Surname	Centre Number	Candidate Number
First name(s)		0

Examiner only

REVISE .wales

GCSE

R.WM-MNH-U3-002

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MOCK PAPER B

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.

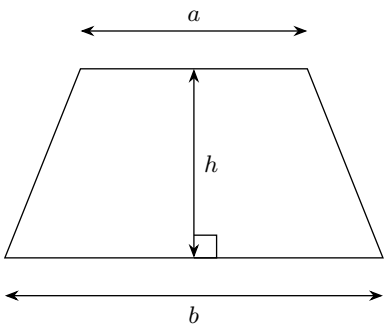
In question **5**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

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**	

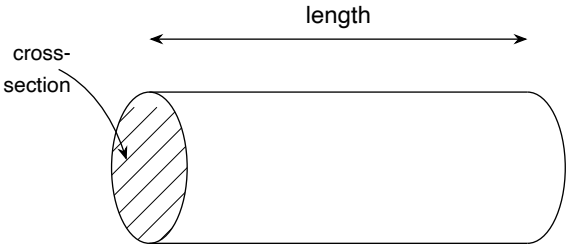
RWMMNHU3 02

Formula List – HIGHER TIER

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

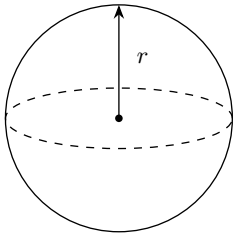


Volume of prism = area of cross-section $\times$ length



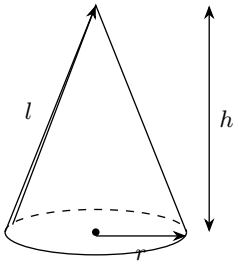
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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

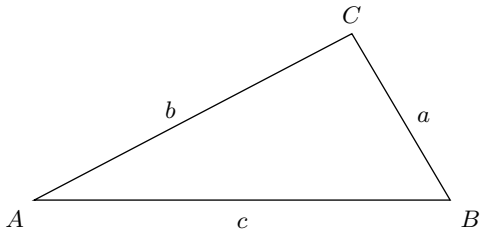


In any triangle ABC

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 records three short measurements taken during a workshop investigation.

Quantity	Measurement	Result
Fuel pump	delivers 54 litres in 45 seconds	? litres/min
Brass ingot	mass 672 g, volume 80 cm^3	? g/cm^3
Goods train	travels 248 km in 3 hours 6 minutes	? km/h

(a) Calculate the flow rate of the fuel pump in litres per minute. [2]

Flow rate = ... litres/min

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

Density = ... g/cm^3

(c) Calculate the average speed of the goods train in kilometres per hour, correct to 1 decimal place. [2]

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Average speed = ... km/h

2. The diagram below shows a flat metal washer, formed from a circular disc of radius 9 cm with a concentric circular hole of radius 4 cm cut from its centre. The shaded region is the remaining metal.

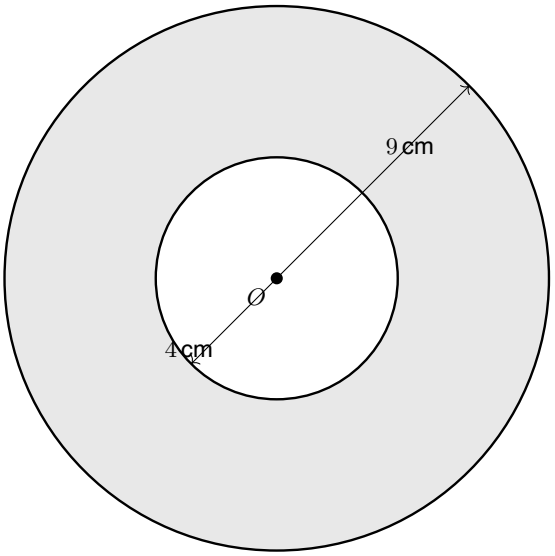

Diagram not drawn to scale

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

Area = ... cm^2

(b) Calculate the total perimeter of the shaded region (i.e. the combined length of the outer and inner edges), giving your answer in cm correct to 1 decimal place. [3]

Perimeter = ... cm

(c) A different circular disc has circumference 18π cm. Find the exact area of this disc, giving your answer in the form $k\pi$ where k is an integer. [2]

Area = ... cm^2

3. A wooden door-stop is modelled as a triangular prism $ABCDEF$ with a horizontal rectangular base $ABCD$. The cross-section ABE is a right-angled triangle, right-angled at B, with $AB = 12$ cm and $BE = 5$ cm. The depth of the prism is $BC = 8$ cm.

