



GCSE



C300UB0–1

FRIDAY, 8 NOVEMBER 2024 – MORNING

MATHEMATICS – COMPONENT 2

**CALCULATOR – ALLOWED MATHEMATICS
HIGHER TIER**

**2 hours 15 minutes plus your additional
time allowance**

**THE USE OF 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.	6	
2.	3	
3.	4	
4.	8	
5.	1	
6.	6	
7.	5	
8.	8	
9.	3	
10.	2	
11.	4	
12.	3	
13.	4	
14.	3	
15.	5	
16.	2	
17.	7	
18.	9	
19.	6	
20.	1	
21.	9	
22.	4	
23.	4	
24.	7	
25.	6	
Total	120	

ADDITIONAL MATERIALS

An additional Formulae Booklet.

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

ITEMS INCLUDED WITH QUESTION PAPER

A separate Formula List.

A separate Diagram Booklet.

Models for Question 2 and Question 18.

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

Take π as $3 \cdot 142$ 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 diagrams for Question 1 in the separate Diagram Booklet. The diagrams are NOT drawn to scale. There are two diagrams, a right – angled triangle labelled ABC and a square.**

In the triangle ABC :

$$AC = 7.2 \text{ cm}$$

$$CB = 13.5 \text{ cm}$$

Angle ACB is a right – angle.

The perimeter of the triangle is equal to the perimeter of the square.

Calculate the area of the square.

You must show all your working.

(Turn over)

Area of square = _____ cm²
[6 marks]

(Turn over)

- 2. Ask for the model for Question 2.
The model is NOT made to scale.
The model represents a large cylinder
of wax.**

**Elijah has a large cylinder of wax.
It has a radius of 7 cm and
a height of 21 cm.**

**He melts down the large cylinder of
wax to make small wax cylinders each
with a volume of 102 cm^3**

**How many complete small wax
cylinders can Elijah make?**

(Turn over)

[3 marks]

3. The density of copper is 8.96 g/cm^3
A solid copper statue has a volume
of 1540 cm^3
Calculate its mass in kilograms.
Give your answer correct to two
significant figures.

(Turn over)

Mass = _____ **kg**

[4 marks]

(Turn over)

4. (a) Simplify $4w^3y^5 \times 7w^2y$

[2 marks]

(b) (i) Solve $n + 11 < 4n - 5$

[3 marks]

continued on the next page . . .

(Turn over)

Question 4 (b) continued

4. (b) (ii) n is an integer.

**What is the least possible
value of n ?**

[1 mark]

continued on the next page . . .

(Turn over)

Question 4 continued

4. (c) Make x the subject of the formula.

$$\frac{a}{x} = c$$

[1 mark]

(d) Look at the diagram for Question 4 (d). The diagram shows a number line.

Represent the inequality

$-3 < x \leq 1$ on the number line.

[1 mark]

(Turn over)

5. 1 micrometre =
 1×10^{-4} centimetres.

Which of the answers below
represents

2.4 micrometres in METRES?

Circle your answer.

$$2.4 \times 10^{-4}$$

$$2.4 \times 10^{-6}$$

$$2.4 \times 10^2$$

$$2.4 \times 10^{-2}$$

$$2.4 \times 10^{-5}$$

(Turn over)

16

[1 mark]

(Turn over)

6. A new supermarket is about to open in a town with 8000 houses.

For the first four weeks, £10 vouchers will be sent out to encourage people to visit the supermarket.

At the start of the first week, 30% of the houses in the town will each be sent a voucher.

At the start of each of the next three weeks, a voucher will be sent to 30% of the houses that have NOT YET RECEIVED a voucher.

The vouchers need to be used in the supermarket by the end of the four weeks.

continued on the next page . . .

(Turn over)

Question 6 continued

6. (a) John, the supermarket manager, says

“By the end of the four weeks, 6079 of the vouchers will have been used.”

Show that John could be correct.

(Turn over)

[4 marks]

continued on the next page . . .

(Turn over)

Question 6 continued

6. (b) (i) State an assumption that John has made in part (a).

[1 mark]

continued on the next page . . .

(Turn over)

Question 6 (b) continued

6. (b) (ii) If John's assumption was not correct, what effect would this have on the number of vouchers used by the end of the four weeks?

[1 mark]

(Turn over)

7. (a) The table below shows some of the values of $y = 2x^2 - 3x - 4$ for values of x from -2 to 3

Complete the table by finding the value of y for $x = -1$ and for $x = 3$

x	$y = 2x^2 - 3x - 4$
-2	10
-1	
0	-4
1	-5
2	-2
3	

[2 marks]

Question 7 continued

- 7. (b) On the graph paper provided for Question 7 (b) in the separate Diagram Booklet, draw the graph of $y = 2x^2 - 3x - 4$ for values of x from -2 to 3**

[2 marks]

- (c) What is the equation of the straight line that intersects the curve $y = 2x^2 - 3x - 4$ to give the solutions to the equation $2x^2 - 3x - 7 = 0$?**

(Turn over)

24

[1 mark]

(Turn over)

- 8. (a) Tiana and Kamal work at a bank.
Their hourly pay rates are
different.**

**On Thursday, Tiana worked for
six hours and Kamal worked for
seven hours.**

**Their combined income on
Thursday was £185.75**

**On Friday, Tiana worked for
five hours and Kamal worked for
four hours.**

**Their combined income on Friday
was £130.50**

continued on the next page . . .

(Turn over)

Question 8 (a) continued

Use an algebraic method (not trial and improvement) to calculate Tiana and Kamal's hourly pay rates.

You must show all your working.

(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)

Tiana's hourly pay rate is _____

Kamal's hourly pay rate is _____

[5 marks]

continued on the next page . . .

Question 8 continued

8. (b) Fran also works at the bank part – time.

She earns 35% less than the full – time salary at her pay rate.

Fran’s annual part – time salary is £24 570

What would Fran’s annual salary be if she worked full time?

(Turn over)

30

[3 marks]

(Turn over)

9. There are 1800 eels in a lake.

On Saturday morning, Sadia captured a random sample of x eels from the lake and tagged them.

She then released them back into the lake.

On Sunday morning, Sadia captured a second random sample of 150 eels from the lake.

Seven of the eels in this sample were already tagged.

Use these values to calculate an estimate for x , the number of eels tagged in Sadia's first sample.

(Turn over)

[3 marks]

(Turn over)

- 10. Look at the diagram for Question 10 in the separate Diagram Booklet. The diagram shows a shape on a coordinate grid.**

Enlarge the shape shown on the grid by scale factor $\frac{1}{3}$, using (4, 2) as the centre of enlargement.

[2 marks]

(Turn over)

11. Look at the diagram for Question 11 in the separate Diagram Booklet. The diagram is NOT drawn to scale. The diagram shows port A and port B.

A ship sails 11 km due south from port A.

It then travels 17 km due east and arrives at port B.

Calculate the bearing of port B from port A.

The bearing of port B from port A
is _____

[4 marks]

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

The diagram is NOT drawn to scale.

The points A , B , C and D lie on the circumference of the circle.

The line EF is a tangent to the circle at point D .

Angle $ABC = 116^\circ$

Angle $ACD = 51^\circ$

Prove that angle $CDE = 65^\circ$

Give reasons for your answer.

(Turn over)

[3 marks]

**13. Enrico and Hugo are both boxers.
At the start of a six – week training
block:**

- **Enrico weighs EXACTLY
170 pounds.**
- **Hugo weighs EXACTLY
175 pounds.**

After the six – week training block:

- **Enrico has lost 9 pounds,
CORRECT TO THE NEAREST
POUND.**
- **Hugo has lost 12 pounds,
CORRECT TO THE NEAREST
TWO POUNDS.**

continued on the next page . . .

Question 13 continued

What is the greatest possible difference between Enrico's PERCENTAGE weight loss and Hugo's PERCENTAGE weight loss?

(Turn over)

[illegible]

(Turn over)

**The greatest possible difference
between Enrico's percentage weight
loss and Hugo's percentage weight
loss is _____ %.**

[4 marks]

(Turn over)

14. Look at the information for Question 14 in the separate Diagram Booklet. It shows 11 cards.

**Marcus has the cards shown.
He places these cards in a bag.**

Marcus selects two of the cards at random from the bag.

The letters are recorded and the two cards are replaced in the bag.

He repeats this process 275 times.

How many times would you expect Marcus to select the two cards with the letter A?

43

[3 marks]

(Turn over)

15. Kiera took part in a race.

She ran at an average speed of $(1 \cdot 8x + 7)$ kilometres per hour for $(5x + 0 \cdot 5)$ kilometres.

It took her 1 hour and 15 minutes to complete the race.

**How far, in kilometres, did Kiera run?
You must use an algebraic method
(not trial and improvement).
You must show all your working.**

(Turn over)

45

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.

Kiera ran _____ km

[5 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 the triangle OQR .**

In the triangle OQR , $OQ = 6q$ and $OR = 8r$.

S is the mid-point of QR .

Find RS in terms of q and r .

Give your answer in the form $aq + br$, where a and b are integers.

[2 marks]

(Turn over)

- 17. (a) Look at the diagram for Question 17 (a) in the separate Diagram Booklet. The diagram is a histogram.**

A town council wishes to trial traffic – calming measures along a particular road in the town where the speed limit is 30 mph (miles per hour).

For the first trial, additional 30 mph signs were put in place. Irene surveyed the average speed at which cars travelled along the road.

The results are shown in the histogram.

continued on the next page . . .

