Surname	Centre Number	Candidate Number
First name(s)		0

Examiner only

REVISE .wales

GCSE

R.WM-MNH-U3-001

R.WM-MNH-U3-001

MOCK PAPER A

MATHEMATICS AND NUMERACY (DOUBLE AWARD)

UNIT 3: CALCULATOR-ALLOWED HIGHER TIER

2 hours

ADDITIONAL MATERIALS

A calculator will be required for this examination.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the additional page at the back of the booklet. Question numbers must be given for all work written on the additional page.

Take π as $3{\cdot}14$ or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question **5**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**8**	
3.	**11**	
4.	**9**	
5.	**11**	
6.	**12**	
7.	**11**	
8.	**11**	
9.	**11**	
Total	**90**	

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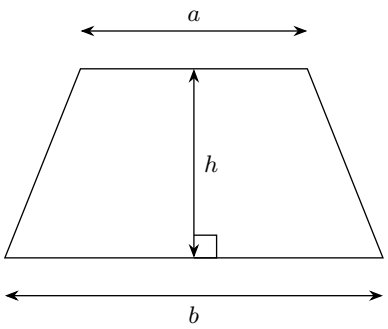
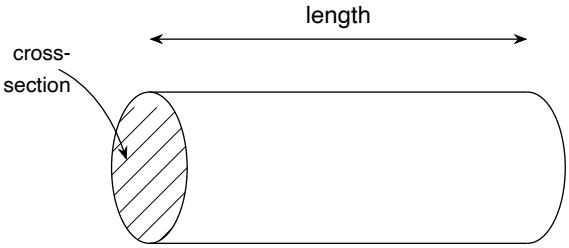
Formula List – HIGHER TIER

Area of trapezium $= \frac{1}{2}(a+b)h$

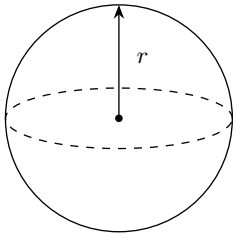


Volume of prism = area of cross-section $\times$ length



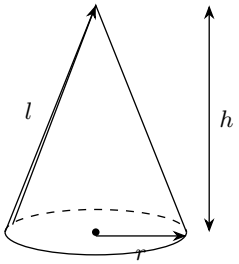
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



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

Curved surface area of cone $= \pi r l$

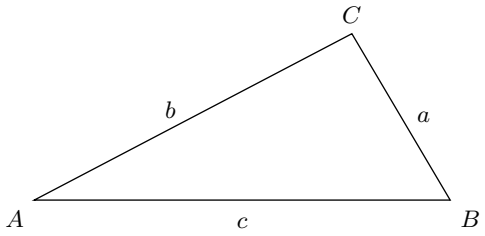


In any triangle ABC

Sine rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

1. The table below summarises three short measurements taken during a school science investigation.

Quantity	Measurement	Result
Cycle journey	$14{\cdot}4$ km in 36 minutes	? km/h
Metal block	mass 486 g, volume 60 cm^3	? g/cm^3
Tap flow	fills a $2{\cdot}5$ litre jug in 20 seconds	? litres/min

(a) Calculate the average speed of the cycle journey in kilometres per hour. [2]

Average speed = ... km/h

(b) Calculate the density of the metal block in grams per cubic centimetre. [2]

Density = ... g/cm^3

(c) Calculate the flow rate of the tap in litres per minute. [2]

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Flow rate = ... litres/min

2. The diagram below shows a metal plate. The plate is formed from a rectangle $ABCD$ measuring 20 cm by 12 cm, with a quarter-circle of radius 8 cm removed at corner C. The points E and F are where the curved edge meets the sides of the rectangle.

