

## GCSE Mathematics (1MA1) – Aiming for Grade 7 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).

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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 7 on similar questions from either the Summer 2023 or November 2023 exam sittings achieved on average 25.0 marks from these questions.

| Grade | 9    | 8    | 7    | 6    | 5    | 4   | 3   |
|-------|------|------|------|------|------|-----|-----|
| Mark  | 31.6 | 29.8 | 25.0 | 20.0 | 12.7 | 6.5 | 3.2 |

Answer all questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 (a) Show that the equation  $x^4 - x^2 - 5 = 0$  can be written in the form  $x = \sqrt[4]{x^2 + 5}$

$$x^4 = x^2 + 5$$

$$x = \sqrt[4]{x^2 + 5}$$

1 mark for correct rearrangement must see

(1)

- (b) Starting with  $x_0 = 1.5$

use the iteration formula  $x_{n+1} = \sqrt[4]{x_n^2 + 5}$  three times to find an estimate for a solution of  $x^4 - x^2 - 5 = 0$

$$x_0 = 1.5 \quad 1 \text{ mark}$$

$$x_1 = \sqrt[4]{1.5^2 + 5} = 1.6409$$

1 mark

$$x_2 = \sqrt[4]{1.6409^2 + 5} = 1.66539..$$

1 mark

$$x_3 = \sqrt[4]{1.66..^2 + 5} = 1.6697..$$

Both  $x_2$  and  $x_3$  round to 1.67

Final mark

1.67

(3)

(Total for Question 1 is 4 marks)

2 Starting with  $x_0 = 1.45$

use the iteration formula  $x_{n+1} = \frac{6}{x^2 + 2}$  twice to find an estimate

for the solution of  $x^3 + 2x - 6 = 0$

Give your answer correct to 4 decimal places.

$$x_0 = 1.45$$

$$x_1 = \frac{6}{1.45^2 + 2} = 1.46252... \quad 1 \text{ mark}$$

$$x_2 = \frac{6}{1.462^2 + 2} = 1.44963... \quad 1 \text{ mark}$$

so 1.4496 (4dp)

Final mark

$$1.4496$$

Answers in the range 1.4496 to 1.4497 accepted (Total for Question 2 is 3 marks)

3 Here are the first four terms of a quadratic sequence.

3                  9                  17                  27

Find an expression, in terms of  $n$ , for the  $n$ th term of this sequence.

1 mark for second differences

|       |   |   |    |    |
|-------|---|---|----|----|
| $n =$ | 1 | 2 | 3  | 4  |
|       | 3 | 9 | 17 | 27 |
|       |   | 6 | 8  | 10 |
|       |   |   | 2  | 2  |

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so  $n^2 \Rightarrow$

|   |   |   |    |
|---|---|---|----|
| 1 | 4 | 9 | 16 |
| 2 | 5 | 8 | 11 |
|   | 3 | 3 | 3  |

1 mark for working with  $n$  squared

so  $n^2 + 3n - 1$

$$2 \div 2 = 1$$

$$3n - 1$$

$$n^2 + 3n - 1$$

Final mark

(Total for Question 3 is 3 marks)

4 The cumulative frequency table gives information about the ages of 80 people working for a company.

| Age ( $a$ years) | Cumulative frequency |
|------------------|----------------------|
| $20 < a \leq 30$ | 20                   |
| $20 < a \leq 40$ | 48                   |
| $20 < a \leq 50$ | 64                   |
| $20 < a \leq 60$ | 75                   |
| $20 < a \leq 70$ | 80                   |

