GCSE

3300U50-1

TUESDAY, 23 MAY 2023 – 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.	2	
2.	4	
3.	6	
4.	4	
5.	7	
6.	3	
7.	5	
8.	3	
9.	4	
10.	4	
11.	5	
12.	4	
13.	7	
14.	5	
15.	6	
16.	6	
17.	5	
Total	80	

(Turn over)

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.

Models for Question 12.

Cut out shape for Question 1 (a).

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

1. Look at the diagram for Question 1 in the separate Diagram Booklet.
The diagram shows a shape on a coordinate grid.

(a) Translate the shape shown using the column vector $\begin{pmatrix} -1 \\ 7 \end{pmatrix}$

A cut out shape is available for this question.

[1 mark]

continued on the next page . . .

Question 1 continued

1. (b) Write down the column vector that will reverse the translation in part (a).

[1 mark]

2. (a) Express 675 as a product of its prime factors in index form.

(Turn over)

[3 marks]

Question 2 continued

2. (b) 360 expressed as a product of its prime factors in index form is $2^3 \times 3^2 \times 5$

What is the smallest whole number that 360 can be multiplied by to give a square number?

Smallest whole number is

_____

[1 mark]

3. (a) Simplify each of the following.

Circle your answer in each case.

(i) $m^4 \times m^3 =$

m^7	m^{12}	m^{43}	$7m$	$12m$

[1 mark]

continued on the next page . . .

Question 3 (a) continued

3. (a) (ii) $\frac{m^{15}}{m^{5}} =$

m^{75}	$\frac{1}{m^{3}}$	m^{3}	m^{10}	$\frac{1}{m^{10}}$

[1 mark]

continued on the next page . . .

Question 3 continued

3. (b) Write down an expression for the *n*th term of the following sequence.

4, 11, 18, 25, ...

[2 marks]

continued on the next page . . .

Question 3 continued

3. (c) List all of the integers that satisfy the following inequality.

$$13 < 2n < 19$$

Integers are

[2 marks]

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

The diagram shows the line AB.

Using only a ruler and a pair of compasses, construct an angle of $60°$ at point B.

[1 mark]

continued on the next page . . .

Question 4 continued

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

The diagram shows the line *LM*.

***R* is a point on the line *LM*.**

Using only a ruler and a pair of compasses, construct an angle of 90° at point *R*.

[1 mark]

continued on the next page . . .

Question 4 continued

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

The diagram shows the line *XY* and a point *P*.

Using only a ruler and a pair of compasses, construct a perpendicular line from the point *P* to the line *XY*.

[2 marks]

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

Look at the diagram for Question 5 in the separate Diagram Booklet.
The diagram is NOT drawn to scale.

The shape consists of a semicircle attached to one side of a right – angled triangle.

continued on the next page . . .

Question 5 continued

In the diagram,

Angle *ABC* = 90°

***AB* = 8 cm**

***BC* = 6 cm**

***BC* is the diameter of the semicircle.**

Calculate the perimeter of the shape.

Use π = 3•14

You must show all your working.

(Turn over)

(Turn over)

[5 marks + 2 marks OCW]

6. Two time periods are measured as

4 hours 40 minutes and

2 hours 50 minutes.

Each measurement is correct to the nearest 10 minutes.

What is the least possible sum of these two time periods?

Give your answer in hours and minutes.

(Turn over)

Answer =

_____ hours _____ minutes

[3 marks]

7. Whitney walks, cycles or travels on the bus to work each day.

On any randomly chosen day:

- the probability that she walks to work is 0·25
- the probability that she cycles to work is 0·45

At work, the probability that there will be a fire drill on any randomly chosen day is 0·04

How Whitney travels to work is independent of whether or not there is a fire drill.

continued on the next page . . .

Question 7 continued

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

The diagram is an incomplete tree diagram.

Complete the tree diagram.

[3 marks]

Question 7 continued

7. (b) On a randomly chosen day, what is the probability that Whitney walks to work and there is a fire drill?

[2 marks]

8. Look at the table for Question 8 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]

9. (a) Express $0 \cdot 0076$ in standard form.

_____

_____

[1 mark]

continued on the next page . . .

Question 9 continued

9. (b) Calculate the value of

$$(3 \times 10^{17}) \times (2 \times 10^{-12})$$

Give your answer in standard form.

[1 mark]

continued on the next page . . .

Question 9 continued

9. (c) Calculate the value of

$$(2{\cdot}3 \times 10^4) + (5 \times 10^3)$$

Give your answer in standard form.

[2 marks]

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

The diagram is NOT drawn to scale.

***XY* is a tangent to a circle, centre *O*, at the point *A*.**

Angle *AYO* = 54°

(a) What percentage of the whole circle is shaded?

You MUST show how you calculated your answer.

(Turn over)

[3 marks]

continued on the next page . . .

Question 10 continued

10. (b) What tangent property of circles did you use in order to answer part (a)?

[1 mark]

11. (a) Given that y is inversely proportional to x and that $y = 0{\cdot}2$ when $x = 160$, find an expression for y in terms of x.

[3 marks]

continued on the next page . . .

Question 11 continued

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

x	y
160	0·2
128	
	0·8

[2 marks]

12. Ask for the models for Question 12.

The models are NOT made to scale.

The models represent a sphere and a cone.

The sphere has a diameter of 6 cm.

The cone has a base radius of 10 cm and a height of 9 cm.

Find the ratio of the volume of the sphere to the volume of the cone.

Give your answer in its simplest form.

(Turn over)

Volume of the sphere : Volume of the cone

= _____ : _____

[4 marks]

13. Look at the diagram for Question 13 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

Triangle *ABC* is right – angled.

The area of triangle *ABC* is 0•75 m^2

(a) Show that $16x^2 - 8x - 3 = 0$

(Turn over)

[3 marks]

continued on the next page . . .

Question 13 continued

13. (b) (i) Solve the equation

$$16x^2 - 8x - 3 = 0$$

You must use an algebraic method.

[3 marks]

Question 13 (b) continued

13. (b) (ii) Find the length of *BC*.

You must JUSTIFY any decision that you make.

[1 mark]

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

The table shows some of the values of $y = x + \frac{1}{x}$ for values of x from 0•2 to 4

(a) (i) Complete the table by finding the value of y for $x = 0•5$

[1 mark]

Question 14 (a) continued

14. (a) (ii) On the graph paper provided for Question 14 (a) (ii) in the separate Diagram Booklet, draw the graph of

$$y = x + \frac{1}{x}$$ for values of x from 0·2 to 4

[2 marks]

continued on the next page . . .

Question 14 continued

14. (b) Use your graph to solve the equation $x + \frac{1}{x} = 3$

[2 marks]

15. A box contains 5 blue discs and 3 yellow discs.

Three discs are to be chosen at random, without replacement.

(a) Calculate the probability that the three discs chosen will all be the same colour.

[3 marks]

continued on the next page . . .

Question 15 continued

15. (b) Calculate the probability that exactly one blue disc is selected.

[3 marks]

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

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

(a) Given that $\sin 62° = 0{\cdot}8829$, correct to 4 decimal places, write down all the solutions of the equation

$$\sin x = -0{\cdot}8829$$

for values of x from $0°$ to $360°$

(Turn over)

[2 marks]

continued on the next page . . .

Question 16 continued

16. (b) (i) Look at the diagram for Question 16 (b) (i) in the separate Diagram Booklet.