(Turn over)

Question 17 (a) continued

Use the histogram to calculate an estimate for the median speed, in mph, of the cars Irene surveyed. You must show all your working.

(Turn over)

50

Estimated median speed

= _____ mph

[3 marks]

continued on the next page . . .

(Turn over)

Question 17 continued

17. (b) Look at the diagram for Question 17 (b) in the separate Diagram Booklet. The diagram is a histogram.

In the second trial, SPEED BUMPS were put in place.

Irene surveyed the average speed of 150 cars.

The results are shown in the histogram.

Irene says,

“80% of cars travel at 30 mph or less when speed bumps are in place.”

continued on the next page . . .

(Turn over)

Question 17 (b) continued

17. (b) (i) Show that Irene could be correct.

[2 marks]

continued on the next page . . .

(Turn over)

Question 17 (b) continued

17. (b) (ii) Explain why Irene could be incorrect.

[1 mark]

continued on the next page . . .

(Turn over)

Question 17 continued

17. (c) Use information from the histograms to decide which traffic calming measure is most effective.

30 mph signs

☐

Speed bumps

☐

Give a reason to justify your answer.

[1 mark]

(Turn over)

- 18. Ask for the model for Question 18.
The model is NOT made to scale.
The model is a shape made from a
cone and a hemisphere.**

**Look at the diagram for Question 18.
The diagram is NOT drawn to scale.
The diagram is simplified 2D diagram
of the cone and hemisphere.
The cone has height 5 cm and
base radius $(x + 1)$ cm.**

The volume of the shape is $24\pi \text{ cm}^3$

(a) Show that $2x^3 + 11x^2 + 16x = 65$

(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)

[5 marks]

continued on the next page . . .

(Turn over)

Question 18 continued

- 18. (b) A solution to the equation**
 $2x^3 + 11x^2 + 16x = 65$ lies
between 1.6 and 1.7
Use the method of trial and
improvement to find the solution
correct to two decimal places.

(Turn over)

[4 marks]

(Turn over)

19. There are 143 Year 6 pupils going on a school trip to an adventure centre. They can choose to take part in up to three activities.

- All the pupils took part in at least one activity.**
- 8 pupils took part in all three activities.**
- 23 pupils took part in rock climbing and coasteering.**
- 29 pupils took part in rock climbing and gorge walking.**
- 22 pupils took part in coasteering and gorge walking.**
- 65 pupils took part in coasteering.**
- 76 pupils took part in rock climbing.**

continued on the next page . . .

(Turn over)

Question 19 continued

- 19. (a) Look at the diagram for Question 19 (a) in the separate Diagram Booklet. The diagram is an incomplete Venn diagram. Complete the Venn diagram to display this information.**

(Turn over)

[3 marks]

continued on the next page . . .

(Turn over)

Question 19 continued

19. (b) A Year 6 pupil is chosen at random.

Find the probability that this pupil takes part in gorge walking and coasteering ONLY.

[1 mark]

continued on the next page . . .

(Turn over)

Question 19 continued

- 19. (c) Given that a randomly chosen pupil from Year 6 took part in gorge walking, find the probability they also took part in rock climbing.**

[2 marks]

(Turn over)

20. Simplify $\frac{2(y-7)^5}{(y-7)^{-3}}$

[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 shows a circle split into sectors, segments and triangles. A , B , C and D are points on the circumference of the circle with centre O .

The lines AC and BD are diameters of the circle.

Angle $AOB = 55^\circ$

The area of sector AOB is 12 cm^2

Find the perimeter of the shaded segment.

You must show all your working.

[illegible]

(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)

**The perimeter of the shaded segment
is _____ cm**

[9 marks]

(Turn over)

22. Look at the diagram for Question 22 in the separate Diagram Booklet.

The diagram shows a sketch of $y = \cos x$ for the values of x from 0° to 360°

- (a) Solve the equation $\cos x = -0.731$ for all values of x from 0° to 360°**

[2 marks]

continued on the next page . . .

(Turn over)

Question 22 continued

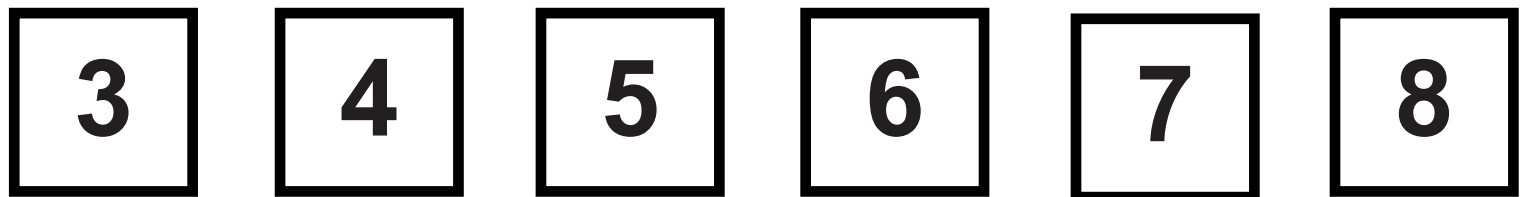
- 22. (b) On the diagram provided for Question 22 (b) in the separate Diagram Booklet, draw a sketch of $y = \cos x - 1$ for the values of x from 0° to 360° . You must indicate any important values on the axes.**

[2 marks]

(Turn over)

23. Bert and Rehan use six – digit codes to lock their phones.

They must use these digits to create their code:



Each digit can only be used once in a code.

Bert's code must meet the following conditions:

- **The first digit is a multiple of four.**
- **The second and third digits are both prime numbers.**
- **There are no conditions for the remaining digits.**

Rehan does not have any conditions for his code.

continued on the next page . . .

(Turn over)

Question 23 continued

**How many more code combinations
can Rehan choose from than Bert?**

(Turn over)

[4 marks]

24. y is inversely proportional to w^3
 w is directly proportional to the
square root of x .

$$y = \frac{1}{9} \text{ and } x = 4 \text{ when } w = 6$$

Find a formula for y in terms of x in
the form $y = mx^n$, where m and n are
fractions in their simplest form.

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)

[7 marks]

(Turn over)

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

The diagram shows x and y axis.

By first completing the square, draw a sketch of $y = 4x^2 - 16x - 6$

You must clearly indicate the coordinates of any stationary points and the intercept with the y -axis.

(Turn over)

[6 marks]

TOTAL 120 MARKS
END OF PAPER

(Turn over)

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

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

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

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

C300UB0 –1

FRIDAY, 8 NOVEMBER 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: _____

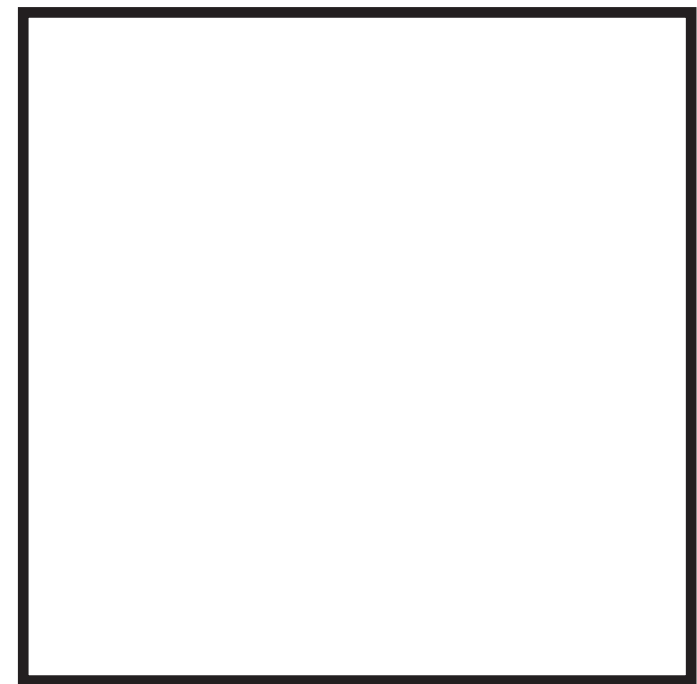
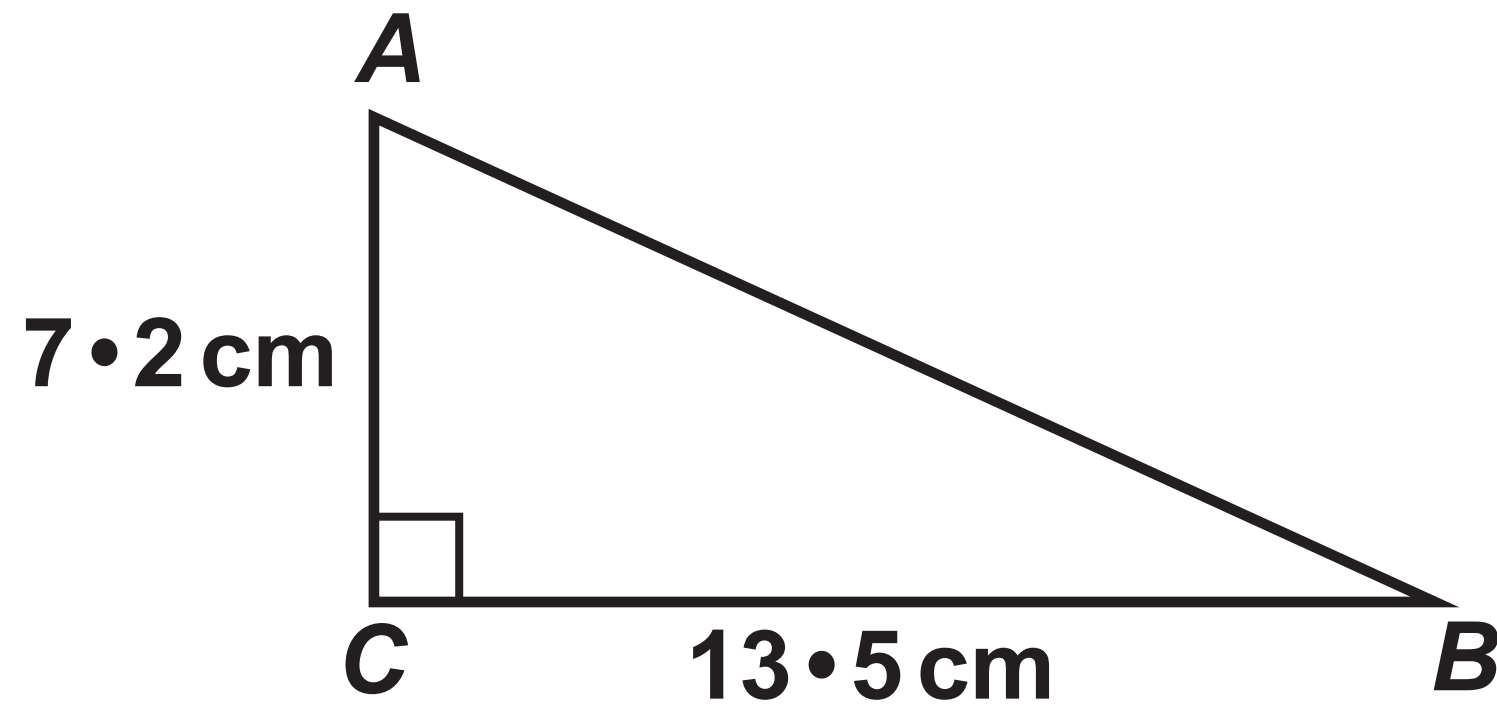
First name(s): _____

