



GCSE



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.

(Turn over)

**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.**

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

Take π as 3.142 or use the π button on your calculator.

(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.

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

(Turn over)

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.**

continued on the next page . . .

(Turn over)

Question 1 continued

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.**

(Turn over)

8

[5 marks]

(Turn over)

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]

continued on the next page . . .

(Turn over)

Question 2 continued

- 2. (c) Look at the diagram for Question 2 (c) in the separate Diagram Booklet. The diagram shows a number line.**

Represent the inequality

$$\mathbf{-2 < x \leq 3}$$

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 .

(Turn over)

(Turn over)

Area of triangle *BCD* is _____ cm^2

[5 marks]

(Turn over)

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.

continued on the next page . . .

(Turn over)

Question 4 continued

- 4. (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 . . .

(Turn over)

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.”

continued on the next page . . .

(Turn over)

Question 5 continued

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

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

(Turn over)

[3 marks]

continued on the next page . . .

(Turn over)

Question 5 continued

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]

(Turn over)

- 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.

continued on the next page . . .

(Turn over)

Question 6 (a) continued

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.

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 6 continued

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.

(Turn over)

(Turn over)

[5 marks]

(Turn over)

8. Make R the subject of the formula

$$P = \sqrt[3]{RQ}$$

[2 marks]

(Turn over)

9. (a) Show that

$$2x(7x - 8y) - 3y(x - 5y)$$

$$\equiv 14x^2 - 19xy + 15y^2$$

(Turn over)

[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]

(Turn over)

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]

(Turn over)

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.

continued on the next page . . .

(Turn over)

Question 11 continued

**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)

(Turn over)

Force = _____ **N**

[4 marks]

(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!

Costal Erosion.

**It is not safe to stand
within 10 m of the
base of the cliff.**

(Turn over)

continued on the next page . . .

Question 12 continued

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

Yes

☐

No

☐

Show how you decide.

(Turn over)

41

[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.**

(Turn over)

(Turn over)

[4 marks]

(Turn over)

45

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

You must show all your working.

(Turn over)

[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.

(Turn over)

(Turn over)

[3 marks]

(Turn over)

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.

continued on the next page . . .

(Turn over)

Question 16 continued

(a) Lewis says,

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

Is Lewis correct?

Yes

☐

No

☐

continued on the next page . . .

(Turn over)

Question 16 continued

**Use information from the
diagrams to justify your answer.**

[1 mark]

continued on the next page . . .

(Turn over)

Question 16 continued

16. (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?**

(Turn over)

[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.**

continued on the next page . . .

(Turn over)

Question 17 continued

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

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

[2 marks]

continued on the next page . . .

(Turn over)

Question 17 continued

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

(Turn over)

60

[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.

(Turn over)

(Turn over)

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

[3 marks]

(Turn over)

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]

(Turn over)

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)

67

[4 marks]

(Turn over)

21. (a) Simplify $\frac{4x^2 - 25}{6x^2 - 15x}$

(Turn over)

[4 marks]

(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

$$ax + by + c = 0$$

(Turn over)

71

(Turn over)

72

[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)

(Turn over)

75

(Turn over)

76

[6 marks]

(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**

continued on the next page . . .

(Turn over)

Question 24 continued

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

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

(Turn over)

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Turn over)

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Turn over)

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 .

(Turn over)

(Turn over)

[3 marks]

(Turn over)

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.

(Turn over)

Velocity is _____ kilometres per hour.
[2 marks]

continued on the next page . . .

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

(Turn over)

[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]

continued on the next page . . .

(Turn over)

Question 26 continued

- 26. (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)

91

[3 marks]

(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.

(Turn over)

(Turn over)

(Turn over)

(Turn over)

[7 marks]

END OF PAPER

TOTAL 120 MARKS

(Turn over)

[illegible]

(Turn over)

[illegible]

(Turn over)

[illegible]

(Turn over)

[illegible]

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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

