

## GCSE Mathematics (1MA1) – Higher Tier Paper 1H

### November 2022 student-friendly mark scheme

**Please note that this mark scheme is not the one used by examiners for making scripts. It is intended more as a guide to good practice, indicating where marks are given for correct answers. As such, it doesn't show follow-through marks (marks that are awarded despite errors being made) or special cases.**

**It should also be noted that for many questions, there may be alternative methods of finding correct solutions that are not shown here – they will be covered in the formal mark scheme.**

### NOTES ON MARKING PRINCIPLES

#### Guidance on the use of codes within this mark scheme

M1 – method mark. This mark is generally given for an appropriate method in the context of the question. This mark is given for showing your working and may be awarded even if working is incorrect.

P1 – process mark. This mark is generally given for setting up an appropriate process to find a solution in the context of the question.

A1 – accuracy mark. This mark is generally given for a correct answer following correct working.

B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.

C1 – communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.

Some questions require all working to be shown; in such questions, no marks will be given for an answer with no working (even if it is a correct answer).

**Question 1 (Total 3 marks)**

| Part | Working or answer an examiner might expect to see  | Mark | Notes  |
|------|--|------|--|
|      | For example:<br>$250 \times 2 \rightarrow 125 \times 2 \rightarrow 25 \times 5 \rightarrow 5 \times 5$ | M1   | This mark is given for a complete method to find the prime factors (could be shown on a factor tree) |
|      | $2 \times 2 \times 5 \times 5 \times 5$  | M1   | This mark is given for a method to find a complete factorisation                                     |
|      | $2^2 \times 5^3$   | A1   | This mark is given for the correct answer only   |

**Question 2 (Total 4 marks)**

| Part | Working an or answer examiner might expect to see   | Mark | Notes  |
|------|---|------|--|
| (a)  | $\frac{8}{5} + \frac{9}{4} = \frac{(4 \times 8) + (5 \times 9)}{20} = \frac{32 + 45}{20}$ | M1   | This mark is given for a method to find a suitable common denominator          |
|      | $\frac{87}{20} = 3 \frac{17}{20}$   |      | This mark is given for the correct answer only                                 |
| (b)  | $2 \frac{2}{3} = \frac{8}{3}$   | M1   | This mark is given for find $2 \frac{2}{3}$ as an improper fraction            |
|      | $\frac{8}{3} \div 6 = \frac{8}{3} \times \frac{1}{6} = \frac{8}{18} = \frac{4}{9}$        | A1   | This mark is given for an unsimplified fraction which equates to $\frac{4}{9}$ |

**Question 3 (Total 2 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes  |
|------|---|------|--|
|      | $2^{-5+8} = 2^3$<br>$(2^3)^2 =$                   | M1   | This mark is given for a method to simplify the powers |
|      | $2^6$   | A1   | This mark is given for the correct answer only         |

**Question 4 (Total 2 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes  |
|------|---|------|--|
|      | For example:<br>$4 \times 32 = 128$               | M1   | This mark is given for the digits 128 seen     |
|      | 0.00128   | A1   | This mark is given for the correct answer only |

**Question 5 (Total 2 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes  |
|------|---|------|--|
|      | $\frac{15}{80} \times 40\,000$                    | M1   | This mark is given for a method to find the expected number of model B |
|      | 7500  | A1   | This mark is given for the correct answer only                         |

**Question 6 (Total 6 marks)**

| Part    | Working or answer an examiner might expect to see                          | Mark | Notes  |
|---------|--|------|--|
| (a)(i)  | $a : b = 2 : 6$ or $a : b = 1 : 3$<br>$b : c = 6 : 5$ or $b : c = 3 : 2.5$ | P1   | This mark is given for a process to compare ratios                             |
|         | $2 : 6 : 5$  | A1   | This mark is given for a correct answer only                                   |
| (a)(ii) | $\frac{2}{2 + 6 + 5}$  | P1   | This mark is given for a process to find $a$ as a fraction                     |
|         | $\frac{2}{13}$   | A1   | This mark is given for a correct answer only                                   |
| (b)     | $n = 2m$<br>$p = 5 \times 2m = 10m$  | P1   | This mark is given for a process to express all numbers in terms of one number |
|         | $1 : 10$   | A1   | This mark is given for a correct answer only                                   |

