

GCSE Mathematics (1MA1) – Aiming for Grade 8 2H

Student-friendly mark scheme

Please note that this mark scheme is not the one used by examiners for marking 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.

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).

The following table shows the marks scored on average at certain grades on similar questions from live exams.

For example: A student who achieved a Grade 8 on similar questions from either the Summer 2023 or November 2023 exam sittings achieved on average 29.6 marks from these questions.

Grade	9	8	7	6	5	4	3
Mark	33.6	29.6	23.3	15.0	8.0	3.1	1.2

Answer all questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The incomplete table and the incomplete histogram give information about the times taken by some students to run a race.

Freq. density

$$10 \div 4 = 2.5$$

$$15 \div 3 = 5$$

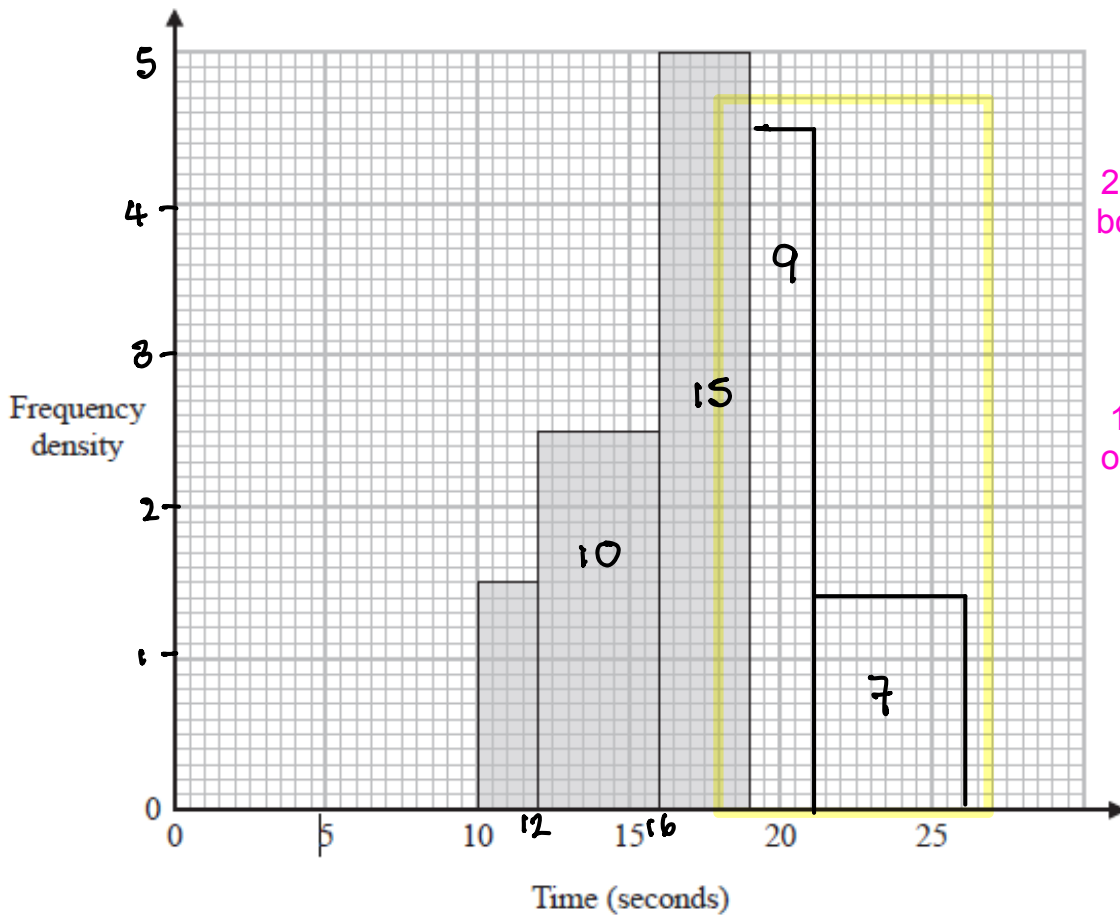
$$9 \div 2 = 4.5$$

$$7 \div 5 = 1.4$$

Time (t seconds)	Frequency
$10 < t \leq 12$	3
$12 < t \leq 16$	10
$16 < t \leq 19$	15
$19 < t \leq 21$	9
$21 < t \leq 26$	7

1 mark

$$1.5 \times 2 = 3$$



2 marks for both correct bars

1 mark for one correct bar

None of these students had a time for the race such that $t < 10$ or $t > 26$

(a) Use the histogram to complete the table.