Centre Number: _____

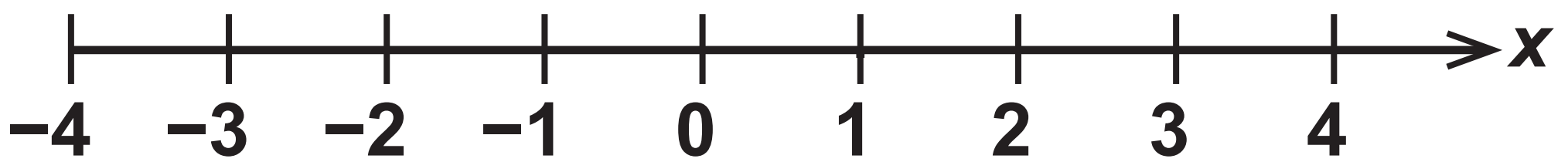
Candidate Number: 0 _____

Question 1

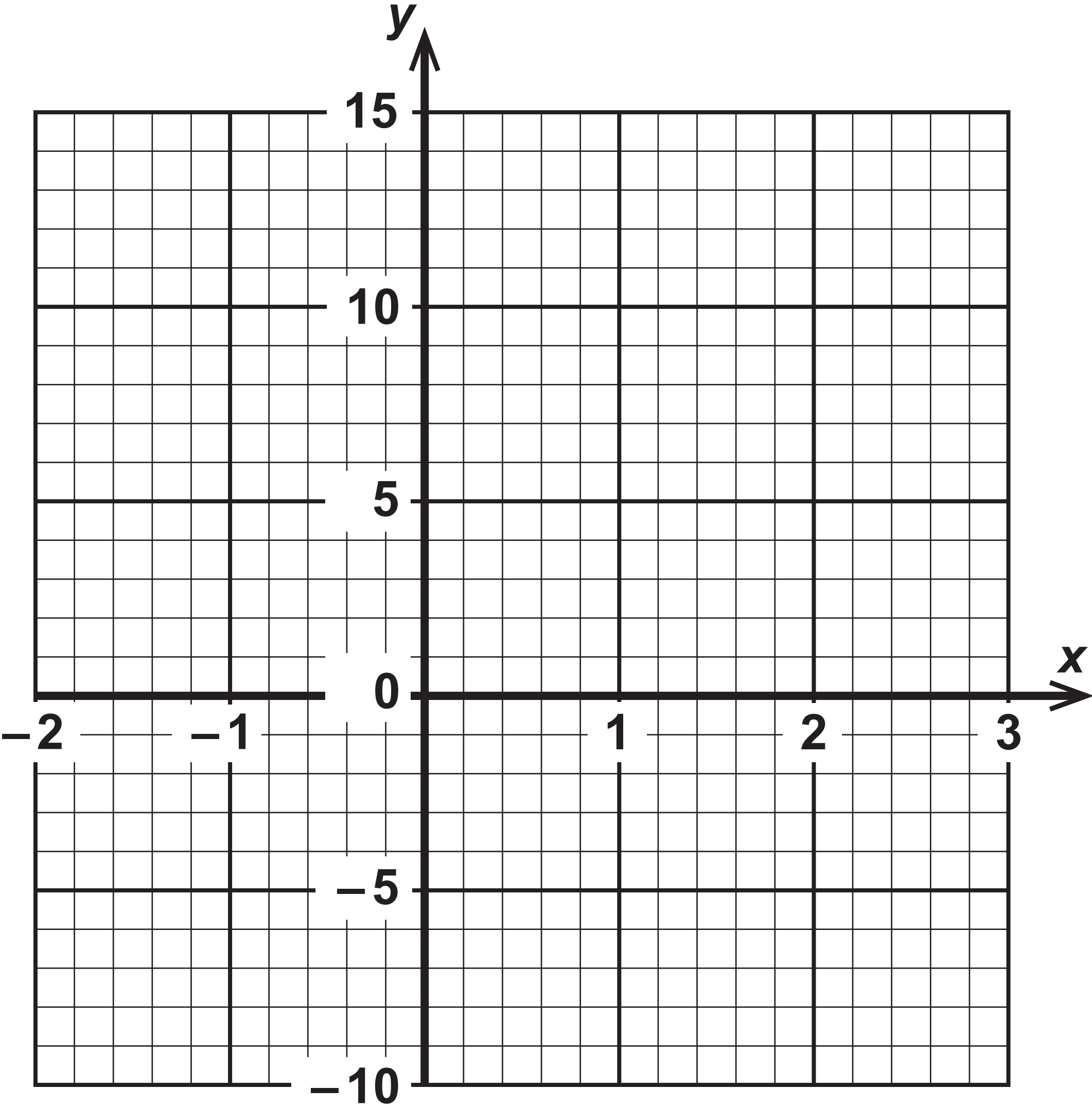
Diagrams NOT drawn to scale



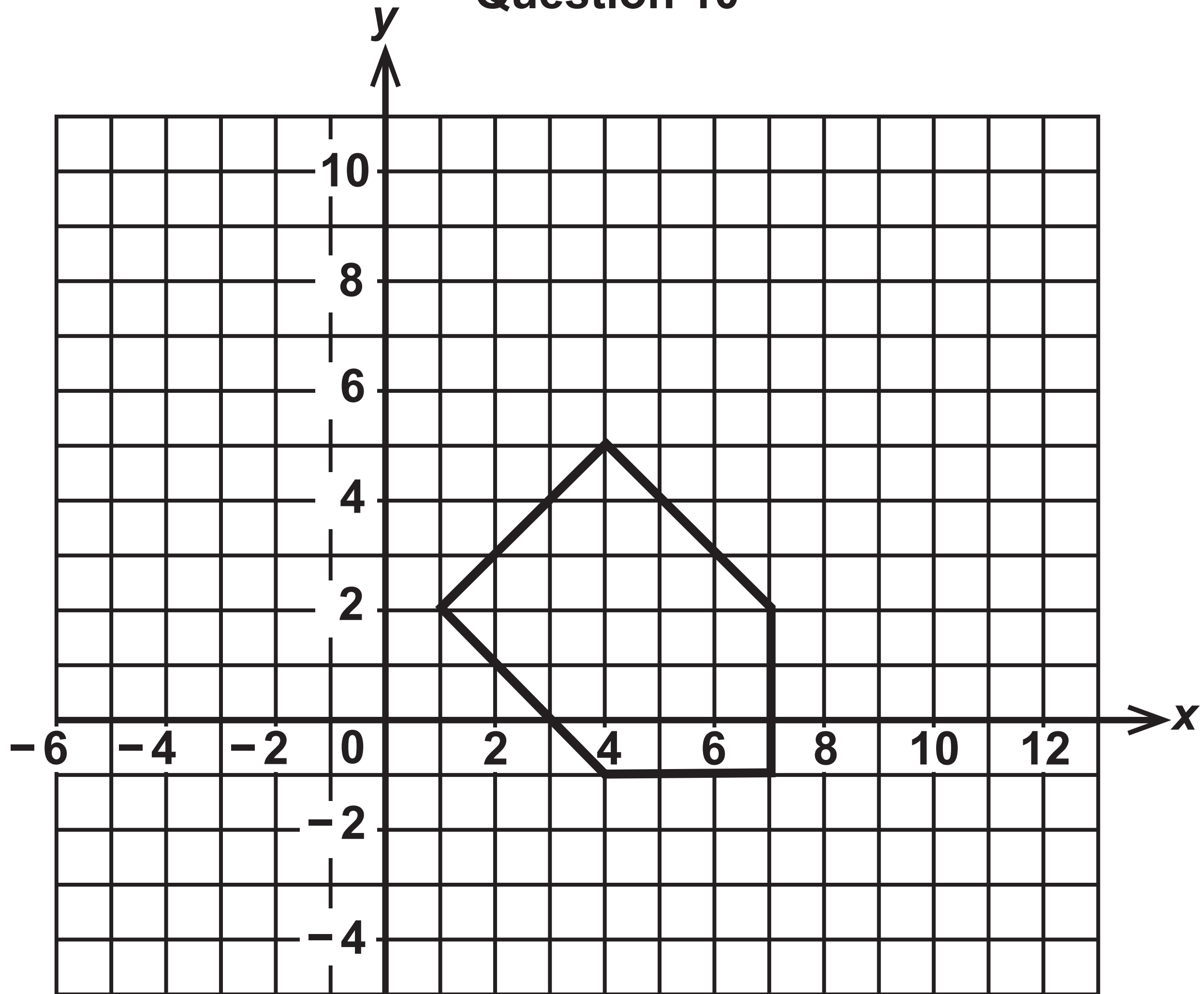
Question 4 (d)



