# Cambridge IGCSE™

#### MATHEMATICS

0580/42 May/June 2023

Paper 4 (Extended) 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.

| Ma | 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)     | 111  | 3     | M2 for $180 - \frac{180 - 42}{2}$ oe or $42 + \frac{180 - 42}{2}$ oe<br>or M1 for $\frac{180 - 42}{2}$ oe   |
| 1(b)     | 150  | 3     | M1 for $k \div (3 + 4 + 5) [\times p]$<br>where $p = 1, 3, 4$ or 5<br>or $\frac{5}{12}$ oe<br>B1 for 360 used   |
| 1(c)     | $\frac{3}{5}$ cao nfww   | 4     | <b>B3</b> for $\frac{72}{120}$<br>or <b>B2</b> for $[d = ]$ 72 or $[h = ]$ 120<br>or <b>M1</b> for 360 ÷ 5 oe isw<br>or 180 – (360 ÷ 6) isw<br>or for (6 – 2) × 180 [÷ 6] |
| 1(d)     | x + 2x - 5 + x + 20 + 3x - 40 = 360  | M1    | Accept equivalent equation<br>e.g. $7x - 25 = 360$  |
|          | 7x = 360 + 5 - 20 + 40 or better   | M1    | <b>FT</b> <i>their</i> equation, accept e.g. $7x = 385$   |
|          | <i>x</i> = 55  | B1    |   |
|          | 55 and 125<br>or 105 and 75  | B1dep | Dep on M1M1B1<br>Accept $55 + 3 \times 55 - 40 = 180$<br>or $2 \times 55 - 5 + 55 + 20 = 180$<br>If B0 scored, SC1 for 55, 75, 105 and 125                                |
|          | Opposite angles sum to 180 oe<br>[so <i>PQRS</i> 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<br>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<br>or M1 for 500 × 1.16<br>OR<br>M1 for 830 ÷ 1.16<br>M1 for ( <i>their</i> 715.5 – 500 ) × 1.16  |

| Question | Answer                              | Marks      | Partial Marks   |
|----------|-------------------------------------|------------|---|
| 2(b)(i)  | 33.5 or 33.51                       | 2          | <b>M1</b> for $\frac{12400}{37000}$ [×100] oe   |
|          |                                     |            | If 0 scored, <b>SC1</b> for answer 66.5 or 66.48 to 66.49   |
| 2(b)(ii) | 38 184 cao                          | 2          | <b>M1</b> for 37 000 × $\left(1 + \frac{3.2}{100}\right)$ oe  |
|          |                                     |            | or <b>B1</b> for 1184   |
| 2(c)(i)  | 441 or 440.6<br>or 440.64 to 440.65 | 3          | <b>B2</b> for answer 3941 or 3940.6 or 3940.64 to 3940.65   |
|          |                                     |            | or <b>M2</b> for $3500 \times \left(1 + \frac{2.4}{100}\right)^5 - 3500$  |
|          |                                     |            | or <b>M1</b> for $3500 \times \left(1 + \frac{2.4}{100}\right)^5$ oe isw  |
| 2(c)(ii) | 16                                  | 3          | <b>B2</b> for 15[.0] nfww to 15.1   |
|          |                                     |            | or <b>M2</b> for 3500 × $\left(1 + \frac{2.4}{100}\right)^{13}$ oe seen   |
|          |                                     |            | or $3500 \times \left(1 + \frac{2.4}{100}\right)^{16}$ oe seen  |
|          |                                     |            | or M1 for $(2.4)^n$   |
|          |                                     |            | $(3500 \text{ or } their \ 3941) \times (1 + \frac{1}{100})$  |
| - / > /> |                                     |            | associated with 5000 oe   |
| 3(a)(1)  | $\frac{(x+3)(2x+5)}{2} = 60$        | MI         | Accept $(x + 3)(2x + 5) = 2 \times 60$ or 120<br>Accept e.g. $(x + 3)(x + 2.5) = 60$ without<br>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<br>2x (x-5) + 21(x-5) [= 0]<br>or $x (2x+21) - 5 (2x+21) [= 0]$  |
|          |                                     |            | OR  |
|          |                                     |            | (2x + a)(x + b) [ = 0] where $ab = -105or 2b + a = 11$  |
|          | -10.5 and 5                         | <b>B</b> 1 |   |

