

GCSE Mathematics (1MA1) – Aiming for Grade 8 3H

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 25.4 marks from these questions.

Grade	9	8	7	6	5	4	3
Mark	30.8	25.4	19.2	14.3	9.6	5.6	2.6

Answer all questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The table shows some information about the heights of a group of adults.

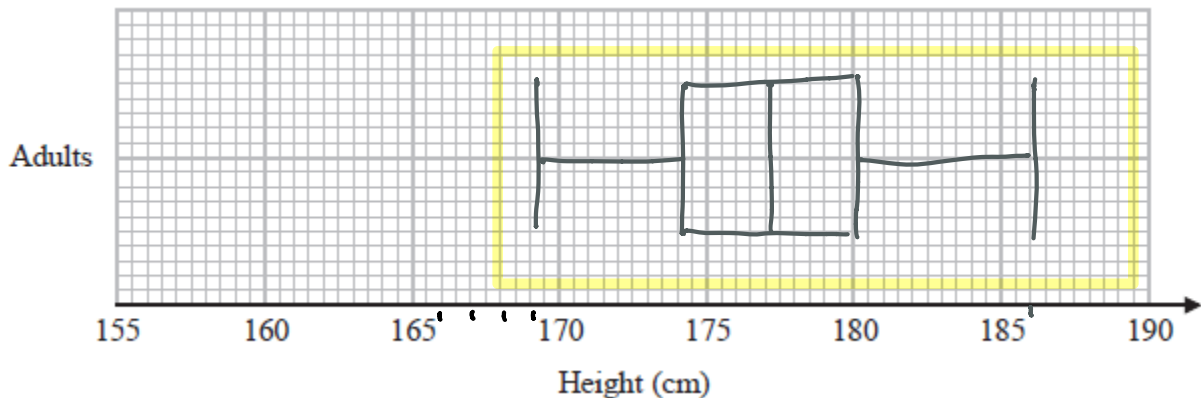
2 marks at least
three correct
points drawn

1 mark for at
least two correct
points drawn

least height	169 cm
greatest height	186 cm
median	177 cm
lower quartile	174 cm
upper quartile	180 cm

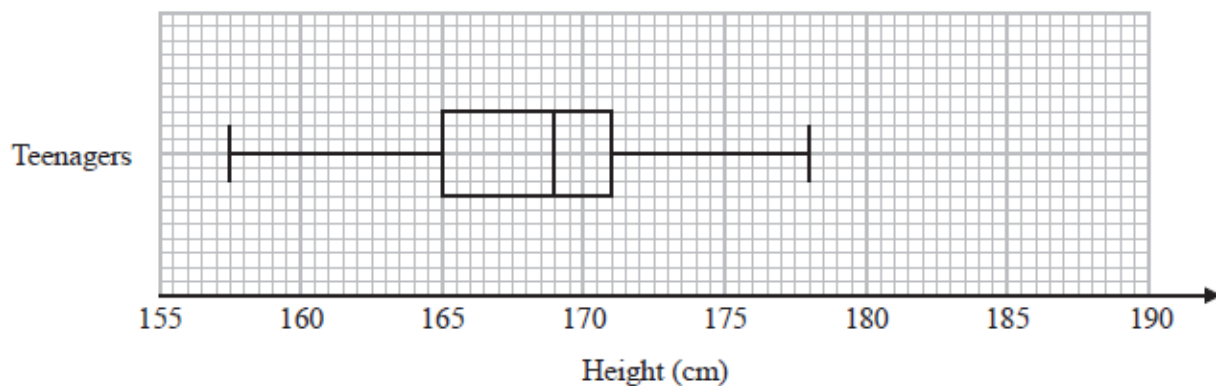
3 marks for fully
correct box plot

- (a) On the grid, draw a box plot for the information in the table.



(3)

The box plot below shows the distribution of the heights of a group of teenagers.



- (b) Compare the distribution of the heights of the adults with the distribution of the heights of the teenagers.

1 mark for correct comparison of medians

The median for adults is greater so on average they are taller.