The diagram shows a set of axes.

Use the axes to sketch the graph of $y = -\sin x$ for values of x from $0°$ to $360°$

You must indicate any important values on the y – axis.

[2 marks]

continued on the next page . . .

Question 16 (b) continued

16. (b) (ii) Look at the diagram for Question 16 (b) (ii) in the separate Diagram Booklet.

The diagram shows a set of axes.

Use the axes to sketch the graph of $y = \sin x + 1$ for values of x from $0°$ to $360°$

You must indicate any important values on the y – axis.

[2 marks]

17. (a) Expand and simplify

$$\left(4 - \sqrt{6}\right)\left(1 + \sqrt{6}\right)$$

(Turn over)

[2 marks]

continued on the next page . . .

Question 17 continued

17. (b) (i) Write down an INTEGER value of x that is greater than 5, for which $x^{\frac{3}{2}}$ is rational.

$x =$ _____

[1 mark]

continued on the next page . . .

Question 17 (b) continued

17. (b) (ii) Write down an INTEGER value of x that is greater than 5, for which $x^{\frac{2}{3}}$ is rational.

$x =$ _____

[1 mark]

continued on the next page . . .

Question 17 (b) continued

17. (b) (iii) Write down an INTEGER value of x that is greater than 5, for which $x^{\frac{3}{2}}$ AND $x^{\frac{2}{3}}$ are both rational.

x = _____

[1 mark]

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

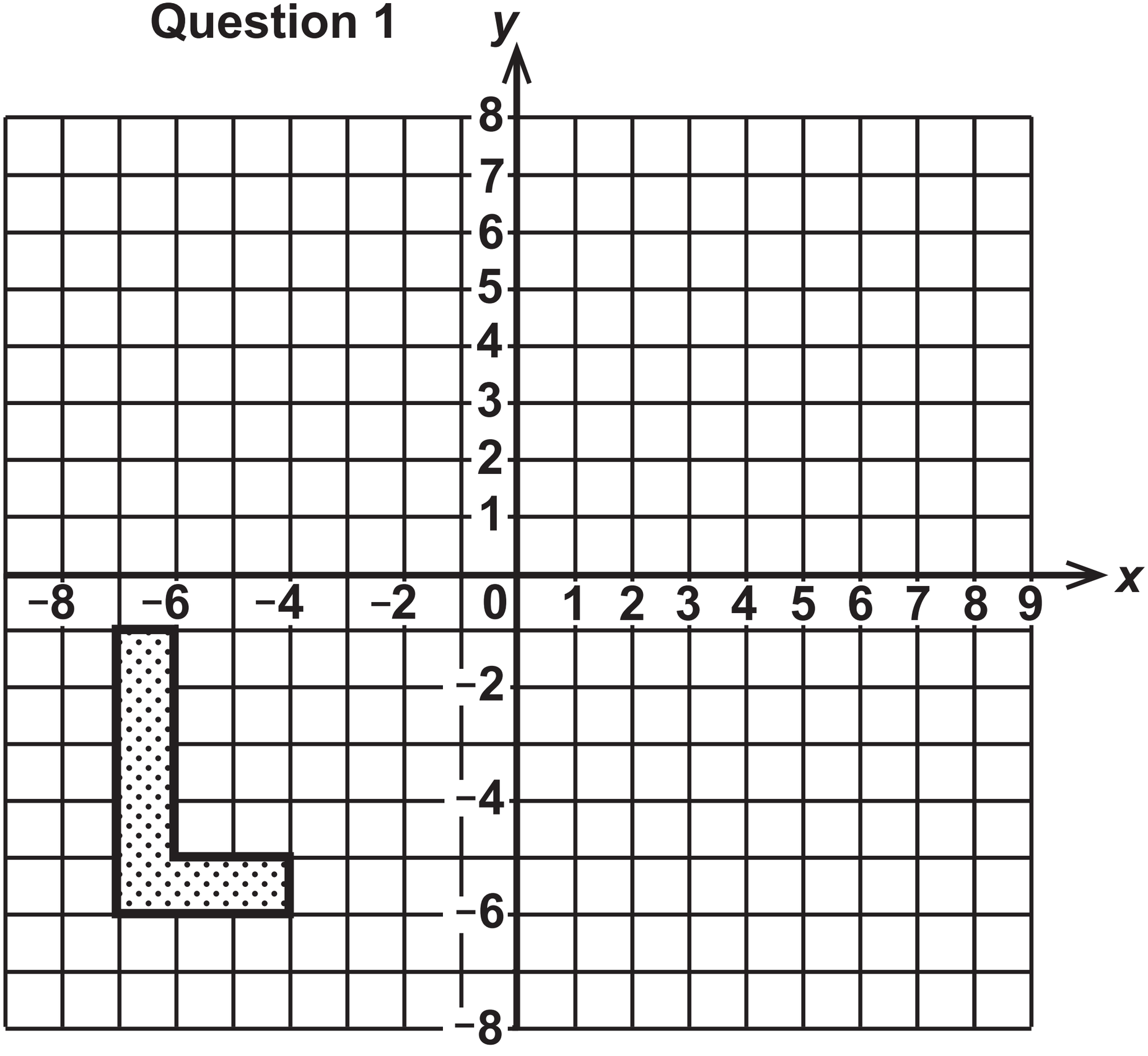
Surname: _____

First name(s): _____

Centre Number: _____

Candidate Number: 0_____

Question 1



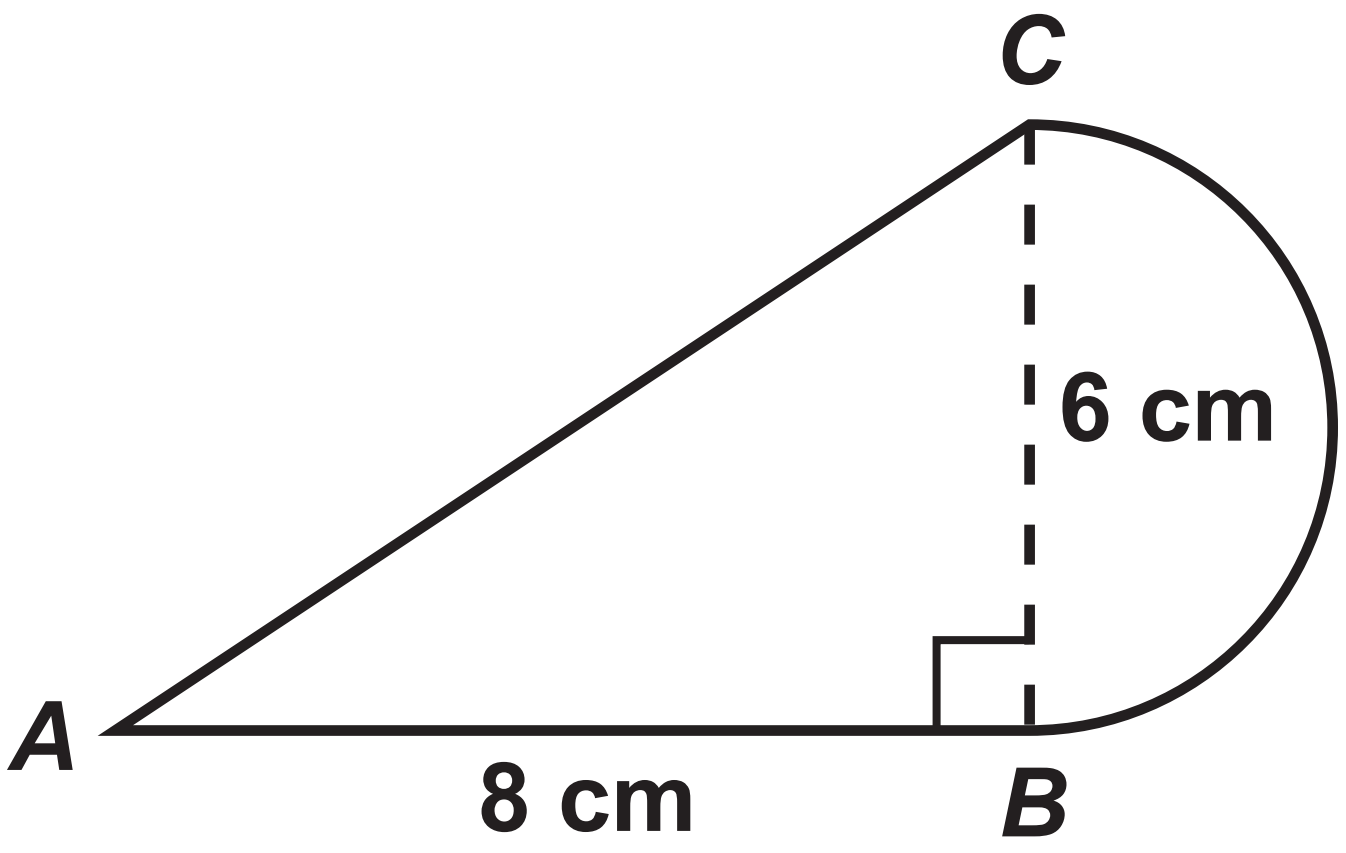
Question 4 (a)

