Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2021**

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 2021 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.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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)	$\frac{450}{8+7+3}\times 8$ oe	**2**	**M1** for $\frac{450}{8+7+3}$
1(a)(ii)	75	**1**	
1(a)(iii)	56	**2**	**M1** for $\frac{32}{100}\times(450-200-$ *their* 75) oe or $\frac{32}{100}\times\frac{450}{8+7+3}\times 7$ oe If 0 scored, **SC1** for answer 231
1(a)(iv)	59 000 nfww	**3**	**B2** for 58 600 to 58 800 or **B1** for 293 to 294 or **M1** for $\frac{\text{figs}485\times 200}{165}$ oe If 0 scored, **SC1** for *their* more accurate answer seen and rounded to the nearest 1000
1(b)(i)	3 075 000	**1**	
1(b)(ii)	3.075×10^6	**1**	**FT** *their* (b)(i)
1(c)	32.5	**2**	**M1** for $x\times\left(1+\frac{16}{100}\right)$ = 37.7 or better
1(d)	2460 or 2458. …	**2**	**M1** for $1800\left(1+\frac{2.1}{100}\right)^{15}$ oe
2(a)(i)	90	**1**	
2(a)(ii)	68	**1**	
2(a)(iii)	52	**1**	**FT** 120 – *their* (a)(ii)
2(a)(iv)	20	**2**	**B1** for 60 in working or as answer
2(b)(i)	97.5	**4**	**M1** for mid-points soi (50, 70, 90, 115, 145, 180) **M1** for use of Σfm with m in correct interval including both boundaries **M1** for (dep on 2nd M1) for $\Sigma fm \div 80$
2(b)(ii)	Bars with heights 0.9, 0.5, 0.3, 0.175 and with correct widths	**4**	**B1** for each correct bar If 0 scored, **SC1** for 3 or 4 correct frequency densities

Question	Answer	Marks	Partial Marks
2(b)(iii)	$\frac{28}{395}$ oe	**3**	**M2** for [2 ×] $\frac{16}{80}\times\frac{14}{79}$ oe or **M1** for $\frac{16}{80}$ or $\frac{16}{79}$oe or $\frac{14}{80}$oe or $\frac{14}{79}$ oe seen If 0 scored, **SC1** for answer $\frac{7}{100}$ oe
3(a)(i)	$\frac{AD}{46.1}$ = tan 64 oe or better	**M1**	
	94.51 to 94.52	**A1**	
3(a)(ii)	46[.0] or 45.96… nfww	**3**	**M2** for $56.5\times\frac{\sin 94}{78.4}$oe or **M1** for $\frac{56.5}{\sin BAC}=\frac{78.4}{\sin 94}$oe
3(a)(iii)	102.3 or 102.4 or 102.34 to 102.38	**4**	**M2** for [cos$C$ =] $\frac{38.6^2+78.4^2-94.5^2}{2\times 38.6\times 78.4}$ or **M1** for $94.5^2 = 38.6^2 + 78.4^2 - 2\times 38.6\times 78.4\times\cos C$ and **A1** for –0.214 or –0.2144 to –0.2137 If 0 scored, **SC2** for [CAD =] 23.5 or 23.51 to 23.52 or for [CDA =] 54.1 or 54.14…
3(b)	16.2 or 16.15…	**3**	**M2** for $\frac{1}{2}\times 21.5\times 27.6\sin 111=\frac{1}{2}\times 34.3\times d$ oe or **M1** for $\frac{1}{2}\times 21.5\times 27.6\sin 111$ seen or $\frac{1}{2}\times 34.3\times d$ oe soi
4(a)(i)	Image at (–5, 6) (–5, 8) (–6, 7)	**2**	**B1** for translation by $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\5\end{pmatrix}$
4(a)(ii)	Image at (3, 1) (3, 3) (4, 2)	**2**	**B1** for reflection in $y = 1$ or $x = k$
4(a)(iii)	Image at (3, 4) (3, 8) (1, 6)	**2**	**B1** for enlargement, sf 2, in wrong position
4(b)	Rotation 90º [anticlockwise] oe (–3, 0)	**3**	**B1** for each

