Cambridge Assessment International Education

# Cambridge IGCSE™

**MATHEMATICS** **0580/43**

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.

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

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.



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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).

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|---|
| GENERIC MARKING PRINCIPLE 6:<br><br>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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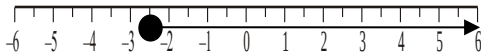
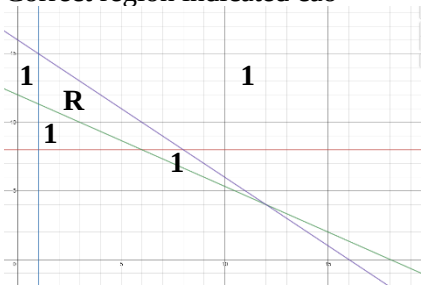
| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 1(a)(i) | 60.9 or 60.86 to 60.87 | **1** | |
| 1(a)(ii) | 375 | **2** | **M1** for $\frac{250}{12}$ [× 18] oe |
| 1(a)(iii) | 30 nfww | **3** | **M1** for figs2200 ÷ 800 [× 12]oe<br>**M1** for 1500 ÷ 600 [× 12] oe |
| 1(b)(i) | 1.92 | **2** | **M1** for $k \times \left(1+\frac{25}{100}\right) = 2.4[0]$ oe or better |
| 1(b)(ii) | 43.75 or $43\frac{3}{4}$ | **3** | **M2** for $\left(\left(1+\frac{25}{100}\right)\times\left(1+\frac{15}{100}\right)[-1]\right)[\times 100]$ oe<br>or $\left(1+\frac{25}{100}\right)\times\left(1+\frac{15}{100}\right)\times 100\,[-100]$<br>or for $\frac{2.40\times\left(1+\frac{15}{100}\right)}{\textit{their}\textbf{(b)(i)}}\times 100$ [– 100] oe<br>or **M1** for $2.40\times\left(1+\frac{15}{100}\right)$ or $\left(1+\frac{25}{100}\right)\times\left(1+\frac{15}{100}\right)$ oe |
| 1(c) | 18 nfww | **3** | **M2** for $\frac{200 \text{ to } 210}{11.5-0.25}$ or $\frac{200+5}{11 \text{ to } 11.5}$ oe<br>or<br>**M1** for 200 + 5, 200 – 5, 11.5 + 0.25 or 11.5 – 0.25 |

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| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 2(a)(i) | $p^{14}$ final answer | **1** | |
| 2(a)(ii) | $6m^4$ final answer | **2** | **B1** for $6m^k$ or $km^4$ in final answer or correct answer seen and spoilt |
| 2(a)(iii) | $\frac{4}{3x^3y^9}$ or $\frac{4x^{-3}y^{-9}}{3}$ final answer | **3** | **B2** for correct answer seen and spoilt<br>or 2 correct elements in final answer<br>or **B1** for one of $\frac{4}{3}$ or $\frac{3}{4}$ oe or $\boldsymbol{x^3}$ **or** $\boldsymbol{y^9}$ seen |
| 2(b) | 3, 12, 27 | **2** | **B1** for 12 or 27 |
| 2(c)(i) | $3n + 10$ oe final answer | **2** | **B1** for $3n + k$ oe or $jn + 10$ oe ($j \neq 0$)<br>or for correct expression shown in working and then spoilt |
| 2(c)(ii) | $2n^3 + 1$ oe final answer | **2** | **B1** for 3rd diff = 12 (both needed) or for cubic answer<br>or for correct expression shown in working and then spoilt |
| 2(d) | 38 | **3** | **M2** for $3x = 4 \times 23 + 22$<br>or **M1** for $3x - 22 = 4 \times 23$<br>or for $\frac{3x}{4} = 23 + \frac{22}{4}$ oe |
| 2(e) | $\frac{-8 \pm \sqrt{8^2 - 4(3)(-20)}}{2 \times 3}$<br>or $\frac{-8}{2\times3} \pm \sqrt{\frac{8^2}{4\times3^2} - \frac{(-20)}{3}}$<br>or better | **B2** | **B1** for $\sqrt{8^2 - 4(3)(-20)}$ oe<br>or $\frac{-8+\sqrt{q}}{2\times3}$ oe or $\frac{-8-\sqrt{q}}{2\times3}$ oe or both |
| | – 4.24, 1.57 final answers | **B2** | **B1** for each<br>If **B0, SC1** for answers – 4.2 or –4.23 or –4.240 to – 4.239 **and** 1.6 or 1.572 to 1.573<br>or – 4.24 **and** 1.57 seen in working<br>or for –1.57 and 4.24 as final answer |