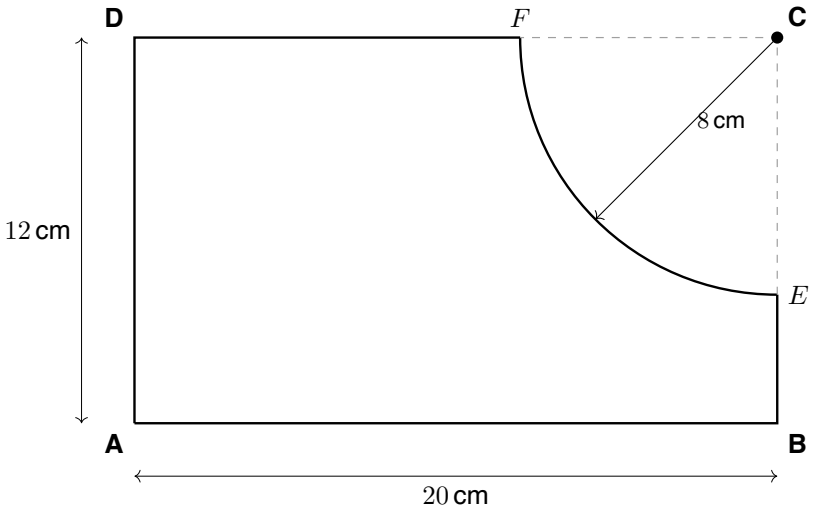

Diagram not drawn to scale

(a) Calculate the area of the plate, giving your answer in cm^2 correct to 1 decimal place. [3]

Area = ... cm^2

(b) Calculate the perimeter of the plate (i.e. the total length of the boundary, including the curved edge), giving your answer in cm correct to 1 decimal place. [3]

Perimeter = ... cm

(c) A circular hub-cap has area 64π cm^2. Find the exact circumference of the hub-cap, giving your answer in the form $k\pi$ where k is an integer. [2]

Circumference = ... cm

3. A storage box is modelled as a cuboid $ABCDEFGH$ with $AB = 18$ cm, $BC = 9$ cm and $CG = 6$ cm, as shown.

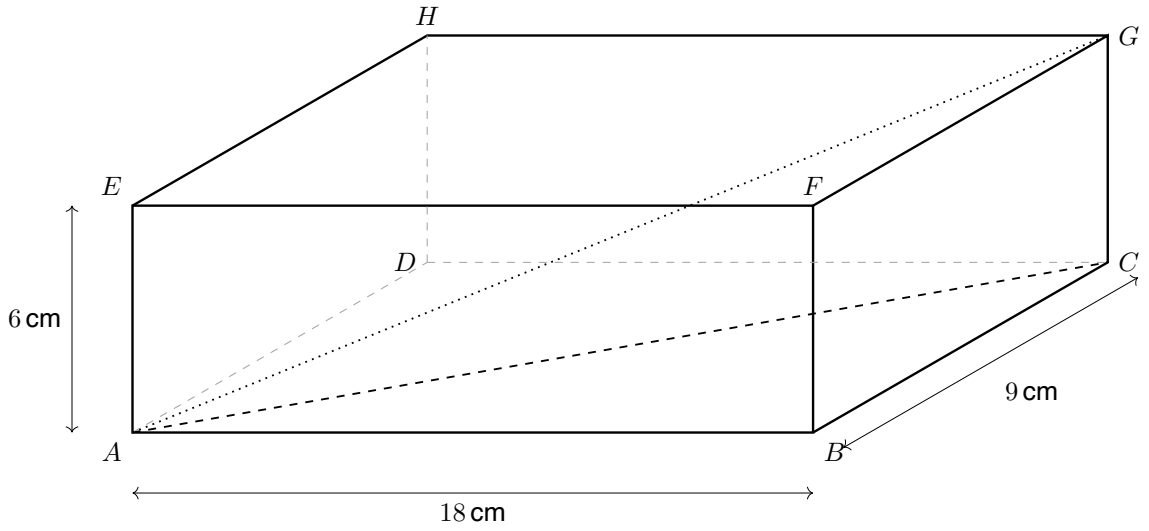

Diagram not drawn to scale

(a) Calculate the length of the diagonal AC of the base of the box, giving your answer in cm correct to 1 decimal place. [3]

