



GCSE



C300UB0-1

WEDNESDAY, 7 JUNE 2023 – MORNING

MATHEMATICS – COMPONENT 2

CALCULATOR – ALLOWED MATHEMATICS

HIGHER TIER

2 hours 15 minutes plus your additional time allowance

**A CALCULATOR WILL BE REQUIRED
FOR THIS EXAMINATION**

Surname: _____

First name(s): _____

Centre Number: _____

Candidate Number: 0 _____

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	4	
2.	5	
3.	4	
4.	7	
5.	8	
6.	7	
7.	4	
8.	4	
9.	7	
10.	5	
11.	4	
12.	3	
13.	5	
14.	5	
15.	5	
16.	5	
17.	5	
18.	4	
19.	6	
20.	5	
21.	7	
22.	5	
23.	6	
Total	120	

(Turn over)

ADDITIONAL MATERIALS

An additional formulae booklet.

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

ITEMS INCLUDED WITH QUESTION PAPER

A separate Formula List.

A separate Diagram Booklet.

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

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 the 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, taking care to number the question(s) correctly.

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.

You are reminded of the need for good English and orderly, clear presentation in your answers.

1.

Use:

$$\text{Pressure} = \frac{\text{Force (N)}}{\text{Area (cm}^2\text{)}}$$

The base of a filing cabinet is a rectangle.

It measures **45 cm** by **60 cm**.

The whole of the base is in contact with the horizontal ground.

- (a) The empty filing cabinet exerts a force of **675 N** on the ground.

What is the pressure exerted on the ground by the empty filing cabinet?

Give your answer in **N/cm²**

(Turn over)

[2 marks]

1. (b) When the filing cabinet is full, the pressure it exerts on the ground is 0.75 N/cm^2

What is the force that the full filing cabinet exerts on the ground?

Give your answer in newtons (N).

(Turn over)

7

[2 marks]

(Turn over)

- 2. Look at the diagram for Question 2 in the separate Diagram Booklet.**

The diagram shows information about the percentage of households in Eduvale that owned a DESKTOP computer for the even – numbered years from 2006 to 2018.

- (a) (i) Complete this statement.**

The percentage of households that owned a desktop computer decreased the most between the even – numbered years _____ and _____ .

[1 mark]

continued on the next page . . .

Question 2 (a) continued

2. (a) (ii) Jane says,

“The graph shows that 70% of people owned a desktop computer in 2009 because it passes through that point.”

Is Jane correct?

Yes

☐

No

☐

Explain how you decide.

[1 mark]

continued on the next page . . .

(Turn over)

Question 2 continued

2. (b) The table below shows information about the percentage of households in Eduvale that had an internet connection for the even – numbered years from 2006 to 2018.

Year	Internet connection (%)
2006	45
2008	55
2010	65
2012	75
2014	85
2016	90
2018	95

continued on the next page . . .

(Turn over)

Question 2 (b) continued

- 2. (b) (i) On the diagram for Question 2, plot the information for internet connection.**

[1 mark]

- (ii) In which even – numbered year was the difference in the percentage of households in Eduvale owning a desktop computer and the percentage of households having an internet connection the greatest?**

[1 mark]

continued on the next page . . .

(Turn over)

Question 2 (b) continued

- 2. (b) (iii) Eduvale is a large town in a county. Comment on how, in this COUNTY, the percentage of households owning a desktop computer and the percentage of households having an internet connection are LIKELY to have changed in this time period.**

[1 mark]

- 3. Eric is carrying out a survey for a company that makes energy drinks, Pop and Whizz. He asks 200 randomly selected adults to complete his survey.**

(a) Pop costs £1 per bottle.

As part of his survey, Eric wants to find out how much money each month adults spend on Pop.

In the box provided for Question 3 (a) in the separate Diagram Booklet, write a suitable question for his survey to collect this information.

You must include response boxes.

[2 marks]

continued on the next page . . .

Question 3 continued

- 3. (b) Look at the table for Question 3 (b) in the separate Diagram Booklet.**

In another question, he asks the 200 adults how many bottles of Whizz they buy each month.

The table shows the results for the 200 adults.

Find the probability that an adult chosen at random from these 200

- (i) does not buy Whizz,**

[1 mark]

continued on the next page . . .

(Turn over)

Question 3 (b) continued

- 3. (b) (ii) is 26 to 35 years old and buys
5 or more bottles of Whizz
each month.**

[1 mark]

4. (a) Look at the diagram for Question 4 (a) in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows a circle inside a square of side **8.2 cm**.

The sides of the square are tangents to the circle.

Find the area of the shaded region.

You must show all your working.

[4 marks]

continued on the next page . . .

(Turn over)

Question 4 continued

4. (b) Look at the diagram for Question 4 (b) in the separate Diagram Booklet.
The diagram is NOT drawn to scale.

The diagram shows a parallelogram, labelled ***ABCD***.

It is a cross – section of a prism.

In the diagram,

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

$$DC = 9.8 \text{ cm}$$

The perpendicular height of the parallelogram is 7 cm.

The length of the prism is 16 cm.

Find the volume of the prism.

[3 marks]

5. (a) Solve $7x - 5 = 2x + 3$

[2 marks]

continued on the next page . . .

(Turn over)

Question 5 continued

5. (b) Roza is buying bananas and apples.

**She buys X bananas which cost
30 pence each.**

**She buys 2 more apples than the number
of bananas she buys.**

Her apples cost 25 pence each.

She pays a total of £5.45

**Use an algebraic method to find the
number of bananas Roza buys.**

(Turn over)

[4 marks]

continued on the next page . . .

(Turn over)

Question 5 continued

5. (c) Factorise $x^2 + 5x + 4$

[2 marks]

(Turn over)

6. Look at the information provided for Question 6 in the separate Diagram Booklet. The information is about two saving accounts.

Heath has **£3000** to invest for five years.

No extra money will be paid in or withdrawn during these five years.

He is going to choose one of these accounts.

- (a) Which account gives Heath the greater **PERCENTAGE INCREASE** in his money at the end of **5** years and by how much is it greater?

Show how you decide.

State any assumption that you make.

Account _____ gives the greater
percentage increase by _____ %

Assumption _____

[6 marks]

(Turn over)

Question 6 continued

- 6. (b) Comment on the effect that your assumption in part (a) has had on your decision.**

[1 mark]

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

The diagram shows a small park with gates at *A*, *B*, *C* and *D*.

The scale is 1 cm represents 10 m.

A new outdoor gym is to be built in the park.

This should be:

- at least 55 m from the gate at *A*
- nearer to the gate at *B* than the gate at *C*.

Use a ruler and a pair of compasses to show accurately on the diagram the region of the park where the outdoor gym can be built.

Indicate clearly the region that is your answer.

[4 marks]

8. Look at the diagram for Question 8 in the separate Diagram Booklet.
The diagram is NOT drawn to scale.

An aircraft is making its final approach ready to land.

The aircraft is:

- flying at 3° to the horizontal,
- 2.5 km horizontally from the start of the runway,

as shown on the diagram.

Calculate the vertical height of the aircraft above the horizontal ground.

You must show all your working.

[4 marks]

9. Look at the diagram for Question 9 in the separate Diagram Booklet. The diagram shows an incomplete tree diagram.

A factory makes loaves of bread which are wrapped in packaging.

Independently, for any loaf wrapped in packaging, chosen at random:

- The probability that there is a fault with the bread is **0.02**
- The probability that there is a fault with the packaging is **0.01**

- (a) Complete the tree diagram to show this information.

[2 marks]

continued on the next page . . .

Question 9 continued

9. (b) A loaf wrapped in packaging is chosen at random.

(i) Calculate the probability that neither the bread nor the packaging has a fault.

[2 marks]

continued on the next page . . .

(Turn over)

Question 9 (b) continued

9. (b) (ii) Calculate the probability that either the bread or the packaging has a fault but they do not both have a fault.

[3 marks]

(Turn over)

10. In this question, all lengths are in metres.

Look at the diagram for Question 10

in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows Terry's garden.

The patio is a SQUARE and the lawn is a rectangle.

The lawn is $5xy$ metres long and $x + y$ metres wide.

The patio is a square with sides y metres and $4x$ metres.

The area of the lawn is 172.8 m^2

Use an algebraic method to find the area of Terry's patio.

[5 marks]

(Turn over)

11. Rearrange this formula to make y the subject.

$$a = 7(x + y^5) + 2$$

[illegible]

[4 marks]

(Turn over)

- 12. Look at the diagram for Question 12 in the separate Diagram Booklet.**

The diagram shows a box plot.

The box plot summarises the heights, in cm, of a class of students.

Use the box plot to complete the table below.

Range	
Median	
Lower quartile	
Upper quartile	
Interquartile range	

[3 marks]

(Turn over)

13. Enya's house is put up for sale at the start of April.

It does not sell, so at the start of May, the sale price of the house is reduced by 20%

At the start of June, the sale price is reduced by 15% of the price at the start of May.

(a) Enya says,

“My house has been reduced in price by a total of 35%.”

Explain why Enya is incorrect.

[1mark]

continued on the next page . . .

(Turn over)

Question 13 continued

13. (b) The house is then sold for £306 000

What was the original sale price of the house at the beginning of April?

[4 marks]

(Turn over)

14. The area of country *A* is 1 078 000 km²,
correct to 4 significant figures.

The area of country *B* is 249 300 km²,
correct to 4 significant figures.

The two countries merge to form country *C*.

(a) Calculate the upper bound of the area
of country *C*.

[2 marks]

continued on the next page . . .

(Turn over)

Question 14 continued

- 14. (b) The population density of a country is the number of people per km^2**

Country C has a population of 82 000 000, correct to the nearest million.

Calculate the least possible value of the population density for country C.

You must show all your working.

[3 marks]

15. (a) Solve $x^2 - 36 \leq 0$

[3 marks]

continued on the next page . . .

(Turn over)

Question 15 continued

- 15. (b) Look at the diagram for Question 15 (b) in the separate Diagram Booklet.**

The diagram shows a set of axes.