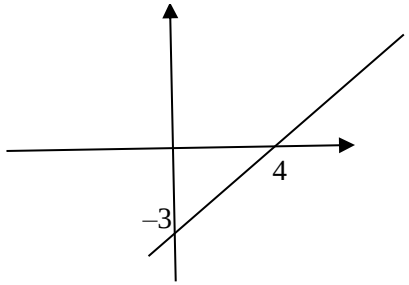
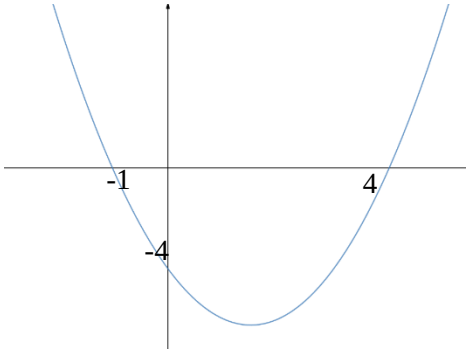
| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 3(a) | Correct histogram | **3** | **B1** for each correct block<br>If 0 scored, **SC1** for two of $\frac{28}{15}$, $\frac{33}{20}$, $\frac{13}{10}$ or 1.87 or 1.866 to 1.867, 1.65, 1.3 |
| 3(b) | 38.65 | **4** | **M1** for 12.5, 20, 32.5, 50, 65 soi<br>**M1** for $\sum fx$ where $x$ is in the correct interval including boundaries<br><br>**M1dep** for $\sum fx \div 100$ |
| 4(a) | Triangle drawn at (1, – 5), (1, – 7), (5, – 5) | **2** | **B1** for reflection in any horizontal line<br>If 0 scored, **SC1** for reflection in $x = -2$ |
| 4(b) | Triangle drawn at (– 2, 0), (– 2, – 1), (0, – 1) | **2** | **B1** for correct size and orientation but wrong position |
| 4(c) | Rotation<br><br>90 [anticlockwise] oe<br><br>[centre] (– 1, 0) | **3** | **B1** for each |