$AC =$ ..... cm

(b) Calculate the length of the space diagonal AG, giving your answer in cm correct to 1 decimal place. [3]

$AG =$ ..... cm

(c) Calculate the angle that the diagonal AG makes with the base $ABCD$, giving your answer in degrees correct to 1 decimal place. [3]

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Angle = ... °

(d) A second cuboid is similar to the box above and has a space diagonal of 63 cm. Find the length AB of this second cuboid. [2]

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$AB =$ . . . . . cm

4. A solid is made from a cylinder of radius 5 cm and height 12 cm, with a solid cone of radius 5 cm and vertical height 12 cm attached to its top.

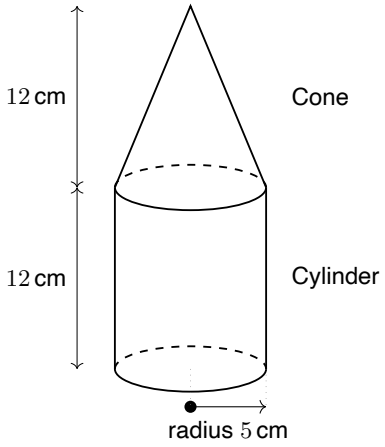

Diagram not drawn to scale

(a) Calculate the total volume of the solid, giving your answer in cm^3 correct to the nearest whole number. [3]

Volume = ... cm^3

(b) Calculate the curved surface area of the cone, giving your answer in cm^2 correct to 1 decimal place. [3]

Curved S.A. = ... cm^2

(c) A second, similar cone has a base radius of 15 cm. Find the volume of this second cone, giving your answer in cm^3 correct to the nearest whole number. [3]

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Volume = ... cm^3

5. *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

A walker sets off from village P and walks in a straight line to village Q, then in a straight line to village R, before returning directly to P. The map below shows the three villages to a scale of 1 cm representing 2 km. North is indicated by the arrow.

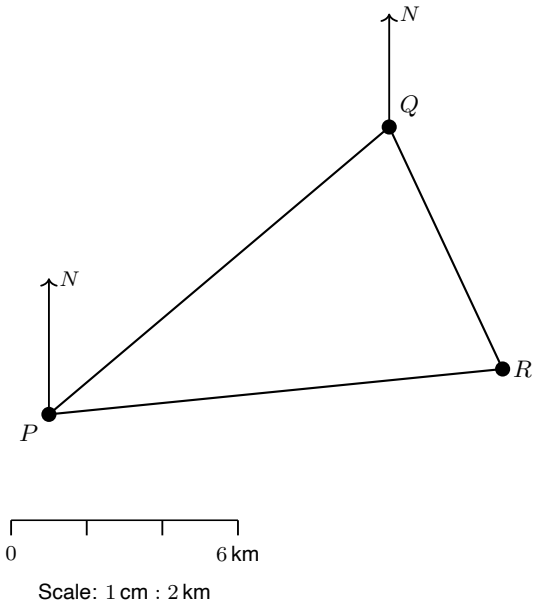

Diagram not drawn to scale

(a) By measuring carefully on the map, find the bearing of Q from P, giving your answer to the nearest degree. [3]

Bearing = ... °

(b) By measuring the distance QR on the map, calculate the real-life distance from Q to R in kilometres. [3]

Distance $QR =$ ..... km

(c) On arriving at R, the walker plans to return directly to P. State the bearing on which the walker should travel from R to reach P, and explain how you obtained it from the bearing of R from P. [3 + 2 OCW]

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Return bearing = ... °

6.

(a) Use the quadratic formula to solve $2x^2 - 7x + 3 = 0$, giving your answers correct to 2 decimal places where appropriate. [3]

$x =$ ..... or $x =$ .....