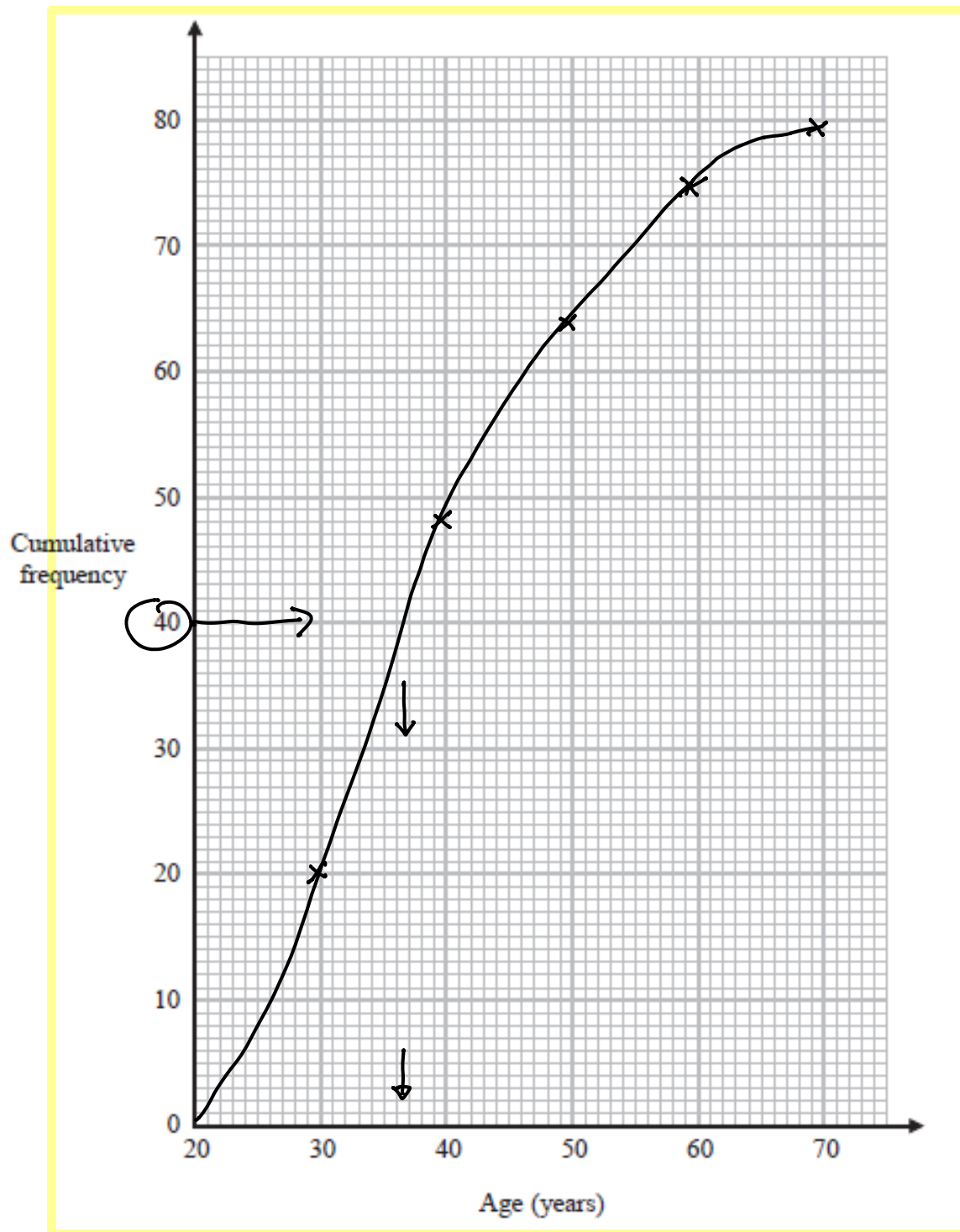
- (a) On the grid on the next page, draw a cumulative frequency graph for this information. (2)
- (b) Use your graph to find an estimate for the median age.

Your graph may vary slightly

37

..... years

1 mark. Answer in the range 36 to 38. (1)  
Or FT using your graph.