Question	Answer	Marks	Partial Marks
5(a)	–1, –0.375, 3	**3**	**B1** for each
5(b)	Correct graph	**4**	**B3FT** for 8 or 9 correct points or **B2FT** for 6 or 7 correct points or **B1FT** for 4 or 5 correct points
5(c)	$y = 2 – x$ ruled correctly AND –0.45 to –0.35 1 2.35 to 2.45	**4**	**B2** for $y = 2 – x$ ruled or **B1** for [$y =$] $2 – x$ soi or $y = k – x$ ruled or $y = kx + 2$ ruled, but not $y = 2$ **B2** for all three values or **B1** for any two values
6(a)(i)	4.5, $4\frac{1}{2}$ or $\frac{9}{2}$	**3**	**M1** for $8x – 12 = 24$ or $2x – 3 = 6$ **M1** for reaching $ax = b$ correctly FT *their* first step
6(a)(ii)	$x > -\frac{4}{3}$ or $x > -1\frac{1}{3}$ final answer	**2**	**M1** for $6x > 6 – 14$ or $x + \frac{14}{6} > 1$
6(b)	[$y =$] $\sqrt[3]{\frac{2x^3 – V}{3}}$ oe final answer	**3**	**M1** for isolating term in y **M1** for division by 3 or FT *their* first step **M1** for cube root or FT *their* previous step to the final answer
6(c)	$4n^2 – 20n + 12$	**M2**	**B1** for $4n^2 – 10n – 10n + 25$
	$4(n^2 – 5n + 3)$ or correct explanation linked to expression	**A1**	with no errors seen e.g. 4, [–]20 and 12 are all multiples of 4 or divides each term or each coefficient by 4
6(d)(i)	$p = –3$ and $q = 23$	**3**	**B2** for $23 – 2(x – 3)^2$ OR **M1** for [q] $– 2x^2 – 4px – 2p^2$ or $–2(x – 3)^2$ seen **B1** for either $p = –3$ or $q = 23$ or **FT** $q = 5 + 2$(*their* p)^2
6(d)(ii)	(3, 23)	**1**	**FT** *their* (d)(i)
6(e)	69	**2**	**M1** for figs 13^2 oe
7(a)(i)	$\frac{16\pi}{3}$ or $5\frac{1}{3}\pi$ final answer	**2**	**M1** for $\frac{1}{2} \times \frac{4}{3}\pi \times 2^3$ oe

Question	Answer	Marks	Partial Marks
7(a)(ii)	2.4[0]	**4**	**B3** for answer in range 2.396… to 2.40… OR **M3** for *their* $\frac{16\pi}{3} + \pi \times 2^2 \times 5.2 +$ $\frac{1}{3}\pi \times 2^2 \times h = \frac{88\pi}{3}$ oe or **M2** for $\frac{88\pi}{3} - \textit{their}\ \frac{16\pi}{3} - \pi \times 2^2 \times 5.2$ oe or **M1** for $\pi \times 2^2 \times 5.2$ oe or $\frac{1}{3}\pi \times 2^2 \times h$ oe soi
7(a)(iii)	1 hour 38 min or 1 hour 37.8 min to 1 hour 37.9… min	**3**	**B2** for 1.63[2…] or 98 [mins] or 97.8 to 97.9…] or **M1** for $\frac{\frac{88\pi}{3} \times 620}{35000}$ [× 60] oe
7(b)	8.5[0] or 8.496 to 8.497	**4**	**M3** for [r=] $\sqrt{\frac{65}{\frac{140}{360}\pi - \frac{1}{2}\sin 140}}$ oe or **M2** for $\frac{140}{360}\pi \times r^2 - \frac{1}{2} r^2 \times \sin 140$ [=65] oe or **M1** for either area expression seen
8(a)(i)	$\frac{12}{x}$ or 12 ÷ x final answer	**1**	
8(a)(ii)	$\frac{12}{x-4} - \textit{their}\ \frac{12}{x} = 1.5$ oe	**M1**	Accept 3 or more term equivalents
	$12x - 12(x-4) = 1.5x(x-4)$ or $\frac{12x - 12(x-4)}{x(x-4)}$ [= 1.5]	**M1**	Correctly clearing fractions, or correctly collecting into a 'single fraction' FT *their* expression dep on two fractions both with algebraic denominators
	$12x - 12x + 48 = 1.5x^2 - 6x$	**M1**	Correctly multiplying *their* two sets of brackets FT *their* expression dep on two fractions both with algebraic denominators or first M1 given
	[$1.5x^2 - 6x - 48 = 0$] $x^2 - 4x - 32 = 0$	**A1**	One further step either 3 term equation or division throughout by 1.5 leading to solution With no errors or omissions seen, dep on **M3**