Question 4 (b)

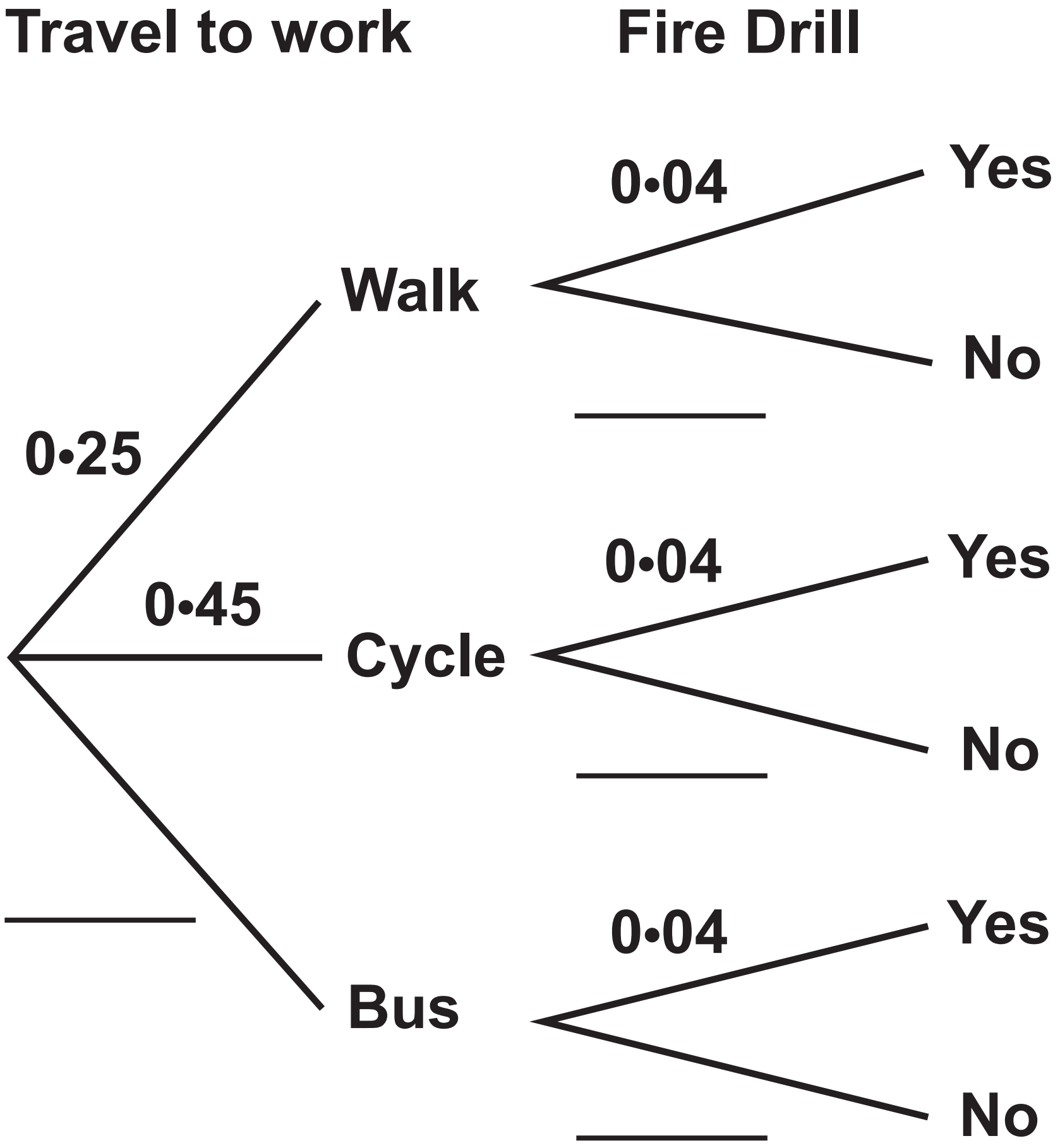
Question 4 (c)

Question 5

Diagram NOT drawn to scale



Question 7 (a)


Travel to work
Fire Drill
Walk
0·25
0·04
Yes
No
Cycle
0·45
0·04
Yes
No
Bus
0·04
Yes
No

