GCSE

3300U50-1

MONDAY, 14 NOVEMBER 2022 – MORNING

MATHEMATICS

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		
Question	**Maximum Mark**	**Mark Awarded**
1.	5	
2.	3	
3.	3	
4.	6	
5.	5	
6.	3	
7.	4	
8.	2	
9.	4	
10.	6	
11.	6	
12.	3	
13.	3	
14.	3	
15.	4	
16.	3	
17.	3	
18.	4	
19.	3	
20.	2	
21.	5	
Total	80	

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.

Cut out shapes for Question 12.

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.

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 π as $3{\cdot}14$

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 10, the assessment will take into account the quality of your organisation, communication and accuracy in writing.

1. In a group of 200 people:

- **105 people do not have black hair and do not wear glasses**
- **20 people have black hair and wear glasses**
- **70 people have black hair.**

(a) Look at the diagram for Question 1 (a) in the separate Diagram Booklet.
The diagram is an incomplete Venn diagram.

Complete the Venn diagram to show this information.

The universal set, ε, contains all 200 people.

[3 marks]

1. (b) One of these people is chosen at random. What is the probability that this person wears glasses?

[2 marks]

2. **Look at the diagram for Question 2 in the separate Diagram Booklet.**
The diagram is NOT drawn to scale.

Triangle ABC is shown in the diagram.
Using only a ruler and a pair of compasses, construct an accurate drawing of triangle ABC in the space below the diagram.
Side AC has been drawn for you.
All construction lines and arcs must be shown.

[3 marks]

3. Express 1575 as a product of its prime factors in index form.

[3 marks]

4. Simplify the following expressions.

(a) $2e^3f \times 3e^4f^7$

[2 marks]

(b) $7c(c + 5) - 2(3c^2 + 6c - 7)$

[4 marks]

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

The diagram shows the graph of a straight line for values of x from -1 to 3

(a) (i) Write down the gradient of the line shown.

_____

_____

_____

[1 mark]

(ii) Write down the equation of the line in the form $y = mx + c$

_____

_____

_____

[2 marks]

continued on the next page . . .

Question 5 continued

5. (b) Show that the lines

$$y = 3x - 8 \quad \text{and} \quad 2y - 6x = 23$$

are parallel to each other.

[2 marks]

6. Look at the table for Question 6
in the separate Diagram Booklet.
The table shows six different formulae.

In the formulae, each measurement of length is represented by a letter.
Consider the dimensions implied by each formula.
For each case, write down whether the formula could be for a length, an area, a volume or none of these.

The first one has been done for you.

[3 marks]

7. (a) Calculate the value of

$$(3 \times 10^4) \div (6 \times 10^{-3})$$

Give your answer in standard form.

[2 marks]

continued on the next page . . .

Question 7 continued

7. (b) Calculate the value of

$$(4{\cdot}78 \times 10^4) + (1{\cdot}5 \times 10^2)$$

Give your answer in standard form.

[2 marks]

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

Which complete method, using Pythagoras's Theorem, can be used to find x?

Circle your answer.

$x = 25^2 + 10^2$
$x = \sqrt{25^2 + 10^2}$
$x = 25^2 - 10^2$
$x = \sqrt{25^2 - 10^2}$
$x = \sqrt{(25 - 10)^2}$

[1 mark]

continued on the next page . . .

Question 8 continued

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

Which of the following calculations can be used to find y?

Circle your answer.

$\sin 25^\circ = y \times 40$
$\sin 40^\circ = \frac{25}{y}$
$\sin 25^\circ = \frac{y}{40}$
$\sin 40^\circ = \frac{y}{25}$
$\sin 40^\circ = y \times 25$

[1 mark]

9. **Look at the diagram for Question 9 in the separate Diagram Booklet.**

The diagram is NOT drawn to scale.

In the diagram,

***P*, *Q* and *R* are points on the circumference of a circle with centre *O*.**

Angle *QPO* = 38°

Angle *QRP* = *x*°

Calculate the value of *x*.

You must state ALL the angle properties that you use.

You must show all your working.

[4 marks]

10. IN THIS QUESTION, YOU WILL BE ASSESSED ON THE QUALITY OF YOUR ORGANISATION, COMMUNICATION AND ACCURACY IN WRITING.

On Monday morning, Twm picked n apples from a tree.

Ceri picked 5 times as many apples as Twm.

On Monday afternoon, Twm picked 19 more apples.

Ceri gave 7 of her apples to Twm.

Ceri still had more apples than Twm.

Write down an inequality in terms of n to show the above information.

Use your inequality to find the least possible number of apples Twm picked on Monday morning.

You must show all your working.

[4 marks + 2 marks OCW]

11. (a) Given that y is DIRECTLY proportional to x^3 and that $y = 108$ when $x = 3$

(i) find an expression for y in terms of x.

[3 marks]

continued on the next page . . .

Question 11 (a) continued

11. (a) (ii) Use the expression you found in part (a) (i) to complete the following table.

x	y
3	108
5	
	4000

[2 marks]

11. (b) It is known that e is INVERSELY proportional to f.

Describe what happens to e when f is doubled.

[1 mark]

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

The diagram shows shape A and shape B on a coordinate grid.

Describe fully the SINGLE transformation that transforms shape A onto shape B.

Cut out shapes are available for this question.

[3 marks]

13. Look at the diagram for Question 13 in the separate Diagram Booklet.
The diagram is NOT drawn to scale.

In the diagram, the lines *AC* and *BD* BISECT each other.

Prove that triangles *ABE* and *CDE* are congruent.
You must state the condition of congruence.

[3 marks]

14. Look at the diagram for Question 14 in the separate Diagram Booklet.

The diagram shows a set of axes.

Using the axes, find the region which satisfies the following inequalities.

$$y \leq \frac{1}{2}x + 1$$

$$y + x \geq 0$$

$$x \leq 3$$

You must clearly indicate the region that represents your answer.

[3 marks]

15. (a) Express $0{\cdot}6\dot{5}\dot{4}$ as a fraction.

[2 marks]

continued on the next page . . .

Question 15 continued

15. (b) Evaluate $27^{-\frac{2}{3}}$

[2 marks]

16. A cone and a cylinder have equal volumes.

The cone has a base radius of r cm and a height of h cm.

The cylinder has a base radius of r cm and a height of $\frac{3}{2}r$ cm.

Find h in terms of r.

You must express your answer in its simplest form.

[3 marks]

17. Evaluate the mean of the following three numbers:

$$\sqrt{20} \quad \left(\sqrt{5}\right)^3 \quad 11\sqrt{5}$$

Express your answer in the form $a\sqrt{5}$, where a is an integer.

[3 marks]

18. **Ffion has some blue cards and some yellow cards.**

She takes 7 of the blue cards and 3 of the yellow cards and puts them in a box.

Ffion removes one card from the box at random and replaces it with TWO cards of the other colour.

Then she removes a second card from the box at random.

Calculate the probability that the two cards that Ffion removed are of different colours.

[4 marks]

19. **The highest point of a curve is called a maximum point.**

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

The diagram shows a sketch of the curve with equation $y = f(x)$

The maximum point of this curve has coordinates $(-5, 4)$

continued on the next page . . .

Question 19 continued

19. (a) For each of the following, write down the coordinates of the maximum point of the curve with the given equation.

(i) $y = 2f(x)$

The coordinates of the maximum point are

(_____ , _____)

[1 mark]

(ii) $y = f(x - 7)$

The coordinates of the maximum point are

(_____ , _____)

[1 mark]

continued on the next page . . .

Question 19 continued

19. (b) The curve with equation $y = f(x)$

is reflected in the y – axis.

Write down the equation of the transformed curve.

You should use function notation.

