Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 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.

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

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This document consists of **11** printed pages.

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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

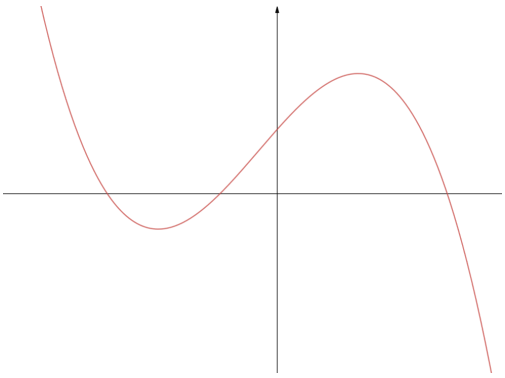
Question	Answer	Marks	Partial Marks
1(a)	10 07	**1**	
1(b)	123	**2**	**M1** for 10 30 – 8 27 soi or 10 30 – 8 52 + 25 soi or 25 + 50 + 48
1(c)	25.2, $25\frac{1}{5}$	**2**	**M1** for figs 29.4 ÷ 70 [× 60] oe
1(d)	\$142.1[0] cao	**4**	**M2** for [adults =] 56 ÷ 8 × 5 and [child =] 56 ÷ 8 × 3 or better or **M1** for 56 ÷ (5 + 3) × k where k = 1, 3 or 5 **M1** for *their* 35 × 2.80 + *their* 21 × 2.80 × $\frac{3}{4}$ oe
2(a)(i)	Triangle drawn at (2, – 1), (2, – 4), (3, – 4)	**2**	**B1** for two correct points If 0 scored, **SC1** for reflection of triangle T in $y = -x$
2(a)(ii)	Triangle drawn at (– 5, 6), (– 2, 5), (– 5, 5)	**2**	**B1** for translation by $\begin{pmatrix}-1\\k\end{pmatrix}$ or by $\begin{pmatrix}k\\3\end{pmatrix}$ If 0 scored **SC1** for triangle drawn at (–4.5, 3.5), (–4.5, 4.5) and (–1.5, 3.5)
2(a)(iii)	Enlargement [SF] – 1.5 oe [centre] (0, 3)	**3**	**B1** for each
2(b)	28.8, $28\frac{8}{10}$, $28\frac{4}{5}$	**2**	**M1** for 1.2^2 oe
3(a)(i)(a)	187 or 186.7 to 186.8 or $186\frac{42}{53}$	**1**	
3(a)(i)(b)	2 : 7 : 42 cao	**2**	**B1** for 106 : 371 : 2226 or any equivalent ratio If 0 scored, **SC1** for 2 : 7 : 42 in the wrong order
3(a)(ii)	33.3 or 33.28 to 33.29	**2**	**M1** for $\frac{2967-2226}{2226}$ [× 100] oe or $\frac{2967}{2226} \times 100$ [– 100] oe

Question	Answer	Marks	Partial Marks
3(a)(iii)	1706 cao nfww	**3**	**B2** for 1705 to 1706.0… or 1710 or **M1** for $\left(1+\frac{30.48}{100}\right)x = 2226$ oe or better If 0 or M1 scored, **SC1** for rounding *their* decimal answer seen to nearest integer
3(b)	3897	**5**	**B1** for $a = 2000$ **M2** for [b =] $\sqrt[3]{\frac{2662}{2000}}$ or **M1** for $2662 = 2000b^3$ **M1** for *their* $2000 \times \left(\sqrt[3]{\frac{2662}{their 2000}}\right)^7$ or for *their a* × (*their b*)^7 provided *their a* and *their b* are clearly identified in the working If 0 or M1 scored, **SC1** for rounding *their* decimal answer seen to nearest integer.
4(a)	$\frac{(12-2)\times 180}{12}$ [= 150] oe or $180 - \frac{360}{12}$ [= 150]	**1**	Accept $\frac{(2\times 12-4)\times 90}{12}$ [= 150]
4(b)(i)	$\frac{3}{\cos 75}$ oe or $\frac{6\sin 75}{\sin 30}$	**M2**	**M1** for $\frac{3}{AO} = \cos 75$ oe or $\frac{r}{\sin 75} = \frac{6}{\sin 30}$
	11.59…	**A1**	
4(b)(ii)(a)	72.8 or 72.9 or 72.82 to 72.89…	**2**	**M1** for $2 \times \pi \times 11.6$
4(b)(ii)(b)	12.1 or 12.06 to 12.08	**2**	**M1** for [6 +] *their* **(b)(ii)(a)** ÷ 12 oe
4(c)	806 or 807 or 805.9 to 807.4	**3**	**B2** for 402.9… to 403.7 OR **M2** for $\frac{1}{2}\times 6\times 11.6\times \sin 75\times 12\times 2$ oe or **M1** for $\frac{1}{2}\times 6\times 11.6\times \sin 75\ [\times k]$ oe
5(a)(i)	$20 < t \leqslant 35$	**1**	

