



**GCSE**

**3310U50-1**

**TUESDAY, 8 NOVEMBER 2022 – MORNING**

**MATHEMATICS – NUMERACY**

**UNIT 1: NON – CALCULATOR**

**HIGHER TIER**

**1 hour 45 minutes plus your additional  
time allowance**

**THE USE OF A CALCULATOR IS NOT  
PERMITTED IN THIS EXAMINATION**

**Surname:** \_\_\_\_\_

**First name(s):** \_\_\_\_\_

**Centre Number:** \_\_\_\_\_

**Candidate Number:**   0

**For Examiner's use only**

<b>Question</b>	<b>Maximum Mark</b>	<b>Mark Awarded</b>
<b>1.</b>	<b>15</b>	
<b>2.</b>	<b>13</b>	
<b>3.</b>	<b>8</b>	
<b>4.</b>	<b>6</b>	
<b>5.</b>	<b>8</b>	
<b>6.</b>	<b>6</b>	
<b>7.</b>	<b>5</b>	
<b>8.</b>	<b>5</b>	
<b>9.</b>	<b>11</b>	
<b>10.</b>	<b>3</b>	
<b>Total</b>	<b>80</b>	

**(Turn over)**

**ADDITIONAL MATERIALS**

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

**ITEMS INCLUDED WITH QUESTION PAPER**

**A separate Formula Booklet.**

**A separate Diagram Booklet.**

**Model for Question 9 (b).**

**The Diagram Booklet MUST be handed in to the invigilators and sent for marking.**

**(Turn over)**

**INSTRUCTIONS TO CANDIDATES**

**Use black ink, black ball – point pen, black felt tip or your usual method.**

**Write your name, centre number and candidate number in the spaces on the front cover.**

**Answer ALL questions.**

**Write your answers in the spaces provided.**

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

**Take  $\pi$  as 3.14**

**(Turn over)**

**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 1 (a), the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.**

**(Turn over)**

- 1. (a) IN THIS PART OF THE QUESTION, YOU WILL BE ASSESSED ON THE QUALITY OF YOUR ORGANISATION, COMMUNICATION AND ACCURACY IN WRITING.**

**Malik has two orchards.**

**He has apple trees and pear trees in his north orchard.**

**He has pear trees and cherry trees in his west orchard.**

**continued on the next page . . .**

**(Turn over)**

**Question 1 (a) continued**

**Look at the information provided for Question 1 (a) in the separate Diagram Booklet.**

**The information is about Malik's two orchards.**

**How many CHERRY trees does Malik have?**

**You must show all your working.**

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**(Turn over)**





**Question 1 continued**

**1. (b) Malik's crop of apples this year has a total mass of 5280 pounds.**

**He makes apple juice from  $\frac{1}{6}$  of the mass of his apple crop.**

**Malik makes 2 litres of apple juice from every 5 kg of apples.**

**Calculate the number of litres of apple juice Malik makes.**

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**(Turn over)**



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**[6 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 1 continued**

- 1. (c) Look at the diagrams for Question 1 (c) in the separate Diagram Booklet. The diagrams are NOT drawn to scale.**

**Malik makes cherry jam using some of the fruit from his trees.**

**Malik makes a poster to advertise his jam.**

**He also makes labels for the jars.**

**The poster and the labels are mathematically similar.**

**continued on the next page . . .**

**(Turn over)**

**Question 1 (c) continued**

**Calculate the height of the poster.**

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**[2 marks]**

**(Turn over)**

- 2. Look at the diagram for Question 2 in the separate Diagram Booklet. The diagram is a map.**

**Whales are sometimes spotted in the Irish Sea, off the west coast of Wales.**

**A minke whale was spotted on a bearing of:**

- $010^\circ$  from Aberporth**
- $280^\circ$  from Aberystwyth.**

**continued on the next page . . .**

**(Turn over)**

**Question 2 continued**

**2. (a) Scientists decide to search for other whales in the Irish Sea. The search area is the region within 20 km of the position where the minke whale was spotted.**

**Using the scale given, show this search area on the map.**

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**[4 marks]**

**(Turn over)**

**Question 2 continued**

**2. (b) This minke whale has a length of 20 feet.**

**Remember:**

**1 inch  $\approx$  2.5 cm,**

**1 foot = 12 inches**

**Use these facts to complete the following statement.**

**The minke whale has a length of \_\_\_\_\_ metres.**

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**(Turn over)**



**Question 2 continued**

- 2. (c) The brain of a minke whale has 12.8 billion neocortical neurons. A female human brain has 19 billion neocortical neurons.**

**Remember:**

**1 billion = 1000 million**

**continued on the next page . . .**

**(Turn over)**

**Question 2 (c) continued**

**2. (c) (i) Calculate an ESTIMATE for the number of neurons in a minke whale brain expressed as a percentage of the number of neurons in a female human brain. You must show all your working.**

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**(Turn over)**

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**Approximately \_\_\_\_\_ %**

**[2 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 2 (c) continued**

**2. (c) (ii) 10% of all neocortical neurons are lost over a human lifespan.**

**Calculate the number of neocortical neurons in a female human brain at the end of a lifespan.**

**Give your answer in standard form.**

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**(Turn over)**

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**[4 marks]**

**(Turn over)**

**3. (a) Look at Diagram 1 for Question 3 (a) in the separate Diagram Booklet.**

**Diagram 1 is a cumulative frequency diagram.**

**The lengths of the 60 yachts in Eog Marina were measured. The results are shown in Diagram 1.**

**The shortest yacht has a length of 3 m.**

**The longest yacht has a length of 22 m.**

**continued on the next page . . .**

**(Turn over)**

**Question 3 (a) continued**

**Look at Diagram 2 for  
Question 3 (a) in the separate  
Diagram Booklet.**

**Use the information on the  
previous page and in  
Diagram 1 to complete a  
box – and – whisker diagram  
on Diagram 2.**

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**[3 marks]**

**(Turn over)**

**Question 3 continued**

**3. (b) The lengths of the 68 yachts in Clwyd Marina were measured.**

**For these yachts:**

- **the lower quartile of their lengths is 10 m**
- **25% have lengths greater than 18 m**
- **the median length is 11.6 m.**

**continued on the next page . . .**

**(Turn over)**

**Question 3 (b) continued**

**3. (b) (i) Calculate how many of the yachts in Clwyd Marina have lengths greater than 10 m.**

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\_\_\_\_\_ yachts

**[2 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 3 (b) continued**

**3. (b) (ii) In which marina, Eog or Clwyd, is the interquartile range of the lengths of the yachts greater?**

**Eog Marina**

**Clwyd Marina**

**You must show all your working.**

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**(Turn over)**

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**[2 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 3 (b) continued**

**3. (b) (iii) In which marina is the longest yacht?**

**Eog Marina**

**Clwyd Marina**

**Can't tell**

**You must give a reason for your answer.**

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**(Turn over)**

**30**

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**[1 mark]**

**(Turn over)**

4. Melin is a company that packages flour for sale in supermarkets.

It packages the flour in cylindrical bags.

The area of the cross – section of each of these bags is  $25 \text{ cm}^2$

(a) Write down an expression, in terms of  $\pi$ , for THE RADIUS OF THE BASE of each of these bags.

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(Turn over)

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**[2 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 4 continued**

**4. (b) Each bag has a volume  
of  $500 \text{ cm}^3$**

**(i) Currently the bags are  
filled with flour at a rate of  
 $\frac{1}{4}$  of a bag per second.**

**Complete the following  
statement.**

**Melin packages bags of flour at a  
rate of \_\_\_\_\_  $\text{cm}^3$  per minute.**

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**(Turn over)**

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**[2 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 4 (b) continued**

**4. (b) (ii) A new cylindrical bag is designed to have the same capacity and to be more stable.**

**Melin decides to increase the area of the cross – section of its original bags by 100%. Calculate the height of this new bag.**

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**(Turn over)**

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**[2 marks]**

**(Turn over)**

**5. Madeleine is researching the effects of waves. She does this at two different beaches, Llanddawel and Abertig. She measures the masses of pebbles in a sample taken from each beach.**

**(a) Look at the diagram for Question 5 (a) in the separate Diagram Booklet.**

**The diagram is a histogram.**

**It shows the masses of the pebbles in the sample taken from Llanddawel beach.**

**continued on the next page . . .**

**(Turn over)**

**Question 5 (a) continued**

**Calculate an estimate for the percentage of pebbles in Madeleine's sample that had a mass of less than 70 g.**

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**(Turn over)**



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**[5 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 5 continued**

**5. (b) Look at the diagram for Question 5 (b) in the separate Diagram Booklet. The diagram is a different histogram.**

**It shows the masses of the pebbles in the sample taken from Abertig beach.**

**The scale on the vertical axis is missing.**

**continued on the next page . . .**

**(Turn over)**

**Question 5 (b) continued**

**5. (b) (i) 120 pebbles each had a mass of less than 30 g.**

**Use this fact to complete the frequency density axis on the diagram.**

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**[2 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 5 (b) continued**

- 5. (b) (ii) What was the median mass of the pebbles in the sample taken from Abertig beach?  
Circle your answer.**

<b>30 g</b>	<b>40 g</b>	<b>45 g</b>	<b>50 g</b>	<b>50.5 g</b>
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**[1 mark]**

**(Turn over)**

6. Look at the diagram for Question 6 in the separate Diagram Booklet. The diagram is NOT drawn to scale. Luke wants to lay wooden flooring in the living room of his house. The plan view of his living room floor is shown, labelled ***ABCDEF***.