Question 7 (b)

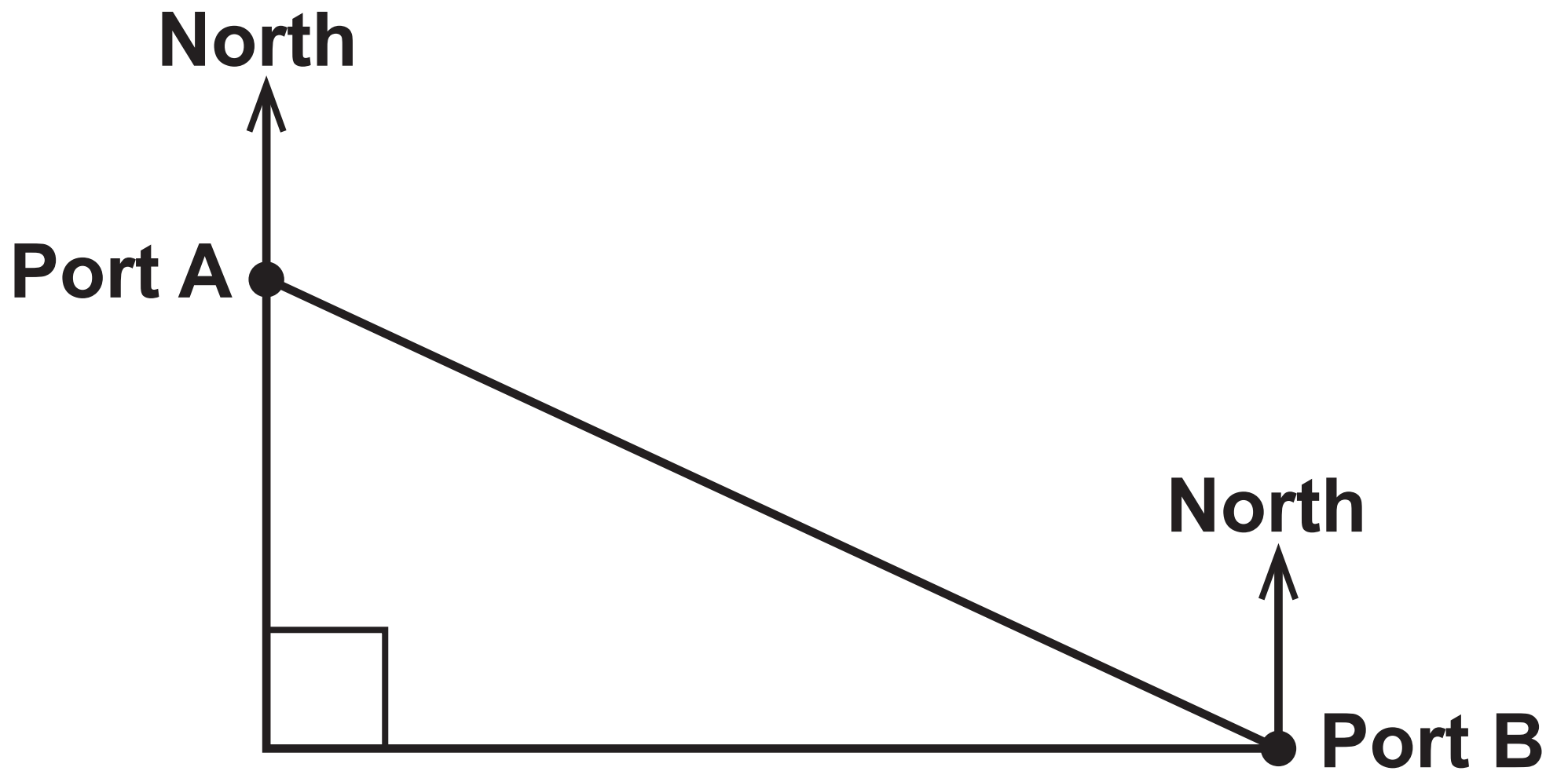


Question 10



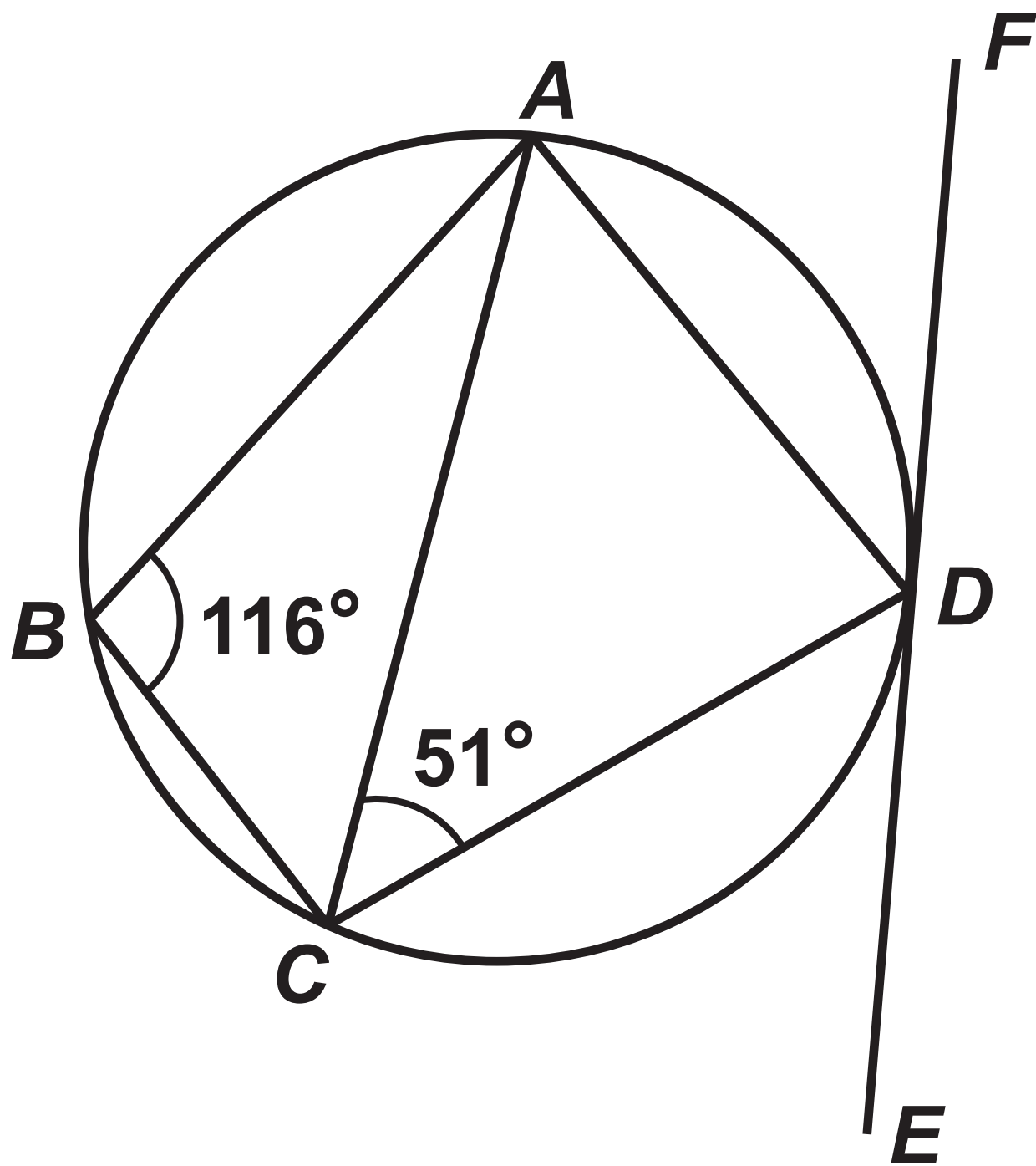
Question 11

Diagram NOT drawn to scale



Question 12

Diagram NOT drawn to scale

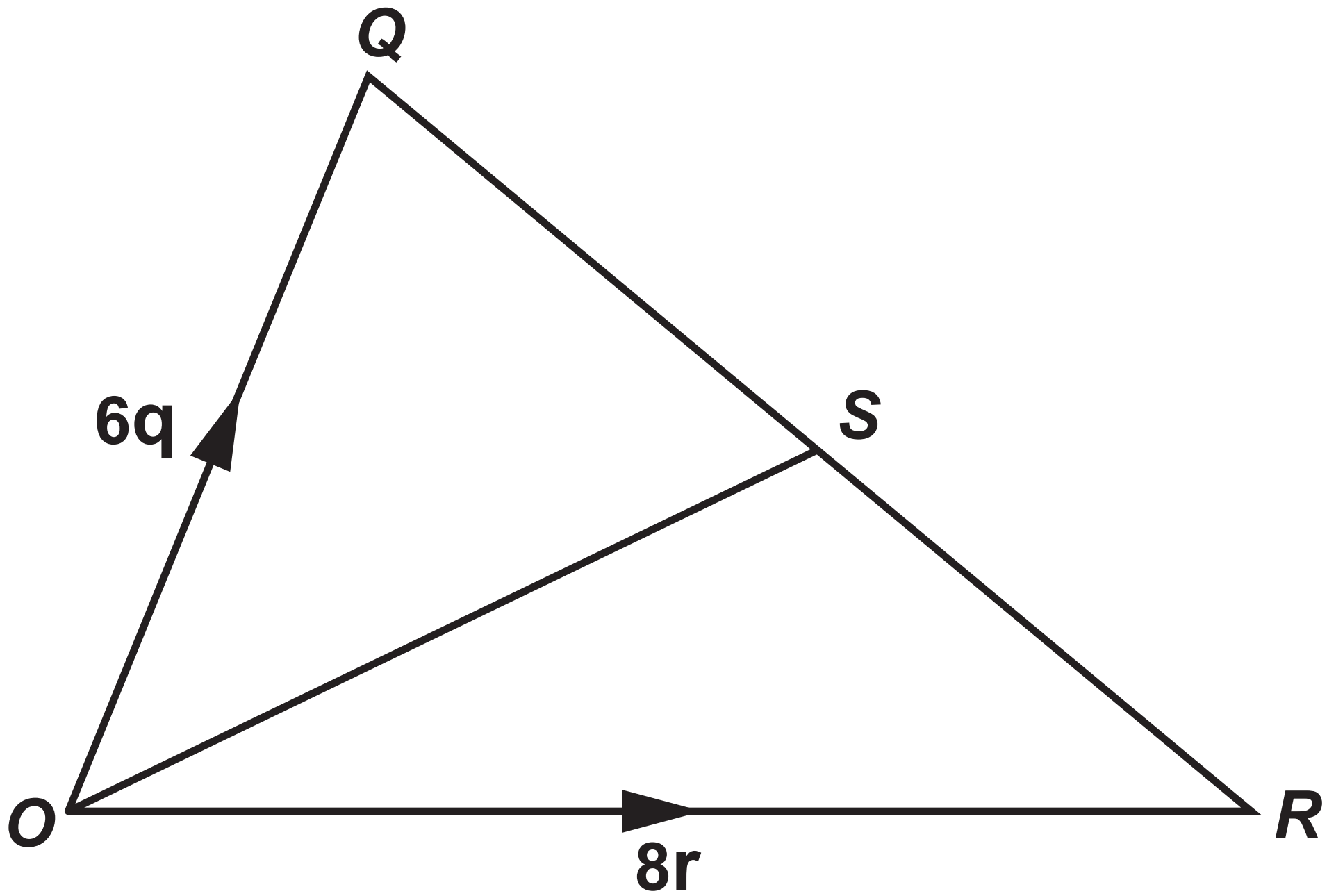


Question 14