(b) Solve the equation [4]

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

giving your answers correct to 2 decimal places.

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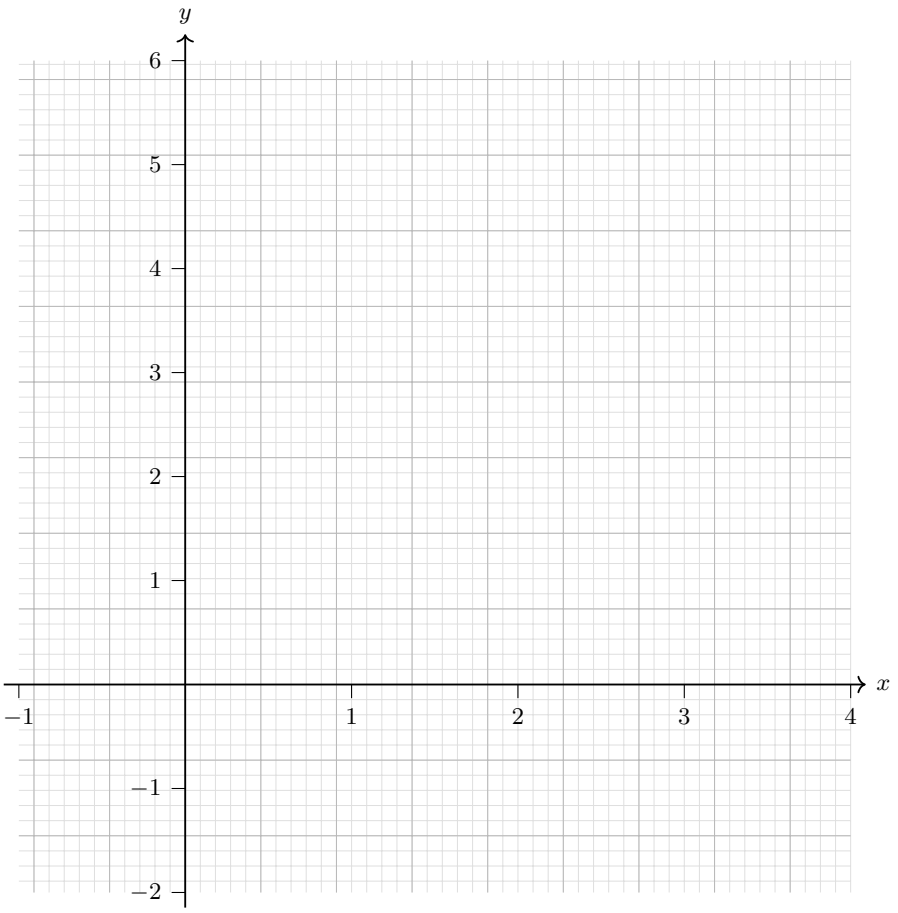
$x =$ . . . . . .

(c) Complete the table of values for $y = x^2 - 3x + 1$, then draw its graph on the grid provided for $-1 \leq x \leq 4$. By drawing a suitable straight line on the same grid, use your graph to estimate the solutions of the equation $x^2 - 4x - 1 = 0$. [5]

x	-1	0	1	2	3	4
y	5	1	?	?	1	?



Line drawn: $y =$ .....

Solutions of $x^2 - 4x - 1 = 0$: .....

