Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS (US) **0444/43**

Paper 4 (Extended) **October/November 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.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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.

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)	Reflection $y = -1$	**2**	**B1** for each
1(b)	Triangle at (0, –3), (4, –1), (4, –3)	**2**	**B1** for translation $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$ or for three correct vertices
1(c)	Triangle at (–2, 2), (–2, 6), (–4, 6)	**2**	**B1** for rotation about (0, 0) 90° clockwise or 90° counterclockwise with wrong centre or for three correct vertices
1(d)	Triangle at (–3, –1), (–3, –2), (–1, –1)	**2**	**B1** for scale factor $-\frac{1}{2}$ with wrong centre or scale factor $\frac{1}{2}$ with centre (0, 0) or for three correct vertices
2(a)(i)	$\frac{240}{(23+25)} \times 23$	**M1**	
2(a)(ii)	11 : 10	**2**	**M1** for 110 : 100 or better or **SC1** for 10 : 11, following boys 100, girls 110
2(a)(iii)	276	**2**	**M1** for $240 \times \left(1+\frac{15}{100}\right)$ oe or **B1** for 36 seen
2(a)(iv)	150	**3**	**M2** for $\frac{240}{100+60}$ [× 100] oe or **M1** for evidence of 160[%] associated 240
2(b)	464 000	**3**	**M1** for $256\,000 \times \left(1+\frac{2}{100}\right)^{30}$ oe **A1** for 463 700 to 463 710 **B1** for *their* more accurate answer seen and rounded to nearest 1000

Question	Answer	Marks	Partial Marks
2(c)	4.5[0]	**3**	**M2** for [x =] $\sqrt[32]{4.09}$ oe or **M1** for $(x)^{32} = 4.09$ oe If 0 scored, **SC2** for answer 3.6 or 3.59 or 3.588… or **SC1** for $\sqrt[32]{3.09}$ or 1.0358 to 1.036 seen
3(a)(i)	427 or 427.2 to 427.3…	**2**	**M1** for $\pi \times 8 \times 17$
3(a)(ii)	1010 or 1005 …	**4**	**M2** for $\sqrt{17^2 - 8^2}$ oe or **M1** for $h^2 + 8^2 = 17^2$ oe **M1** for $\frac{1}{3} \times \pi \times 8^2 \times$ *their* h oe
3(a)(iii)	804 or 804.2 to 804.4 or 808	**1**	**FT** *their* **(ii)** × 0.8
3(a)(iv)	396 or 395.6 to 395.8 or 392	**1**	**FT** 1200 – *their* **(iii)**
3(b)(i)	$\frac{1}{54}$	**4**	**B3** for $\frac{\frac{4}{3}\pi r^3}{72\pi r^3}$ or better or **M2** for $\frac{\frac{4}{3} \times \pi \times r^3}{\pi \times (3r)^2 \times 8r}$ or $72 \times \pi \times r^3$ or **M1** for $\pi \times (3r)^2 \times 8r$ If 0 scored, **SC2** for answer of $\frac{1}{18}$
3(b)(ii)	972π final answer	**4**	**B2** for $r = \frac{9}{2}$ oe or **M1** for $4\pi r^2 = 81\pi$ or better **M1** for $2 \times \pi \times (3 \times$ *their* $r) \times (8 \times$ *their* $r)$ isw
4(a)	–1, 3	**2**	**B1** for each
4(b)	Correct graph	**3**	**B2FT** for 6 or 7 correct points or **B1FT** for 4 or 5 correct points
4(c)	Correct ruled tangent and –2 ⩽ gradient ⩽ –1.5	**3**	**B2** for close attempt at tangent at x = –4 and answer in range OR **B1** for ruled tangent at x = –4 with no daylight and **M1** for rise/run **also dep on** close attempt at tangent. Must see correct or implied calculation from a drawn tangent.

Question	Answer	Marks	Partial Marks
4(d)	–3, 3	**1**	
4(e)	Correct graph	**4**	**B3FT** for 7 or 8 correct points or **B2FT** for 5 or 6 correct points or **B1FT** for 3 or 4 correct points
4(f)(i)	3.6 to 3.85	**1**	
4(f)(ii)	$x >$ *their* **(f)(i)**	**1**	**FT**
4(g)	$\frac{x^2}{4} = \frac{9}{x} + \frac{4}{x}$ or $\frac{x^3}{4} - 4 = 9$	**M1**	Allow $\frac{13}{x}$ for $\frac{9}{x} + \frac{4}{x}$
	52	**A1**	
5(a)(i)	265 or 265.3 to 265.4 nfww	**4**	**M1** for mid-values 150, 225, 275, 400 soi **M1** for Σfx where x is in correct interval including boundaries **M1 dep** for $\Sigma fx \div 52$ dependent on second **M1**
5(a)(ii)	Correct histogram	**4**	**B1** for each correct block If 0 scored, **SC1** for the four frequency densities seen
5(b)(i)	100	**1**	
5(b)(ii)	56	**1**	
5(b)(iii)	62	**1**	
5(b)(iv)	24	**1**	
5(b)(v)	88	**2**	**M1** for evidence of 12 written
6(a)	52[.0] or 52.02 …	**4**	**M2** for [cos =] $\frac{13^2 + 4^2 - 11^2}{2 \times 13 \times 4}$ or **M1** for $11^2 = 13^2 + 4^2 - 2 \times 13 \times 4 \cos(...)$ **A1** for [$\cos^{-1}$ =] $\frac{64}{104}$ oe or 0.615 or 0.6153 to 0.6154

