Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/41**

Paper 4 Extended **October/November 2022**

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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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

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Question	Answer	Marks	Partial Marks
1(a)(i)	1580 or 1583 to 1584	**2**	**M1** for $\pi \times 6^2 \times 14$
1(a)(ii)	452 or 452.3 to 452.4...	**2**	**M1** for $\left[\frac{1}{2}\right] \times \frac{4}{3} \times \pi \times 6^3$
1(b)(i)	7.85 ÷ 1000 [= 0.00785]	**M1**	
1(b)(ii)	16[.0] or 15.95 to 15.99	**2**	**FT {***their* **(a)(i)** + *their* **(a)(ii)}** × 0.00785 evaluated to 3 sig fig or better **M1** for (*their* **(a)(i)** + *their* **(a)(ii)**) × 0.00785
1(c)(i)	16.2 or 16.21 to 16.23	**3**	**M2** for $\frac{2000 - 50 \times \frac{4}{3} \times \pi \times 2^3}{2000} [\times 100]$ or for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000} \times 100$ or **M1** for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000}$
1(c)(ii)	6.87 or 6.870 to 6.872	**1**	FT $\sqrt[3]{2000 - \textit{their}\left(50 \times \frac{4}{3} \times \pi \times 2^3\right)}$ evaluated to 3sf or better
1(d)	$\frac{2}{3}$ oe	**4**	**M1** for $[\pi](3R)^2 + [\pi]3R \times 9R$ oe **M1** for $2[\pi]x^2 + 2[\pi]x \times 7x$ oe **M1** for *their* area of cone = *their* area of cylinder seen
2(a)(i)	2990 cao	**1**	
2(a)(ii)	1.0 cao	**1**	
2(a)(iii)	2100 cao	**1**	
2(b)	97	**1**	
2(c)	$\frac{1}{64}$ final answer	**1**	
2(d)	$7.01[0] \times 10^{-3}$	**1**	
2(e)	1.65×10^x	**2**	**M1** for final answer figs 165 or for $15 \times 10^{x-1}$ seen or for 0.15×10^x seen

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Question	Answer	Marks	Partial Marks
2(f)	37.7... – 3.7... [= 34] oe	**M1**	
	$\frac{34}{90}$ oe fraction	**B1**	
3(a)	$-2 < x \leqslant 4$ oe	**1**	
3(b)(i)	$-3 \leqslant x < 3$ final answer	**3**	**M2** for $-3 \leq x < k$ or for $k \leqslant x < 3$ or for $-6 \leqslant 2x < 6$ or for $-\frac{3}{2} - \frac{3}{2} \leqslant x < \frac{9}{2} - \frac{3}{2}$ or **M1** for $-3 - 3 \leqslant 2x < 9 - 3$ or for $-\frac{3}{2} \leqslant x + \frac{3}{2} < \frac{9}{2}$ After 0 scored SC1 for $-3 \leqslant x$ or for $x < 3$
3(b)(ii)	–3, –2, –1, 0, 1, 2 final answer	**2**	**FT** *their* **(i)** as long as negative and positive values **B1FT** for one error or omission
3(c)(i)	$\frac{36}{17}$ oe	**4**	**B3** for $-15x - 2x = 5 + 4 - 45$ or better OR **B2** for $45 - 15x - 2x - 4 = 5$ oe OR **M1** for correct removal of fraction or **M1** for correct removal of brackets
3(c)(ii)	–8	**3**	**B2** for $5x - 3x = 9 - 25$ or better or **M1** for $5(x + 5) = 3(x + 3)$ oe or better
4(a)(i)	550 nfww	**3**	**M2** for $\frac{500 \times 2 \times 5}{100} + 500$ oe or **M1** for $\frac{500 \times 2 \times 5}{100}$ oe
4(a)(ii)	546.65	**2**	**M1** for $500 \times \left(1 + \frac{1.8}{100}\right)^5$ oe
4(a)(iii)	8 nfww	**3**	**B2** for final answer 13 OR **M2** for trials correctly comparing both investments to 7 and 8 more years or **M1** for at least two trials correctly comparing both investments