The equation of the transformed curve is

$y =$ _____

[1 mark]

20. Look at the diagram for Question 20 in the separate Diagram Booklet.

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

Given that $\cos 25^\circ = 0{\cdot}9063$, correct to 4 decimal places, write down all the solutions of the equation

$$\cos x = -0{\cdot}9063$$

for values of x from 0° to 360°

[2 marks]

21. Solve the following equation.

Do not use a trial and improvement method.

$$\frac{y}{y + 1} = \frac{2}{4y - 5}$$

[5 marks]

END OF PAPER

TOTAL 80 MARKS

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

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MATHEMATICS

UNIT 1: NON – CALCULATOR

HIGHER TIER

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

Diagram Booklet

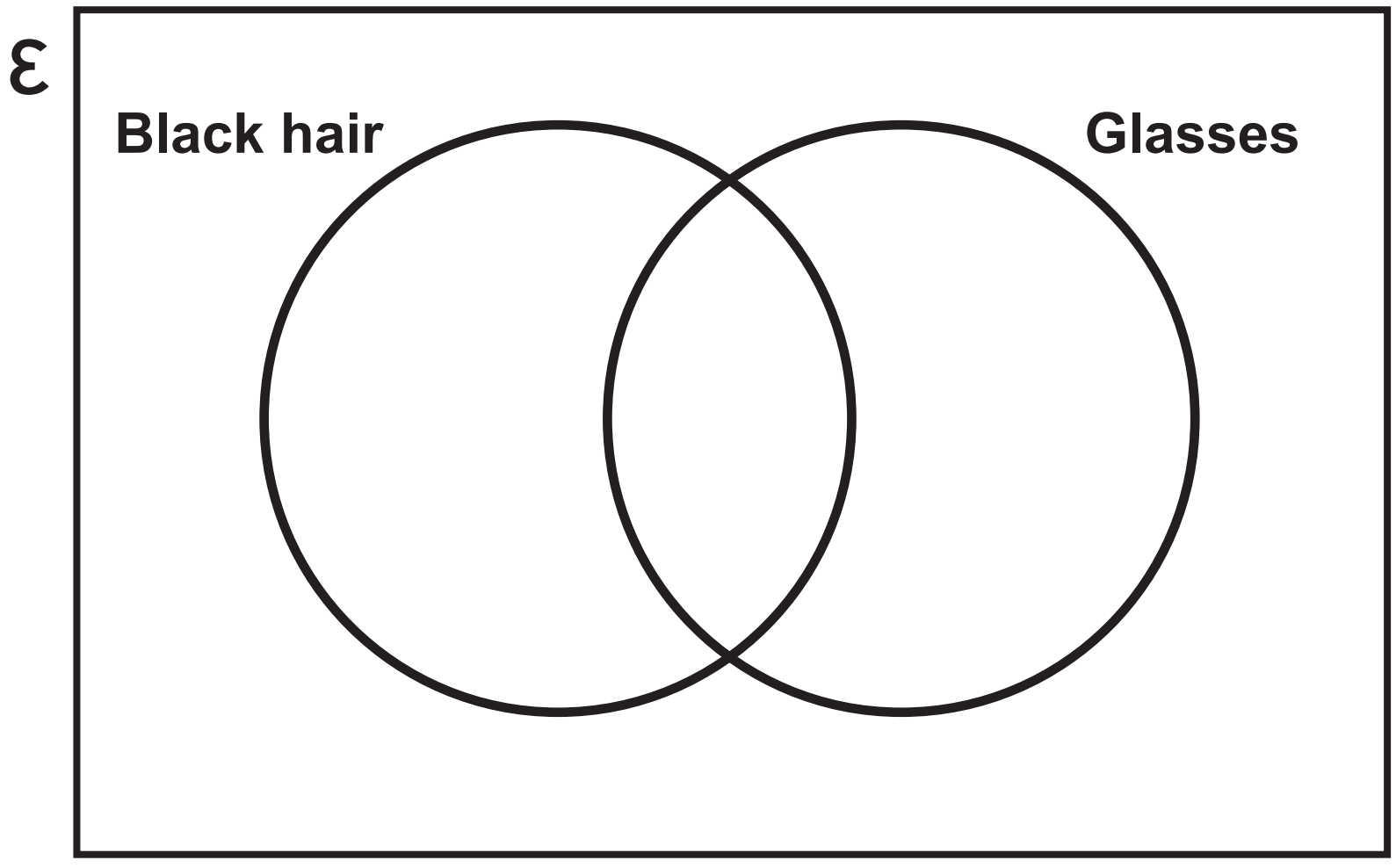
Surname: _____

First name(s): _____

Centre Number: _____

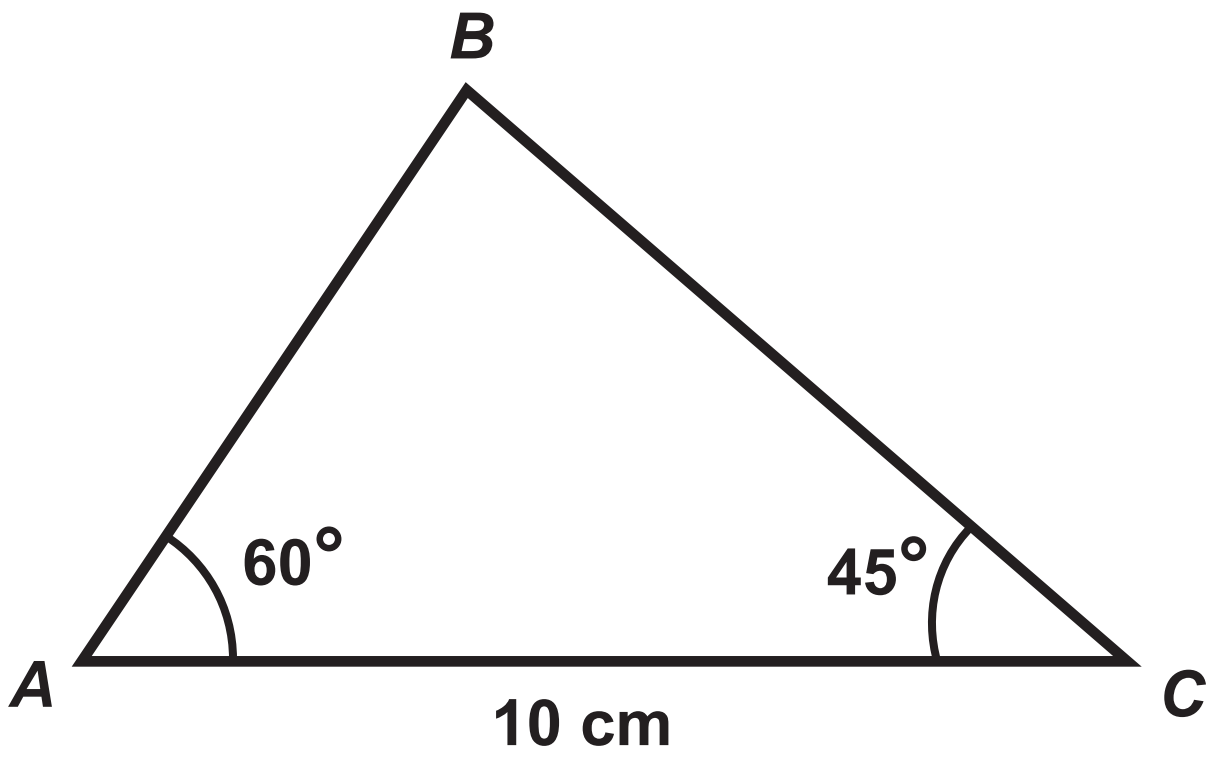
Candidate Number: 0 _____

Question 1 (a)