E X A M I N A T I O N

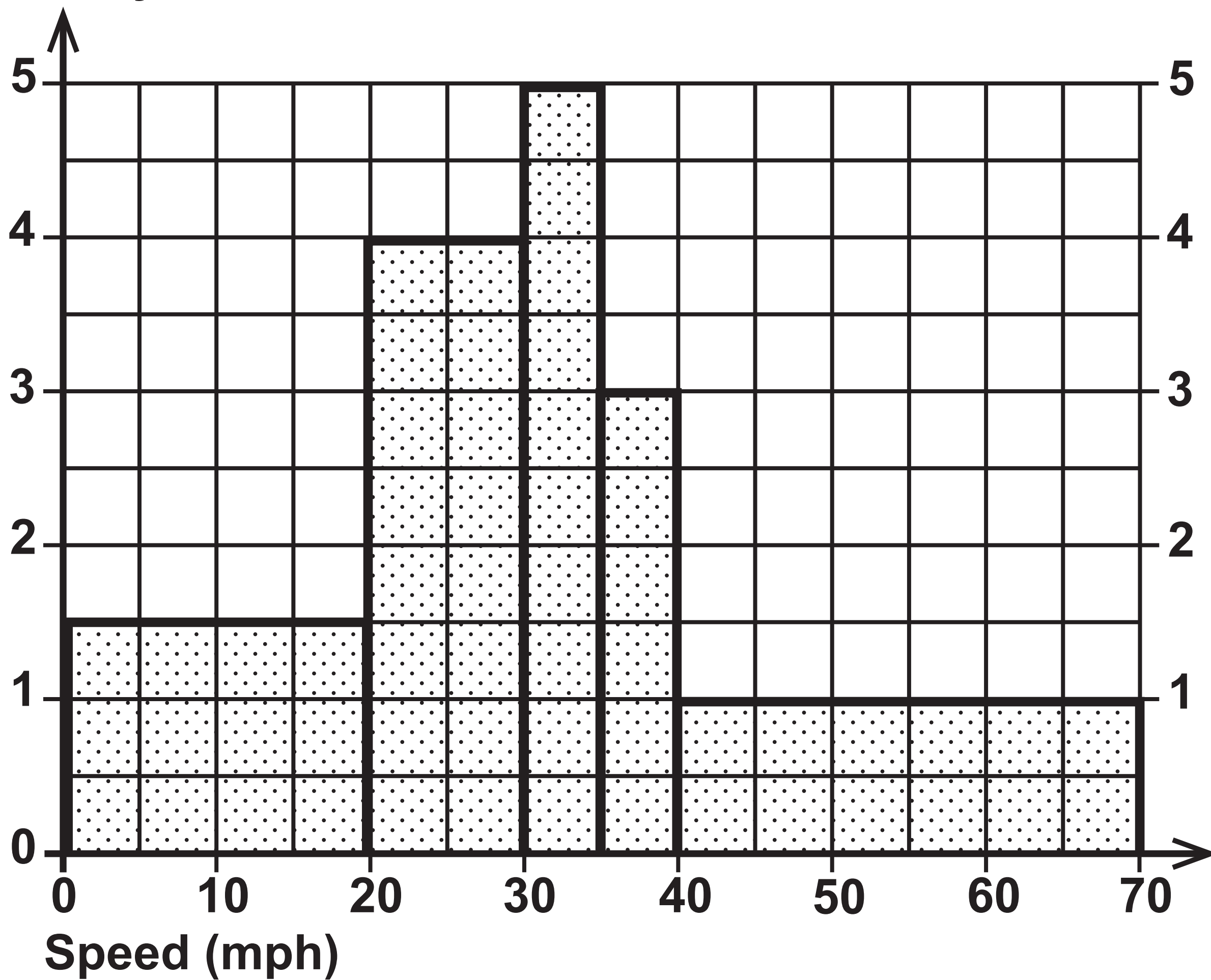
Question 16

Diagram NOT drawn to scale

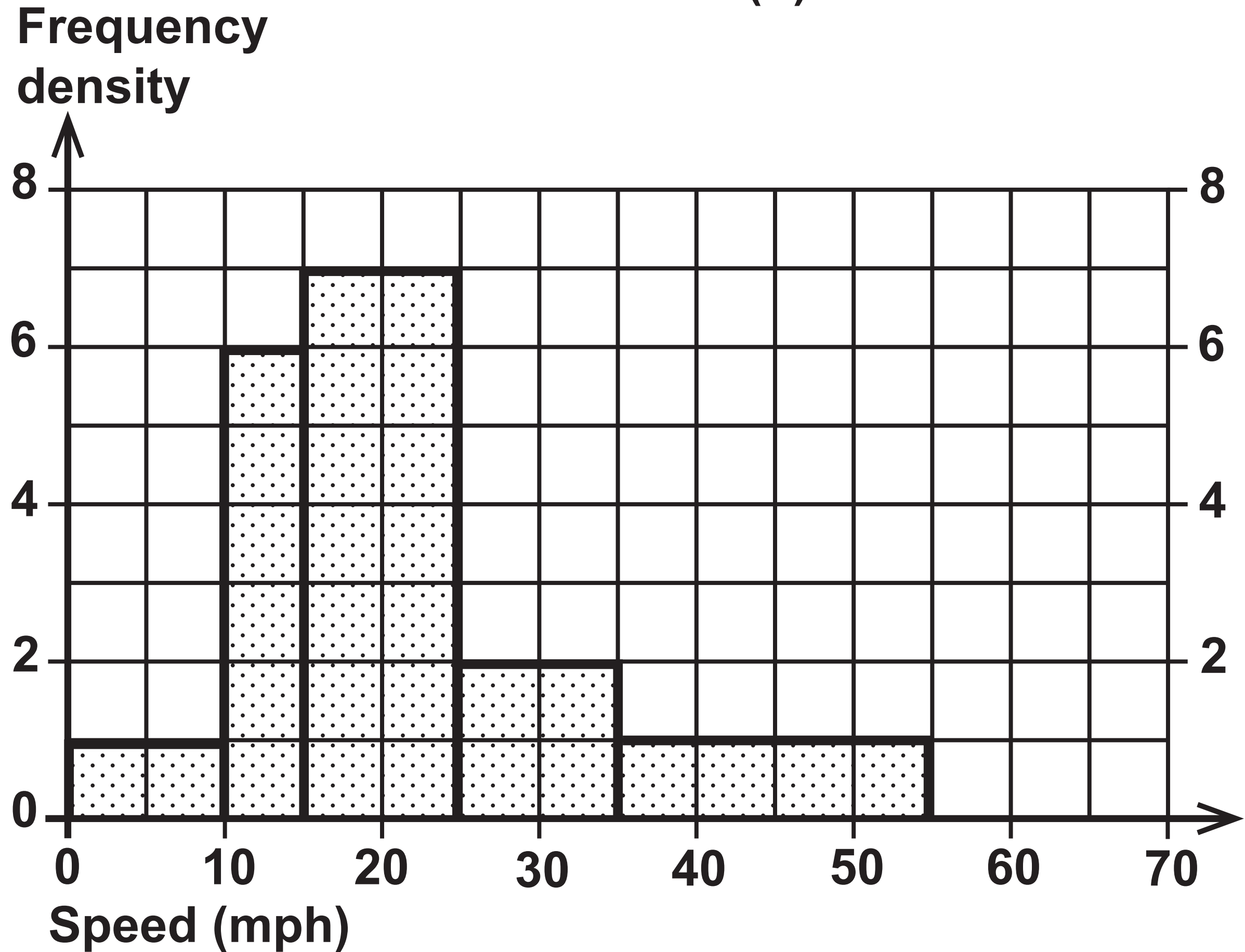


**Frequency
density**

Question 17 (a)

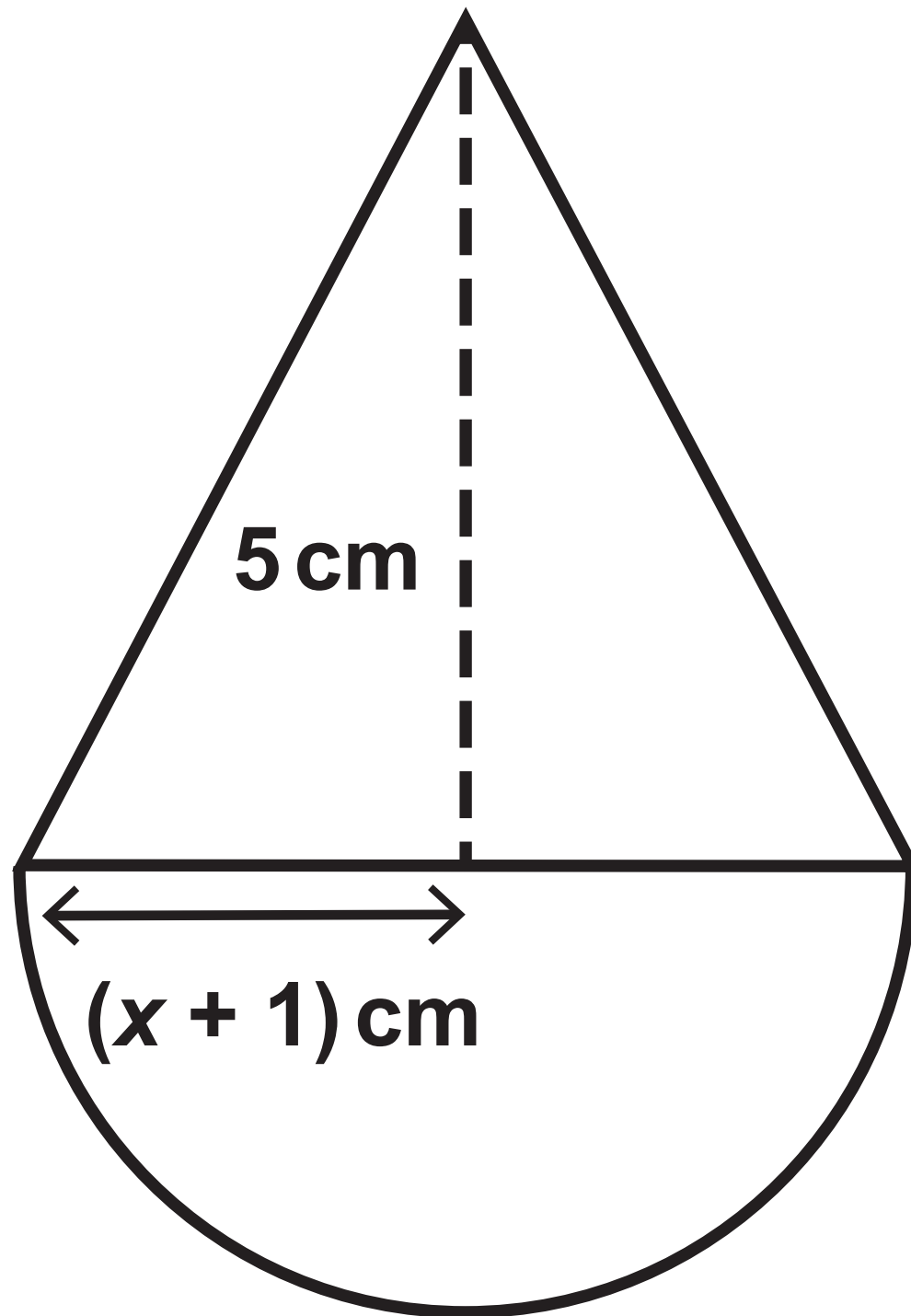


Question 17 (b)



