



GCSE



C300UA0 – 1

WEDNESDAY, 6 NOVEMBER 2024 – MORNING

**MATHEMATICS – COMPONENT 1
NON – CALCULATOR MATHEMATICS
HIGHER TIER**

**2 hours 15 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.	7	
2.	4	
3.	6	
4.	7	
5.	7	
6.	6	
7.	7	
8.	6	
9.	5	
10.	9	
11.	3	
12.	7	
13.	10	
14.	7	
15.	8	
16.	5	
17.	9	
18.	7	
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.

Model for Question 9.

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

(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. (a) Expand and simplify $3(5p - 2) - 7(p - 4)$

[2 marks]

continued on the next page . . .

(Turn over)

Question 1 continued

1. (b) Look at the diagram for Question 1 (b) in the separate Diagram Booklet. The diagram is NOT drawn to scale.

The diagram shows the triangle *PQR*.

In the diagram:

$$\text{Angle } RPQ = (5x + 7)^\circ$$

$$\text{Angle } PQR = (8x - 27)^\circ$$

$$\text{Angle } QRP = (6x - 9)^\circ$$

Show that the triangle is NOT isosceles.

You must use an algebraic method and not trial and improvement.

6

[5 marks]

(Turn over)

2. $\mathbf{p} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

Find the values of m and n such that

$$m(\mathbf{p} + \mathbf{q}) = \begin{pmatrix} 5 \\ n \end{pmatrix}$$

$m =$ _____ $n =$ _____

[3 marks]

(continued on the next page)

(Turn over)

Question 2 continued

2. (b) Write down the vector **r** which is parallel to the vector **q** and is **3** times as long.

$$\mathbf{r} = \begin{pmatrix} \\ \end{pmatrix}$$

[1 mark]

(Turn over)

3. Look at the table for Question 3 in the separate Diagram Booklet. The table gives information about a pizza delivery company.

Jim works in the office for a pizza delivery company. Last night he recorded the times for the first **50** deliveries.

These times are recorded in the table.

- (a) Calculate an estimate of the mean time for these **50** deliveries.

[4 marks]

continued on the next page . . .

(Turn over)

Question 3 continued

3. (b) Calculate an estimate of the percentage of these deliveries that took **25 minutes** or more.

[2 marks]

(Turn over)

4. (a) Write 882 as a product of its prime factors in index form.

[3 marks]

continued on the next page . . .

(Turn over)

Question 4 continued

4. (b) Two numbers, S and T , have been written as a product of prime factors in index form:

$$S = a^3 \times b \times c^2$$

$$= a^3bc^2$$

$$T = a^2 \times b^3 \times c^3$$

$$= a^2b^3c^3$$

- (i) Circle the correct expression for the
HIGHEST COMMON FACTOR of S and T .

abc
a^2bc^2
$a^5b^4c^5$
$a^6b^3c^6$
$a^3b^3c^3$

[1 mark]

continued on the next page . . .

(Turn over)

Question 4 (b) continued

4. (b) (ii) Circle the correct expression for the
LOWEST COMMON MULTIPLE of S and T .

Remember:

$$S = a^3 \times b \times c^2$$

$$= a^3bc^2$$

$$T = a^2 \times b^3 \times c^3$$

$$= a^2b^3c^3$$

abc
a^2bc^2
$a^5b^4c^5$
$a^6b^3c^6$
$a^3b^3c^3$

[1 mark]

continued on the next page . . .

(Turn over)

Question 4 continued

4. (c) Find the values of p , q and r so that the following is correct.

$$7 \times 10^p + 6 \times 10^q + 8 \times 10^r = 7600 \cdot 008$$

$p =$ _____

$q =$ _____

$r =$ _____

[2 marks]

(Turn over)

5. (a) Write down the next term in the following sequence.

$$-\frac{2}{m}, \quad \frac{4}{3m}, \quad -\frac{8}{5m}, \quad \frac{16}{7m}, \quad \dots$$

[2 marks]

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

$$-3, \quad 3, \quad 9, \quad 15, \quad 21, \quad \dots$$

[2 marks]

continued on the next page . . .

(Turn over)

Question 5 continued

- 5. (c) (i) The first seven terms of a Fibonacci sequence are given by**

1, 1, 2, 3, 5, 8, 13, ...

Find the 11th term of this sequence.

[1 mark]

continued on the next page . . .

(Turn over)

Question 5 (c) continued

5. (c) (ii) The first four terms of a different Fibonacci–type sequence have been expressed algebraically.

$$n, \quad p, \quad n + p, \quad n + 2p, \quad \dots$$

Write the expression for the 7th term of this sequence.

Give your answer in its simplest form.

[2 marks]

(Turn over)

6. (a) Simplify the following ratio,

$$15 \text{ cm}^2 : 300 \text{ mm}^2$$

[2 marks]

continued on the next page . . .

(Turn over)

Question 6 continued

6. (b) Sura is making a cake. The main ingredients are flour, sugar and dried fruit.

She uses these ingredients with their masses in the ratio **5 : 3 : 7**

- (i) What fraction of the main ingredients is the mass of the dried fruit?

[1 mark]

continued on the next page . . .

(Turn over)

Question 6 (b) continued

- 6. (b) (ii) The combined mass of the flour and sugar is 560 g.**

What is the mass of the dried fruit?

[3 marks]

7. Hannah and Imran often play badminton and tennis matches against each other.

The probability that Hannah wins a badminton match is $\frac{9}{10}$

The probability that Hannah wins both a badminton match AND a tennis match is $\frac{9}{50}$

One Saturday, Hannah and Imran play one badminton match and one tennis match.

The outcomes of the matches are independent.