Question	Answer	Marks	Partial Marks
4(b)	1476 cao	**3**	**B2** for 1480 or 1476.2 ... OR **M1** for $2500\times\left(1-\frac{10}{100}\right)^5$ oe **B1** for their more accurate answer seen correctly rounded to the nearest dollar.
4(c)	3.2[0] or 3.200 to 3.201	**3**	**M2** for (...) = $\sqrt[22]{2}$ oe isw or **M1** for [N] × (...)^{22} = 2[N]
5(a)(i)	9.4	**1**	
5(a)(ii)	2.4	**2**	**B1** for [uq =] 10.4 or [lq =] 8 but not as final answer
5(a)(iii)	18	**2**	**B1** for 82 seen
5(b)(i)	34.65 or $34\frac{13}{20}$	**4**	**M1** for midpoints 10, 25, 32.5, 40, 52.5 soi **M1** for Σfx where values of x are in interval or on boundary **M1 dep on second M** for $\frac{\Sigma fx}{150}$
5(b)(ii)	0.3, 5.7, ..., 7.95, 1.5	**3**	**B2** for any two correct or **B1** for one correct or for at least three frequency densities seen 0.2, 3.8, 8, 5.3, 1 oe or **M1** for [factor] 1.5
5(b)(iii)	$\frac{7}{745}$ oe	**2**	**M1** for $\frac{15}{150}\times\frac{14}{149}$
6(a)(i)	$\begin{pmatrix}-3\\3\end{pmatrix}$	**1**	
6(a)(ii)	$\begin{pmatrix}3\\2\end{pmatrix}$	**1**	
6(a)(iii)	3.61 or 3.605 to 3.606	**2**	**M1** for $2^2 + 3^2$ oe
6(b)	(6, 1)	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
6(c)	$\frac{2}{7}\mathbf{g} + \frac{3}{14}\mathbf{h}$	**4**	**B3** for correct unsimplified expression for $\overrightarrow{MK}$ or **B2** for $[\overrightarrow{MK} =] \frac{2}{7}\mathbf{g} + k\mathbf{h}$ or $[\overrightarrow{MK} =] k\mathbf{g} + \frac{3}{14}\mathbf{h}$ or $\overrightarrow{HK} = \frac{2}{7}(\mathbf{g} - \mathbf{h})$ oe or $\overrightarrow{GK} = \frac{5}{7}(\mathbf{h} - \mathbf{g})$ oe or **M1** for correct route for $\overrightarrow{MK}$
7(a)(i)	4	**1**	
7(a)(ii)	16	**1**	**FT** $2^{their\,4}$
7(b)	3	**1**	
7(c)	$\frac{1}{4}$ oe	**2**	**M1** for $\frac{2}{x} = 2^3$ or better
7(d)	$\frac{5-x}{2}$ oe final answer	**2**	**M1** for $x = 5 - 2y$ or $y + 2x = 5$ oe or $\frac{y}{2} = \frac{5}{2} - x$ oe
7(e)	$\frac{11x - x^2 + 2}{x}$ final answer	**3**	**B2** for $\frac{x(10-x)+2+x}{x}$ oe single fraction or **B1** for $x(10 - x) + 2 + x$ oe or **M1** for $10 - x + \frac{2}{x} + 1$
7(f)	$[a =] 1$ $[b =] -21$ $[c =] 100$	**4**	**B3** for $x^2 - 21x + 100$ OR **M1** for $(10-x)^2 - (10-(10-x))$ oe or better **B2** for $[(10-x)^2] = 100 - 10x - 10x + x^2$ or **B1** for three out of four terms of $[(10-x)^2] = 100 - 10x - 10x + x^2$ correct
7(g)	1024	**2**	**M1** for $[x =]$ h(10) oe or better
8(a)	$[\cos =] \frac{15^2 + 8^2 - 20^2}{2.15.8}$	**M2**	**M1** for $20^2 = 15^2 + 8^2 - 2.15.8\cos(\quad)$
	117.54 to 117.55	**A2**	**A1** for $-\frac{37}{80}$ or $-\frac{111}{240}$ or –[0].4625

Question	Answer	Marks	Partial Marks
8(b)	53.2 or 53.19 to 53.23	**2**	**M1** for $0.5 \times 8 \times 15 \times \sin(117.5)$ oe
8(c)	15.5 or 15.52 to 15.53	**2**	**M1** for $15^2 + 4^2$ oe
8(d)	7.1 or 7.13 or 7.125 to 7.126	**3**	**M2** for tan [P]= $\frac{4-3}{8}$ oe or for 7.1 or 7.13 or 7.125 to 7.126 seen or **M1** for vertical line = 4 – 3 soi After 0 scored **SC1** for correct angle identified
8(e)	11.5 nfww or 11.48 to 11.49...	**5**	**B1** for height of 3.5 soi **M2** for $15^2 + 4^2 - 2.15.4\cos(117.5)$ or **M1** for $\cos 117.5 = \frac{15^2 + 4^2 - (...)^2}{2.15.4}$ **M1** for tan = $\frac{3.5}{\textit{their}\ 17.216...}$ oe After M0 scored **SC1** for correct angle identified
9(a)(i)	$x(3x+4)+2(x-1)[=20]$	**M1**	Correct expression with brackets unexpanded
	Leading to $3x^2 + 6x - 22 = 0$ with no errors or omissions	**A1**	Must see equated to 20 and brackets expanded first to award A1
9(a)(ii)	$\frac{-6 \pm \sqrt{6^2 - 4(3)(-22)}}{2.3}$ oe or for $= -1 \pm \sqrt{1 + \frac{22}{3}}$ oe	**B2**	**B1** for $\sqrt{6^2 - 4(3)(-22)}$ or $\frac{-6 + \text{or} - \sqrt{k}}{2.3}$ or $(x+1)^2 = k$ oe
	–3.887 and 1.887 cao	**B2**	**B1** for one correct answer or for answers –3.89 or – 3.88 or -3.886 or –3.8868 to –3.8867 and 1.88 or 1.89 or 1.886 or 1.8867 to 1.8868 or correct answers seen in working or –1.887 and 3.887 answers
9(a)(iii)	5.77 or 5.773 to 5.774	**1**	**FTdep** 2(positive x +1) evaluated to 3 sig. fig. or more, dep on $x > 1$

Question	Answer	Marks	Partial Marks
9(b)	$y^2+3y-40[=0]$ oe	**B4**	Oe 3 term quadratic **M3** for $15y-20(y-2)=y(y-2)$ oe Or **M2** for $\frac{15}{y-2}-\frac{20}{y}=1$ oe Or **M1** for $H(y-2)=15$ or $hy=20$ soi
	$(y+8)(y-5)$ [= 0] oe	**B2**	**Strict FT** a three term quadratic **B1FT** for $(y+a)(y+b)$ where $ab = -40$ or $a+b=3$ or y(y – 5) + 8 (y – 5) or $y(y+8)-5(y+8)$
	5	**B1**	
10(a)(i)	4 or 5 or 7 or 8 or 9	**1**	
10(a)(ii)	[a =] 3, [b =] 10	**2**	**B1** for each or for a and b transposed
10(b)	$6x^5-30x^4$	**B2**	**B1** for $6x^5$ or $-30x^4$
	their derivative = 0.	**M1**	
	(0, 0) and (5, –3125)	**B2**	**B1** for (5, –3125) or for $x = 0$ and $x = 5$

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