In the diagram,

$$AF = 4.4 \text{ m}$$

$$FE = 8 \text{ m}$$

$$EC = 5.4 \text{ m}$$

$$DB = 5 \text{ m}$$

Angle ***BAF***, angle ***AFE*** and angle ***FEC*** are right angles.

continued on the next page . . .

(Turn over)

**Question 6 continued**

**All the measurements shown on the diagram are CORRECT TO THE NEAREST 0.2 m.**

**Luke knows that:**

- **each pack of wooden flooring covers EXACTLY 3 m<sup>2</sup>**
- **10% needs to be added to the area of the floor that is to be covered, to ensure he has enough wooden flooring.**

**continued on the next page . . .**

**(Turn over)**

**Question 6 continued**

**Calculate the minimum number  
of packs needed to guarantee that  
Luke has enough wooden flooring  
to cover his living room floor.  
You must show all your working.**

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**(Turn over)**





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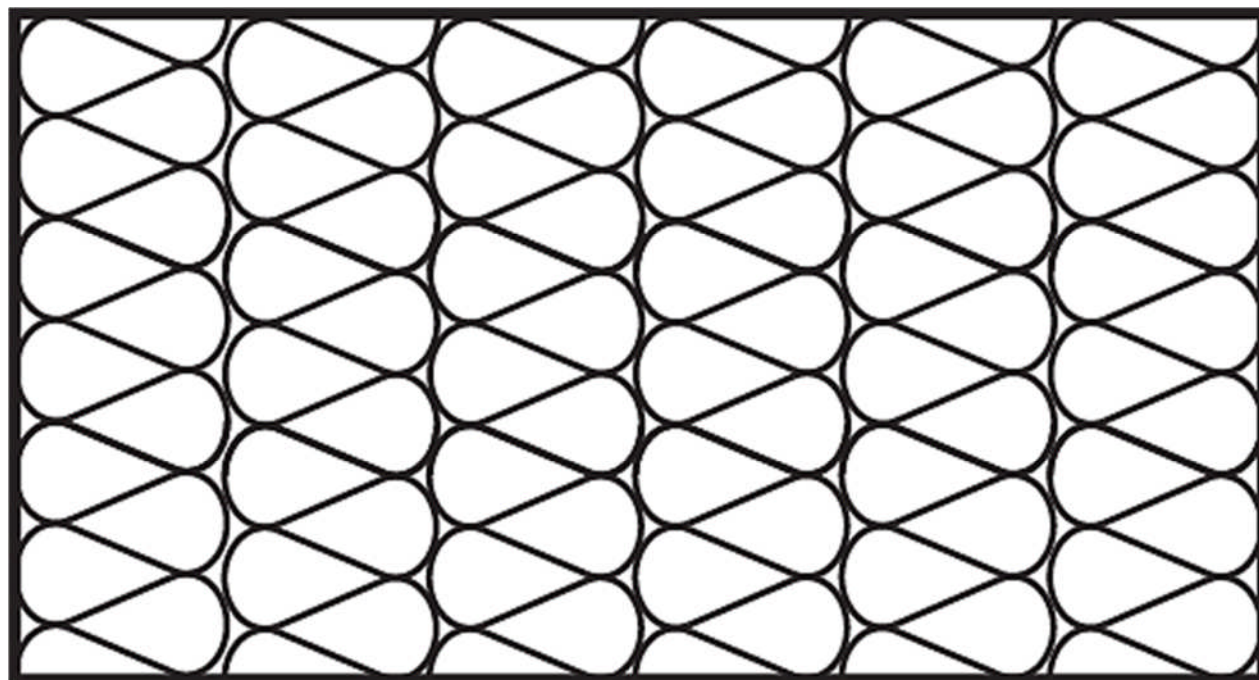
**Number of packs is** \_\_\_\_\_

**[6 marks]**

**(Turn over)**

7. Look at the diagram below.

The diagram represents a bottle rack that Nia saw in her local hotel.



Nia decides to make a smaller bottle rack in the same style.

Look at the diagram for Question 7 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The front view of her bottle rack is shown.

continued on the next page . . .

(Turn over)

**Question 7 continued**

**Nia made the rack from bending a long sheet of metal.**

**It has straight sections, each of length 6.6 cm. It also has curved sections that are all arcs of a circle with radius 4.5 cm and sector angles of  $120^\circ$  or  $240^\circ$**

**Calculate the length of the sheet of metal that Nia needed for her design. Give your answer in terms of  $\pi$ , in its simplest form.**

**You must show all your working.**

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**Length of metal sheet needed**

**= \_\_\_\_\_ cm**

**[5 marks]**

**(Turn over)**

- 8. Look at Diagram 1 and Diagram 2 for Question 8 in the separate Diagram Booklet. The diagrams are NOT drawn to scale.**

**Emma wants to know how much water is in a pond near her house. She has taken width measurements of the pond every 3 m along its length.**

**These width measurements are shown on the plan view of the pond (Diagram 1).**

**continued on the next page . . .**

**(Turn over)**

**Question 8 continued**

**Emma has used these width measurements to sketch the graph shown (Diagram 2).**

**Emma knows that the pond has a uniform depth of 1.2 m.**

**Use the trapezium rule with 4 strips to calculate an estimate for the volume of water in the pond.**

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**(Turn over)**





**9. (a) Geralit owns 2 ice cream shops.**

**On a sunny Saturday,**

**Geralit sold 400 ice creams in**

**total in 4 hours in the 2 shops.**

**Geralit is considering opening  
another ice cream shop.**

**He expects the sales per hour**

**in each of the 3 shops to be**

**the same.**

**continued on the next page . . .**

**(Turn over)**

**Question 9 (a) continued**

**His ice cream shops will be open for 5 hours a day.**

**Calculate how many ice creams Gerallt would expect to sell in total on a sunny Saturday in 5 hours in the 3 shops.**

**You must show all your working.**

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**(Turn over)**

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**[3 marks]**

**continued on the next page . . .**

**(Turn over)**

**Question 9 continued**

- 9. (b) Ask for the model for Question 9 (b). The model is NOT drawn to scale.**

**Gerallt has decided to open a new ice cream shop at his local seafront.**

**He has designed his new ice cream shop to look like half an ice cream cone.**

**The design consists of half a hollow cone connected to half a hollow hemisphere, as shown on the model.**

**continued on the next page . . .**

**(Turn over)**

**Question 9 (b) continued**

**Look at the diagram for Question 9 (b) in the separate Diagram Booklet. The diagram is NOT drawn to scale.**

**The diagram shows the plan view of the ice cream shop.**

**The radius of the base of the half hemisphere is 3 m.**

**The perpendicular height of the cone is shown as  $h$  on the diagram.**

**continued on the next page . . .**

**(Turn over)**

**Question 9 (b) continued**

**Gerallt designed the shop so that the volume of the half cone is equal to the volume of the half hemisphere.**

**Calculate the length  $x$ .**

**Give your answer in the form**

**$a\sqrt{b}$ , where  $a$  and  $b$  are both**

**integers and  $b$  is as small**

**as possible.**

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**(Turn over)**







**10. A rubber ball is dropped from a height of 8 m onto horizontal ground.**

**After each bounce, the ball reaches a maximum height that is 17% lower than the maximum height reached after its previous bounce.**

**Look at the diagram for Question 10 in the separate Diagram Booklet.**

**The diagram is NOT drawn to scale.**

**The diagram shows the path of the ball for the first few bounces.**

**continued on the next page . . .**

**(Turn over)**



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**[3 marks]**

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**END OF PAPER**

**TOTAL 80 MARKS**

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**(Turn over)**









**GCSE**

**3310U50-1**

**TUESDAY, 8 NOVEMBER 2022 – MORNING**

**MATHEMATICS – NUMERACY  
UNIT 1: NON – CALCULATOR  
HIGHER TIER**

**The Diagram Booklet MUST  
be handed in to the invigilators  
and sent for marking.**

# **Diagram Booklet**

**Surname:** \_\_\_\_\_

**First name(s):** \_\_\_\_\_

**Centre Number:** \_\_\_\_\_

**Candidate Number:** 0 \_\_\_\_\_

## Question 1 (a)

### Information

**In the north orchard,**

- **Malik has a total of 35 trees**
- **number of apple trees : number of pear trees = 4 : 3**

**In the west orchard,**

- **Malik has twice as many PEAR trees as he has  
PEAR trees in the north orchard**
- **number of pear trees : number of cherry trees = 5 : 11**