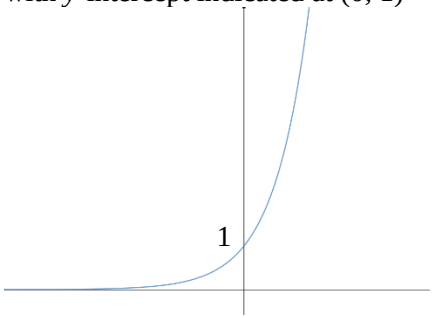
| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 5(a) | $\left(\frac{(36+50)\times 40}{2}\right)\times 120$ oe<br>or<br>$\left(\frac{(0.36+0.5)\times 0.4}{2}\right)\times 1.2$ oe | **M2** | **M1** for $\frac{(36+50)\times 40}{2}$ oe or $\frac{(0.36+0.5)\times 0.4}{2}$ oe |
| | 206400 ÷ 1000 = 206.4<br>or 0.2064 × 1000 = 206.4 nfww | **A1** | Must see an explicit conversion |
| 5(b) | 5 [minutes] 44 seconds | **3** | **B2** for 344 [seconds] oe 5.73…[mins]<br>or **M1** for figs206.4 ÷ figs 6 oe |
| 5(c)(i) | 28[.0] or 27.96 to 27.97 | **3** | **M2** for $[r^2=]\ \frac{\text{figs } 2064}{(\textit{figs}84)\pi}$<br>or **M1** for $\pi r^2 \times \textit{figs}84 = \text{figs } 2064$ |
| 5(c)(ii) | 140 cao | **2** | **M1** for $0.6h = 84$ oe<br>ALT method<br>**M1** for $\pi\times(\textit{their}$ **(c)(i)**$)^2\times h = \textit{figs}206400\div 0.6$ oe |
| 5(d) | 128 or 127.7 to 127.8 | **4** | **B3** for $40^2+120^2+18^2$ oe<br>OR<br>**B1** for horizontal length 18 soi<br>**M1** for any correct attempt at 2-dimensional Pythagoras'<br>$18^2 + 120^2$, $120^2 + 40^2$, $18^2 + 40^2$ |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 6(a)(i) | 38 | **2** | **M1** for $5 \times 3^2 - 7$ oe |
| 6(a)(ii) | $[\pm]\sqrt{\frac{P+7}{5}}$ oe final answer | **3** | **M1** for $P + 7 = 5k^2$ or $\frac{P}{5} = k^2 - \frac{7}{5}$<br>**M1** for $k^2$ = ……. FT *their* first step<br>**M1** for square root to final answer<br>Max M2 for incorrect answer |
| 6(b)(i) | $x \geqslant -2.5$ final answer | **2** | **M1** for $-4x \leqslant 7 + 3$ or better |
| 6(b)(ii) |  | **1** | **FT** *their* inequality in **(b)(i)** |
| 6(c)(i) | $x = 2$ broken line | **B1** | |
| | $y = 32 - x$ solid line | **B1** | |
| | $2x + 3y = 72$ solid line | **B2** | **B1** for line passing through (0, 24) or (36, 0) |
| | Correct region indicated cao<br> | **B2** | **B1** for region satisfying 3 of the inequalities |
| 6(c)(ii) | (16, 16) | **2** | **M1** for substitution into $2x + y$ for any integer point in *their* region |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 7(a)(i) | $\frac{1}{15}$ oe | **3** | **M2** for $2\times\frac{1}{6}\times\frac{1}{5}$ oe<br>or **M1** for $\frac{1}{6}\times\frac{1}{5}$ oe<br>or list or indication of 2 correct pairs<br><br>If 0 scored, **SC1** for answer $\frac{1}{18}$ oe |
| 7(a)(ii) | $\frac{7}{15}$ oe | **3** | **M2** for $\left(\frac{4}{6}\times\frac{3}{5}\right)+2\left(\frac{1}{6}\times\frac{1}{5}\right)$ oe or $14\left(\frac{1}{6}\times\frac{1}{5}\right)$ oe<br>or $1-2\left(\frac{2}{6}\times\frac{4}{5}\right)$<br><br>or **M1** for $\left(\frac{4}{6}\times\frac{3}{5}\right)$ or $2\left(\frac{1}{6}\times\frac{1}{5}\right)$ oe or $2\left(\frac{2}{6}\times\frac{4}{5}\right)$<br>or correct identification of 14 pairs<br>If 0 scored, **SC1** for answer $\frac{5}{9}$ |
| 7(b) | $\frac{1}{10}$ oe nfww | **4** | **M3** for $6\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)+6\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ oe<br>or **M2** for $6\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ oe or $2\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ oe<br>or **M1** for $k\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ where $k$ is an integer and $1 \leqslant k \leqslant 12$ but not $k = 2$ or $k = 6$<br>or identifies –2, 2 and 5 or –3, 3 and 5 as the 3 cards needed<br><br>If 0 scored, **SC1** for answer $\frac{1}{18}$ |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 8(a) | [cos $B$ = ] $\frac{9.5^2 + 7.7^2 - 10^2}{2 \times 9.5 \times 7.7}$ oe | **M2** | **M1** for $10^2 = 9.5^2 + 7.7^2 - 2 \times 9.5 \times 7.7 \cos B$ oe or better |
| | 70.206 to 70.207 or 70.21 to 70.22 | **A2** | **A1** for $\frac{2477}{7315}$ oe or 0.339 or 0.3386…. |
| 8(b)(i) | 140.4 | **1** | |
| 8(b)(ii) | 19.8 | **1** | **FT** (180 – *their* **(b)(i)**) ÷ 2 |
| 8(b)(iii) | 70.2 | **1** | **FT** 90 – *their* **(b)(ii)** |
| 8(c) | 5.31 or 5.314 to 5.315 | **3** | **M2** for $\frac{5}{\cos \textit{ their}\,\textbf{(b)(ii)}}$ oe<br>or **M1** for $\frac{5}{r} = \cos(\textit{their}\,\textbf{(b)(ii)})$ oe |
| 8(d) | 38.8 or 38.9 or 38.78 to 38.85 | **4** | **M3** for $\frac{0.5 \times 9.5 \times 7.7 \times \sin 70.2}{\pi \times (\textit{their}\,\textbf{(c)})^2}$ [×100]<br>OR<br>**M1** for 0.5 × 9.5 × 7.7 × sin70.2<br>**M1** for $\pi \times (\textit{their}\,\textbf{(c)})^2$ |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 9(a)(i) | Correct sketch of $3x - 4y = 12$ with $y = -3$ and $x = 4$ indicated on axes<br><br> | **2** | **B1** for line with positive gradient |
| 9(a)(ii) | Correct sketch of $y = x^2 - 3x - 4$ with (0, – 4) indicated as $y$ – intercept and $x = -1$ and $x = 4$ indicated as roots<br><br><br>Minimum in fourth quadrant, not at $x = 0$ | **4** | **B3** for correct sketch with one value omitted or incorrect or for a poor sketch with all 3 intercepts correct.<br>or **B2** for roots $x = -1$ and $x = 4$ soi with no extra roots<br>or for correct shape with $y = -4$ indicated<br>or **B1** for correct shape<br>or for $(x - 4)(x + 1)$ shown<br>or for incorrect sketch with (0, – 4 ) indicated as $y$ – intercept |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 9(a)(iii) | Correct sketch of $y = 6^x$<br>with $y$-intercept indicated at (0, 1)<br><br> | **2** | **B1** for increasing exponential graph seen on both sides of the $y$-axis. |
| 9(b)(i) | $8 - 4x^2$ [+ 0] | **2** | **B1** for two terms correct and one extra incorrect term or for one of two terms correct or for correct answer seen and spoilt |
| 9(b)(ii) | 4 | **2** | **M1** for substitution of $x = -1$ into *their* **(b)(i)** |
| 9(b)(iii) | (3, –7) and (–3, 17) | **5** | **B4** for (3, –7) or (–3, 17)<br>or **B3** for $x = \pm 3$<br>or **M2** for $x^2 = 9$ or $k(x - 3)(x + 3) = 0$ oe<br>or for correct method for solving *their* **(b)(i)** = – 28<br>or **M1** for *their* **(b)(i)** = – 28 |

