



GCSE



C300UB0-1

TUESDAY, 7 JUNE 2022 – 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.	4	
2.	3	
3.	5	
4.	5	
5.	7	
6.	6	
7.	5	
8.	4	
9.	4	
10.	5	
11.	4	
12.	3	
13.	4	
14.	3	
15.	5	
16.	7	
17.	4	
18.	3	
19.	5	
20.	5	
21.	5	
22.	5	
23.	10	
24.	9	
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.

Model for Question 8.

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)

1. The table below shows the mass of 90 carrots grown by a gardener.

Mass, m (grams)	Number of carrots
$30 < m \leq 60$	9
$60 < m \leq 90$	33
$90 < m \leq 120$	38
$120 < m \leq 150$	8
$150 < m \leq 180$	2

Calculate an estimate for the mean mass of these carrots.

(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.

[4 marks]
(Turn over)

- 2. Jan, Freda and Pieter share some money.**

Freda gets 3 times as much as Jan.

Pieter gets half as much as Freda.

- (a) Write down the ratio of the amounts of money that they each get.**

Give your answer in its simplest form.

(Turn over)

Jan : Freda : Pieter =

_____ : _____ : _____

[2 marks]

continued on the next page . . .

(Turn over)

Question 2 continued

**2. (b) What fraction of the money
does Pieter get?**

[1 mark]

(Turn over)

3.

EDUDIG Digger £35 950
--

Samir buys this digger and expects to use it for 1250 hours each year.

The digger will decrease in value at a yearly rate of 18% of its value at the end of the previous year.

Use this information to calculate the decrease in value of Samir's digger when it has been used for 10 000 hours.

(Turn over)

(Turn over)

12

[5 marks]

(Turn over)

**4. A circular wheel makes
42 complete turns each minute.**

**(a) How many degrees does it turn
through in one second?**

14

[illegible]

[3 marks]
(Turn over)

Question 4 continued

4. (b) (i) State ONE assumption you have made in your answer to part (a).

[1 mark]

continued on the next page . . .

(Turn over)

Question 4 (b) continued

4. (b) (ii) How would your answer to part (a) change if this assumption was not correct?

[1 mark]

(Turn over)

5. (a) Solve $2x + 5 = 11 + 5x$

[2 marks]

continued on the next page . . .

(Turn over)

Question 5 continued

5. (b) Solve $8x - (3x + 1) = 2$

Give your answer as a fraction.

[3 marks]

continued on the next page . . .

(Turn over)

Question 5 continued

- 5. (c) Tansy is trying to solve**
 $1 < x + 2 \leq 5$ where x is a
whole number.
Here is her work.

$$1 - 2 < x \text{ and } x \leq 5 - 2$$

$$- 1 < x \text{ and } x \leq 3$$

$$- 1 < x \leq 3$$

x is $- 1, 0, 1, 2$ or 3

continued on the next page . . .

(Turn over)

Question 5 (c) continued

Ali says,

“You have made an error.”

Is Ali correct?

Yes ☐

No ☐

Show clearly how you decide.

(Turn over)

[1 mark]

continued on the next page . . .

(Turn over)

Question 5 continued

- 5. (d) Look at the diagram for Question 5 (d) in the separate Diagram Booklet. The diagram shows a number line.**

**Represent the inequality
 $x > -2$ on the number line.**

[1 mark]

(Turn over)

6. In an experiment, a scientist records the temperature, $y^{\circ}\text{C}$, of an object as it is heated for x seconds.

The scientist thinks that the equation $y = mx + c$ is a good fit for this data.

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

The diagram shows his results on a scatter graph and his line of best fit.

continued on the next page . . .

(Turn over)

Question 6 continued

- 6. (a) Estimate the number of seconds for which the object has been heated when its temperature is 35°C**

[1 mark]

continued on the next page . . .

(Turn over)

Question 6 continued

- 6. (b) When $x = 70$ seconds, the scientist measures the value of y to be 52°C**

Use this information to decide whether the line of best fit is likely or unlikely to give reliable predictions for values of y when x is greater than 50 seconds.

Likely

☐

Unlikely

☐

Explain how you decide.

(Turn over)

[1 mark]

continued on the next page . . .

(Turn over)

Question 6 continued

- 6. (c) The line of best fit passes through the points (0, 15) and (10, 22)**

Find the equation of the line of best fit.

Give your answer in the form

$y = mx + c$

(Turn over)

[3 marks]
(Turn over)

Question 6 continued

6. (d) Explain what the gradient of the line of best fit represents in this context.

[1 mark]

(Turn over)

7. Look at the diagram for Question 7 in the separate Diagram Booklet. The diagram is NOT drawn to scale.

ABC is a right – angled triangle.

AB = 4.8 cm and angle *BAC* = 57°

Calculate the area of triangle *ABC*.

[illegible]

(Turn over)

Area = _____ **cm²**

[5 marks]

(Turn over)

8. Ask for the models for Question 8.
The models are NOT made to scale.

A wedge is cut from a cylinder
of cheese of radius 7 cm and
height 5 cm. The volume of this
wedge is 154 cm^3

What percentage of the whole
cheese is this wedge?

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.

[4 marks]

(Turn over)

9. Bronny takes part in a triathlon.

In this race she:

- **swims 1.5 km in $\frac{3}{4}$ hour,**
- **cycles at an average speed of 27 km/h for 1 hour and 30 minutes,**
- **runs 9 km in 1 hour.**

The average speed of the winner of the triathlon is 16.1 km/h.

Show that Bronny does not win the race.

(Turn over)

[illegible]

(Turn over)

[4 marks]

(Turn over)

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

David is trying archery for the first time.

He stands at A and tries to shoot an arrow at the target T but misses.

The arrow lands at a point X such that:

- **X is equidistant from S and R ,**
- **XY is perpendicular to the path.**

continued on the next page . . .

(Turn over)

Question 10 continued

Construct accurately the position of X and measure by how many degrees David's shot is inaccurate. You must use a ruler and a pair of compasses to construct suitable arcs and lines.

David's shot is inaccurate

by _____°

[5 marks]

(Turn over)

11. Look at the diagram for Question 11 in the separate Diagram Booklet.

The diagram shows triangle ABC and triangle PQR on a coordinate grid.

(a) Describe the single transformation that maps triangle ABC to triangle PQR .

[2 marks]

continued on the next page . . .