Question	Answer	Marks	Partial Marks
5(a)(ii)	28 nfww	**4**	**M1** for midpoints **soi** **M1** for use of $\sum fm$ with m in correct interval including both boundaries **M1** (dep on 2nd M1) for $\sum fm \div 80$
5(b)(i)	$\frac{7}{8}$ cao	**2**	**M1** for $\frac{18+28+24}{80}$ oe
5(b)(ii)	$\frac{25}{126}$ oe	**3**	**M2** for [2 ×]$\left(\frac{3}{28}\times\frac{25}{27}\right)$ or [2 ×] $\left(\frac{25}{28}\times\frac{3}{27}\right)$ oe or **M1** for either $\frac{3}{28}$ or $\frac{25}{27}$ or $\frac{25}{28}$ or $\frac{3}{27}$ If 0 scored, **SC1** for answer $\frac{75}{392}$ oe
5(c)(i)	28 and 56	**1**	
5(c)(ii)	Correct diagram	**3**	**B1FT** *their* **(c)(i)** for plots at 5 correct heights **B1** for 5 plots at upper ends of intervals on correct vertical line **B1FT** (dep on at least B1) for increasing curve or polygon through 5 points After 0 scored, **SC1FT** for 4 correct points plotted
5(c)(iii)	Strict FT *their* reading at 80th percentile for an increasing curve/polygon	**2**	**B1** for 64 written or a mark at cf = 64 on graph or a mark on curve at (t, 64)
5(c)(iv)	Correct integer reading at $t = 45$	**M1**	**FT** *their* cf graph for all three marks
	$\frac{80-(\textit{their}\text{ reading at }t=45)}{80}$ [× 100] or $\frac{(\textit{their}\text{ reading at }t=45)}{80}\times 100$	**M1**	
	Percentage consistent with *their* reading	**A1**	If no working shown then SC1 for a correct percentage that follows from a correct reading from *their* graph.
6(a)	$5b - 2a$ final answer	**2**	**B1** for $5b$ or $-2a$ in final answer or for $5b - 2a$ seen
6(b)	$6x - 23$ final answer nfww	**2**	**M1** for $4x - 20$ or $-3 + 2x$