(1)

(b) Use the table to complete the histogram.

(2)

(Total for Question 1 is 3 marks)

- 2 Show that $\frac{x^2 - x - 6}{2x^2 - 5x - 3}$ can be written in the form $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

$$x^2 - x - 6 = (x - 3)(x + 2)$$

1 mark

$$2x^2 - 5x - 3 = (2x + 1)(x - 3)$$

1 mark

$$\frac{(x - 3)(x + 2)}{(2x + 1)(x - 3)} = \frac{x + 2}{2x + 1}$$

1 mark

$$\begin{aligned} a &= 1 \\ b &= 2 \\ c &= 2 \\ d &= 1 \end{aligned}$$

(Total for Question 2 is 3 marks)

- 3 ABC is a triangle.

Calculate the size of angle BAC .

Give your answer correct to 1 decimal place.

$$\frac{\sin 70}{18} = \frac{\sin BCA}{15}$$

1 mark

$$\text{so } \sin BCA = \frac{15 \sin 70}{18}$$

1 mark

$$BCA = \sin^{-1} \left(\frac{\sin 70}{18} \times 15 \right)$$

$$= 51.54 \dots$$

1 mark

$$BAC = 180 - (70 + 51.54 \dots)$$

$$= 58.4568 \dots$$

Final mark. **58.5**

(Total for Question 3 is 4 marks)

Answer in the range 58.4 to 58.5

- 4 Show that the equation $x^3 + 2x - 6 = 0$ can be rearranged to give $x = \frac{6}{x^2 + 2}$

$$x^3 + 2x - 6 = 0$$

$$x^3 + 2x = 6$$

$$x(x^2 + 2) = 6$$

so $x = \frac{6}{x^2 + 2}$ as required.

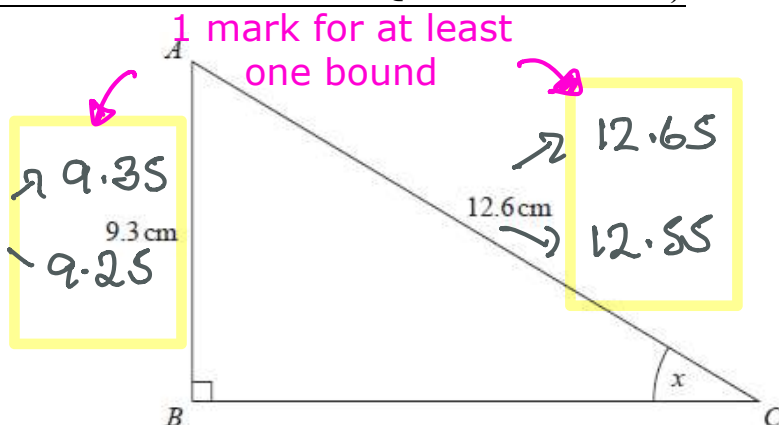
1 mark

Total for Question 4 is 1 mark)

- 5 ABC is a right-angled triangle.

$AB = 9.3$ cm correct to the nearest mm.

$AC = 12.6$ cm correct to the nearest mm.



Calculate the lower bound for the size of the angle marked x .

You must show all your working.

1 mark

$$\sin x = \frac{9.25}{12.65} = 0.731...$$

$$= 46.98...$$

1 mark

$$= 47 \text{ to the nearest degree}$$

Answer in the range 46.98 to 47

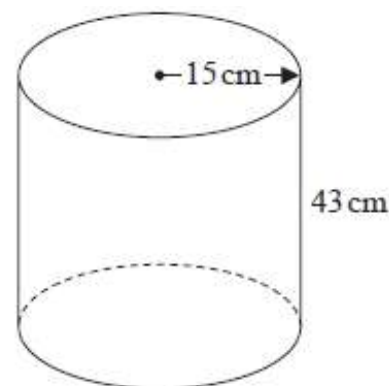
47

(Total for Question 5 is 3 marks)

- *6 The diagram shows an empty tank in the shape of a cylinder.

The cylinder has radius 15 cm and height 43 cm.

Water flows into the tank at a rate of 0.47 litres per minute.



Calculate the number of minutes it will take to completely fill the tank.
Give your answer correct to the nearest minute.

$$\text{Volume} = \pi \times 15^2 \times 43$$

1 mark

$$= 30394.90892 \text{ cm}^3$$

1 mark

$$1 \text{ litre} = 1000 \text{ cm}^3 \quad \text{so} \quad 30.394908... \text{ litres.}$$

$$30.394... \div 0.47 = 64.6700... \text{ minutes}$$

1 mark

65 to nearest minute.