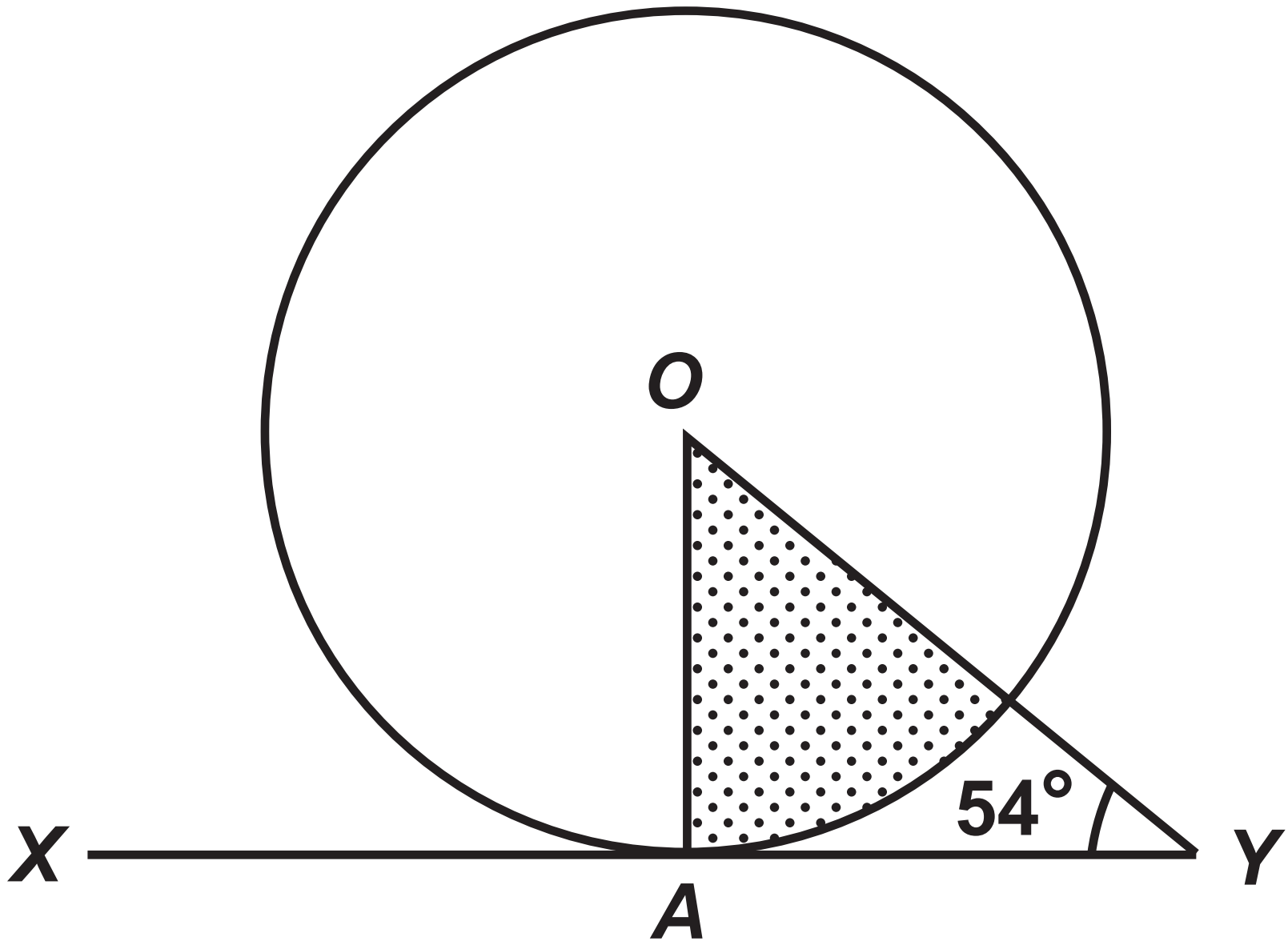
Question 8

Table

FORMULA	FORMULA COULD BE FOR
$4d + r - 2w$	length
$w(x + b + h)$	
$d^3 + 3{\cdot}14r$	
$\frac{w^3}{d^2}$	
$3{\cdot}14r^3 - xbh$	
$\frac{4w^2}{d}$	