(Turn over)

Question 11 continued

- 11. (b) On the grid, draw the enlargement of triangle ABC , scale factor -1 , centre $(0, 3)$**

[2 marks]

(Turn over)

12. (a) Find the next term of the following sequence.

0, 7, 26, 63, 124, _____

[1 mark]

continued on the next page . . .

(Turn over)

Question 12 continued

12. (b) Find the n th term of the following sequence.

3, 9, 19, 33, 51, ...

(Turn over)

[2 marks]

(Turn over)

13. A cuboid of copper has a mass of 2150.4 grams and a volume of 240 cm^3

A sphere of copper has a radius of $x \text{ cm}$.

Show that the mass, in grams, of the sphere is less than $38x^3$

(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)

[4 marks]

(Turn over)

14. Simplify $\frac{(5x^2y)^5}{y^6}$

(Turn over)

51

[3 marks]

(Turn over)

- 15. (a) Jim squeezes 1 pink grapefruit.
He obtains 250 ml of juice,
CORRECT TO THE NEAREST
50 ml.**

**Jim thinks he will obtain a
maximum of 900 ml of juice if
he squeezes 3 pink grapefruit.**

**Assuming each pink grapefruit
is the same size, is Jim likely
to be correct?**

Yes

☐

No

☐

Show how you decide.

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 15 continued

15. (b) The mass of a red grapefruit is 150 grams, CORRECT TO THE NEAREST 5 GRAMS.

The mass of a lemon is 85 grams, CORRECT TO THE NEAREST 5 GRAMS.

The total mass, CORRECT TO THE NEAREST 5 GRAMS, of this red grapefruit, lemon and an orange is 370 grams.

continued on the next page . . .

(Turn over)

Question 15 (b) continued

**Calculate the minimum mass
of the orange.**

(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.

[3 marks]
(Turn over)

16. As part of an experiment two groups of people, *A* and *B*, took the same general knowledge test.

The test had a maximum of 100 marks.

(a) Look at the table for Question 16 (a) in the separate Diagram Booklet.

The first two columns of the table summarise the results of the test for the 45 people in GROUP A.

continued on the next page . . .

(Turn over)

Question 16 (a) continued

**16. (a) (i) Complete the cumulative
frequency column.**

[1 mark]

continued on the next page . . .

(Turn over)

Question 16 (a) continued

**16. (a) (ii) Explain why 60 is a
reasonable estimate of
the median mark.**

[1 mark]

continued on the next page . . .

(Turn over)

Question 16 continued

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

The diagram is a box plot.

The box plot shows the distribution of the marks of the people in GROUP *B*.

continued on the next page . . .

(Turn over)

Question 16 (b) continued**16. (b) (i) For the people in GROUP A:**

Minimum mark	25
Range	75
Lower quartile	45
Median	60
Upper quartile	75

**Draw the box plot for GROUP A
on the grid.**

[3 marks]
(Turn over)

Question 16 (b) continued

- 16. (b) (ii) Make TWO comments to compare the results of GROUP A and GROUP B. One comment must include an appropriate average. The other comment must include a measure of spread.**

Comment 1 _____

(Turn over)

Question 16 (b) (ii) continued

Comment 2 _____

[2 marks]

(Turn over)

- 17. On the grid provided for Question 17 in the separate Diagram Booklet, draw the region which satisfies all of these inequalities.**

$$y \leq 5$$

$$y < 3 - 2x$$

$$y \geq x + 2$$

$$x \geq -2$$

Indicate clearly the region that is your answer.

(Turn over)

65

[illegible]

[4 marks]
(Turn over)

18. At a hotel, 70 guests completed a feedback survey.

The survey had 3 statements, *A*, *B* and *C*.

Guests could tick 0, 1, 2 or all 3 of these statements.

Look at the diagram for Question 18 in the separate Diagram Booklet.

The diagram is a Venn diagram.

The Venn diagram shows the numbers of the 70 guests who ticked each statement.

continued on the next page . . .

(Turn over)

Question 18 continued

- 18. (a) One of these guests is chosen at random. Find the probability that this guest ticked statement *A* or statement *C* but not statement *B*.**

[1 mark]
(Turn over)

Question 18 continued

- 18. (b) Given that a guest ticked at least one statement, find the probability that this guest ticked statement *B*.**

[2 marks]
(Turn over)

- 19. (a) Find the equation of the line
parallel to $4x = 5 - y$
which passes through the
point $(1, -1)$**

**Give your answer in the form
 $y = mx + c$**

(Turn over)

[3 marks]

continued on the next page . . .

(Turn over)

Question 19 continued

- 19. (b) Find the equation of the line**
perpendicular to $y = 1 - \frac{x}{5}$
which passes through the
point (0, 7)

(Turn over)

72

[2 marks]

(Turn over)

20. R is proportional to $P\left(1 - \frac{P}{100}\right)$

When P is 50, R is 0.02

(a) Find a formula for R in terms of P .

(Turn over)

74

[illegible]

[3 marks]
(Turn over)

Question 20 continued

20. (b) Find the positive value of P for which R is 0

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)

76

[2 marks]

(Turn over)

21. There are 8 seats in the front row of a theatre.

8 friends sit down in this row.

(a) When each friend can sit in any of the 8 seats, find the number of different seating arrangements possible.

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 21 continued

**21. (b) Liesa and Todd are 2 of
the 8 friends.**

**Find the probability that Liesa
is sitting in the first seat on
the left and Todd is sitting
next to her.**

(Turn over)

80

[3 marks]

(Turn over)

**22. A solution, x , of the equation
 $x^3 + x - 1 = 0$ lies in the interval
‘between 0.5 and 1’**

**Kate uses the method of interval
bisection to find the solution
correct to one decimal place.**

**(a) Show that Kate’s second
interval for x is
‘between 0.5 and 0.75’**

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 22 continued

**22. (b) Complete Kate's third interval
for X ,**

'between _____ and 0.75'

[1 mark]

continued on the next page . . .

(Turn over)

Question 22 continued

22. (c) Continue Kate's method of interval bisection to show that the solution is $x = 0.7$ correct to one decimal place.

(Turn over)

85

[2 marks]

(Turn over)

23. Debra buys a total of 4 kg of flour and butter at a market.

She pays £7 for her flour and £9 for her butter.

She buys x kg of flour.

(a) Look at the table for Question 23 (a) in the separate Diagram Booklet.

Complete the table.

[1 mark]

continued on the next page . . .