Question	Answer	Marks	Partial Marks
8(a)(iii)	$(x + 4)(x – 8)$	**M2**	**M1** for $(x + a)(x + b)$ where $ab = –32$ or $a + b = –4$ or for $x(x + 4) – 8(x + 4)$ or $x(x – 8) + 4(x – 8)$
	–4 and 8	**B1**	
8(a)(iv)	3	**2**	**FT** $\frac{12}{their\ 8 - 4}$ **M1** for $\frac{12}{their\ 8 - 4}$ or $\frac{12}{their\ 8} + 1.5$ oe or for answer $\frac{12}{their\ 8}$
8(b)	69.6	**3**	**M2** for $\frac{430 \text{ to } 440}{6 + 0.25}$ or $\frac{440 – 5}{6 \text{ to } 6.5}$ oe or **M1** for 440 + 5 oe or 440 – 5 oe or 6 + 0.25 oe or 6 – 0.25 oe seen
9(a)(i)	(3, 1)	**1**	
9(a)(ii)	$\begin{pmatrix} -10 \\ 15 \end{pmatrix}$	**1**	
9(a)(iii)	3.61 or 3.605 to 3.606	**2**	**M1** for $(–2)^2 + 3^2$ oe
9(b)(i)(a)	$\frac{1}{2}\mathbf{c}$	**1**	
9(b)(i)(b)	$\mathbf{a} + \frac{1}{2}\mathbf{c}$ oe	**1**	FT **a** + *their* (b)(i)(a)

Question	Answer	Marks	Partial Marks
9(b)(ii)(a)	$\overrightarrow{OP} = \frac{1}{3}(2\mathbf{a} + \mathbf{c})$ oe and $\overrightarrow{OQ} = \frac{1}{2}(2\mathbf{a} + \mathbf{c})$ oe OR $\overrightarrow{OP} = \frac{2}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ OR $\overrightarrow{PQ} = \frac{1}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ **and** correct comment e.g. have the same base vector or that they are multiples of one another **and** they share a common point OR e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$	**2**	**B1** for $\overrightarrow{OP}$ or $\overrightarrow{PQ}$ factorised or for correct multiplicative statement on relationship without factorised vectors e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $\frac{2}{3}\overrightarrow{OQ} = \overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$, $1.5\left(\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}\right) = \mathbf{a} + \frac{1}{2}\mathbf{c}$
9(b)(ii)(b)	1.5 oe	**1**	
10(a)	(2, –10) and (–2, 22)	**5**	**B2** for $3x^2 - 12$ isw or **B1** for $3x^2 + k$ or $px^2 - 12$ ($p \neq 0$) or for $3x^2 - 12 + 6$ isw **M1** for setting *their* derivative = 0 or $\frac{dy}{dx} = 0$ **B1** for $x = \pm 2$ or for one correct coordinate pair
10(b)	(2, –10) minimum with correct reason or sketch (–2, 22) maximum with correct reason or sketch	**3**	**B2** for 1 correct with correct reasoning or **B2FT** for correct evaluation with correct 2nd derivative for both of *their* different x values or **M1** for showing [2nd derivative =] $6x$ or gradients for one value on either side of one correct stationary point or for reasonable sketch of cubic
11(a)(i)	10.2	**2**	**M1** for $\frac{YZ}{13.6} = \frac{15.3}{20.4}$ oe or better

Question	Answer	Marks	Partial Marks
11(a)(ii)	143.1	**3**	**M2** for $\left(\frac{20.4}{13.6}\right)^2 \times 63.6$ oe or **M1** for $\left(\frac{20.4}{13.6}\right)^2$ or $\left(\frac{13.6}{20.4}\right)^2$ oe **Alt method** **M2** for ½ × 20.4 × 15.3 × sin *R* where *R* is $\sin^{-1}\left(\frac{63.6}{0.5\times 13.6\times their\text{(a)(i)}}\right)$ or **M1** for $R = \sin^{-1}\left(\frac{63.6}{0.5\times 13.6\times their\text{(a)(i)}}\right)$
11(b)	0.55	**3**	**M2** for [ratio of areas] = $\left(\sqrt[3]{\frac{37.5}{64.8}}\right)^2$ or $\left(\sqrt[3]{\frac{64.8}{37.5}}\right)^2$ oe or **M1** for [ratio of lengths] = $\sqrt[3]{\frac{37.5}{64.8}}$ or $\sqrt[3]{\frac{64.8}{37.5}}$ oe or for $\left(\frac{0.792}{x}\right)^3 = \left(\frac{64.8}{37.5}\right)^2$ oe