65

Final mark

minutes

(Total for Question 6 is 4 marks)

- 7 The functions f and g are such that

$$f(x) = (2x + 3)^2 \quad \text{and} \quad g(x) = 2x - 1$$

Find $g^{-1}(x)$

$$y = 2x - 1$$

$$+1 \quad +1$$

$$2x = y + 1$$

$$x = \frac{y+1}{2}$$

$$\therefore g^{-1}(x) = \frac{x+1}{2}$$

1 mark

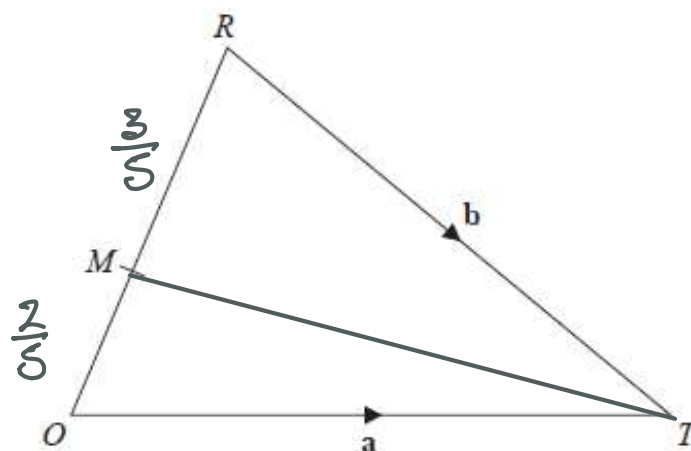
$$\frac{x+1}{2}$$

Final mark

$$g^{-1}(x) = \frac{x+1}{2}$$

(Total for Question 7 is 2 marks)

8 ORT is a triangle.



$$\vec{OT} = \mathbf{a} \quad \vec{RT} = \mathbf{b}$$

M is the point on OR such that $OM : MR = 2 : 3$

Express $\vec{MT}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.
Give your answer in its simplest form.

$$\vec{OR} = \boxed{a - b} \quad 1 \text{ mark}$$

$$\begin{aligned} \vec{MT} &= \vec{MR} + \vec{RT} \\ &= \boxed{\frac{3}{5}(a - b)} + b \quad 1 \text{ mark} \\ &= \frac{3}{5}a - \frac{3}{5}b + b \end{aligned}$$

$$\begin{aligned} &= \boxed{\frac{3}{5}a + \frac{2}{5}b} \\ &= \boxed{\frac{1}{5}(3a + 2b)} \end{aligned}$$

Final mark for
either of these

$$\frac{1}{5}(3a + 2b)$$

(Total for Question 8 is 4 marks)

- 9 Prove algebraically that $0.0\dot{7}2\dot{3}$ can be written as $\frac{241}{3330}$

$$\begin{array}{rcl} 1000x & = & 72.3723\dots \\ x & = & 0.0723723\dots \end{array}$$

