Cambridge Assessment International Education

# Cambridge IGCSE™ (9–1)

**MATHEMATICS** **0980/42**

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.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.





**[Turn over**

## 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.

| 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

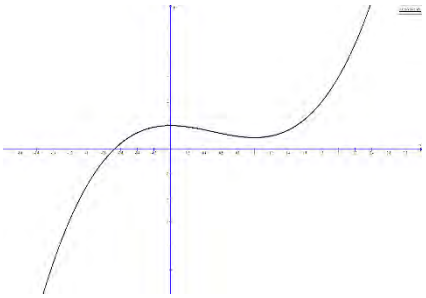
| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 1(a) | 150 | **2** | **B1** for answer 150*k*<br><br>or **M1** for prime factors of 30 or 75 seen<br>or a list of multiples of both 30 and 75 with at least 3 of each<br>or for $\frac{30\times75}{15}$ oe<br>or for answer $2\times3\times5^2$ |
| 1(b) | 152<br><br>190<br><br>266 | **3** | Accept in any order<br>**B2** for two correct answers<br>or **M1** for $\frac{608}{4+5+7}\times k$ oe where $k$ =1, 4, 5, 7 |
| 1(c) | $2.61\times10^{-2}$ $2.61\times10^{-2}$ or $2.608\ldots\times10^{-2}$ | **2** | **B1** for figs 2608 or 261 seen<br><br>If 0 scored, **SC1** for answer $2.6[0]\times10^{-2}$ without more accurate value in standard form seen |
| 1(d) | $\frac{27}{99}$ oe fraction | **1** | |
| 1(e) | 2.8 | **1** | |
| | $g/cm^3$ or $g\ cm^{-3}$ | **1** | |
| 2(a) | *PQR* = 90 angle in semi-circle | **B1** | |
| | *PRQ* = 61 angle sum of triangle [= 180] | **B1** | |
| | *PSQ* = 61 angle in same segment | **B1** | If 0 scored **SC1** for *PSQ* = *PRQ* [= 61] soi |
| 2(b) | 57 | **4** | **B1** for *ABT* = 98<br><br>**B1** for *TAB* or *ATB* = 41<br><br>**B1** for *BTC* = 41 or *TBC* = 82 or *ATC* =82 soi |
| 3(a) | 8.25 or 8.246… | **3** | **M2** for $(3--5)^2+(2-4)^2$ oe or better<br>or **M1** for $(3--5)$ and $(2-4)$ oe seen |
| 3(b) | $[y=]\ 4x+7$ | **5** | **B1** for [midpoint] (− 1, 3) soi<br>**M1** for [gradient of *l* =] $\frac{4-2}{-5-3}$ oe<br>**M1** for gradient $-1$ / *their* $\left(-\frac{1}{4}\right)$<br>**M1dep on at least M1** for *their* (− 1, 3) substituted into *y* = *their m* × *x* + *c* oe |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 3(c) | (0, − 8) and (0, 16) | **4** | **B3** for (0, −8) or (0, 16) or for –8 and 16<br>OR<br>**B2** for distance = [±]12 soi<br>or **M1** for $13^2 - (5[-0])^2$ oe<br>**B1** for both answers (0, *k*), $k \neq 0$ or 4<br><br>**ALT METHOD**<br>**B3** for (0, −8) or (0 , 16) or for – 8 and 16<br>OR<br>**M2** for $y^2 - 8y - 128$ [= 0]<br>or for $(y - 4)^2 = 144$ or better<br>or **M1** for $13^2 = (-5 - 0)^2 + (4 - y)^2$ oe<br><br>**B1** for both answers (0, *k*), $k \neq 0$ or 4 |
| 4(a) | 7.06 or 7.058… or 7.059 | **3** | **M2** for $\sqrt{6.4^2 + 10.9^2 - 2 \times 6.4 \times 10.9 \times \cos 38}$ oe<br><br>OR<br>**M1** for $6.4^2 + 10.9^2 - 2 \times 6.4 \times 10.9 \times \cos 38$ oe<br><br>**A1**= 49.8... |
| 4(b)(i) | 97 | **1** | |
| 4(b)(ii) | 15.3[0…] | **3** | **M2** for [*AB* =] $\frac{10.9 \times \sin \textit{their } 97}{\sin 45}$<br>or **M1** for $\frac{\sin \textit{their } 97}{AB} = \frac{\sin 45}{10.9}$ oe |
| 4(c) | 72.8 to 72.81… | **3** | **M2** for<br>$\frac{1}{2}(6.4) \times 10.9 \times \sin 38 + \frac{1}{2}\textit{their } 15.3 \times 10.9 \times \sin 38$<br>oe<br>or **M1** for $\frac{1}{2} \times 6.4 \times 10.9 \times \sin 38$ oe<br>or $\frac{1}{2} \times \textit{their} 15.3 \times 10.9 \times \sin 38$ oe<br>or **M1** for height =10.9 × sin38 oe |