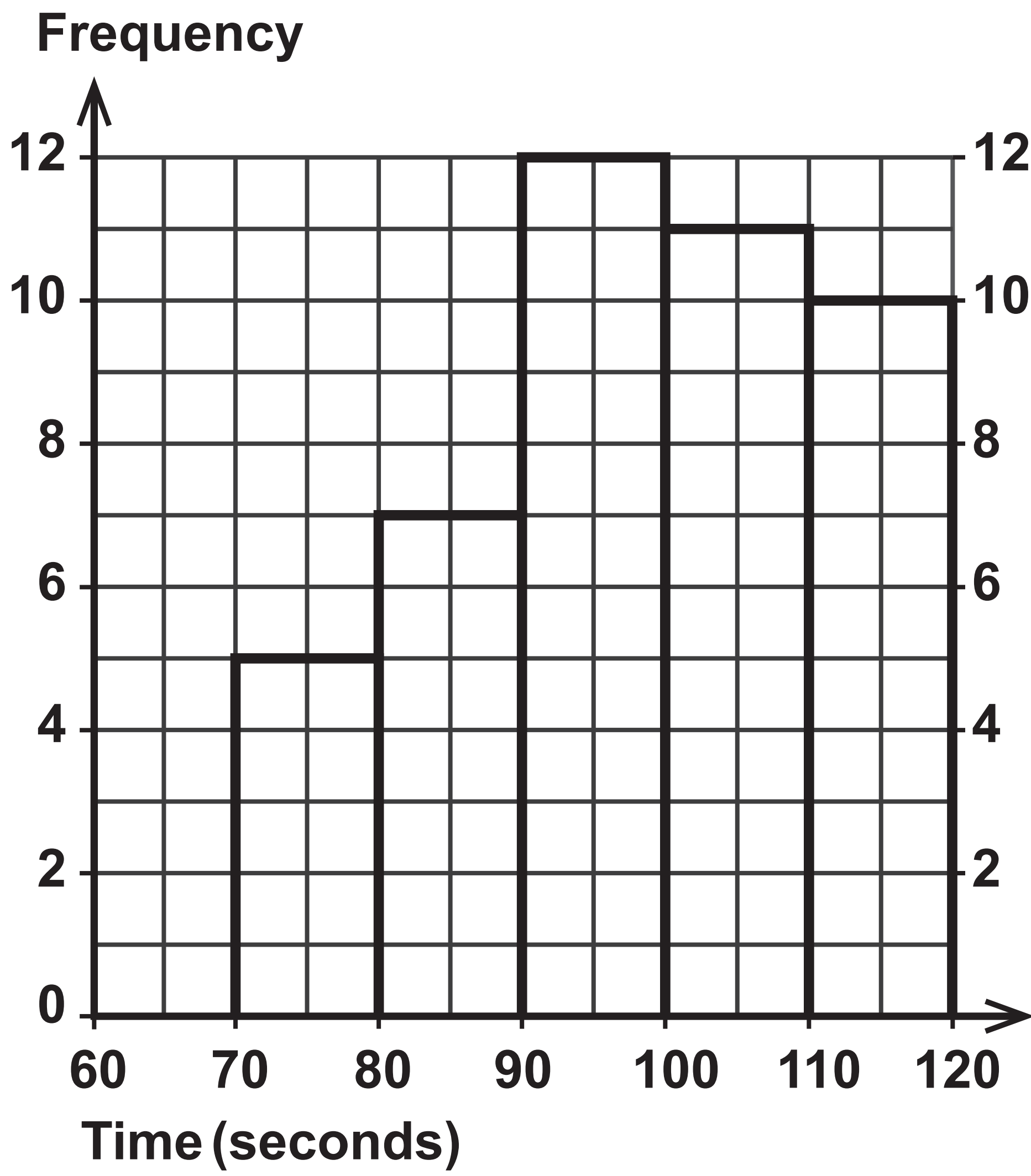
Surname: _____

First name(s): _____

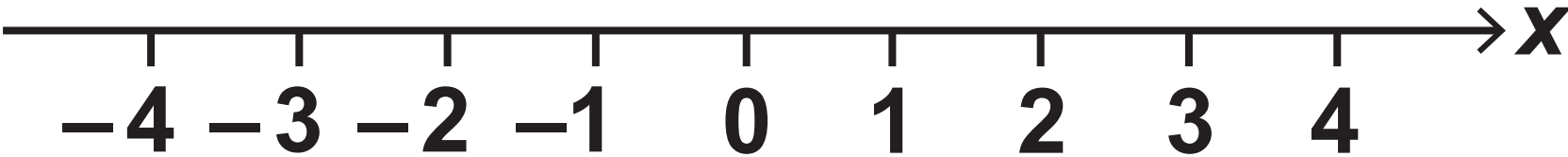
Centre Number: _____

Candidate Number: 0 _____

Question 1

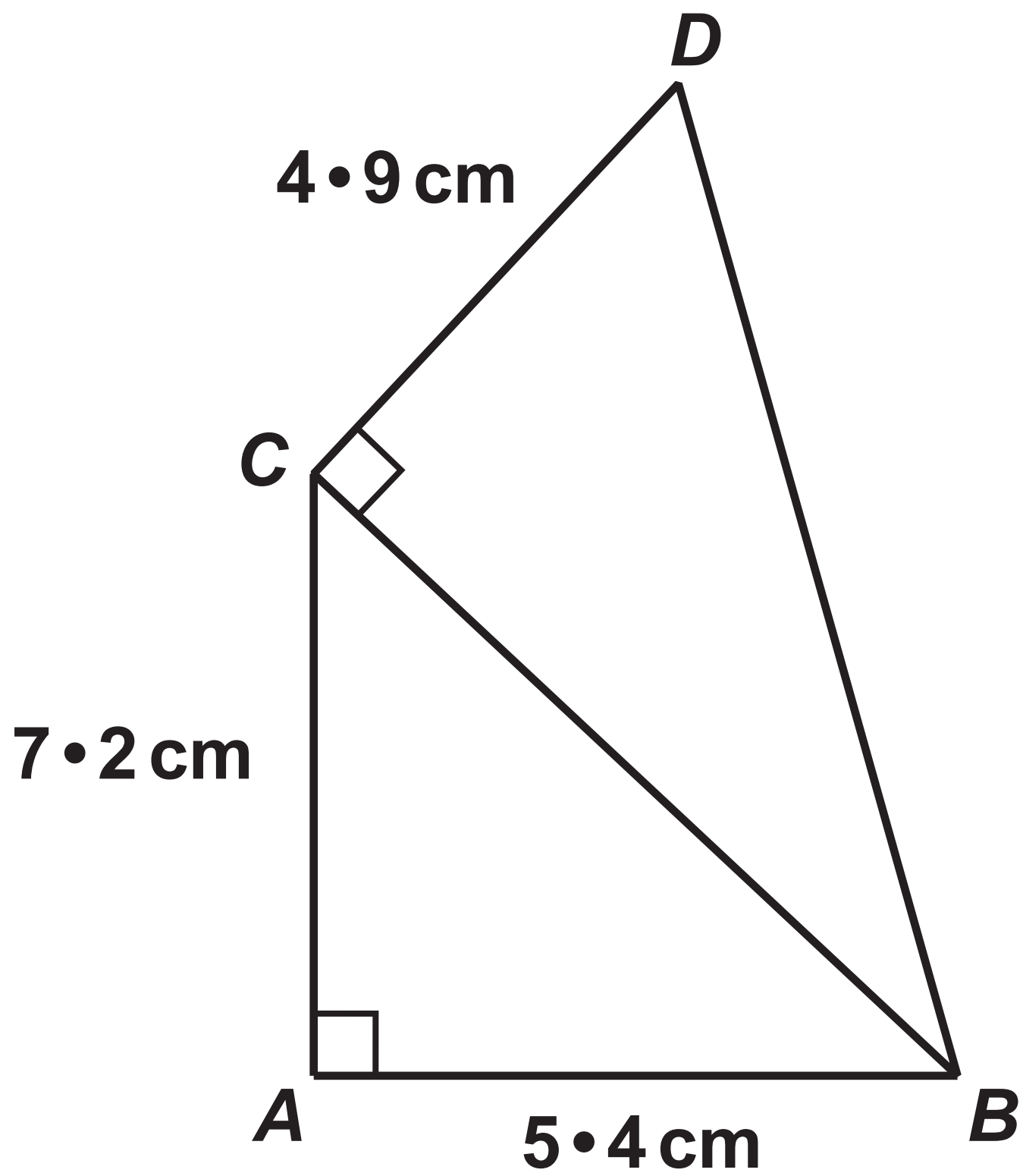


Question 2 (c)

