



Cambridge IGCSE™

MATHEMATICS (US)

0444/43

Paper 4 (Extended)

October/November 2020

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 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **9** printed pages.

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)(i) | Triangle at $(-3, 2)$ $(-3, 3)$ $(-5, 2)$ | 2 | B1 for correct rotation about incorrect point or for rotation 90 clockwise around $(0, 0)$ |
| 1(a)(ii) | Triangle at $(5, -2)$ $(6, -2)$ $(5, 0)$ | 2 | B1 for translation by $\begin{pmatrix} 3 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$ |
| 1(b) | Enlargement [SF] 3 [Centre] $(1, 4)$ | 3 | B1 for each |
| 2(a)(i) | $5.101[00\dots] \times 10^8$ final answer | 1 | |
| 2(a)(ii) | 361 150 800 oe | 2 | FT <i>their</i> (a)(i) M1 for $\frac{70.8}{100} \times 510\,100\,000$ or for $\frac{70.8}{100} \times \text{their a(i)}$ |
| 2(b)(i) | 6070 oe | 1 | |
| 2(b)(ii) | 32 000 oe | 2 | B1 for figs 32 |
| 2(b)(iii) | 6.68 or 6.677 ... | 2 | M1 for $\frac{6.41 \times 10^5}{9.6[0] \times 10^6} [\times 100]$ oe |
| 2(b)(iv) | 1250 or 1248 to 1249 oe | 2 | B1 for figs 125 or figs 1248 to figs 1249 |
| 2(c)(i) | 25.1 or 25.08... | 2 | M1 for $\frac{7.53[\times 10^9] - 6.02[\times 10^9]}{6.02[\times 10^9]}$ oe or $\frac{7.53[\times 10^9]}{6.02[\times 10^9]} \times 100$ |
| 2(c)(ii) | 1.33 or 1.325... | 3 | M2 for $\sqrt[17]{\frac{7.53[\times 10^9]}{6.02[\times 10^9]}}$ or $\sqrt[17]{1 + \frac{\text{their}(c)(i)}{100}}$ or M1 for $6.02[\times 10^9] \times p^{17} = 7.53[\times 10^9]$ or $p^{17} = 1 + \frac{\text{their}(c)(i)}{100}$ |
| 3(a)(i) | $\frac{1}{11}$ oe | 1 | |

| Question | Answer | Marks | Partial Marks |
|-----------|--|-----------|---|
| 3(a)(ii) | $\frac{1}{110}$ oe | 2 | M1 for $\frac{1}{11} \times \frac{1}{10}$ oe |
| 3(a)(iii) | $\frac{4}{55}$ oe | 3 | M2 for $\left(\frac{2}{11} \times \frac{1}{10}\right) + \left(\frac{3}{11} \times \frac{2}{10}\right)$ oe or M1 for $\left(\frac{2}{11} \times \frac{1}{10}\right)$ or $\left(\frac{3}{11} \times \frac{2}{10}\right)$ seen oe |
| 3(b)(i) | $\frac{1}{165}$ oe | 2 | M1 for $\frac{3}{11} \times \frac{2}{10} \times \frac{1}{9}$ oe |
| 3(b)(ii) | $\frac{1}{5}$ oe | 5 | M4 for $3\left(\frac{2}{11} \times \frac{1}{10} \times \left[\frac{9}{9}\right]\right) + 3\left(\frac{3}{11} \times \frac{2}{10} \times \frac{8}{9}\right)$ oe or M3 for $3\left(\frac{3}{11} \times \frac{2}{10} \times \frac{8}{9}\right)$ or M2 for $3\left(\frac{2}{11} \times \frac{1}{10} \times \left[\frac{9}{9}\right]\right)$ or $\frac{3}{11} \times \frac{2}{10} \times \frac{8}{9}$ oe or M1 for $\frac{2}{11} \times \frac{1}{10} \times \left[\frac{k}{9}\right]$ where k is 3, 6 or 9 |
| 3(b)(iii) | $\frac{131}{165}$ oe | 2 | M1 for $1 - (\text{their (b)(i)} + \text{their(b)(ii)})$ oe |
| 4(a) | 81 | 1 | |
| | 81 | 2 | FT <i>their w</i> B1 for angle $ODC = 9$ |
| | 123 | 2 | FT <i>their [y =] 42 + their x</i> B1 for angle $ADC = 48$ and 9 oe |
| | 33 | 2 | B1 for angle $ACD = 42$ or M1 for $180 - 81 - 48 - 9 - 9$ oe |
| 4(b)(i) | Angle $PTU =$ angle PRQ corresponding Angle $PUT =$ angle PQR corresponding Angle RPQ is common oe | M2 | Accept in any order M1 for one correct pair with reason If 0 scored, SC1 for two correct pairs of equal angles identified with incorrect/no reasons |
| | Corresponding angles are equal oe | A1 | |