**Question 7 (Total 2 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes   |
|------|---|------|---|
|      | $\frac{10\,000}{2 \times 4}$                      | P1   | This mark is given for a process to use the area of the base in the formula |
|      | 1250  | A1   | This mark is given for the correct answer only                              |

**Question 8 (Total 2 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes   |
|------|---|------|---|
|      | $5 \times 7, 7 \times 2$                          | M1   | This mark is given for a method to find possible values for $m$ and $n$ |
|      | For example:<br>$m = 35$ and $n = 14$             | A1   | This mark is given for a correct pair of values found                   |

**Question 9 (Total 4 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes   |
|------|---|------|---|
| (a)  | $-4, -5, 0, 5$                                    | B2   | These marks are given for all values correct<br>(B1 is given for 2 or 3 values correct)                           |
| (b)  |   | B2   | These marks are given for a fully correct graph drawn<br>(B1 is given for at least five values plotted correctly) |

**Question 10 (Total 4 marks)**

| Part | Working or answer an examiner might expect to see  | Mark | Notes  |
|------|--|------|--|
| (a)  | $\frac{10}{6+8+9+7+10} \times \frac{10}{6+8+9+7+10}$ $= \frac{10}{40} \times \frac{10}{40} = \frac{100}{1600}$ | M1   | This mark is given for a method to find the probability of a score of 5 both times       |
|      | $\frac{1}{16}$   | A1   | This mark is given for the correct answer only   |
| (b)  | $\frac{6}{40} \times 100$  | M1   | This mark is given for a method to find the percentage of times a score of 1 is expected |
|      | 15   | A1   | This mark is given for the correct answer only   |

**Question 11 (Total 2 marks)**

| Part | Working or answer an examiner might expect to see          | Mark | Notes   |
|------|--|------|---|
|      | Enlargement<br>Scale factor $\frac{1}{3}$<br>Centre (0, 2) | B2   | These marks are given for all three aspects of the transformation stated (B1 is given for two aspects stated) |

**Question 12 (Total 4 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes  |
|------|---|------|--|
|      | For example:<br>$15x + 6y = 33$<br>$8x + 6y = 12$ | M1   | This mark is given for a method to eliminate y         |
|      | $7x = 21, x = 3$                                  | A1   | This mark is given for finding the correct value for x |
|      | For example:<br>$12 + 3y = 6$<br>$-6 = 3y$        | M1   | This mark is given for a method to find the value of y |
|      | $y = -2$  | A1   | This mark is given for finding the correct value for x |

**Question 13 (Total 3 marks)**

| Part | Working or answer an examiner might expect to see   | Mark | Notes  |
|------|---|------|--|
|      | $p \propto \frac{1}{t} \text{ or } p = \frac{k}{t}$ $1 = \frac{k}{100} \text{ so } k = 100$ | M1   | This mark is given for a method to find a value for the constant $k$ |
|      | $5 = \frac{100}{t}, t = 20$   | A1   | This mark is given for a method to find the missing value of $t$     |
|      | $p = \frac{100}{25} = 4, p = \frac{100}{2} = 50$  | A1   | This mark is given for a method to find the missing values of $p$    |

**Question 14 (Total 3 marks)**

| Part | Working or answer an examiner might expect to see | Mark | Notes   |
|------|---|------|---|
|      |   | B3   | <p>These marks are given for a fully correct histogram</p> <p>(B2 is given for at least 3 correct blocks or all 4 frequency densities 1, 5, 6 and 1.5 correct)</p> <p>(B1 is given for at least 2 correct blocks or at least 3 frequency densities correct)</p> |

**Question 15 (Total 3 marks)**

| Part | Working or answer an examiner might expect to see     | Mark | Notes   |
|------|---|------|---|
|      | $\frac{4\pi}{2 \times \pi \times 18} = \frac{x}{360}$ | P1   | This mark is given for a process to use equal proportions |
|      | $x = \frac{4\pi}{36\pi} \times 360$                   | P1   | This mark is given for a process to find the value of $x$ |
|      | 40  | A1   | This mark is given for the correct answer only            |

