



C300UB0-1

MONDAY, 3 JUNE 2024 – 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.	5	
2.	5	
3.	5	
4.	4	
5.	5	
6.	4	
7.	5	
8.	2	
9.	3	
10.	4	
11.	4	
12.	4	
13.	4	
14.	4	
15.	3	
16.	6	
17.	4	
18.	3	
19.	3	
20.	4	
21.	4	
22.	3	
23.	6	
24.	7	
25.	3	
26.	9	
27.	7	
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.

Models for Question 11 and Question 24.

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 questions.

Write your answers in the spaces provided in this booklet.

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.

Take π as **3.142** 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.

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

Answer ALL questions.

- 1. Look at the diagram for Question 1 in the separate Diagram Booklet.**

The diagram is a frequency diagram.

45 students took part in a 400 m race.

Their times, in seconds, were recorded.

The frequency diagram shows the results.

The groups used are as follows:

$70 \leq \text{time} < 80$, $80 \leq \text{time} < 90$,

$90 \leq \text{time} < 100$, $100 \leq \text{time} < 110$

and $110 \leq \text{time} < 120$

Calculate an estimate for the mean time it took to complete the race.

[5 marks]

2. (a) Factorise $x^2 - 5x - 24$

[2 marks]

continued on the next page . . .

(Turn over)

Question 2 continued

2. (b) Simplify $(3h^2)^3$

[2 marks]

**(c) Look at the diagram for Question 2 (c)
in the separate Diagram Booklet.**

The diagram shows a number line.

Represent the inequality $-2 < x \leq 3$

on the number line.

[1 mark]

(Turn over)

3. Look at the diagram for Question 3 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows two right-angled triangles ***ABC*** and ***BCD***.

In the diagram:

AB = 5.4 cm, ***AC*** = 7.2 cm

and ***CD*** = 4.9 cm.

Calculate the area of triangle ***BCD***.

Area of triangle ***BCD*** is _____ cm^2

[5 marks]

4. For her lunch, Gina sometimes eats a salad and sometimes drinks a coffee.

The probability she eats a salad for lunch on a given day is 0.4

The probability she drinks a coffee on a given day is 0.25

Eating a salad for lunch and drinking a coffee are independent.

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

The diagram shows an incomplete tree diagram.

Complete the tree diagram.

[2 marks]

continued on the next page . . .

Question 4 continued

4. (b) Calculate the probability that, on a given day, Gina does not eat a salad for lunch but does drink a coffee.

[2 marks]

(Turn over)

5. Look at the diagram for Question 5 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows that when a ball is dropped, the maximum height it reaches after each bounce decreases.

Maddox says,

“Each time the ball bounces it reaches a height that is 55% of the maximum height reached on its previous bounce.”

- (a) The ball is dropped from a height of 4 m.

What height will the ball reach above the ground after its 7th bounce?

[3 marks]

- 5. (b) (i) State any assumptions you have made in answering part (a).**

[1 mark]

continued on the next page . . .

(Turn over)

Question 5 (b) continued

- 5. (b) (ii) What effect could your assumption have on your answer to part (a)?**

[1 mark]

6. (a) Look at the diagram for Question 6 (a) in the separate Diagram Booklet.

The diagram shows an incomplete Venn diagram.

There are **50** people in a sports club.

Two of the sports the people can take part in are rowing and cycling.

Of these **50** people:

- **27** take part in rowing
- **32** take part in cycling
- **8** do not take part in rowing or cycling.

Complete the Venn diagram to show this information.

[2 marks]

6. (b) One person is chosen at random from the sports club.

Find the probability that they take part in rowing but not in cycling.

[2 marks]

(Turn over)

7. Abdul is travelling from the UK to Brazil for a holiday.

Abdul has £825 to exchange for Brazilian reals (R\$).

The exchange rate is £1 = 6.27R\$.

The bank Abdul uses to exchange his money only has 50R\$ notes.

What is the maximum amount of Brazilian reals Abdul can buy and what will this cost him in pounds?

Give your answer correct to the nearest penny.
You must show all your working.

[5 marks]

8. Make **R** the subject of the formula $P = \sqrt[3]{RQ}$

[2 marks]

(Turn over)

9. (a) Show that

$$2x(7x - 8y) - 3y(x - 5y) \equiv 14x^2 - 19xy + 15y^2$$

[2 marks]

continued on the next page . . .

(Turn over)

Question 9 continued

- 9. (b) In part (a) the identity symbol ($\equiv$) has been used.**

Explain why this has been used and not an equal sign.

[1 mark]

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

The diagram shows lines AB and BC .

The point D is equidistant from the lines AB and BC .

Point D is also equidistant from the points B and C .

Using only a ruler and a pair of compasses, **CONSTRUCT** suitable arcs and lines to show the position of point D .

[4 marks]

11. Ask for the model for Question 11.

The model is NOT made to scale.

The model represents a cylindrical fish tank standing on horizontal ground.

The base of the fish tank has a radius of 24 cm.

All the base of the fish tank is in contact with the ground.

The fish tank exerts a pressure of 0.97 N/cm^2 on the ground.

What force is exerted on the ground by the fish tank?

Use:

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

(Turn over)

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

The diagram is NOT drawn to scale.

The diagram shows a vertical cliff which is **35** metres high.

Pierre is standing at point **P**.

From point **P**, the angle of elevation to the top of the cliff is 72°

Pierre sees this warning sign.



Warning!
Coastal Erosion.
It is not safe to stand
within 10 m of the base
of the cliff.

Is Pierre standing a safe distance from the base of the cliff?

Yes

☐

No

☐

continued on the next page . . .

(Turn over)

Question 12 continued**Show how you decide.**

[4 marks]**(Turn over)**

- 13. A solution to the equation $2x^3 - 5x - 23 = 0$ lies between 2 and 3**

Use the method of trial and improvement to find the solution correct to 1 decimal place.

[illegible]

[4 marks]

14. Solve $\frac{4y + 5}{2} - \frac{y + 1}{3} = \frac{5}{6}$

You must show all your working.

[illegible]

[4 marks]

(Turn over)

15. A solid cone has a base radius of y cm.
The height of the cone is six times its radius.
The cone is made from material which has a
density of 7 g/cm^3
Write an expression for the mass of the cone
in grams.
Give your answer, in terms of y and π , in its
simplest form.

[3 marks]

16. A video game company investigated how long, in minutes, one group of 10-year-old students and one group of 14-year-old students spent playing video games last Wednesday evening.

Look at the diagrams for Question 16 in the separate Diagram Booklet. The diagrams display the results for each age group.

(a) Lewis says,

“14-year-olds spend longer, on average, playing video games than 10-year-olds.”

Is Lewis correct?

Yes ☐ No ☐

Use information from the diagrams to justify your answer.

[1 mark]

(b) Complete the following sentences using information from the diagrams.

(i) The percentage of 14-year-old students that spent less than 40 minutes playing video games last Wednesday evening was
_____ %

[1 mark]

continued on the next page . . .

(Turn over)

Question 16 (b) continued

- 16. (b) (ii) The percentage of 10-year-old students that spent more than 100 minutes playing video games last Wednesday evening was**

_____ %

[2 marks]

continued on the next page . . .

(Turn over)

Question 16 continued

- 16. (c) Compare the inter–quartile range of the times each age group spent playing video games last Wednesday evening.**

What conclusions can you draw about the length of time 10–year–olds and

14–year–olds spent playing video games last Wednesday evening?

[2 marks]

(Turn over)

17. Noah and Jenny play a game.

Each shoots an arrow at a target.

The arrow is removed from the target after each shot.

For each of their shots:

- **Noah hits the target with
a probability of $\frac{1}{5}$**
- **Jenny hits the target with
a probability of $\frac{3}{10}$**

Noah and Jenny take it in turns to shoot an arrow at the target.

In the game, Noah shoots the first arrow.

When one of them hits the target the game ends and that person wins the game.

continued on the next page . . .

Question 17 continued

- 17. (a) Calculate the probability that Jenny wins the game on her first shot.**

[2 marks]

- 17. (b) Calculate the probability that Noah wins the game on his second shot.**

[2 marks]

(Turn over)

18. Kian went for a run.

The route he runs is 3000 metres,

CORRECT TO THE NEAREST 100 metres.

He ran the route in a time of 720 seconds,

CORRECT TO THE NEAREST 10 seconds.

Calculate Kian's GREATEST possible average speed for this run.

Give your answer in metres per second.

You must show all your working.

Kian's greatest possible average speed is
_____ metres per second.

[3 marks]

19. Look at the diagram for Question 19 in the separate Diagram Booklet. The diagram shows a shape on a grid.

Enlarge the shape shown on the grid by a scale factor of -2

Use $(3, 2)$ as the centre of enlargement.

[3 marks]

20. Look at the diagram for Question 20 in the separate Diagram Booklet. The diagram is NOT drawn to scale.

The diagram shows points R , S and T on the circumference of a circle with centre O .