(Turn over)

Question 23 continued

- 23. (b) The cost per kilogram of her butter is £5 more than the cost per kilogram of her flour.**

Use this information and the table in part (a) to show that

$$5x^2 - 4x - 28 = 0$$

(Turn over)

(Turn over)

[5 marks]

continued on the next page . . .

(Turn over)

Question 23 continued

23. (c) Use an algebraic method to find the cost of a kilogram of her flour.

You must show all your working.

(Turn over)

[4 marks]

(Turn over)

24. Look at the diagram for Question 24 in the separate Diagram Booklet. The diagram is NOT drawn to scale.

Angle ABC is acute.

The area of triangle ABC is 45.0 cm^2

Show that angle $ABC = 50^\circ$ correct to the nearest integer and hence calculate angle ADC .

(Turn over)

(Turn over)

(Turn over)

[9 marks]

END OF PAPER

TOTAL 120 MARKS

(Turn over)

[illegible]

(Turn over)

[illegible]

(Turn over)

[illegible]

C300UB0-1

TUESDAY, 7 JUNE 2022 – 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

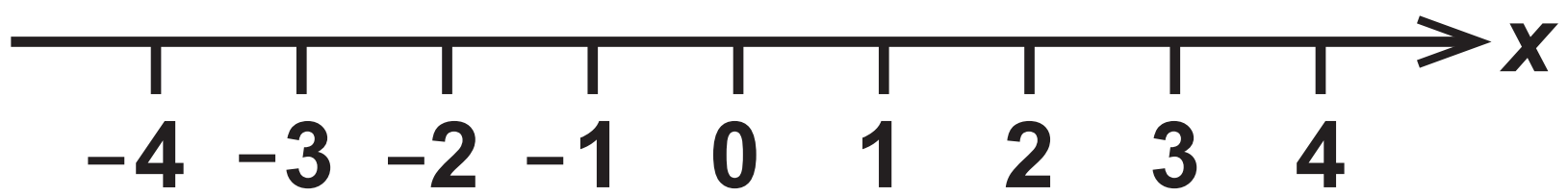
Surname: _____

First name(s): _____

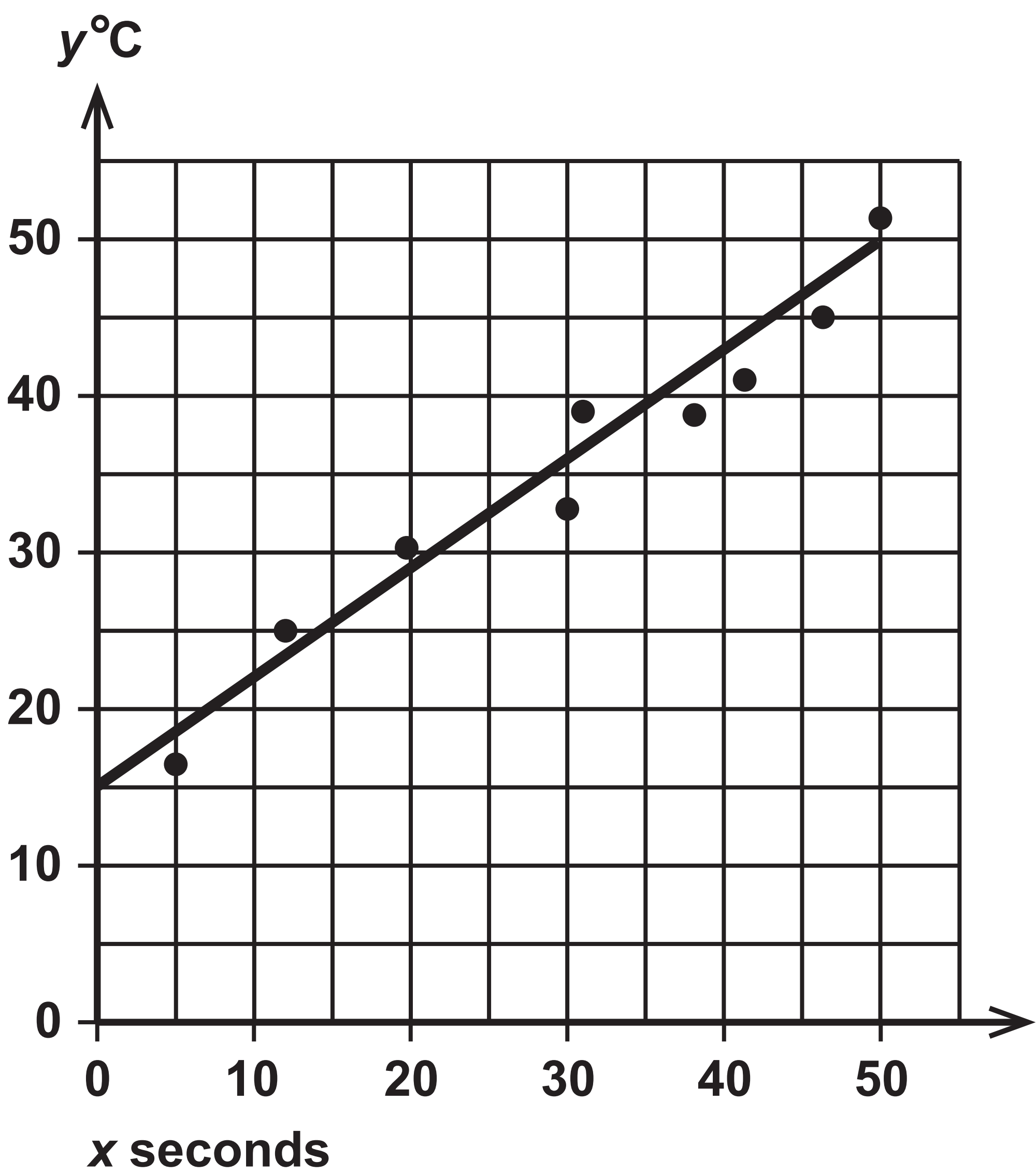
Centre Number: _____

Candidate Number: 0 _____

Question 5 (d)