# Question 1 (c)

Diagrams NOT drawn to scale

**POSTER**

**48 cm**



**JAM JAR LABEL**

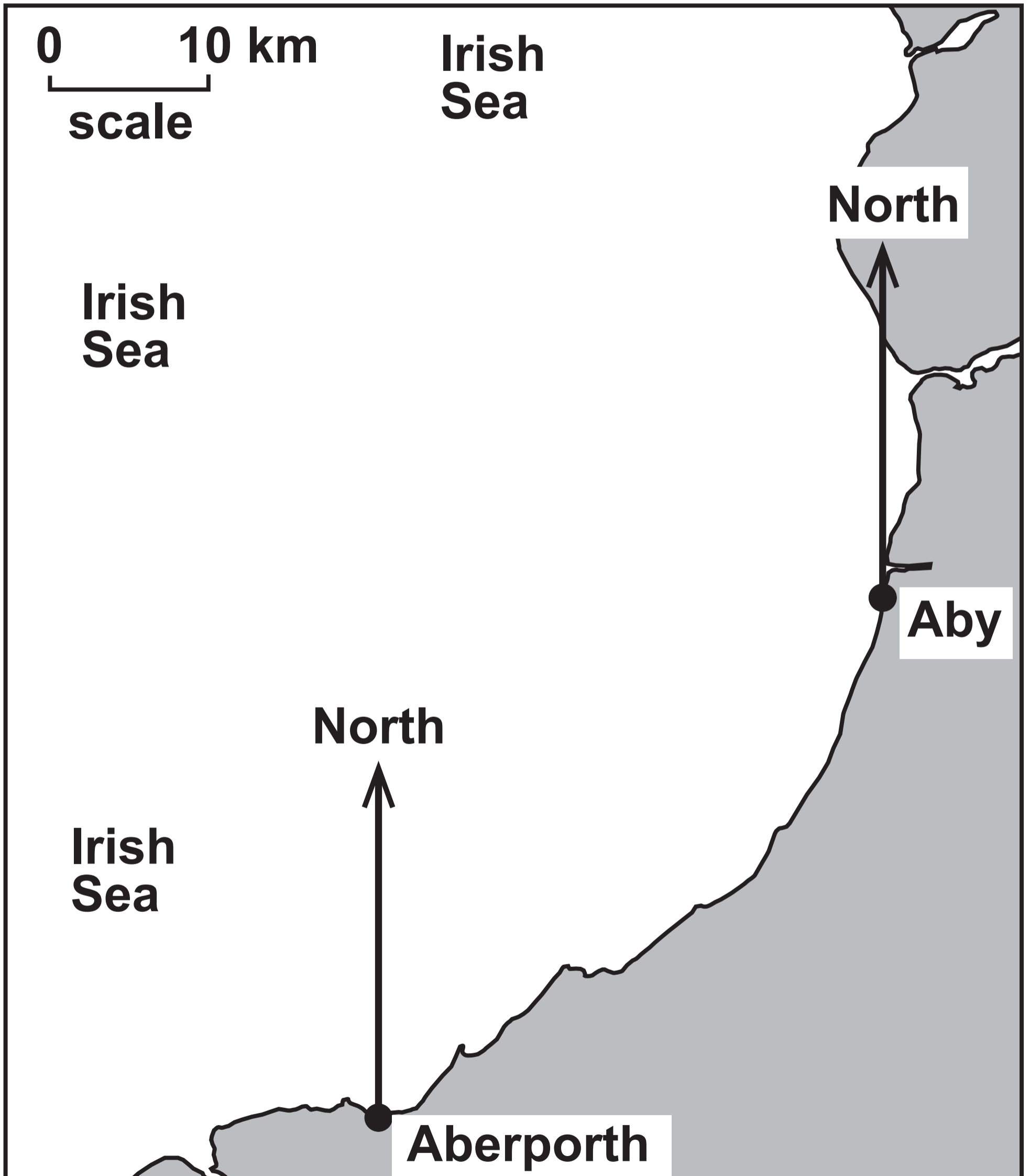
**8 cm**



## Question 2

**Key:**

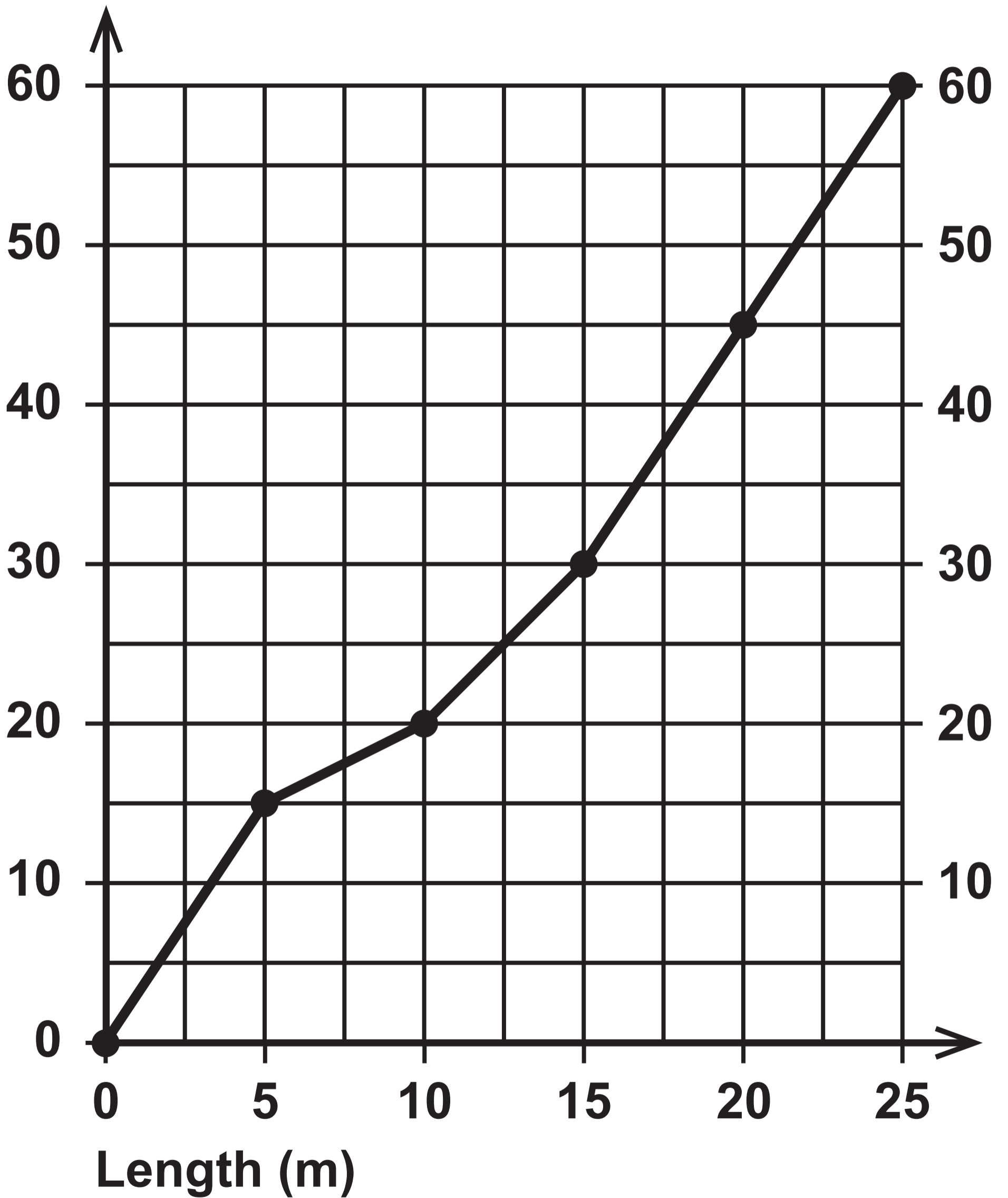
