Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2023**

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 May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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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.

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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

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Question	Answer	Marks	Partial Marks
1(a)	111	**3**	**M2** for $180 - \frac{180-42}{2}$ oe or $42 + \frac{180-42}{2}$ oe or **M1** for $\frac{180-42}{2}$ oe
1(b)	150	**3**	**M1** for $k \div (3 + 4 + 5)$ [$\times p$] where $p = 1, 3, 4$ or 5 or $\frac{5}{12}$ oe **B1** for 360 used
1(c)	$\frac{3}{5}$ cao nfww	**4**	**B3** for $\frac{72}{120}$ or **B2** for [d =] 72 or [h =] 120 or **M1** for 360 ÷ 5 oe isw or 180 – (360 ÷ 6) isw or for (6 – 2) × 180 [÷ 6]
1(d)	$x + 2x - 5 + x + 20 + 3x - 40 = 360$	**M1**	Accept equivalent equation e.g. $7x - 25 = 360$
	$7x = 360 + 5 - 20 + 40$ or better	**M1**	**FT** *their* equation, accept e.g. $7x = 385$
	$x = 55$	**B1**	
	55 and 125 or 105 and 75	**B1dep**	**Dep on M1M1B1** Accept 55 + 3 × 55 – 40 = 180 or 2 × 55 – 5 + 55 + 20 = 180 If B0 scored, **SC1** for 55, 75, 105 and 125
	Opposite angles sum to 180 oe [so *PQRS* is a cyclic quadrilateral]	**A1**	**Dep on M1M1B1B1**
1(e)	48.7 or 48.69 to 48.70…	**3**	**M2** for $\frac{360-50}{360} \times 2 \times \pi \times 9$ oe or **M1** for $\frac{50}{360} \times 2 \times \pi \times 9$ oe
2(a)	249.98 to 250[.0…]	**3**	**M2** for 830 – 500 × 1.16 or **M1** for 500 × 1.16 OR **M1** for 830 ÷ 1.16 **M1** for (*their* 715.5… – 500) × 1.16

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Question	Answer	Marks	Partial Marks
2(b)(i)	33.5 or 33.51…	**2**	**M1** for $\frac{12\,400}{37\,000}$ [×100] oe If 0 scored, **SC1** for answer 66.5 or 66.48 to 66.49
2(b)(ii)	38 184 cao	**2**	**M1** for 37 000 × $\left(1+\frac{3.2}{100}\right)$ oe or **B1** for 1184
2(c)(i)	441 or 440.6 or 440.64 to 440.65	**3**	**B2** for answer 3941 or 3940.6 or 3940.64 to 3940.65 or **M2** for 3500 × $\left(1+\frac{2.4}{100}\right)^5$ – 3500 or **M1** for 3500 × $\left(1+\frac{2.4}{100}\right)^5$ oe isw
2(c)(ii)	16	**3**	**B2** for 15[.0] nfww to 15.1 or **M2** for 3500 × $\left(1+\frac{2.4}{100}\right)^{15}$ oe seen or 3500 × $\left(1+\frac{2.4}{100}\right)^{16}$ oe seen or **M1** for (3500 or *their* 3941) × $\left(1+\frac{2.4}{100}\right)^n$ associated with 5000 oe
3(a)(i)	$\frac{(x+3)(2x+5)}{2}=60$	**M1**	Accept $(x + 3)(2x + 5) = 2 \times 60$ or 120 Accept e.g. $(x + 3)(x + 2.5) = 60$ without division by 2 shown for M1 (but not A1)
	$2x^2 + 6x + 5x + 15$ seen	**B1**	Accept $2x^2 + 11x + 15$ seen
	$2x^2 + 11x – 105 = 0$	**A1**	Correct completion after M1B1 with the fraction seen removed with no errors or omissions seen
3(a)(ii)	$(2x + 21)(x – 5)$ [= 0]	**M2**	**M1** for partial factors $2x(x – 5) + 21(x – 5)$ [= 0] or $x(2x + 21) – 5(2x + 21)$ [= 0] OR $(2x + a)(x + b)$ [= 0] where $ab = – 105$ or $2b + a = 11$
	–10.5 and 5	**B1**	