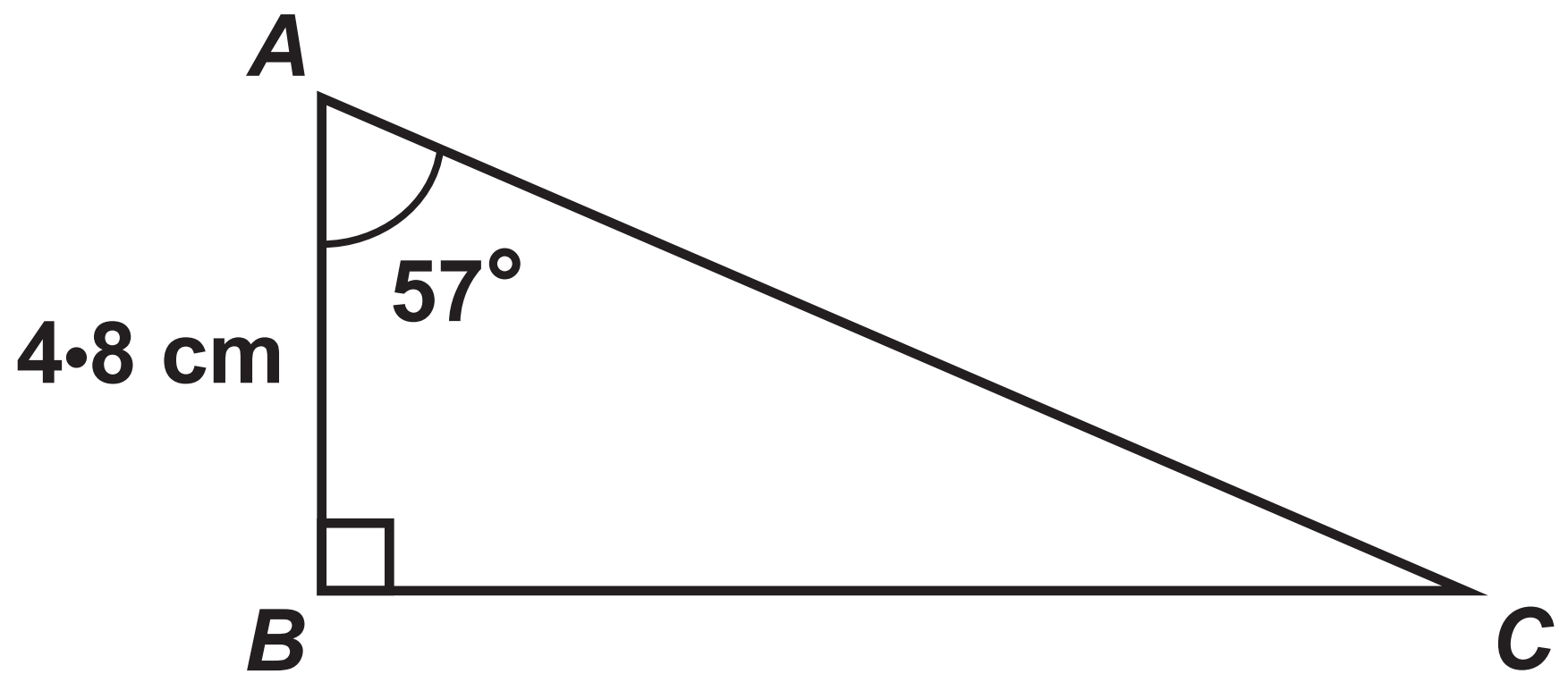


Question 6

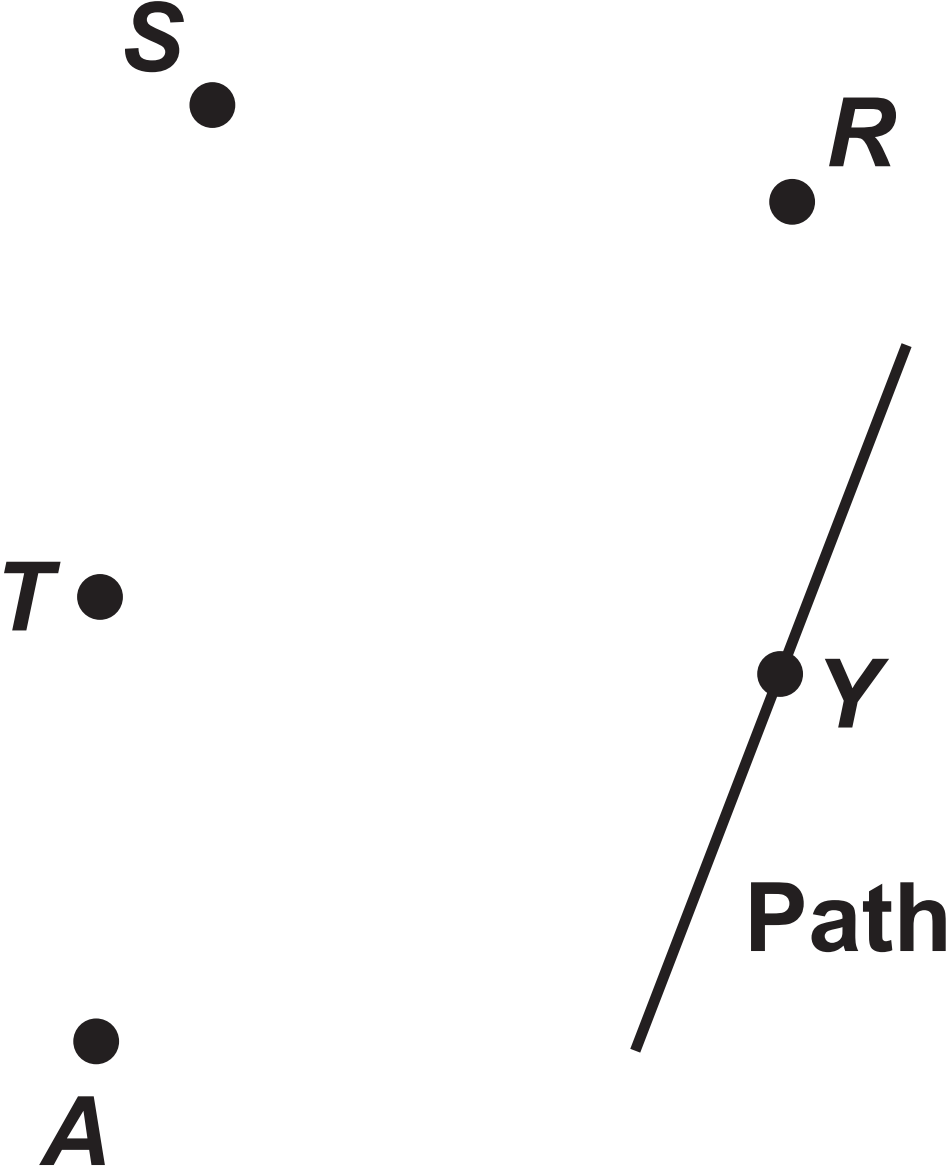


Question 7

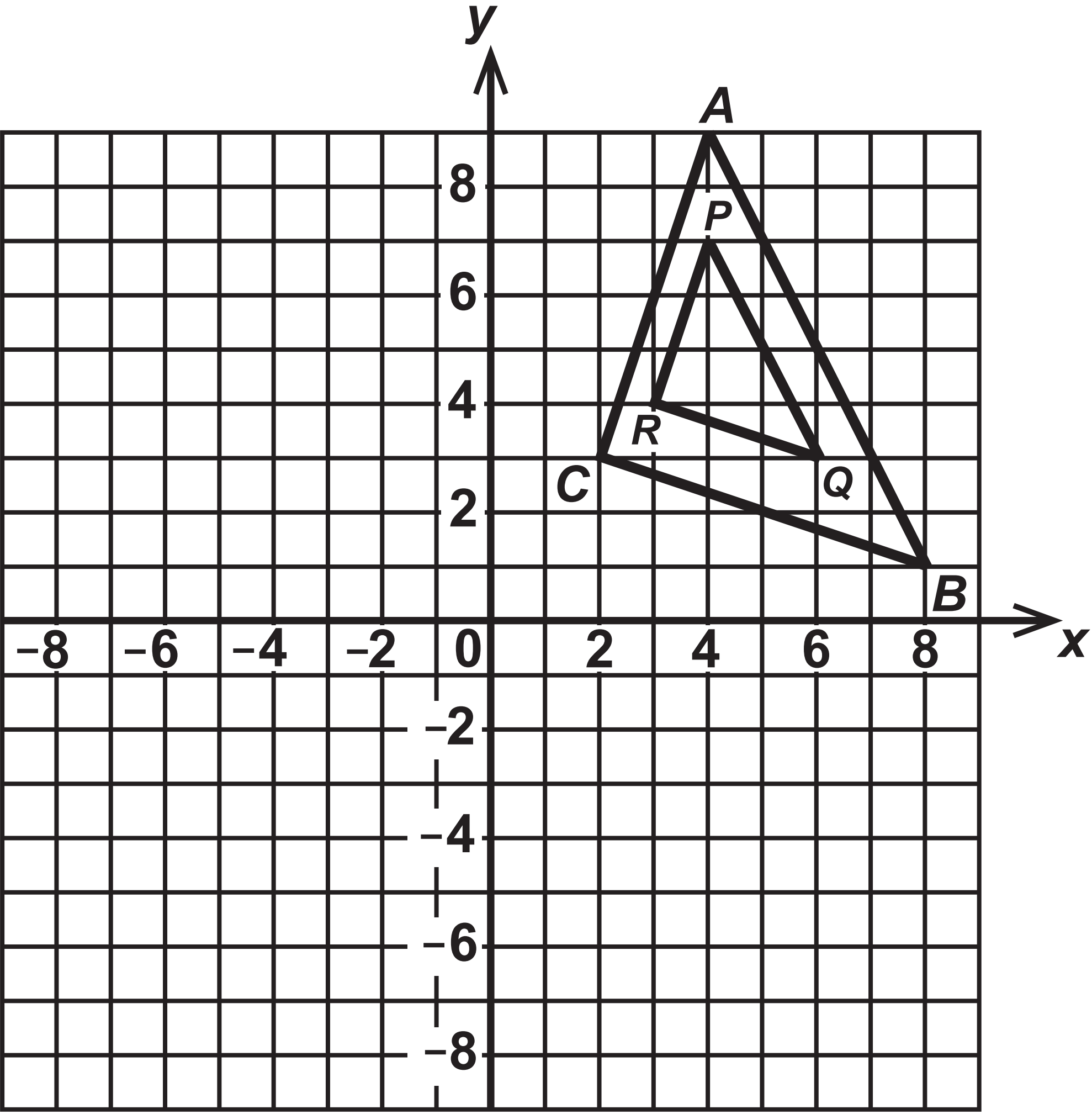
