Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2019**

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.

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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)(i)	1254	**2**	**M1** for 342 ÷ 3
1(a)(ii)	27.3 or 27.27…	**1**	
1(b)	867	**2**	**M1** for $1020\times\frac{15}{100}$ oe or $1020\times\left(1-\frac{15}{100}\right)$ oe
1(c)	4.5[0]	**3**	**M2** for $\frac{79.5[0]}{100+6}[\times 6]$ oe or $\frac{79.5[0]}{100+6}\times 100$ oe or **M1** for 79.5[0] associated with 106[%]
1(d)	22.6 or 22.58… nfww	**4**	**M1** for $\frac{45}{20}$ or better and **M2** for $\frac{60+45}{\textit{their}\ 2\text{h}\ 24\text{min}+\textit{their}\ \frac{45}{20}}$ or **M1** for *their* $\frac{45}{20}$ + *their* 2h 24min
1(e)	91.6[0] to 91.61	**3**	**M2** for $480\times\left(1+\frac{2.1}{100}\right)^4-430$ oe OR **M1** for $480\times\left(1+\frac{2.1}{100}\right)^4$ oe **A1** for 522, 521.6[0] to 521.61
1(f)	112.8125	**2**	**B1** for 2.5 or 9.5 seen

Question	Answer	Marks	Partial Marks
2(a)(i)	$2a + a + 2b + 3b + 10 = 180$ leading to $3a + 5b = 170$ without error or omission	**1**	
2(a)(ii)	$8a + 3a + 2b + b + 50 + 4b - 2a = 360$ leading to $9a + 7b = 310$ without error or omission	**1**	
2(a)(iii)	Correct method to eliminate one variable	**M1**	
	[a =]15 [b=]25	**A2**	**A1** for each correct value If 0 scored, **SC1** for two values that satisfy one of the equations or for two correct answers with no/incorrect working
2(a)(iv)	30	**1**	
2(b)	–1.5 or $-1\frac{1}{2}$ or $-\frac{3}{2}$	**2**	**M1** for $6x = -12 + 3$ or better
2(c)	$\frac{3x+3}{2}$ oe final answer	**3**	**M1** for $8x - 2y = 5x - 3$ or $4x - y = \frac{1}{2}(5x - 3)$ **M1FT** for isolating the y term correctly
2(d)	$9x^6$	**2**	**M1** for $(3x^3)^2$ or $\left(729x^{18}\right)^{\frac{1}{3}}$ seen or for $9x^k$ or kx^6 as final answer
2(e)	$\frac{x}{x-5}$ final answer nfww	**3**	**M1** for $x(x + 5)$ **M1** for $(x - 5)(x + 5)$
3(a)	5, –3, 21	**3**	**B1** for each
3(b)	Fully correct curve	**4**	**B3 FT** for 9 or 10 points or **B2 FT** for 7 or 8 points or **B1 FT** for 5 or 6 points
3(c)	–2.9 to –2.7 0 1.7 to 1.9	**2**	**B1** for 2 correct values

