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MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2016**

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	Mark	Part marks
1 (a) (i)	36 600	3	**M2** for $6100 \div 2 \times (2 + 7 + 3)$ oe or **M1** for $6100 \div 2$ soi
(ii)	$16\frac{2}{3}$ or 16.7 [16.66 to 16.67]	1	
(b)	1 231 708 final answer nfww	5	**M4** for $5964 \times 15 + 28400 \times 35 + 8236 \times 18$ or **M3** for 5964×15 **and** $28\,400 \times 35$ or for $5964 \times 15 + 42\,600 \times$ *their* decimal $\frac{2}{3}$ $\times 35 + (42\,600 - 5964 - 42\,600 \times$ *their* decimal $\frac{2}{3}) \times 18$ or **M2** for 5964×15 **or** $28\,400 \times 35$ or for $42\,600 \times$ *their* decimal $\frac{2}{3} \times 35$ or **M1** for $0.14 \times 42\,600$ or $42\,600 \div 3 \times 2$
(c)	27.2[0] nfww	5	**M2** for $23.80 \div 0.7$ oe or **M1** for 23.80 associated with 70% oe and **M2** for *their* $(23.80 \div 0.7) \times 0.8$ or **M1** for *their* $(23.80 \div 0.7) \times 0.2$
2 (a)	$x > \frac{12}{5}$ oe final answer	2	**B1** for $\frac{12}{5}$ oe in answer with incorrect or no sign or **M1** for one correct step e.g. $5x > 9 + 3$
(b) (i)	$(y - 6)(x + 3)$ final answer	2	**M1** for $y(x + 3) - 6(3 + x)$ or $x(y - 6) + 3(y - 6)$
(ii)	$8(x + 3y)(x - 3y)$ final answer	3	**M2** for $2(2x + 6y)(2x - 6y)$ or $(8x + 24y)(x - 3y)$ or $(8x - 24y)(x + 3y)$ or $4(2x - 6y)(x + 3y)$ or $4(2x + 6y)(x - 3y)$ or $(4x - 12y)(2x + 6y)$ or $(4x + 12y)(2x - 6y)$ or **M1** for $8(x^2 - 9y^2)$ or $(x + 3y)(x - 3y)$

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Question	Answer	Mark	Part marks
(c)	$r = \frac{1}{p+7}$ final answer nfww	4	**M1** removes fraction correctly **M1** collects terms in r **M1** removes r as a factor from their terms in r **M1dep** divides by bracket to leave r and denominator simplified
3 (a) (i)	10	1	
(ii)	–3.4 to –3.3 and –0.4 to –0.3 and 1.6 to 1.7	3	**B1** for each
(iii)	y = –2.3 to –2.1oe y = 10 to 10.1oe	2	**B1** for each
(b) (i)	2, –1, 4	3	**B1** for each
(ii)	Fully correct curve drawn	4	**SC3** for correct curves but branches joined or touching y-axis or **B2FT** for 8 or 9 correct plots or **B1FT** for 6 or 7 correct plots and **B1** indep for two separate branches not touching or crossing y- axis
(iii)	–3.4 to –3.2 and 1.8 to 1.9	2	**B1** for each
(c)	3.2 oe	2FT	**FT** 2 ÷ *their* (a)(i) + 3 **M1** for f(–2) = 10 or *their* (a)(i) used
(d)	1	1	
4 (a) (i)	0.0025 or $\frac{1}{400}$ oe	2	**M1** for 0.05^2 oe
(ii)	0.9975 or $\frac{399}{400}$ oe	1FT	**FT** for 1 – (*their* (a)(i)) oe
(b)	0.171 or 0.1714 to 0.1715 or $\frac{6859}{40\,000}$	3	**M2** for $4(0.05 \times 0.95^3)$ oe **M1** for 0.05×0.95^3 oe seen or for the 4 combinations correctly identified

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Question	Answer	Mark	Part marks
(c)	376 nfww	4	**M1** for midpoints soi (condone 1 error or omission) (225, 275, 325, 375, 425, 475) and **M1** for use of Σfx with x in correct interval including both boundaries (condone 1 further error or omission) and **M1** (dependent on second M) for $\Sigma fx \div 200$
(d) (i)	16	1	
(ii)	33	2	**M1** for $0.8 \times 50 + 0.26 \times 100$
5 (a) (i)	275	2	**M1** for $360 - 40 - 45$ oe
(ii)	095	2FT	**FT** *their* (a) – 180 **M1** for *their* (a) – 180 oe or 180 – 40 – 45
(b)	464.66 to 464.67 [= 464.7]	4	**M2** for $510^2 + 720^2 - 2 \times 510 \times 720 \cos 40$ or **M1** for correct implicit equation **A1** for 215 900 to 215 920
(c)	44.9 or 44.86 to 44.87…	3	**M2** for $\frac{510 \sin(40)}{464.7}$ or **M1** for correct implicit equation
6 (a) (i)	Correct image (2, –5) (4, –5) (4, –1)	2	**SC1** for reflection in $y = 0$ or 3 correct points not joined
(ii)	Correct image (–2, 1) (–6, 1) (–6, –1)	2	**SC1** for rotation 90 clockwise any centre or 3 correct points not joined
(iii)	Translation by $\begin{pmatrix} 1 \\ 9 \end{pmatrix}$	2	**B1** for each
(iv)	Enlargement [SF] – ½ oe [Centre] (2, 1)	1 1 1	
(b) (i)	$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	2	**B1** for one correct row or column but not the identity matrix
(ii)	Reflection $x = 0$ oe	1 1	