- (a) Look at the diagram for Question 7 (a) in the separate Diagram Booklet. The diagram shows an incomplete tree diagram.

Complete the tree diagram.

[4 marks]

continued on the next page . . .

(Turn over)

Question 7 continued

- 7. (b) Calculate the probability that Hannah wins exactly one match.**

[3 marks]

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

Four triangles are shown in the diagram,
Triangle *A*, Triangle *B*, Triangle *C*
and Triangle *D*.

For each of the following statements choose
'True', 'False' or 'Need more information'.

Tick ONE box for each statement.

Statement	True	False	Need more information
Triangle <i>A</i> is congruent to Triangle <i>B</i>			
Triangle <i>C</i> is congruent to Triangle <i>D</i>			
Triangle <i>A</i> is congruent to Triangle <i>C</i>			

[2 marks]

continued on the next page . . .

(Turn over)

Question 8 continued

8. (b) Is it possible to draw an isosceles triangle with an exterior angle of 60° ?

Tick the appropriate box and show working to explain your reason.

Yes

☐

No

☐

Reason: _____

[2 marks]

continued on the next page . . .

(Turn over)

Question 8 continued

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

Two triangles are shown in the diagram.

Show that the two triangles are mathematically similar.

[2 marks]

(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)

10. **280** students took tests in each of the three subjects, Biology, Chemistry and Physics.

Each test consisted of questions worth a total of **40** marks.

- (a) The following table below shows a summary of the Biology test data.

Lowest mark	10
Highest mark	40
Lower quartile	20
Median	30
Interquartile range	15

On the grid provided for Question 10 (a) in the separate Diagram Booklet, draw a box plot to represent this data.

[3 marks]

continued on the next page . . .

(Turn over)

Question 10 continued

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

Two box plots have been drawn representing the test data for Chemistry and Physics.

(i) Calculate the number of students that were awarded **10 or more marks in Physics.**

[2 marks]

continued on the next page . . .

(Turn over)

Question 10 (b) continued

- 10. (b) (ii) Two teachers disagree over the spread of the marks.**

One teacher states that the SPREAD of marks is the same for all THREE tests.

The other teacher states that the SPREAD of the marks is the same in ONLY TWO of the tests.

**Explain why BOTH TEACHERS are correct.
You must give values to justify your answer.**

[3 marks]

10. (c) A DIFFERENT set of students sat a mathematics test. The test was out of 60 marks.

The results obtained were recorded in the table shown below and a cumulative frequency graph was drawn.

Mark (m)	Cumulative Frequency
$0 < m \leq 10$	4
$0 < m \leq 20$	10
$0 < m \leq 30$	22
$0 < m \leq 40$	35
$0 < m \leq 50$	36
$0 < m \leq 60$	40

continued on the next page . . .

(Turn over)

Question 10 continued

Look at the graph for Question 10 (c) in the separate Diagram Booklet. The diagram shows the cumulative frequency graph.

Criticise the graph.

[1 mark]

(Turn over)

11. Alison lives in a town with a population of 45 000

It is predicted that the population of the town will:

- increase by 2% EVERY SIX MONTHS for the next 4 years
- decrease by 5% PER YEAR for the following 3 years.

(a) Alison wants to calculate what the population of the town will be after 7 years.

She completes the boxes in the calculation below:

$$\text{POPULATION} = 45\,000 \quad \boxed{\times 1.02^4} \quad \boxed{\div 1.05^3}$$

BOTH BOXES have been completed incorrectly.
Complete each box below with the correct calculation.

$$\text{POPULATION} = 45\,000$$

[2 marks]

continued on the next page . . .

(Turn over)

Question 11 continued

- 11. (b) Look at the diagram for Question 11 (b) in the separate Diagram Booklet. The diagram shows five sketches A, B, C, D and E.**

Which sketch best shows the town's changing population over the 7–year period.

Sketch _____

[1 mark]

12. (a) Evaluate $27^{\frac{2}{3}}$

[2 marks]

(b) Two solid shapes are similar.

The ratio of their surface areas is $1 : k$

Write, in terms of k , an expression for the ratio of their volumes.

[1 mark]

continued on the next page . . .

(Turn over)

Question 12 continued

12. (c) Rearrange the following formula to make m the subject.

$$\frac{5m - 3p}{m} = 2w$$

[4 marks]

(Turn over)

13. Look at the diagram for Question 13 in the separate Diagram Booklet. The diagram is NOT drawn to scale. In this question all lengths are in metres.

The diagram shows a shape made from two rectangles.

The total area of the shape is 98 m^2

(a) Show that $2x^2 + 3x - 27 = 0$

[4 marks]

continued on the next page . . .

(Turn over)

Question 13 continued

13. (b) Calculate the perimeter of the shape.

You must use an algebraic method and show all your working.

[6 marks]

(Turn over)

14. Look at the diagram for Question 14 in the separate Diagram Booklet. The diagram is a graph. The graph shows the depth of water in a container over a period of 7 minutes.

- (a) Calculate an estimate of the rate at which the water level is changing at $t = 6$
Simplify your answer as far as possible.

[3 marks]

- (b) Calculate the average rate at which the water level is changing between
 $t = 1 \cdot 5$ and $t = 3 \cdot 5$

[2 marks]

continued on the next page . . .

(Turn over)

Question 14 continued

- 14. (c) From time $t = 7$ minutes, the rest of the water flows out of the container until it is empty.**

During this time the depth of water decreases at a constant rate of $\frac{5}{6}$ cm per second.

Complete the graph.

[2 marks]

15. (a) Look at the information for Question 15 (a) in the separate Diagram Booklet.

As part of a multiple – choice examination, students were asked the question shown:

Derek chose **A**.