On the axes, sketch the part of the graph $y = x^2 - 36$ that represents the solution to the inequality $x^2 - 36 \leq 0$

Mark any intercepts with the X – axis on your sketch.

[2 marks]

(Turn over)

16. Look at the diagram for Question 16 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows a sector, ABD , of a circle with centre D and a triangle, BCD .

$$AD = 15 \text{ m}$$

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

$$\text{Angle } ADB = 62^\circ$$

Angle ADC is a right angle.

Show that the area of $ABCD$ is 150 m^2 , correct to 3 significant figures.

(Turn over)

17. Look at the diagram for Question 17 in the separate Diagram Booklet.

The diagram shows the graphs of

$$y = x^2 + \frac{1}{x} \text{ and } y = 2x + 1 \text{ for values}$$

of x between -2 and 3

- (a) Show that where the line and curve intersect, x satisfies the equation

$$x^3 - 2x^2 - x + 1 = 0$$

[3 marks]

(Turn over)

Question 17 continued

17. (b) Write down the solutions to the equation

$$x^3 - 2x^2 - x + 1 = 0$$

Estimate your answers correct to

1 decimal place.

[2 marks]

(Turn over)

18. (a) $f(x) = x^3$

Find $f^{-1}(x)$

[1 mark]

continued on the next page . . .

(Turn over)

Question 18 continued

18. (b) $g(x) = (5x - 1)^3$

Expand and simplify $g(x)$

[illegible]

(Turn over)

[3 marks]

19. (a) Look at the diagram for Question 19 (a) in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows a triangle ABC .

In the diagram,

$$AB = 13 \text{ cm}$$

$$\text{Angle } BAC = 38^\circ$$

$$\text{Angle } BCA = 67^\circ$$

Calculate the length of BC .

[3 marks]

(Turn over)

Question 19 continued

19. (b) Look at the diagram for Question 19 (b) in the separate Diagram Booklet.
The diagram is NOT drawn to scale.

The diagram shows triangle ***DEF***.

In the diagram,

$$DE = 6 \text{ cm}$$

$$DF = 11 \text{ cm}$$

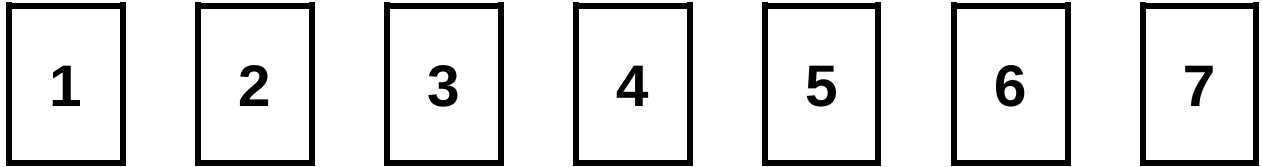
$$\text{Angle } EDF = 43^\circ$$

Calculate the length of ***EF***.

[3 marks]

(Turn over)

20. Sian has seven numbered cards as shown below.



She shuffles them and turns them face down.
She then turns them over to make a 7 – digit number.

(a) How many different 7 – digit numbers
can Sian make?

[2 marks]

(Turn over)

Question 20 continued

**20. (b) How many of these 7 – digit numbers
are multiples of 5?**

[2 marks]

continued on the next page . . .

(Turn over)

Question 20 continued

20. (c) What proportion of these 7 – digit numbers are NOT multiples of 5?

[1 mark]

(Turn over)

21. Look at the diagram for Question 21 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram represents an inverted cone held in a stand.

The radius of the cone is 20 cm and the height of the cone is 50 cm.

Jake pours some water into this cone.

When he stops, the radius of the surface of the water is 6 cm.

The surface of the water is parallel to the base of the cone.

Rhian then pours water into the cone until it is completely full.

She pours the water at a rate of 1 litre per 10 seconds.

How many seconds does it take Rhian to fill the cone?

(Turn over)

22. (a) The first 5 terms of a sequence are shown below.

5 8 11 14 17

Complete the term – to – term rule for this sequence.

$$t_1 = 5$$

$$t_{n+1} = t_n \quad \underline{\hspace{2cm}} \quad , \quad n \geq 1$$

[1 mark]

continued on the next page . . .

Question 22 continued

22. (b) (i) Show that $x^3 - 2x - 5 = 0$ can be

rearranged as $x = \sqrt{\frac{2x + 5}{x}}$

[1 mark]

continued on the next page . . .

(Turn over)

Question 22 (b) continued

22. (b) (ii) Use the iterative formula

$$x_{n+1} = \sqrt{\frac{2x_n + 5}{x_n}} \quad \text{with } x_1 = 2$$

to find a solution of $x^3 - 2x - 5 = 0$
correct to **1** decimal place.

Write down all your values of X_{n+1}

[illegible]

(Turn over)

[3 marks]

23. In this question, x and y are horizontal and vertical distances in metres.

Look at the diagram for Question 23 in the separate Diagram Booklet.

An engineer designs a tunnel.

He models the uniform cross – section of this tunnel using the graph shown in the diagram.

The tunnel is 50 metres long and will cost £250 per m^3 to excavate.

Use the graph with four vertical strips of equal width to calculate an estimate of the cost of excavating this tunnel.

Cost of excavating the tunnel will be

£ _____

[6 marks]

END OF PAPER

TOTAL 120 MARKS

(Turn over)

Question number	Additional pages, if required. Write the question number(s) in the left - hand margin.

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WEDNESDAY, 7 JUNE 2023 – MORNING