Question	Answer	Marks	Partial Marks
6(c)	$\frac{35-x}{2x(x-5)}$ or $\frac{35-x}{2x^2-10x}$ oe final answer nfww	**3**	**B1** for $3(2x) - 7(x - 5)$ or better isw **B1** for $2x(x - 5)$ as common denominator isw, allow expanded
6(d)	–5	**3**	**M1** for $13 - 4x = 18 - 3x$ oe or $\frac{-4x}{3} + x = 6 - \frac{13}{3}$ oe **M1FT** for $-4x + 3x = 18 - 13$ oe or for $\frac{-x}{3} = \frac{5}{3}$
6(e)	$[x =] \frac{5p}{y+10}$ oe final answer	**4**	**M1** for correctly clearing the x from the denominator **M1** for correctly expanding the brackets or (dealing with the 5 correctly throughout) **M1** for correctly isolating terms in x **M1** for correctly factorising and dividing by the bracket Max 3 marks if answer is incorrect
7(a)	87.[0] or 86.98 to 86.99	**3**	**M2** for $\sqrt{82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76}$ oe OR **M1** for $82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76$ oe **A1** for 7570 or 7566 to 7567
7(b)	66.1 or 66.2 or 66.13 to 66.17	**3**	**M2** for $\frac{82 \times \sin 76}{\textit{their}\ \textbf{(a)}}$ oe or **M1** for $\frac{82}{\sin C} = \frac{\textit{their}\ \textbf{(a)}}{\sin 76}$ oe
7(c)	13.3 or 13.30 to 13.31	**3**	**M2** for $AG = 55 \cos 76$ oe or **M1** for recognition that CG is perpendicular to AB

Question	Answer	Marks	Partial Marks
7(d)	54.1 or 54.13… **and** 125.9 or 125.86 to 125.87	**5**	**B4** for 54.1 or 54.13… or 125.9 or 125.86 to 125.87 **M3** for [sin Q =] $\frac{0.5\times82\times55\times\sin76}{0.5\times90\times60}$ oe or **M2** for $0.5 \times 82 \times 55 \times \sin 76 = 0.5 \times 60 \times 90 \times \sin Q$ oe or **M1** for $0.5 \times 82 \times 55 \times \sin 76$ oe or for $0.5 \times 60 \times 90 \sin Q$ = *their* area of *ABC* If **B4** not scored then **SC1** for two angles seen that sum to 180 (from use of sine ratio) but not 0 and 180.
8(a)(i)	(–0.5, 1)	**2**	**B1** for each
8(a)(ii)	$\begin{pmatrix} 7 \\ -3 \end{pmatrix}$	**2**	**B1** for each
8(a)(iii)	7.62 or 7.615 to 7.616	**2**	**FT** *their* **(a)(ii)** **M1** for (*their* 7)^2 + (*their* –3)^2 oe
8(a)(iv)	[y =] $–4x –1$ final answer	**3**	**B2** for answer $–4x + c$ [oe] or for correct equation in different form or for $–4x +–1$ or for $–4m – 1$ OR **M1** for $\frac{-5-7}{1--2}$ oe **M1** for correct substitution shown of (–2, 7) or (1, –5) or *their* (–0.5, 1) into y = (*their m*)$x + c$ oe OR **M1** for $7 = –2m + c$ and $–5 = m + c$ **A1** for $m = –4$ and $c = –1$
8(a)(v)	[y =] $\frac{1}{4}x + \frac{11}{4}$ final answer	**3**	**M1** for grad = $\frac{1}{4}$ oe nfww soi, FT negative reciprocal of *their* gradient from **(iv)** **M1** for correct substitution shown of (5, 4) into y = (*their m*)$x + c$ oe or, if no substitution shown, (5, 4) satisfies *their* final linear equation.