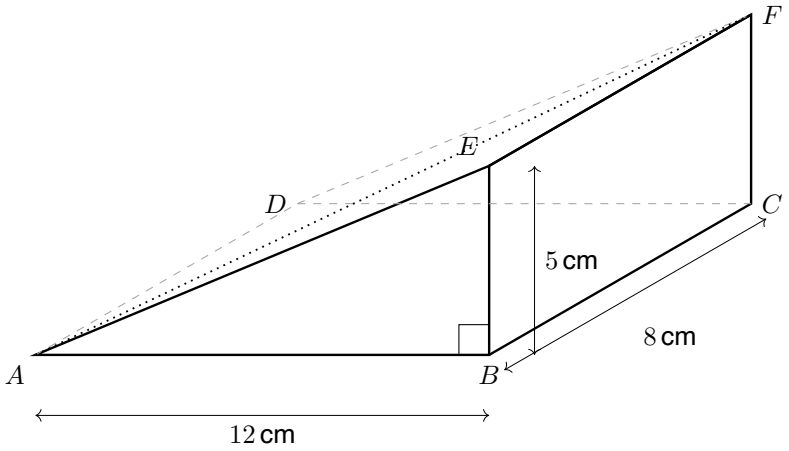

Diagram not drawn to scale

(a) Calculate the length of the sloping edge AE of the cross-section, giving your answer in cm correct to 1 decimal place. [3]

$AE =$ ..... cm

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

$AF =$ ..... cm

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

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Angle = ... °

(d) A second door-stop is similar to the one above. Its sloping edge corresponding to AE [2]
measures $32{\cdot}5$ cm. Find the depth (corresponding to BC) of this second door-stop.

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Depth = ... cm

4. A storage tank is modelled as a solid hemisphere of radius 4 cm joined to the top of a cylinder of radius 4 cm and height 10 cm.

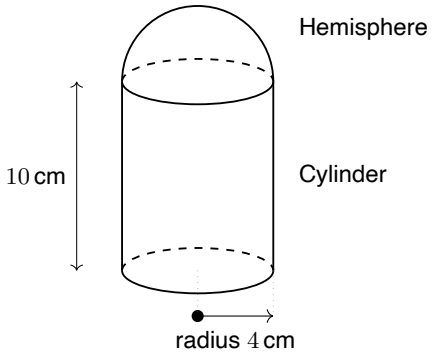

Diagram not drawn to scale

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

Volume = ... cm^3

(b) Calculate the total external surface area of the tank (i.e. the curved cylinder surface, the curved hemisphere surface, and the flat circular base), giving your answer in cm^2 correct to 1 decimal place. [3]

Surface area = ... cm^2

(c) A second tank is similar to the first and has a total volume of $4860\,cm^3$. Find the radius of the second tank, giving your answer in cm correct to 1 decimal place. [3]

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Radius = ... cm

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

A hiker leaves checkpoint X and walks in a straight line to checkpoint Y, then in a straight line to checkpoint Z. The map below shows the three checkpoints to a scale of 1 cm representing 500 m. North is indicated by the arrows.

