Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS (US) **0444/43**

Paper 4 (Extended) **October/November 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	Partial Marks
1(a)(i)	$180 \div (2 + 3 + 5) \times 5$ [= 90]	**1**	with no errors seen
1(a)(ii)	7.05 or 7.053…	**3**	**M2** for $\frac{x}{12} = \sin 36$ oe or better or **B1** for 36 or 54 seen
1(b)(i)	13	**2**	**M1** for $7.8 \div 3$ soi
1(b)(ii)	36.9 or 36.86 to 36.87	**3**	**B1** for smallest angle identified **M1** for $\sin[\ ] = \frac{3}{5}$ oe or $\sin[\ ] = \frac{7.8}{\textit{their}\ \textbf{b(i)}}$ oe If zero scored, **SC1** for calculation of 53.1
2(a)	343	**1**	
2(b)(i)	1	**1**	
2(b)(ii)	x^{10} final answer	**1**	
2(b)(iii)	$9x^{16}$ final answer	**2**	**B1** for x^{12} or x^{16} or $(3x^8)^2$ seen
2(c)(i)	$2(x – 3)(x + 3)$ final answer	**2**	**M1** for $(2x + 6)(x – 3)$ or $(2x – 6)(x + 3)$ or $(x – 3)(x + 3)$
2(c)(ii)	$\frac{2(x+3)}{x+10}$ or $\frac{2x+6}{x+10}$ final answer nfww	**3**	**M2** for $(x + 10)(x – 3)$ or **M1** for $(x + a)(x + b)$ where $ab = –30$ or $a + b = 7$
3(a)	480	**3**	**M2** for $456 \div \left(1 – \frac{5}{100}\right)$ oe or **M1** for associating 456 with 95%
3(b)	261.47	**2**	**M1** for $200 \times \left(1 + \frac{1.5}{100}\right)^{18}$

Question	Answer	Marks	Partial Marks
3(c)	1.2	**3**	**M2** for $\sqrt[17]{\frac{2449.62}{2000}}$ oe, soi by 1.012[0…] or **M1** for $\frac{2449.62}{2000}$ or $2000 \times (\ldots)^{17} = 2449.62$
3(d)	$c - \frac{cp}{100}$ oe	**2**	**M1** for $\frac{cp}{100}$ seen
4(a)	$80 < t \leqslant 100$	**1**	
4(b)	86 nfww	**4**	**M1** for midpoints soi **M1** for use of Σfx with x in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\Sigma fx \div 150$
4(c)(i)	Reference to not knowing the individual values so we do not know the highest or the lowest values	**1**	
4(c)(ii)	62.4	**2**	**M1** for $26 \div 150$ or $360 \div 150$
4(d)	$\frac{22}{150}$ oe	**1**	
4(e)(i)	$\frac{90}{22350}$ oe	**2**	**M1** for $\frac{10}{150} \times \frac{9}{149}$ After zero scored, **SC1** for answer $\frac{100}{22500}$ oe
4(e)(ii)	$\frac{440}{22350}$ oe	**3**	**M2** for $\frac{10}{150} \times \frac{22}{149} + \frac{22}{150} \times \frac{10}{149}$ oe or **M1** for $\frac{10}{150} \times \frac{22}{149}$ or $\frac{22}{150} \times \frac{10}{149}$ oe After zero scored, **SC1** for answer $\frac{440}{22500}$ oe
4(f)	13, 8.5, 7.25, 1.1	**3**	**B2** for 3 correct or **B1** for 1 correct or for 3 correct FD.s 5.2, 3.4, 2.9, 0.44 oe

Question	Answer	Marks	Partial Marks
5(a)(i)	Image at (0, 1), (0, 2), (–3, 1)	**2**	**B1** for reflection in $y = 0$ or $x = k$
5(a)(ii)	Image at (0, 0), (0, –2), (6, –2)	**2**	**B1** for correct size and correct orientation wrong position or for 2 correct vertices plotted
5(a)(iii)	Image at (–5, 4), (–5, 5), (–2, 4)	**2**	**B1** for translation by $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$
5(b)	Rotation 90° clockwise oe (4, –1)	**3**	**B1** for each
6(a)	–7	**1**	
6(b)	$5 - 2x$	**2**	**M1** for $2(3 - x) - 1$
6(c)(i)	$\frac{4}{3}$ oe	**2**	**M1** for $2x - 1 = 3 - x$
6(c)(ii)	–3	**1**	
6(d)	$\frac{x+1}{2}$ oe final answer	**2**	**M1** for $x = 2y - 1$ or $y + 1 = 2x$ or $\frac{y}{2} = x - \frac{1}{2}$
6(e)	$\frac{3x-2}{x}$ final answer	**2**	**M1** for $3 - \frac{2}{x}$
6(f)	16	**1**	
7(a)(i)	25.5 or 25.46…	**2**	**M1** for $\pi \times 5^2 \times h = 2000$ oe
7(a)(ii)	9.85 or 9.847…	**3**	**M2** for $[r^3=]\ 2000 \div \left(\frac{2}{3}\pi\right)$ oe or **M1** for $\frac{2}{3}\ \pi r^3 = 2000$ oe
7(a)(iii)	952 or 952.4…	**3**	**M2** for $[6 \times]\ \sqrt[3]{2000}^2$ or **M1** for $\sqrt[3]{2000}$ or 6 times *their* area of one face
7(b)(i)	22.5 or 22.49…	**2**	**M1** for $\frac{1}{2} \times 7 \times 10 \times \sin 40$
7(b)(ii)	$\sqrt{(10^2 + 7^2 - 2 \times 10 \times 7 \cos 40)} + 7 + 10$	**M3**	**M2** for $10^2 + 7^2 - 2 \times 10 \times 7 \cos 40$ or **M1** for correct implicit cosine rule
	23.46…	**A2**	**A1** for 6.46… or 41.7 to 41.8