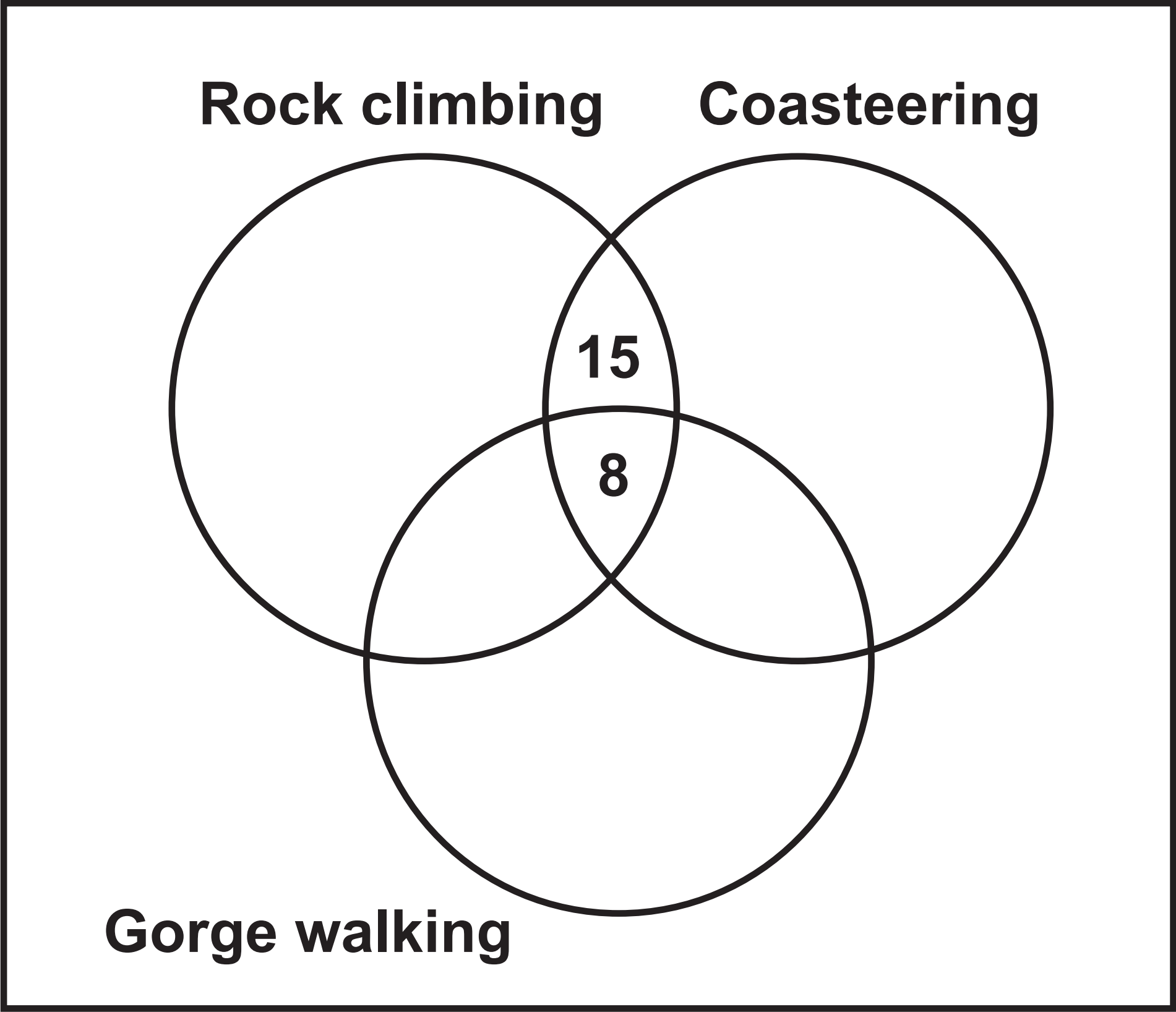
Question 18

Diagram NOT drawn to scale



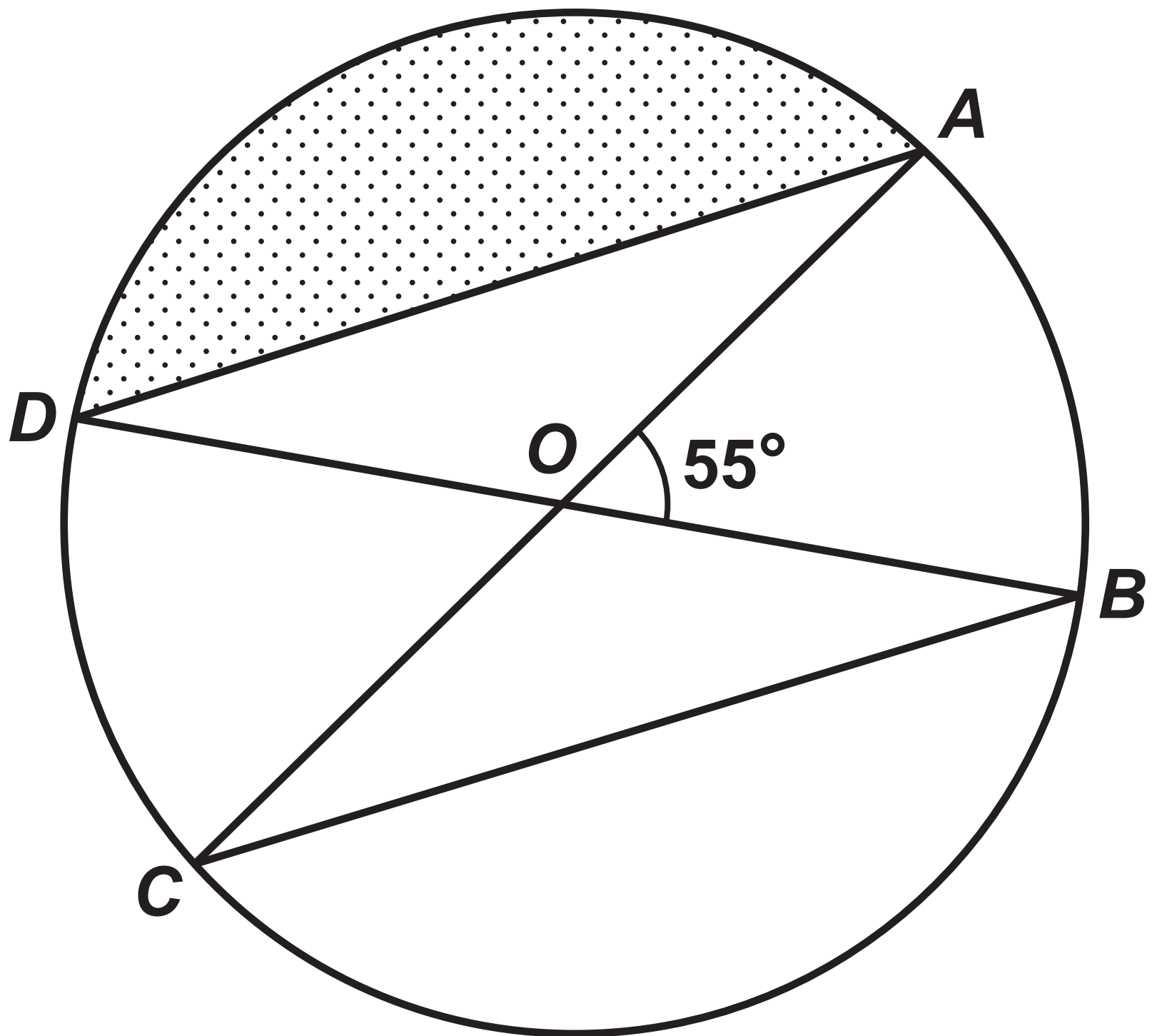
Question 19 (a)