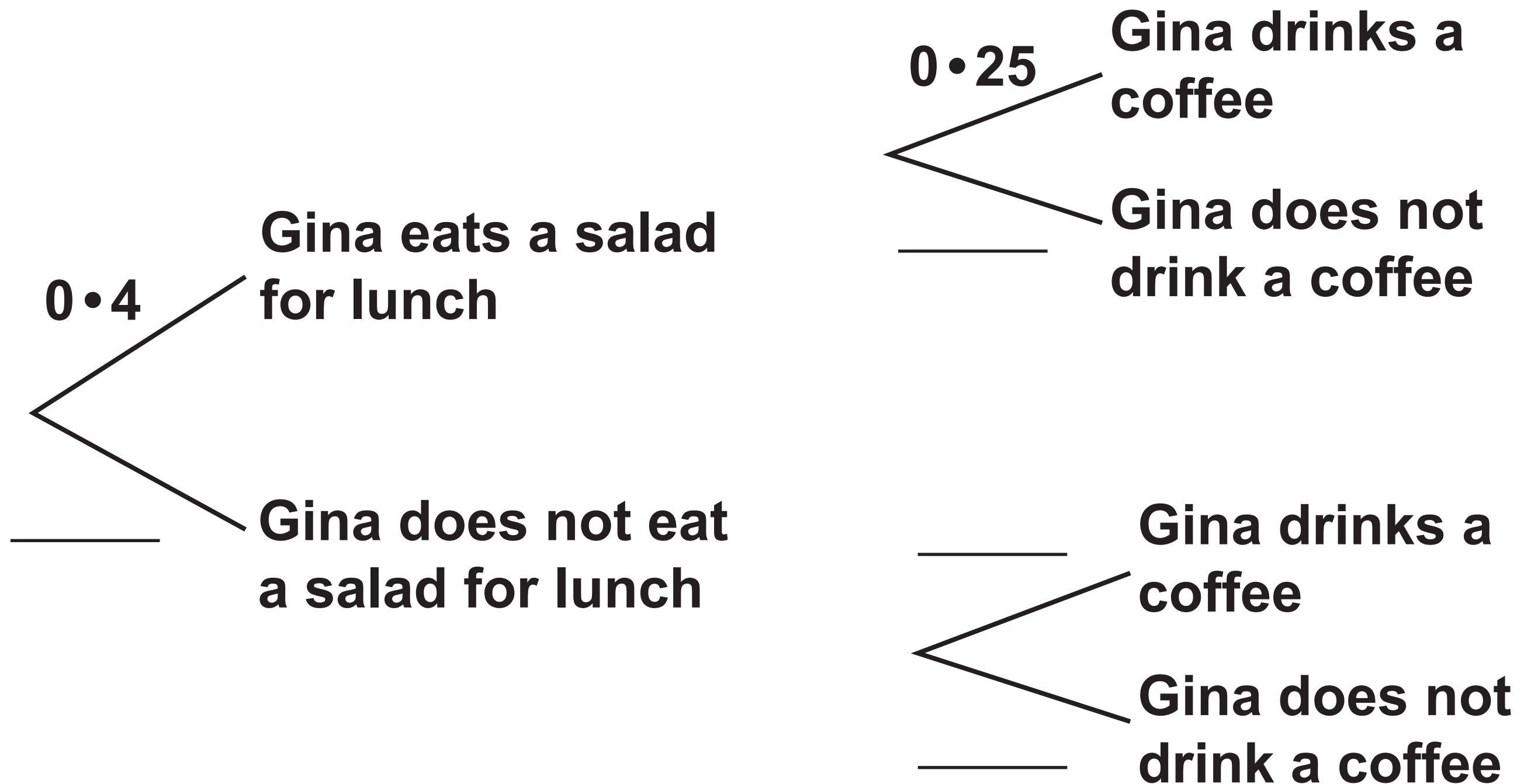


Question 3

Diagram NOT drawn to scale

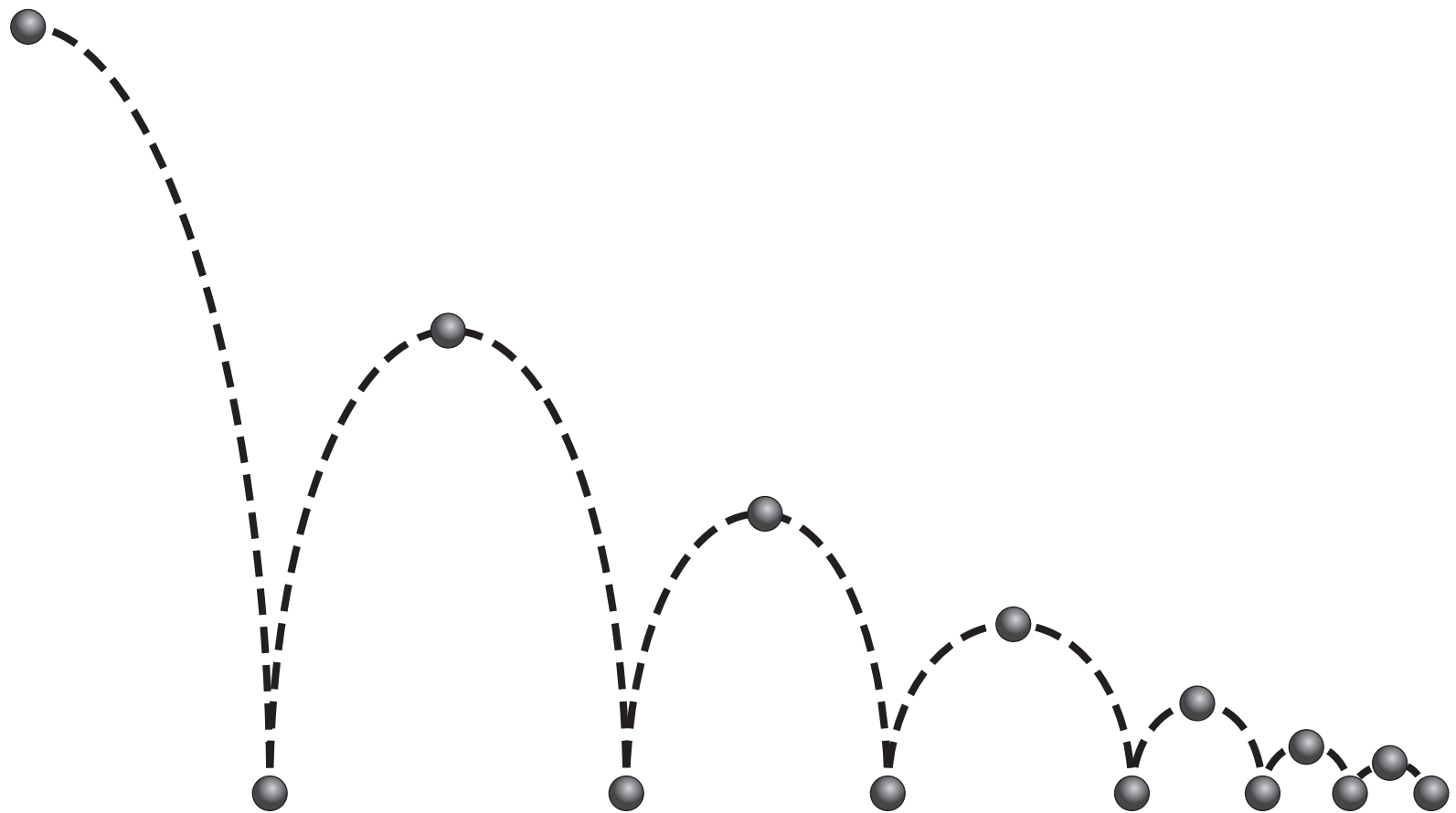


Question 4 (a)

