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Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS (US) **0444/41**

Paper 4 Extended **May/June 2018**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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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)	$\frac{9}{9+7+4}\times 680$	**1**	
1(b)	238 136	**3**	**B2** for 238 or 136 or **M1** for $\frac{7}{9+7+4}\times 680$ oe or $\frac{4}{9+7+4}\times 680$ oe seen
1(c)	272	**2**	**M1** for 306 ÷ 1.125
1(d)	1.37	**3**	**M2** for $(17.56-5\times 2.69)\div 3$ or **M1** for $17.56-5\times 2.69$ or **B1** for 13.45 [cost of apples]
1(e)	40.8[0]	**3**	**3FT** for 0.3 × *their* 136 from part **(b)** or **M2** for *their* $136(\frac{1}{2}+\frac{1}{5})$ or better or **M1** for *their* $136\times\frac{1}{2}$ or *their* $136\times\frac{1}{5}$ or **B1** for 68 or 27.2 or $\frac{3}{10}$ or 0.3 seen
2(a)	Correct parallel line from angle copied using arcs	**2**	**B1** for correct without/wrong arcs
2(b)	Correct ruled perpendicular at *C* with 2 correct pairs of arcs	**2**	**B1** for correct without/wrong arcs
2(c)	*ABCD* completed accurately	**1**	
2(d)	Correct ruled bisector of angle *ABC* with 2 correct pairs of arcs	**2**	**B1** for correct bisector of angle *ABC* without/wrong arcs
2(e)	143 to 147	**1**	

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Question	Answer	Marks	Partial Marks
3(a)	6.06 or 6.060 to 6.061	**3**	**M2** for $\frac{82500-77500}{82500}[\times 100]$ oe or **M1** for $\frac{77500}{82500}[\times 100]$ soi
3(b)	13 674 cao	**3**	**M1** for $12000\left(1+\frac{2.2}{100}\right)^6$ **A1** for 13673.7...
4(a)(i)	$(2n+m)(m-3)$ final answer	**2**	**M1** for $m(2n+m)-3(2n+m)$ or $2n(m-3)+m(m-3)$
4(a)(ii)	$(2y-9)(2y+9)$ final answer	**1**	
4(a)(iii)	$(t-4)(t-2)$ final answer	**2**	**B1** for $(t-4)(t-2)$ seen and spoiled or **M1** for $t(t-2)-4(t-2)$ or $t(t-4)-2(t-4)$ or $(t+a)(t+b)$ where $a+b=-6$ or $ab=+8$
4(b)	$[x=]\frac{2m}{k+1}$	**4**	**M1** for $xk=2m-x$ or $k=\frac{2m}{x}-1$ **M1** for $xk+x=2m$ or $k+1=\frac{2m}{x}$ **M1** for $x(k+1)=2m$
4(c)	correctly eliminating one variable	**M1**	
	$[x=]$ 6	**A1**	
	$[y=]$ –2	**A1**	If 0 scored **SC1** for 2 values satisfying one of the original equations or **SC1** if no working shown, but 2 correct answers given
4(d)(i)	$3m-4(m+4)=6m(m+4)$	**M1**	or $\frac{3m-4(m+4)}{m(m+4)}[=6]$ oe
	$3m-4m-16=6m^2+24m$	**M1**	removes brackets correctly
	$6m^2+25m+16=0$	**A1**	with no errors or omissions

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Question	Answer	Marks	Partial Marks
4(d)(ii)	$\dfrac{-25 \pm \sqrt{(25)^2 - 4(6)(16)}}{2 \times 6}$ or $\dfrac{-25}{12} \pm \sqrt{\left(\dfrac{25}{12}\right)^2 - \dfrac{16}{6}}$	2	**B1** for $\sqrt{(25)^2 - 4(6)(16)}$ or better or **B1** for $\left(m + \dfrac{25}{12}\right)^2$ and if in form $\dfrac{p+\sqrt{q}}{r}$ or $\dfrac{p-\sqrt{q}}{r}$ **B1** for $p = -25$ and $r = 2(6)$
	– 0.79 and –3.38 final ans cao	2	**B1** for each **SC1** for –0.8 and –3.4 or for –0.78 and –3.37 or –0.789… and –3.377… or 0.79 and 3.38 or –0.79 and –3.38 seen in working
5(a)	4.79 or 4.788 to 4.789	3	**M2** for $\sqrt[3]{\dfrac{230 \times 3}{2 \times \pi}}$ oe or **M1** for $230 = \dfrac{2}{3} \times \pi \times r^3$ oe If 0 scored **SC1** for answer 3.8[0…]
5(b)(i)	8.7[0] or 8.702 to 8.704	3	**M2** for $(300 - 230) \div (1.6^2 \pi)$ or **M1** for $\pi \times 1.6^2 \times h$
5(b)(ii)	6.4	3	**M2** for $1.6 \times \sqrt[3]{\dfrac{19200}{300}}$ oe or **M1** for sf $\sqrt[3]{\dfrac{19200}{300}}$ or $\sqrt[3]{\dfrac{300}{19200}}$ oe or for $\left(\dfrac{1.6}{r}\right)^3 = \dfrac{300}{19200}$
6(a)	$x = 0$	1	
6(b)	Tangent ruled at $x = 0.5$	B1	No daylight between tangent and curve at point of contact
	–9 to –6.5	2	**dep** on ruled tangent or close attempt at tangent at $x = 0.5$ **M1** for rise/run also dep on tangent or close attempt at tangent at $x = 0.5$