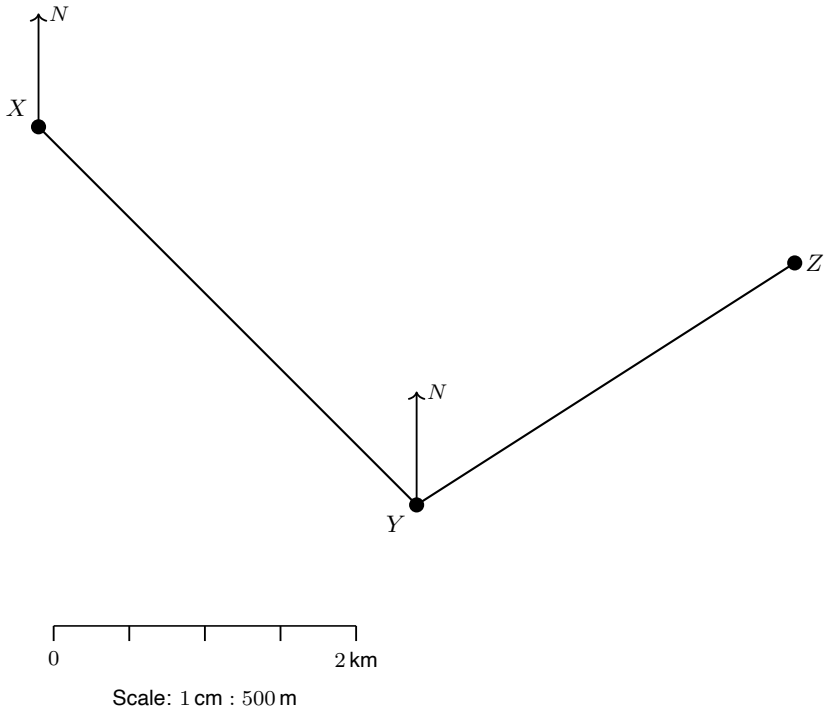

Diagram not drawn to scale

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

Bearing = ... °

(b) By measuring the distance YZ on the map, calculate the real-life distance from Y to Z in kilometres. [3]

Distance $YZ =$ ..... km

(c) The hiker walks the full route $X \to Y \to Z$ at a steady speed of 4 km/h, taking no breaks. Calculate, in minutes, the total time taken for the journey. You must show all of your working. [3 + 2 OCW]

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Total time = ... minutes

6.

(a) Use the quadratic formula to solve $3x^2 + 4x - 8 = 0$, giving your answers correct to 2 decimal places. [3]

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

(b) Solve the equation [4]

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

giving your answers correct to 2 decimal places.

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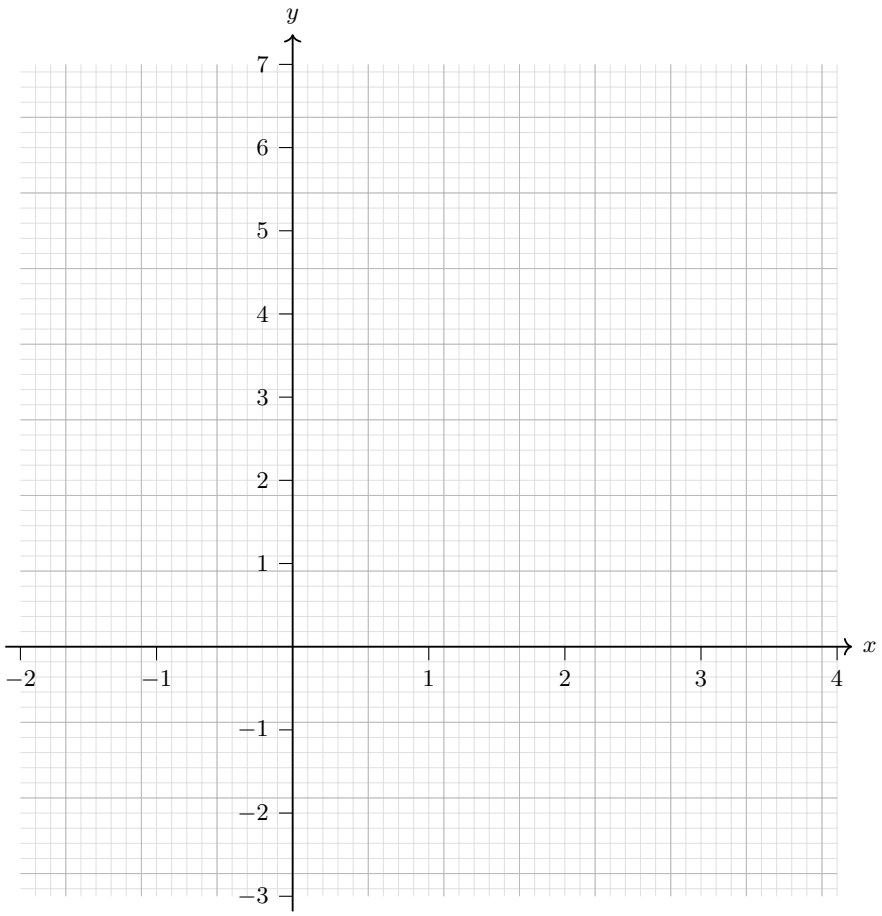
$x =$ . . . . . .

