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MATHEMATICS

0580/43

Paper 4 (Extended)

May/June 2016

MARK SCHEME

Maximum Mark: 130

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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
nfw	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 nfw	5	M4 for $5964 \times 15 + 28400 \times 35 + 8236 \times 18$ or M3 for 5964×15 and 28400×35 or for $5964 \times 15 + 42\,600 \times \text{their decimal } \frac{2}{3}$ $\times 35 + (42\,600 - 5964 - 42\,600 \times \text{their decimal } \frac{2}{3}) \times 18$ or M2 for 5964×15 or 28400×35 or for $42\,600 \times \text{their decimal } \frac{2}{3} \times 35$ or M1 for $0.14 \times 42\,600$ or $42\,600 \div 3 \times 2$
(c)	27.2[0] nfw	5	M2 for $23.80 \div 0.7$ oe or M1 for 23.80 associated with 70% oe and M2 for $\text{their } (23.80 \div 0.7) \times 0.8$ or M1 for $\text{their } (23.80 \div 0.7) \times 0.2$
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 nfw	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 -2.1 oe $y = 10$ to 10.1 oe	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 ÷ <i>their</i> (a)(i) + 3 M1 for $f(-2) = 10$ or <i>their</i> (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 $1 - (\text{their (a)(i)})$ 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 nfw	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 <i>their</i> (a) – 180 M1 for <i>their</i> (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] – $\frac{1}{2}$ 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 $12x - 10(x-1) = 0.5x(x-1)$ or better Brackets expanded $x^2 - 5x - 20 = 0$ with no errors or omissions seen	M2 M1 A1	M1 for $\frac{12}{x-1}$ or $\frac{10}{x}$ FT $\frac{10}{x} - \frac{12}{x-1} = 0.5$ only Dep on M3 and brackets expanded
(ii)	$\sqrt{(-5)^2 - 4(1)(-20)}$ or better $p = -(-5), r = 2(1)$ or better – 2.62, 7.62 final answers	B1 B1 B1B1	Seen anywhere or $(x - \frac{5}{2})^2$ oe 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 $\frac{5}{2} - \sqrt{\left(\frac{5}{2}\right)^2 + 20}$ 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 $12 \div (\text{their +ve root} - 1)$ or $0.5 + 10 \div (\text{their } 7.62)$ in hrs and mins, rounded to nearest min M1 for $12 \div (\text{their +ve root} - 1)$ or $0.5 + 10 \div (\text{their } 7.62)$
(b) (i)	2.5	1	
(ii)	1312.5 final answer	3	M2 for any complete correct method e.g $25 \times 10 \div 2 + 45 \times 25 + 5 \times 25 \div 2$ 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 nfw	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 $\sqrt{12^2 - \text{their radius}^2}$ and M1 indep for $\frac{1}{3} \pi \times \text{their radius}^2 \times \text{their } h$ ($h \neq 12$ 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 nfw	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 2 nd correct simplified equation M1 for correctly eliminating one variable for their equations in a and b A1 for $a = \frac{1}{2}$ nfw A1 for $b = \frac{3}{2}$ nfw

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