Is he correct?

Yes ☐ No ☐

Give calculations to support your answer.

[2 marks]

continued on the next page . . .

(Turn over)

Question 15 continued

15. (b) Express $0.\overline{1234}$ as a fraction.

Give your answer in its simplest form.

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[3 marks]

continued on the next page . . .

(Turn over)

Question 15 continued

15. (c) ESTIMATE the value of $(1.9 \times 10^3)^5$

Give your answer in standard form.

[3 marks]

16. Look at the diagram for Question 16 in the separate Diagram Booklet. The diagram is NOT drawn to scale. The diagram shows a triangle ABC .

In the diagram:

$$AB = 14 \text{ cm}$$

$$AC = 15 \text{ cm}$$

$$\text{Angle } BAC = 37^\circ$$

The ratio of the area of the triangle to the area of a circle is $7 : 16\pi$

Given that $\sin 37^\circ = 0.6$, calculate the radius of the circle.

(Turn over)

[5 marks]

(Turn over)

17. (a) Simplify $\frac{35}{\sqrt{5}} - \sqrt{5}$

[3 marks]

continued on the next page . . .

(Turn over)

Question 17 continued

- 17. (b) Find the values of q and r to make the following equation correct.**

$$(5 + 2\sqrt{3})(4 - q\sqrt{3}) + 40 + r\sqrt{3} = 18$$

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

$q =$ _____ $r =$ _____

[6 marks]

(Turn over)

18. The functions g and h are such that

$$g(x) = 2x + 3 \quad \text{and} \quad h(x) = x^2$$

(a) Find $g^{-1}(x)$

[2 marks]

continued on the next page . . .

(Turn over)

Question 18 continued

18. (b) Given that $gh(x) = hg(x) - x^2 + 1$

show that $x^2 + 12x + 7 = 0$

[illegible]

[5 marks]

END OF PAPER

TOTAL 120 MARKS

(Turn over)

[illegible]

(Turn over)

[illegible]

(Turn over)

[illegible]

(Turn over)

[illegible]

C300UA0-1

WEDNESDAY, 6 NOVEMBER 2024 – MORNING

MATHEMATICS – COMPONENT 1

NON – CALCULATOR MATHEMATICS

HIGHER TIER

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

Diagram Booklet

Surname: _____

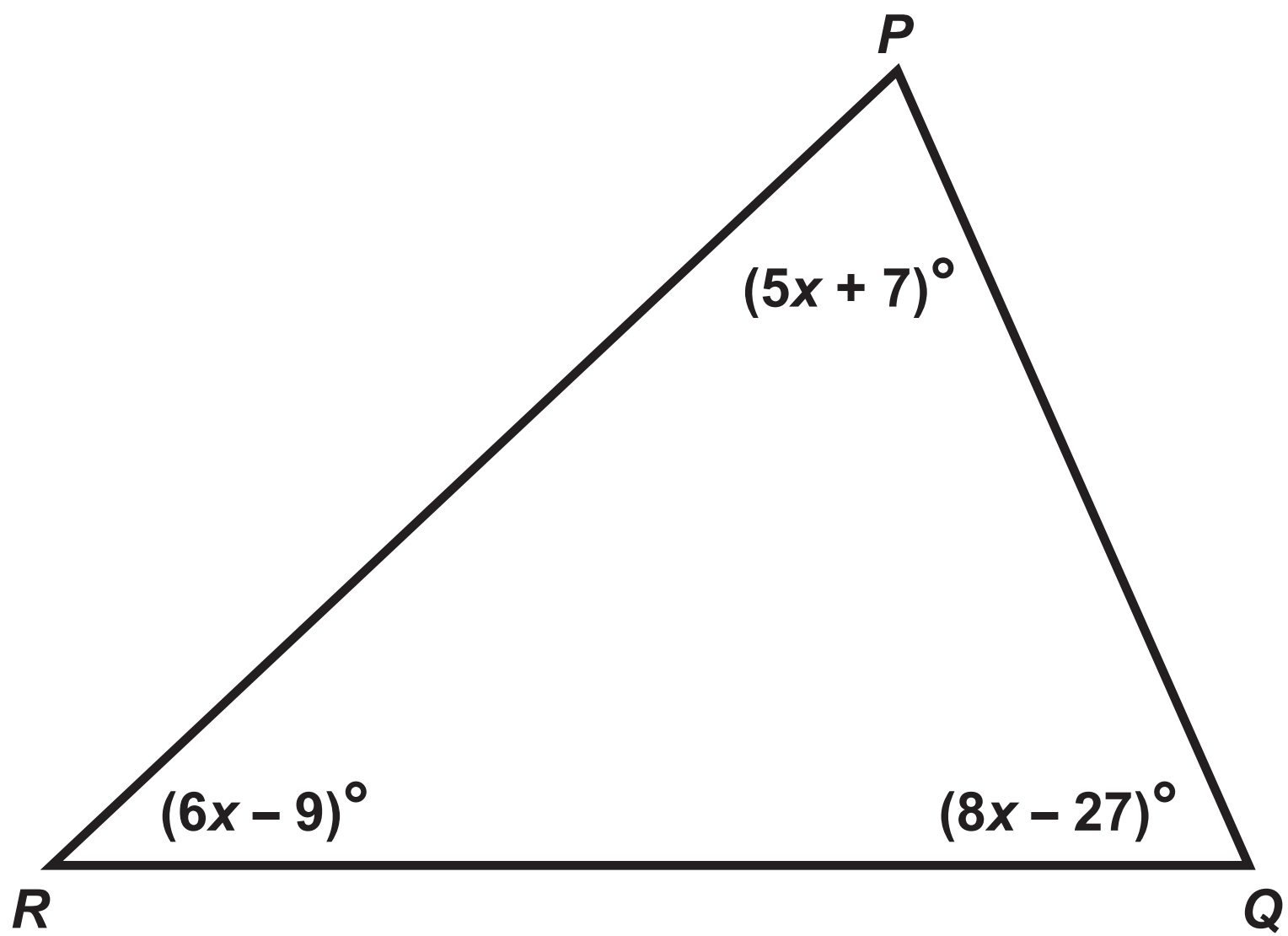
First name(s): _____

Centre Number: _____

Candidate Number: 0 _____

Question 1 (b)