**Aby = Aberystwyth**



# Question 3 (a)

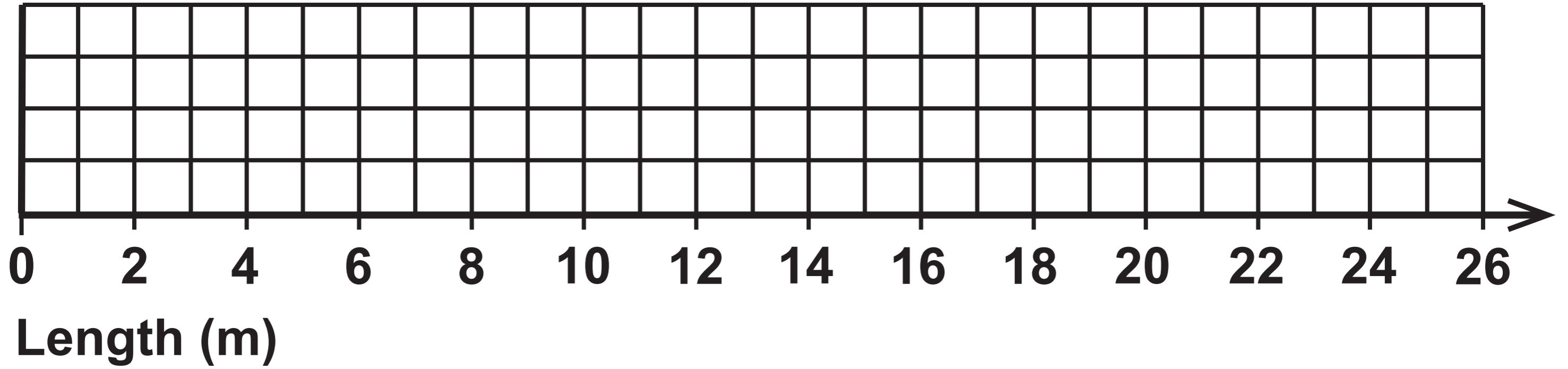
Cumulative  
frequency

Diagram 1



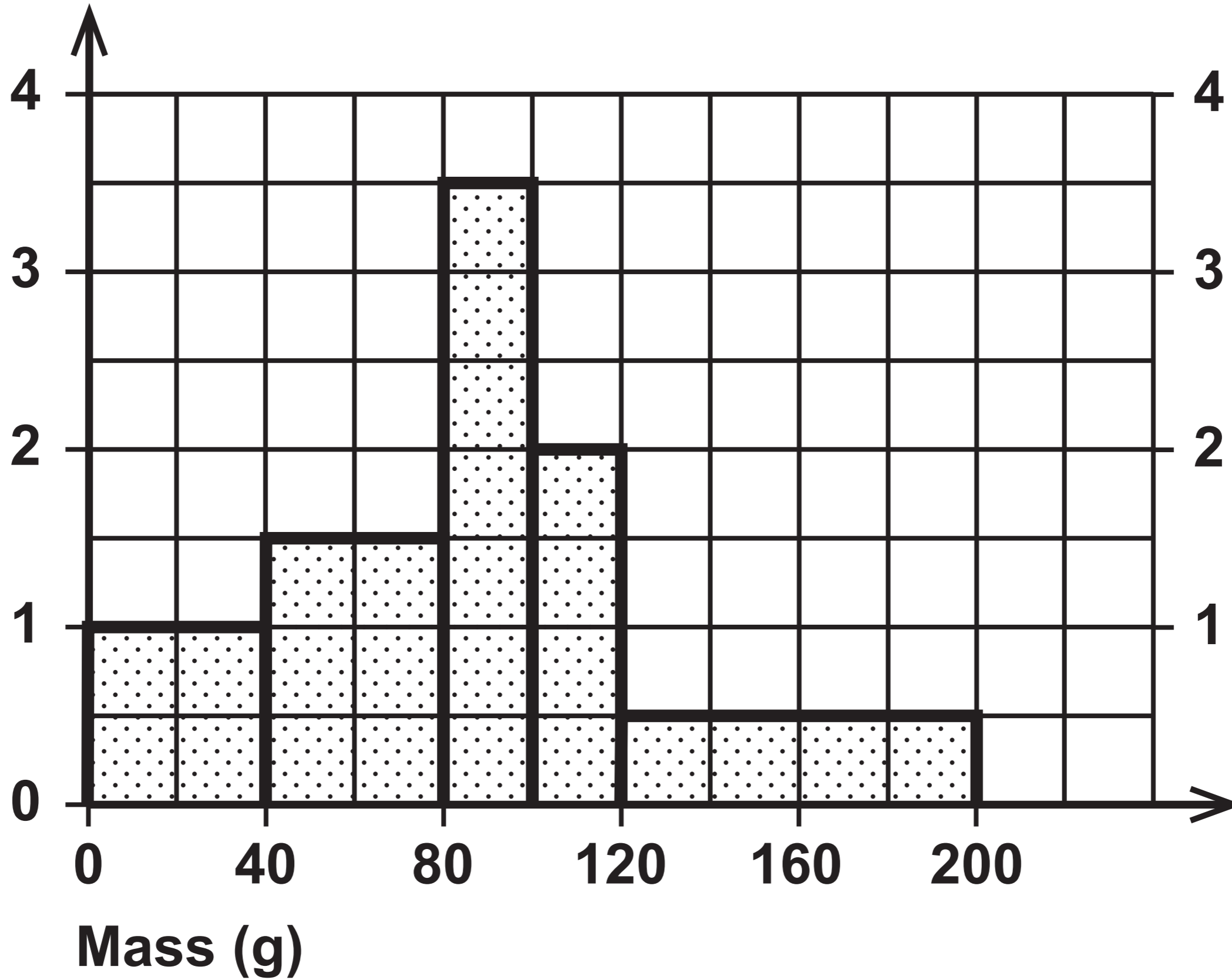
# Question 3 (a)

## Diagram 2



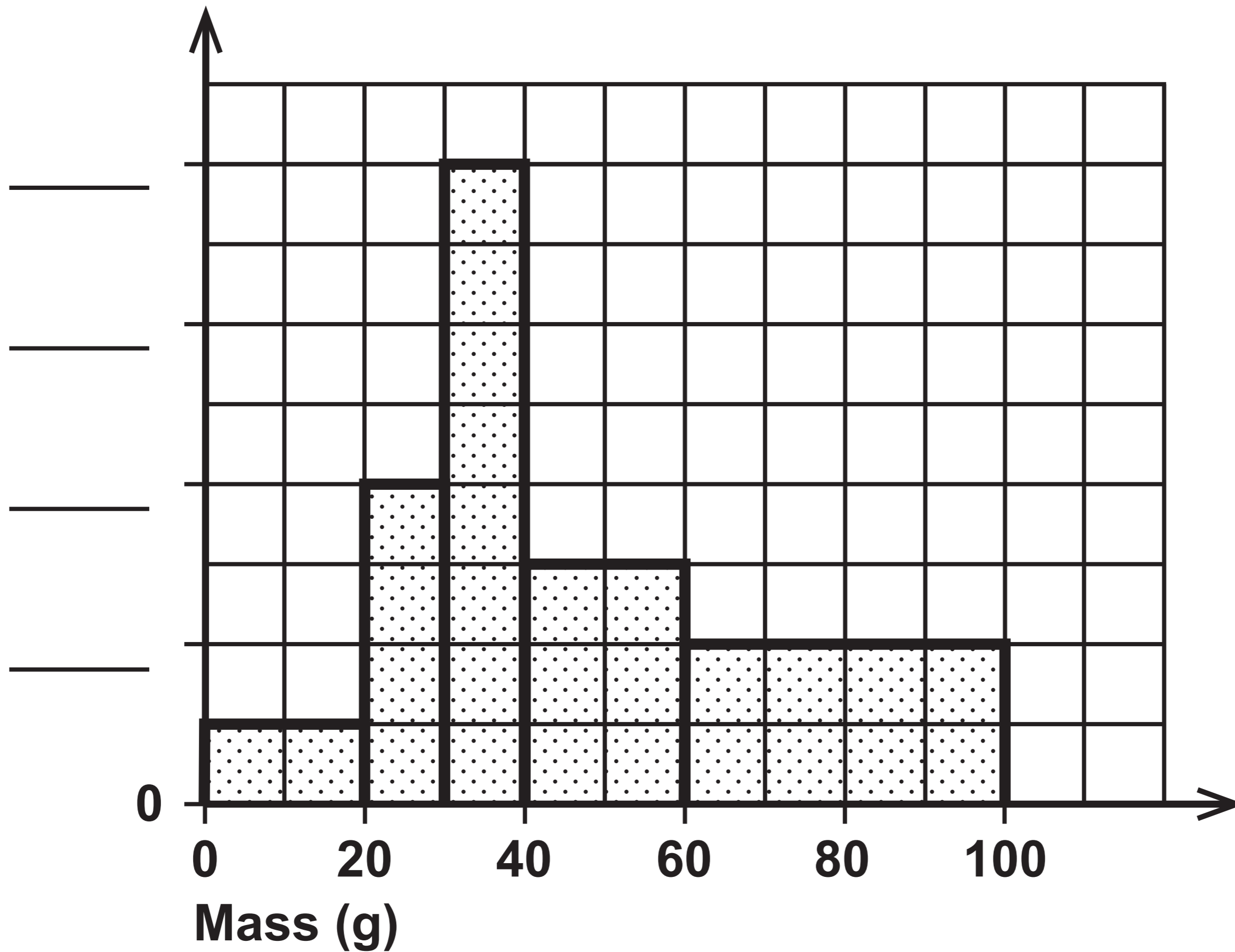
# Question 5 (a)