7. In triangle ABC, $AB = 8{\cdot}5$ cm, $AC = 11{\cdot}2$ cm and angle $BAC = 58°$.

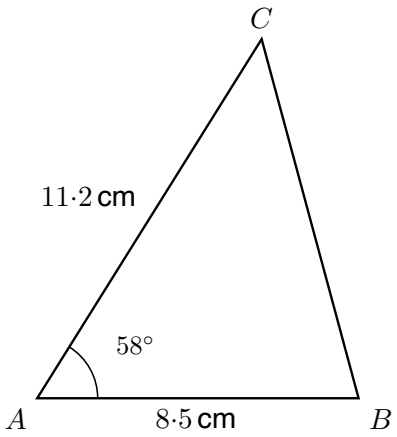


Diagram not drawn to scale

(a) Calculate the length of BC, giving your answer in cm correct to 1 decimal place. [3]

$BC =$ ..... cm

(b) Calculate the area of triangle ABC, giving your answer in cm^2 correct to 1 decimal place. [2]

Area = ... cm^2

In a separate triangle PQR, $PQ = 14$ cm, $QR = 9$ cm and angle $QPR = 32°$. The angle QRP is obtuse.

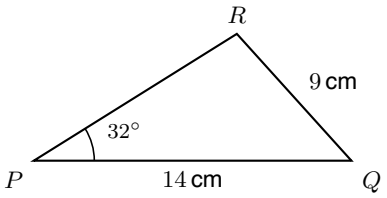


Diagram not drawn to scale

(c) Find the size of angle QRP, giving your answer correct to 1 decimal place. [3]

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Angle $QRP =$ . . . . . $^\circ$

(d) **Show that** the length PR is less than 11 cm. You must show all of your working. [3]

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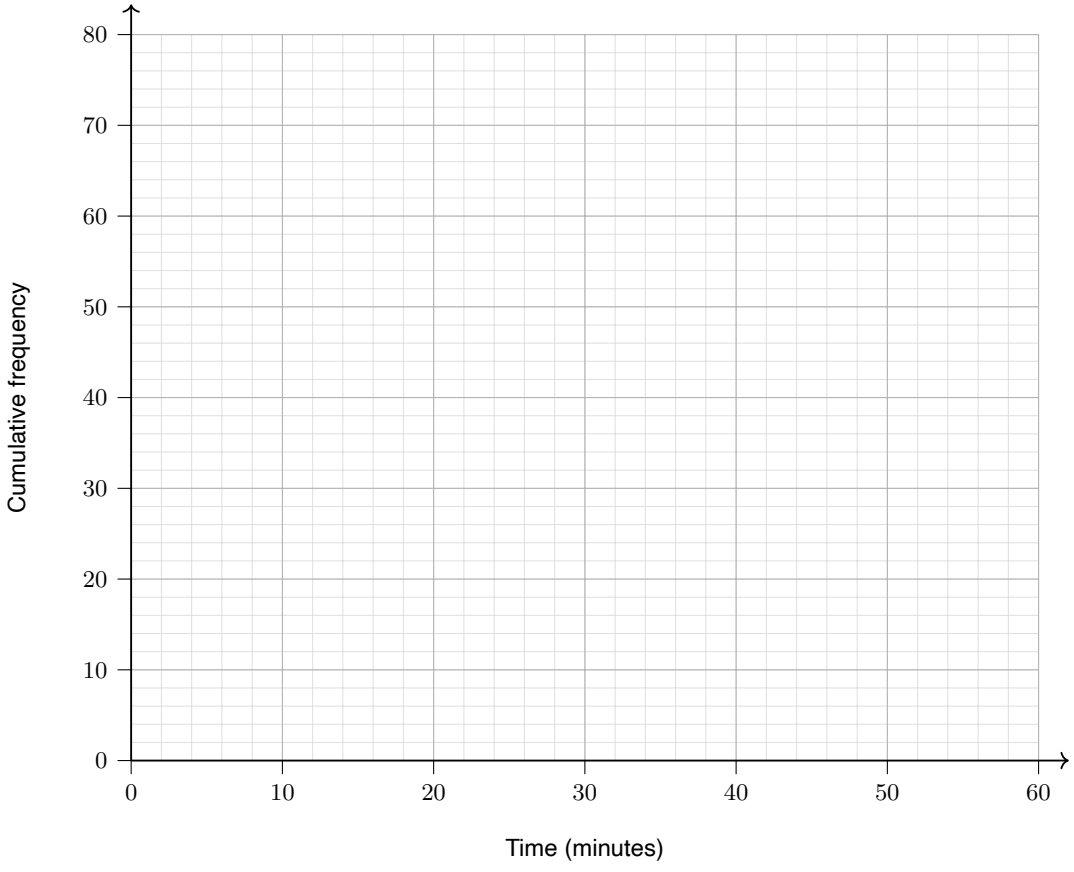
8. The table below shows the times, in minutes, taken by 80 commuters to travel from home to work.