The lines QR and QT are both tangents to the circle.

Angle $RST = 66^\circ$

Show that angle $RQT = 48^\circ$

Give a reason for each step of your answer.

(Turn over)

$$\frac{4x^2 - 25}{6x^2 - 15x}$$
[illegible]

(Turn over)

- 22. A line, L , passes through the point $(-1, 5)$**

and is perpendicular to $y = \frac{1}{2}x + 5$

Find the equation of the line L .

Give your answer in the form $ax + by + c = 0$

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There is no handwriting or other markings on the paper.

[3 marks]

(Turn over)

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

The diagram is NOT drawn to scale.

The diagram shows triangle ZWY .

The line ZX splits triangle ZWY into two triangles.

WXY is a straight line.

$$ZW = 11.8 \text{ cm}$$

$$ZX = 13.1 \text{ cm}$$

$$XY = 7.8 \text{ cm}$$

$$\text{Angle } ZWX = 61^\circ$$

Calculate the length of YZ .

(Turn over)

24. Ask for the wooden horses for Question 24.

Hollie makes wooden horses that are mathematically similar.

There is a large horse and a small horse.

The distance between the front legs and the back legs on the large horse is 16 cm

The distance between the front legs and the back legs on the small horse is 10 cm

The large horse has a total surface area of 640 cm^2

Hollie uses spray paint to cover the total surface area of each horse.

One can of spray paint covers an area of 9300 cm^2 and costs £8.45

continued on the next page . . .

Question 24 continued

Calculate the cost of buying the LEAST number of cans of spray paint required to cover 30 large horses and 50 small horses.

[illegible]

(Turn over)

[7 marks]

25. Look at the diagram for Question 25 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows:

- the circle with equation $x^2 + y^2 = 32$
- a tangent to the circle. The tangent passes through $(t, 0)$ and $(0, t)$.

Calculate the value of t .

[3 marks]

26. One of the attractions at a theme park is a roller coaster.

Look at the diagram for Question 26 in the separate Diagram Booklet.

The diagram is a graph showing the velocity of the roller coaster, in metres per second, for the first 14 seconds.

- (a) Calculate, in KILOMETRES PER HOUR, the velocity of the roller coaster at time $t = 4$ seconds.

Velocity is _____
kilometres per hour.

[2 marks]

continued on the next page . . .

(Turn over)

Question 26 continued

- 26. (b) Calculate an estimate for the acceleration of the roller coaster at time $t = 2$ seconds.**

Give your answer in m/s^2

[3 marks]

continued on the next page . . .

(Turn over)

Question 26 continued

- 26. (c) Describe the acceleration of the roller coaster between $t = 4$ and $t = 10$ seconds.**

[1 mark]

- (d) Use FIVE vertical strips of equal width to calculate an estimate for the distance the roller coaster travelled between $t = 4$ and $t = 14$ seconds.
Give your answer in metres.**

(Turn over)

(Turn over)

- 27. Find the coordinates of the points of intersection of the curve $3x^2 + 2y^2 = 12$ and the line $y = x - 3$**
- Give your solutions correct to 1 decimal place.**
- You must show all your working.**

[illegible]

[7 marks]

END OF PAPER

TOTAL 120 MARKS

(Turn over)

[illegible]

(Turn over)

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

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MONDAY, 3 JUNE 2024 – 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