Frequency  
density



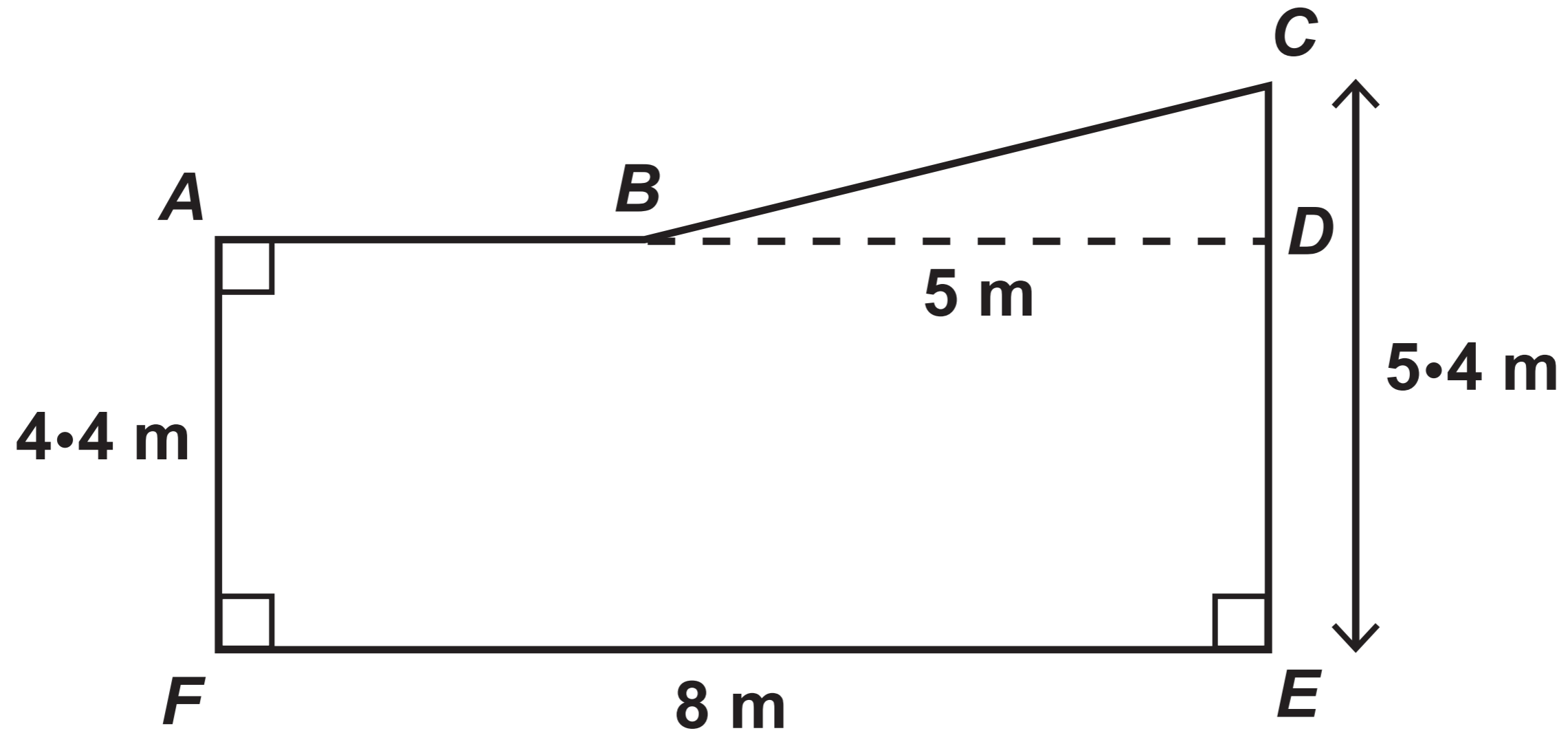
**Frequency  
density**

**Question 5 (b)**



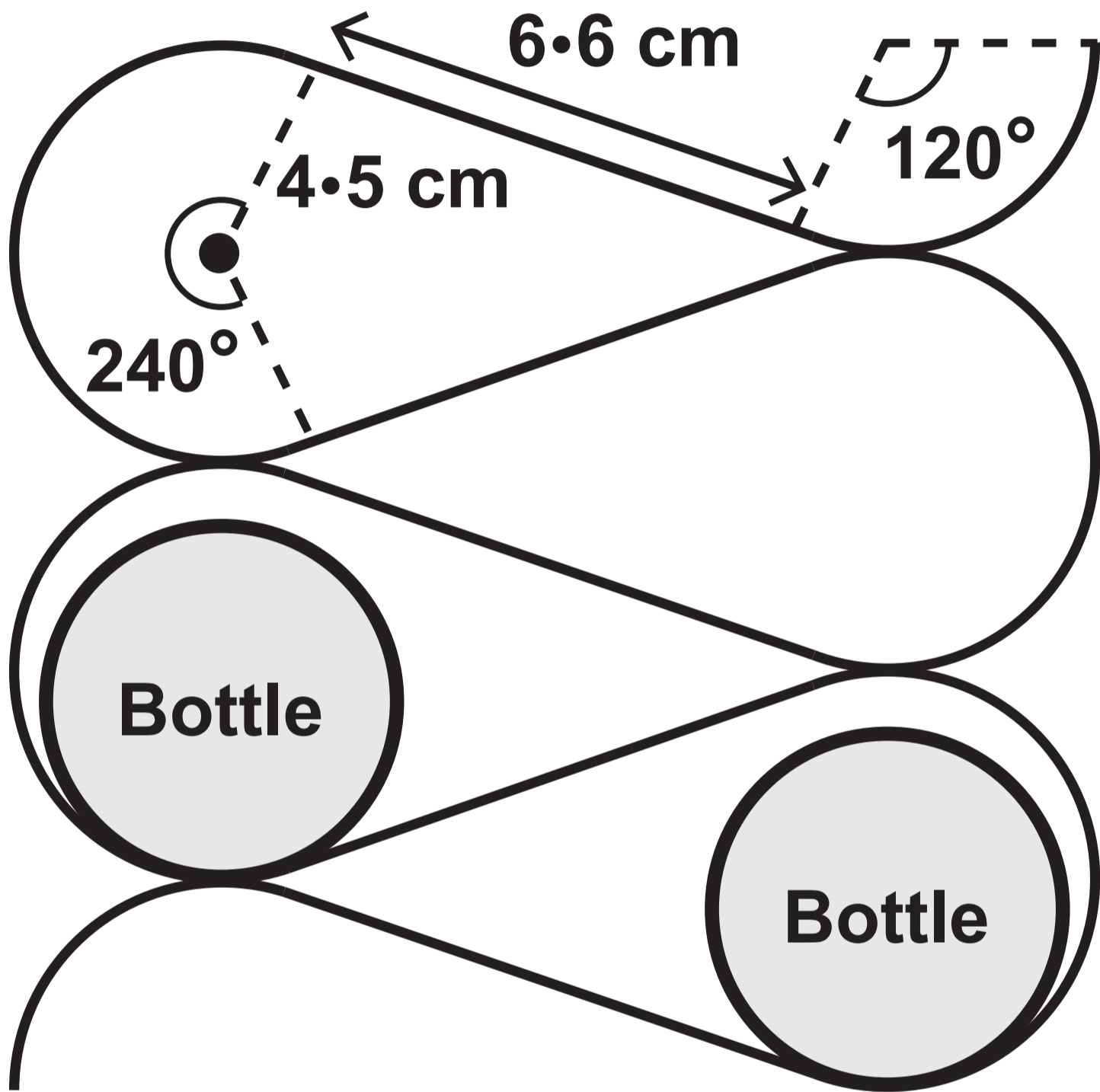
# Question 6

Diagram NOT drawn to scale



# Question 7

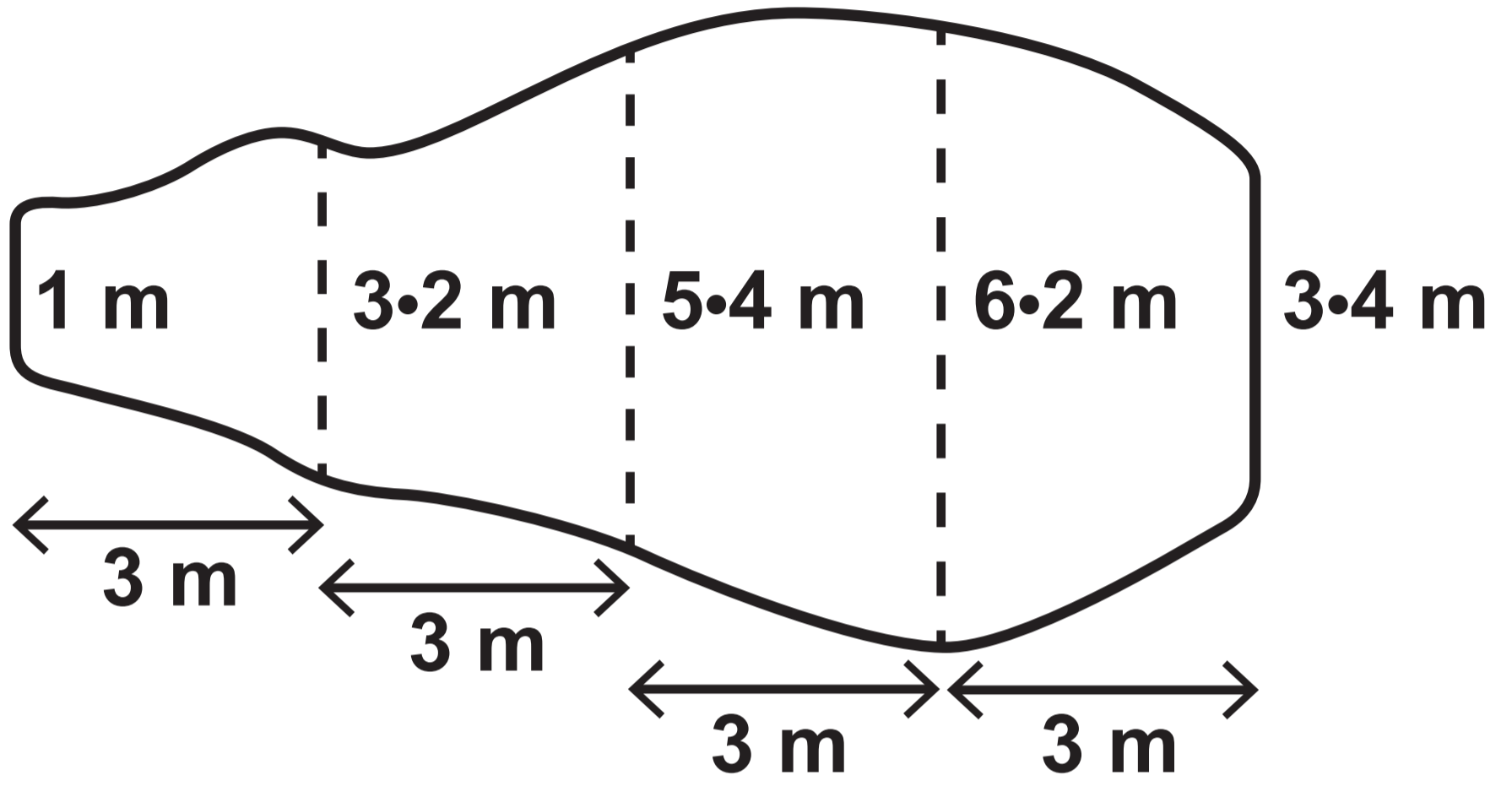