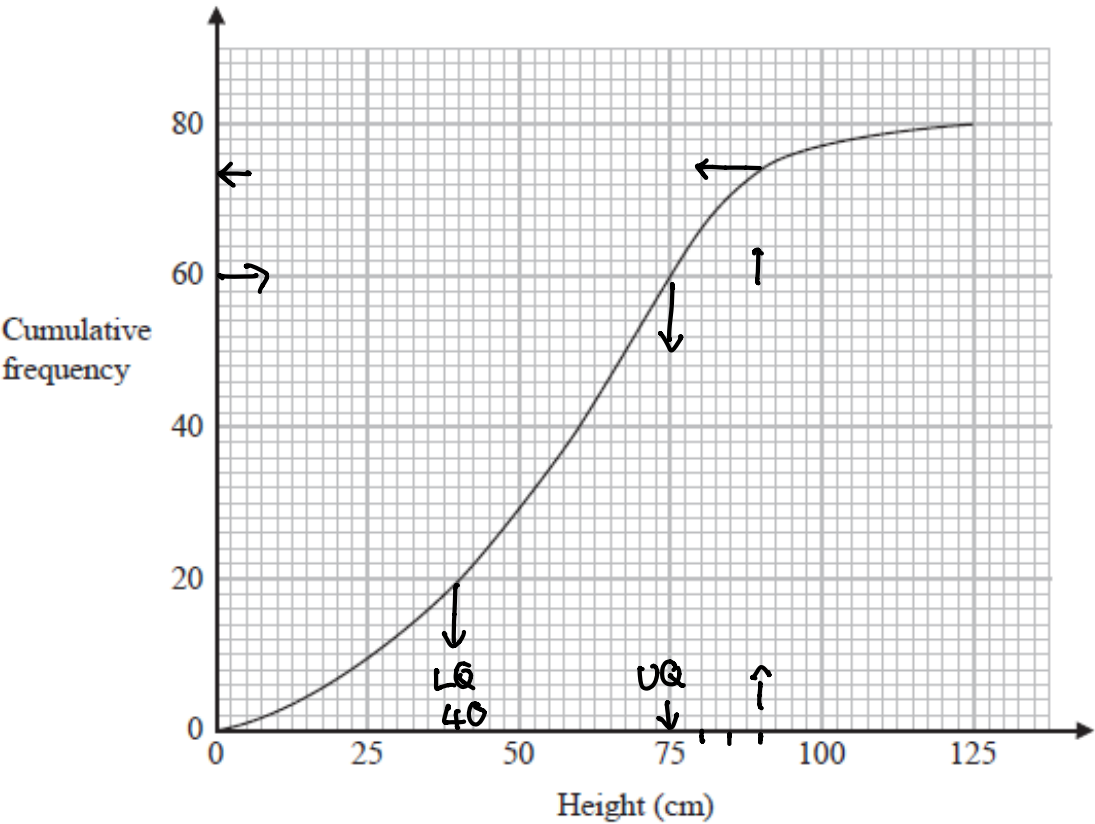
The IQR of both groups is the same so they have similar spread of heights

1 mark for correct comparison of spread (IQR or range)

(2)

(Total for Question 1 is 5 marks)

- 2 Alan grew 80 plants of the same type outside.
- The cumulative frequency graph shows information about the heights, in cm, of these plants.



One of the plants is chosen at random.

(a) Find an estimate for the probability that this plant will have a height greater than 90 cm.

1 mark

$$80 - 74 = 6$$

$$\frac{6}{80}$$

Final mark

(2)

(b) Use the graph to find an estimate for the interquartile range of the heights.

1 mark for either of these

$$LQ = 40 \quad UQ = 75 \quad 75 - 40$$

$$35$$

Final mark

cm

(2)

Alan also grew plants of the same type inside.

The interquartile range of the heights of these plants is 30 cm.

(c) Give one comparison between the distribution of the heights of the plants grown inside with the distribution of the heights of the plants grown outside.

The inside plants have more consistent heights (30 is smaller than 35) as the IQR is smaller.

1 mark for suitable comparison of the IQR

(1)

(Total for Question 2 is 5 marks)

***3** Seija works at a weather station.

The table gives information about the temperature, T °C, at midday for each of 50 cities in the UK on Tuesday.

Temperature (T °C)	Frequency
$10 < T \leq 15$	2
$15 < T \leq 20$	8
$20 < T \leq 25$	13
$25 < T \leq 30$	21
$30 < T \leq 35$	6

Seija says,
“The median temperature is 22.5 °C because 22.5 is the middle number in the middle group.”

