 to 1.4	**3**	**B2** for correct line and 2 correct values or no line and 3 correct values or **B1** for no line and 2 correct values or **B1** for correct line
4(e)	Tangent ruled at $x = 1$	**B1**	No daylight at point of contact. Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = 0.8$ and 1.2
	–6 to –4	**2**	Dep on **B1** or close attempt at tangent at $x = 1$ **M1** for rise/run for *their* tangent at $x = 1$
5(a)(i)	50890 or 50893 to 50900.4	**2**	**M1** for $\pi \times 18^2 \times 50$

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Question	Answer	Marks	Part marks
5(a)(ii)	20.5 or 20.52 to 20.534	3	**B2** for answer 29.5 or 29.46 to 29.48 OR **M2** for $(50900-30000)\div(\pi\times18^2)$ oe or **M1** for (figs 50.9 –figs 30) ÷ ($\pi\times$ figs18^2) or **M1** for $(50900-30000)=(\pi\times18^2)h$ oe OR **alternative method** **M2** for $50-\frac{30000}{\pi\times18^2}$ oe **M1** for figs $30=\pi\times$figs $18^2\times(50-h)$ oe or for $\frac{\text{figs}\,30}{\pi\times\text{figs}18^2}$ oe OR **alternative method** **M2** for $\frac{(50.9-30)}{50.9}\times50$ oe or **M1** for $\frac{(50.9-30)}{50.9}$ or $\frac{30}{50.9}\times50$ oe or **M1** for $\frac{(\text{figs }50.9-\text{figs }30)}{\text{figs }50.9}\times50$ oe
5(a)(iii)	334 nfww	4	**M2** for figs $30\div\frac{2}{3}\pi\times3.5^3$ oe or **M1** for $\frac{1}{2}\times\frac{4}{3}\pi\times3.5^3$ oe and **B1** for 30 000
5(b)(i)	3.28[6..] or 3.29	3	**M2** for [$r^2=$] $\frac{95\times3}{8.4\pi}$ oe or **M1** for $\frac{1}{3}\pi\times r^2\times8.4$ [= 95]
5(b)(ii)	93.1 to 93.6	4	**M3** for $\pi\times3.3\times\sqrt{3.3^2+8.4^2}$ or **M2** for $\sqrt{3.3^2+8.4^2}$ or **M1** for $3.3^2+8.4^2$
6(a)(i)	$-7x+55$ final answer	2	**M1** for $8x+20$ or $-15x+35$ or answer $-7x+k$ or $kx+55$
6(a)(ii)	$x^2-14x+49$ final answer	2	**M1** for 3 of $x^2-7x-7x+49$

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Question	Answer	Marks	Part marks
6(b)(i)	–18	**3**	**M1** for a correct first step ie correctly multiplying by 3 or correctly dividing by 2 or for correctly subtracting 5 **M1** for correctly reaching $ax = b$ from *their* first step
6(b)(ii)	15	**3**	**M2** for $6x - 4x = 21 + 9$ oe or **M1** for $6x - 21$ or correct division by 3 or for correctly reaching $ax = b$ from *their* first step
6(b)(iii)	5 and –5	**3**	**B2** for 5 or –5 or **M1** for $[x^2 =] (74 + 1) \div 3$ or better
7(a)	(–0.5, 3)	**2**	**B1** for one correct value
7(b)	$[y =] -2x + 2$ final answer	**3**	**M1** for $\frac{-2-8}{2--3}$ or better **M1** for substitution of (–3, 8) or (2, –2) or *their* midpoint into $y = mx + c$ with *their m*
7(c)	$y = -2x + 7$ oe	**2FT**	**FT** *their* **(b)** **M1** for $y = (their-2)x + k$ ($k \neq 2$) or $y = kx + 7$ ($k \neq 0$) If zero scored, **SC1** for $(their - 2)x + 7$
7(d)	$x - 2y + 9 = 0$ or $2y - x - 9 = 0$ oe	**4**	**B3** for any correct equivalent in wrong form Or **M2** for $y = ½ x + k$ oe (**FT** negative reciprocal of *their* gradient in **(b)**) or **M1** for grad = ½ (**FT** negative reciprocal of *their* gradient in **(b)**) **M1** for substitution of (1, 5) into $y = mx + c$ oe with *their m*
8(a)(i)	290	**2**	**M1** for 180 + 110 oe
8(a)(ii)	156.8 or 156.7[9..]	**5**	**B1FT** for $CBA = 10°$ (*their* **(a)** – 280) and **B3** for [angle ACB =]13.2° or **M2** for $[\sin C] = \frac{50\sin(their10)}{38}$ or **M1** for $\frac{50}{\sin C} = \frac{38}{\sin(their10)}$ oe

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Question	Answer	Marks	Part marks
8(a)(iii)	8.68 or 8.677 to 8.684	**3**	**M2** for [x =]50sin(*their*10) oe or **M1** for $\sin(\textit{their}10) = \frac{x}{50}$ oe or **M1** for a correct right-angled triangle drawn with 50 as hypotenuse
8(b)(i)	$x(x - 25) = 2200$	**1**	and no errors seen
8(b)(ii)	$\frac{-(-25) \pm \sqrt{(-25)^2 - 4(1)(-2200)}}{2(1)}$ or better	**B2**	**B1** for $\sqrt{(-25)^2 - 4(1)(-2200)}$ or better **or** for $\left(x - \frac{25}{2}\right)^2$ oe or **B1** for $\frac{-(-25) + \sqrt{q}}{2(1)}$ or $\frac{-(-25) - \sqrt{q}}{2(1)}$ or both or for $\frac{25}{2} + \text{or} - \sqrt{\left(\frac{25}{2}\right)^2 + 2200}$
	–36.04 and 61.04 final answer	**B1,B1**	If **B0B0, SC1** for values in ranges –36.042 to –36.041 **and** 61.041 to 61.042 seen or for answers –36[.0] or –36.042 to –36.041 **and** 61[.0] or 61.041 to 61.042 or –36.04 **and** 61.04 seen in working or for –61.04 **and** 36.04 as final ans
9(a)(i)	5 and 13	**1**	
9(a)(ii)	$8n - 3 = 203$	**M1**	Evaluation of 25th or 26th term with supporting evidence or explanation
	25.75 or $25\frac{3}{4}$	**A1**	Second evaluation of 25th or 26th terms with supporting evidence or explanation If zero scored, **SC1** for 25.75 or 197 and 205 with partial evidence or explanation
9(b)(i)	$6n + 7$ oe final answer	**2**	**B1** for $6n + c$ or $kn + 7$ $k \neq 0$
9(b)(ii)	$n^2 + n + 2$ oe final answer	**2**	**B1** for a quadratic expression or second difference = 2
9(c)	[y =] 10	**2**	**M1** for $5(20 - y) = 50$
	[First term =] 14	**2**	**M1** for $5(x - \textit{their } y) = 20$ or for $20 \div 5 + \textit{their } y$