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Cambridge International General Certificate of Secondary Education

MATHEMATICS (US)

0444/43

Paper 4 (Extended)

October/November 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)	Triangle drawn at (-4, 3), (-1, 3), (-1, 4)	2	SC1 for correct reflection in $x = k$ or $y = 1$
(b)	Triangle drawn at (1, 7), (1, 6), (4, 6)	2	SC1 for translation by $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 3 \end{pmatrix}$
(c)	Triangle drawn at (2, 3), (2, 1), (8, 1)	2	
(d)	Rotation	1	
	90° clockwise oe	1	Accept -90°
	(7, 4)	1	

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Question	Answer	Mark	Part marks	
2	(a) (i)	1050	2	M1 for $924 \div 22$ oe or $924 \div 0.88$ oe If zero scored, SC1 for 126 seen
	(ii)	12	1	
	(iii)	$5\frac{1}{4}$ hrs or 5.25 hrs	2	M1 for $9 \div (7 + 5)$ or $540 \div (7 + 5)$ If zero scored, SC1 for answer 3.75h or 3h 45 mins
	(b)	24.6[0]	3	M2 for $15.99 \div \left(1 - \frac{35}{100}\right)$ oe or M1 for 65% associated with 15.99
	(c)	63	3	M2 for $35 \times \sqrt{\frac{2835}{875}}$ oe or M1 for $\sqrt{\frac{2835}{875}}$ or $\sqrt{\frac{875}{2835}}$ or better or $\frac{\sqrt{2835}}{?} = \frac{\sqrt{875}}{35}$ oe OR M2 for $\sqrt{2835 \times \frac{35}{\text{their}(875 \div 35)}}$ oe or M1 for $\frac{35}{\text{their}(875 \div 35)}$ or $\frac{\text{their}(875 \div 35)}{35}$
(d)	(i)	0.661[0]	1	
	(ii)	48	3	M2 for $\frac{18.50 - 12.50}{12.50} \times 100$ or M1 for $\frac{18.50 - 12.50}{12.50}$ or $\frac{18.50}{12.50} \times 100$

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Question	Answer	Mark	Part marks
3 (a)	-4.5 and 10.5	2	B1 for each value
(b)	Correct curve	5	B4 for correct curve with branches joined OR B3 FT for 9 or 10 points or B2 FT for 7 or 8 points or B1 FT for 5 or 6 points and B1 independent for one branch on each side of the y-axis and not touching or crossing the y-axis
(c)	5	1	
(d) (i)	Line $y = 15 - 3x$ ruled and -0.4 to -0.31 0.35 to 0.45 2.2 to 2.3	4	B3 for correct line and 2 correct values or B2 for correct line or M1 for ruled line with gradient -3 or through (0, 15) or SC2 for no/wrong line and three correct values or SC1 for no/wrong line and two correct values or for correct freehand line
(ii)	[a =] 6 [b =] -14 [c =] 0	3	B2 for $6x^3 - 14x^2 + 2 = 0$ oe or M1 for correct removal of denominator or collection of terms on one side
4 (a)	$\frac{1}{64}$	2	M1 for $\frac{1}{8} \times \frac{1}{8}$
(b)	$\frac{63}{64}$	1FT	FT 1 – their (a)
(c)	$\frac{30}{64}$ oe	2	M1 for $[2 \times] \frac{3}{8} \times \frac{5}{8}$ oe
(d)	$\frac{7}{64}$	3	M2 for $\frac{1}{8} \times \frac{1}{8} + \frac{1}{8} \times \frac{3}{8} + \frac{3}{8} \times \frac{1}{8}$ oe or M1 for identifying combinations required, (8, 8) and (8, 6) and (8, 5) or identifying 6 out of the 7 possible outcomes
(e)	$\frac{24}{64}$ oe	3	M2 for $\frac{1}{8} \times \frac{7}{8} + \frac{3}{8} \times \frac{4}{8} + \frac{2}{8} \times \frac{2}{8} + \frac{1}{8} \times \frac{1}{8}$ oe or $\frac{7}{8} \times \frac{1}{8} + \frac{6}{8} \times \frac{1}{8} + \frac{4}{8} \times \frac{2}{8} + \frac{1}{8} \times \frac{3}{8}$ oe or M1 for the sum of any two correct products from above oe isw

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Question	Answer	Mark	Part marks	
5	(a)			
		$[\cos ABL =] \frac{40^2 + 61.1^2 - 92.1^2}{2 \times 40 \times 61.1}$	M2	M1 for correct implicit version
		130.11...	A2	A1 for $[\cos ABL =] -0.644\dots$ or $-\frac{7873}{12220}$ or $-\frac{3149.2}{4888}$
(b)				
	[0]59.5 or 59.50 to 59.511	4	M2 for $\frac{40 \sin 130.1}{92.1}$ or $\frac{61.1 \sin 130.1}{92.1}$ or M1 for $\frac{\sin A}{40} = \frac{\sin 130.1}{92.1}$ or $\frac{\sin L}{61.1} = \frac{\sin 130.1}{92.1}$ and A1 for 19.39 to 19.4... or 30.48 to 30.49...	
(c)				
	1h 50min	5	M2 for $[BC =] 2 \times 40 \times \cos(180 - 130.1)$ oe or M1 for $\frac{x}{40} = \cos(180 - 130.1)$ oe OR M2 for $[BC =]$ $\sqrt{\{40^2 + 40^2 - 2 \times 40 \times 40 \cos(\text{their } 80.2)\}}$ or M1 for correct implicit version OR M2 for $[BC =] \frac{40 \sin(\text{their } 80.2)}{\sin 49.9}$ or M1 for correct implicit version and M1 for $\frac{\text{their } BC}{28}$ A1 for 1.84[0...] to 1.841	