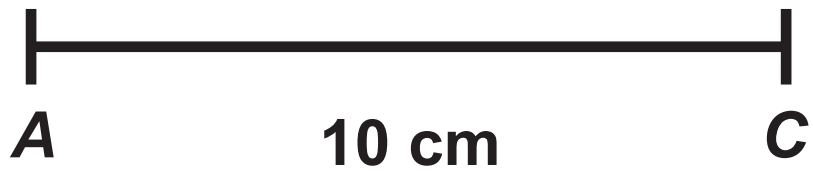


Question 2

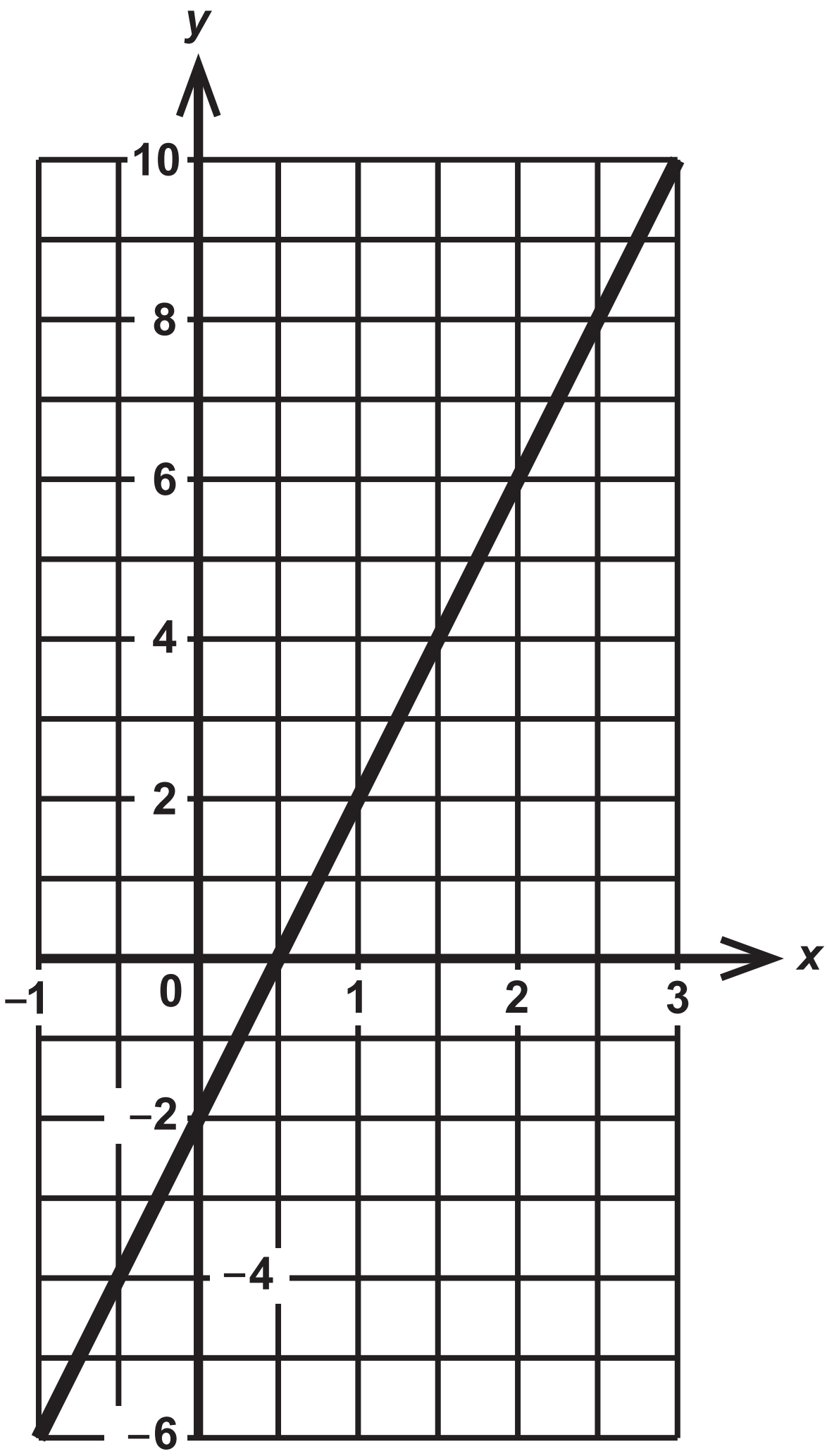
Diagram NOT drawn to scale



In the space below, contruct an accurate drawing of triangle ABC shown above.



Question 5



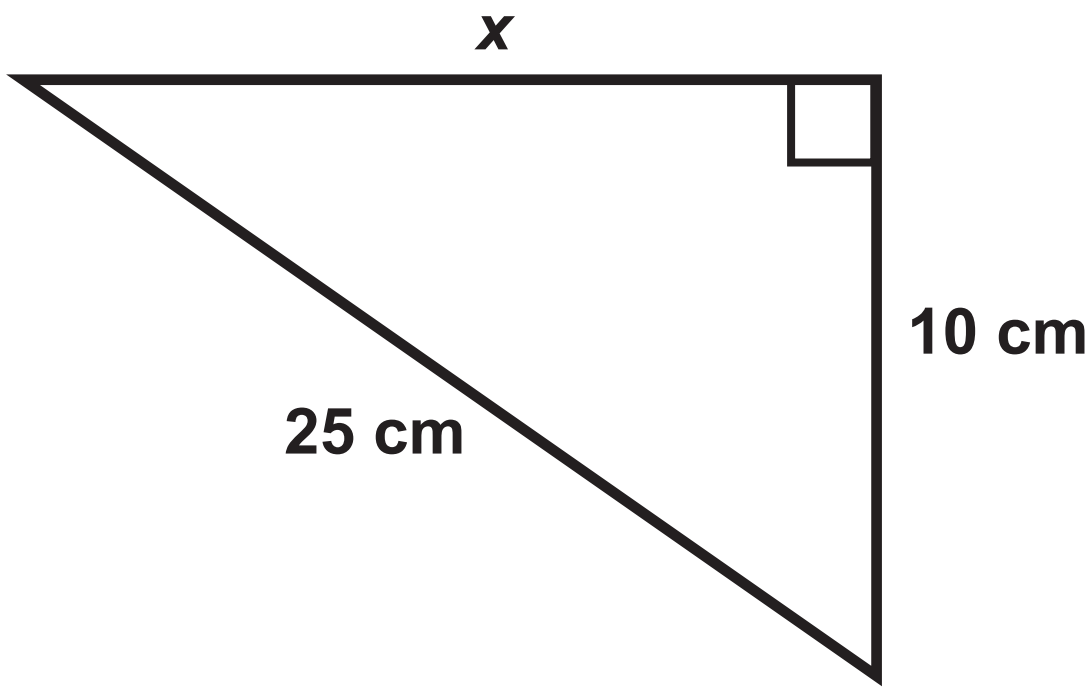
Question 6

Table

FORMULA	FORMULA COULD BE FOR
$7d^3 - def$	volume
$7de - 5e^2 + \frac{d^2e}{f}$	
$5def - 6ef + e^2$	
$4d^2e + 4e^2d$	
$3d + 8e + 2f$	
$d^2 - def$	