Diagram NOT drawn to scale



Question 10



Question 11

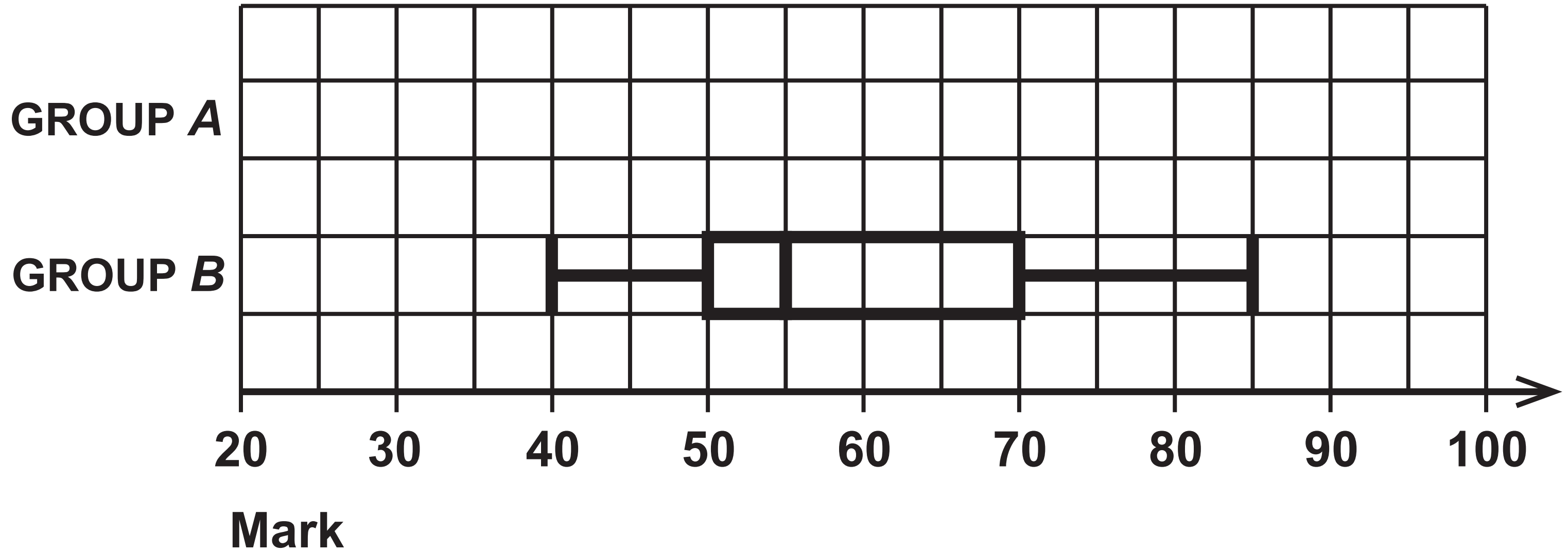


Question 16 (a)