MATHEMATICS – COMPONENT 2

CALCULATOR – ALLOWED MATHEMATICS

HIGHER TIER

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

Diagram Booklet

Surname: _____

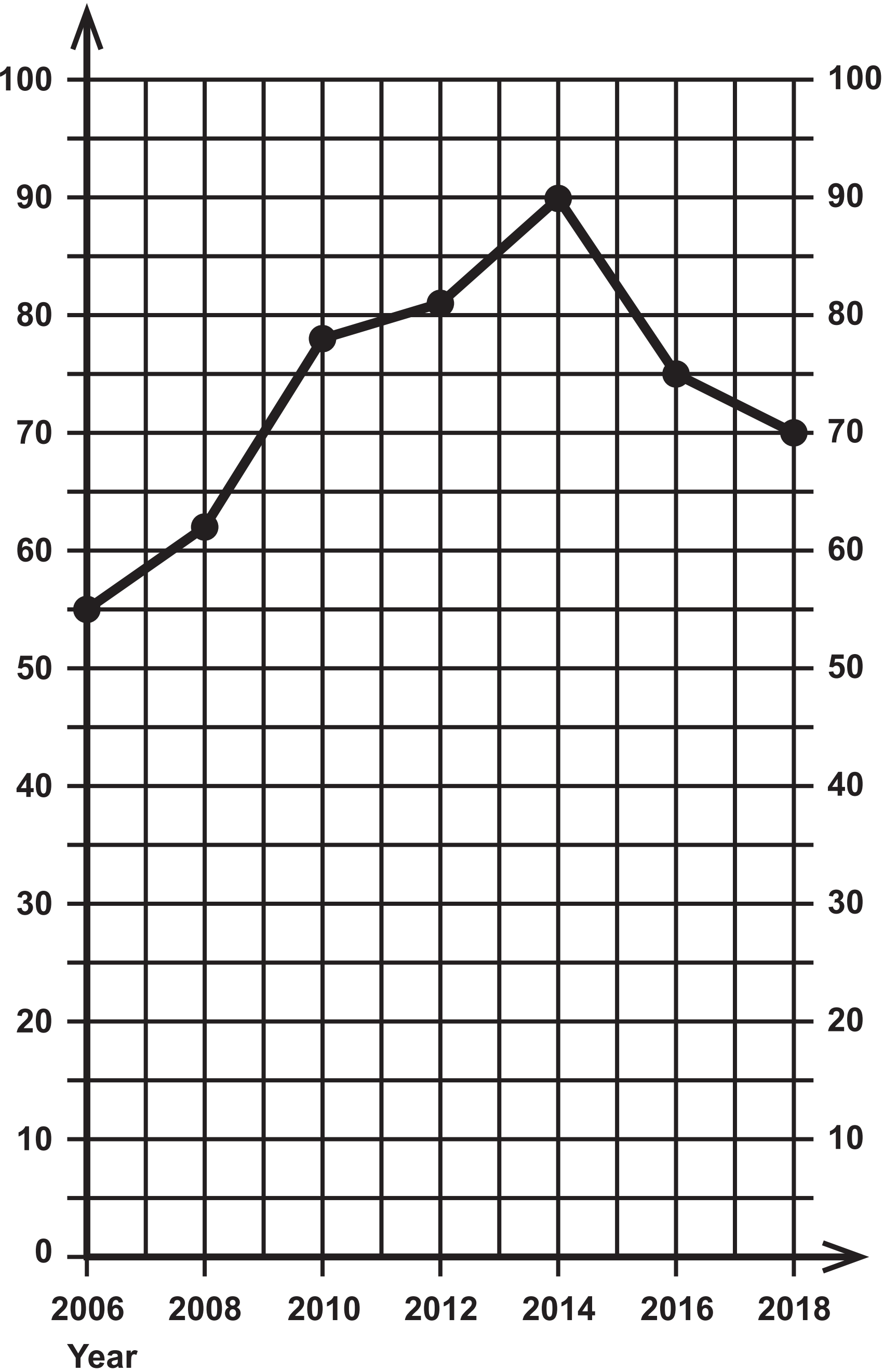
First name(s): _____

Centre Number: _____

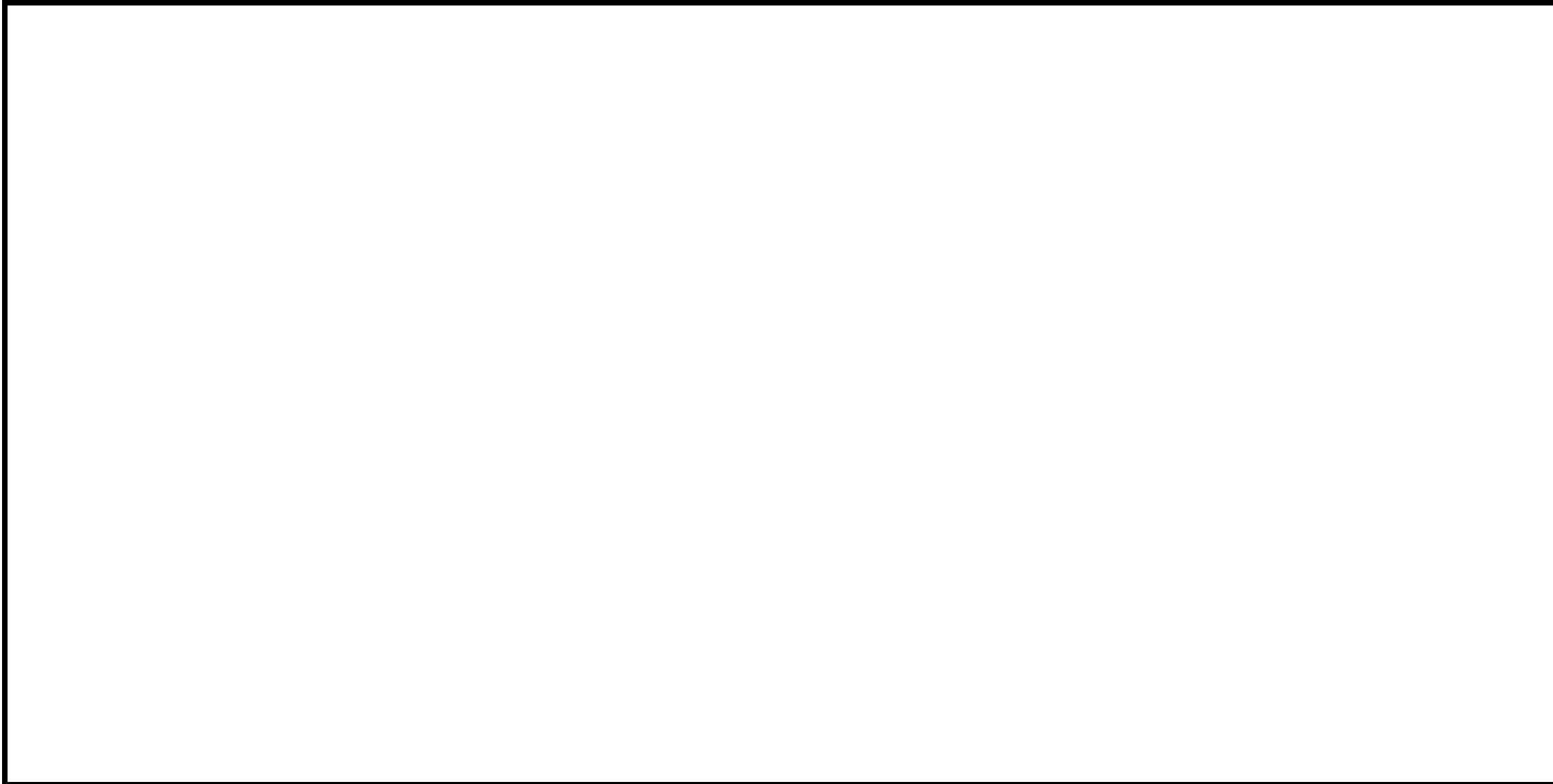
Candidate Number: 0 _____

Question 2

Percentage (%)



Question 3 (a)

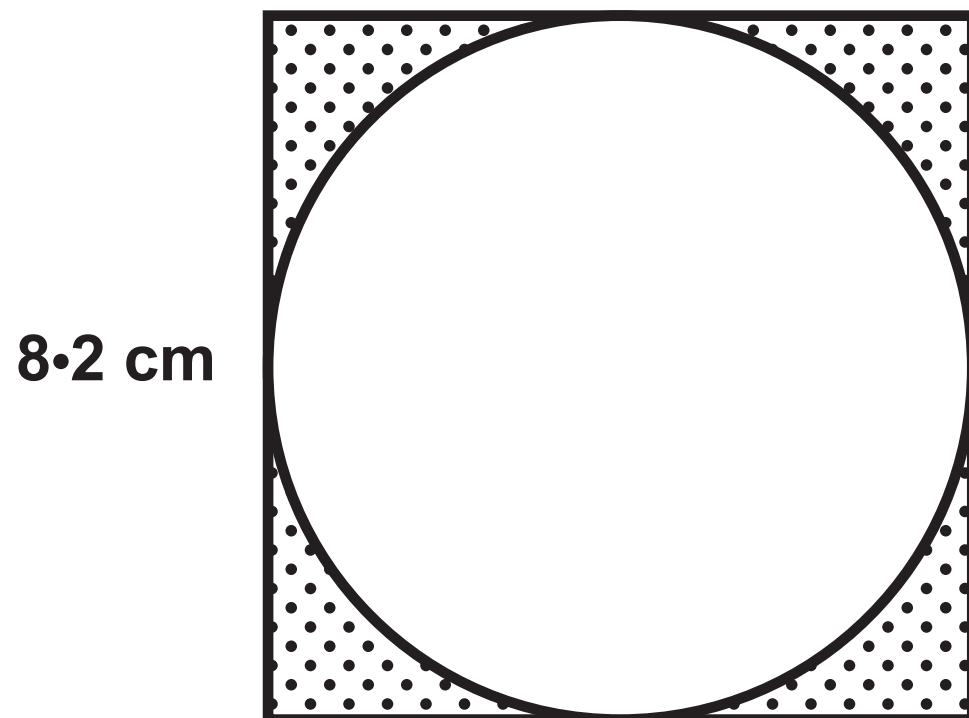


Question 3 (b)
Table

		Number of bottles			
		0	1 to 4	5 to 10	more than 10
Age (years)	18 to 25	26	12	6	6
	26 to 35	29	34	41	2
	Older than 35	32	11	1	0

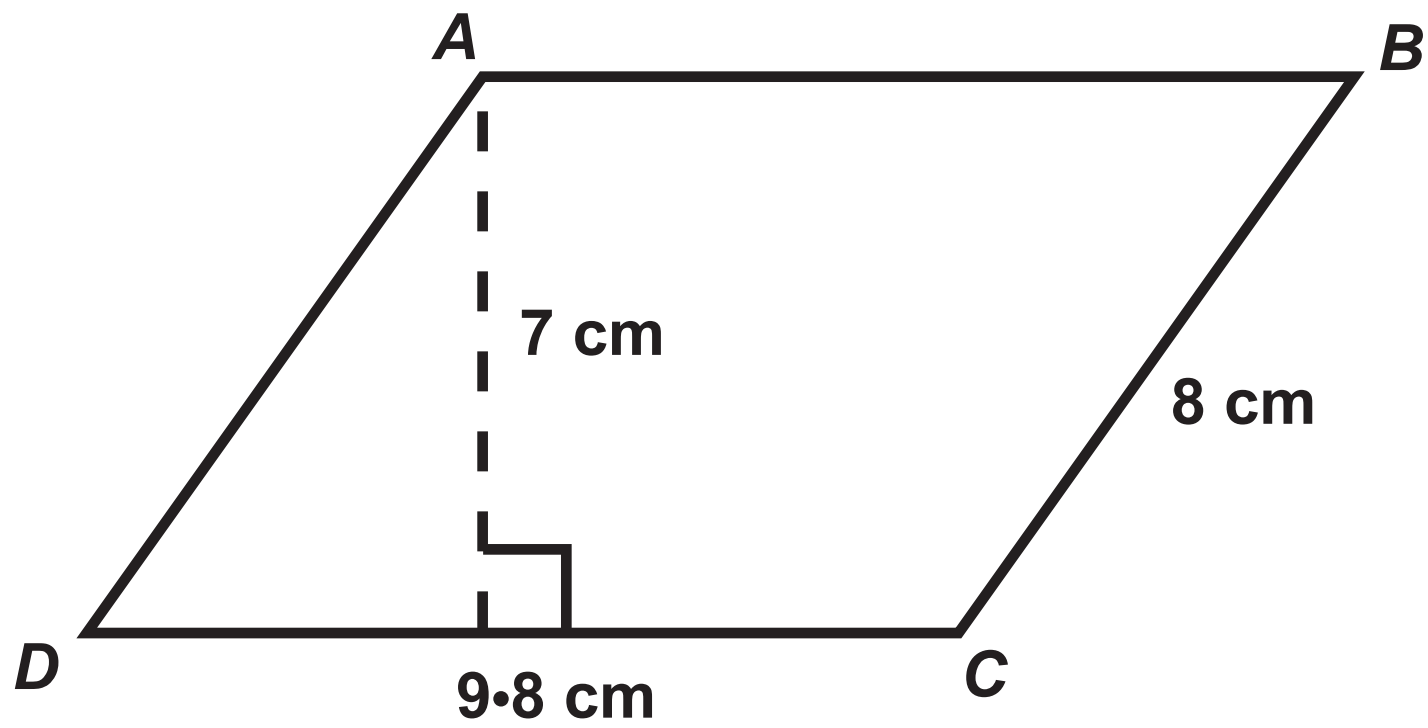
Question 4 (a)

Diagram NOT drawn to scale



Question 4 (b)