**Question 16 (Total 4 marks)**

| Part | Working or answer an examiner might expect to see  | Mark | Notes  |
|------|--|------|--|
| (a)  | $(2m + 1)^2 = (4m^2 + 4m + 1)$<br>$(2n - 1)^2 = (4n^2 - 4n + 1)$   | M1   | This mark is given for a method to expand $(2m + 1)^2$ or $(2n - 1)^2$             |
|      | $(4m^2 + 4m + 1) - (4n^2 - 4n + 1)$<br>$= 4m^2 + 4m + 1 - 4n^2 + 4n - 1$<br>$= 4m^2 + 4m - 4n^2 + 4n$                            | M1   | This mark is given for a method to find an expression with both expansions correct |
|      | $= 4(m^2 + m - n^2 + n)$<br>$= 4(m + n)(m - n + 1)$  | C1   | This mark is given for a full proof with no errors                                 |
| (b)  | Yes, Sophia is correct.<br>$2m + 1$ and $2n - 1$ are both odd numbers and the right-hand side of the equation is a multiple of 4 | C1   | This mark is given for a correct reason supported by a valid explanation           |

**Question 17 (Total 2 marks)**

| Part | Working or answer an examiner might expect to see  | Mark | Notes  |
|------|--|------|--|
|      | $\left(\frac{8}{27}\right)^{\frac{1}{3}} = \left(\frac{2}{3}\right)$ or $\left(\frac{8}{27}\right)^4 = \left(\frac{4096}{531441}\right)$<br>$\left(\frac{2}{3}\right)^4 =$ or $\left(\frac{4096}{531441}\right)^{\frac{1}{3}} =$ | M1   | This mark is given for a method to find the cube root or find a power of 4 |
|      | $\frac{16}{81}$  | A1   | This mark is given for the correct answer only                             |

**Question 18 (Total 3 marks)**

| Part | Working or answer an examiner might expect to see  | Mark | Notes  |
|------|--|------|--|
|      | $OBA = \frac{180 - x}{2}$ angles in a triangle add up to 180<br>base angles of an isosceles triangle are equal   | M1   | This mark is given for a method to find the angle $OBA$                |
|      | $ABC = 90 - \frac{180 - x}{2} = \frac{180}{2} - \frac{180 - x}{2}$ $= \frac{180}{2} - \frac{180}{2} + \frac{x}{2} = \frac{x}{2} \text{ (or } \frac{1}{2}x)$ the tangent to a circle is perpendicular to the radius | M1   | This mark is given for a method to find the angle $ABC$                |
|      |  | C1   | This mark is given for correct reasons given for each stage of working |

**Question 19 (Total 5 marks)**

| Part | Working an or answer examiner might expect to see  | Mark | Notes   |
|------|--|------|---|
|      | $\frac{(x+1) - x}{x(x+1)} = 4 \quad \text{so} \quad \frac{1}{x(x+1)} = 4,$   | P1   | This mark is given for a process to find a common denominator   |
|      | $1 = 4x(x+1)$ $1 = 4x^2 + 4x$ $4x^2 + 4x - 1$  | P1   | This mark is given for rearranging to express the equation as a quadratic to be solved                        |
|      | $\frac{-4 \pm \sqrt{4^2 - 4 \times 4 \times -1}}{2 \times 4}$ or<br>$\left(x + \frac{1}{2}\right)^2 - \frac{1}{2} = 0$ | P1   | This mark is given for a process to substitute into the quadratic formula<br><br>or<br>to complete the square |
|      | $\frac{-4 \pm \sqrt{32}}{8} \quad \text{or} \quad \pm \sqrt{\frac{1}{2}} - \frac{1}{2}$                                | A1   | This mark is given for finding solutions for the values of $x$  |
|      | $-\frac{1}{2} + \frac{1}{2}\sqrt{2}, \quad -\frac{1}{2} - \frac{1}{2}\sqrt{2}$   | A1   | This mark is given for answers in the form $a \pm b\sqrt{2}$ as required                                      |