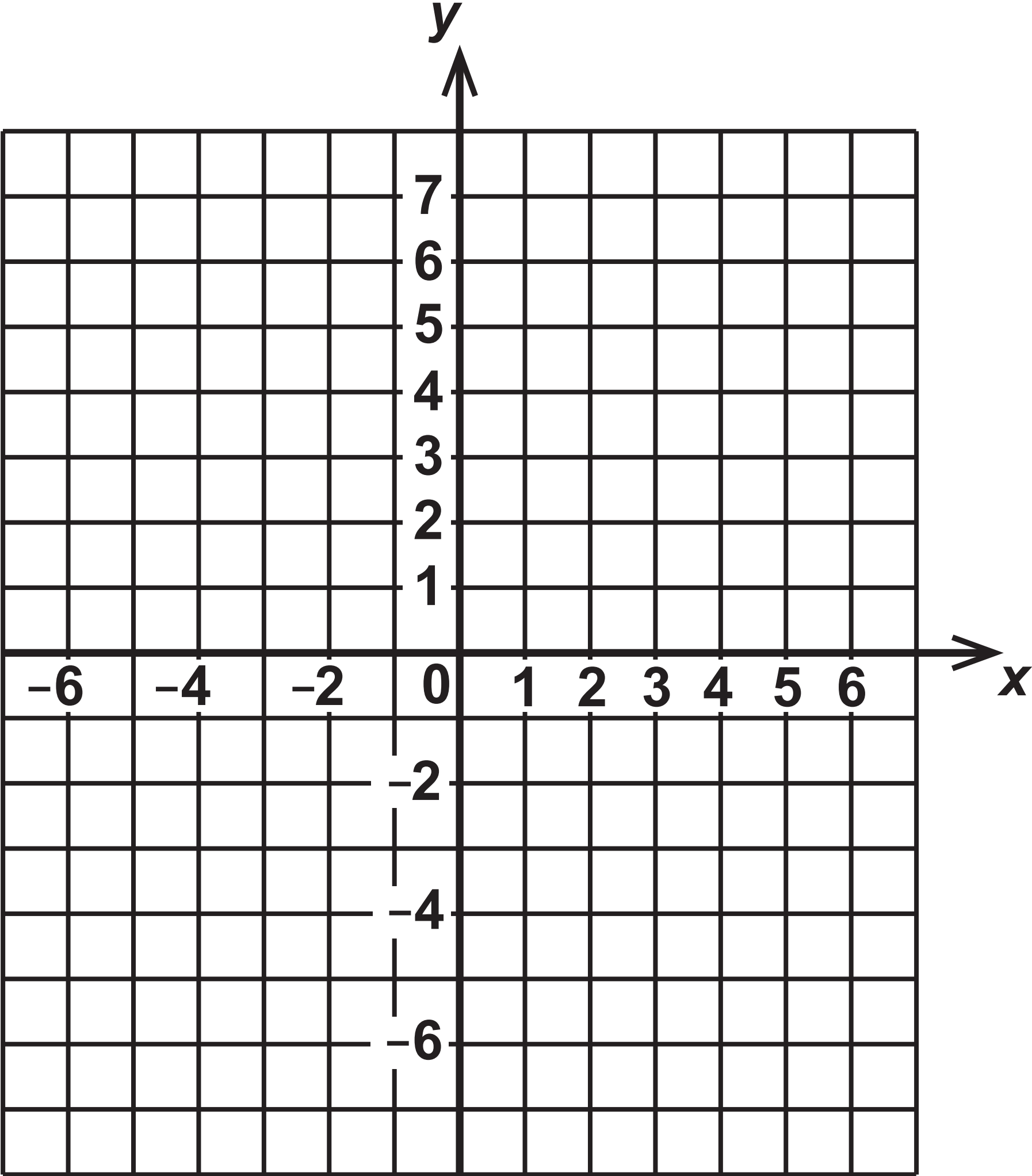
Table

Mark	Frequency	Cumulative Frequency
$0 < p \leq 20$	0	0
$20 < p \leq 40$	7	7
$40 < p \leq 60$	16	
$60 < p \leq 80$	15	
$80 < p \leq 100$	7	