Time, t (minutes)	**Frequency**
$0 < t \leq 10$	6
$10 < t \leq 20$	14
$20 < t \leq 30$	22
$30 < t \leq 40$	20
$40 < t \leq 50$	12
$50 < t \leq 60$	6

(a) Complete the cumulative frequency column below and draw the cumulative frequency curve on the grid provided. [3]

Time, $t \leq$	**Cumulative frequency**
10	
20	
30	
40	
50	
60	

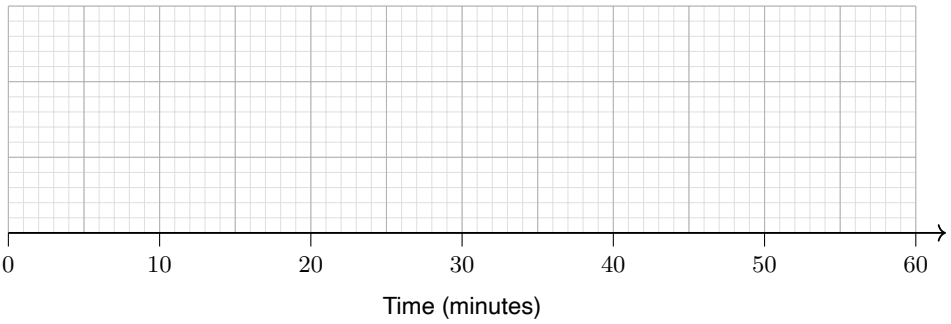


(b) Use your cumulative frequency curve to estimate the median travel time and the interquartile range. [3]

Median = ... minutes

IQR = ... minutes

(c) On the grid below, draw a box-and-whisker plot for the commuter data, using your estimates for the median and quartiles. The minimum is 2 minutes and the maximum is 58 minutes. [3]



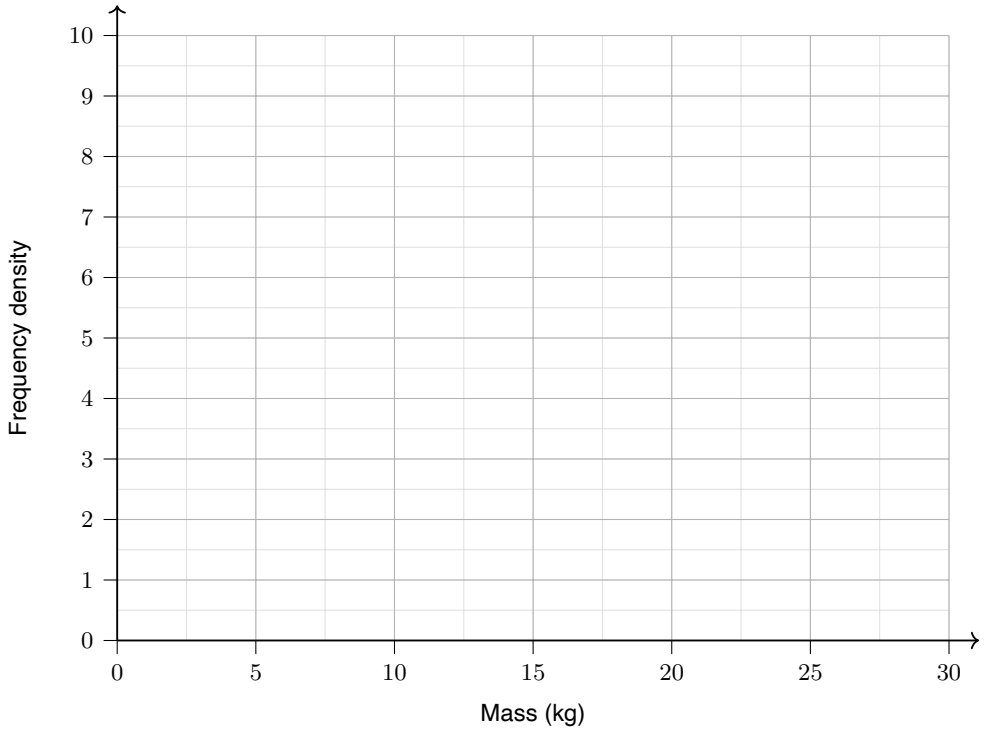
A second group of 80 commuters, using a different route, had a median travel time of 35 minutes and an interquartile range of 8 minutes.