Question	Answer	Marks	Partial Marks
3(d)	Tangent ruled at $x = 2$	**B1**	
	10 to 14	**B2**	Dep on correct tangent or close attempt at tangent at $x = 2$ **M1** for rise/run **also dep on** correct tangent drawn or close attempt at tangent Must see correct or implied calculation from a drawn tangent
3(e)	6	**1**	
4(a)	36.8 or 36.84…	**2**	**M1** for $\frac{h}{107} = \tan 19$ or $\frac{h}{\sin 19} = \frac{107}{\sin 71}$ oe or better
4(b)	42.1 or 42.12… from cosine rule	**4**	**M2** for $[\cos BAC =]\frac{158^2 + 132^2 - 107^2}{2 \times 158 \times 132}$ or **M1** for implicit version **A1** for $[\cos BAC =]\frac{30939}{41712}$ or 0.7417…
4(c)	35.8 or 35.84… from sine rule	**3**	**M2** for $\frac{86 \times \sin 116}{132}[= 0.58557...]$ or **M1** for $\frac{\sin CAD}{86} = \frac{\sin 116}{132}$ oe
4(d)	9670 or 9669 to 9676	**3**	**M2** for $\frac{1}{2} \times 158 \times 132 \times \sin(their\ (b))$ oe and $\frac{1}{2} \times 86 \times 132 \times \sin(64 - their\ (c))$ oe or **M1** for either area
4(e)	214.2 or 214.1… or 214	**2**	**M1** for [180 +]70–*their* (c) oe
5(a)(i)	52	**1**	
5(a)(ii)	36	**1**	
5(a)(iii)	26	**1**	**FT** 62 – *their* (a)(ii) evaluated correctly
5(b)	Valid comment	**1**	Strict **FT** *their* (a)(iii), e.g. distances for females are more varied
5(c)	$\frac{11}{20}$ oe	**2**	**M1** for 27 written or answer of $\frac{27}{60}$ oe
5(d)(i)	[18 9] 14 12 5 [2]	**2**	**B1** for 1 correct value

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Question	Answer	Marks	Partial Marks
5(d)(ii)	48.75 nfww	**4**	**M1** for midpoints soi **M1** for use of $\sum fx$ with *their* frequencies **M1** (dep on 2nd M1) for $\sum fx \div$ (60 or by *their* $\sum f$)
6(a)(i)	Angle ABC=52 nfww	**B1**	ALTERNATIVE [Reflex] angle AOC = 256
	Opposite angles in cyclic quad oe Angles in opposite segments	**B1**	Angle at centre=2 × angle at circumference/arc
	[Angle AOC=104] Angle at centre=2 × angle at circumference/arc nfww	**B1**	Angles around a point
6(a)(ii)	22 nfww	**2**	**B1** for angle OAC = 38 or angle CAD = 24
6(a)(iii)	28	**1**	
6(a)(iv)	36.6 or 36.62 to 36.63 nfww	**3**	**B2** for 7.4 or 17.42 to 17.43 or **M2** for $9.6\times 2+\frac{104}{360}\times 2\times\pi\times 9.6$ or **M1** for $\frac{104}{360}\times 2\times\pi\times 9.6$
6(b)(i)	81	**3**	**M2** for $\frac{A}{36}=\left(\sqrt[3]{\frac{2187}{648}}\right)$ oe or better or for $A\times\frac{648}{36}\times\sqrt[3]{\frac{2187}{648}}=2187$ oe or better or **M1** for $\frac{A^3}{36^3}=\frac{2187^2}{648^2}$ oe or $\sqrt[3]{\frac{2187}{648}}$ or $\sqrt[3]{\frac{648}{2187}}$
6(b)(ii)	8.05 or 8.051 to 8.052…	**3**	**M2** for $\left[r^3=\right]\frac{2187\times 3}{4\times\pi}$ oe or **M1** for $\frac{4\pi r^3}{3}=2187$ **SC2** for $\frac{648\times 3}{4\times\pi}$ or **SC1** for $\frac{4\pi r^3}{3}=648$
7(a)	Reflection y = –1	**2**	**B1** for each
7(b)(i)	Image at (–6, 5) (–6, 7) (–5, 7) (–4, 5)	**2**	**B1** for translation by $\begin{pmatrix}-3\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$