| Question | Answer | Marks | Partial Marks |
|-------------|--|-------|---|
| 4(b)(ii)(a) | 4 : 7 oe | 1 | |
| 4(b)(ii)(b) | 41.25 oe | 3 | <p>M2 for $20 \times \left(\frac{7}{4}\right)^2$ oe</p> <p>or $20 \times \frac{7^2 - 4^2}{4^2}$ oe</p> <p>or M1 for $\left(\frac{7}{4}\right)^2$ or $\left(\frac{4}{7}\right)^2$</p> <p>or $\frac{7^2 - 4^2}{4^2}$ or $\frac{4^2}{7^2 - 4^2}$</p> |
| 5(a)(i) | 43 | 1 | |
| 5(a)(ii) | 65 | 1 | |
| 5(a)(iii) | 13 | 1 | |
| 5(b) | 80 | 3 | <p>M2 for $\frac{400}{18} \times \frac{60 \times 60}{1000}$ oe</p> <p>Or M1 for $\frac{400}{18}$</p> <p>or for <i>their</i> speed in m/s $\times \frac{60 \times 60}{1000}$</p> <p>or for $\frac{400}{1000}$ and $\frac{18}{60 \times 60}$ soi</p> |
| 6(a) | 2, 3, 4, 5 | 2 | <p>B1 for 3 correct and no extra or 4 correct and one extra</p> <p>or M1 for $1 < x \leq 5$</p> |
| 6(b)(i) | $3y(2y - 5x)$ | 2 | <p>B1 for $3(2y^2 - 5xy)$ or $y(6y - 15x)$ or for the correct answer seen and then spoiled</p> |
| 6(b)(ii) | $(y - 3x)(y + 3x)$ | 2 | <p>B1 for $(y + 3)(y - 3)$</p> |
| 6(c) | $\frac{4x + 5}{(x - 1)(2x + 1)}$ or $\frac{4x + 5}{2x^2 - x - 1}$ final answer | 3 | <p>M1 for $3(2x + 1) - 2(x - 1)$ oe isw</p> <p>M1 for $(x - 1)(2x + 1)$ oe isw</p> |
| 7(a)(i) | 366 | 2 | <p>M1 for $(8 \times 5 + 8 \times 11 + 5 \times 11) [\times 2]$</p> |
| 7(a)(ii) | 267.18 | 1 | <p>FT <i>their</i> (a)(i)</p> |
| 7(b)(i) | 32.82 | 2 | <p>FT 300 – <i>their</i> (a)(ii) dep on (a)(ii) < 300</p> <p>M1 for 300 – <i>their</i> (a)(ii) dep on (a)(ii) < 300</p> |