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Question	Answer	Marks	Partial Marks
6(c)(i)	0 2.4 or better 4	3	**B1** for each
6(c)(ii)	Correct smooth curve	4	**B3FT** for 6 or 7 correct plots or **B2 FT** for 4 or 5 correct plots or **B1 FT** for 2 or 3 correct plots **FT** *their* table
6(d)	$x^3 + 3x + 4 = 10 - 8x^2$ and correctly completed	1	
6(e)	line $y = -2x + 2$ drawn and -0.45 to -0.35 nfww	3	**B2** for ruled $y = -2x + 2$ or **B1** for $-2x + 2$ seen or for line $y = -2x + c$ drawn or for $y = cx + 2$ $(c \neq 0)$ drawn and **B1** for -0.45 to -0.35 nfww
7(a)	18	3	**B2** for 20 nfww or **M1** for $8x + x = 180$ or better
7(b)	32	3	**B1** for angle $DBC = 58$ **B1** for angle $BCD = 90$
7(c)(i)	24	2	**B1** for angle $PRQ = 24$
7(c)(ii)	29.4 or 29.40 to 29.41	3	**M2** for $\frac{360-48}{360} \times 2 \times \pi \times 5.4$ or **B2** for answer (minor arc) 4.52 or 4.523 to 4.524… or **M1** for $\frac{48}{360} \times 2 \times \pi \times 5.4$
8(a)(i)	Translation $\begin{pmatrix} -8 \\ 2 \end{pmatrix}$ oe	2	**B1** for each
8(a)(ii)	Enlargement [sf =] $\frac{1}{2}$ oe $(-4, 0)$	3	**B1** for each
8(a)(iii)	Rotation 90° clockwise oe $(1, -1)$	3	**B1** for each
8(b)	Triangle with (1, −1), (5, −1), (1, 7)	2	**B1** for correct size and orientation in wrong position or for 3 correct points not joined

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Question	Answer	Marks	Partial Marks
9(a)	$\frac{5}{8}$ $\frac{3}{8}$ $\frac{1}{6}$ $\frac{5}{6}$ $\frac{7}{10}$ $\frac{3}{10}$	3	**B1** for each pair
9(b)	$\frac{5}{48}$ oe	2	**M1FT** for $their\frac{5}{8}\times their\frac{1}{6}$
9(c)	$\frac{304}{480}$ oe	3	**M2** for $their\frac{5}{8}\times their\frac{5}{6}+their\frac{3}{8}\times their\frac{3}{10}$ oe or **M1** for $their\frac{5}{8}\times their\frac{5}{6}$ or $their\frac{3}{8}\times their\frac{3}{10}$
10(a)(i)	12.6 or 12.64 to 12.65	3	**M2** for $12^2+(-4)^2$ OR **B1** for $\begin{pmatrix}12\\-4\end{pmatrix}$ **M1** for $(their12)^2+(their-4)^2$
10(a)(ii)	$\begin{pmatrix}-11\\13\end{pmatrix}$	2	**B1** for $\begin{pmatrix}-11\\k\end{pmatrix}$ or $\begin{pmatrix}k\\13\end{pmatrix}$ or for $[\overrightarrow{BA}=]\begin{pmatrix}-8\\7\end{pmatrix}$
10(b)	$\frac{1}{2}$**(b – a)** oe	2	**M1** for correct route or correct unsimplified answer or **B1** for $\overrightarrow{QS}=$ **b – a** oe
11(a)	0.125 (or $\frac{1}{8}$), 1, 8	2	**B1** for two correct and no extras or one wrong or for 3 correct and one extra
11(b)	89	2	**M1** for g(9) or $(x^2+8)^2+8$ soi
11(c)	5	1	
11(d)	$4x^2+8$ oe final answer	1	
11(e)	–1.5 oe	2	**M1** for $5-2x=8$
11(f)	$\frac{5-x}{2}$ oe	2	**M1** for $x=5-2y$ or for $y+2x=5$ or for $\frac{y}{2}=\frac{5}{2}-x$

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Question	Answer	Marks	Partial Marks
11(g)	$4x^2 - 20x + 33$ final answer	3	**M1** for $(5-2x)^2 + 8$ **B1** for $[(5-2x)^2 =]$ $25 - 10x - 10x + 4x^2$ oe
12(a)	18 28	2	**B1** for each
12(b)	$3n + 3$ oe	2	**B1** for $3n + k$ oe or $cn + 3$ oe $c \neq 0$
12(c)	45	2	**M1** for identifying 7th pattern or **M1** for *their* $(3n+3) = 24$
12(d)	$[a =]\frac{3}{2}$ oe $[b =]\frac{13}{3}$ oe	6	**M1** for any correct substitution e.g. $\frac{1}{6}(2)^3 + 2^2a + 2b$ **A1** for one of e.g. $\frac{1}{6} + a + b = 6$ oe $\frac{8}{6} + 4a + 2b = 16$ oe $\frac{27}{6} + 9a + 3b = 31$ oe $\frac{64}{6} + 16a + 4b = 52$ oe **A1** for another of the above **M1** for correctly eliminating one variable from *their* equations **A1** for $a = \frac{3}{2}$ **A1** for $b = \frac{13}{3}$ oe