Diagram NOT drawn to scale



# Question 8

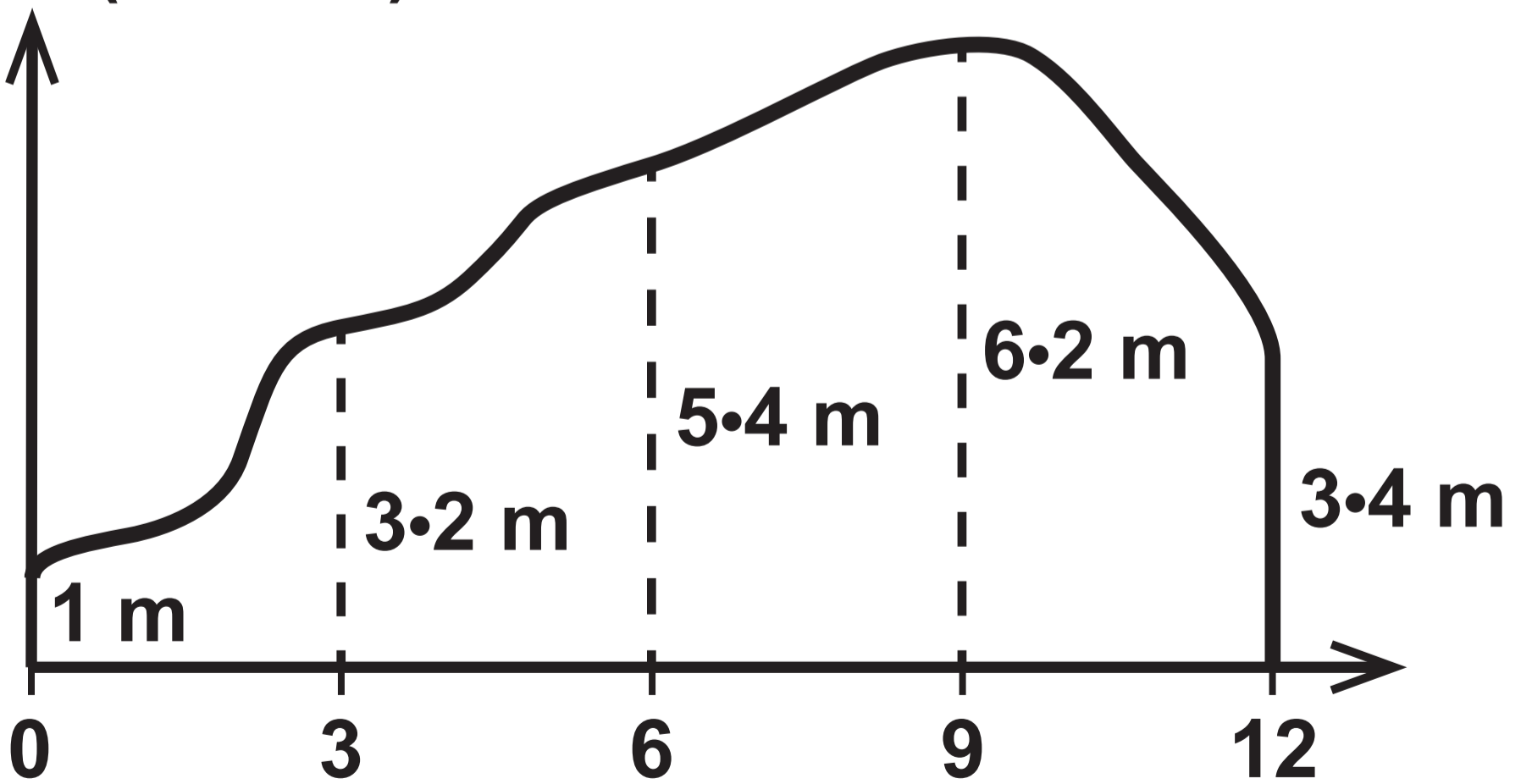
Diagram NOT drawn to scale

## Diagram 1



## Diagram 2

Width (metres)

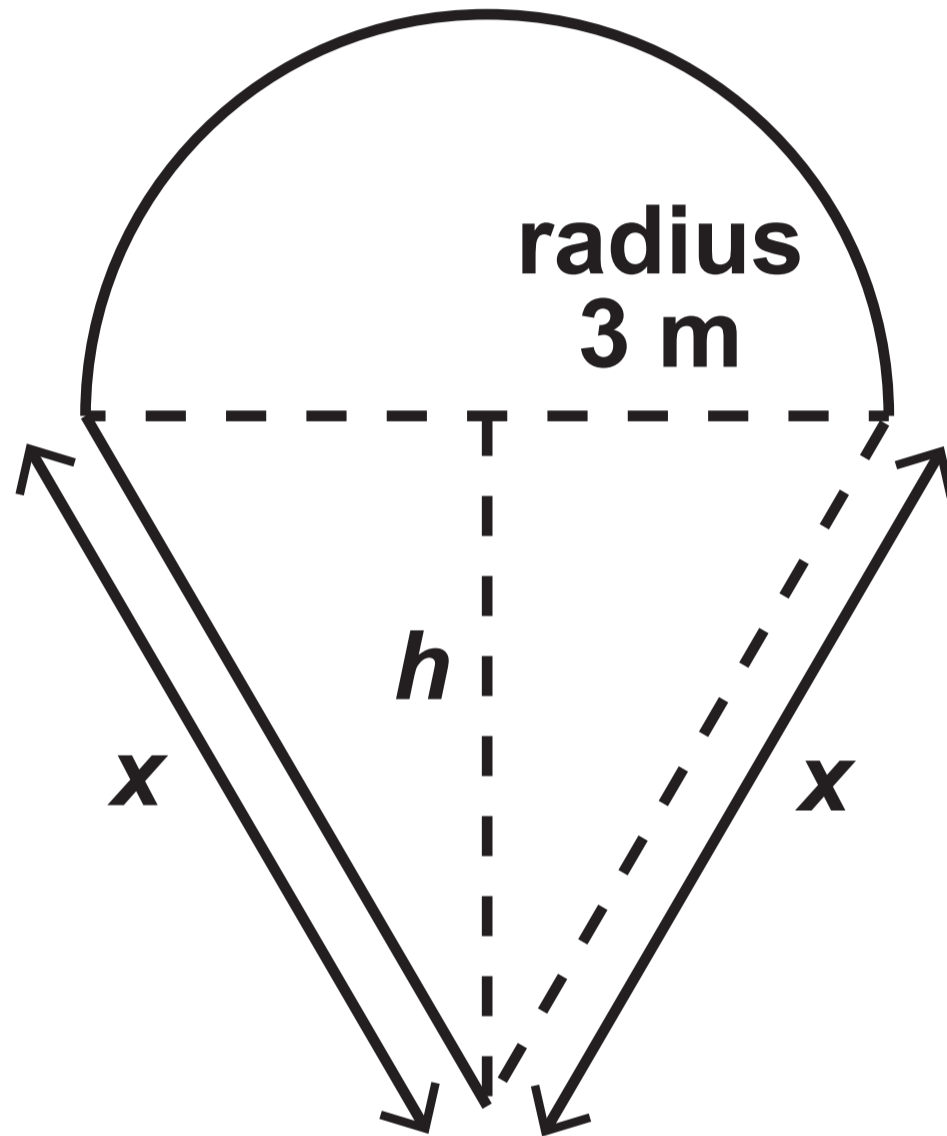


Distance along the length of the pond (metres)