Diagram NOT drawn to scale



Question 6

Information

ACCOUNT A

4% compound interest per year

Interest rates can vary

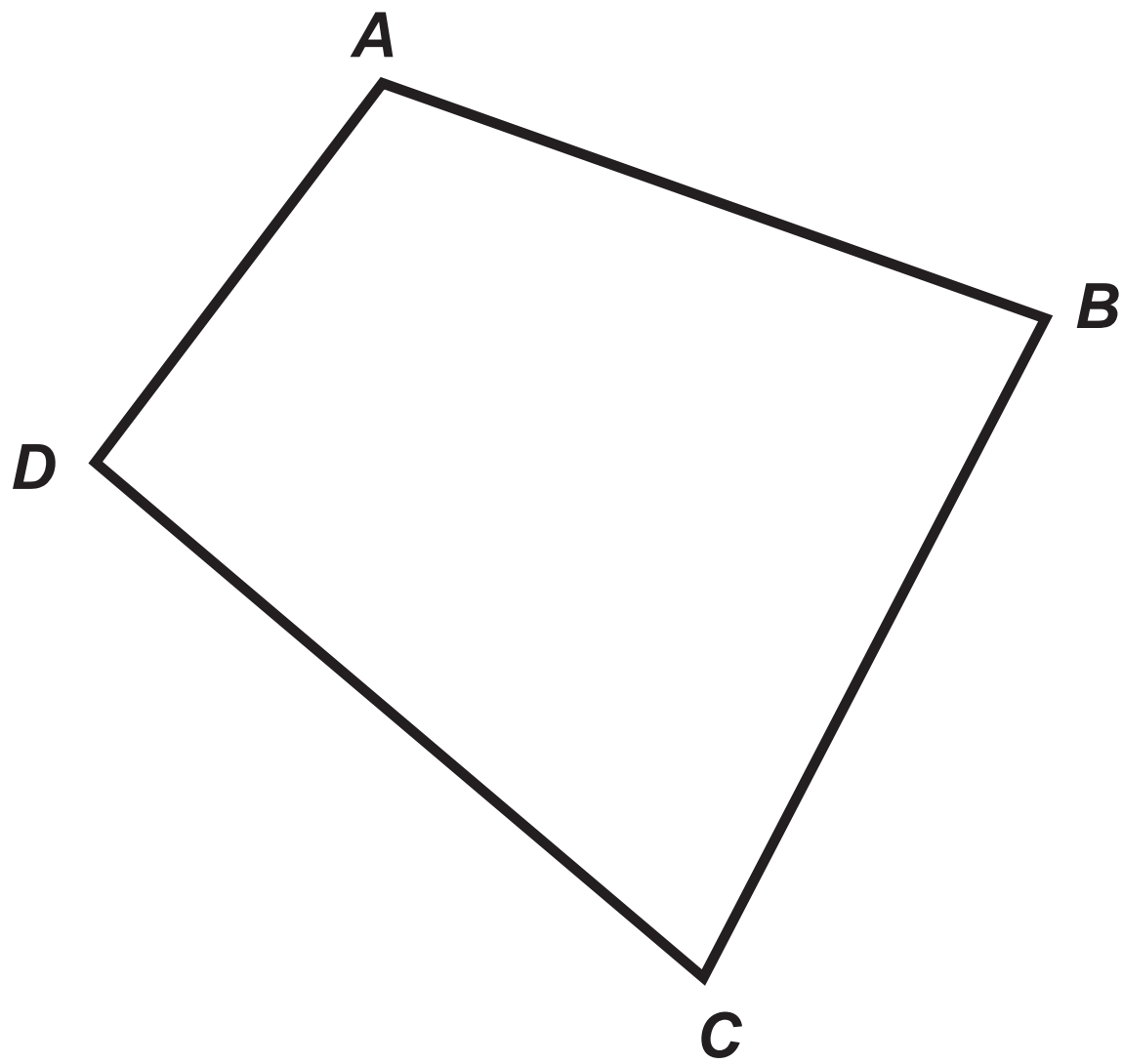
ACCOUNT B

Guaranteed interest at the end of

**5 years of £190 for
each £1000 invested**

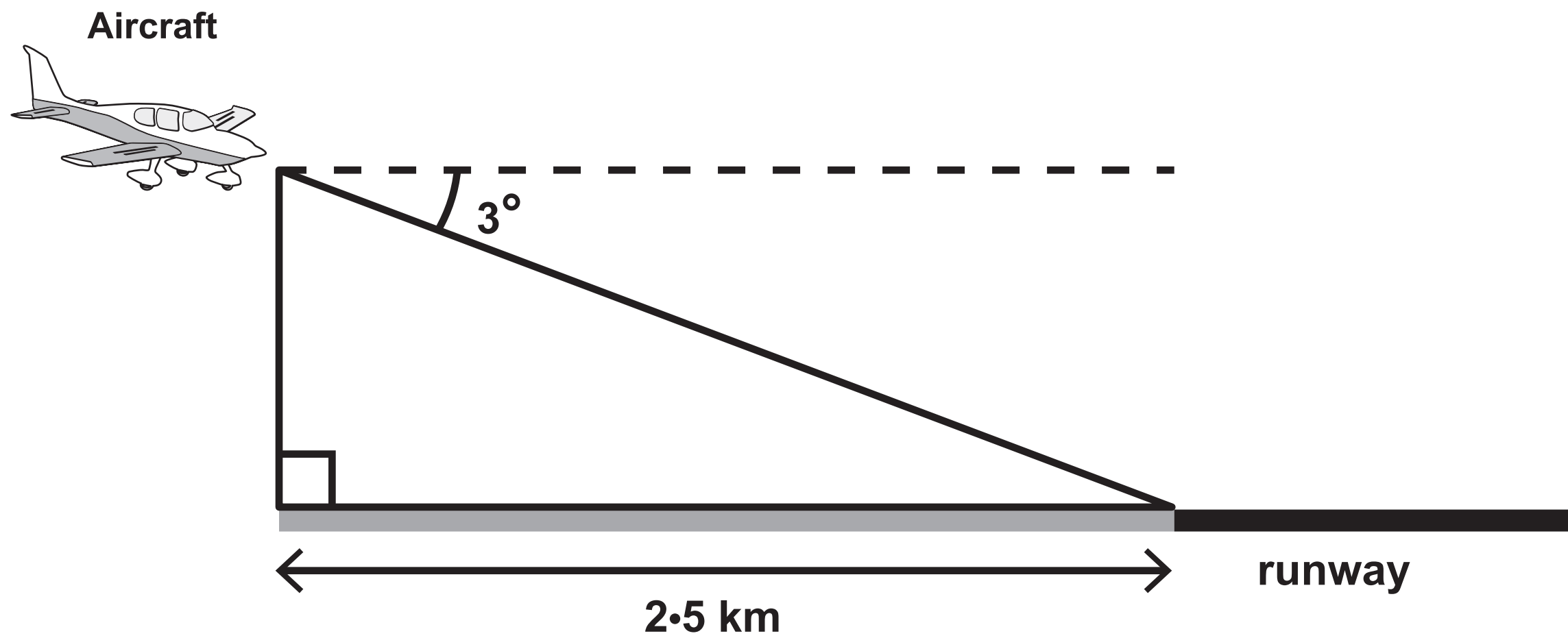
Question 7

Scale: 1 cm represents 10 m