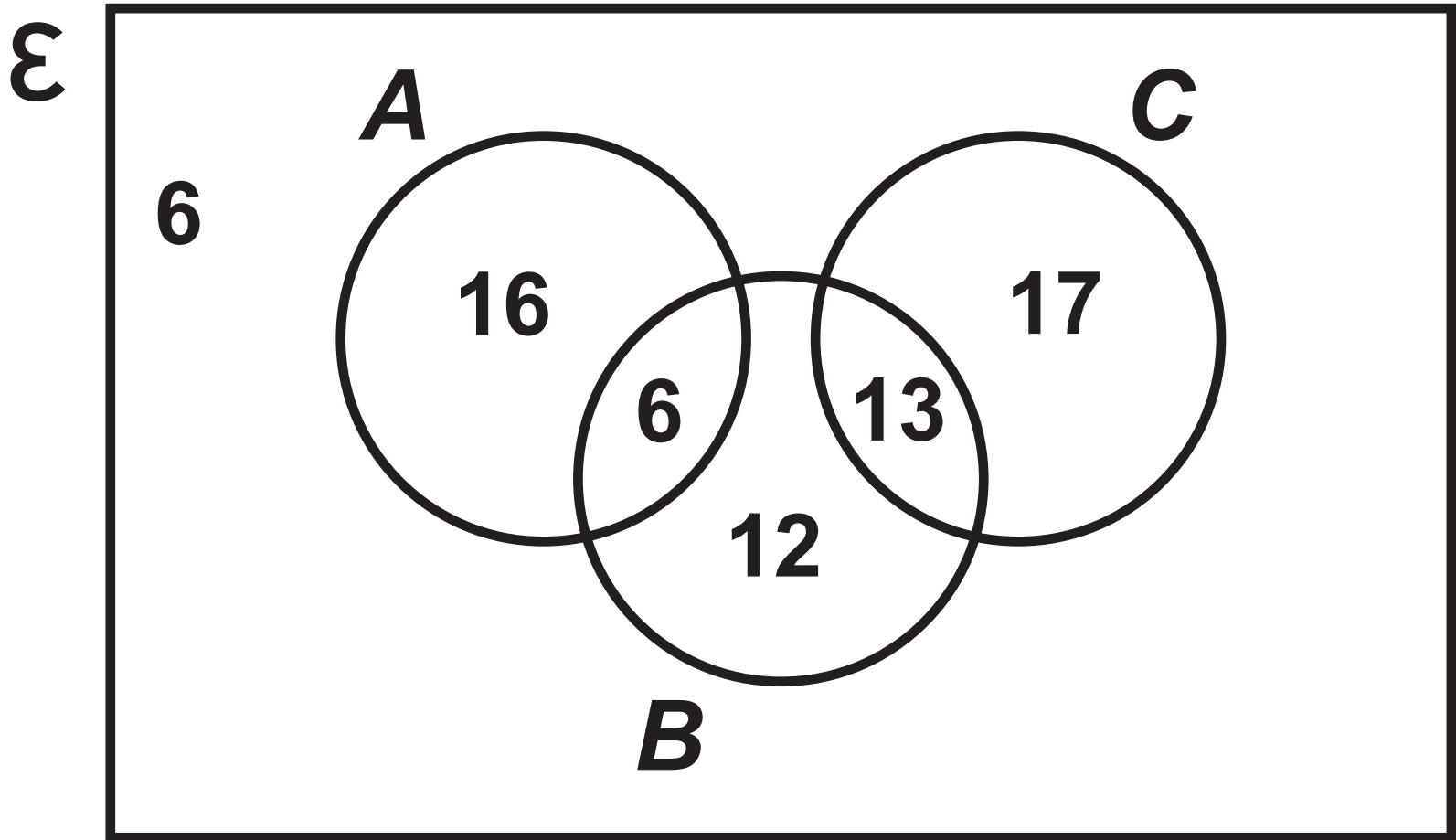
Question 16 (b)



Question 17



Question 18



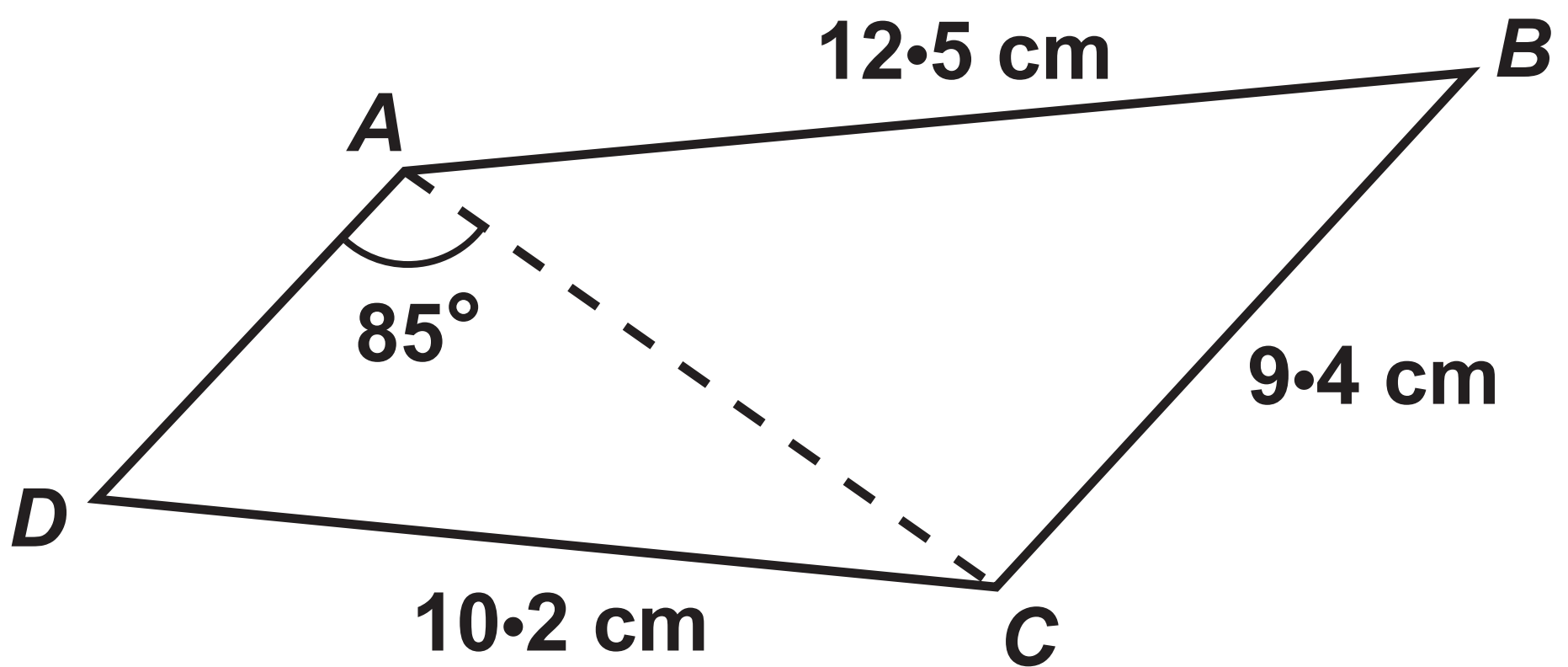
Question 23 (a)

Table

	Flour	Butter
Total cost (£)	7	9
Number of kg bought	x	$4 - x$
Cost per kg (£)	$\frac{7}{x}$	

Question 24

Diagram NOT drawn to scale



**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:

$$v = u + at$$

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

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

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TUESDAY, 7 JUNE 2022 – 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:**