| Question  | Answer                      | Marks | Partial Marks  |
|-----------|-----------------------------|-------|--|
| 3(a)(iii) | 61.9 or 61.92 to 61.93      | 3     | <b>M2</b> for $\tan = \frac{2 \times their 5 + 5}{their 5 + 3}$ oe   |
|           |                             |       | or <b>B1FT</b> for $2 \times their 5 + 5$ and <i>their</i> $5 + 3$   |
| 3(b)(i)   | 28.1 or 28.07 to 28.08      | 1     | FT their 90 – their (a)(iii) unless their<br>(a)(iii) < 45, in which case FT their<br>(a)(iii)   |
| 3(b)(ii)  | 10                          | 3     | M2 for $(their 5+3) \times \sqrt{\frac{93.75}{60}}$ oe   |
|           |                             |       | or M1 for $\sqrt{\frac{55776}{60}}$ or $\sqrt{\frac{3577}{93.75}}$ oe seen<br>or $\left(\frac{their5+3}{x}\right)^2 = \frac{60}{93.75}$ oe |
| 4(a)(i)   | $1.65 < h \le 1.8$          | 1     |  |
| 4(a)(ii)  | 1.63875                     | 4     | M1 for midpoints soi   |
|           |                             |       | <b>M1</b> for use of $\sum fh$ with <i>h</i> in correct interval including both boundaries   |
|           |                             |       | <b>M1dep on 2nd M1</b> for $\sum fh \div 80$   |
| 4(b)(i)   | $\frac{1}{40}$ oe           | 1     |  |
| 4(b)(ii)  | $\frac{63}{395} \text{ oe}$ | 3     | <b>M2</b> for $\frac{56}{80} \times \frac{9}{79} [\times 2]$ oe  |
|           |                             |       | or <b>B1</b> 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 <b>SC2</b> for<br>answer $\frac{117}{632}$ oe   |
|           |                             |       | or <b>SC1</b> for answer $\frac{63}{400}$ oe   |
| 4(c)(i)   | 15, 39, 71, 80              | 2     | <b>B1</b> for 3 correct<br>or <b>M1</b> for 1 error in addition with other<br>values then consistent                                       |

| Question | Answer   | Marks | Partial Marks  |
|----------|--|-------|--|
| 4(c)(ii) | Correct curve  | 3     | <ul> <li>B1 for correct horizontal placement for 5 plots</li> <li>B1FT for correct vertical placement for 5 plots</li> <li>B1FT dep on at least B1 for reasonable increasing curve or polygon through <i>their</i> 5 points</li> <li>If 0 scored SC1 FT for 4 out of 5 points correctly plotted</li> </ul> |
| 4(d)(i)  | Strict FT <i>their</i> UQ – <i>their</i> LQ          | 2dep  | <b>B1dep</b> for <i>their</i> UQ or <i>their</i> LQ seen<br>Dep on increasing curve/polygon for 2<br>marks or B1   |
| 4(d)(ii) | Strict FT <i>their</i> reading at 48                 | 2dep  | <b>B1</b> for 48 written   |
| 5(a)(i)  | 251 or 251.3 to 251.4                                | 2     | <b>M1</b> for $\frac{1}{3} \times \pi \times 4^2 \times 15$ oe   |
| 5(a)(ii) | 79.5 or 79.51  | 5     | M3 for $\pi \times 4 \times \sqrt{4^2 + 15^2}$ oe<br>or M2 for $\sqrt{15^2 + 4^2}$ oe<br>or M1 for $[l^2 = ] 4^2 + 15^2$ oe<br>or $\pi \times 4 \times their l$<br>M1 for<br>$\frac{their \text{ curved surface area}}{their \text{ curved surface area} + \pi \times 4^2} [\times 100]$ oe                |
| 5(b)(i)  | 13 min 20 sec  | 3     | <b>B2</b> for 800 or $\frac{40}{3}$ oe seen<br>or <b>M1</b> for figs 3 ÷ figs 375<br>or figs 3 ÷ 22 500  |
| 5(b)(ii) | 0.472 or 0.4715 to 0.4716                            | 3     | <b>M2</b> for $\pi \times 0.45^2 \times h = 0.3$<br>or $\pi \times 45^2 \times h = 300000$ oe<br>or <b>M1</b> 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     | <b>B1</b> for 2 correct terms isw<br>or for 0.2 and (0.286 or 0.2857) and<br>0.333   |
| 6(a)(ii) | 36   | 2     | <b>M1</b> for $k = \frac{12(2k+3)}{25}$ or better  |