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Question	Answer	Marks	Partial Marks
3(a)(iii)	61.9 or 61.92 to 61.93	**3**	**M2** for tan = $\frac{2 \times \textit{their}\,5 + 5}{\textit{their}\,5 + 3}$ oe or **B1FT** for 2 × *their* 5 + 5 and *their* 5 + 3
3(b)(i)	28.1 or 28.07 to 28.08	**1**	**FT** *their* 90 – *their* **(a)(iii)** unless *their* **(a)(iii)** < 45, in which case FT *their* **(a)(iii)**
3(b)(ii)	10	**3**	**M2** for $(\textit{their}\,5 + 3) \times \sqrt{\frac{93.75}{60}}$ oe or **M1** for $\sqrt{\frac{93.75}{60}}$ or $\sqrt{\frac{60}{93.75}}$ oe seen or $\left(\frac{\textit{their}\,5 + 3}{x}\right)^2 = \frac{60}{93.75}$ oe
4(a)(i)	$1.65 < h \leq 1.8$	**1**	
4(a)(ii)	1.63875	**4**	**M1** for midpoints **soi** **M1** for use of $\sum fh$ with h in correct interval including both boundaries **M1dep on 2nd M1** for $\sum fh \div 80$
4(b)(i)	$\frac{1}{40}$ oe	**1**	
4(b)(ii)	$\frac{63}{395}$ oe	**3**	**M2** for $\frac{56}{80} \times \frac{9}{79}$ [×2] oe or **B1** for $\frac{56}{80}$ or $\frac{9}{79}$ or $\frac{9}{80}$ or $\frac{56}{79}$ oe seen If 0 or B1 scored, instead award **SC2** for answer $\frac{117}{632}$ oe or **SC1** for answer $\frac{63}{400}$ oe
4(c)(i)	15, 39, 71, 80	**2**	**B1** for 3 correct or **M1** for 1 error in addition with other values then consistent

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Question	Answer	Marks	Partial Marks
4(c)(ii)	Correct curve	**3**	**B1** for correct horizontal placement for 5 plots **B1FT** for correct vertical placement for 5 plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 5 points If 0 scored **SC1 FT** for 4 out of 5 points correctly plotted
4(d)(i)	Strict FT *their* UQ – *their* LQ	**2dep**	**B1dep** for *their* UQ or *their* LQ seen Dep on increasing curve/polygon for 2 marks or B1
4(d)(ii)	Strict FT *their* reading at 48	**2dep**	**B1** for 48 written
5(a)(i)	251 or 251.3 to 251.4	**2**	**M1** for $\frac{1}{3}\times\pi\times4^2\times15$ oe
5(a)(ii)	79.5 or 79.51…	**5**	**M3** for $\pi\times4\times\sqrt{4^2+15^2}$ oe or **M2** for $\sqrt{15^2+4^2}$ oe or **M1** for [l^2 =] $4^2 + 15^2$ oe or $\pi\times4\times$ *their* l **M1** for $\frac{\textit{their}\text{ curved surface area}}{\textit{their}\text{ curved surface area}+\pi\times4^2}$ [×100] oe
5(b)(i)	13 min 20 sec	**3**	**B2** for 800 or $\frac{40}{3}$ oe seen or **M1** for figs 3 ÷ figs 375 or figs 3 ÷ 22 500
5(b)(ii)	0.472 or 0.4715 to 0.4716…	**3**	**M2** for $\pi\times0.45^2\times h=0.3$ or $\pi\times45^2\times h=300\,000$ oe or **M1** for $\pi\times\text{figs}45^2\times h=\text{figs}3$ oe
6(a)(i)	$\frac{1}{5}$, $\frac{2}{7}$, $\frac{3}{9}$ final answer	**2**	**B1** for 2 correct terms isw or for 0.2 and (0.286 or 0.2857…) and 0.333…
6(a)(ii)	36	**2**	**M1** for $k=\frac{12(2k+3)}{25}$ or better