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Question	Answer	Marks	Partial Marks
7(b)(ii)	Image at (1, –1) (3, –1) (3, –3) (2, –3)	**2**	**B1** for shape correct size and orientation but wrong position
7(b)(iii)	Image at (1, 2) (1, 6) (3, 6) (5, 2)	**2**	**B1** for shape correct size and orientation, wrong position
8(a)(i)	$\frac{2}{5}$ oe	**2**	**M1** for $\frac{4}{6}\times\frac{3}{5}$
8(a)(ii)	$\frac{3}{5}$ oe	**1**	**FT** 1 – *their* $\frac{12}{30}$ oe
8(b)	$\frac{5}{7}$ oe nfww	**4**	**M3** for $\frac{2}{7}+\frac{5}{7}\times\frac{2}{6}+\frac{5}{7}\times\frac{4}{6}\times\frac{2}{5}$ oe or for $1-\frac{5}{7}\times\frac{4}{6}\times\frac{3}{5}$ oe or **M1** for each of $\frac{5}{7}\times\frac{2}{6}$ and $\frac{5}{7}\times\frac{4}{6}\times\frac{2}{5}$ oe or completed tree diagram with appropriate probabilities shown
9(a)(i)	5	**1**	
9(a)(ii)	1	**2**	**M1** for h(0) or 3^{9-x^2} or better
9(a)(iii)	$9 – 4x^2$ final answer	**1**	
9(a)(iv)	$15 – 2x^2$ final answer	**2**	**M1** for $2(9 – x^2) – 3$ or better
9(b)	$\frac{x+3}{2}$ final answer	**2**	**M1** for $x = 2y – 3$ or $y + 3 = 2x$ or better or $\frac{y}{2}=x-\frac{3}{2}$
9(c)	1.8 or $1\frac{4}{5}$ or $\frac{9}{5}$	**2**	**M1** for $10x-15=3$ or $2x-3=\frac{3}{5}$
9(d)	–1 and 4 nfww	**4**	**M1** for $9 – (2x – 3)^2 = –16$ **A1** for $4x^2 – 12x – 16[= 0]$ oe **M1** (dep on first M1) for correct factors or use of formula or completing the square for their 3-term quadratic OR **M1** for $9 – y^2 = –16$ **A1** for $y^2 = 25$ **M1** (dep on first M1) for $2x – 3 = \pm 5$
9(e)	$\frac{1}{9}$	**1**	

Question	Answer	Marks	Partial Marks
10	$x + 1 - 2x = 3x(x + 1)$	**M2**	**M1** for a common denominator of $x(x + 1)$ seen or attempt to multiply through by denominators or for $\frac{x+1-2x}{x(x+1)} = 3$
	$3x^2 + 4x - 1[= 0]$ oe nfww	**A1**	
	$[x =]\frac{-4 \pm \sqrt{4^2 - 4 \times 3 \times (-1)}}{2 \times 3}$	**B2**	**B1FT** for $\sqrt{4^2 - 4 \times 3 \times (-1)}$ or better or for $\left(x + \frac{2}{3}\right)^2$ **B1FT** for $\frac{-4 + \sqrt{q}}{2 \times 3}$ or $\frac{-4 - \sqrt{q}}{2 \times 3}$ or for $-\frac{2}{3} \pm \sqrt{\frac{1}{3} + \left(\frac{2}{3}\right)^2}$
	–1.55 and 0.22 final answers	**B2**	**B1** for each or **B1** for –1.548 to –1.549 **and** 0.215… or for –1.55 **and** 0.22 seen in working or for –0.22 **and** 1.55 as final answer or for –1.5 or –1.54 **and** 0.2 or 0.21 as final answer
11(a)(i)	8**b** – 4**a** oe	**1**	
11(a)(ii)	6**b**	**1**	
11(a)(iii)	6**b** – 2**a** or 2(3**b** – **a**)	**1**	**FT** –2**a** + *their* (a)(ii)
11(b)	2 : 1 oe final answer	**3**	Dep on correct $\overrightarrow{BC}$ or correct $\overrightarrow{AC}$ seen **B2** for $\overrightarrow{BC}$ = 4**b**–2**a** or **M1** for a correct route for $\overrightarrow{BC}$ in terms of **a** and **b** or for a correct route for $\overrightarrow{AC}$ in terms of **a** and **b** If no/incorrect working seen then **SC1** for final answer of 2 : 1 (oe)

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