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

x	-2	-1	0	1	2	3	4
y	6	?	-2	-3	?	1	?



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

Solutions of $x^2 - 3x - 4 = 0$: .....

7. A surveyor measures a triangular plot LMN, where $LM = 24$ m, $LN = 31$ m and angle $MLN = 47°$.

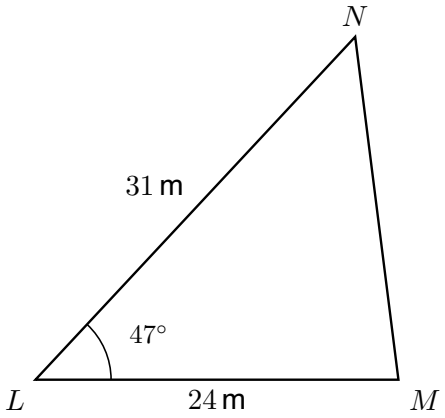


Diagram not drawn to scale

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

$MN =$ ..... m

(b) Calculate the area of the plot LMN, giving your answer in m^2 correct to 1 decimal [2] place.

Area = ... m^2

A second plot STU has $ST = 18$ m, $TU = 13$ m and angle $SUT = 78°$. Angle TSU is acute.

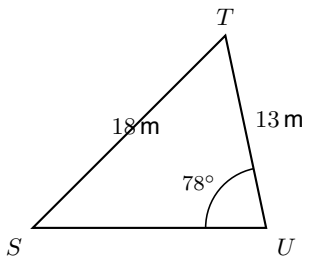


Diagram not drawn to scale

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

Angle $TSU =$ ..... °

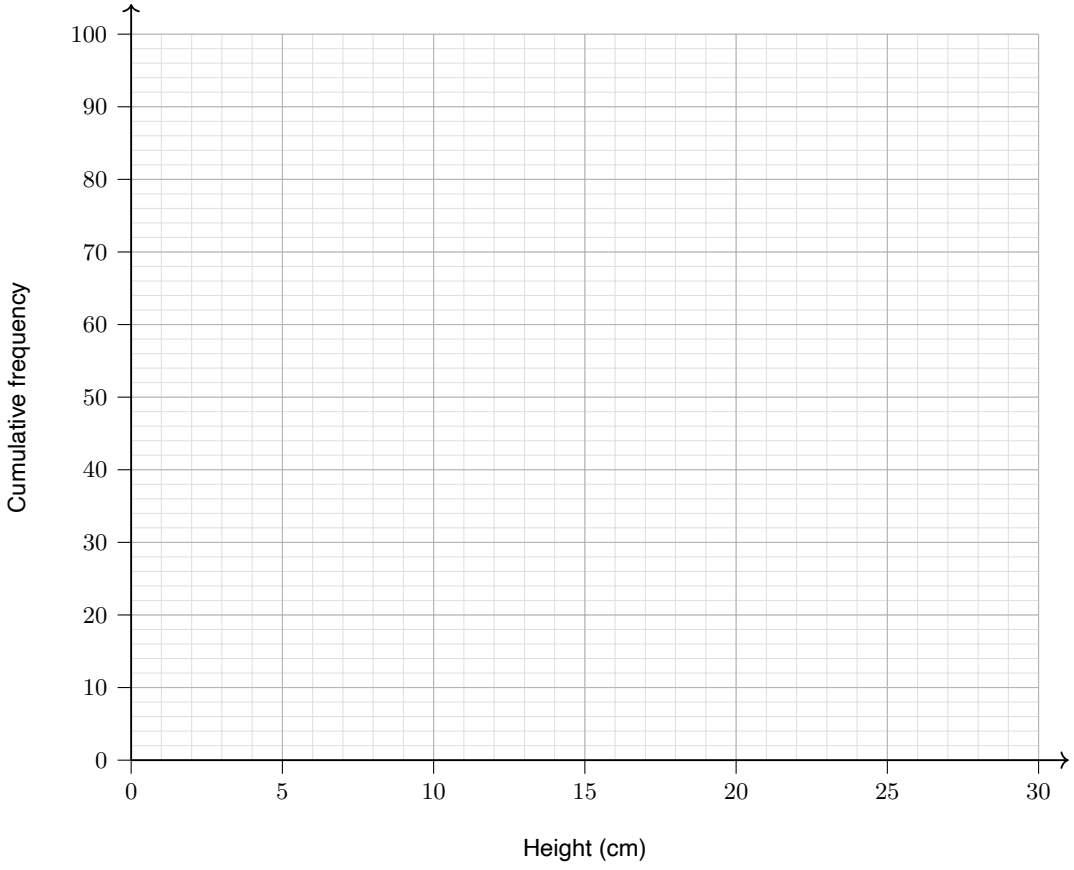
(d) **Show that** the length SU is greater than 15 m. You must show all of your working. [3]