Question	Answer	Marks	Partial Marks
6(b)	62.7 or 62.69 to 62.70	**4**	**M3** for $180 - \sin^{-1}\left(\frac{8\sin 80}{13}\right) - 80$ oe or **M2** for $\sin A = \left(\frac{8\sin 80}{13}\right)$ or **M1** for $\frac{13}{\sin 80} = \frac{8}{\sin A}$ oe **A1** for 37.3 or 37.30 … If 0 scored, **M1** for 180 – 80 – *their A*
6(c)	66.7 or 66.68 to 66.71	**3**	**M1** for $0.5\times13\times4\times\sin(theirACB)$ oe **M1** for $0.5\times8\times13\times\sin(theirACD)$ oe
7(a)(i)	$\frac{3}{5} > \frac{1}{4}$ oe or $\frac{12k}{20k}$ and $\frac{5k}{20k}$ or 0.6 and 0.25 or 60% and 25%	**1**	
7(a)(ii)	$\frac{11}{20}$ oe	**3**	**M2** for $\frac{3}{5}\times\frac{3}{4} + \frac{2}{5}\times\frac{1}{4}$ oe or $1 - \frac{3}{5}\times\frac{1}{4} - \frac{2}{5}\times\frac{3}{4}$ oe or **M1** for $\frac{3}{5}\times\frac{3}{4}$ or $\frac{2}{5}\times\frac{1}{4}$ oe (but not as part of a larger product)
7(b)(i)	$\frac{6}{60}$ oe	**2**	**M1** for $\frac{3}{5}\times\frac{2}{4}\times\frac{1}{3}$ oe If 0 scored, **SC1** for answer $\frac{27}{125}$ oe
7(b)(ii)	0	**1**	Accept $\frac{0}{60}$
7(c)	$\frac{11}{25}$ oe	**3**	**M2** for $\frac{3}{5}\times\frac{3}{5} + \frac{2}{5}\times\frac{1}{5}$ oe or $1 - \frac{3}{5}\times\frac{2}{5} - \frac{2}{5}\times\frac{4}{5}$ oe or **M1** for $\frac{3}{5}\times\frac{3}{5}$ or $\frac{2}{5}\times\frac{1}{5}$ or for a correct tree showing all 25 outcomes with the 11 correct outcomes identified
8(a)(i)	4	**2**	**M1** for correct method using similar triangles e.g. $\frac{10}{5} = \frac{8}{DX}$ oe

Question	Answer	Marks	Partial Marks
8(a)(ii)	36.9 or 36.86 to 36.87	**2**	**M1** for tan = $\frac{6}{8}$ or sin = $\frac{6}{10}$ or cos = $\frac{8}{10}$ oe
(b)	[v =] 150	**B1**	
	[w =] 15	**B2**	**FT** (180 – *their v*) ÷ 2 **M1** for 180 – 2w = *their v* oe or angle POQ = 180 – *their v* oe
	[x =] 15	**B1**	**FT** *their w*
	[y =] 10	**B2**	**M1** for angle TPS = 5° or angle TXS = 20° or OXP = 20° or TXP = 160° (where X is where OT and PS intersect)
8(c)	182 or 182.4 …	**3**	**M2** for $\left(\frac{94}{226}\right)^{\frac{3}{2}}$ $\left[=\frac{V}{680}\right]$ oe or **M1** for ratio of lengths = $\sqrt{\frac{226}{94}}$ or $\sqrt{\frac{94}{226}}$ or better or for $\frac{V^2}{680^2}=\frac{94^3}{226^3}$ oe
9(a)	$\begin{pmatrix}2\\4\end{pmatrix}$ cao	**1**	
9(b)	4.47 or 4.472 …	**2**	**M1** for $(their\ 2)^2+(their\ 4)^2$
9(c)	(7, 10)	**2**	**B1** for each
9(d)	$y=2x-4$ oe	**3**	**M1** for gradient = $\frac{6-2}{5-3}$ oe or answer $y = mx – 4$ **M1** for substituting (3, 2) or (5, 6) into y = *their* $mx + c$ or into $y – k$ = *their* $m(x – h)$ or into *their* $y = mx – 4$
9(e)	(0, –4)	**1**	**FT** *their* **(b)(iv)**
10(a)	0	**1**	
10(b)	5	**2**	**M1** for $3\left(3^x\right)+4$ or better or f($\frac{1}{3}$) or f(3^{-1})
10(c)	$\frac{x+1}{2}$ oe final answer	**2**	**M1** for $x=2y-1$ or $y+1=2x$ or $\frac{y}{2}=x-\frac{1}{2}$ or better
10(d)	$9x+16$	**2**	**M1** for $3(3x + 4) + 4$ oe

Question	Answer	Marks	Partial Marks
10(e)	$9x^2 + 24x + 16$	**2**	**B1** for three terms from $9x^2 + 12x + 12x + 16$ correct
10(f)	27	**2**	**M1** for x = h(*their* g(2))
11(a)	$\frac{8}{15}$	**B1**	
	$\frac{n+2}{2n+3}$ oe	**B2**	**B1** for $n + 2$ as numerator or $2n + 3$ as denominator
11(b)(i)	$1-2n$ oe	**2**	**B1** for $-2n + k$ oe or $pn + 1$ ($p \neq 0$) oe
11(b)(ii)	$n^3 + 1$ oe	**2**	**M1** for cubic expression