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Question	Answer	Mark	Part marks
7 (a) (i)	$\frac{12}{x-1}-\frac{10}{x}=0.5$ oe	M2	**M1** for $\frac{12}{x-1}$ or $\frac{10}{x}$
	$12x - 10(x - 1) = 0.5x(x - 1)$ or better	M1	**FT** $\frac{10}{x}-\frac{12}{x-1}=0.5$ only
	Brackets expanded		
	$x^2 - 5x - 20 = 0$ with no errors or omissions seen	A1	Dep on **M3** and brackets expanded
(ii)	$\sqrt{(-5)^2 - 4(1)(-20)}$ or better	B1	Seen anywhere or $(x-\frac{5}{2})^2$ oe
	$p = –(– 5)$, $r = 2(1)$ or better	B1	Must be in the form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or for $\frac{5}{2}+\sqrt{\left(\frac{5}{2}\right)^2+20}$ or $\frac{5}{2}-\sqrt{\left(\frac{5}{2}\right)^2+20}$
	– 2.62, 7.62 final answers	B1B1	**SC1** for – 2.6 or – 2.623 to – 2.624 and 7.6 or 7.623 to 7.624 or –2.62 and 7.62 seen in working or answers 2.62 and – 7.62
(iii)	1 [hr] 49 [mins]	2FT	**FT** 12 ÷ (*their* +ve root – 1) or 0.5 + 10 ÷ (*their* 7.62) in hrs and mins, rounded to nearest min **M1** for 12 ÷ (*their* +ve root – 1) or 0.5 + 10 ÷ (*their* 7.62)
(b) (i)	2.5	1	
(ii)	1312.5 final answer	3	**M2** for any complete correct method e.g 25 × 10 ÷ 2 + 45 × 25 + 5 × 25 ÷ 2 **M1** for any correct method for a relevant area under the graph
8 (a) (i)	Not possible	1	
(ii)	$\begin{pmatrix} 4 & 0 \\ -2 & 10 \\ 6 & -8 \end{pmatrix}$ final answer	1	
(iii)	$\begin{pmatrix} 14 & 35 \\ -8 & -20 \end{pmatrix}$ final answer	2	**M1** for one correct column or row
(iv)	(–6) final answer	2	**M1** for 14 – 20
(v)	$\begin{pmatrix} -2 & 18 \\ -6 & 22 \end{pmatrix}$ final answer	2	**M1** for one correct column or row

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Question	Answer	Mark	Part marks
(b)	$\frac{1}{8}\begin{pmatrix}5 & -3\\ 1 & 1\end{pmatrix}$ or better isw	**2**	**B1** for $k\begin{pmatrix}5 & -3\\ 1 & 1\end{pmatrix}$ seen or implied, $k \neq 0$ or $\frac{1}{8}\begin{pmatrix}a & b\\ c & d\end{pmatrix}$ seen
9 (a)	270 or 270.17 to 270.22	**3**	**M2** for $\frac{360-145}{360}\times\pi 12^2$ oe or **B1** for 215 seen or **M1** for $\frac{\theta}{360}\times\pi 12^2$ used
(b)	518 or 517.6 to 517.8 nfww	**6**	**B4** for vertical height = 9.62 to 9.63 or **B3** for radius = 7.166 to 7.17 or **B2** for length of sector = 45.[0] or 45.02 to 45.04 or **M1** for $\frac{360-145}{360}\times 2\times\pi\times 12$ oe or for $\sqrt{12^2 - \textit{their radius}^2}$ and **M1** indep for $\frac{1}{3}\pi\times \textit{their radius}^2\times \textit{their } h$ ($h \neq 12$ or $r \neq 12$)
10 (a)	10 15 15 21 35 48	**6**	**B1** for each correct entry
(b) (i)	3	**2**	**M1** for any correct substitution in $n^2 + 4n + p$ = number of tiles eg $2^2 + 4(2) + p = 15$
(ii)	143	**1FT**	**FT** 140 + *their* (b)(i)
(c)	$a = \frac{1}{2}$ oe $b = \frac{3}{2}$ oe nfww	**5**	**B1** for a correct simplified equation e.g. $a + b + 1 = 3$, $4a + 2b + 1 = 6$, $9a + 3b + 1 = 10$ etc **B1** for a 2nd correct simplified equation **M1** for correctly eliminating one variable for *their* equations in a and b **A1** for $a = \frac{1}{2}$ nfww **A1** for $b = \frac{3}{2}$ nfww

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Question	Answer	Mark	Part marks
(d) (i)	171	2FT	**FT** *their a* $\times 17^2$ + *their b* $\times 17 + 1$ **M1** for *their a* $\times 17^2$ + *their b* $\times 17 + 1$
(ii)	673	1FT	**FT** *their* (d)(i) $\times 4 - 11$

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