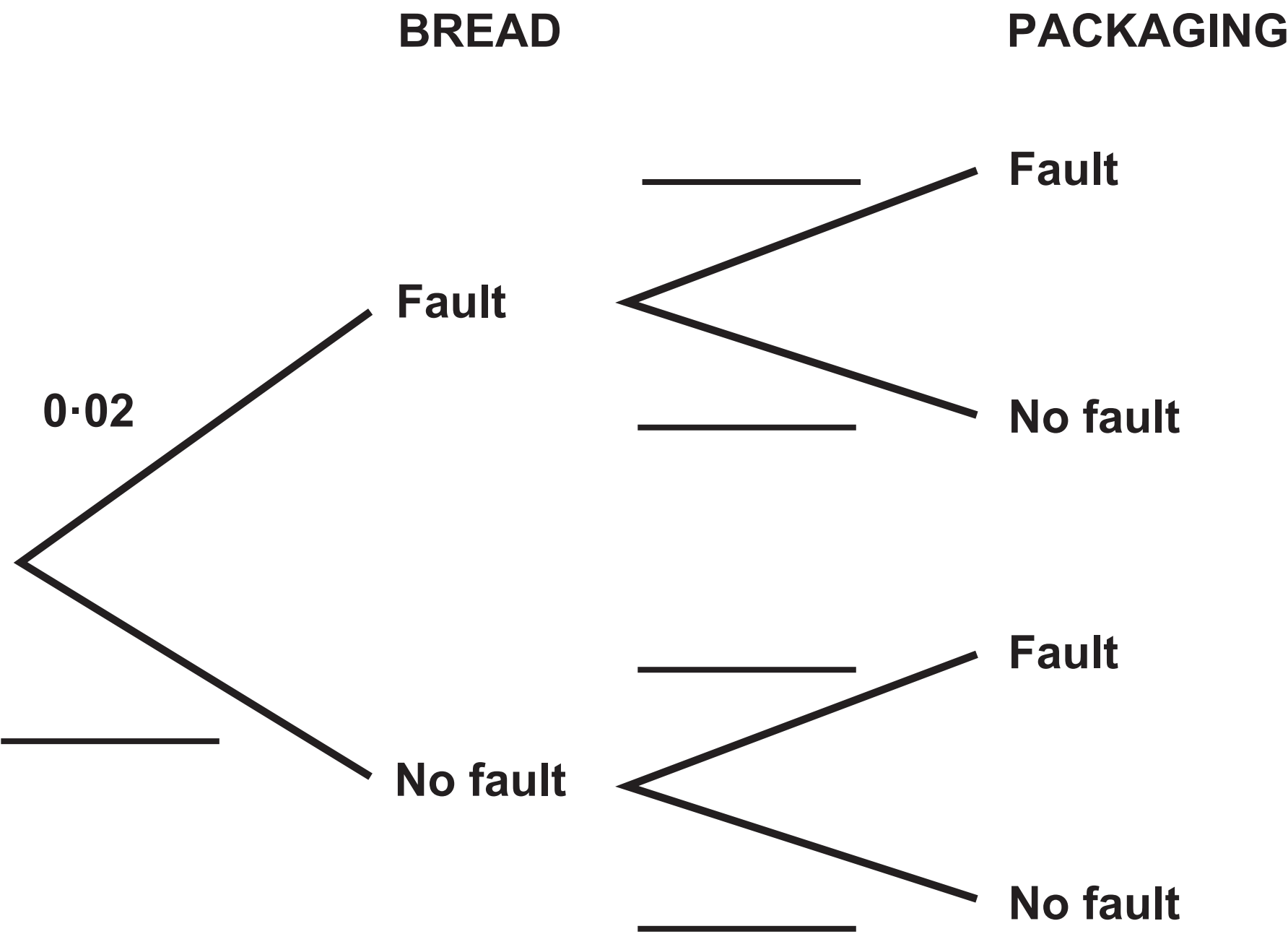


Question 8

Diagram NOT drawn to scale

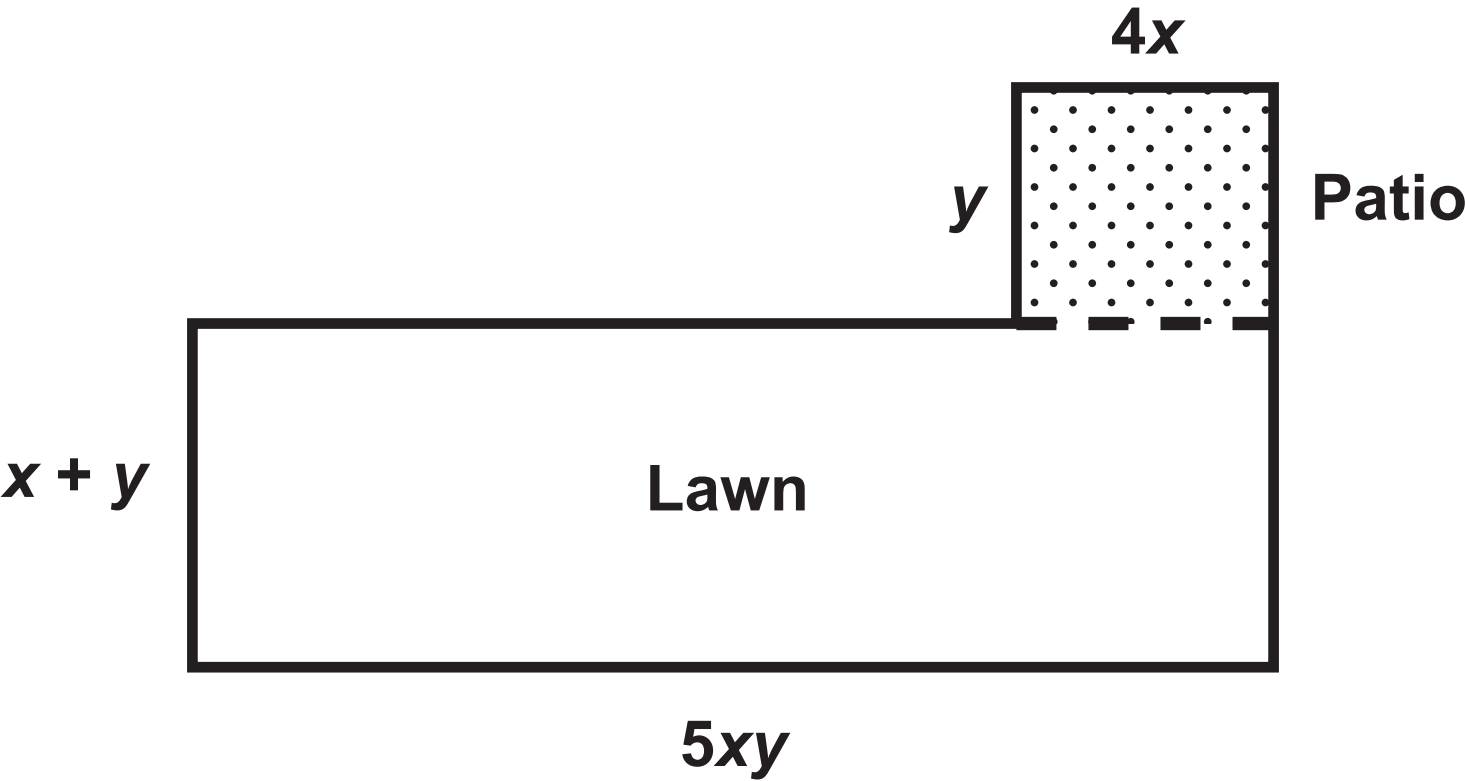


Question 9

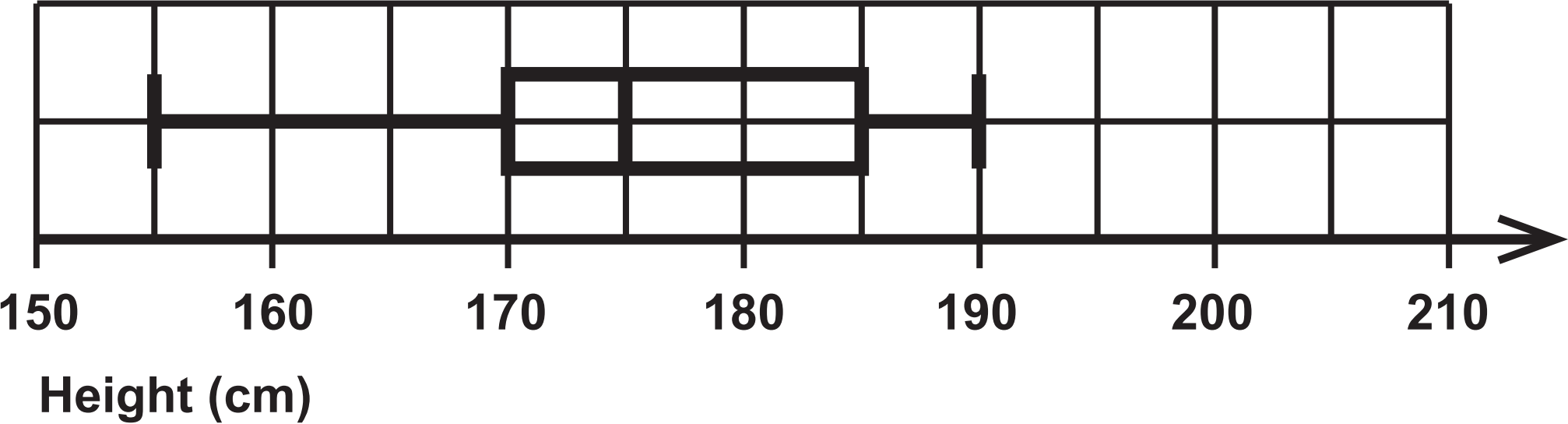


Question 10

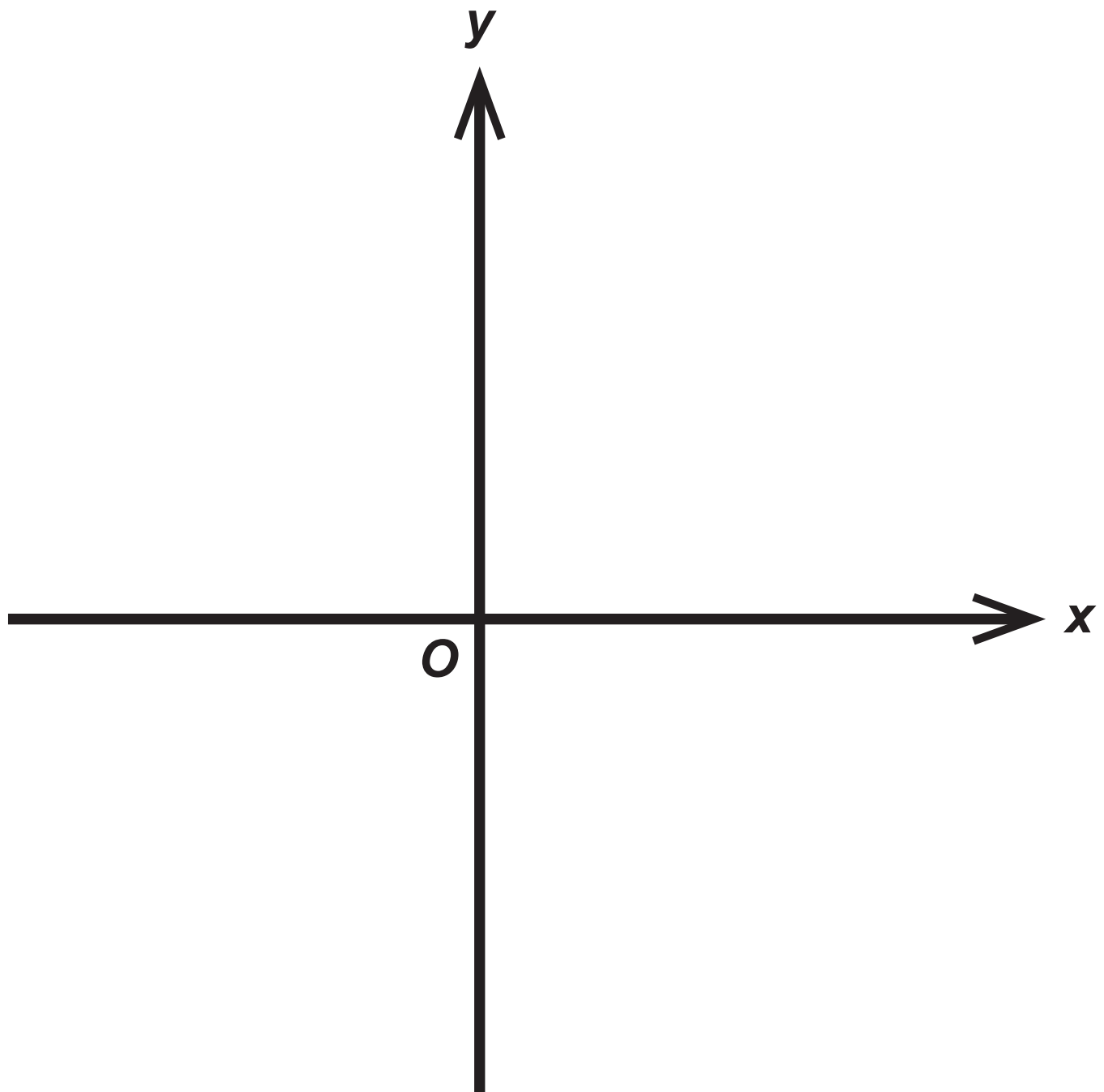
Diagram NOT drawn to scale



Question 12

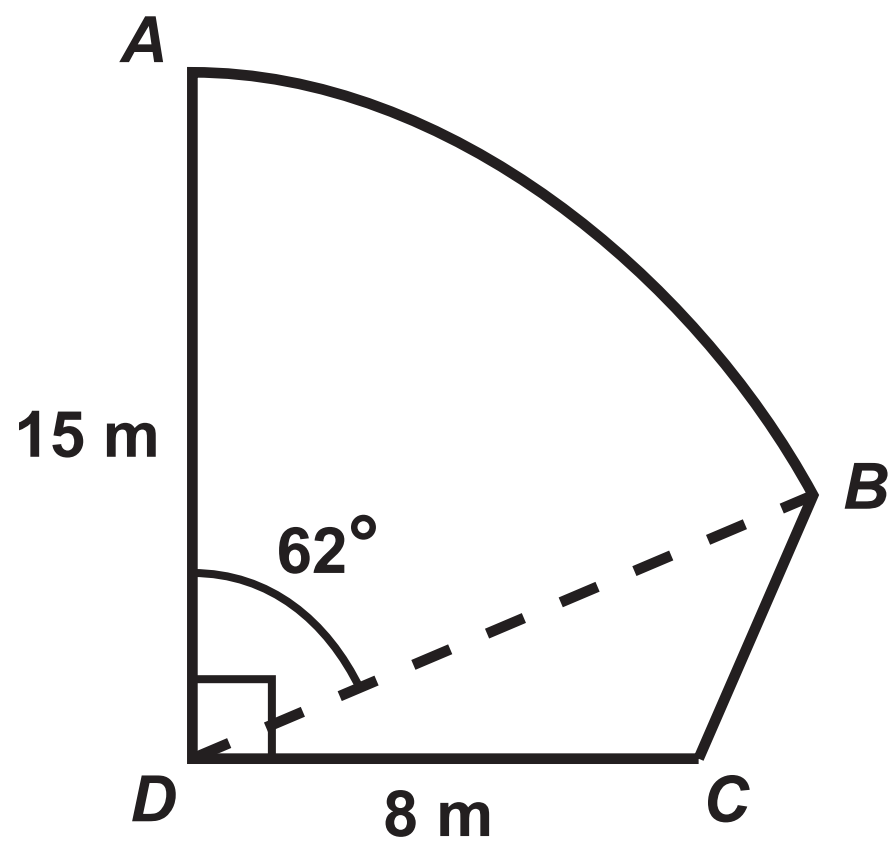


Question 15 (b)