Diagram NOT drawn to scale

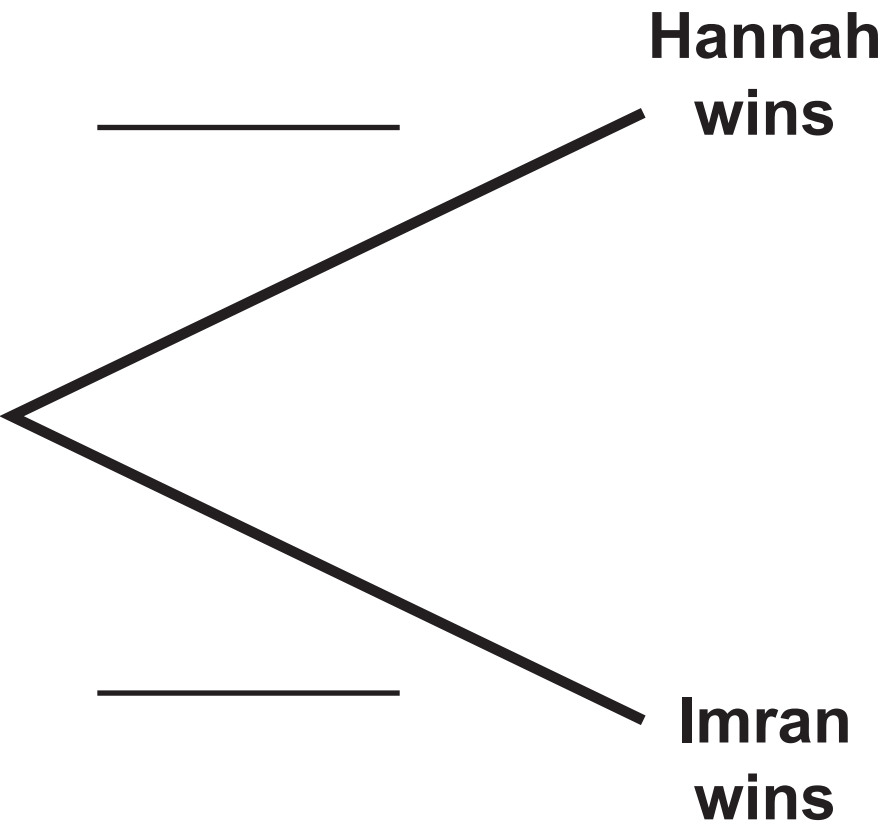


Question 3

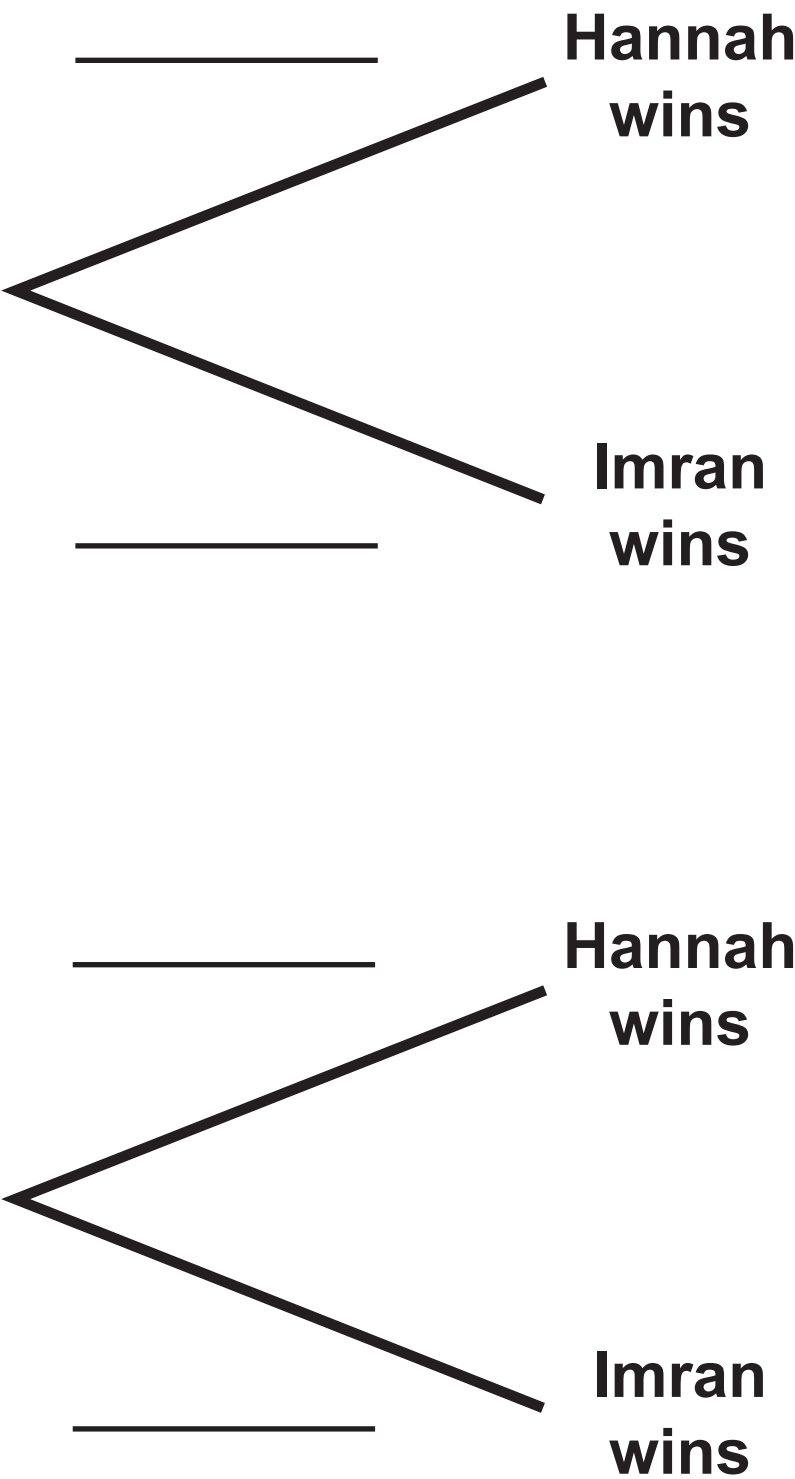
Delivery time (t mins)	Number of deliveries
$0 < t \leq 10$	10
$10 < t \leq 20$	12
$20 < t \leq 30$	16
$30 < t \leq 40$	12