8. A gardener measured the heights, in centimetres, of 100 sunflower seedlings four weeks after planting. The grouped data are shown below.

Height, h (cm)	**Frequency**
$0 < h \leq 5$	4
$5 < h \leq 10$	14
$10 < h \leq 15$	26
$15 < h \leq 20$	30
$20 < h \leq 25$	18
$25 < h \leq 30$	8

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

Height, $h \leq$	**Cumulative frequency**
5	
10	
15	
20	
25	
30	

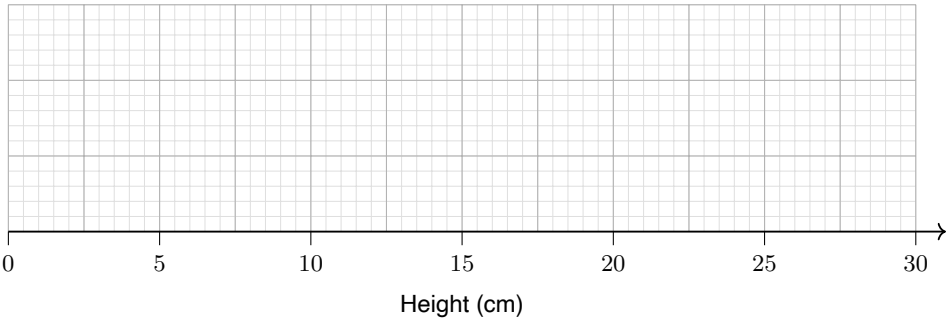


(b) Use your cumulative frequency curve to estimate the median height and the interquartile range. [3]

Median = ... cm

IQR = ... cm

(c) On the grid below, draw a box-and-whisker plot for the seedling data, using your estimates for the median and quartiles. The minimum is 1 cm and the maximum is 29 cm. [3]