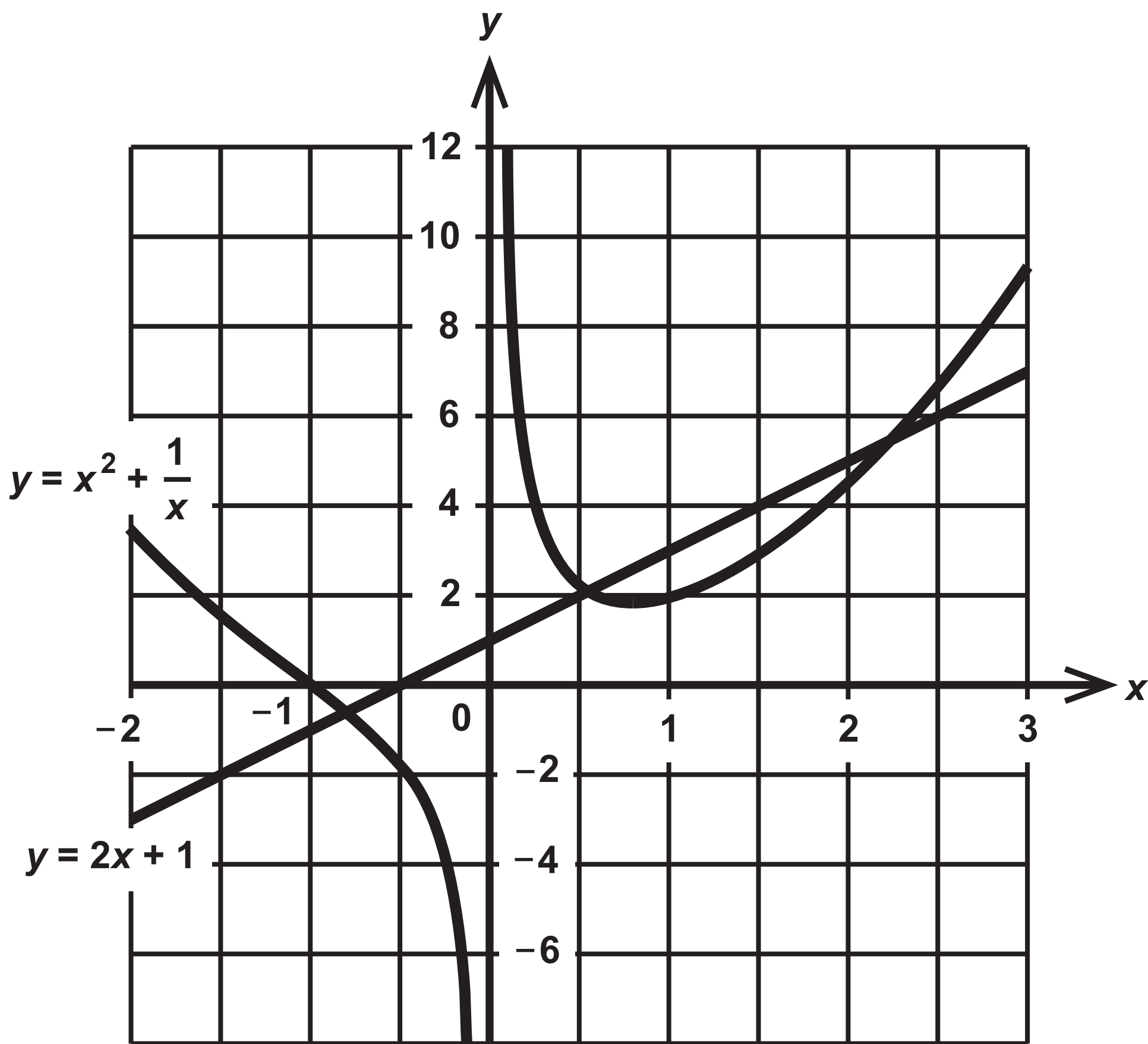


Question 16

Diagram NOT drawn to scale

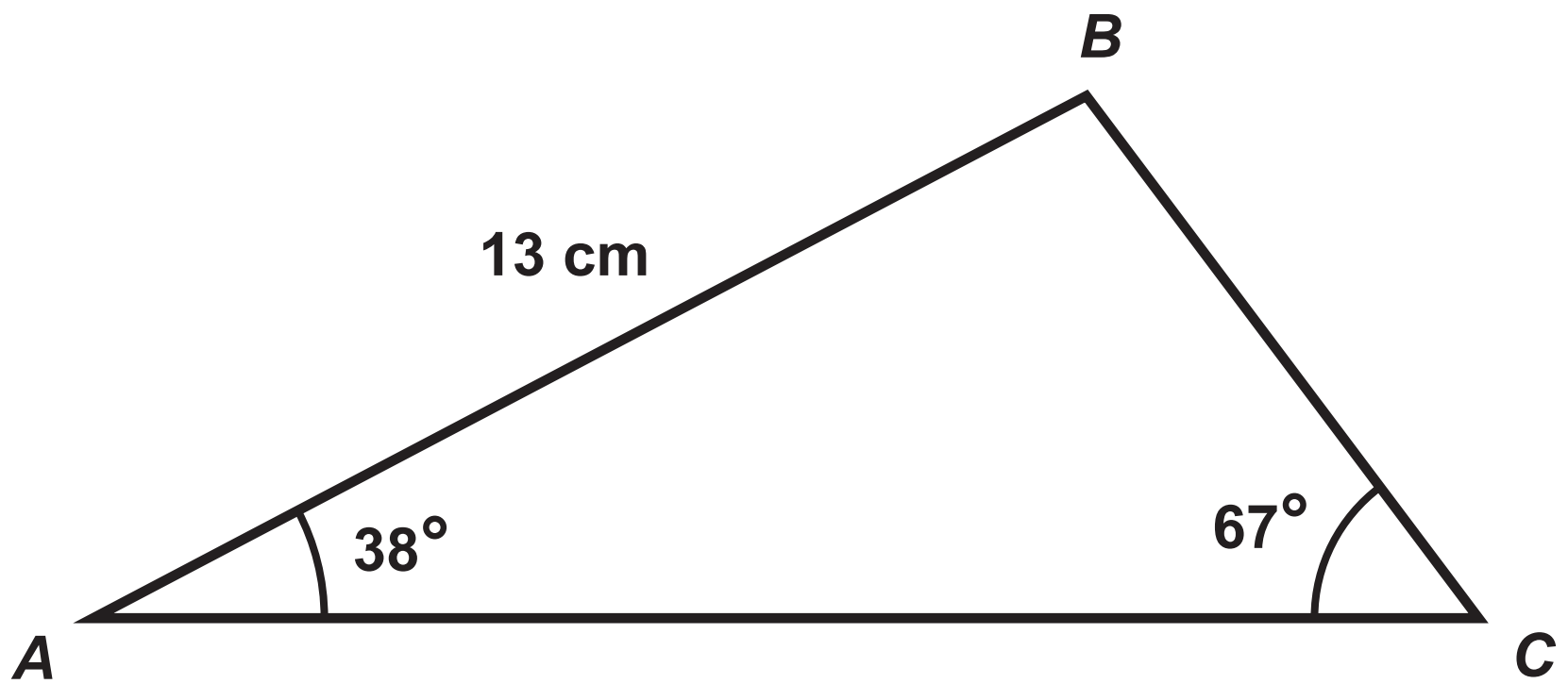


Question 17