## Question 9 (b)

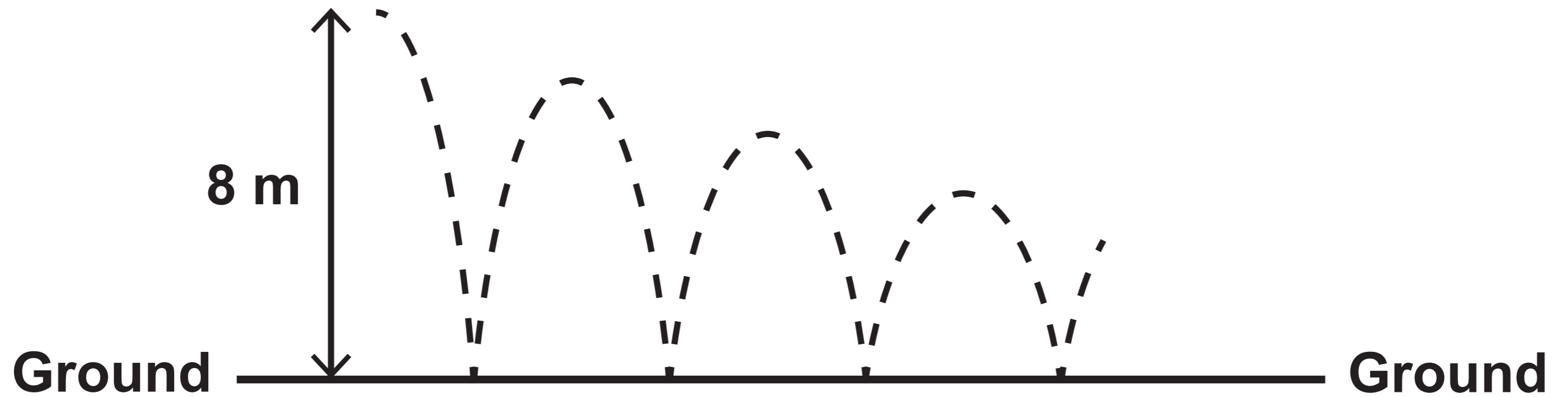
Diagram NOT drawn to scale

PLAN VIEW



# Question 10

Diagram NOT drawn to scale



**GCSE  
MATHEMATICS  
and  
NUMERACY**

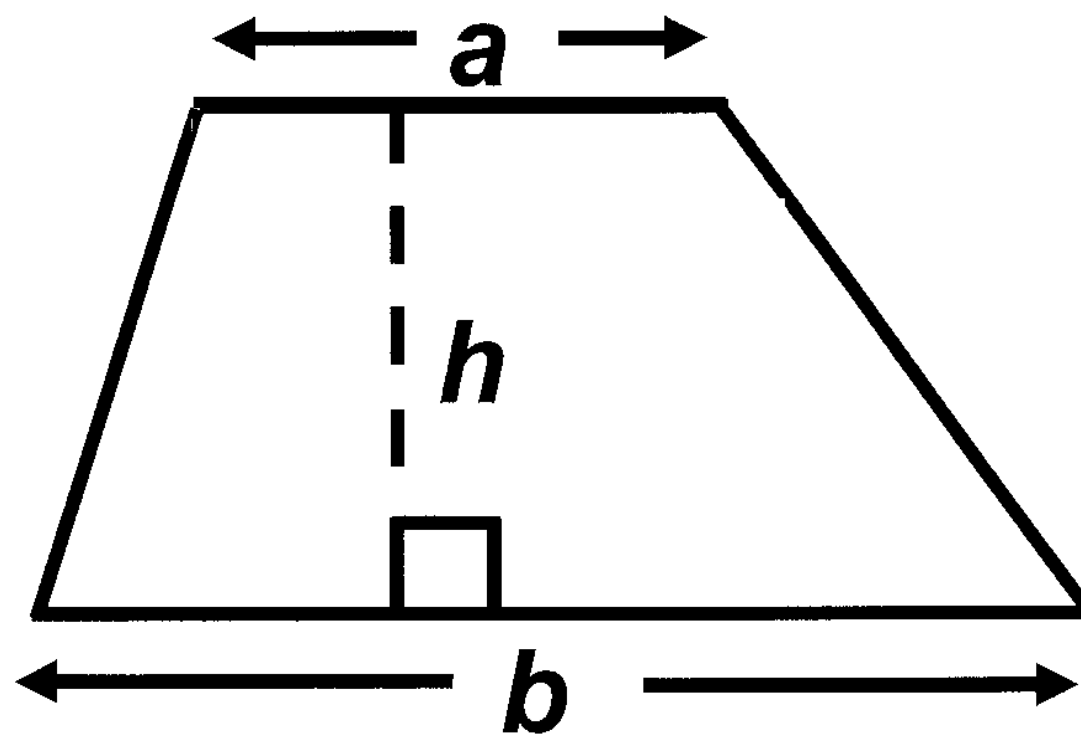
**FORMULA LIST  
HIGHER TIER  
GCSE**

**You must not write on these formula pages.**

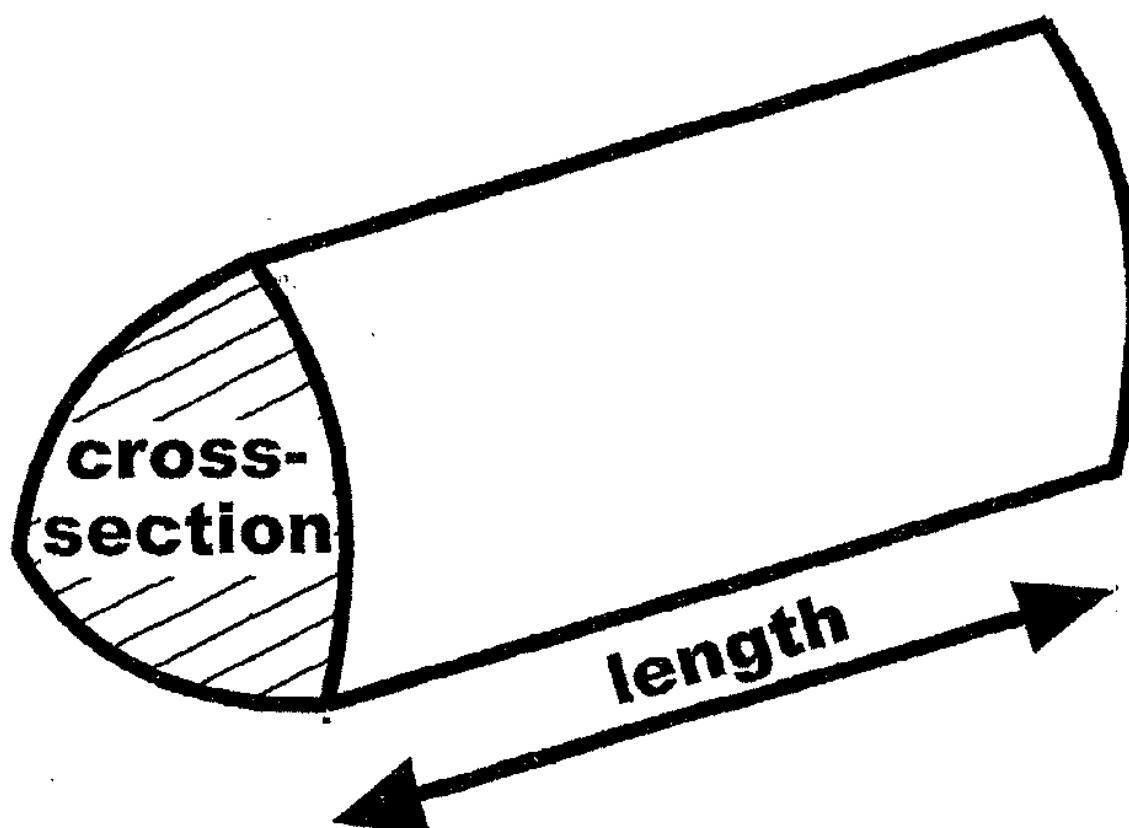
**Anything you write on these formula pages will gain NO credit.**