Question 7 (a)

BADMINTON



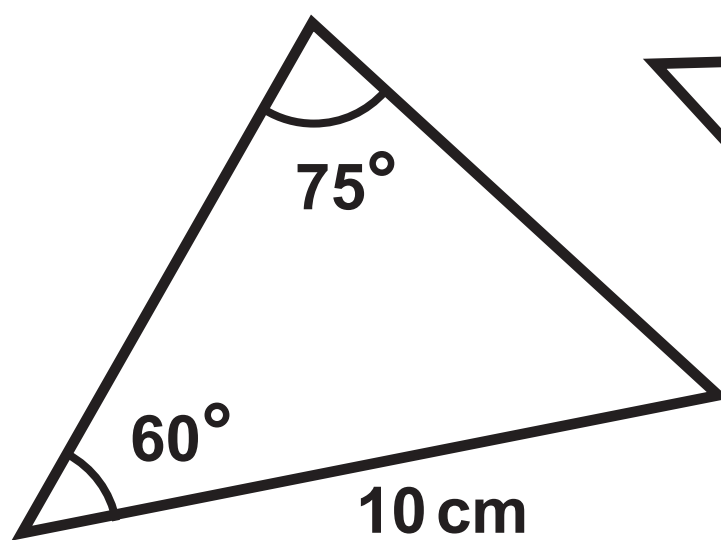
TENNIS



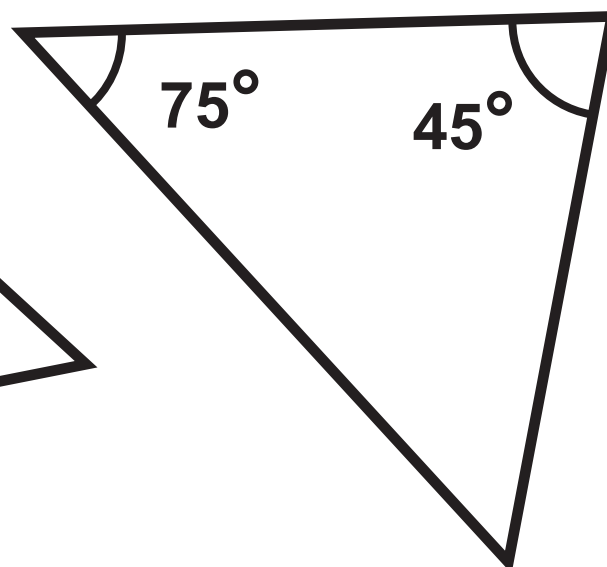
Question 8 (a)