Year 6 pupils

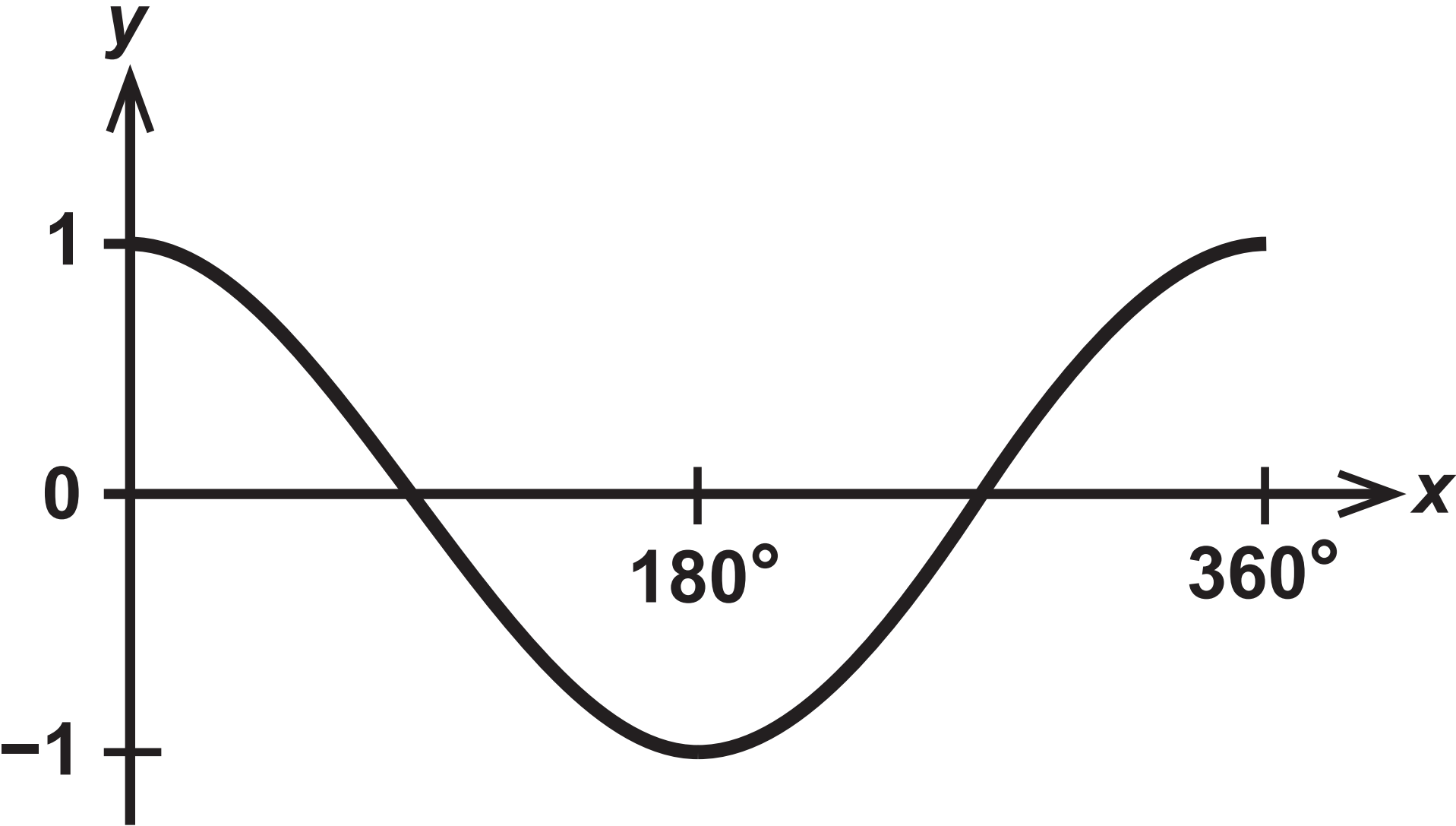


Question 21

Diagram NOT drawn to scale



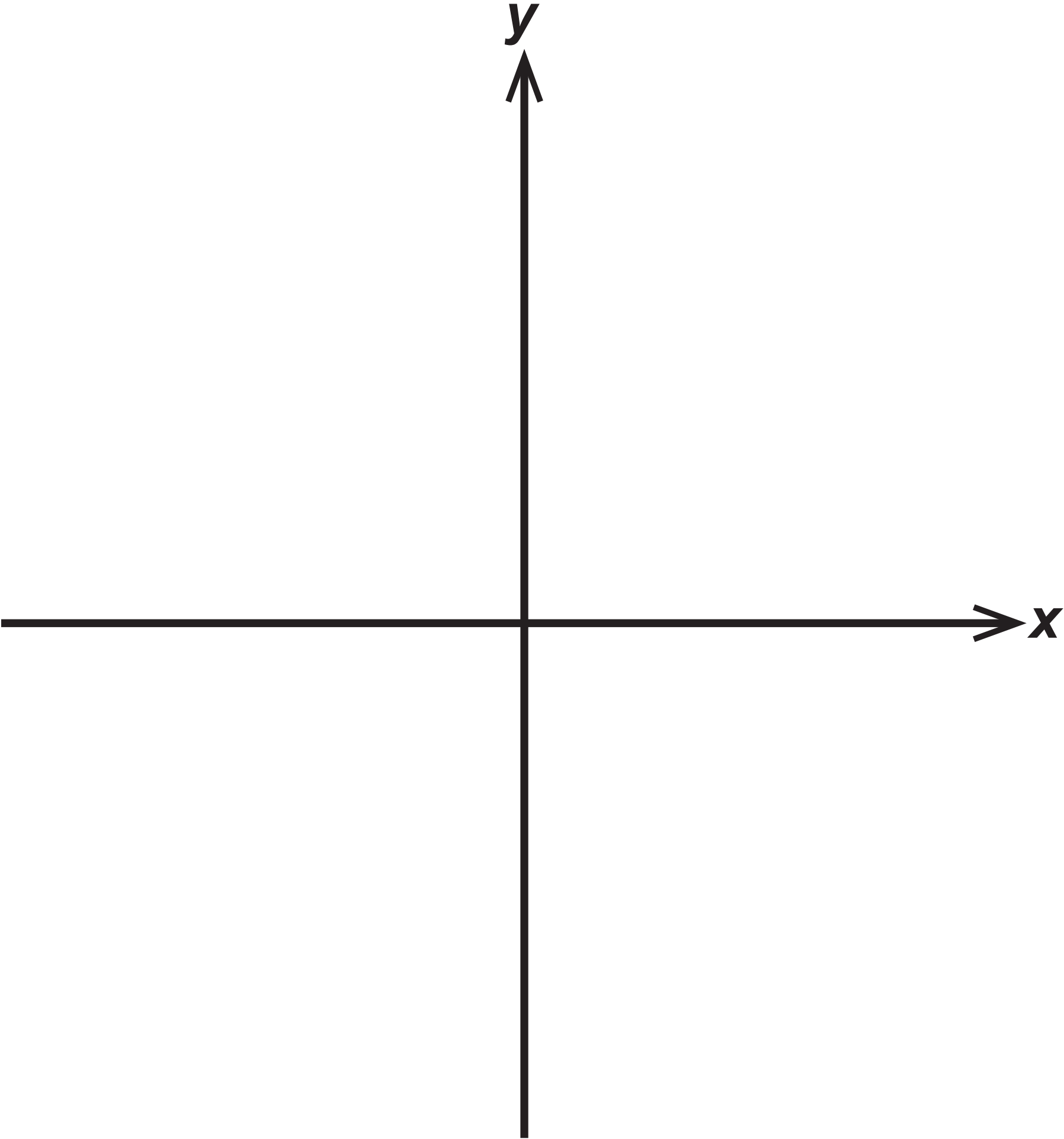
Question 22



Question 22 (b)



Question 25



C300UB0-1A

FRIDAY, 8 NOVEMBER 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:

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

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

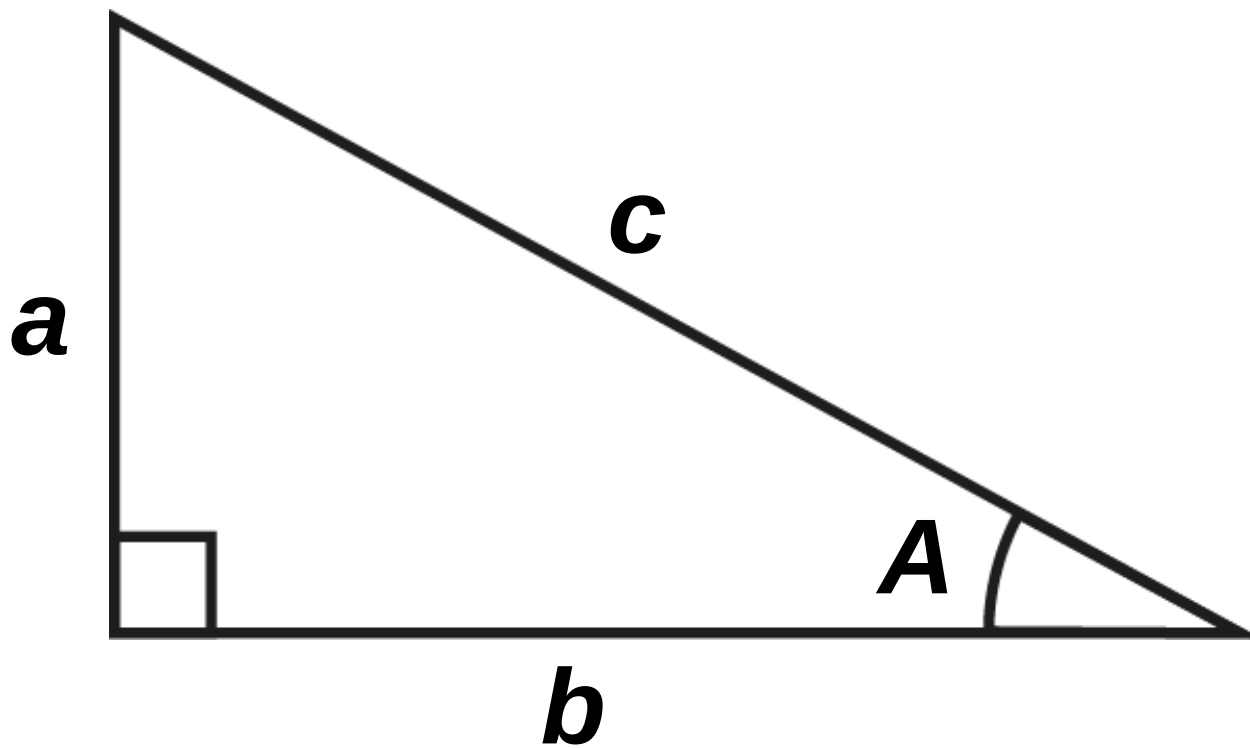
QUADRATIC FORMULA