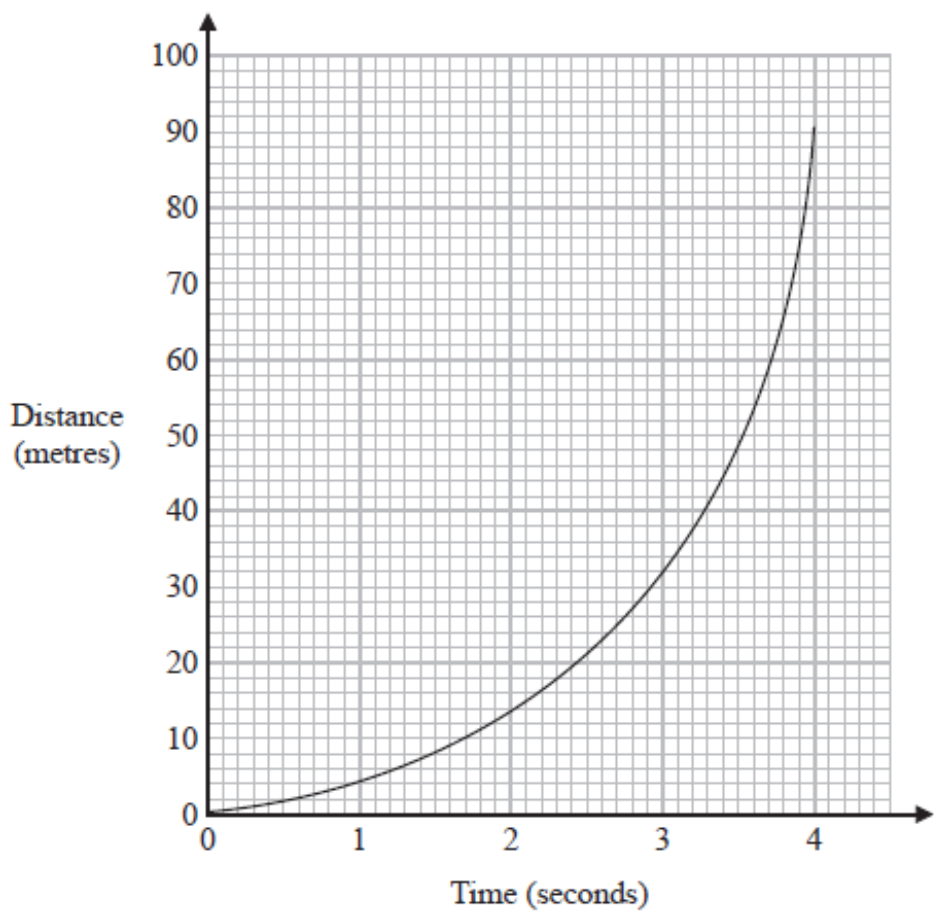
Is Seija correct? Give a reason for your answer.

No, the 25th (middle) temperature would be in $25 < T \leq 30$

1 mark for ‘no’ with acceptable reason

(Total for Question 3 is 1 mark)

4 Here is a distance-time graph.



What does the gradient of the graph represent?

Speed (or velocity)

1 mark

(Total for Question 4 is 1 mark)