Diagram NOT drawn to scale

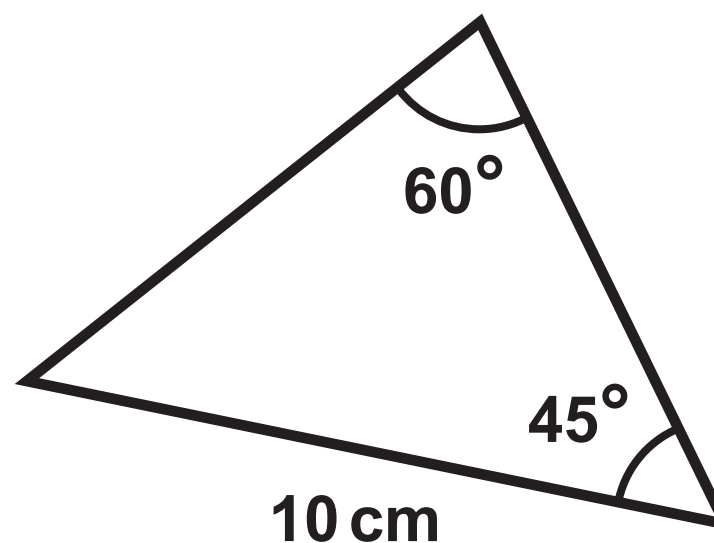
Triangle A



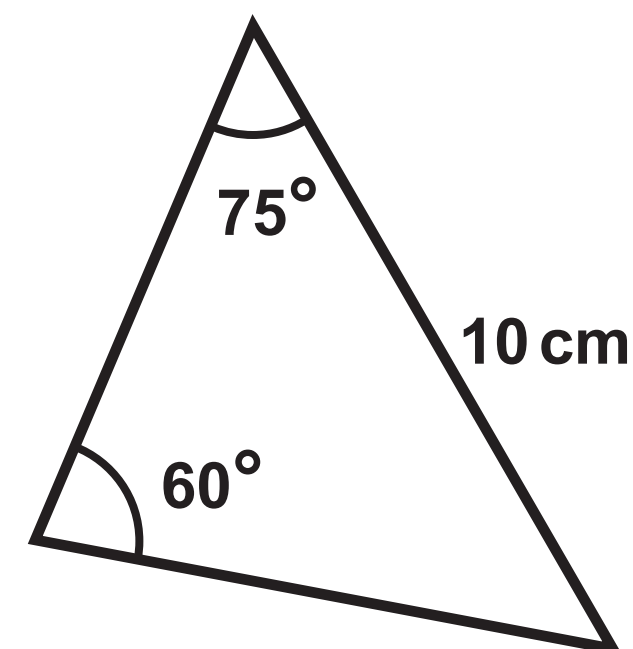
Triangle B



Triangle C

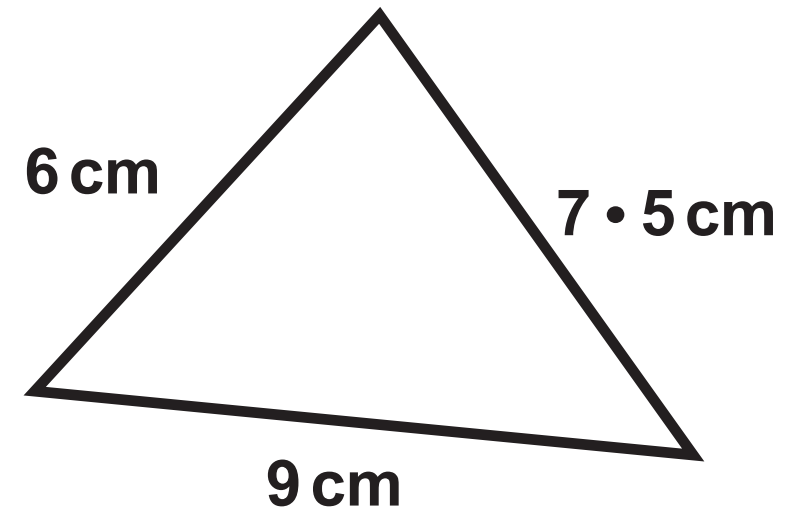
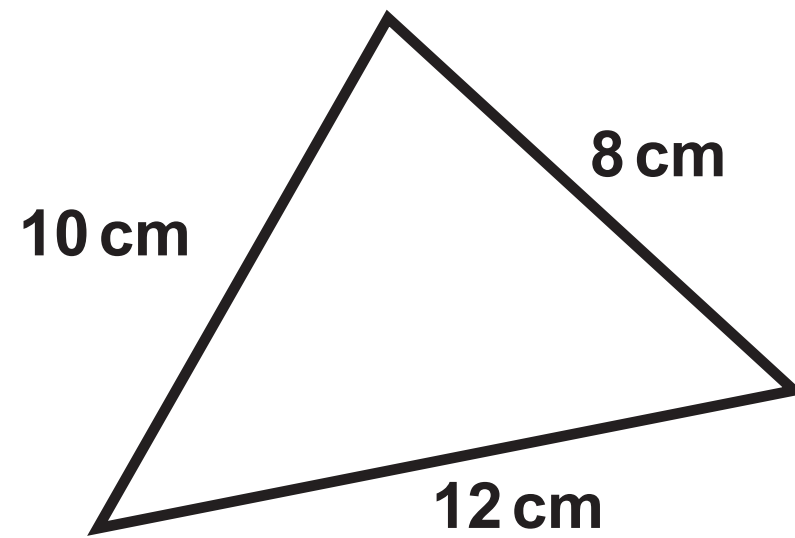


Triangle D



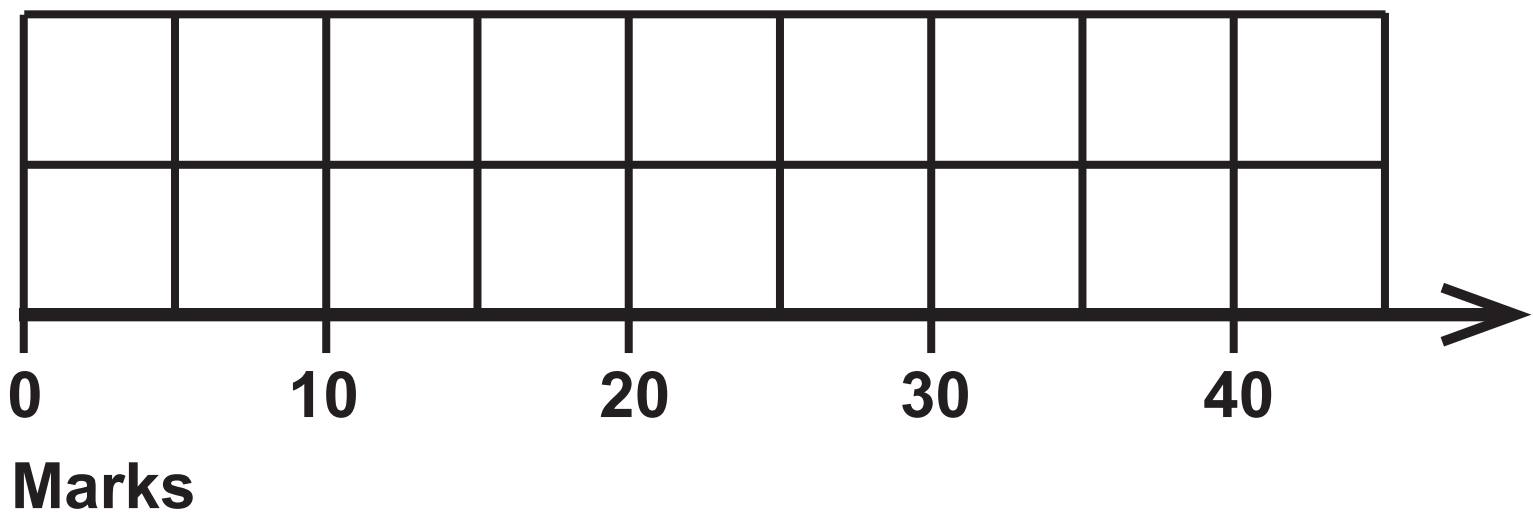
Question 8 (c)