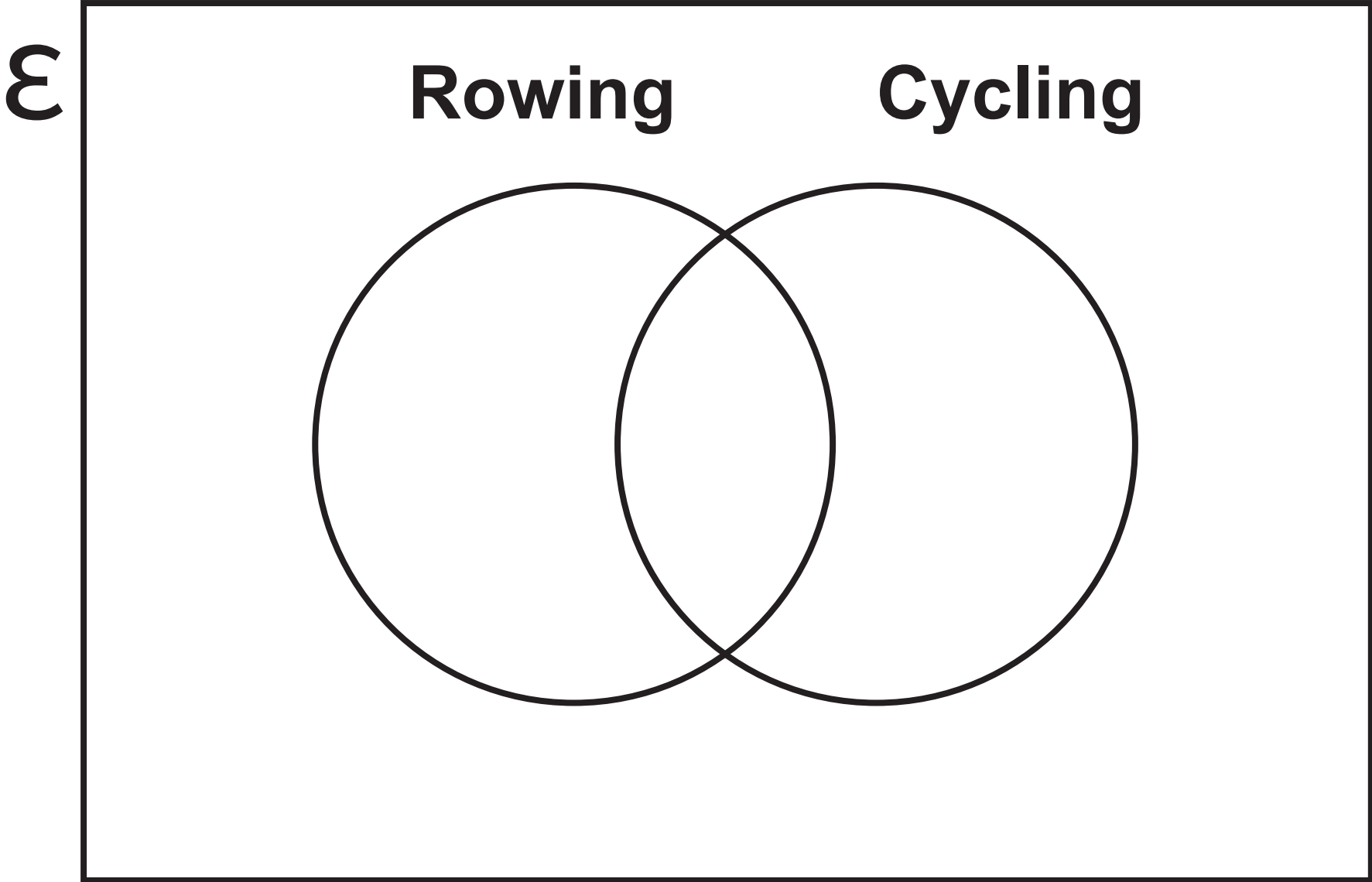


Question 5

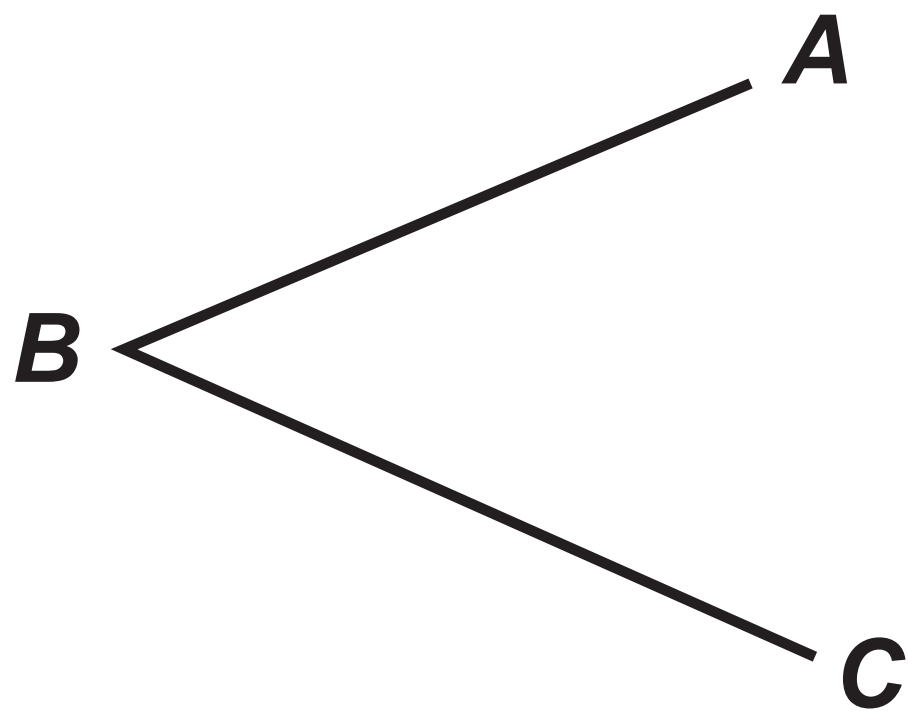
Diagram NOT drawn to scale



Question 6 (a)