Question	Answer	Marks	Partial Marks
8(b)	$2x^2 + 11x - 21$ [= 0]	**M2**	or **M1** for $8 - 5x = 2x^2 + 6x - 13$ oe or better
	$(2x - 3)(x + 7)$ [= 0] oe or $\frac{-11 \pm \sqrt{11^2 - 4 \times 2 \times (-21)}}{2 \times 2}$ or $-\frac{11}{4} \pm \sqrt{\frac{21}{2} + \left(\frac{11}{4}\right)^2}$ oe	**M2**	Allow correct method to solve *their* quadratic equation e.g. formula, complete the square but not for $2x^2 + 6x - 13$ **M1** FT *their* equation for $2x(x + 7) - 3(x + 7)$ [= 0] or $x(2x - 3) + 7(2x - 3)$ [= 0] or $(2x + a)(x + b)$ [= 0] where $ab = -21$ or $2b + a = 11$ OR **M1** for $\sqrt{11^2 - 4 \times 2 \times -21}$ or for $\frac{-11 + \sqrt{k}}{2 \times 2}$ or $\frac{-11 - \sqrt{k}}{2 \times 2}$ OR **M1** for $\left(x + \frac{11}{4}\right)^2$
	$\left(\frac{3}{2}, \frac{1}{2}\right)$ and $(-7, 43)$	**B2**	**B1** for one correct pair or for 2 correct x-values or 2 correct y-values
9(a)	Correct sketch of negative cubic crossing the x-axis at –3, –1 and 3 and crossing the y-axis at 9 	**4**	**B1** for any negative cubic shape with two turning points **B2** for three intercepts only with x-axis labelled at – 3, –1 and 3 or **B1** for one or two correctly labelled x-intercepts **B1** for intercept with y-axis labelled at 9 If no graph drawn, **SC1** for all four intercepts labelled on axes.
9(b)(i)	$3 - x + 3x - x^2$ or better or $3 + x + 3x + x^2$ or better or 9 [$- 3x + 3x$] $- x^2$	**M1**	At least 3 of the four terms correct or for the correct expansion of all three brackets with all 8 terms correct
	Correct completion to [$y =$] $9 + 9x - x^2 - x^3$	**A1**	with no errors or omissions seen

Question	Answer	Marks	Partial Marks
9(b)(ii)	$9 - 2x - 3x^2 = 0$ oe	**B3**	**B2** for $9 - 2x - 3x^2$ or **B1** for two correct terms **M1** for *their* derivative = 0 or stating $\frac{dy}{dx} = 0$
	$\frac{--2 \pm \sqrt{(-2)^2 - 4 \times -3 \times 9}}{2 \times -3}$ oe OR $-\frac{1}{3} \pm \sqrt{\frac{9}{3} + \left(\frac{1}{3}\right)^2}$ oe	**B2**	FT *their* derivative **B1FT** for $\sqrt{(-2)^2 - 4(-3)(9)}$ or better or for $\frac{-(-2) + \sqrt{q}}{2 \times -3}$ or $\frac{-(-2) - \sqrt{q}}{2 \times -3}$ OR **B1** for $\left(x + \frac{1}{3}\right)^2$
	–2.10 and 1.43 final answer	**B2**	**B1** for each or for answers –2.1 or –2.097 … and 1.4 or 1.430 to 1.431 or **SC1** for –2.097... **and** 1.43[0] to 1.431 seen in working or for –1.43 **and** 2.10 as final answer
9(b)(iii)	[a =] – 6 [b =] 17	**3**	**B2** for either a correct or b correct or for [a =] –5.04 or –5.049 to –5.05 **and** [b =] 16.9… seen or **M1** for substitution of one of *their* solutions into $9 + 9x - x^2 - x^3$ oe or **SC1** for reversed answers, $a = 17$, $b = -6$
10(a)	20.8 or 20.76 to 20.79	**4**	**B3** for [BC =] 10.4 or 10.38 to 10.39… or $6\sqrt{3}$ oe or **M2** for $(2x)^2 + x^2 + 6^2 = 24^2$ oe or **M1** for $24^2 - 6^2$ oe or $x^2 + 6^2$ oe or $(2x)^2 + 6^2$ oe, or $x^2 + (2x)^2$ oe or **SC2** for final answer of $12\sqrt{5}$ or 26.8 or 26.83… OR **M3** for $x^2 + \left(\frac{x}{2}\right)^2 + 6^2 = 24^2$ oe or **M2** for $x^2 + \left(\frac{x}{2}\right)^2$ or **M1** for $x^2 + 6^2$ oe or $\left(\frac{x}{2}\right)^2 + 6^2$ oe or $24^2 - 6^2$ oe

Question	Answer	Marks	Partial Marks
10(b)	14.5 or 14.47 to 14.48	**3**	**M2** for $\sin[\ldots] = \frac{6}{24}$ oe or **M1** for recognising the correct angle *GAC*