| Question | Answer  | Marks | Partial Marks  |
|----------|---|-------|--|
| 6(b)(i)  | $n^3 + 5$ oe final answer   | 2     | <b>B1</b> for any cubic<br>or common third differences of 6<br>(at least 2)<br>or for correct answer seen and spoilt   |
| 6(b)(ii) | $100 \times 2^{1-n}$ oe final answer  | 2     | <b>B1</b> 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    |  |
|          | $180 - 52 - \sin^{-1} \left( \frac{60 \sin t heir 52}{87} \right)$  | М3    | M2 for $[\sin[]=] \frac{60 \sin their 52}{87}$ oe<br>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     | <b>B4</b> for dist travelled = 256.9 to 257[.0]<br>or <b>B3</b> for [ <i>AB</i> =] 109.9 to 110[.0]<br>or <b>M3</b> for<br>$60 + 87 + \sqrt{60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1}$ oe<br>or <b>M2</b> for<br>$\sqrt{60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1}$ oe<br>or <i>AB</i> <sup>2</sup> = 12093 to 12097<br>or $\frac{87\sin 95.1}{\sin their 52}$ oe<br>or <b>M1</b> for<br><i>AB</i> <sup>2</sup> = $60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1$<br>oe<br>or $\frac{\sin 95.1}{AB} = \frac{\sin their 52}{87}$ oe<br><b>M1</b> for <i>their</i> total distance $\div 3\frac{20}{60}$ oe |
| 8(a)(i)  | Correct expansion of a pair of brackets<br>$x^{2} - 4x + [1]x - 4$<br>or $x^{2} - 4x - 2x + 8$<br>or $x^{2} + [1]x - 2x - 2$<br>$x^{3} - 4x^{2} + x^{2} - 4x - 2x^{2} + 8x - 2x + 8$<br>leading to and stating<br>$[y = ]x^{3} - 5x^{2} + 2x + 8$ | M1    | accept<br>$x^2 - 3x - 4$<br>or $x^2 - 6x + 8$<br>or $x^2 - [1]x - 2$<br>Accept<br>$x^3 - 3x^2 - 4x - 2x^2 + 6x + 8$<br>or $x^3 - 6x^2 + [1]x^2 + 8x - 6x + 8$<br>or $x^3 - [1]x^2 - 2x - 4x^2 + 4x + 8$<br>leading to and stating<br>$[y = ]x^3 - 5x^2 + 2x + 8$   |

| Question | Answer   | Marks | Partial Marks  |
|----------|--|-------|--|
| 8(a)(ii) | Correct labelled sketch<br>positive cubic<br>Crossing x-axis at $-1$ , 2 and 4 only<br>Crossing y – axis at 8 only | 4     |  |
|          |  |       | <b>B1</b> for positive cubic<br><b>B2</b> for three intercepts only with $x$ -axis<br>labelled at $-1$ , 2 and 4   |
|          |  |       | or <b>B1</b> for 1 or 2 correctly labelled<br>x – intercepts<br><b>B1</b> for a single intercept on <i>y</i> -axis labelled<br>at 8 but not if line $y = 8$  |
| 8(b)     | $3x^2 - 10x - 8 = 0$   | М3    | <b>B2</b> for derivative = $3x^2 - 10x + 2$ isw<br>OR<br><b>B1</b> for derivative with $3x^2$ or $-10x$ given<br>in expression isw<br><b>M1dep on B1</b> for <i>their</i> first derivative =<br>10 |
|          | $x = 4 \text{ and } x = -\frac{2}{3}$  | B1    |  |
|          | (4, 0) and $\left(-\frac{2}{3}, \frac{112}{27}\right)$ oe  | B1    |  |
|          | [y =] 10x - 40<br>and<br>$[y =] 10x + \frac{292}{27}$  | B2    | B1 for each<br>or for two different equations of the form<br>[y = ] 10x + c ( <i>c</i> must be numeric)<br>or for $c = -40$ and $\frac{292}{27}$   |
| 9(a)(i)  | $27x^6y^{12}$ final answer   | 2     | <b>B1</b> 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  |

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

| 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<br>or $x = (\sqrt{28^2 - 20^2}) \sin 45$ oe<br>or M2 for $x^2 + x^2 + 20^2 = 28^2$ oe<br>or $\sin 45 = \frac{x}{\sqrt{28^2 - 20^2}}$<br>or M1 for any correct Pythag in 2D<br>or <i>their</i> AC × sin 45 oe dep on<br>trig/Pythagoras attempt for AC                          |
| 10(b)    | 51.9 or 51.87 to 51.88 | 4     | M3 for sin = $\frac{29 \text{ to } 30}{37 + 0.5}$ or $\frac{30 - 0.5}{37 \text{ to } 38}$ oe<br>or M2 for correct trig statement for<br>correct angle with values in range 29 to 31<br>and 36 to 38<br>or M1 for 30 + 0.5 or 30 - 0.5 or 37 + 0.5<br>or 37 - 0.5 seen<br>or for identifying correct angle <i>RKM</i> |