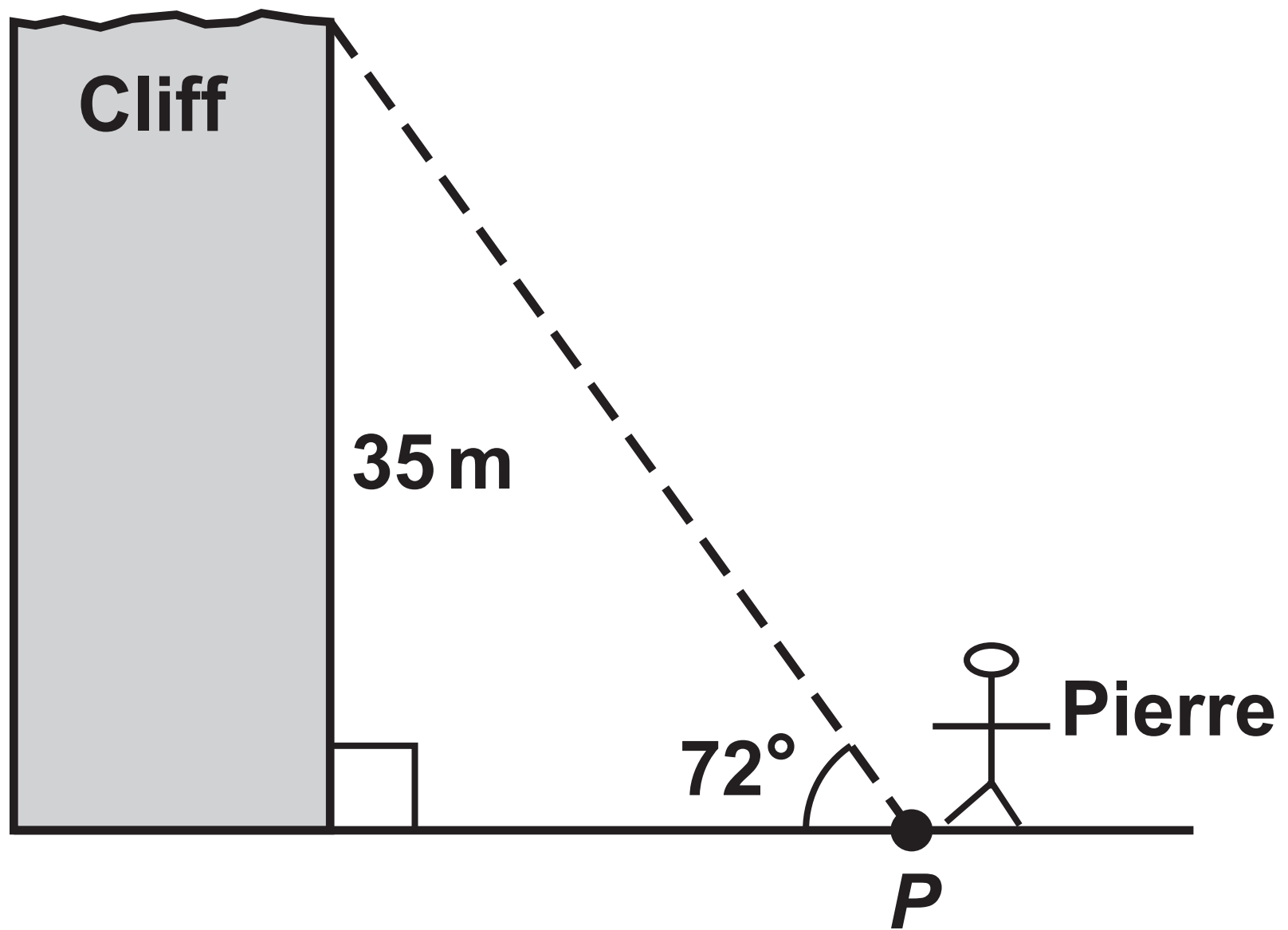


Question 10



Question 12

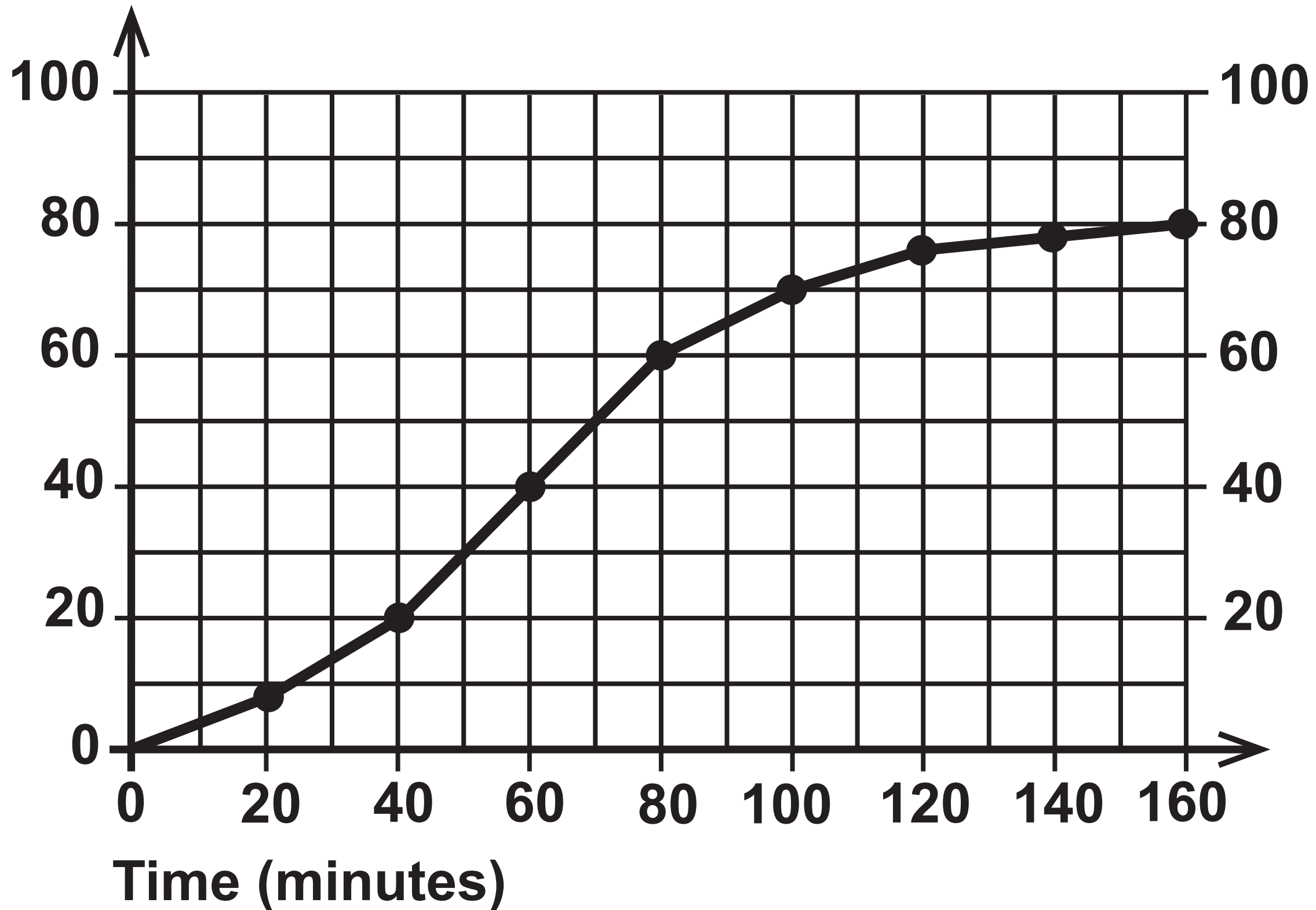
Diagram NOT drawn to scale



Question 16

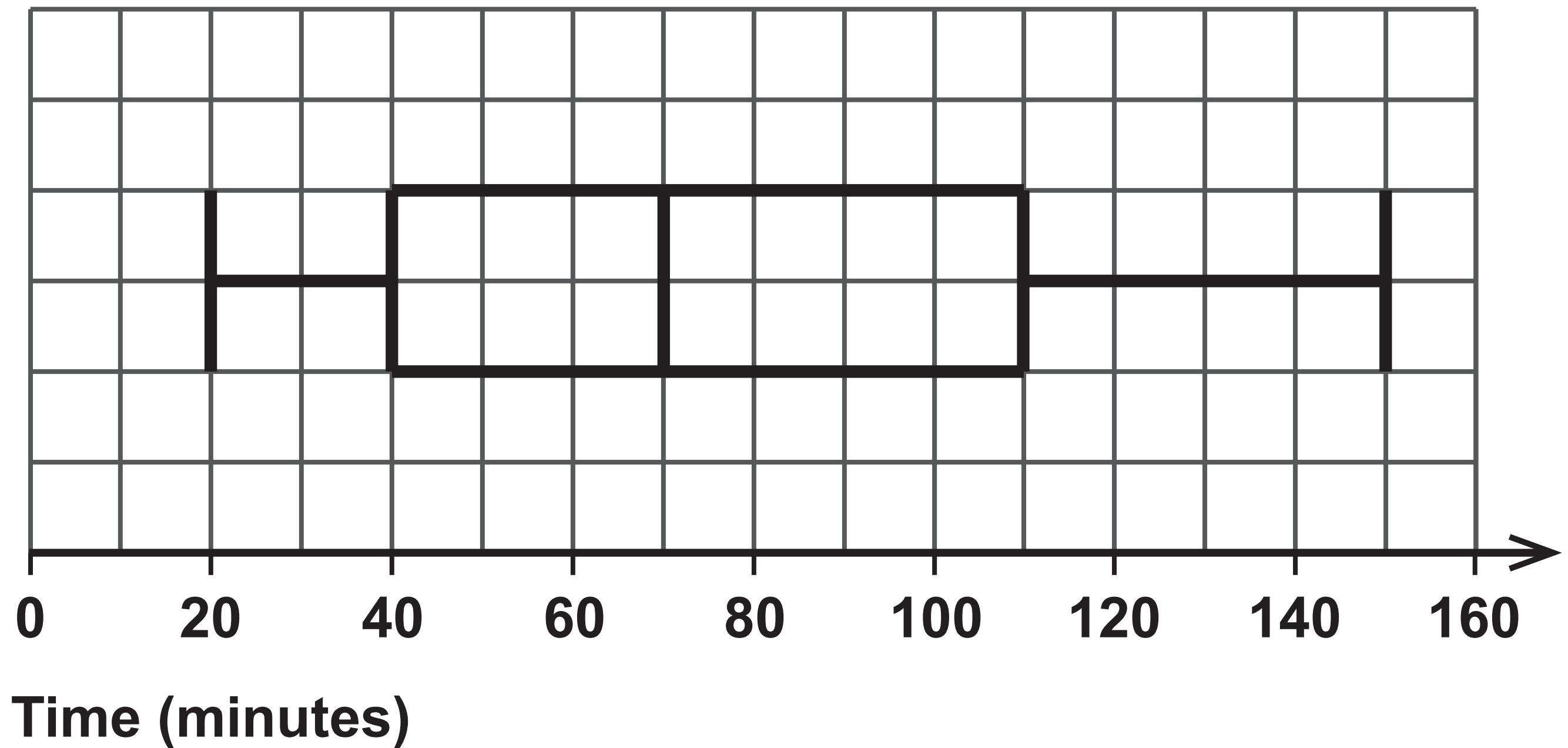
10 – year – old students

Cumulative Frequency

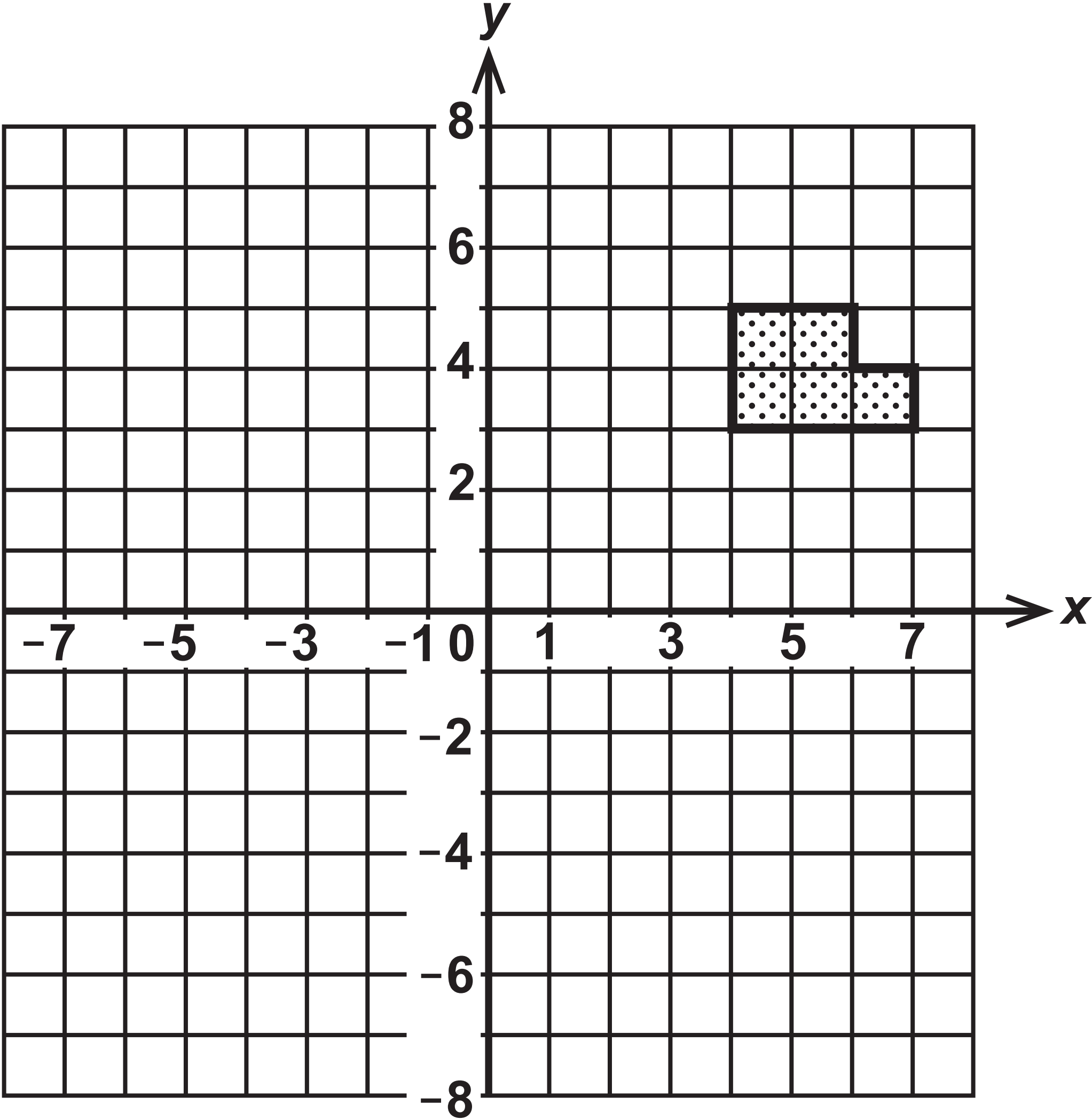


Question 16 (a)