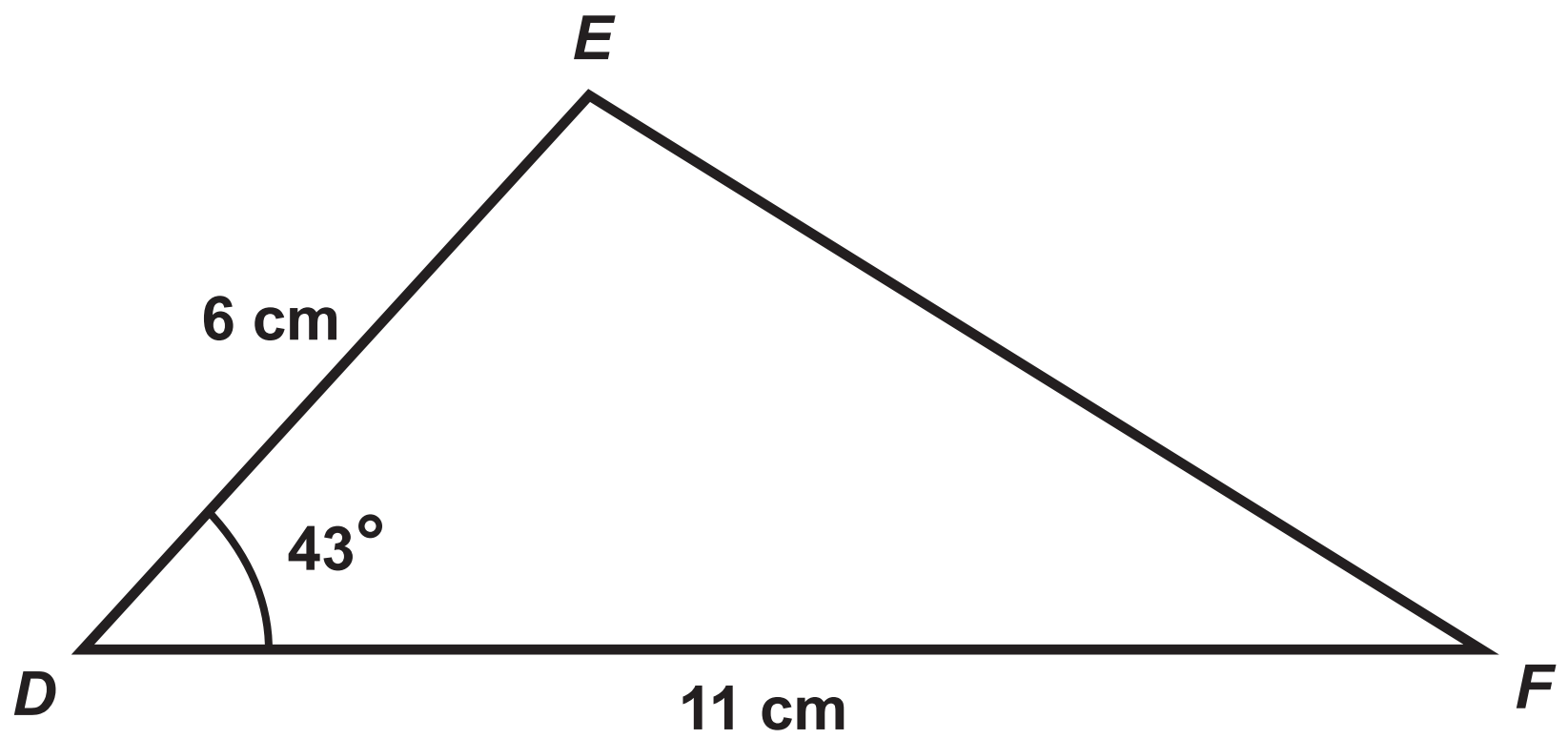
Question 19 (a)

Diagram NOT drawn to scale



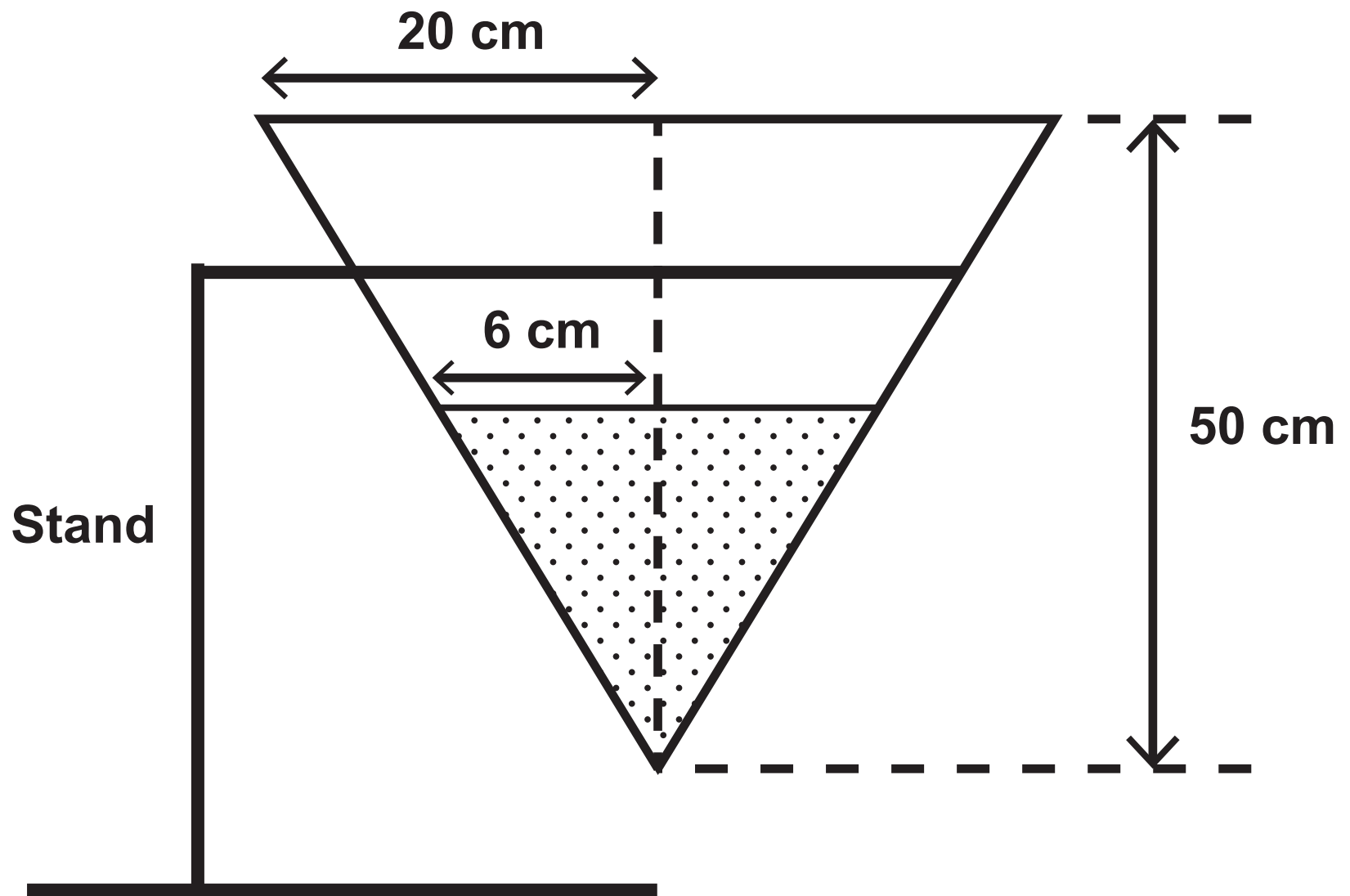
Question 19 (b)