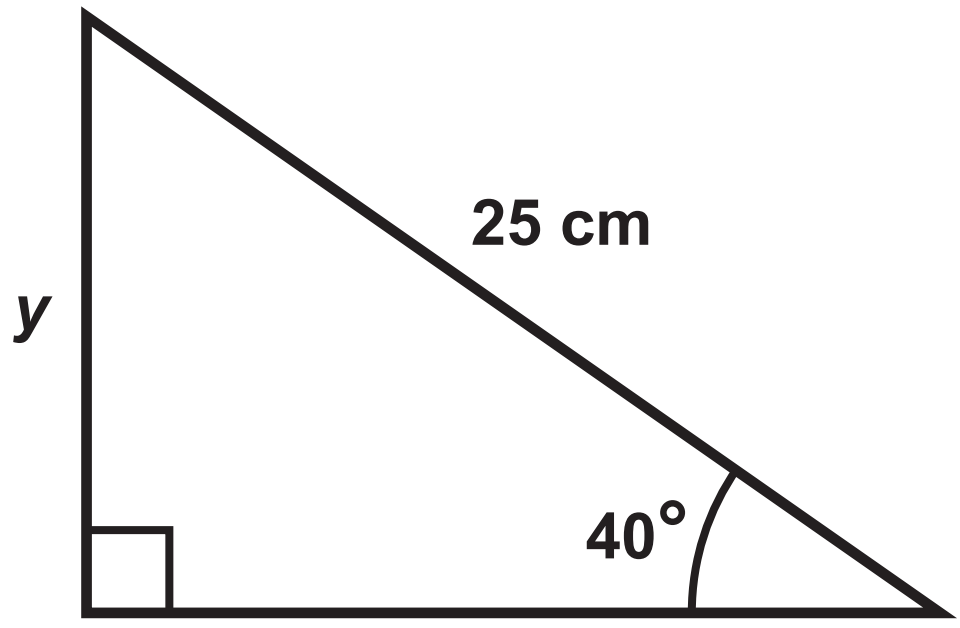
Question 8 (a)

Diagram NOT drawn to scale



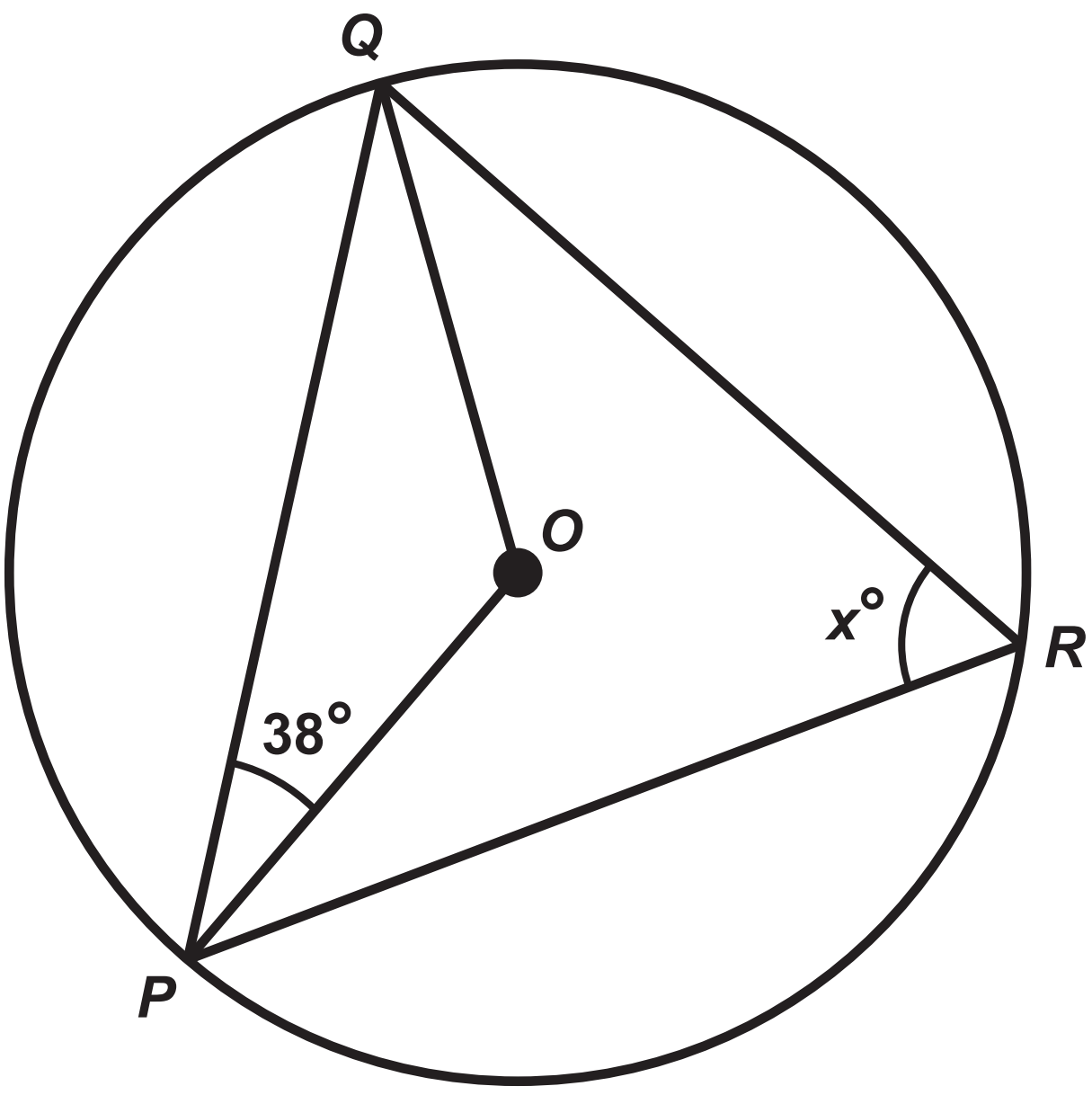
Question 8 (b)