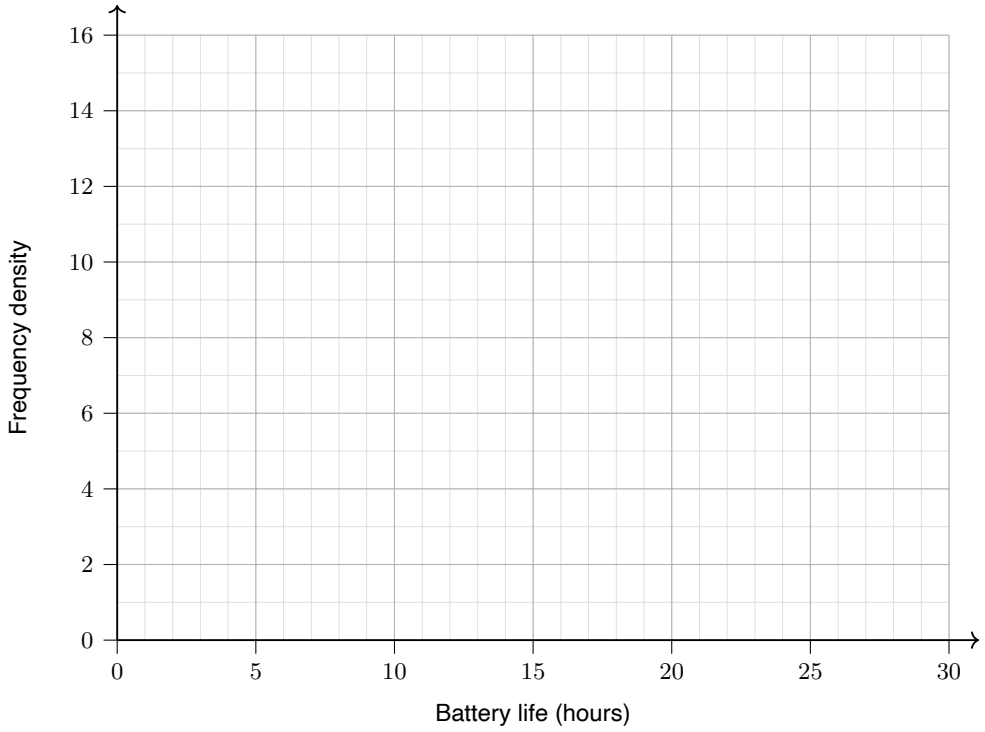
A second batch of 100 seedlings, grown under different conditions, had a median height of 13 cm and an interquartile range of 11 cm.

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

9. A laboratory measures the battery life, in hours, of 200 rechargeable batteries. Partial information is shown below.

Life, ℓ (hours)	**Frequency**	**Frequency density**
$0 < \ell \leq 2$	12	$?$
$2 < \ell \leq 5$	$?$	14
$5 < \ell \leq 10$	60	$?$
$10 < \ell \leq 20$	70	$?$
$20 < \ell \leq 30$	$?$	$?$

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



(b) Use your histogram to estimate the number of batteries with a life greater than 15 hours. [2]

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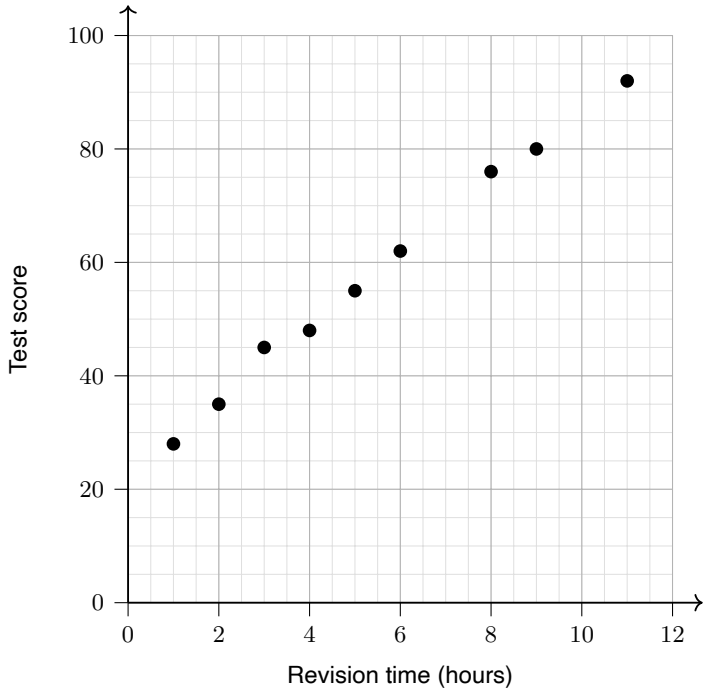
Estimate = ...

The scatter graph below shows the weekly revision time (in hours) and the test score (out of 100) for 10 students. The point for student W has not yet been plotted; their data is revision time 7 hours and test score 72.



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

(d) A different student revised for 10 hours. Use your line of best fit to estimate their test score. State the type and strength of the correlation shown. [2]

Estimated test score = ...

Correlation: .....