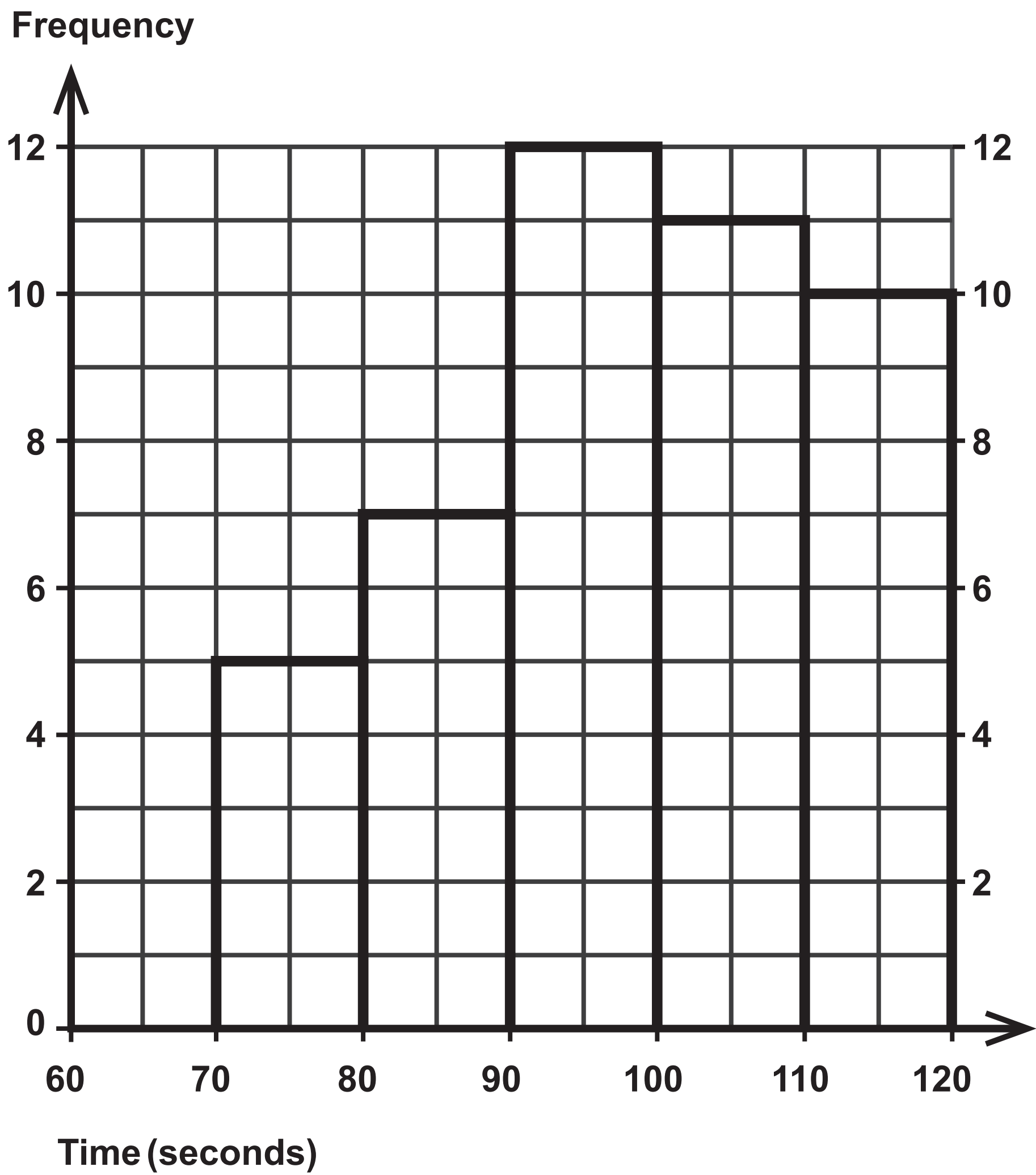
Surname: _____

First name(s): _____

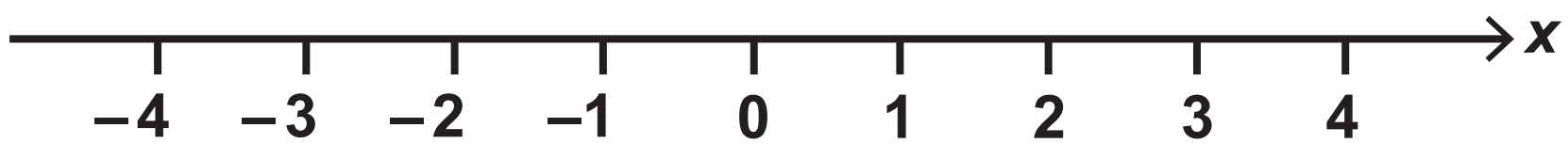
Centre Number: _____

Candidate Number: 0 _____

Question 1

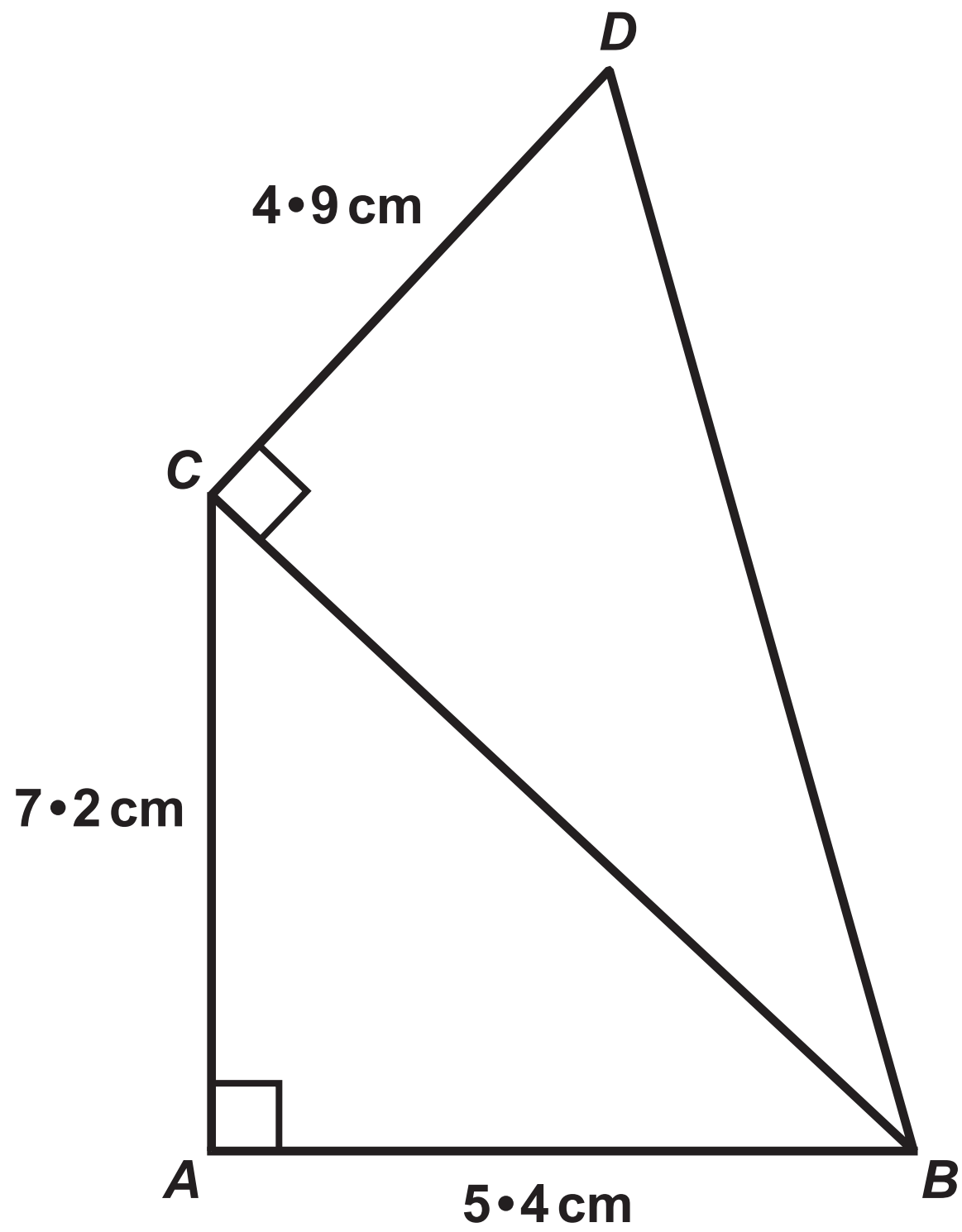


Question 2 (c)