14 – year – old students

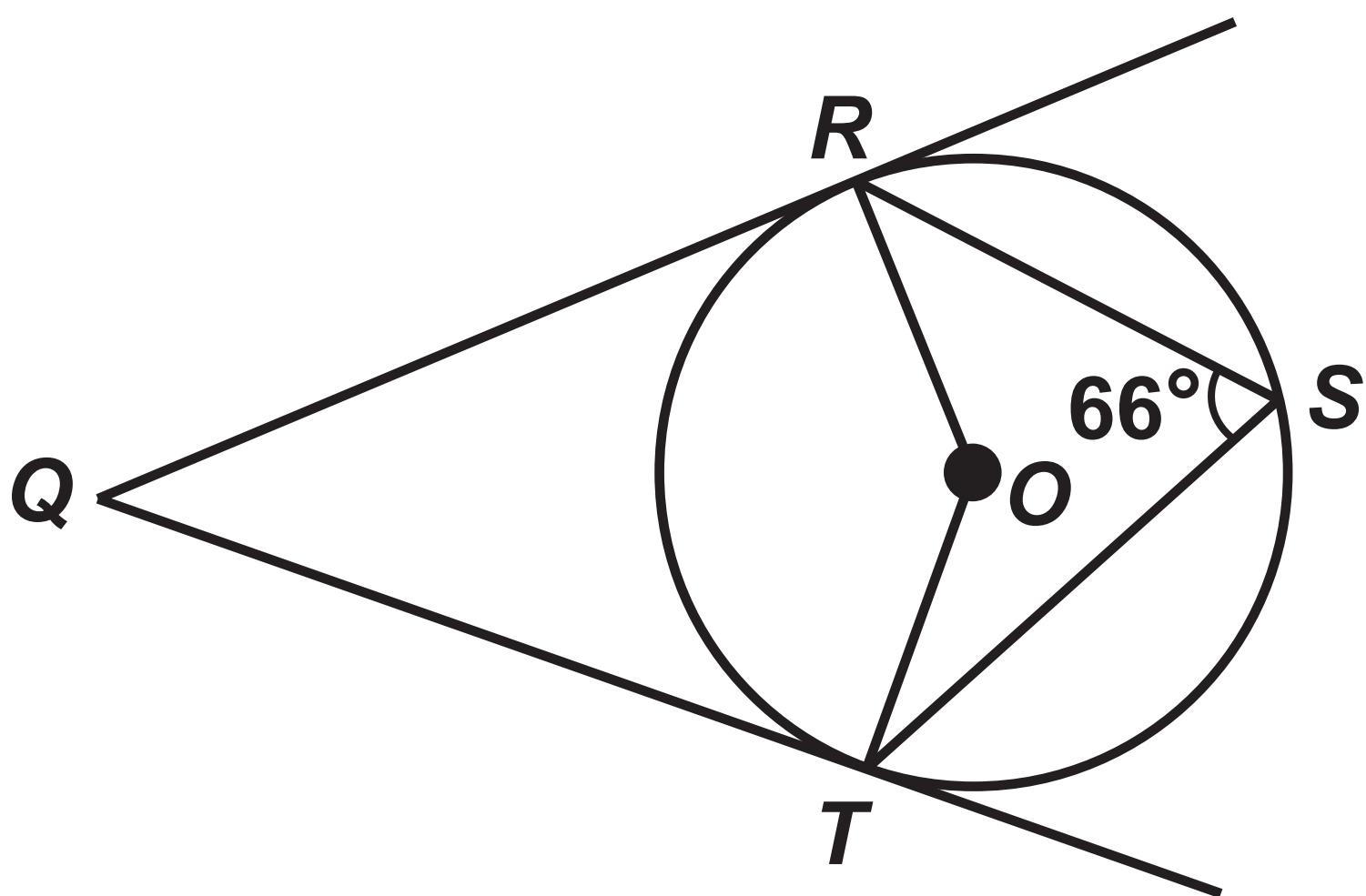


Question 19



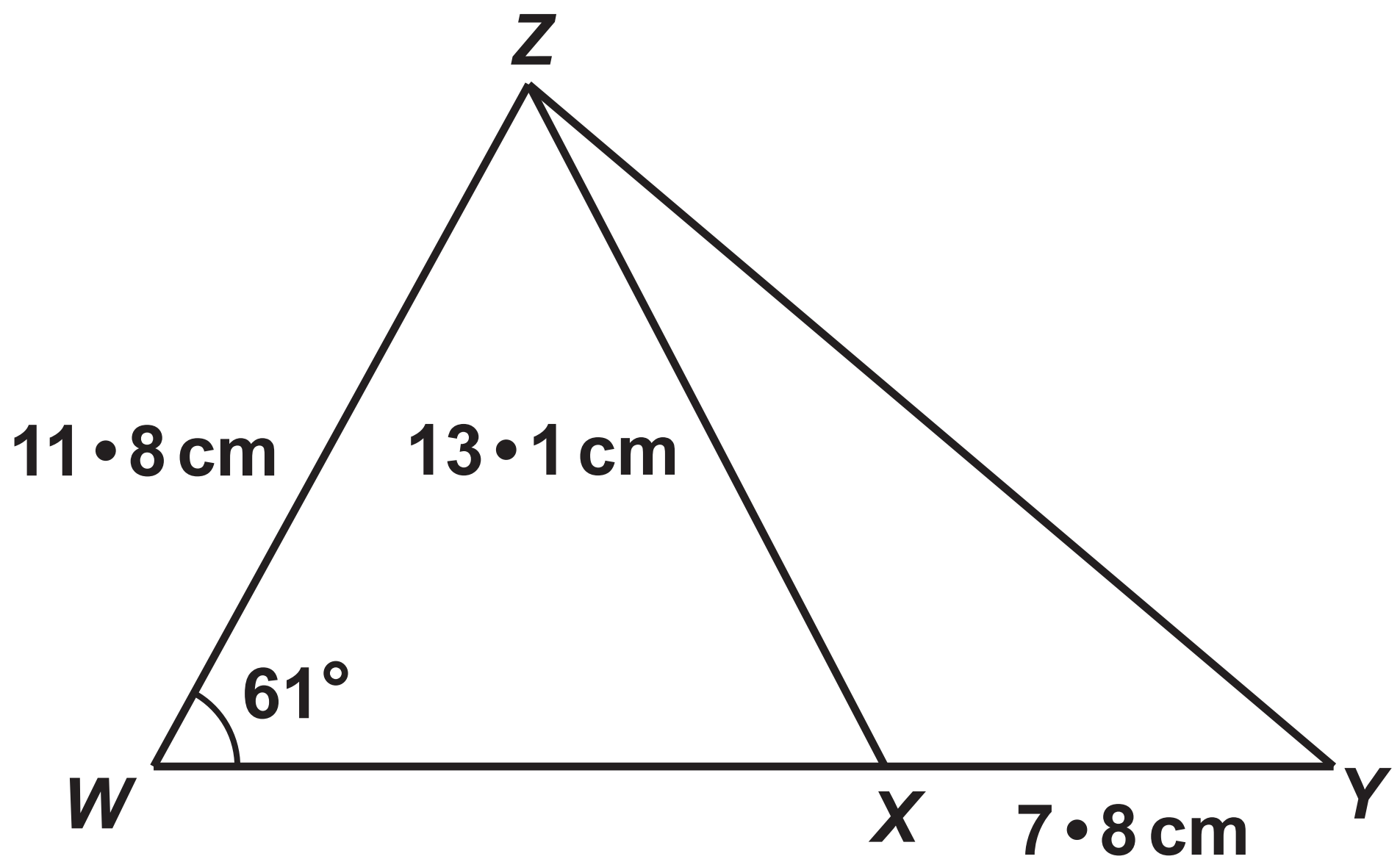
Question 20

Diagram NOT drawn to scale