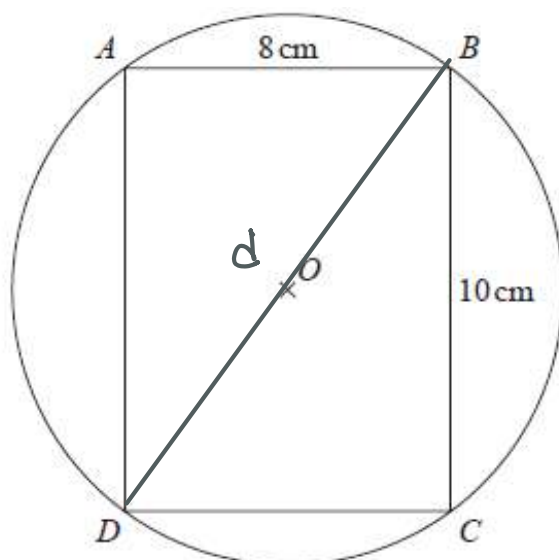


(Total for Question 4 is 3 marks)

2 marks for correct graph

1 mark may be awarded if points plotted consistently within all class intervals (ie not at end points) and joined with a curve

- \*5 The points  $A$ ,  $B$ ,  $C$  and  $D$  lie on a circle, centre  $O$ .  
 $ABCD$  is a rectangle.



$$C = \pi d$$

$$A = \pi r^2$$

$$AB = 8 \text{ cm } BC = 10 \text{ cm}$$

Work out the circumference of the circle.

Give your answer correct to 3 significant figures.

$$d^2 = 10^2 + 8^2 \quad 1 \text{ mark}$$

$$d = \sqrt{10^2 + 8^2} \quad 1 \text{ mark}$$

$$= \sqrt{164}$$

$$C = \pi \times \sqrt{164} \quad 1 \text{ mark}$$

$$= 40.2320 \dots$$

$$\text{3.s.f.}$$

$$= 40.2$$

Final mark.....  $40.2$  cm

(Total for Question 5 is 4 marks)

Answer in the range 40.2 to 40.24

6 Here is a triangle and a rectangle.

$\Delta \Rightarrow$

$$\frac{6x \times 8}{2}$$

$$= 24x$$

1 mark

$\square \Rightarrow$

$$5(4x - 1)$$

$$= 20x - 5$$

1 mark

All measurements are in centimetres.  
 The area of the triangle is 10 cm<sup>2</sup> greater than the area of the rectangle.  
 Work out the value of  $x$ .

$$\Delta = \square + 10$$

$$24x = 20x - 5 + 10$$

1 mark for correct equation

$$4x = 5$$

$$x = \frac{5}{4}$$

$$= 1.25$$

Final mark

$$1.25$$

$x =$

(Total for Question 6 is 4 marks)

7 A biased dice is thrown 60 times.  
 The table shows information about the number that the dice lands on each time.

|                |    |   |   |   |   |    |
|----------------|----|---|---|---|---|----|
| Number on dice | 1  | 2 | 3 | 4 | 5 | 6  |
| Frequency      | 12 | 7 | 8 | 9 | 9 | 15 |

Gethin throws the dice twice.  
 Work out an estimate for the probability that the dice will land on 6 both times.