| 5(a) | Correct lines drawn | **2** | **B1** for one correct with no incorrect lines |
| 5(b)(i)(a) | Translation or translate<br><br>$\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ oe | **2** | **B1** for each |
| 5(b)(i)(b) | Rotation or rotate<br><br>90 [anticlockwise] oe<br><br>[centre] (2, 1) | **3** | **B1** for each |
| 5(b)(ii)(a) | Triangle at (– 5, 6) (– 2, 6) (– 2, 5) | **2** | **B1** for reflection in $y = k$ |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 5(b)(ii)(b) | Triangle at (1, 5) (1, 7) (7, 7) | **2** | **B1** for correct size and orientation, wrong position |
| 6(a) | 42 028 | **2** | **M1** for $\frac{380}{500}$ oe soi isw |
| 6(b) | $\frac{47}{66}$ oe | **4** | 0.712[1…]<br>**M3** for $2\left(\frac{5}{12}\times\frac{4}{11}\right)+2\left(\frac{4}{12}\times\frac{3}{11}\right)+2\left(\frac{5}{12}\times\frac{3}{11}\right)$ oe<br>or $1-\left(\frac{5}{12}\times\frac{4}{11}+\frac{4}{12}\times\frac{3}{11}+\frac{3}{12}\times\frac{2}{11}\right)$ oe<br>or **M2** for sum of 3 or more correct product pairs and no incorrect pairs<br>or for $\frac{5}{12}\times\frac{4}{11}+\frac{4}{12}\times\frac{3}{11}+\frac{3}{12}\times\frac{2}{11}$ and no other pairs<br>or **M1** for $\frac{k}{12}\times\frac{j}{11}$ seen<br>If 0 scored **SC1** for answer $\frac{94}{144}$ oe |
| 6(c) | 52 | **2** | **M1** for $x\times\frac{100-16}{100}=43.68$ oe or better |
| 6(d)(i) | 70 or 70.16[5…] or 70.17 or 70.2 | **3** | **M2** for $\frac{29750 \text{ to } 29800}{400+25}$ or $\frac{29750 \text{ to } 29800}{400+24}$ or $\frac{29800-50}{400 \text{ to } 425}$<br>or **B1** for 29 750 or 29 850 or 29 849 or 375 or 425 or 424 seen |
| 6(d)(ii) | 2399<br>or 2400 nfww | **2** | **B1** for 27 450 or 27 550 or 27 549 or 29 850 or 29 849 seen |
| 7(a) | 25.2 or 25.23… | **4** | **M1** for midpoints **soi**<br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries<br>**M1** (**dep** on 2nd M1) for $\sum fx \div 150$ |
| 7(b) | 5 correct blocks | **4** | **B3** for 4 correct blocks<br>or **B2** for 3 correct blocks<br>or **B1** for 2 correct blocks<br>or block widths 10, 10, 5, 15, 10<br>If 0 scored **SC1** for 4 correct frequency densities from 1.2, 3.8, 6.4, 3.33[3…] and 1.8 oe soi |
| 7(c)(i) | 12, 50, 82, 132, 150 | **2** | **B1** for 3 or 4 correct |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 7(c)(ii) | 92 | **2** | **M1** for 150 −12 oe seen<br>If 0 scored, **SC1** for answer 8[%] |
| 8(a) | $\frac{1}{2}$ or 0.5 oe | **2** | **M1** for $10-3=11p+3p$ oe or better |
| 8(b) | $[m=]\frac{2k}{c^2-g}$ oe final answer | **3** | **M1** for correctly isolating *m* terms<br>**M1** for correctly factorising<br>**M1** for dividing by a bracket with two terms to the final answer<br>Maximum mark **M2** if final answer incorrect |
| 8(c) | 0 4.5 oe | **5** | **B4** for $2x^2-9x\,[=0]$ or $9x-2x^2\,[=0]$ or better<br>OR<br>**M2** for $(2x+3)+4(x-3)=(x-3)(2x+3)$ or better<br>or **M1** for $(2x+3)+4(x-3)$ seen oe<br>or common denominator $(x-3)(2x+3)$ oe<br>**B1** for $2x^2-6x+3x-9$ or better seen |
| 8(d) | $y^2-10y+21[=0]$ or<br>$x^2-4x-12[=0]$ | **M2** | **M1** for $y^2+5(12-2y)=39$ oe<br>or $5x+\frac{(12-x)^2}{2^2}=39$ seen oe |