Question	Answer	Marks	Partial Marks
7(c)	64.9 or 64.92 to 64.94	**3**	**M2** for $28.2 - 2 \times 9 = \frac{c}{360} \times 2 \times \pi \times 9$ oe or **M1** for $\frac{c}{360} \times 2 \times \pi \times 9$ soi
8(a)	9, – 6, 9	**3**	**B1** for each
8(b)	Correct graph	**4**	**B3FT** for 6 or 7 correct points or **B2FT** for 4 or 5 correct points or **B1FT** for 2 or 3 correct points
8(c)	–3.5 to –3.35 and 0.8 to 0.9..	**2FT**	**FT** *their* graph **B1FT** for either
8(d)	$a = \frac{5}{4}$ or $1\frac{1}{4}$ or 1.25 $b = -\frac{49}{8}$ or $-6\frac{1}{8}$ or –6.125	**3**	**B2** for either correct or **M1** for $[2]\left(x+\frac{5}{4}\right)^2$ seen isw or for $2x^2 + 4ax + 2a^2 + b$
9(a)(i)	5	**1**	
9(a)(ii)	$-\frac{3}{2}$ oe	**1**	
9(b)	$\left(\frac{4}{5}, 0\right)$ oe	**2**	**M1** for $5x - 4 = 0$ soi
9(c)	$y = -0.2x + 11$ final answer	**4**	**M2** for $y = -0.2x + b$ oe (any form) **FT** *their* **(a)** or **B1FT** for grad = $\frac{-1}{\textit{their}\ \textbf{(a)(i)}}$ soi and **M1** for substitution of (10, 9) into *their* equation
9(d)	(2, 6)	**3**	**M1** for elimination of one variable **A1** for $x = 2$ or $y = 6$
9(e)	13 oe	**3**	**M2** for $(4 + 9) \times$ *their* $2 \div 2$ oe or **B1** for 9 oe or 4 or –4 seen

Question	Answer	Marks	Partial Marks
10(a)	$\frac{10}{x-0.5}$ final answer	**1**	Accept $\frac{20}{2x-1}$
10(b)(i)	$\frac{10}{x-0.5}-\frac{10}{x}=0.25$ oe	**M1**	**FT** *their* **(a)**
	$10x - 10(x - 0.5) = 0.25x\,(x - 0.5)$ oe	**M1**	Clears algebraic denominators or collects as a single fraction FT *their* algebraic fractions dep on two fractions with algebraic denominators
	$10x - 10x + 5 = 0.25x^2 - 0.125x$ or better	**B1**	Expands brackets
	$2x^2 - x - 40 = 0$	**A1**	Dep on **M1M1B1** and no errors seen
10(b)(ii)	$\frac{--1\pm\sqrt{(-1)^2-4\times2\times-40}}{2\times2}$ oe	**B2**	**B1** for $\sqrt{(-1)^2-4(2)(-40)}$ or better or **B1** for $\frac{--1+\sqrt{q}}{2\times2}$ or $\frac{--1-\sqrt{q}}{2\times2}$ or both
	–4.23 and 4.73 final answers	**B1B1**	**SC1** for –4.229… **and** 4.729… or for –4.23 **and** 4.73 seen in working or for –4.73 **and** 4.23 as final answer or for –4.2 or –4.22 **and** 4.7 or 4.72 as final answer
10(b)(iii)	2 [hours] 7 [minutes]	**3**	**B2** for 2.11 or 2.114 to 2.115 or 126.8 to 126.9 or 127 or **M1** for 10 ÷ *their* positive root from **(b)(ii)**
11(a)(i)	$2^2 \times 3^2 \times 5$ oe	**2**	**M1** for 3 correct prime factors in a tree or table seen before the first error or for 2, 3, 5 identified
11(a)(ii)	540	**2**	**M1** for $2^2 \times 3^3 \times 5$ or 2×3^3 shown or answer 540*k*
11(b)	$X = 8575$ $Y = 6125$	**4**	**B3** for $X = 8575$ or $Y = 6125$ or **B2** for $a = 5$ or $b = 1$ soi or **B1** for $1225 = 5^2 \times 7^2$ or $42\,875 = 5^3 \times 7^3$ or **M1** for $a^2 \times 7^2$ [= 1225] or $a^3 \times 7^{b+2}$ [= 42 875]