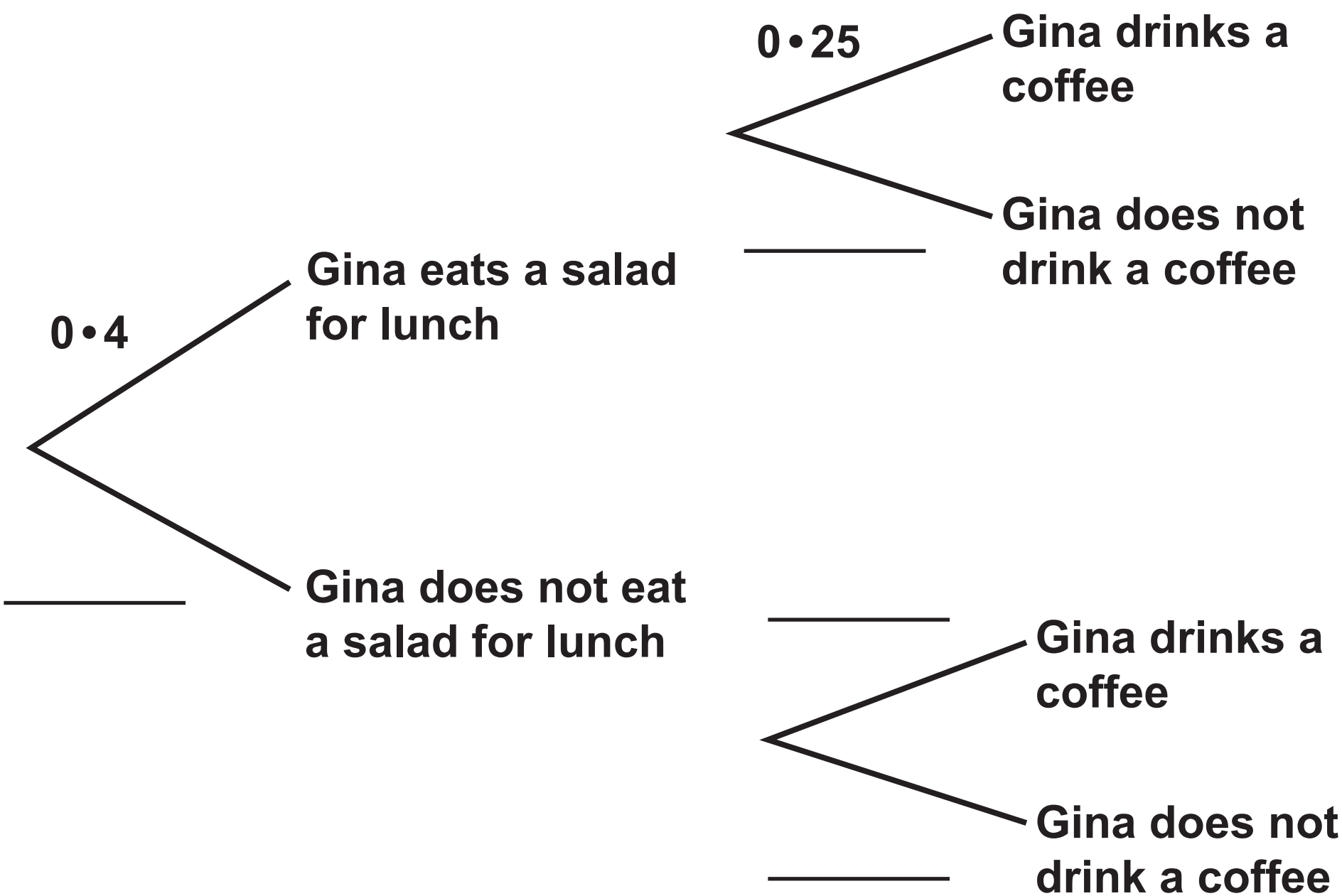


Question 3

Diagram NOT drawn to scale

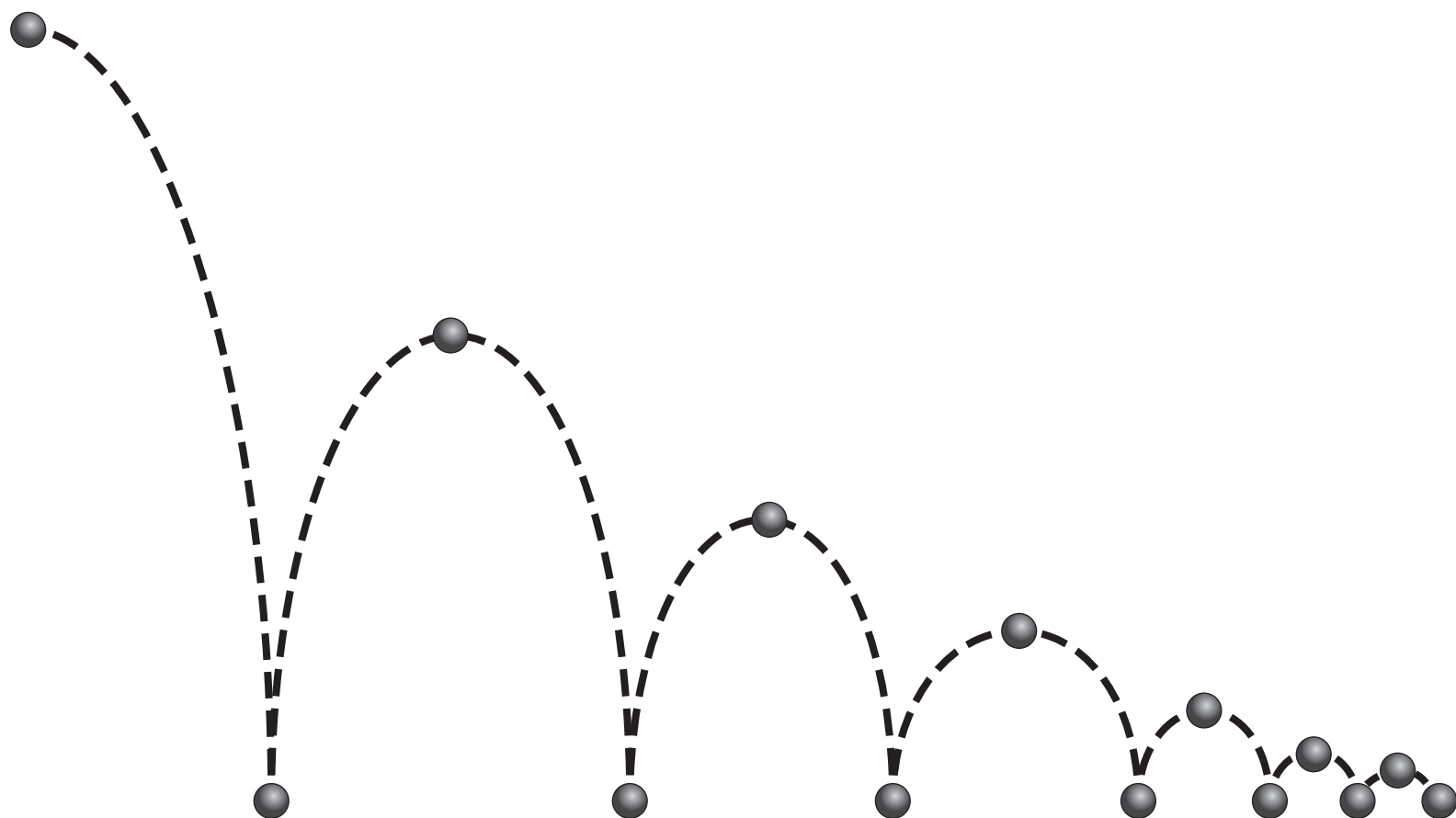


Question 4 (a)



Question 5

Diagram NOT drawn to scale

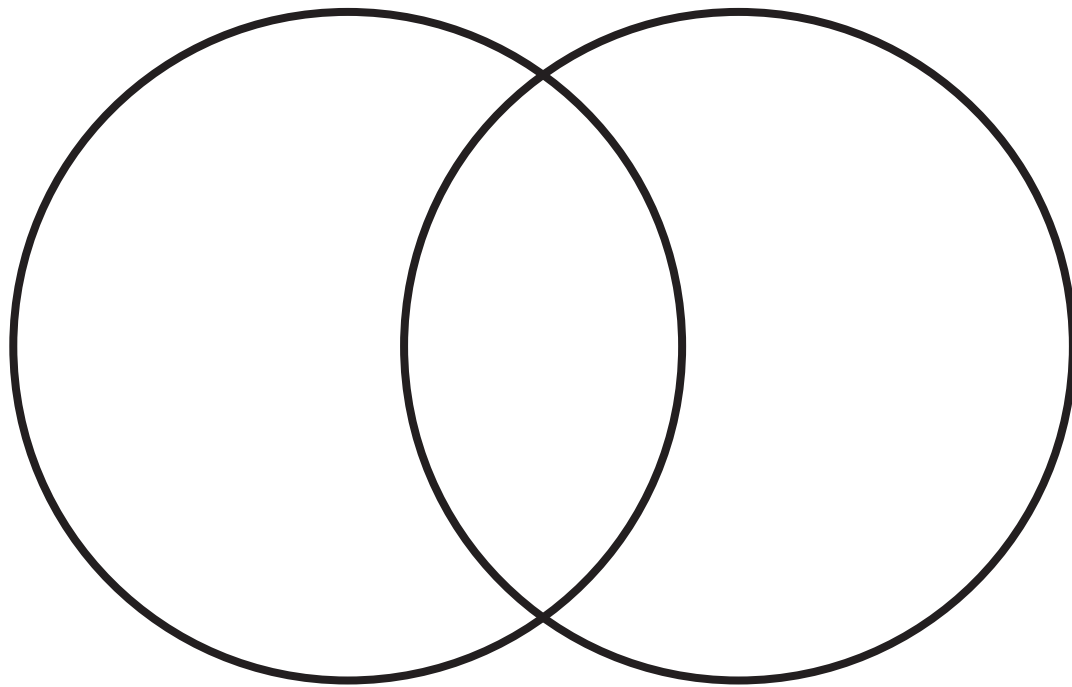


Question 6 (a)