Diagram NOT drawn to scale

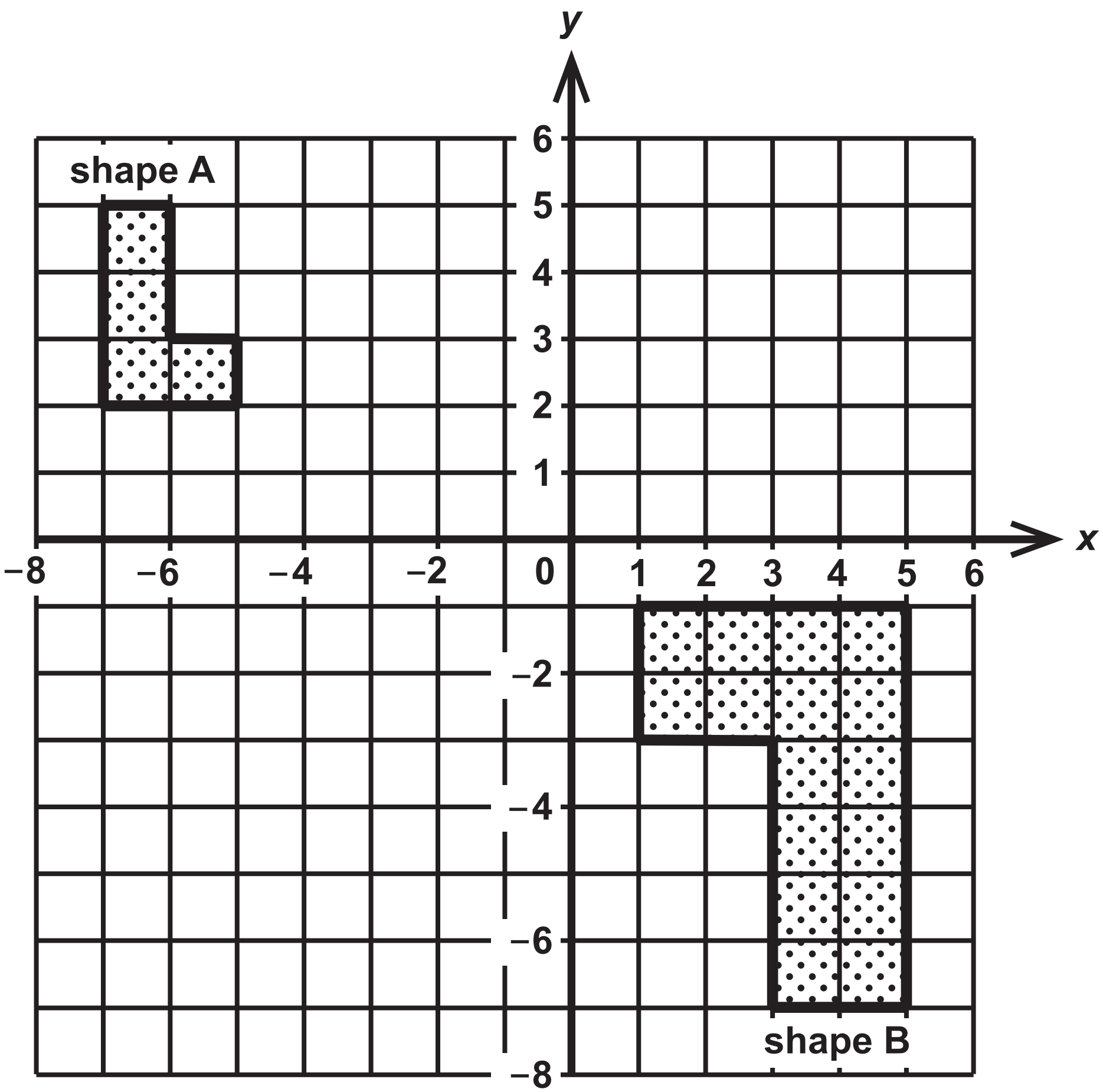


Question 9

Diagram NOT drawn to scale

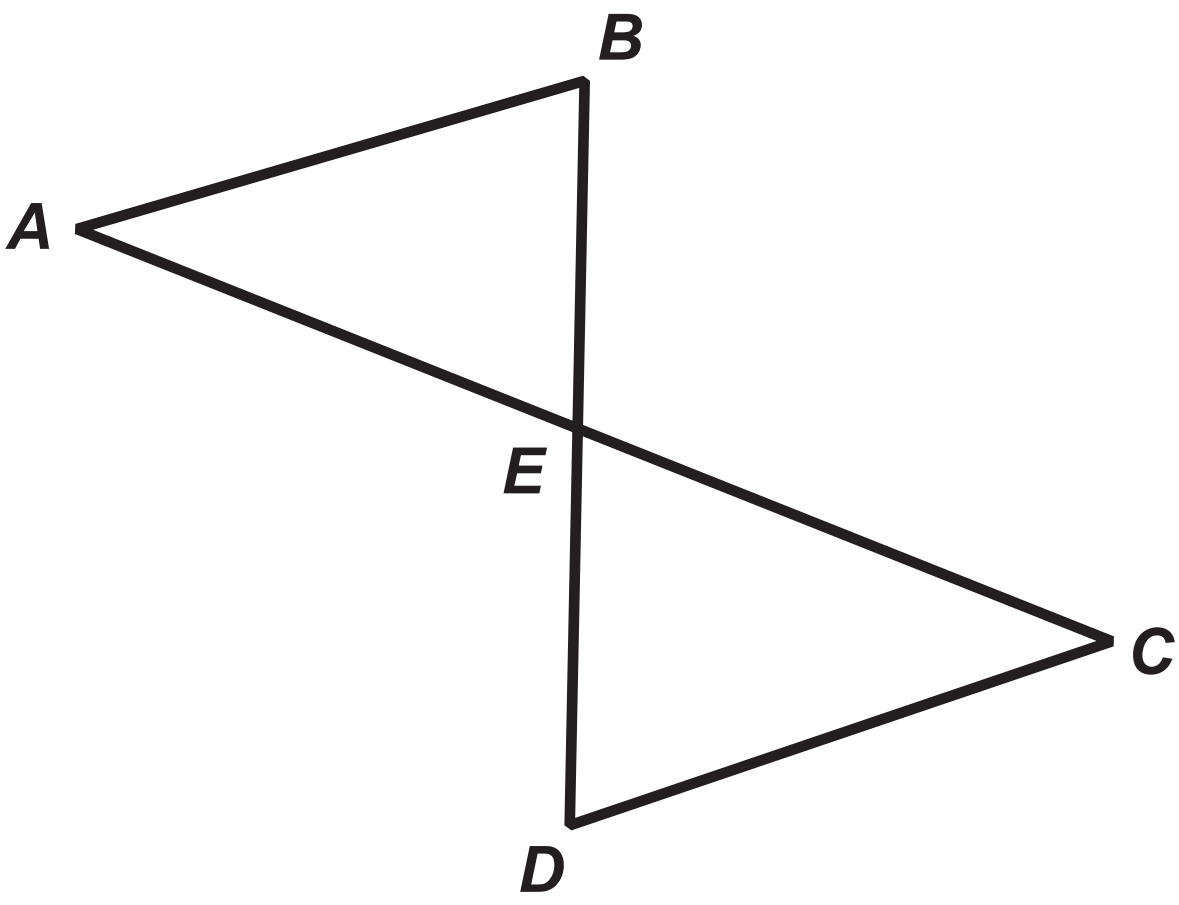


Question 12