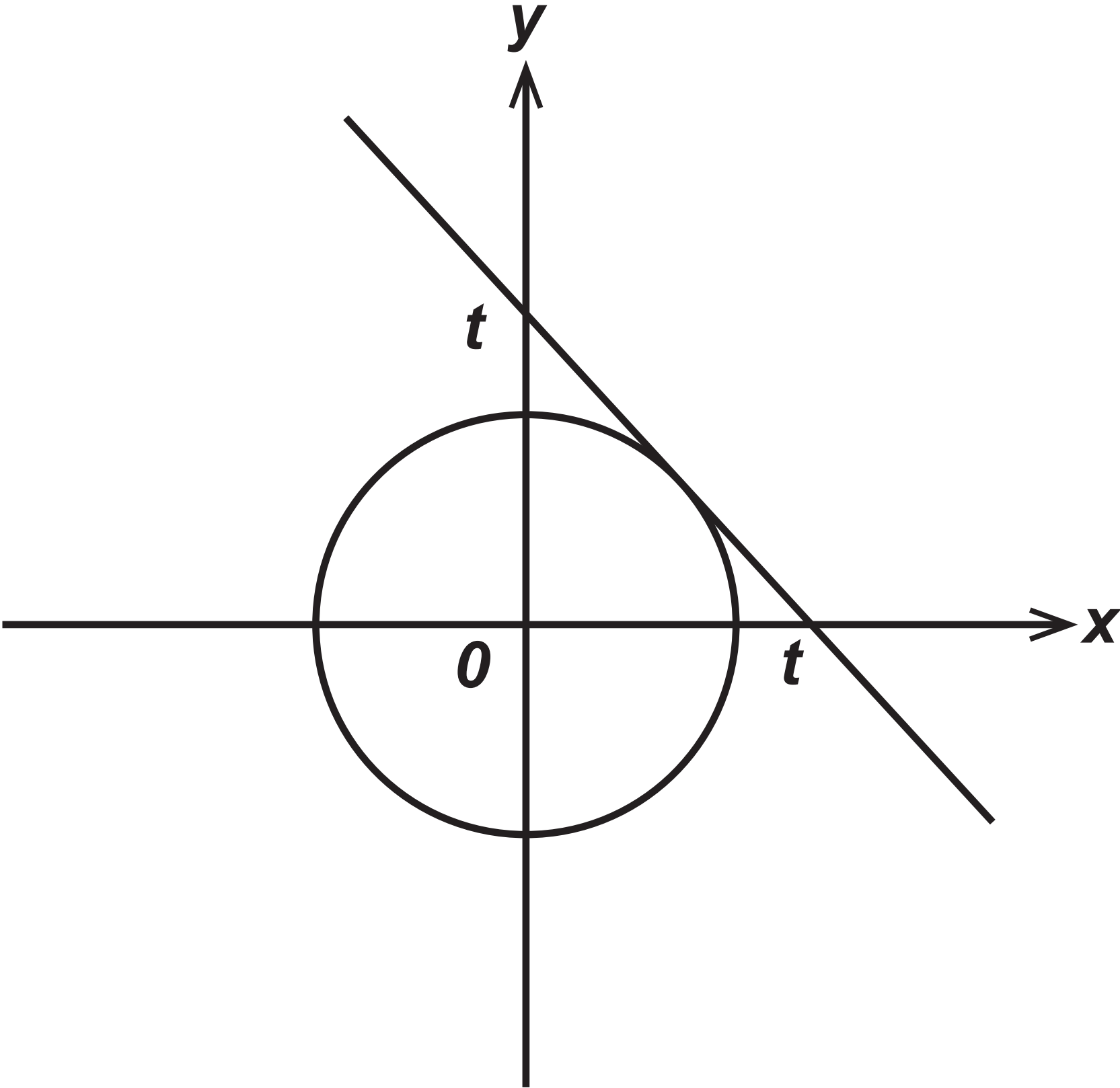


Question 23

Diagram NOT drawn to scale

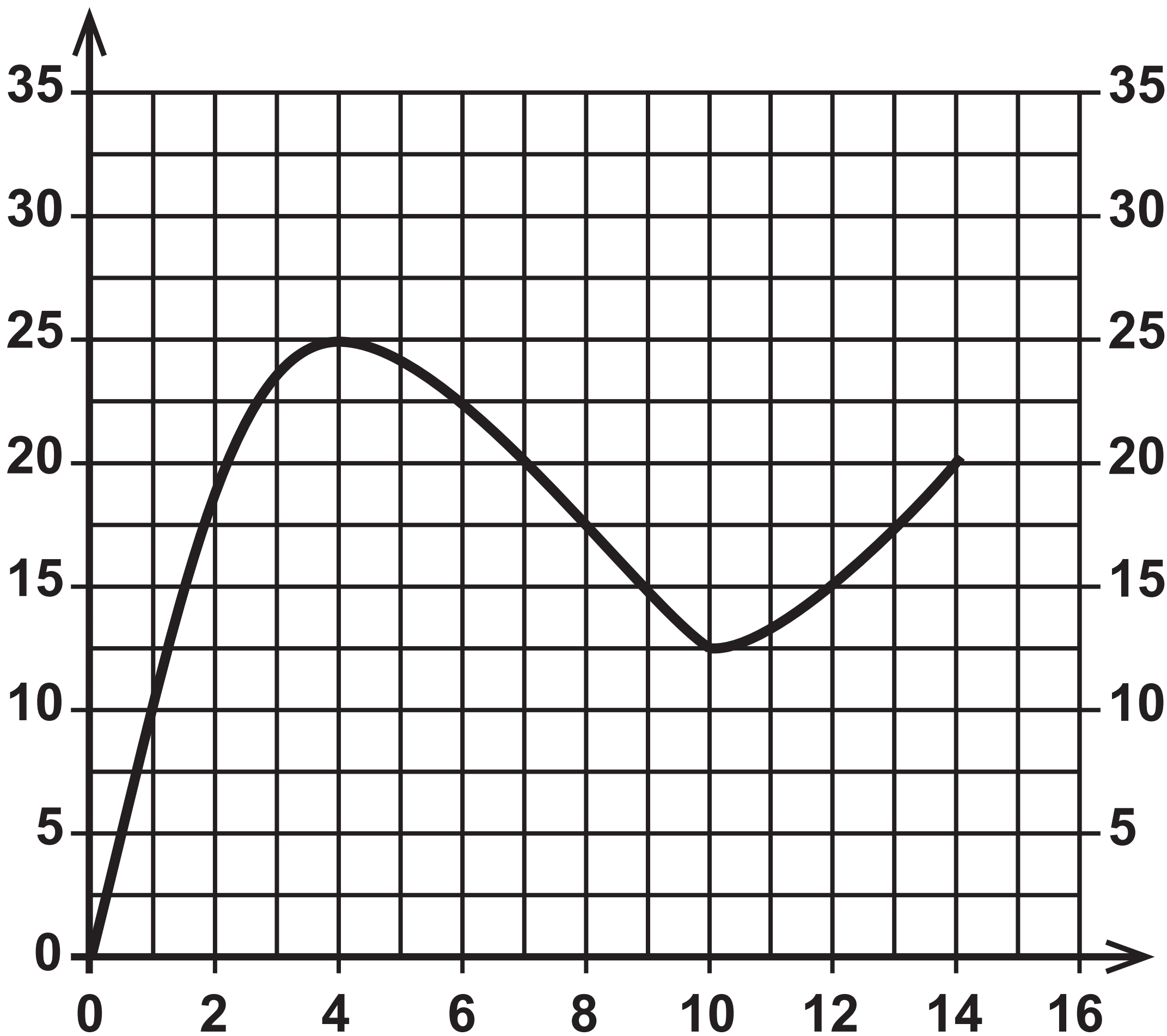


Question 25



Question 26

Velocity (m/s)