| Question | Answer | Marks | Partial Marks |
|-----------|---|-----------|---|
| 7(b)(ii) | $\sqrt{8^2 + 5^2 + 11^2}$ oe or $8^2 + 5^2 + 11^2$ and 13^2 <u>ALTERNATIVE</u> $\sqrt{8^2 + 11^2}$ or $8^2 + 11^2$ and 13^2 | M3 | M2 for $8^2 + 5^2 + 11^2$ or $8^2 + 11^2$ oe or M1 for $8^2 + 5^2$ or $5^2 + 11^2$ oe |
| | Yes and 14.5 or 14.4 or 14.49... or Yes and 13.6[0...] | A1 | Accept equivalent conclusion |
| 7(c) | 32.0[...] | 2 | M1 for $\tan[.] = \frac{5}{8}$ oe |
| 8(a)(i) | $(8 - x)(3 + x)$ | 2 | M1 for $8(3 + x) - x(3 + x)$ or $3(8 - x) + x(8 - x)$ or $(a - x)(b + x)$ where $ab = 24$ or $a - b = 5$ |
| 8(a)(ii) | $[a =] -3$ $[b =] 8$ $[c =] 24$ | 3 | FT <i>their</i> (a)(i) for a and b B1FT for each of a and b or both correct but reversed B1 for $[c =] 24$ |
| 8(a)(iii) | 7 | 4 | B3 for -1 and 6 or B2 for $(x - 6)(x + 1)$ or fully correct formula or M1 for $24 + 5x - x^2 = 18$ |
| 8(b) | $2x^3 + 14x^2 + 20x$ final answer | 6 | B5 for $2x(x^2 + 7x + 10)$ or B4 for $2x(x + 5)(x + 2)$ or $[k](x^3 + 7x^2 + 10x)$ or B3 for $[kx](x^2 + 7x + 10)$ or M2 for $[k] x(x + 5)(x + 2)$ and M1 for $k \times 1 \times 6 \times 3 = 36$ |
| 9(a)(i) | $\begin{pmatrix} 4 \\ 4 \end{pmatrix}$ | 2 | B1 for $\begin{pmatrix} 4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 4 \end{pmatrix}$ |
| 9(a)(ii) | $\begin{pmatrix} -4 \\ 8 \end{pmatrix}$ | 2 | B1 for $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 8 \end{pmatrix}$ |
| 9(a)(iii) | 5.39 or 5.385.. | 2 | M1 for $(-2)^2 + 5^2$ oe |
| 9(b)(i) | a + b | 1 | |

| Question | Answer | Marks | Partial Marks |
|-----------|---|-------|---|
| 9(b)(ii) | $\frac{3}{2}\mathbf{a} + \mathbf{b}$ | 2 | M1 for a correct route, e.g. $\overrightarrow{OA} + \overrightarrow{AE}$ |
| 9(b)(iii) | $2\mathbf{a} + \frac{4}{3}\mathbf{b}$ | 3 | M2 for unsimplified \overrightarrow{OD} or for $\frac{4}{3}\mathbf{b}$ or M1 for \overrightarrow{OD} attempted in terms of a and b or for $\overrightarrow{CD} = \frac{1}{3}\mathbf{b}$ or $\overrightarrow{DB} = \frac{2}{3}\mathbf{b}$ seen |
| 10(a) | -23 | 2 | M1 for $4 - 3(3^x)$ oe soi |
| 10(b) | $\frac{4-x}{3}$ oe final answer | 2 | M1 for $x = 4 - 3y$ or $y + 3x = 4$ or $x + 3y = 4$ or $\frac{y}{-3} = \frac{4}{-3} + x$ oe or $\frac{x}{-3} = \frac{4}{-3} + y$ oe |
| 10(c)(i) | $1 + 6x$ final answer | 2 | M1 for $4 - 3(1 - 2x)$ |
| 10(c)(ii) | $20 - 36x$ or $4(5 - 9x)$ final answer | 4 | B3 for $20 - 36x$ seen in working then spoiled OR M1 for $(4 - 3x)^2 + 4 - 3x - 9(x^2 + x)$ or better B1 for $[(4 - 3x)^2 =] 16 - 12x - 12x + 9x^2$ or better B1 for answer $20 - kx$ or $k - 36x$ oe or answer $20 - 36x + kx^2$ $k \neq 0$ |
| 10(d) | $-\frac{1}{2}$ oe | 2 | M1 for $(3^2)^{kx}$ or $9^{kx} = 9^{-\frac{1}{2}x}$ oe |
| 10(e) | $\begin{pmatrix} -1 \\ 0 \end{pmatrix}$ | 2 | B1 for $\begin{pmatrix} k \\ 0 \end{pmatrix}$ or fully correct description of translation |

| Question | Answer | | Marks | Partial Marks |
|----------|----------|----------------------------|-----------|---|
| 11 | <i>A</i> | 24 | B1 | |
| | | $5n - 1$ oe | B2 | B1 for $5n - k$ or $jn - 1$ oe $j \neq 0$ |
| | <i>B</i> | 127 | B1 | |
| | | $n^3 + 2$ oe | B2 | B1 for n^3 oe |
| | <i>C</i> | 256 | B1 | |
| | | $4^{(n-1)}$ oe | B2 | B1 for 4^k oe |
| | <i>D</i> | $\frac{7}{65}$ | B1 | |
| | | $\frac{n+2}{(n+3)^2+1}$ oe | B2 | B1 for $\frac{n+2}{\text{any quadratic}}$ oe |