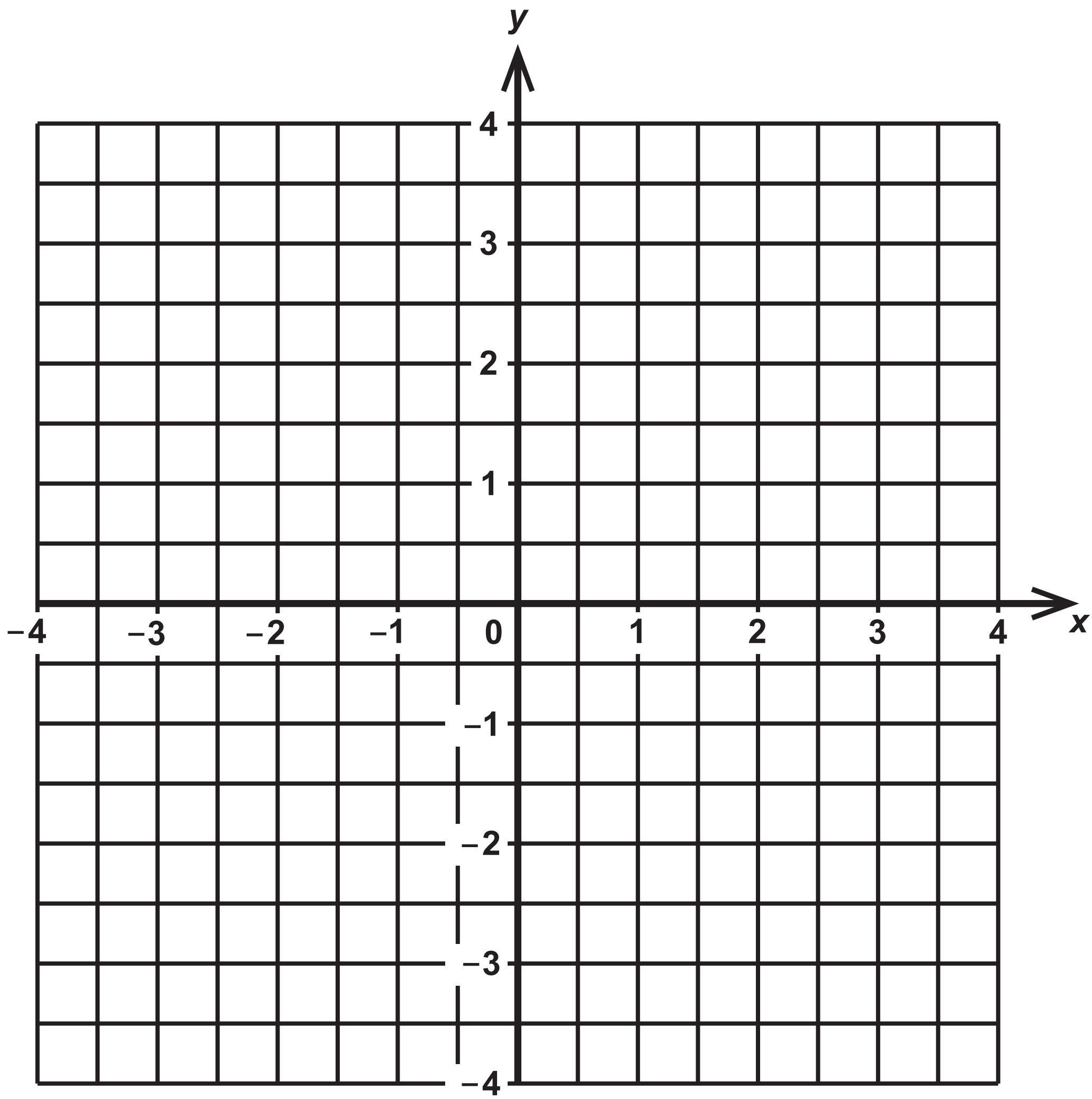


Question 13

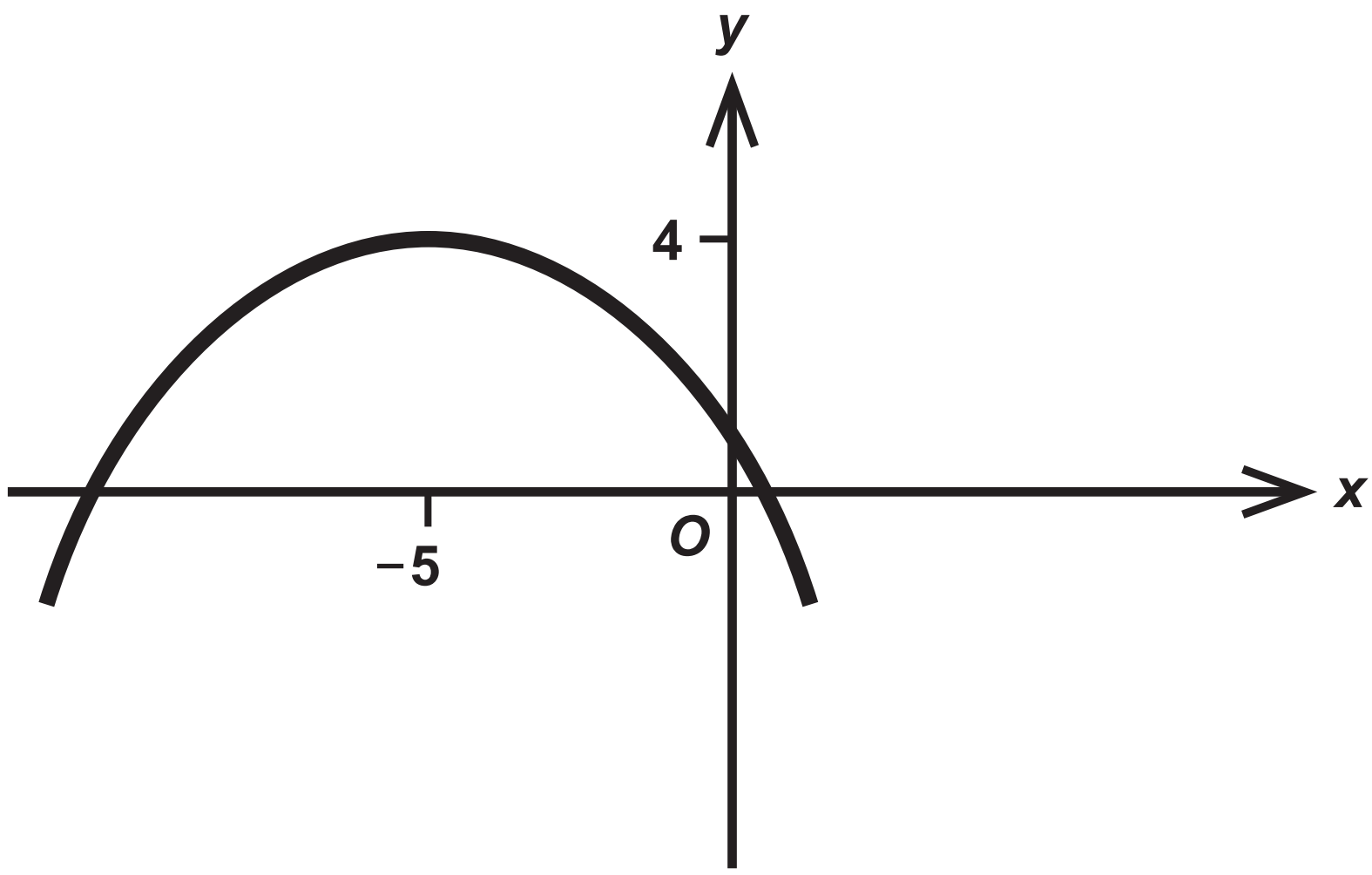
Diagram NOT drawn to scale



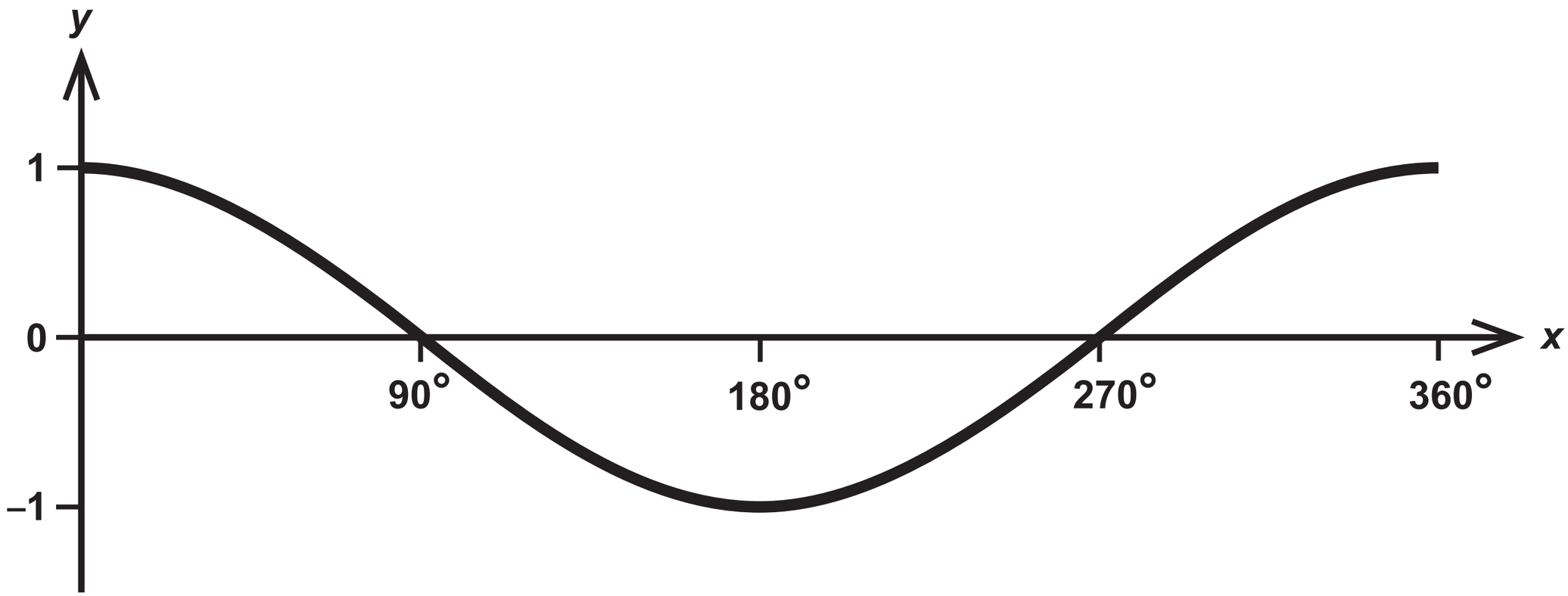
Question 14