Time, t (seconds)

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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:**

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

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

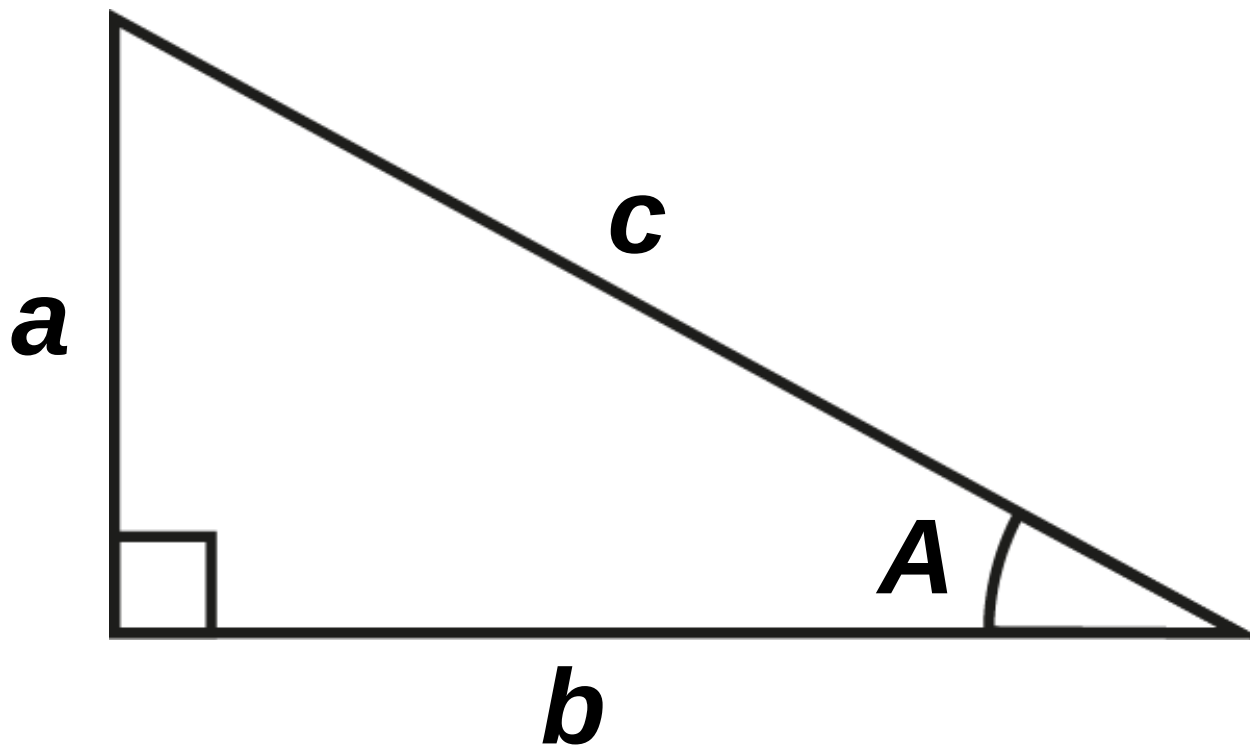
QUADRATIC FORMULA

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

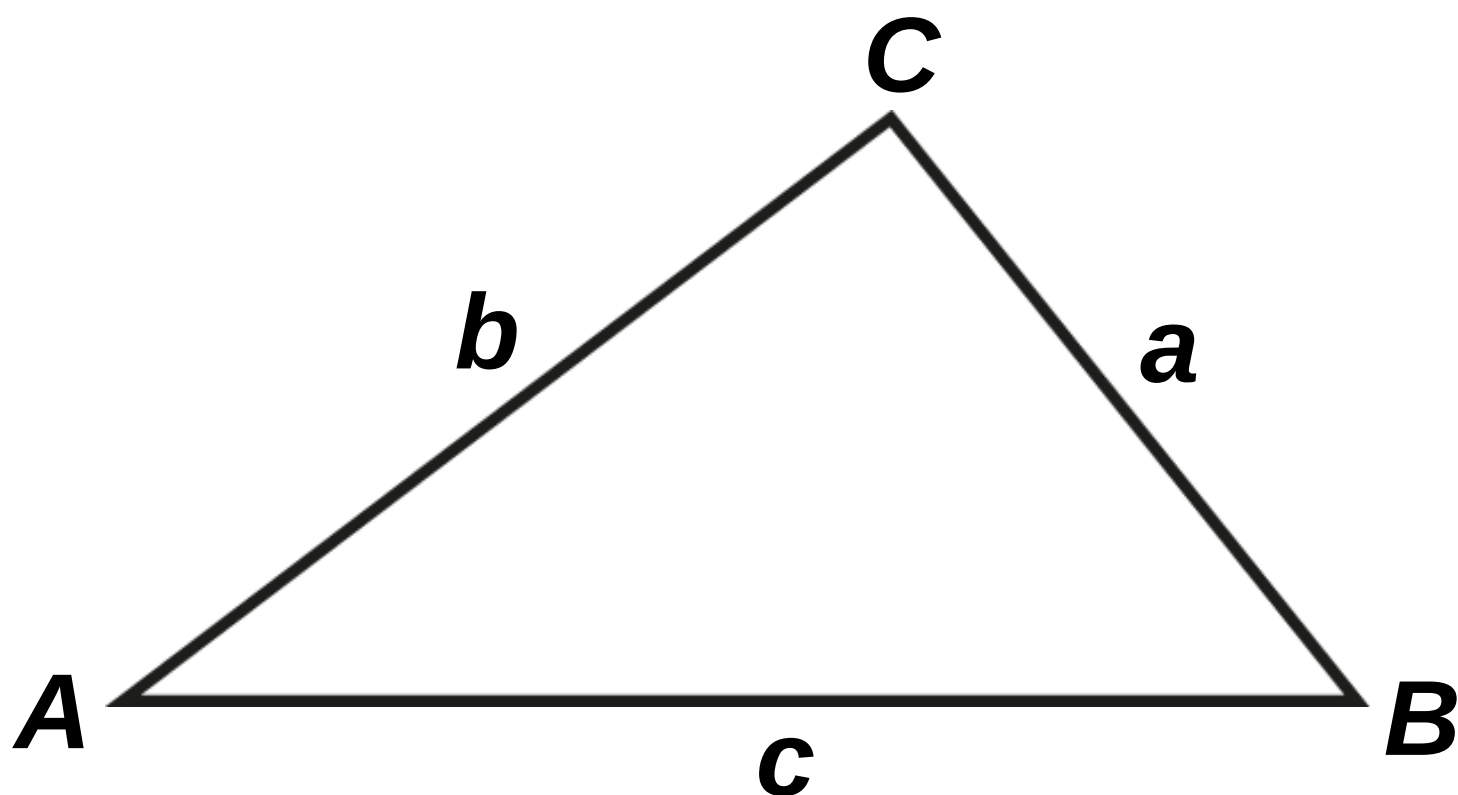


In any right – angled triangle where a , b and c are the length of the sides and c is the hypotenuse:

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

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:

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

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 :

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

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

MATHEMATICS

**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:

$$v = u + at$$

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

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