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

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

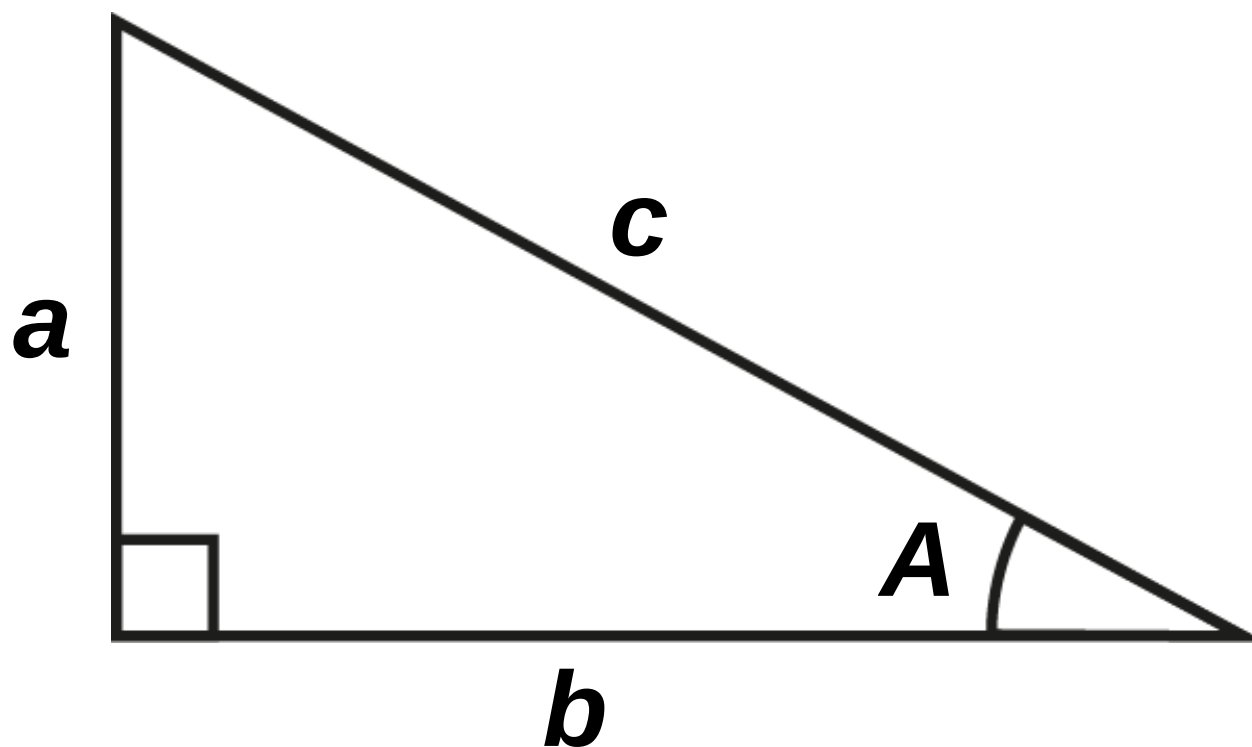
QUADRATIC FORMULA

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

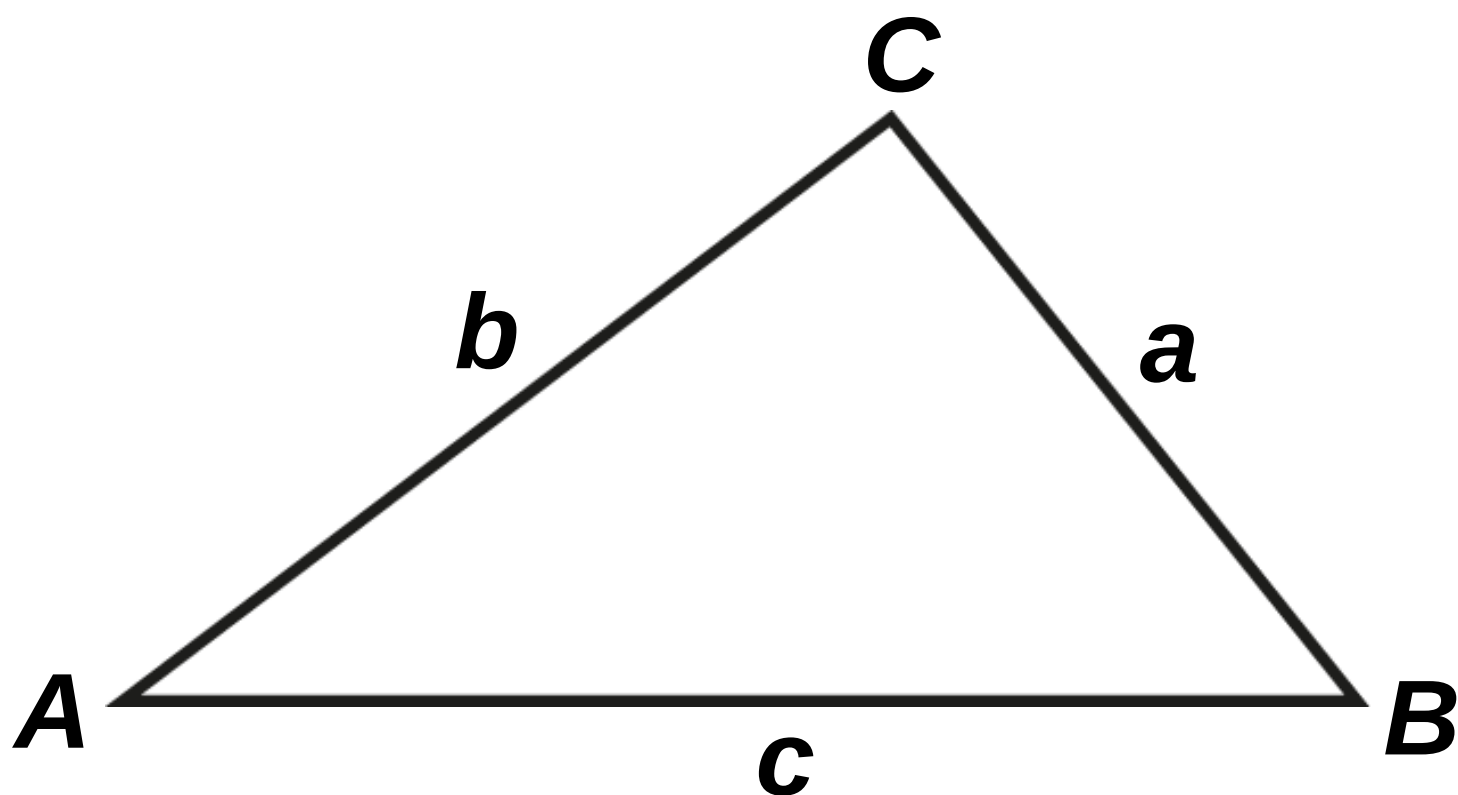


In any right – angled triangle where a , b and c are the length of the sides and c is the hypotenuse:

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

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 :

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

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