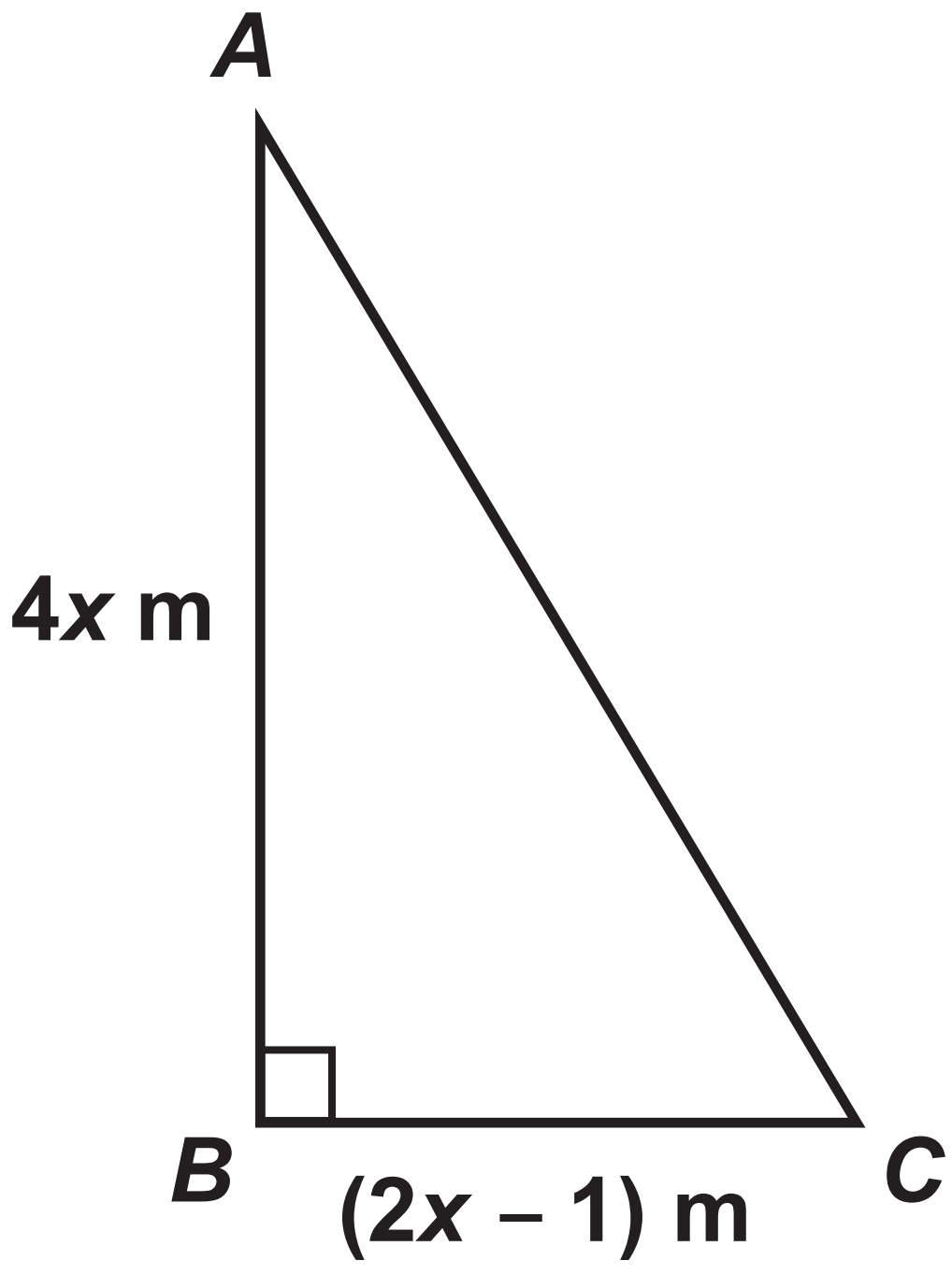
Question 10

Diagram NOT drawn to scale



Question 13

Diagram NOT drawn to scale

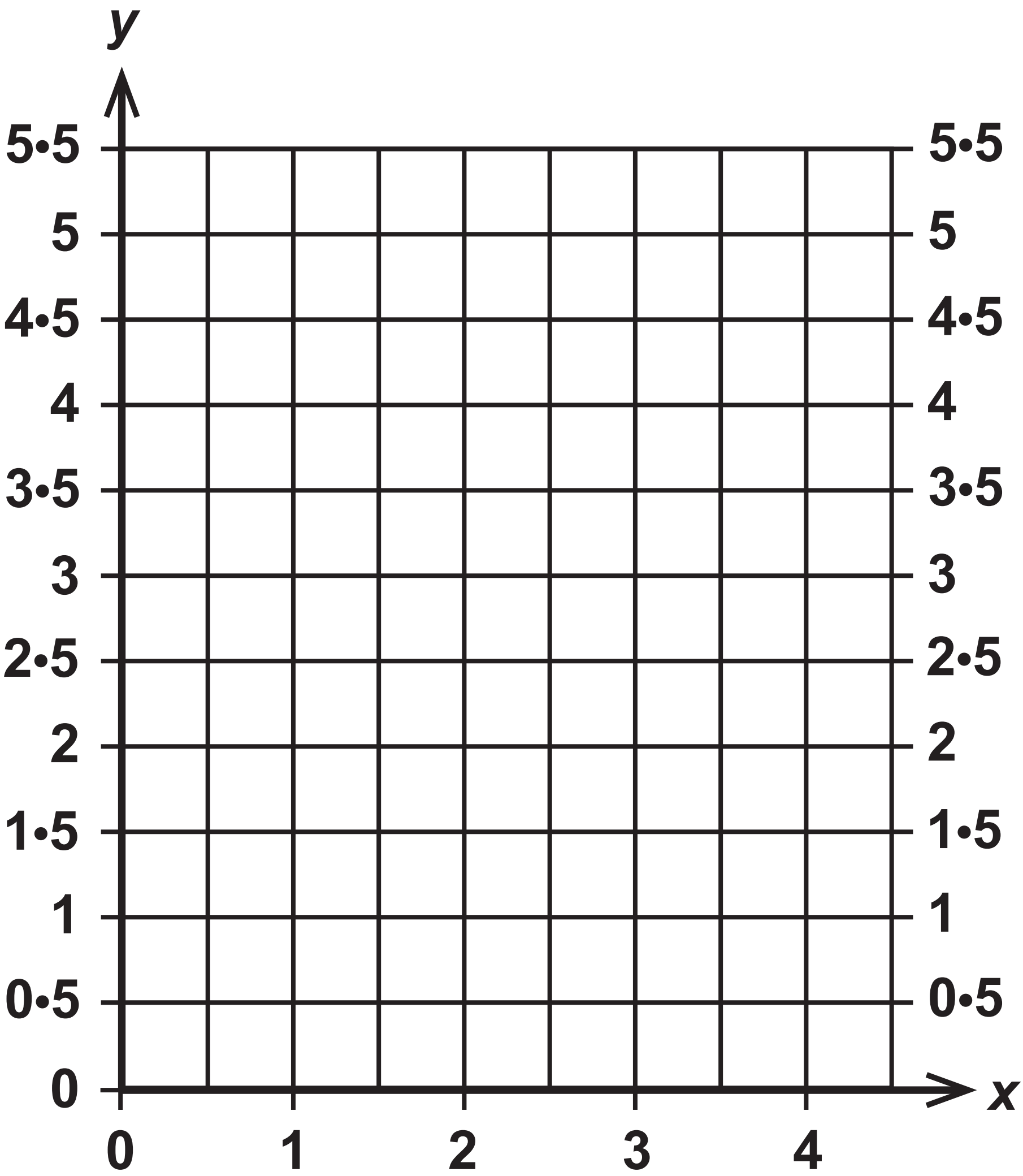


Question 14

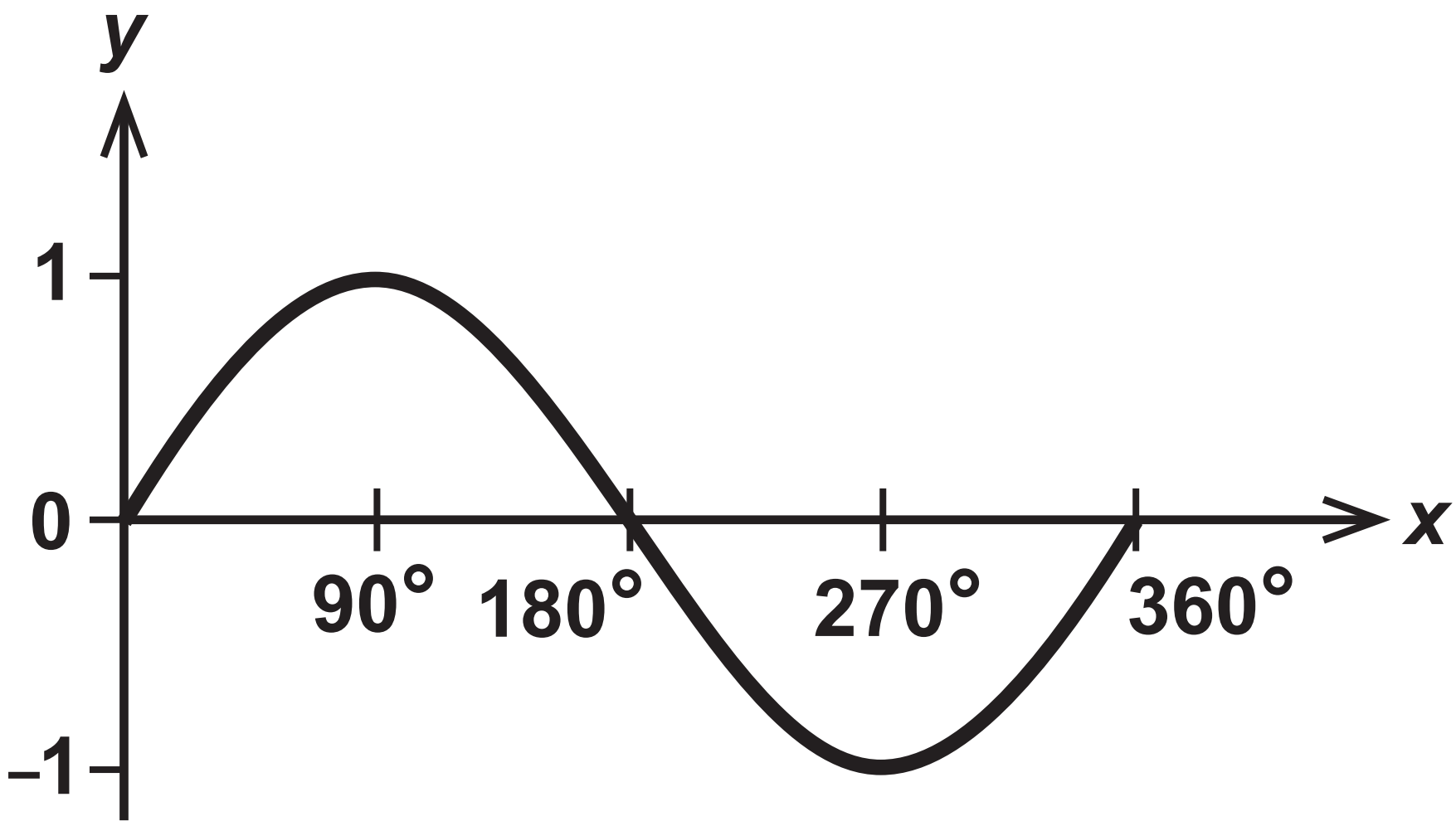