Diagram NOT drawn to scale

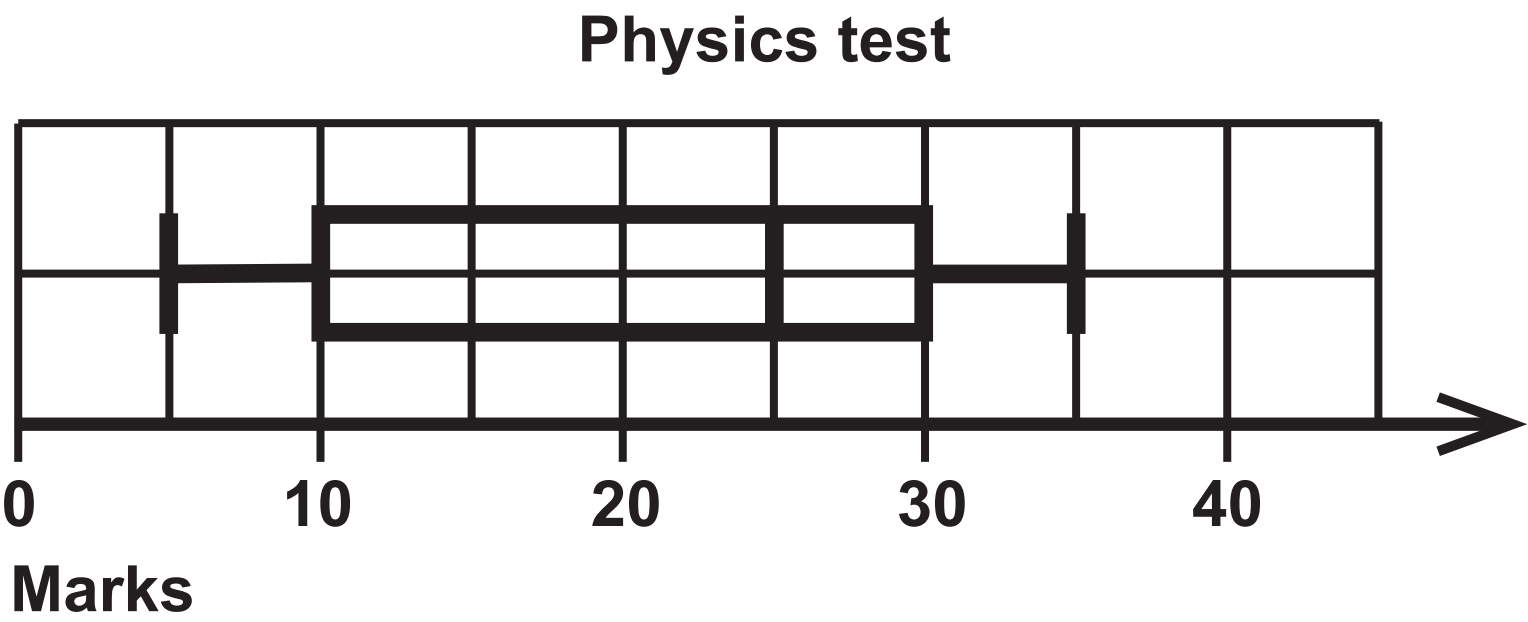
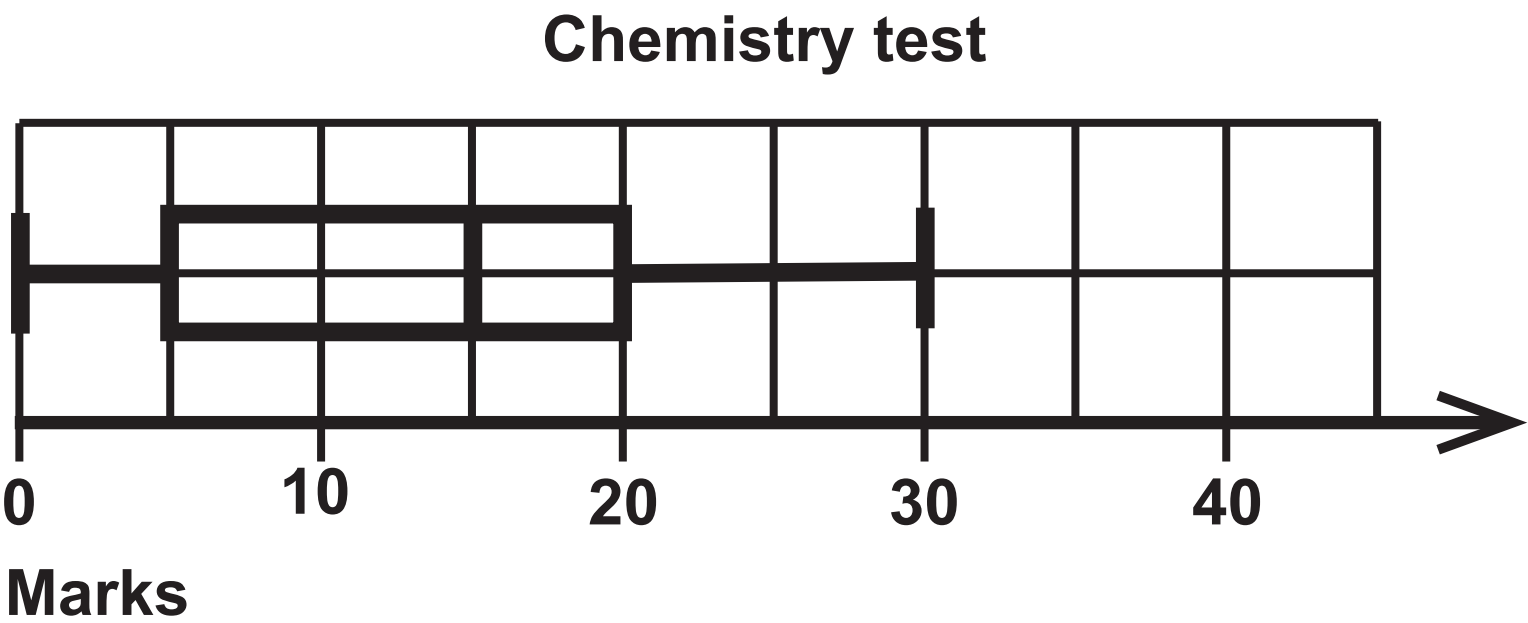