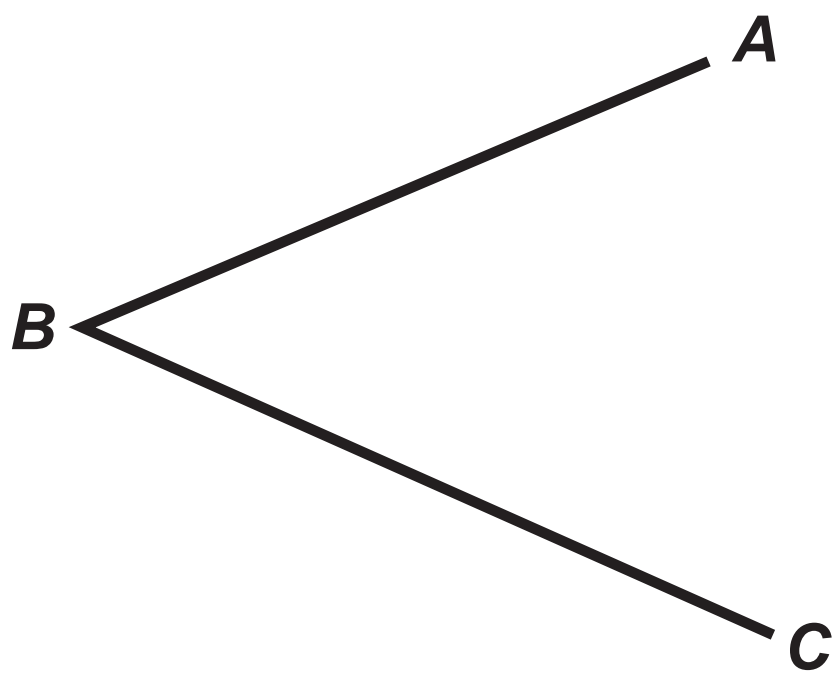
£

Rowing

Cycling

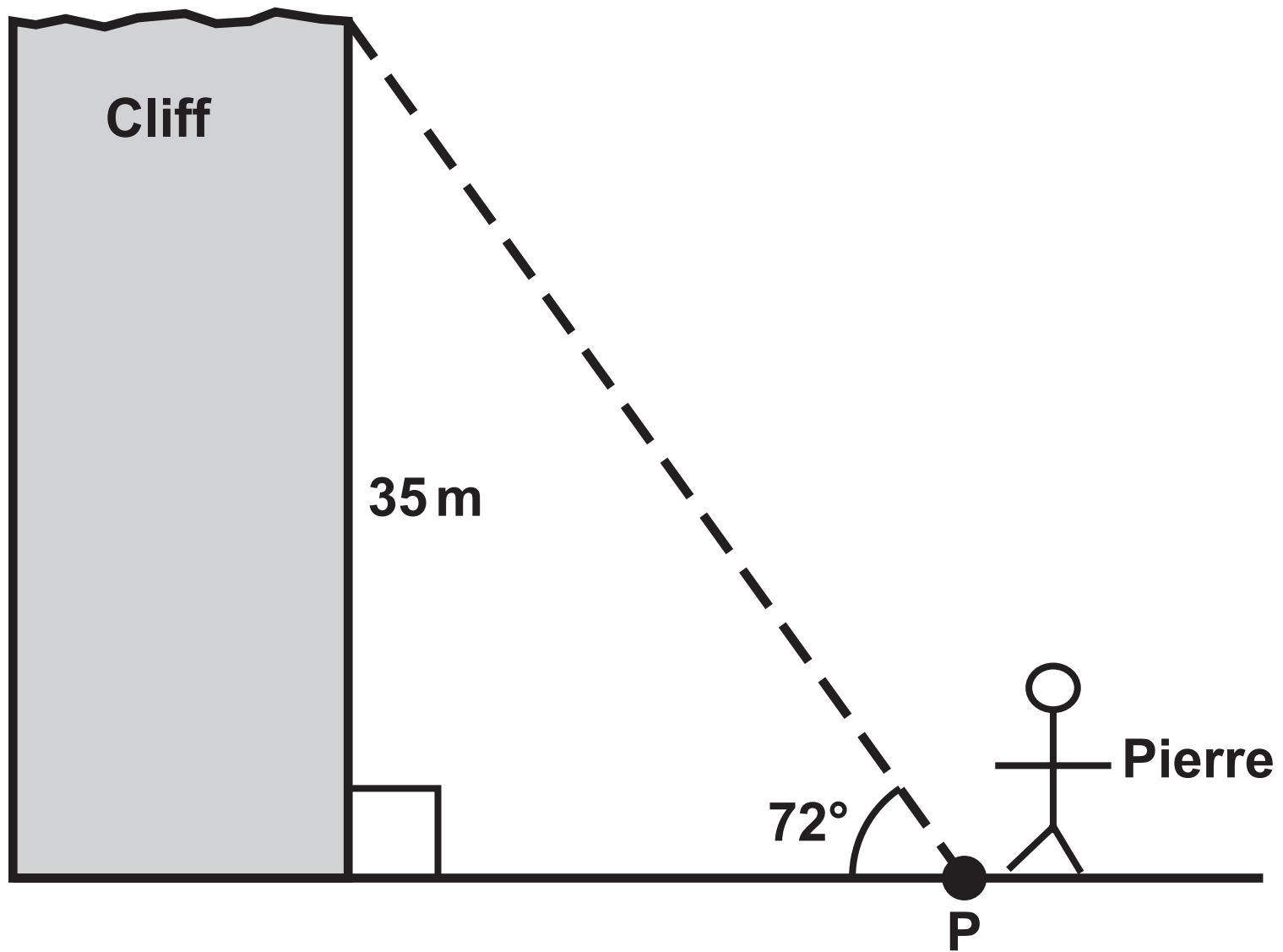


Question 10



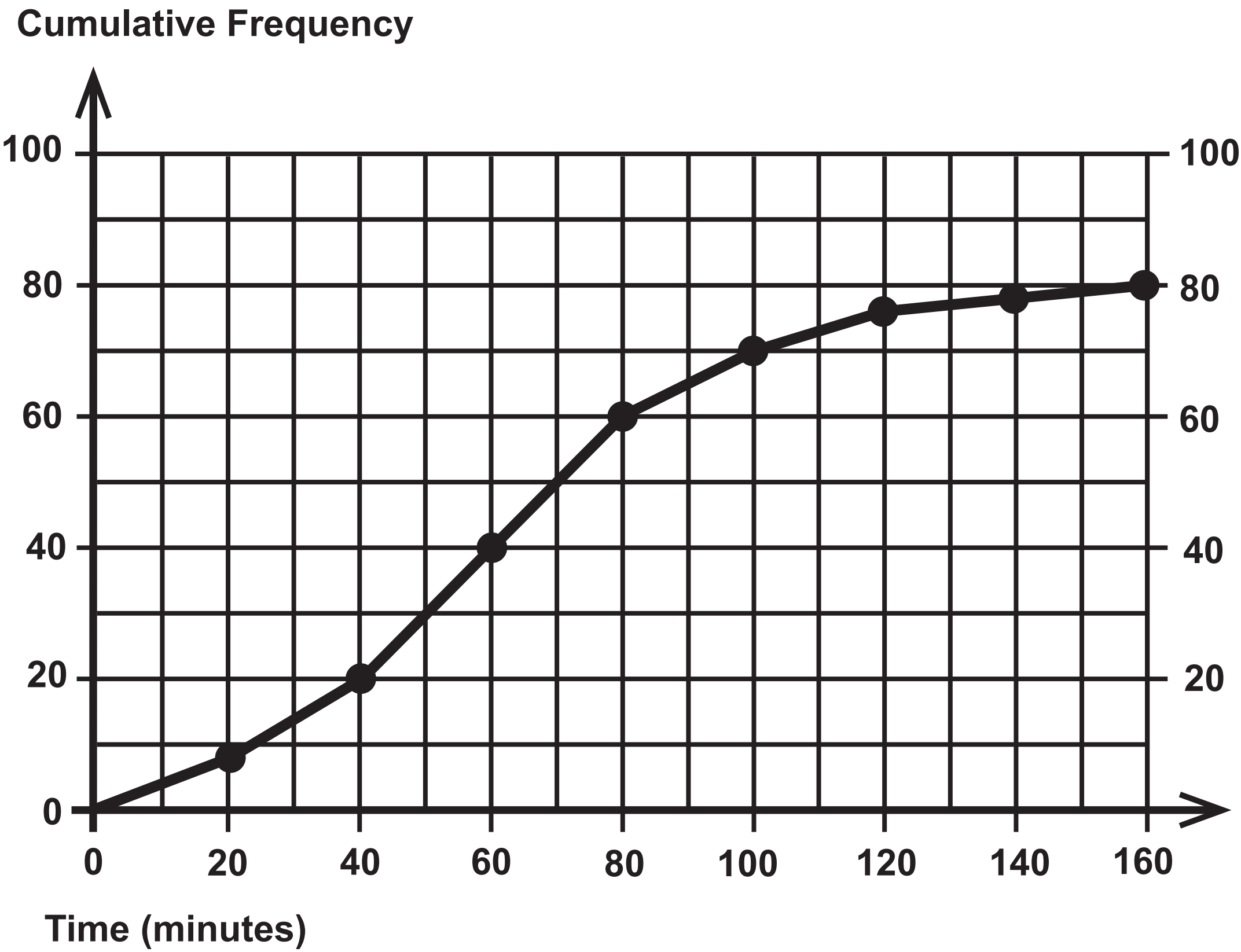
Question 12

Diagram NOT drawn to scale

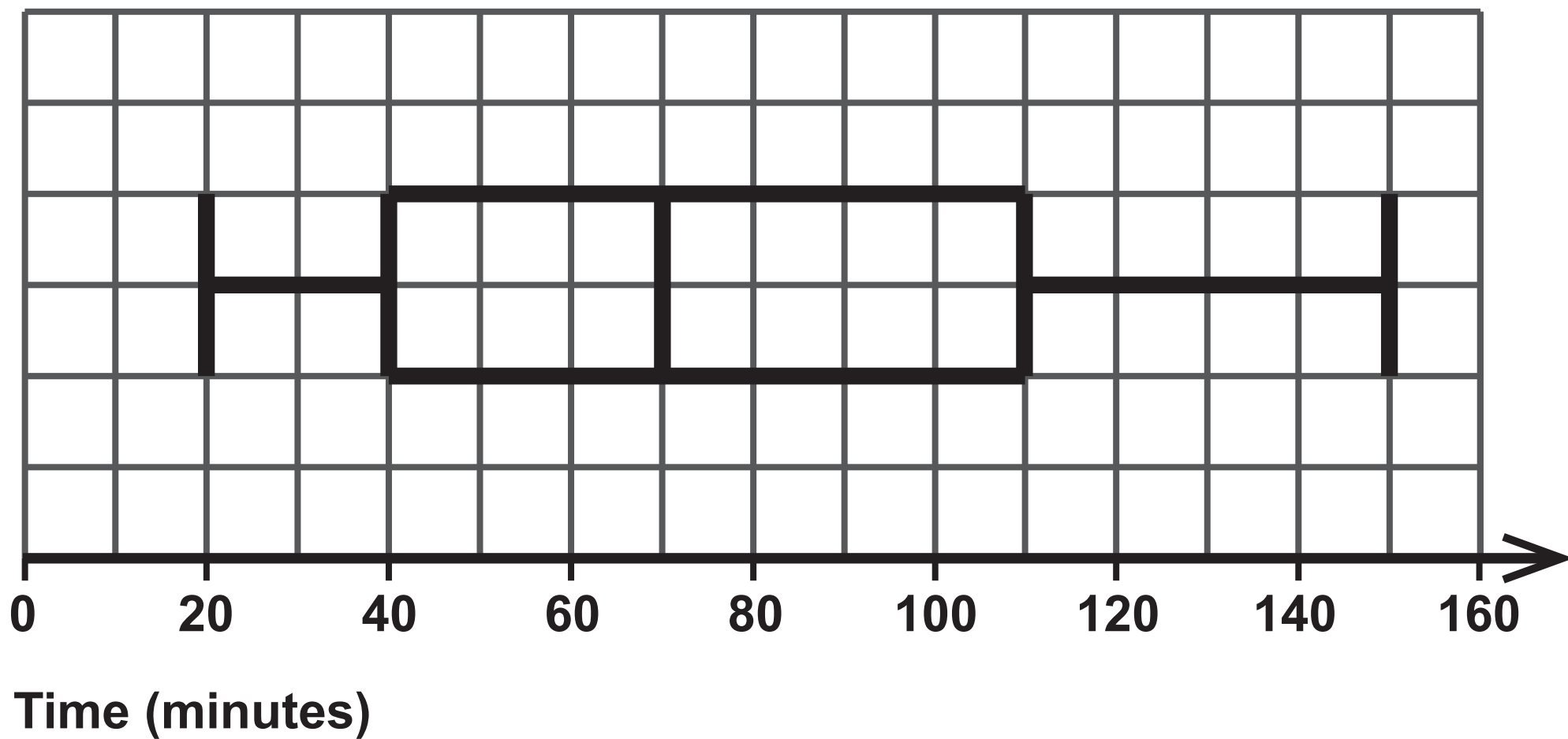


Question 16

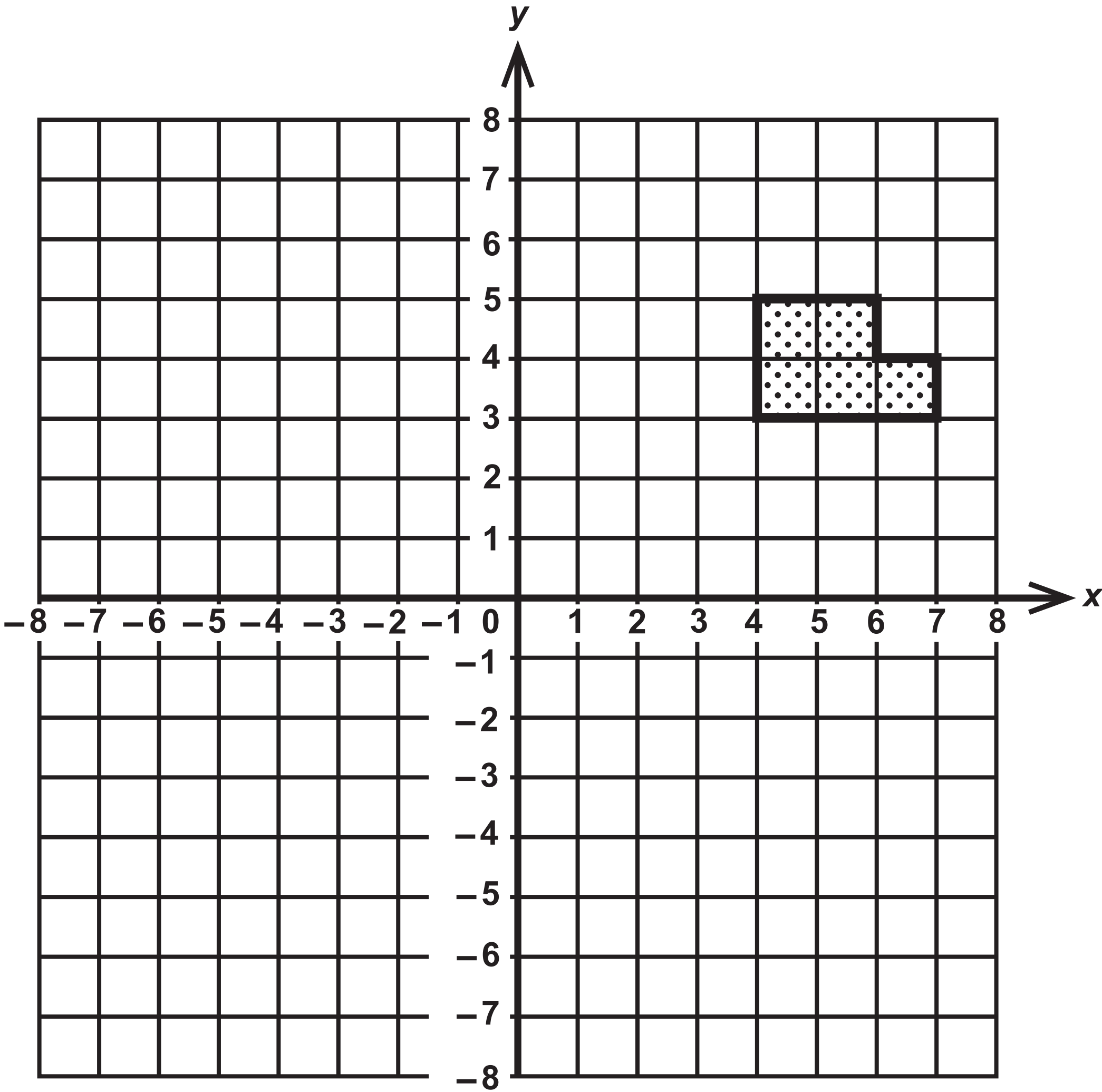
10 – year – old students



14 – year – old students