Table

x	$y = x + \frac{1}{x}$
0·2	5·2
0·5	
0·8	2·05
1	2
2	2·5
3	$3\dot{3}$
4	4·25

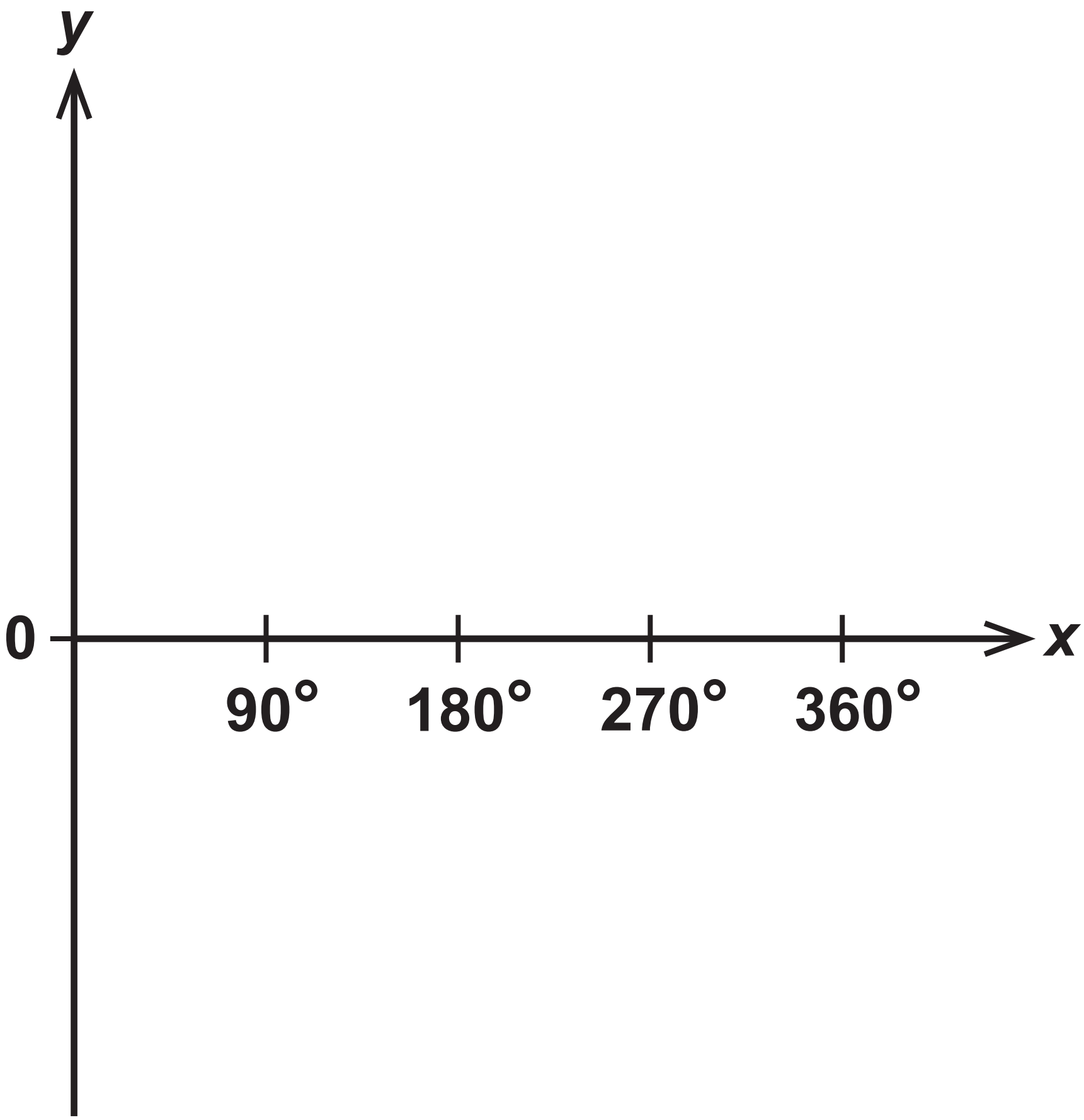
Question 14 (a) (ii)



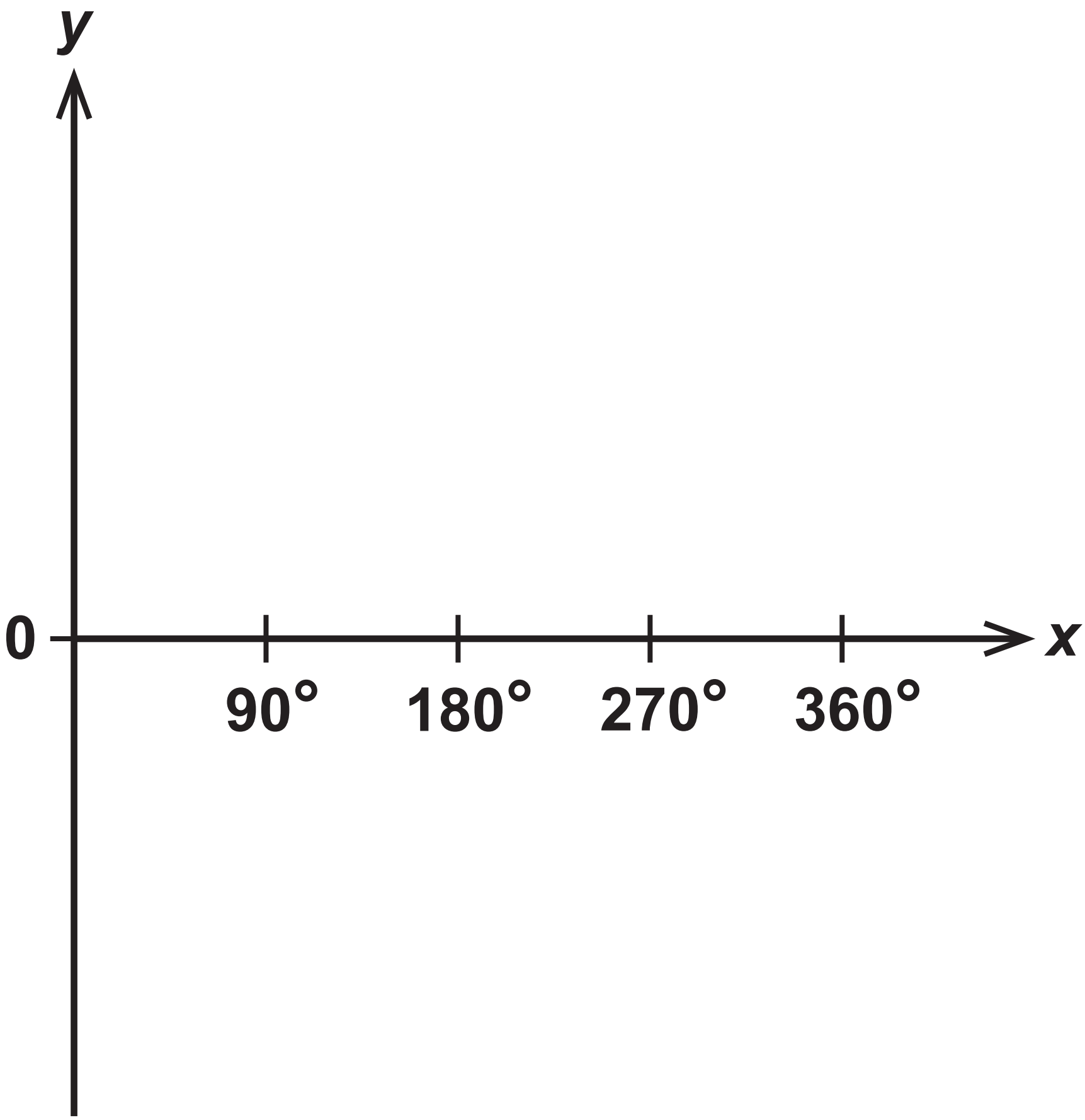
Question 16



Question 16 (b) (i)