## Formula List – Higher Tier

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

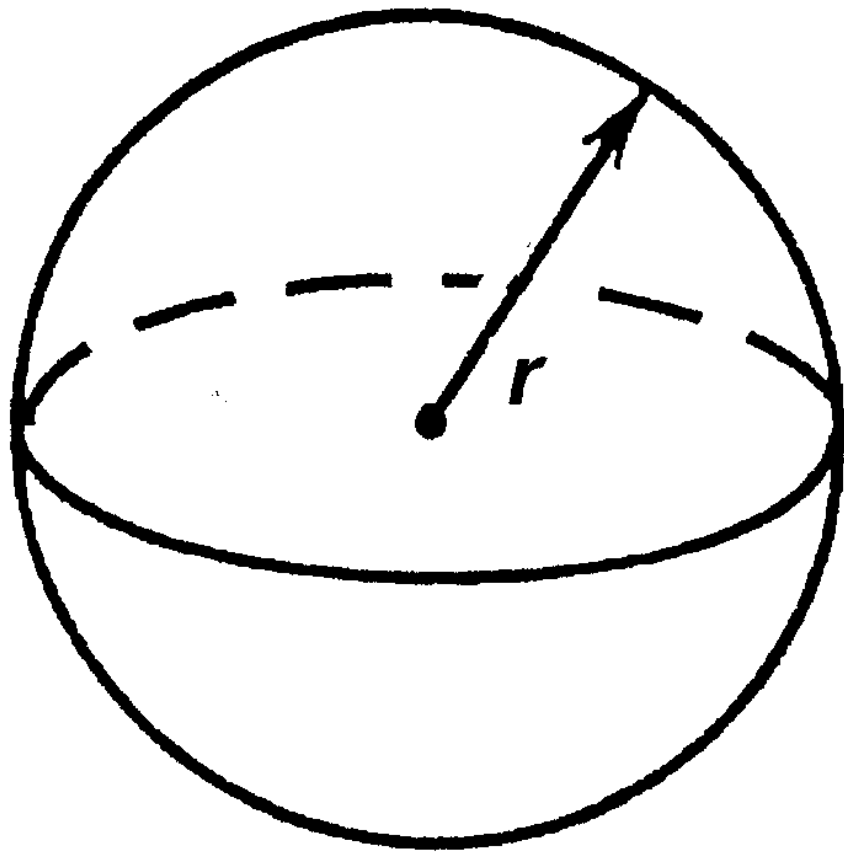


Volume of prism =  
area of cross – section  $\times$  length



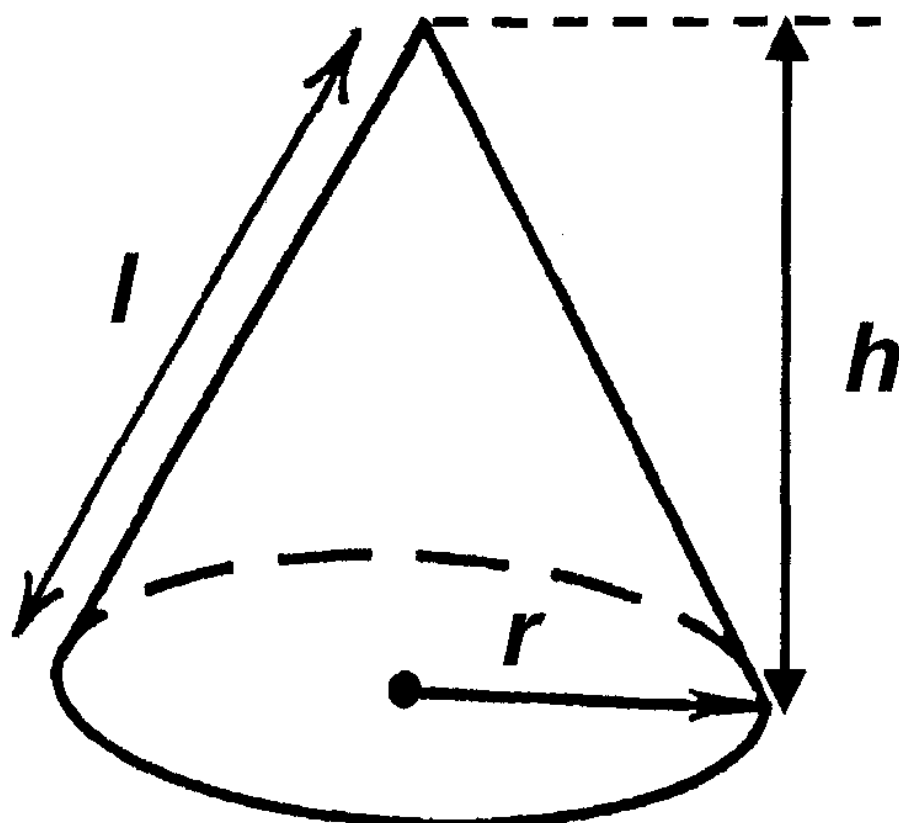
**Volume of sphere =  $\frac{4}{3}\pi r^3$**

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

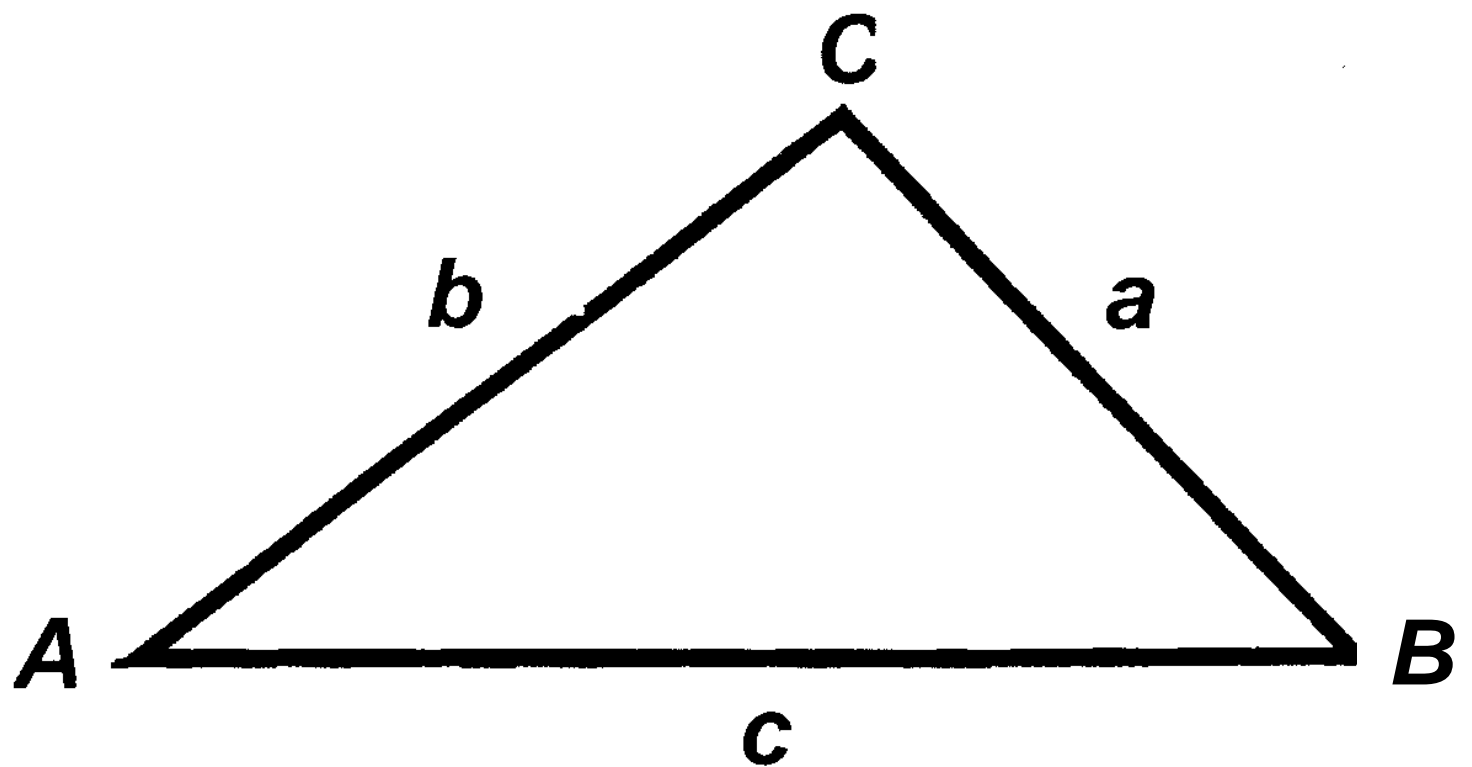


**Volume of cone =  $\frac{1}{3}\pi r^2 h$**

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



**In any triangle ABC**



**Sine Rule**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

**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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

## 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.