**Question 20 (Total 3 marks)**

| Part | Working or answer an examiner might expect to see   | Mark | Notes   |
|------|---|------|---|
|      | $\frac{3}{11} \times \frac{7}{10}$ or $\frac{3}{11} \times \frac{1}{10}$ or $\frac{7}{11} \times \frac{3}{10}$ or $\frac{7}{11} \times \frac{1}{10}$ or<br>$\frac{1}{11} \times \frac{3}{10}$ or $\frac{1}{11} \times \frac{7}{10}$ | P1   | This mark is given for a start to the process to find a probability of two cards of different colours |
|      | $\frac{21}{110} + \frac{3}{210} + \frac{21}{210} + \frac{7}{210} + \frac{3}{210} + \frac{7}{210}$   | P1   | This mark is given for a complete process to find a probability of two cards of different colours     |
|      | $\frac{62}{110}$  | A1   | This mark is given for a correct answer only (accept equivalent fractions, decimals)                  |

**Question 21 (Total 2 marks)**

| Part | Working an or answer examiner might expect to see | Mark | Notes                      |
|------|---|------|----------------------------|
|      | (180, -1)   | B1   | This mark is given for 180 |
|      |   | B1   | This mark is given for -1  |

**Question 22 (Total 4 marks)**

| Part | Working an or answer examiner might expect to see | Mark | Notes  |
|------|---|------|--|
|      | $\sin 30^\circ = 0.5$                             | P1   | This mark is given for recognising the sine of $30^\circ$ is 0.5 |
|      | $\frac{6.5}{\sin ABC} = \frac{10.7}{\sin 30}$     | P1   | This mark is given for the use of the sine rule                  |
|      | $\sin ABC = \frac{6.5 \times 0.5}{10.7}$          | P1   | This mark is given for a process to find the value of $\sin ABC$ |
|      | $\frac{325}{1070}$                                | A1   | This mark is given for a correct answer only                     |

**Question 23 (Total 5 marks)**

| Part | Working an or answer examiner might expect to see   | Mark | Notes   |
|------|---|------|---|
| (a)  | For example:<br>$10 \div \sqrt{5} = 2\sqrt{5}$ , $20\sqrt{5} \div 10 = 2\sqrt{5}$ ,<br>$200 \div 20\sqrt{5} = 2\sqrt{5}$ , $400\sqrt{5} \div 200 = 2\sqrt{5}$ | P1   | This mark is given for a process to identify the common ratio               |
|      | $400\sqrt{5} \times 2\sqrt{5} = 4000$   | A1   | This mark is given for the correct answer only                              |
| (b)  | $\frac{5\sqrt{2}}{8} \div \frac{5\sqrt{2}}{4} = \frac{1}{2}$  | P1   | This mark is given for a process to find the ratio of the 4th and 6th terms |
|      | $\frac{5\sqrt{2}}{4} \div \left(\frac{1}{\sqrt{2}}\right)^3 = \frac{5\sqrt{2}}{4} \times 2\sqrt{2} = \frac{10 \times 2}{4}$                                   | P1   | This mark is given for a process to find the first term                     |
|      | 5   | A1   | This mark is given for the correct answer only                              |

**Question 24 (Total 6 marks)**

| Part | Working an or answer examiner might expect to see  | Mark | Notes  |
|------|--|------|--|
| (a)  | $\frac{4}{3} \pi r^3 = \frac{1}{3} \pi r^2 h$ so $4r = h$  | P1   | This mark is given for a process to equate the two volumes             |
|      | 1 : 4  | P1   | This mark is given for the correct answer only                         |
| (b)  | $4\pi r^2 = \pi r^2 + \pi r l$   | P1   | This mark is given for a process to equate the two surface areas       |
|      | $4\pi r^2 = \pi r^2 + \pi r \sqrt{h^2 + r^2}$  | P1   | The mark is given for a process to substitute $l = \sqrt{h^2 + r^2}$   |
|      | $3\pi r^2 = \pi r \sqrt{h^2 + r^2}$<br>$3r = \sqrt{h^2 + r^2}$<br>$9r^2 = h^2 + r^2$<br>$8r^2 = h^2$ | P1   | This mark is given for a process to find an equation in terms of $r^2$ |
|      | 1 : $\sqrt{8}$   | A1   | This mark is given for the correct answer only                         |