5 Solve $\frac{1}{x+4} + \frac{3}{2-2x} = 1$

$$2 - 2x + 3(x + 4) = (x + 4)(2 - 2x)$$

1 mark

$$2 - 2x + 3x + 12 = 2x - 2x^2 + 8 - 8x$$

$$x + 14 = -6x + 8 - 2x^2$$

1 mark

$$2x^2 + 7x + 6 = 0$$

$$2 \times 6 = 12$$

$$\begin{array}{r} 1, 12, \\ 2, 6 \\ \hline 3, 4 \end{array}$$

$$2x^2 + 4x + 3x + 6 = 0$$

$$2x(x + 2) + 3(x + 2) = 0$$

$$(2x + 3)(x + 2) = 0$$

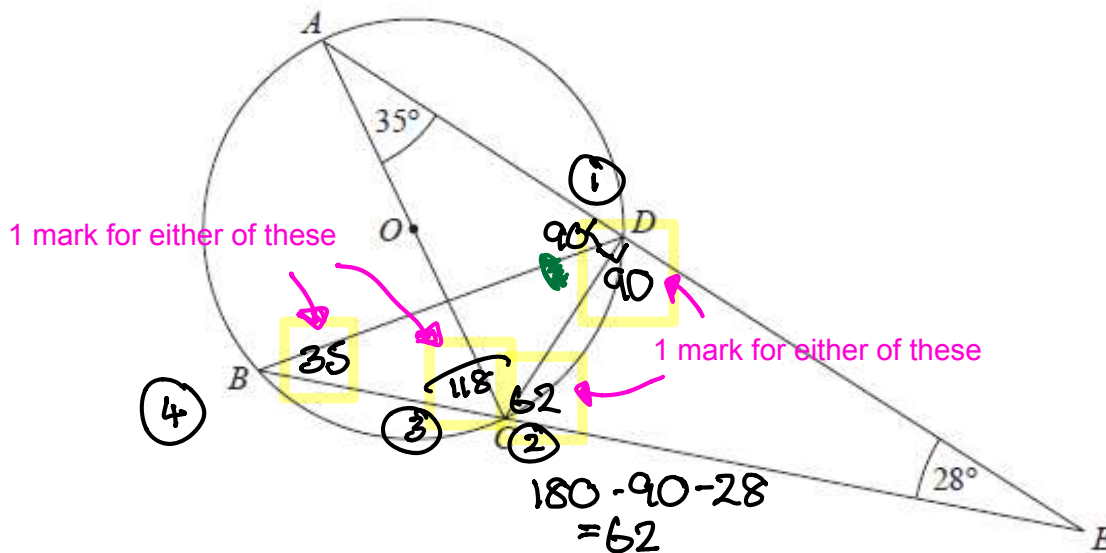
1 mark

$$x = -\frac{3}{2} \quad x = -2$$

Final mark

$$x = -1.5 \quad x = -2$$

(Total for Question 5 is 4 marks)



A, B, C and D are points on the circumference of a circle, centre O .

AC is a diameter of the circle.

ADE and BCE are straight lines.

Work out the size of angle BDC .

Write down any circle theorems that you use.

① angle in a semicircle $= 90^\circ$ $\widehat{ADC} = 90$

so $\widehat{CDE} = 90$ so ② $\widehat{DCE} = 62^\circ$ angles in a triangle add up to 180°

Final mark for an answer of 27 and one correct circle theorem used ie either of these

③ $\widehat{BCD} = 180 - 62 = 118$ angles on a straight line $= 180$

④ $\widehat{BAC} = 35^\circ$ angles in the same segment are equal

$$\begin{aligned} \text{so } \widehat{BDC} &= 180 - 35 - 118 \\ &= 180 - 153 = 27 \end{aligned}$$

27

1 mark

(Total for Question 6 is 4 marks)

- 7 Given that $\frac{2x^2 + y^2}{4x^2 - y^2} = \frac{43}{11}$ where $x > 0$ and $y > 0$

find, in its simplest form, the ratio $x : y$

$$11(2x^2 + y^2) = 43(4x^2 - y^2) \quad 1 \text{ mark}$$

$$22x^2 + 11y^2 = 172x^2 - 43y^2$$

$$54y^2 = 150x^2 \quad 1 \text{ mark}$$

$$y^2 = \frac{150}{54}x^2$$

$$y^2 = \frac{25}{9}x^2$$

$$\text{so } y = \frac{5}{3}x \quad 1 \text{ mark}$$

$$\text{or } x = \frac{3}{5}y$$

$$x : y$$

$$0.6 : 1$$

$$\begin{array}{cc} x & y \\ 3 & 5 \end{array}$$

Final mark

$$3:5$$

(Total for Question 7 is 4 marks)

- 8 The turning point on the graph of $y = g(x)$ has coordinates $(-3, 6)$

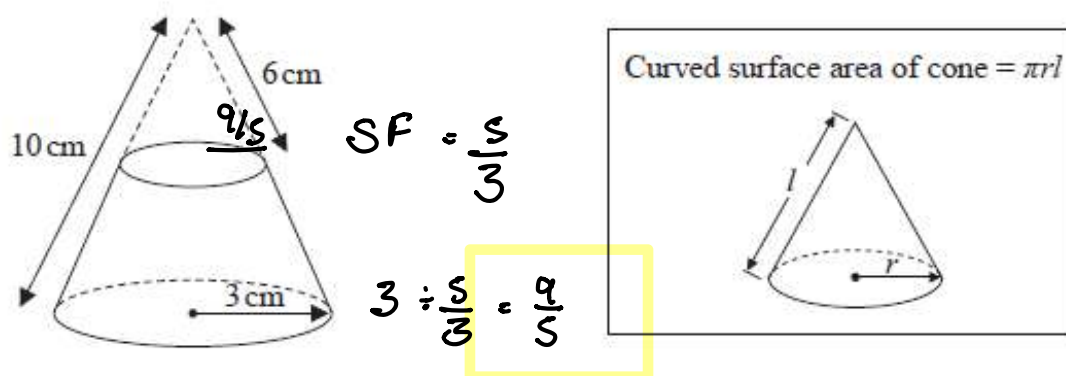
Write down the coordinates of the turning point on the graph of $y = g(x - 7)$

1 mark

$$(\quad 4 \quad , \quad 6 \quad)$$

(Total for Question 8 is 1 mark)

- 9 A solid frustum is made by removing a small cone from a large cone as shown in the diagram.



1 mark

The slant height of the small cone is 6 cm.
 The slant height of the large cone is 10 cm.
 The radius of the base of the large cone is 3 cm.
 Calculate the total surface area of the frustum.
 Give your answer correct to 3 significant figures.