Question 19



Question 20



GCSE
MATHEMATICS
and
NUMERACY

FORMULA LIST

HIGHER TIER

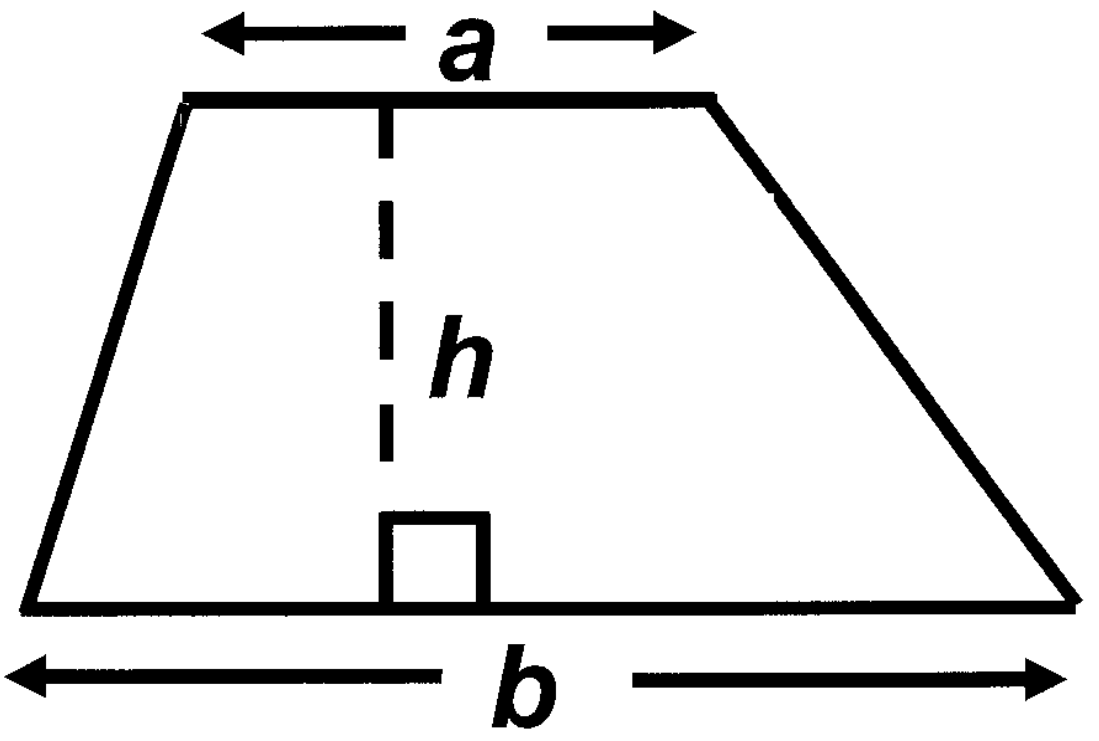
GCSE

You must not write on these formula pages.