| | $(y-3)(y-7)\,[=0]$<br>or $(x+2)(x-6)\,[=0]$ | **M1** | or for correct factors for *their* 3– term quadratic equation<br><br>or for correct substitution into quadratic formula or correctly completing the square for *their* 3–term quadratic equation |
| | $x=-2$ $y=7$<br><br>$x=6$ $y=3$ | **B2** | **B1** for $x=-2$, $x=6$<br>or for $y=7$, $y=3$<br>or for one correct pair of *x* and *y* values |
| 8(e) | $2x^3+x^2-54x+72$ final answer | **3** | **B2** correct expansion of three brackets unsimplified<br>or for final answer of correct form with 3 out of 4 terms correct<br><br>or **B1** correct expansion of two brackets with at least three terms out of four correct |
| 9(a) | *PMR* = *MSR* = right angle[s] or 90° | **B1** | |
| | *PRM* = *MRS* same angle | **B1** | |
| | AAA oe<br><br>OR<br>*MPR* = *SMR* 3rd angle of triangle | **B1** | **Dep** on B1B1 and no errors seen |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 9(b)(i) | 5.5 | **2** | **M1** for $\frac{x}{4.5}=\frac{9.9}{8.1}$ oe |
| 9(b)(ii) | 16.7 or 16.73 to 16.74 | **2** | **M1** for $25\times\left(\frac{8.1}{9.9}\right)^2$ oe<br>or $25\times\left(\frac{4.5}{their\ 5.5}\right)^2$ oe |
| 10(a) | 1, 2, 3 | **2** | **M1** for $15-8>5n-3n$ oe<br><br>If 0 scored, **B1** for 2 correct answers and no others<br>or 3 correct answers with one extra value |
| 10(b)(i) | $10y + 8x \leqslant 80$ oe final answer<br>$x > 4$ oe final answer<br>$2y > x - 4$ oe final answer | **3** | **B1** for each<br><br>If 0 scored, **SC1** for<br>$10y + 8x < 80$ oe final answer<br>and<br>$x \geqslant 4$ oe final answer<br>and<br>$2y \geqslant x - 4$ oe final answer |
| 10(b)(ii) | 23 final answer | **2** | **M1** for 7 and 2 selected soi |
| 11(a)(i) | 4.455 to 4.456… [= 4.46] | **2** | **M1** for [$r$ =] $\frac{28}{2\pi}$ oe |
| 11(a)(ii) | 1250 or 1247 to 1249.9… | **2** | **M1** for $20\times\pi\times4.46^2$ oe |
| 11(a)(iii) | 66[.0] or 65.95 to 66.02 | **3** | **M2** for [tan] = $\frac{20}{2\times4.46}$ oe<br>or **B1** for identifying angle *ANB* on cylinder **not on rectangle** |
| 11(b) | 11.8 or 11.82 to 11.83 | **5** | **M2** for $[r=]\sqrt[3]{\frac{310\times3}{2\pi}}$ oe<br>or $[h=]\sqrt[3]{\frac{310\times3\times4}{\pi}}$ oe<br>or **M1** for $310=\frac{1}{3}\pi\times r^2\times2r$<br>or $310=\frac{1}{3}\pi\left(\frac{h}{2}\right)^2 h$<br>**M2** for $\sqrt{(their\ r)^2+\left(2\times their\ r\right)^2}$ oe<br>or **M1** for $[l^2=]\left(their\ r\right)^2+\left(2\times their\ r\right)^2$ oe |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 12(a) | $3x^2 - 2kx$ | **M2** | **M1** for $3x^2$ or $-2kx$ |
| | *their* $\frac{dy}{dx} = 6$ | **M1** | Dep on at least M1 for derivative |
| | $x = 2$ substituted in *their* $\frac{dy}{dx}$ | **M1** | Dep on at least M1 for derivative |
| | Correct working leading to 1.5 oe | **A1** | A0 if any errors in working leading to 1.5 |
| 12(b) | ( 0, 1) ( 1, 0.5) | **4** | **B3** for $x = 0$ and $x = 1$ or for (1, 0.5)<br>OR<br>**M1** for *their* $\frac{dy}{dx} = 0$<br>**B1** for $3x^2 - 3x$ oe or better |
| 12(c) | correct sketch<br>  | **2** | with max on positive $y$-axis and min in 1st quadrant<br>**B1** for positive cubic<br>or for graph with one max which is on pos $y$-axis and one min which is in 1st quadrant |