Diagram NOT drawn to scale

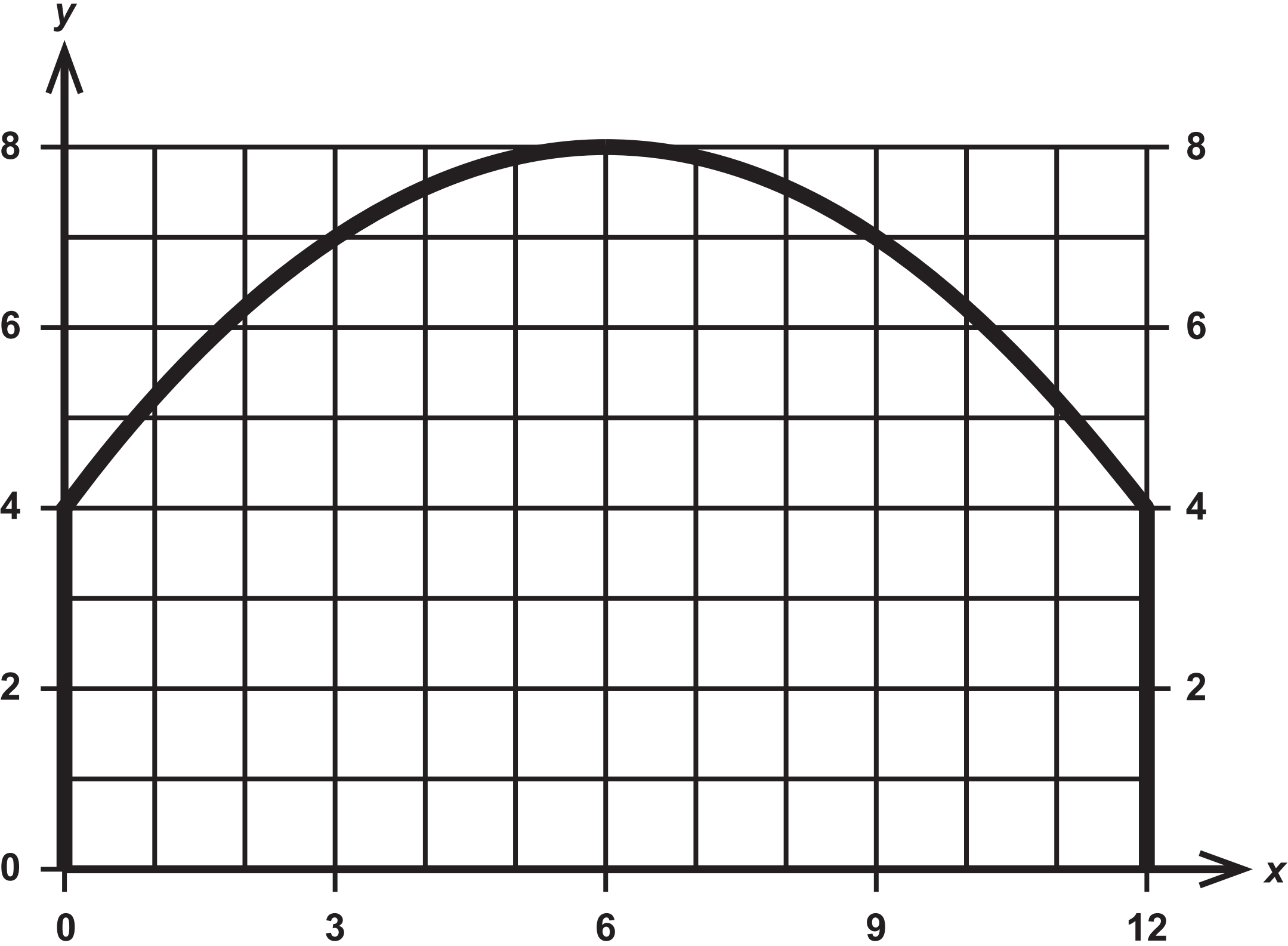


Question 21

Diagram NOT drawn to scale



Question 23



**FORMULA LIST
FOUNDATION TIER
AND HIGHER TIER
GCSE**

You must not write on these formulae pages.

Anything you write on these formulae pages will gain NO credit.

AREA AND VOLUME FORMULAE

Where r is the radius of the sphere or cone,
 l is the slant height of a cone and
 h is the perpendicular height of a cone:

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

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

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

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

KINEMATICS FORMULAE

Where a is constant acceleration,
 u is initial velocity, v is final velocity,
 s is displacement from the position
when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

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WEDNESDAY, 7 JUNE 2023 – MORNING

MATHEMATICS

HIGHER TIER

Additional Formulae

PERIMETER, AREA AND VOLUME

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

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

**Volume of a prism =
area of cross section $\times$ length**

**Where r is the radius and
 d is the diameter:**

$$\text{Circumference of a circle} = 2\pi r = \pi d$$

$$\text{Area of a circle} = \pi r^2$$

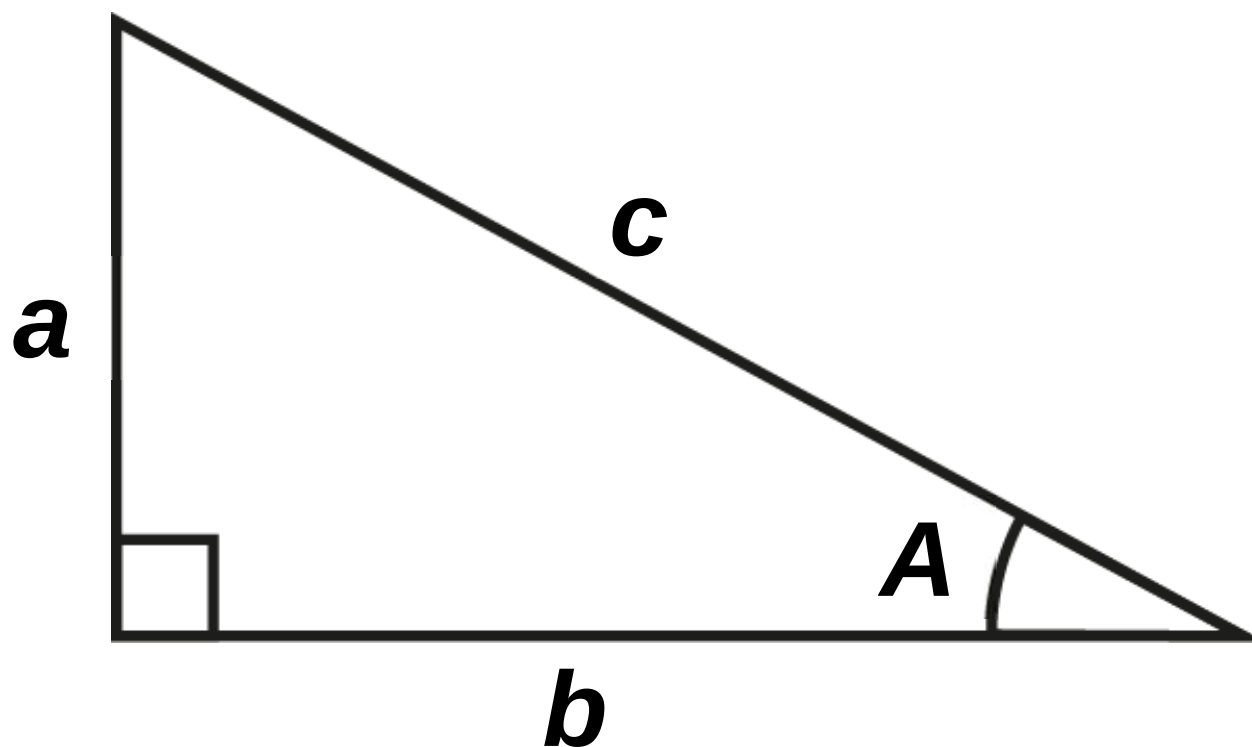
QUADRATIC FORMULA

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$:

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

PYTHAGORAS' THEOREM AND TRIGONOMETRY

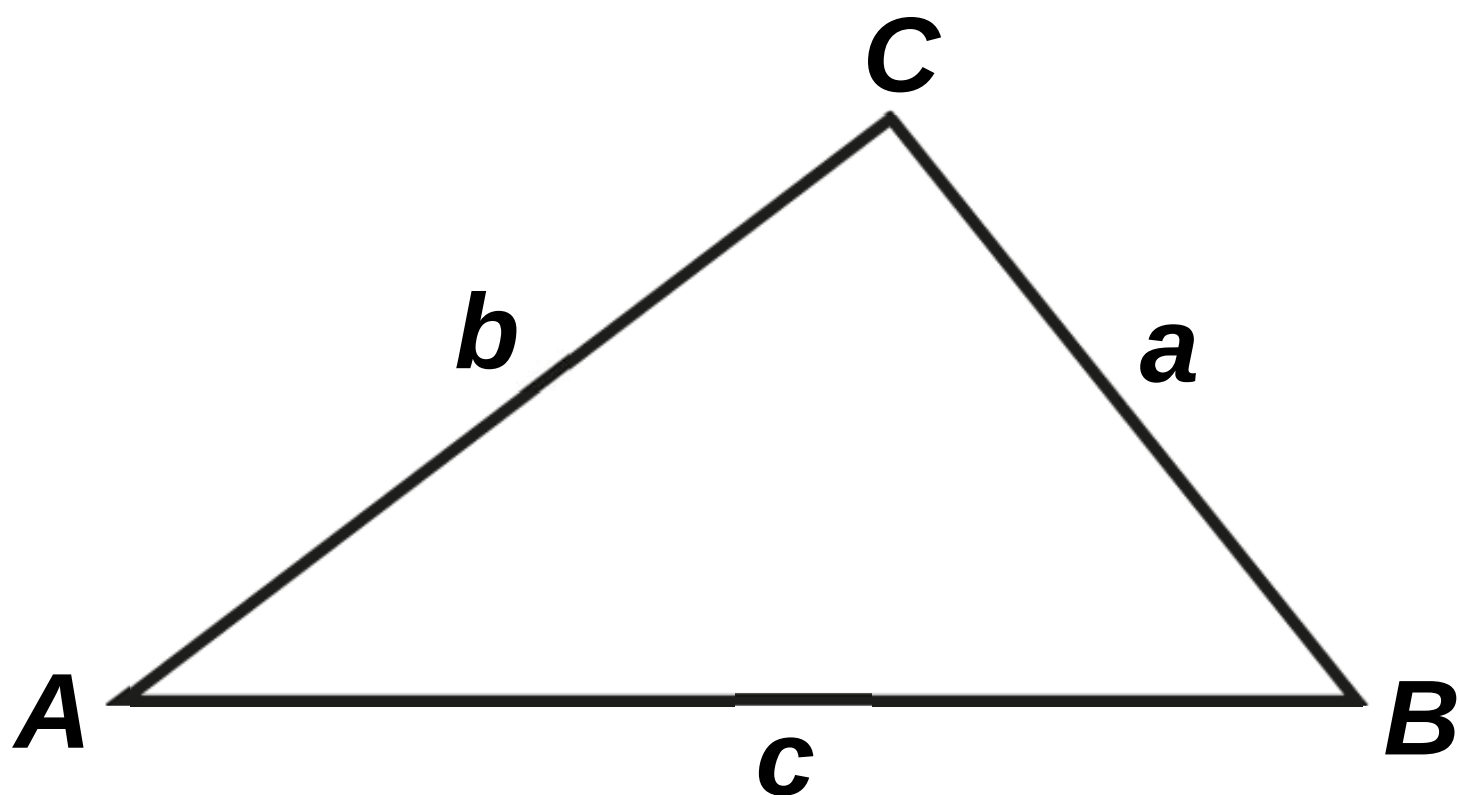


In any right – angled triangle where a , b and c are the length of the sides and c is the hypotenuse:

$$a^2 + b^2 = c^2$$

In any right – angled triangle ABC where a , b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$



In any triangle **ABC** where **a**, **b** and **c** are the length of the sides:

$$\text{sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

cosine rule:

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

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

COMPOUND INTEREST

Where P is the principal amount,
 r is the interest rate over a given period
and n is number of times that the
interest is compounded:

$$\text{Total accrued} = P \left(1 + \frac{r}{100} \right)^n$$

PROBABILITY

Where $P(A)$ is the probability of
outcome A and $P(B)$ is the probability
of outcome B :

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A \text{ given } B) P(B)$$