Question 16 (b) (ii)



GCSE
MATHEMATICS
and
NUMERACY

FORMULA LIST

HIGHER TIER

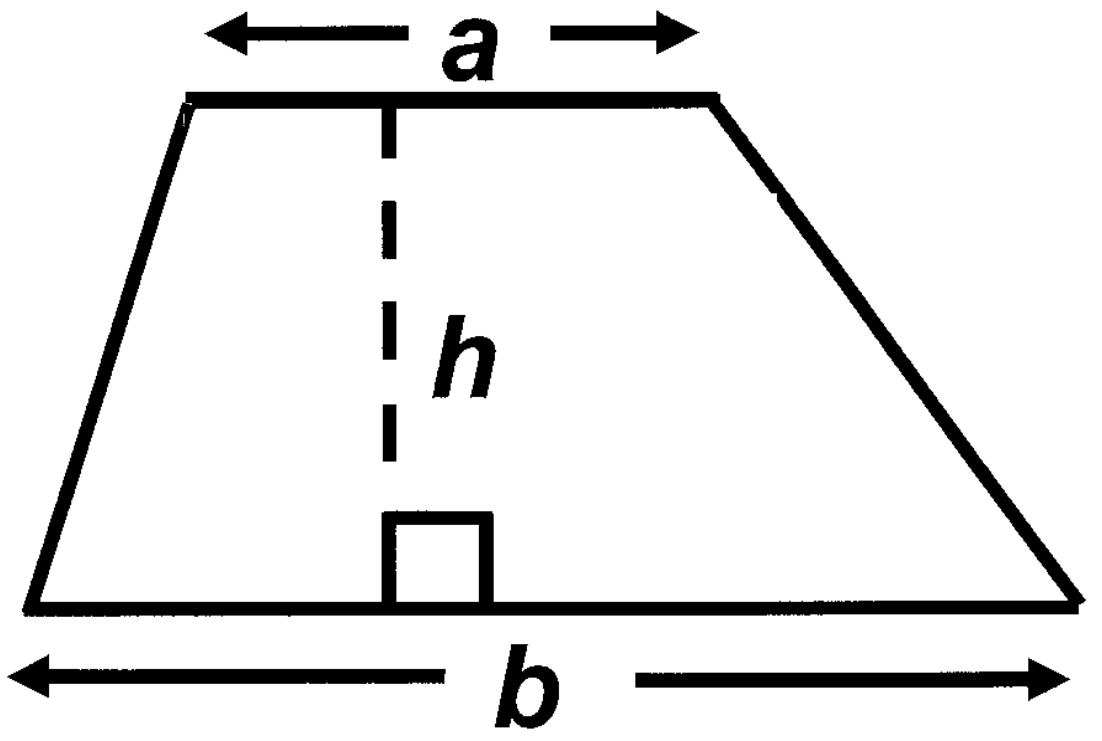
GCSE

You must not write on these formula pages.