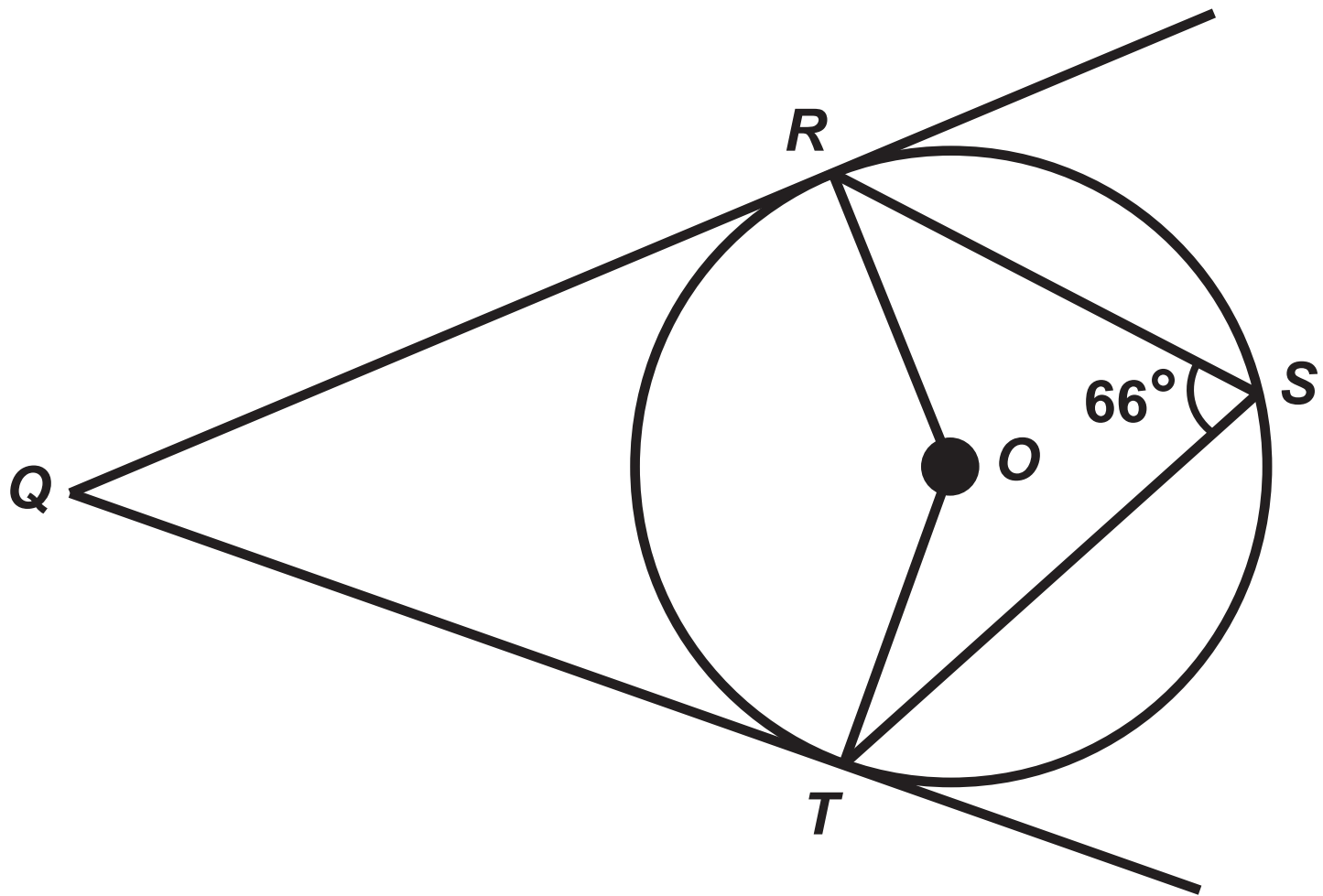


Question 19



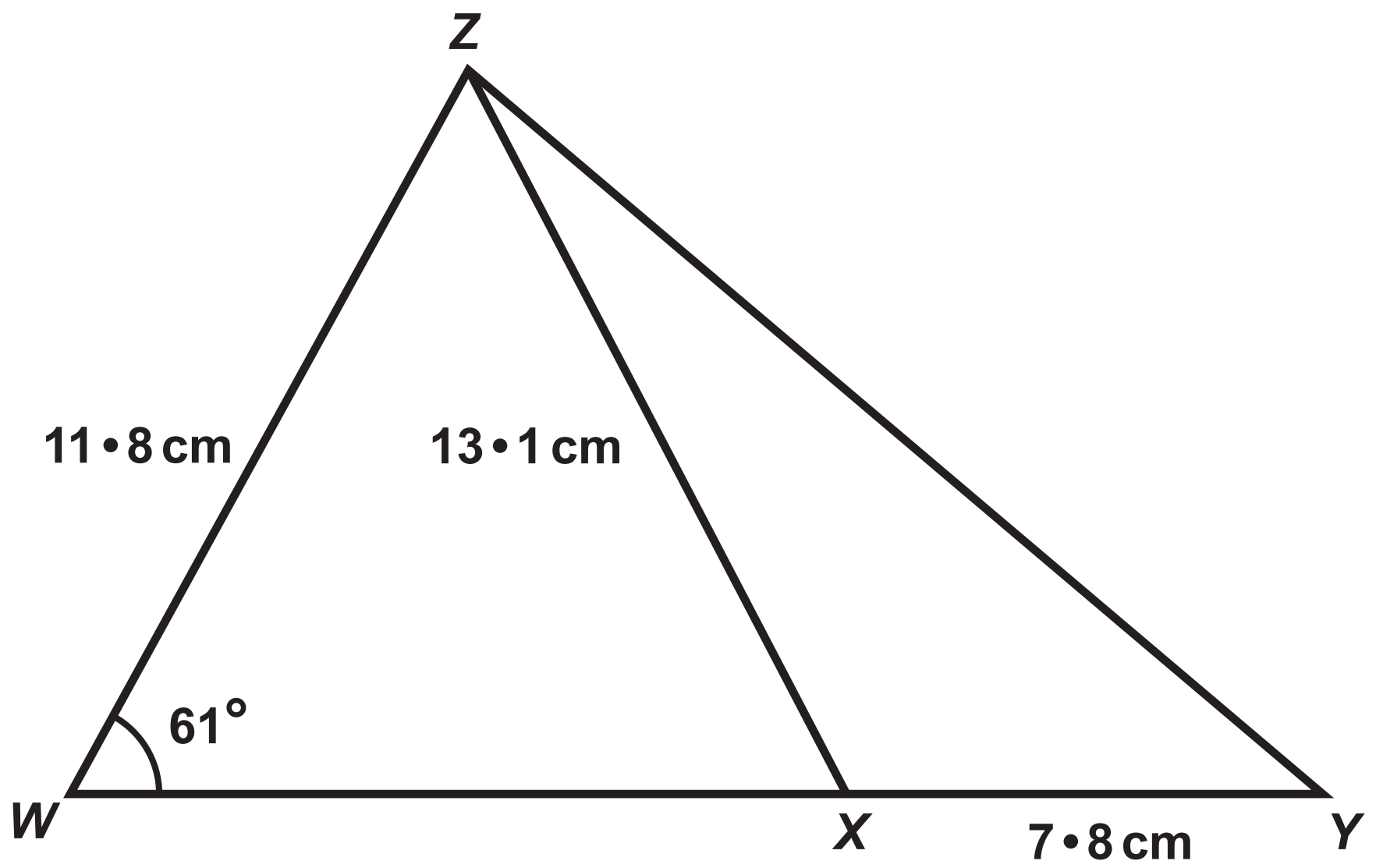
Question 20

Diagram NOT drawn to scale

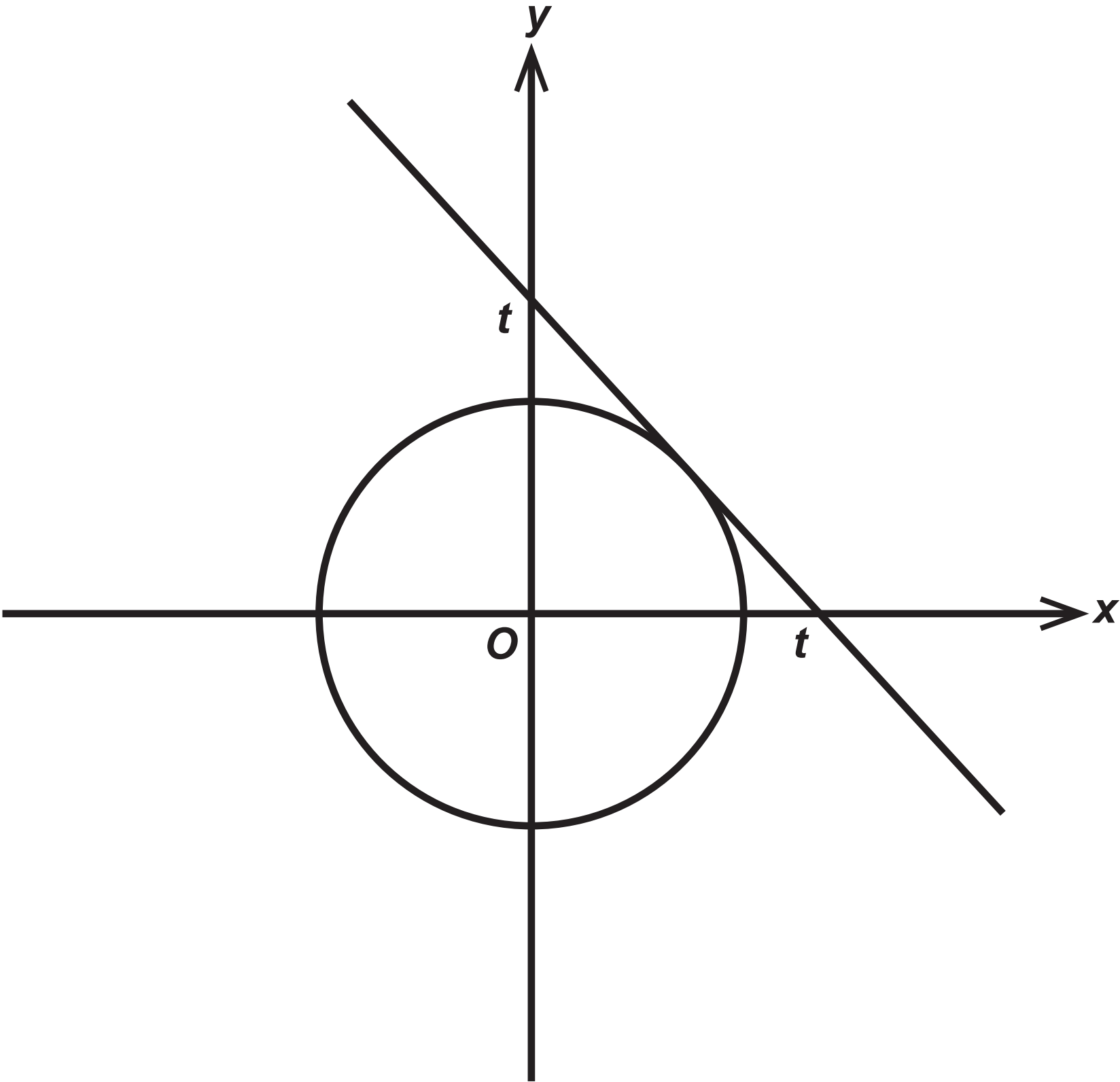


Question 23

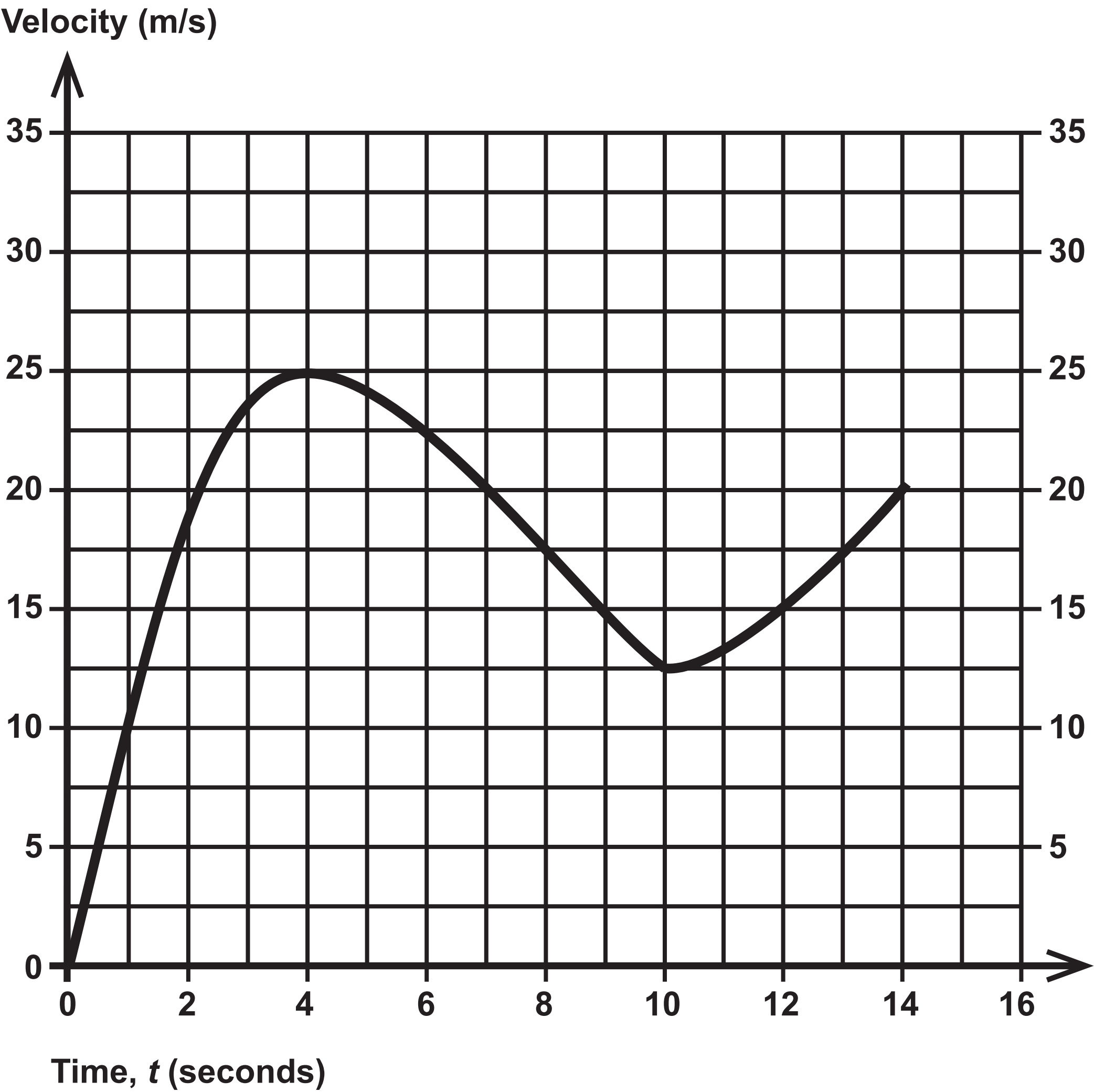
Diagram NOT drawn to scale



Question 25



Question 26



C300UB0-1A