1 mark

$$999x = 72.3$$

$$x = \frac{72.3}{999}$$

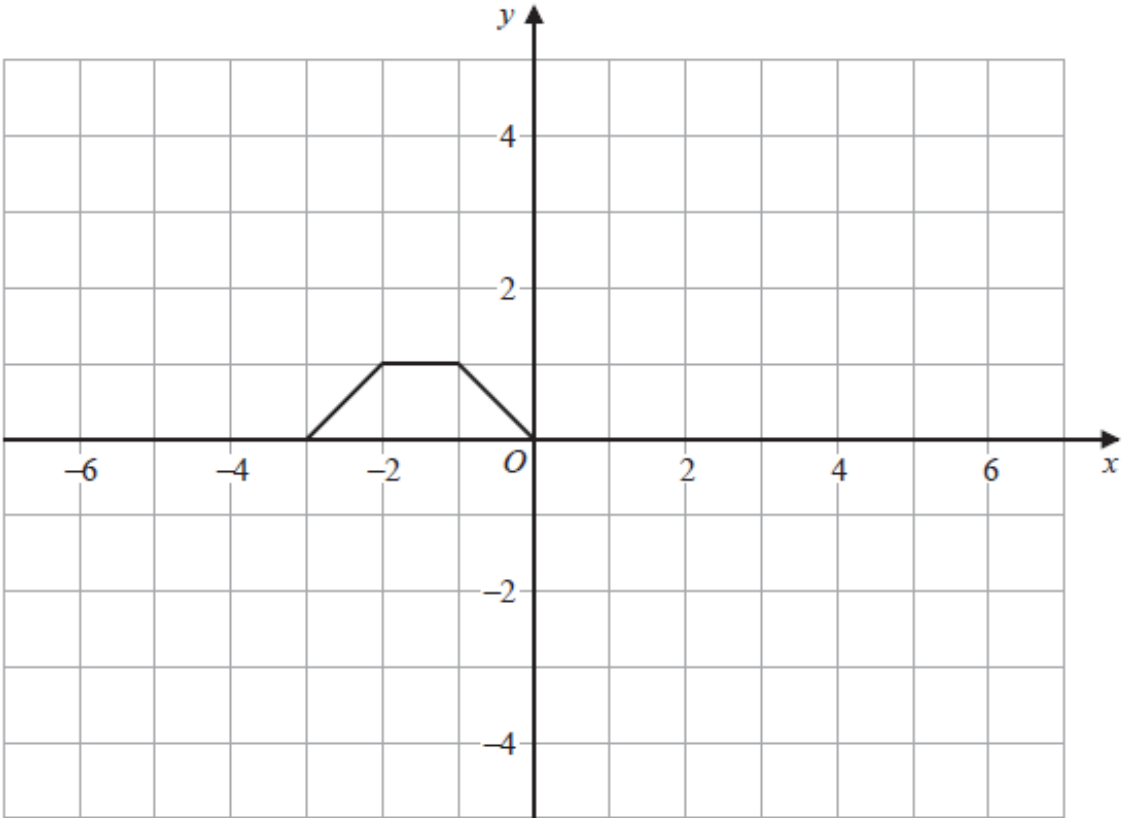
1 mark

$$\frac{72.3}{999} = \frac{723}{9990} \quad \frac{723}{9990} \div 3 = \frac{241}{3330}$$

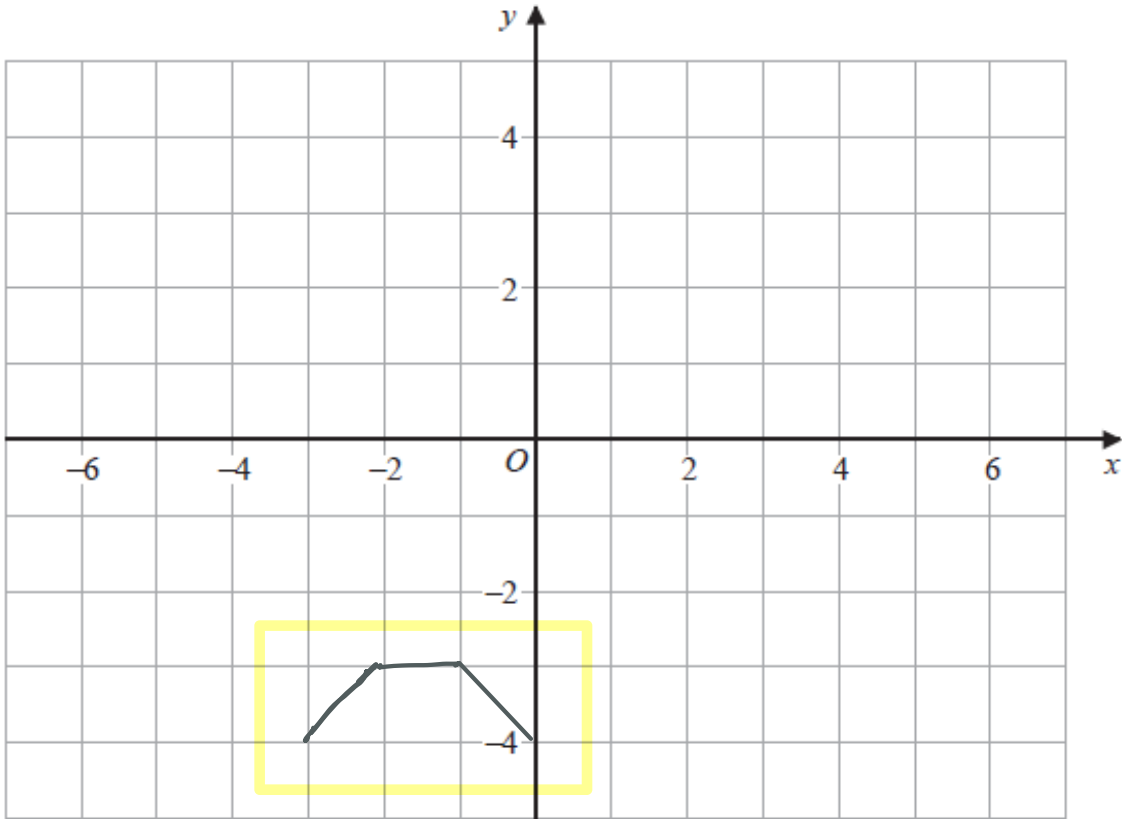
Final mark

(Total for Question 9 is 3 marks)

