Cambridge International Examinations
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	
	90º clockwise oe	1	Accept –90°
	(7, 4)	1	

Question	Answer	Mark	Part marks
2 (a) (i)	1050	2	**M1** for 924 ÷ 22 oe or 924 ÷ 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 ÷ (7 + 5) or 540 ÷ (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 $\sqrt{2835 \times \frac{35}{their(875 \div 35)}}$ oe or **M1** for $\frac{35}{their(875 \div 35)}$ or $\frac{their(875 \div 35)}{35}$
(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 $\frac{18.50}{12.50} \times 100$

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

Question	Answer	Mark	Part marks
5 (a)	[cosABL =] $\frac{40^2 + 61.1^2 - 92.1^2}{2 \times 40 \times 61.1}$	M2	**M1** for correct implicit version
	130.11…	A2	**A1** for [cosABL =] –0.644… 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 × 40 × cos(180 – 130.1) oe or **M1** for $\frac{x}{40}$ = cos(180 – 130.1) oe OR **M2** for [BC =] √{$40^2 + 40^2 - 2 \times 40 \times 40\cos(their\ 80.2)$} or **M1** for correct implicit version OR **M2** for [BC =] $\frac{40\sin(their\ 80.2)}{\sin 49.9}$ or **M1** for correct implicit version **and** **M1** for $\frac{their\ BC}{28}$ **A1** for 1.84[0…] to 1.841

Question	Answer	Mark	Part marks
6 (a) (i)	6000 [7600] 10 200 4200	2	**B1** for 6000 or 10200 If **B0** then **B1FT** for *their* (UQ – LQ)
(ii) (a)	True, median price is lower	1	No inclusion of other statistic
(b)	False, A's UQ < 13 600 oe	1FT	**FT** *their* UQ in **(a)(i)**
(b)	11025	4	Listed values are in thousands **M1** for 3, 7, 9, 11, 13, 18 soi **M1** for Σfm [1323] **M1** (dep on second **M1**) for *their* $\Sigma fm \div 120$
(c)	323.25 nfww	3	**M2** for $9948 - 0.25 \times 8760$ or **M1** for 0.25×8760
7 (a)	Attempt to use $18 - r$ in Pythagoras'	M1	
	$144 = r^2 - 324 + 18r + 18r - r^2$ oe	B2	or **B1** for $324 - 18r - 18r + r^2$
	$468 = 36r$ oe	A1	Correct simplification with no errors
(b)	$[2\times]\ \sin^{-1}\left(\frac{12}{13}\right)$ oe	M1	or $\cos = \left(\frac{13^2+13^2-24^2}{2\times13\times13}\right)$ or better or $[180 -]\ 2 \times \sin^{-1}\left(\frac{5}{13}\right)$
	134.76…	A1	not 67.4×2
(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 $\frac{1}{2} \times 24 \times 5 +$ *their* **(c)(i)** or $\frac{1}{2} \times 13^2 \times \sin 134.8 +$ *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 $40 \times$ *their* **(c)(ii)**
(d)	29.5 or 29.6 or 29.51 to 29.57…	2FT	**M1** for $\pi \times 13^2 \times h =$ *their* **(c)(iii)** or better

Question	Answer	Mark	Part marks
8 (a) (i)	$\begin{pmatrix}12\\-5\end{pmatrix}$	2	**M1** for $\begin{pmatrix}12\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-5\end{pmatrix}$
(ii)	13 nfww	2FT	**M1FT** for $\sqrt{their\,12^2 + their\,(-5)^2}$ **FT** dep on *their* **(a)** being $\begin{pmatrix}a\\b\end{pmatrix}$ where a, b are both non-zero
(b) (i) (a)	**b** – **a**	1	
(b)	$\frac{3}{5}$(**b** – **a**) or $\frac{3}{5}$**b** – $\frac{3}{5}$**a** final answer	1FT	**FT** $\frac{3}{5}$ *their* vector, in terms of **a** and **b**, in **(b)(i)(a)**
(c)	$\frac{1}{5}$(2**a** + 3**b**) or $\frac{2}{5}$**a** + $\frac{3}{5}$**b** final answer	2	**M1** for **a** + *their* vector in **(b)(i)(b)** or any correct route
(ii)	$\frac{3}{2}$ oe	1	
9 (a)	2.25 oe	2	**M1** for $8x + 4x = 22 + 5$ or better
(b)	$x \geqslant 3.5$ final answer	2	**M1** for $6x - 2x \geqslant 14$ or better
(c)	$(x – 7)(x + 3)$ final answer	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)	$12x^2 + xy – 6y^2$ final answer	3	**M2** for $12x^2 + 9xy – 8xy – 6y^2$ or **M1** for any two of the four terms correct

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** *their* **(b)(ii)** if only one positive integer solution

Question	Answer	Mark	Part marks
11	5 and $-\frac{27}{2}$ oe	**7**	**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 and **B2** for $2x^2 + 17x - 135$ [= 0] oe or **B1** for $48x - 24$ or $2x^2 - x + 6x - 3$ or $36x + 108$ or $2x^2 - x + 54x - 27$ or $132 - 12x$ or $37x + 111 - 2x^2 - 6x$ and **M2** for $(2x + 27)(x - 5)$ or *their* 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 $a + 2b = 17$