MONDAY, 3 JUNE 2024 – 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:**

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

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

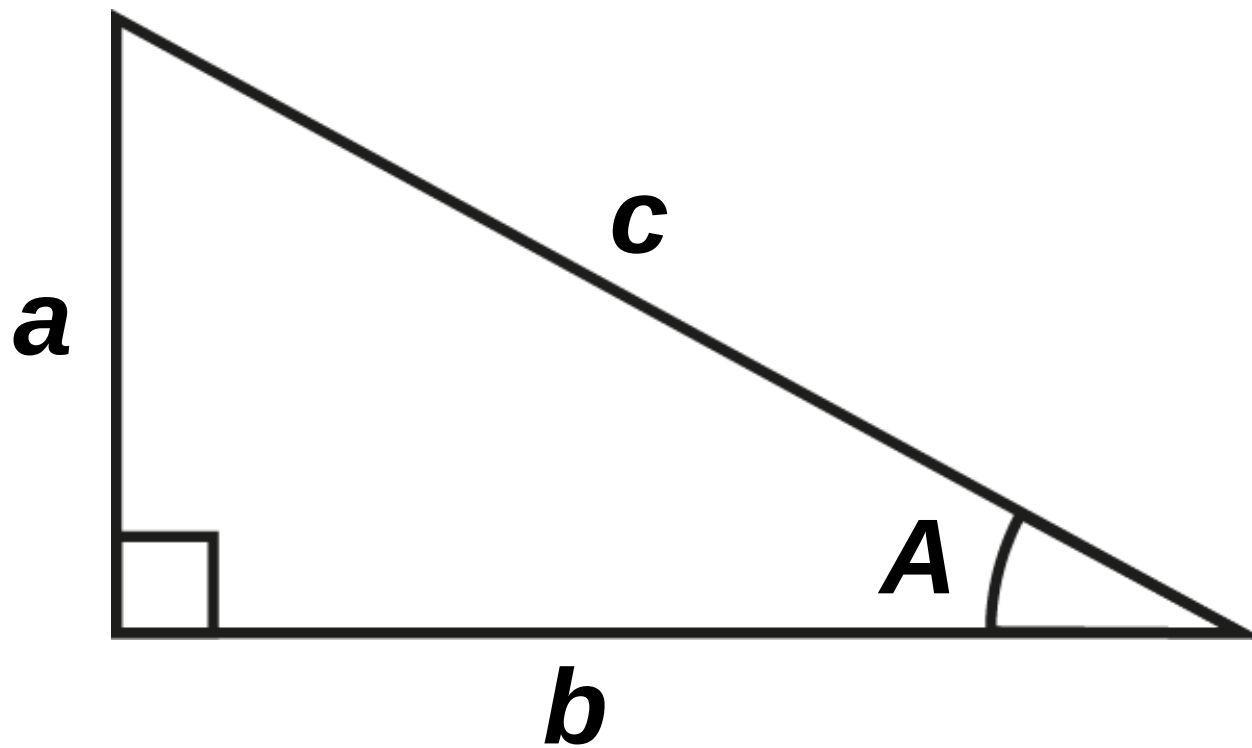
QUADRATIC FORMULA

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

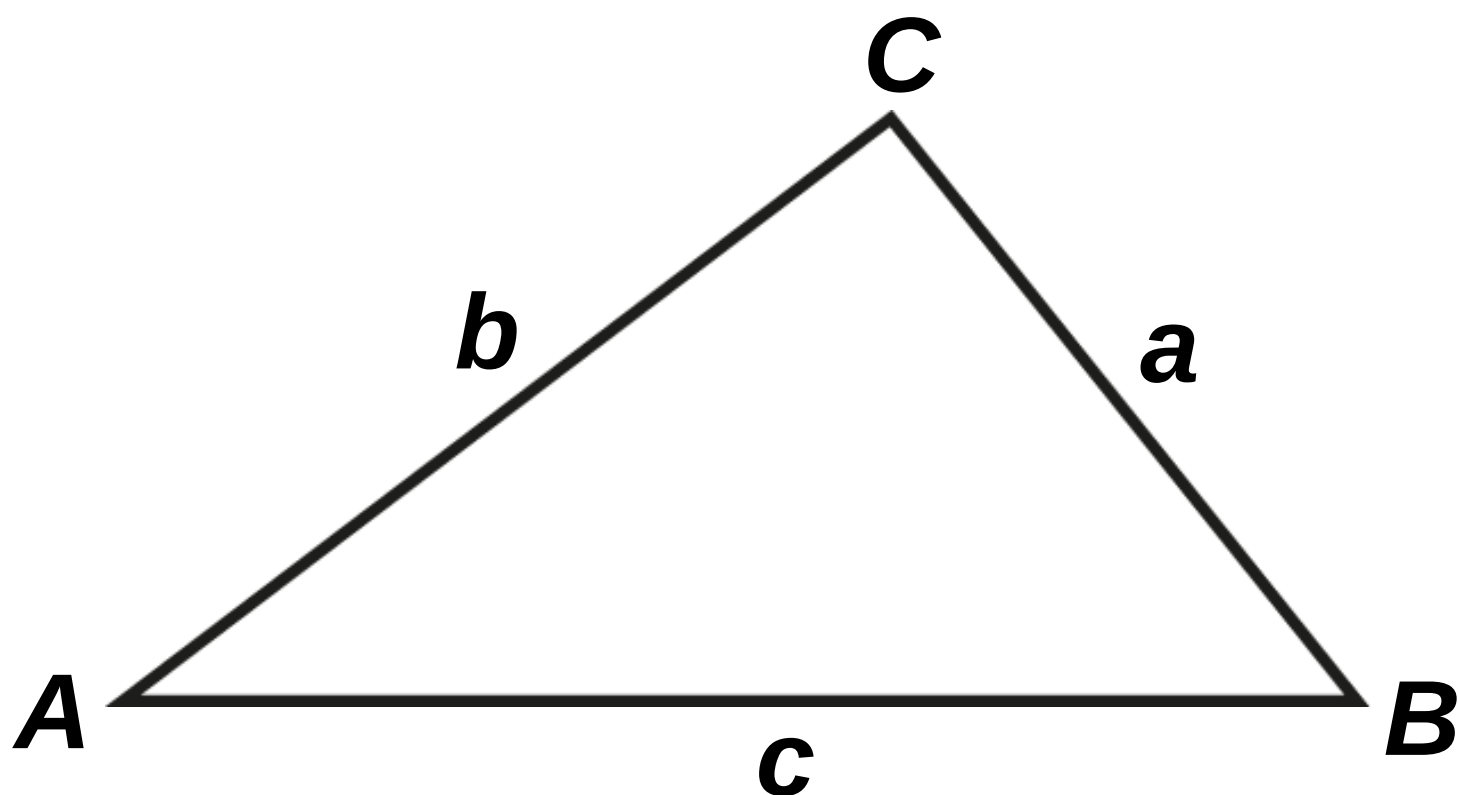


In any right – angled triangle where a , b and c are the length of the sides and c is the hypotenuse:

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

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:

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 :

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

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