10 Here is the graph of $y = f(x)$



On the grid below, draw the graph of $y = f(x) - 4$



1 mark

(Total for Question 10 is 1 mark)

*11 Work out the value of the reciprocal of 0.625

$$\frac{1}{0.625}$$

$$= \frac{8}{5} = 1\frac{3}{5}$$

1 mark

1.6

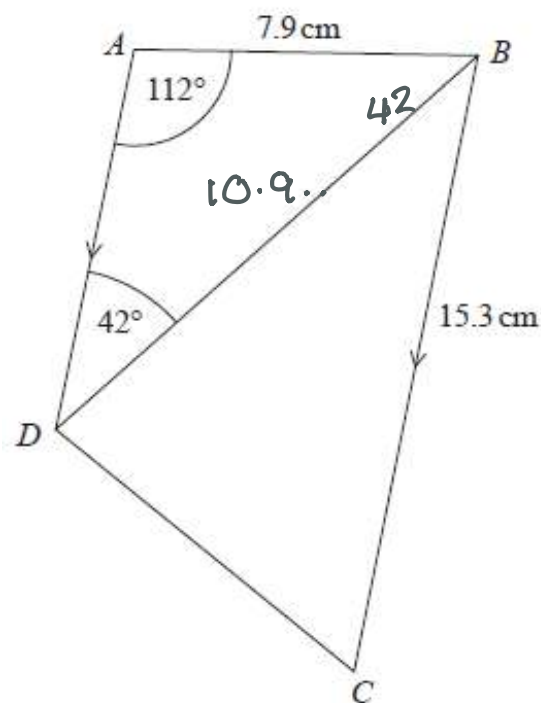
(Total for Question 11 is 1 mark)

12 $ABCD$ is a trapezium.

AD is parallel to BC .

Calculate the area of triangle BCD .

Give your answer correct to 1 decimal place.



$$\frac{BD}{\sin 112} = \frac{7.9}{\sin 42}$$

1 mark

$$BD = \frac{7.9}{\sin 42} \times \sin 112$$

1 mark

$$= 10.9...$$

$$\text{area } BCD = \frac{1}{2} \times 10.9.. \times 15.3 \times \sin 42$$

1 mark

$$= 56.0343...$$

$$\text{so } 56.0 \text{ (1dp)}$$

56.0

Final mark

cm²

(Total for Question 12 is 4 marks)

Answers in the range 56.0 to 56.035 accepted

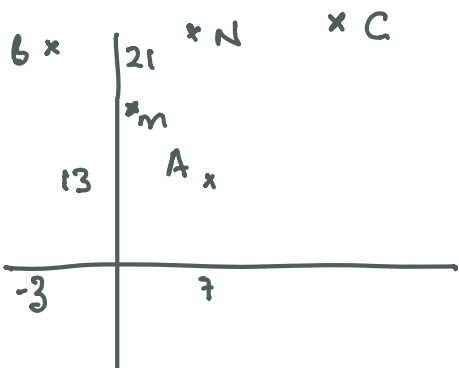
- 13 A is the point with coordinates $(7, 13)$
 B is the point with coordinates $(-3, 21)$
 C is the point with coordinates $(15, 23)$

M is the midpoint of AB .

N is the midpoint of BC .

Work out the distance between M and N .

Give your answer correct to 1 decimal place.



$$\begin{array}{ccc} A & m & B \\ (7, 13) & & (-3, 21) \end{array}$$

$$\begin{array}{ccc} B & N & C \\ (-3, 21) & & (15, 23) \end{array}$$

$$\frac{7-3}{2}, \frac{13+21}{2}$$

1 mark for either of these

$$\frac{-3+15}{2}, \frac{21+23}{2}$$

$$M = (2, 7)$$

$$N = (6, 22)$$

$$MN = \sqrt{(22-7)^2 + (6-2)^2}$$

1 mark

$$= \sqrt{5^2 + 4^2} = \sqrt{41}$$

$$= 6.403...$$

$$6.4$$

Final mark

(Total for Question 13 is 3 marks)

Answers in the range 6.4 to 6.41 accepted

TOTAL FOR PAPER IS 36 MARKS