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

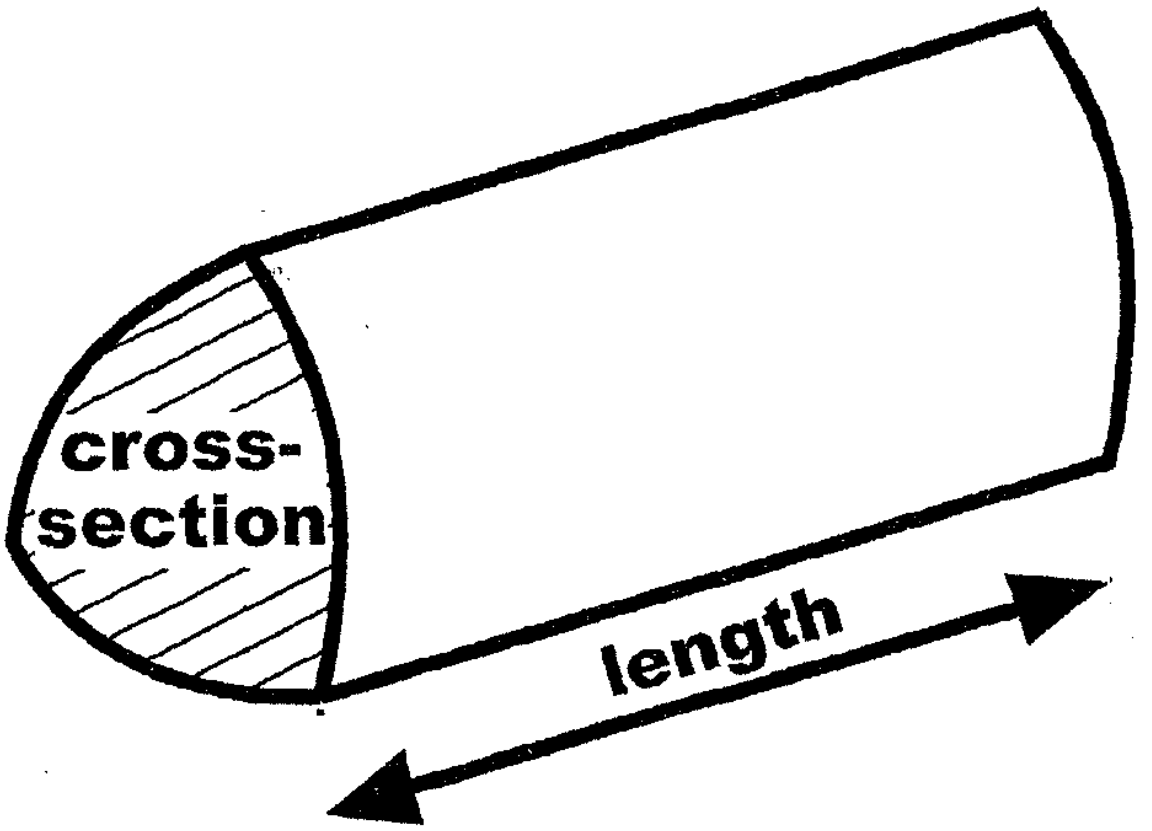
Formula List – Higher Tier

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



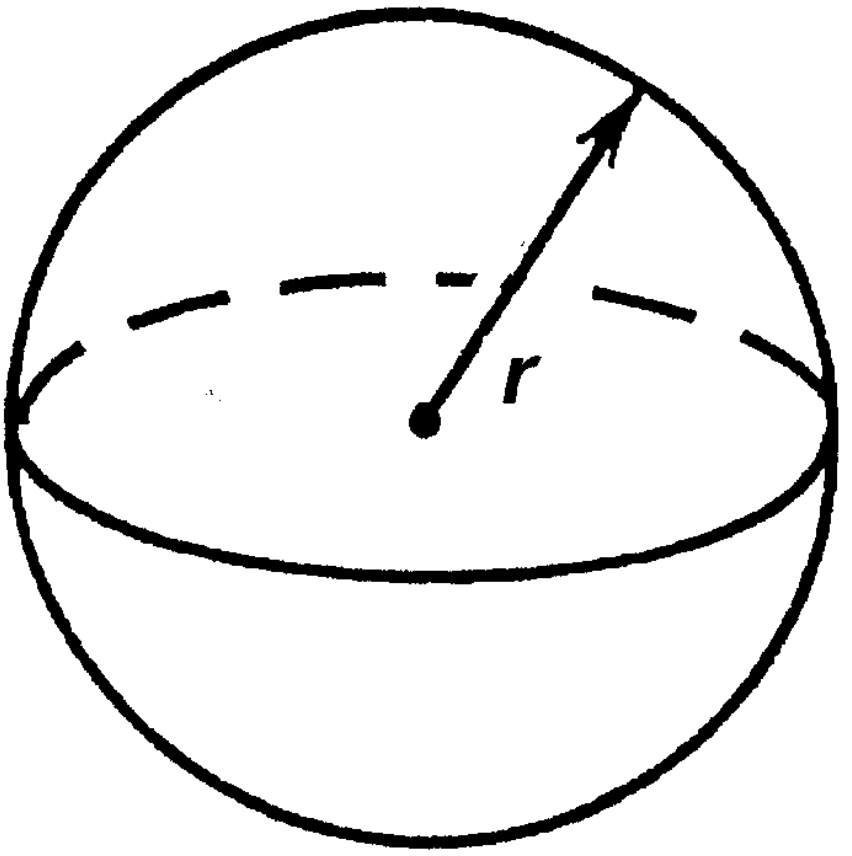
Volume of prism =

area of cross – section × length



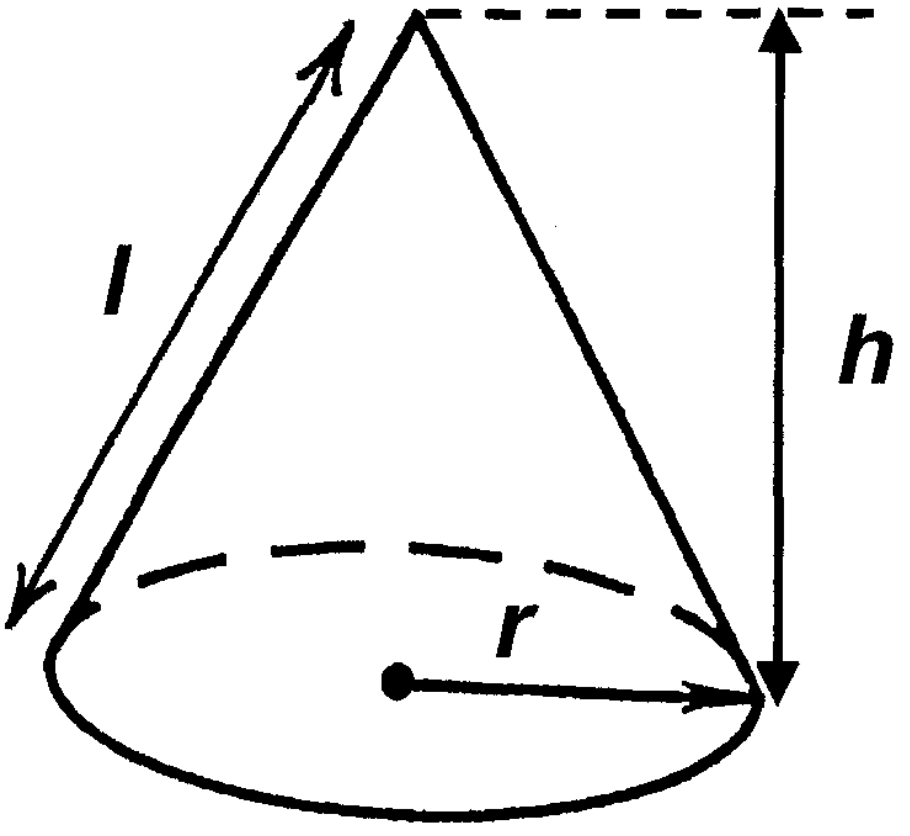
Volume of sphere $= \frac{4}{3}\pi r^3$

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

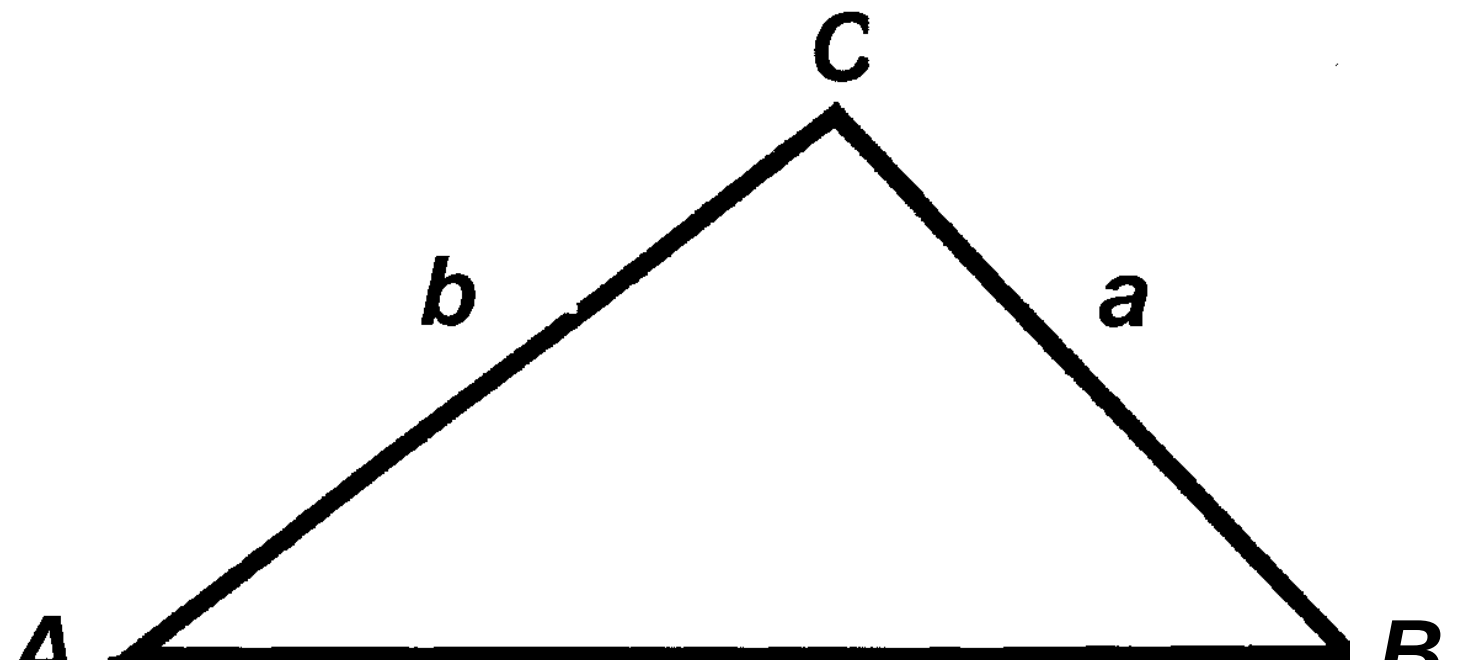


Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle ABC



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

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

Area of triangle $= \dfrac{1}{2}ab\sin C$

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.