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| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 10(a)(i) | 2**a** drawn correctly with direction arrow | **1** | |
| 10(a)(ii) | **a** − **b** drawn correctly with direction arrow | **2** | **B1** for $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$ seen or implied<br>or **M1** for correctly drawing *their* **a** – **b** with an arrow |
| 10(b)(i)(a) | $\mathbf{q} + \frac{3}{4}\mathbf{p}$ final answer | **1** | |
| 10(b)(i)(b) | $\mathbf{q} - \frac{1}{4}\mathbf{p}$ final answer | **2** | **M1** for a correct route |
| 10(b)(i)(c) | $\frac{13}{24}\mathbf{p} - \frac{2}{3}\mathbf{q}$ final answer | **3** | **M2** for $\frac{3}{8}\mathbf{p} - \frac{2}{3}$ (*their* **(b)(i)(b)**) oe<br>or for $-\frac{3}{8}\mathbf{p} - \mathbf{q} + \mathbf{p} + \frac{1}{3}$ (*their* **(b)(i)(b)**) oe<br><br>or **M1** for a correct route or for<br>$[\overrightarrow{BN} =] -\frac{2}{3}$ (*their* **(b)(i)(b)**)<br>or $[\overrightarrow{AN} =] \frac{1}{3}$ (*their* **(b)(i)(b)**)<br>or final answer $k\mathbf{p} - \frac{2}{3}\mathbf{q}$ oe or $\frac{13}{24}\mathbf{p} - k\mathbf{q}$ oe |
| 10(b)(ii) | $\frac{19}{16}\mathbf{p}$ oe final answer | **2** | **M1** for $\overrightarrow{AG} = \frac{3}{8}\mathbf{p} \div 2$ soi<br>or for answer $k\mathbf{p}$ oe |

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