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Question	Answer	Marks	Partial Marks
6(b)(i)	$n^3 + 5$ oe final answer	**2**	**B1** for any cubic or common third differences of 6 (at least 2) or for correct answer seen and spoilt
6(b)(ii)	$100 \times 2^{1-n}$ oe final answer	**2**	**B1** for $2^{-n\,[+k]}$ oe or $\left(\frac{1}{2}\right)^{n[+k]}$ oe in answer or for correct answer seen and spoilt
7(a)	Angle $CAB = 52$	**B1**	
	$180 - 52 - \sin^{-1}\left(\frac{60\sin their\,52}{87}\right)$	**M3**	**M2** for $[\sin[...]=]\ \frac{60\sin their 52}{87}$ oe or **M1** for $\frac{60}{\sin B} = \frac{87}{\sin their 52}$ oe
	95.08…	**A1**	
7(b)	77.1 or 77.08 to 77.11	**6**	**B4** for dist travelled = 256.9 to 257[.0…] or **B3** for [AB =] 109.9 to 110[.0…] or **M3** for $60 + 87 + \sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or **M2** for $\sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or $AB^2 = 12093.\ldots$ to $12097.\ldots$ or $\frac{87\sin 95.1}{\sin their 52}$ oe or **M1** for $AB^2 = 60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1$ oe or $\frac{\sin 95.1}{AB} = \frac{\sin their 52}{87}$ oe **M1** for *their* total distance ÷ $3\frac{20}{60}$ oe
8(a)(i)	Correct expansion of a pair of brackets $x^2 - 4x + [1]x - 4$ or $x^2 - 4x - 2x + 8$ or $x^2 + [1]x - 2x - 2$	**M1**	accept $x^2 - 3x - 4$ or $x^2 - 6x + 8$ or $x^2 - [1]x - 2$
	$x^3 - 4x^2 + x^2 - 4x - 2x^2 + 8x - 2x + 8$ leading to and stating $[y =]\ x^3 - 5x^2 + 2x + 8$	**A1**	Accept $x^3 - 3x^2 - 4x - 2x^2 + 6x + 8$ or $x^3 - 6x^2 + [1]\,x^2 + 8x - 6x + 8$ or $x^3 - [1]\,x^2 - 2x - 4x^2 + 4x + 8$ leading to and stating $[y =]\ x^3 - 5x^2 + 2x + 8$

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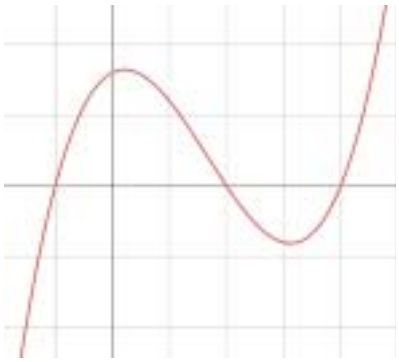
Question	Answer	Marks	Partial Marks
8(a)(ii)	Correct labelled sketch positive cubic Crossing x-axis at –1, 2 and 4 only Crossing y – axis at 8 only 	**4**	**B1** for positive cubic **B2** for three intercepts only with x -axis labelled at – 1, 2 and 4 or **B1** for 1 or 2 correctly labelled x – intercepts **B1** for a single intercept on y-axis labelled at 8 but not if line $y = 8$
8(b)	$3x^2 - 10x - 8$ [= 0]	**M3**	**B2** for derivative = $3x^2 - 10x + 2$ isw OR **B1** for derivative with $3x^2$ or $-10x$ given in expression isw **M1dep on B1** for *their* first derivative = 10
	$x = 4$ and $x = -\frac{2}{3}$	**B1**	
	(4, 0) and $\left(-\frac{2}{3}, \frac{112}{27}\right)$ oe	**B1**	
	[y =] $10x - 40$ and [y =] $10x + \frac{292}{27}$	**B2**	**B1** for each or for two different equations of the form [y =] $10x + c$ (c must be numeric) or for $c = -40$ and $\frac{292}{27}$
9(a)(i)	$27x^6y^{12}$ final answer	**2**	**B1** for two terms correct in answer e.g. $27x^6y^k$ or $27x^ky^{12}$ or kx^6y^{12} or for correct answer seen then spoilt