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

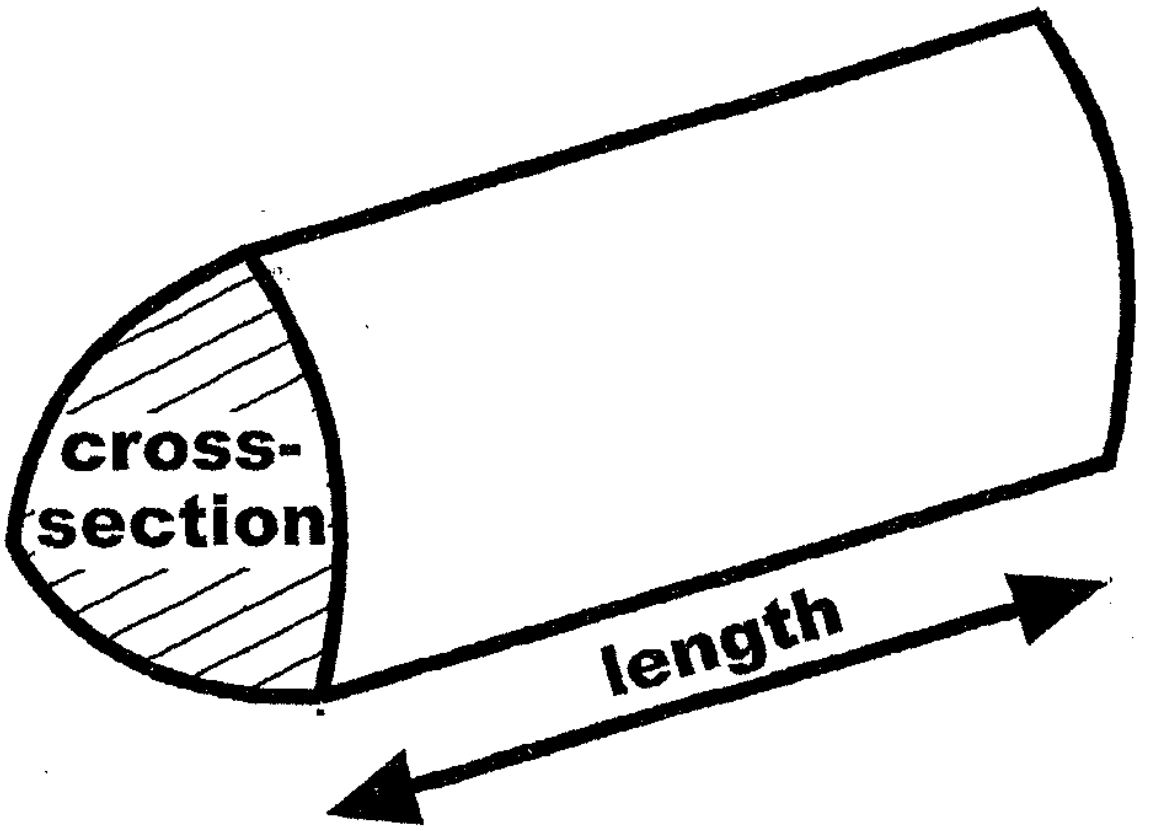
Formula List – Higher Tier

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



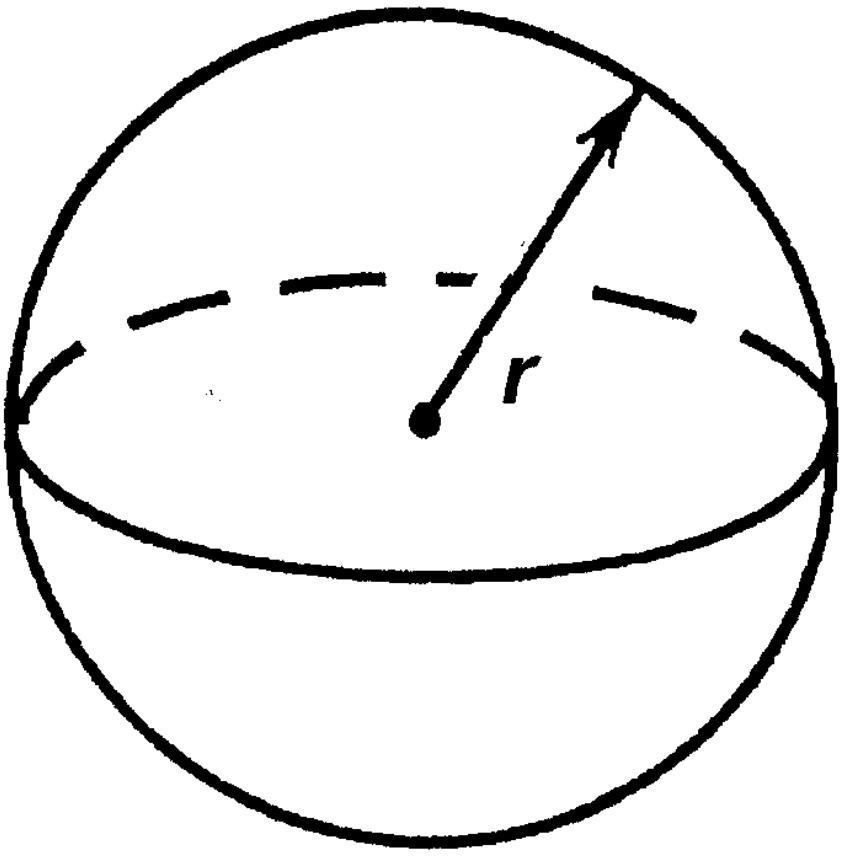
Volume of prism =

area of cross – section × length



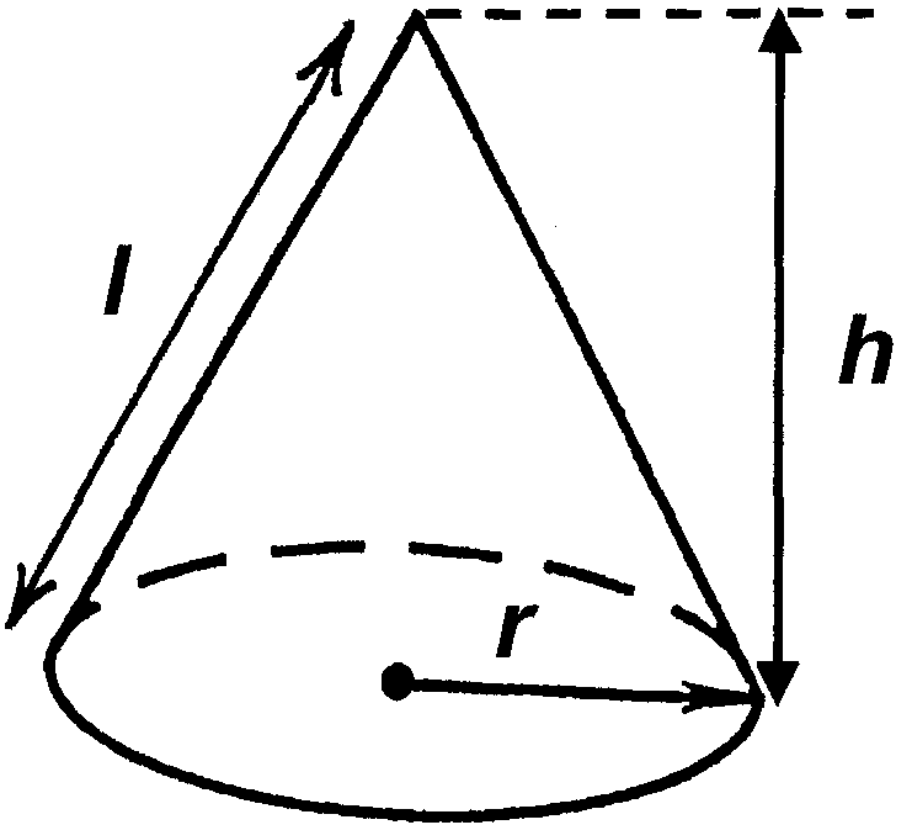
Volume of sphere $= \frac{4}{3}\pi r^3$

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

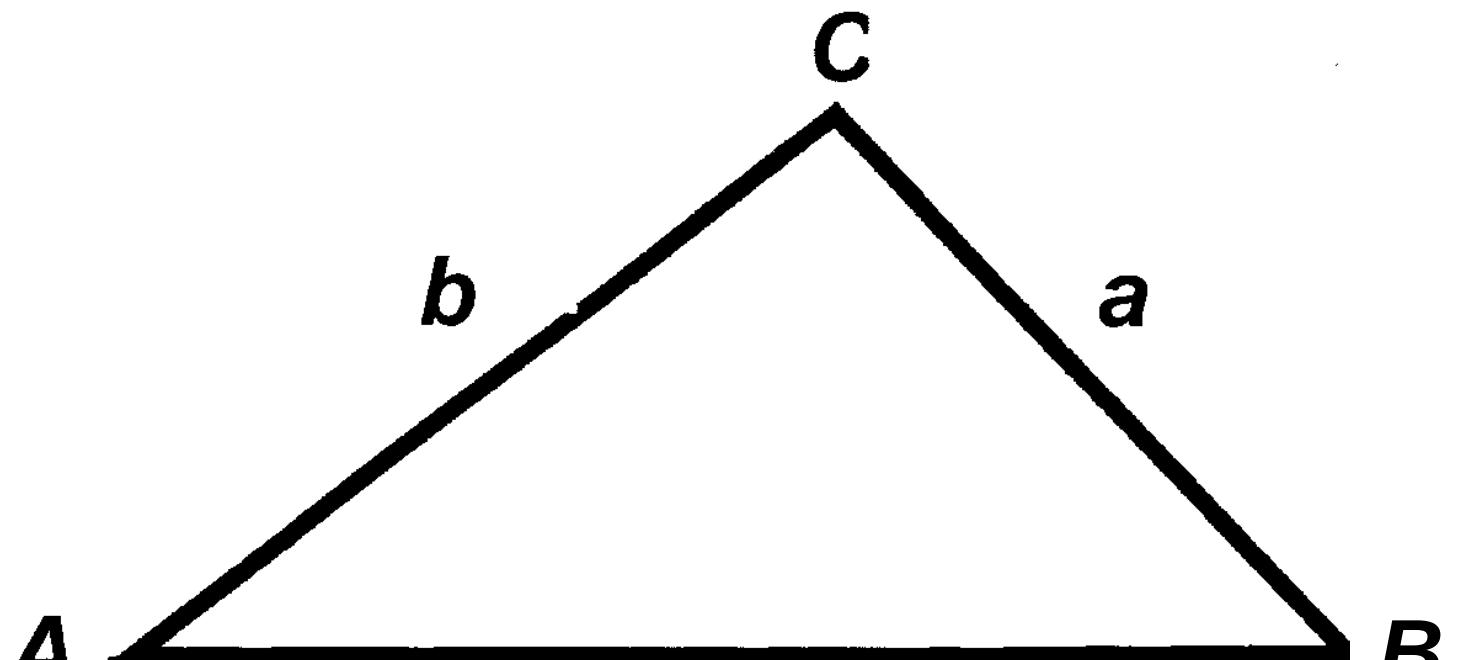


Volume of cone $= \frac{1}{3}\pi r^2 h$

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.