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Question	Answer	Mark	Part marks
6 (a) (i)	6000 [7600] 10 200 4200	2	B1 for 6000 or 10200 If B0 then B1FT for <i>their</i> (UQ – LQ)
(ii) (a)	True, median price is lower	1	No inclusion of other statistic
(b)	(b) False, A's UQ < 13 600 oe 11025	1FT 4	FT <i>their</i> UQ in (a)(i) Listed values are in thousands M1 for 3, 7, 9, 11, 13, 18 soi M1 for Σfm [1323] M1 (dep on second M1) for <i>their</i> $\Sigma fm \div 120$
(c)	323.25 nfw	3	M2 for $9948 - 0.25 \times 8760$ or M1 for 0.25×8760
7 (a)	Attempt to use $18 - r$ in Pythagoras' $144 = r^2 - 324 + 18r + 18r - r^2$ oe $468 = 36r$ oe	M1 B2 A1	or B1 for $324 - 18r - 18r + r^2$ Correct simplification with no errors
(b)	$[2 \times] \sin^{-1}\left(\frac{12}{13}\right)$ oe 134.76...	M1 A1	or $\cos = \left(\frac{13^2 + 13^2 - 24^2}{2 \times 13 \times 13}\right)$ or better or $[180 -] 2 \times \sin^{-1}\left(\frac{5}{13}\right)$
(c) (i)	332 or 332.1 to 332.2...	3	M2 for $\frac{(360 - 134.8)}{360} \times \pi \times 13^2$ or M1 for $\frac{134.8}{360} \times \pi \times 13^2$
(ii)	392 or 392.0 to 392.2...	3	M2 for $\frac{1}{2} \times 24 \times 5 + \textit{their (c)(i)}$ or $\frac{1}{2} \times 13^2 \times \sin 134.8 + \textit{their (c)(i)}$ or M1 for $\frac{1}{2} \times 24 \times 5$ or $\frac{1}{2} \times 13^2 \times \sin 134.8$
(iii)	15700 or 15670 to 15690	1FT	FT for answer to $40 \times \textit{their (c)(ii)}$
(d)	29.5 or 29.6 or 29.51 to 29.57...	2FT	M1 for $\pi \times 13^2 \times h = \textit{their (c)(iii)}$ or better

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Question	Answer	Mark	Part marks
8	(a) (i)	2	M1 for $\begin{pmatrix} 12 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$
	(ii)	2FT	M1FT for $\sqrt{\text{their } 12^2 + \text{their } (-5)^2}$ FT dep on <i>their</i> (a) being $\begin{pmatrix} a \\ b \end{pmatrix}$ where a, b are both non-zero
	(b) (i) (a)	1	$\mathbf{b} - \mathbf{a}$
	(b)	1FT	FT $\frac{3}{5}$ <i>their</i> vector, in terms of \mathbf{a} and \mathbf{b} , in (b)(i)(a)
	(c)	2	M1 for $\mathbf{a} + \text{their}$ vector in (b)(i)(b) or any correct route
(ii)	$\frac{3}{2}$ oe	1	
9	(a)	2	M1 for $8x + 4x = 22 + 5$ or better
	(b)	2	M1 for $6x - 2x \geq 14$ or better
	(c)	2	M1 for $x(x + 3) - 7(x + 3)$ or $x(x - 7) + 3(x - 7)$ or for $(x + a)(x + b)$ where $ab = -21$ or $a + b = -4$
	(d)	3	M2 for $12x^2 + 9xy - 8xy - 6y^2$ or M1 for any two of the four terms correct

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Question	Answer	Mark	Part marks
10 (a)	A: 14 $3n - 1$ oe	3	B1 for 14 B2 for $3n - 1$ oe or M1 for $3n + k$, for any k oe
	B: -4 $26 - 6n$ oe	3	B1 for -4 B2 for $26 - 6n$ oe or M1 for $k - 6n$, for any k oe
	C: 25 n^2 oe	2	B1 for 25 B1 for n^2
	D: 20 $n^2 - n$ oe	2	B1 for 20 B1 for $n^2 - n$ oe
(b) (i)	$\frac{n(3n+1)}{2} = 155$	M1	accept $\frac{3n^2 + n}{2} = 155$
	$3n^2 + n = 310$		Intermediate step must include elimination of fraction, e.g. $n(3n + 1) = 310$
	$3n^2 + n - 310 = 0$	A1	with no errors or omissions
(ii)	$10, -\frac{31}{3}$ oe	3	M2 for $(3n + 31)(n - 10) [= 0]$ or M1 for $3n(n - 10) + 31(n - 10)$ or $n(3n + 31) - 10(3n + 31)$ or $(3n + a)(n + b)$ where $ab = -310$ or $a + 3b = 1$
(iii)	10	1FT	FT <i>their (b)(ii)</i> if only one positive integer solution

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Question	Answer	Mark	Part marks
11	5 and $-\frac{27}{2}$ oe	7	<p>M2 for $12 \times 2(2x - 1) + (x + 3)(2x - 1) = 12 \times 3(x + 3)$ oe or M1 for a common denominator with 2 or more of the terms</p> <p>and B2 for $2x^2 + 17x - 135 [= 0]$ oe or B1 for $48x - 24$ or $2x^2 - x + 6x - 3$ or $36x + 108$</p> <p>or $2x^2 - x + 54x - 27$</p> <p>or $132 - 12x$</p> <p>or $37x + 111 - 2x^2 - 6x$</p> <p>and M2 for $(2x + 27)(x - 5)$ or <i>their</i> correct factors or formula or M1 for $2x(x - 5) + 27(x - 5)$ or $x(2x + 27) - 5(2x + 27)$ or $(2x + a)(x + b)$ where $ab = -135$ or $a + 2b = 17$</p>