1 mark

$$P(6) = \frac{15}{60} = \frac{1}{4}$$

Final mark

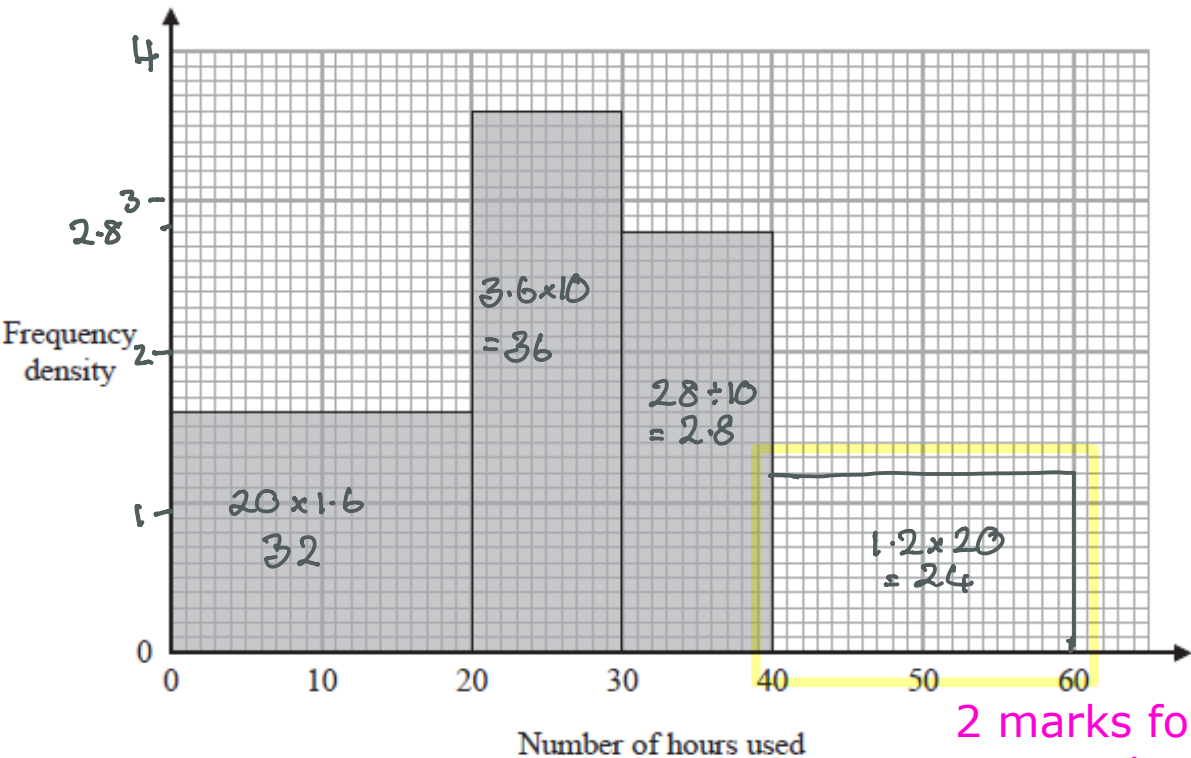
$$P(6, 6) = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$

1 mark

$$\frac{1}{16} \left( \frac{225}{3600} \right)$$

(Total for Question 7 is 3 marks)

- 8 The histogram gives information about the number of hours some students used their phones last week.  
The histogram is incomplete.



2 marks for correct bar

28 students used their phones for between 30 and 40 hours.  
24 students used their phones for between 40 and 60 hours.

$$24 \div 20 = 1.2$$

- (a) Use this information to complete the histogram.

1 mark can be awarded for correct scale or for if 2 marks not awarded

(2)

No student used their phone for more than 60 hours.

- (b) Work out the total number of students.

$$32 + 36 + 28 + 24 = 120$$

1 mark

120 Final mark

(2)

(Total for Question 8 is 4 marks)

- 9  $y$  is proportional to  $x^2$   
 $y = 3$  when  $x = 0.5$   
 $x$  is inversely proportional to  $w$   
 $x = 2$  when  $w = 0.2$   
Find the value of  $y$  when  $w = 2$

$$y \propto x^2$$

$$y = kx^2$$

1 mark for either of these

$$y = 3 \text{ when } x = 0.5$$

$$3 = k \times 0.5^2$$

1 mark for either of these

$$k = \frac{3}{0.5^2} = 12$$

$$y = 12x^2$$

$$x \propto \frac{1}{w}$$

$$x = \frac{k}{w}$$

1 mark

$$\text{when } x = 2 \text{ } w = 0.2$$

$$2 = \frac{k}{0.2} \text{ so } k = 0.4$$

$$x = \frac{0.4}{w}$$

1 mark

$$\text{when } w = 2 \text{ } x = \frac{0.4}{2} = 0.2$$

$$y = 12 \times 0.2^2 = 0.48$$

1 mark

$$y = \boxed{0.48} \text{ Final mark}$$

(Total for Question 9 is 5 marks)

TOTAL FOR PAPER IS 33 MARKS