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Question	Answer	Marks	Partial Marks
9(a)(ii)	$\frac{x^{24}y^{12}}{64}$ final answer	**3**	**B2** for final answer with two correct elements or final answer $\frac{64}{x^{24}y^{12}}$ or $\frac{64^{-1}}{x^{-24}y^{-12}}$ or better or for correct answer seen or **B1** for 64 or x^{24} or y^{12} seen in final answer or final answer $\frac{k}{x^{-24}y^{-12}}$ or **M1** for first correct step seen eg $\left(\frac{x^{16}y^{8}}{16}\right)^{\left[\frac{3}{2}\right]}$ or $\left(\frac{4}{x^{8}y^{4}}\right)^{[-3]}$ or $\left(\frac{4096}{x^{48}y^{24}}\right)^{\left[-\frac{1}{2}\right]}$
9(b)(i)	$(x + 3)(x – 3)$ final answer	**1**	
9(b)(ii)	$\frac{x+3}{2y+5}$ final answer	**3**	**M2** for $(x – 3)(2y + 5)$ or **M1** for $2y(x – 3) + 5(x – 3)$ or $x(2y + 5) – 3(2y + 5)$
9(c)	$5x^2 + 4x – 20$ [= 0] oe or $5y^2 – 78y + 221$ [= 0] oe	**M2**	**M1** for $7 – 2x = 5x^2 + 2x – 13$ oe seen or $y = 5\left(\frac{7-y}{2}\right)^2 + 2\left(\frac{7-y}{2}\right) - 13$ oe seen
	$\frac{-4 \pm \sqrt{(4)^2 - 4(5)(-20)}}{2(5)}$ oe or $-\frac{4}{10} \pm \sqrt{4 + \left(\frac{4}{10}\right)^2}$ oe	**M2**	**FT** *their* 3-term quadratic or **M1** for $\sqrt{(4)^2 - 4(5)(-20)}$ or better or for $\frac{-4+\sqrt{q}}{2\times 5}$ or $\frac{-4-\sqrt{q}}{2\times 5}$ or for $\left(x + \frac{4}{10}\right)^2$ oe
	$x = 1.64$ $y = 3.72$ and $x = – 2.44$ $y = 11.88$	**B2**	**B1** for one correct pair or both x-values correct or both y – values correct

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Question	Answer	Marks	Partial Marks
10(a)	13.9 or 13.85 to 13.86	**4**	**M3** for $2x^2 = 28^2 - 20^2$ or better or $x = \left(\sqrt{28^2 - 20^2}\right)\sin 45$ oe or **M2** for $x^2 + x^2 + 20^2 = 28^2$ oe or $\sin 45 = \dfrac{x}{\sqrt{28^2 - 20^2}}$) or **M1** for any correct Pythag in 2D or *their AC* × sin 45 oe dep on trig/Pythagoras attempt for *AC*
10(b)	51.9 or 51.87 to 51.88	**4**	**M3** for $\sin = \dfrac{29 \text{ to } 30}{37 + 0.5}$ or $\dfrac{30 - 0.5}{37 \text{ to } 38}$ oe or **M2** for correct trig statement for correct angle with values in range 29 to 31 and 36 to 38 or **M1** for 30 + 0.5 or 30 – 0.5 or 37 + 0.5 or 37 – 0.5 seen or for identifying correct angle *RKM*

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