(d) Make *two* statistical comparisons between the two groups of commuters. Refer to the median and the spread of the data. [2]

9. A garage records the masses, in kilograms, of 120 parcels. Partial information is shown below.

Mass, m (kg)	**Frequency**	**Frequency density**
$0 < m \leq 4$	8	?
$4 < m \leq 6$	?	9
$6 < m \leq 10$	40	?
$10 < m \leq 20$	36	?
$20 < m \leq 30$	?	?

(a) Complete the table and draw the corresponding histogram on the grid below. [4]



(b) Use your histogram to estimate the number of parcels with a mass greater than 8 kg. [2]

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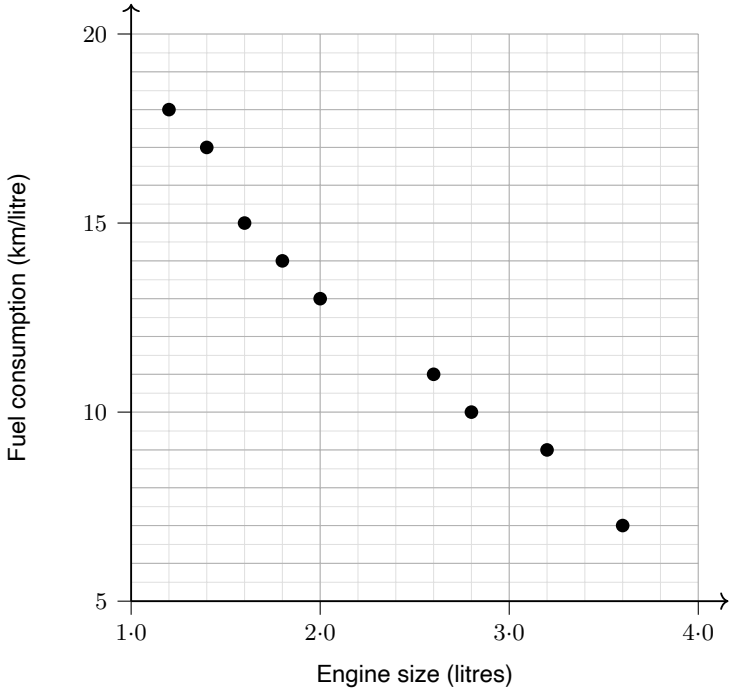
Estimate = ...

The scatter graph below shows the engine size (in litres) and the fuel consumption (in km per litre) of 10 different cars. The point for car K has not yet been plotted; its data is engine size $2{\cdot}4$ litres and fuel consumption 11 km/litre.



(c) Plot the point for car K on the scatter graph above, and draw a line of best fit through all 10 points. [3]

(d) A new car has an engine size of $3{\cdot}0$ litres. Use your line of best fit to estimate the fuel consumption of this car. State the type and strength of the correlation shown. [2]

Estimated fuel consumption = ... km/litre

Correlation: .....

END OF PAPER