1 mark for either of these

$$\text{Base} = \pi \times 3^2 = 9\pi \quad \text{Top} = \pi \times \left(\frac{9}{5}\right)^2 = \frac{81}{25}\pi$$

$$\begin{aligned} \text{Curved area} &= \pi \times 3 \times 10 - \pi \times \frac{9}{5} \times 6 \\ &= 30\pi - \frac{54}{5}\pi \\ &= \frac{96}{5}\pi \end{aligned}$$

1 mark

$$\text{Total} = \frac{96}{5}\pi + 9\pi + \frac{81}{25}\pi$$

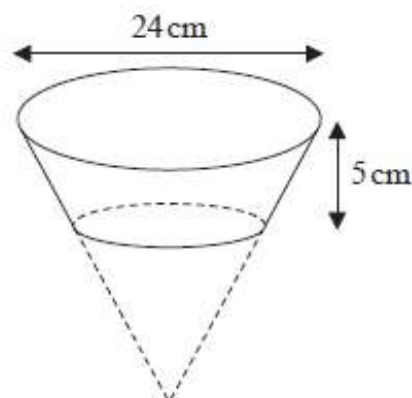
1 mark

$$\begin{aligned} &= \frac{786}{25}\pi \\ &= 98.771... \end{aligned}$$

Final mark

98.8
(3 s.f.)

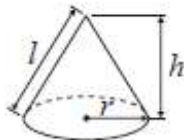
..... cm²
 (Total for Question 9 is 5 marks)
 Range accepted 98.7 to 98.8



Volume of sphere = $\frac{4}{3} \pi r^3$



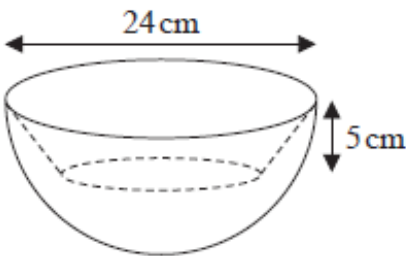
Volume of cone = $\frac{1}{3} \pi r^2 h$



The diagram above shows a frustum **F** of a cone.

The frustum is made by removing a cone with height 10 cm from a solid cone with height 15 cm and base diameter 24 cm.

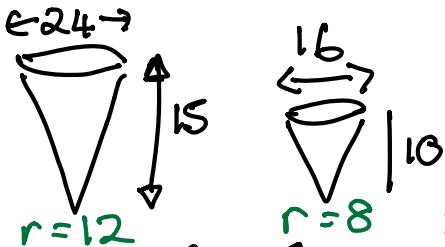
The solid **S** is made by removing **F** from a solid hemisphere as shown in the diagram below.



The hemisphere has diameter 24 cm.

Calculate the volume of solid **S**.

Give your answer correct to 3 significant figures.



$24 \div 1.5 = 16$

1 mark

length SF = 1.5

1 mark for either of these

Volume of frustum = $\frac{1}{3} \pi \times 12^2 \times 15 - \frac{1}{3} \pi \times 8^2 \times 10$

= 1591.740278

1 mark

$$\text{Volume of solid} = \frac{1}{2} \times \frac{4}{3} \times \pi \times 12^3 = 1591.74 \dots$$

$$\begin{aligned} &= 2027.3744 \dots \\ \text{3 s.f.} &= 2030 \end{aligned}$$

Final mark

2030

..... cm³

(Total for Question 10 is 4 marks)

Answers accepted in the range 2026 to 2030

11 Zia has to set a 4-digit security passcode on her phone.

Each digit of the passcode is a number from 1 to 9

1, 2, 3, 4, 5, 6, 7, 8, 9

She can use each number more than once. LOOK

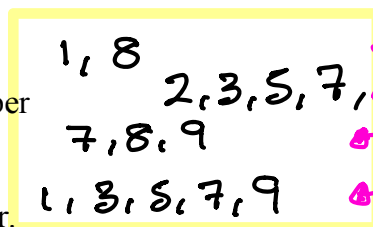
Zia tells her friend Amber that

the first digit is a cube number

the second digit is a prime number

the third digit is greater than 6

the fourth digit is an odd number.



1 mark for any two of these lists

The diagram shows one possible 4-digit passcode.



Amber is going to have one attempt at guessing Zia's passcode.

Work out the probability that Amber guesses Zia's passcode on the first attempt.

Number of combinations

1 mark

$$= 2 \times 4 \times 3 \times 5 = 120$$

$$1 \text{ attempt} = \frac{1}{120}$$

Final mark

$$\frac{1}{120}$$

(Total for Question 11 is 3 marks)

TOTAL FOR PAPER IS 37 MARKS