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

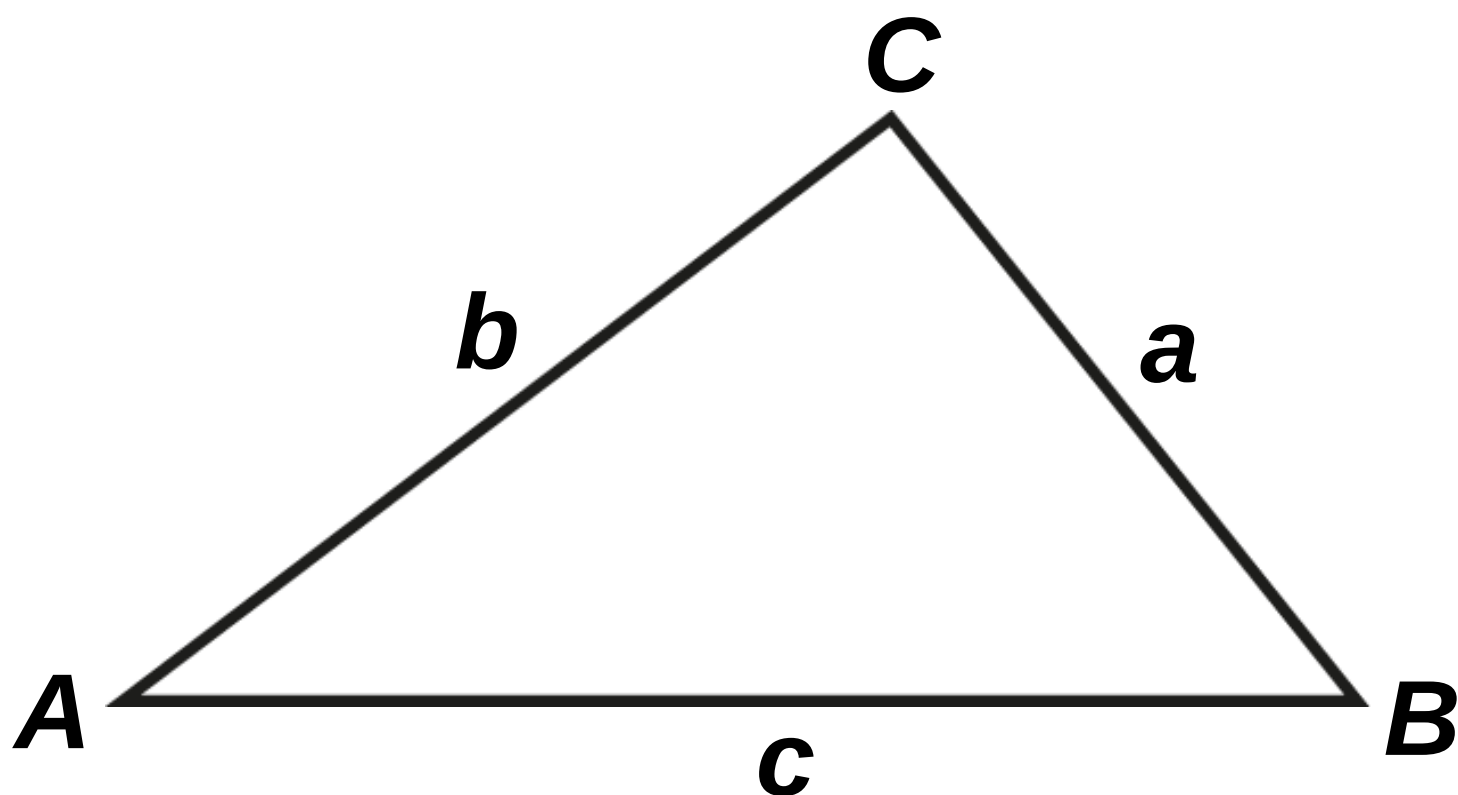


In any right – angled triangle where a , b and c are the length of the sides and c is the hypotenuse:

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

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:

$$v = u + at$$

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

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