Question 10 (a)

Biology test



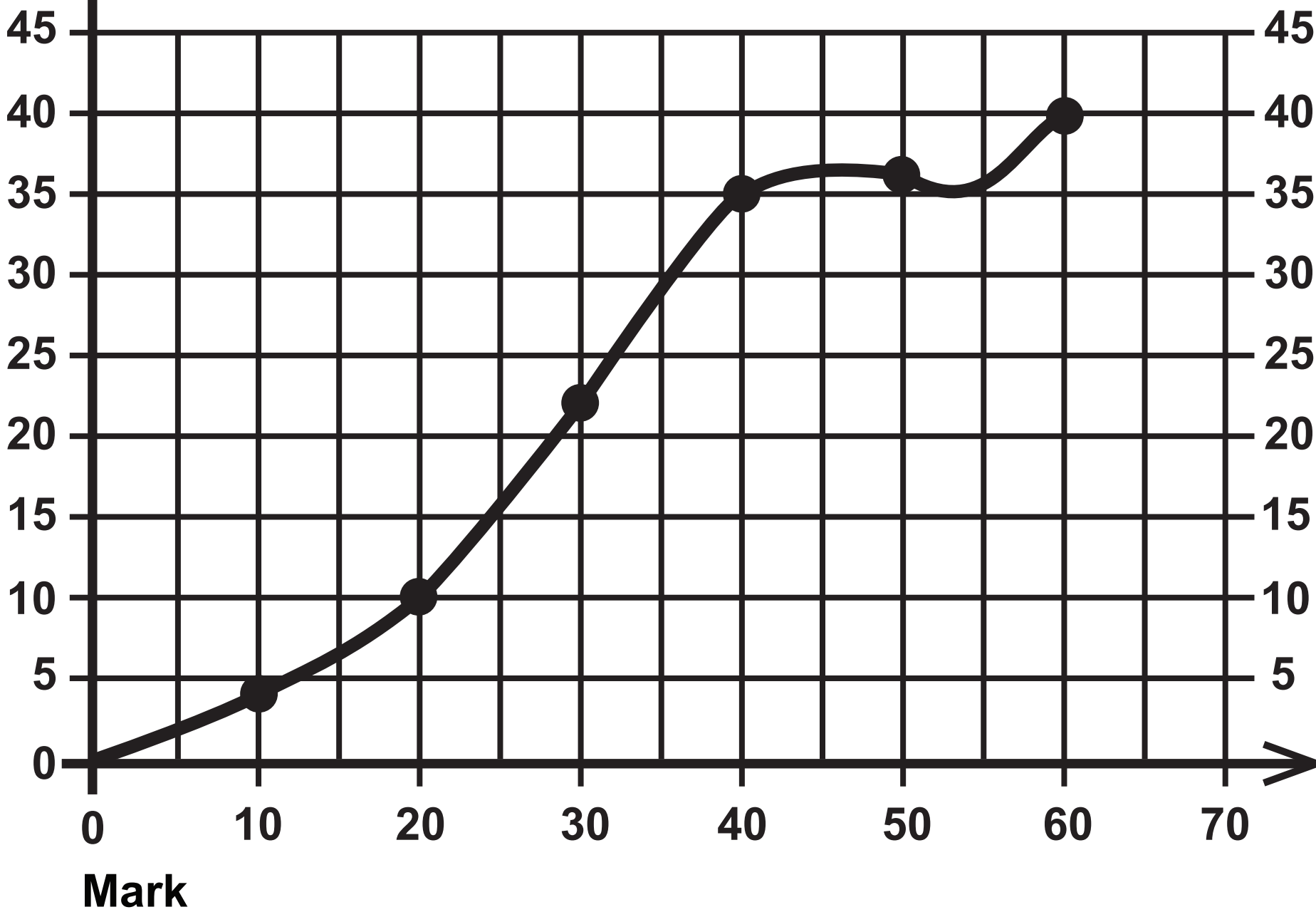
Question 10 (b)



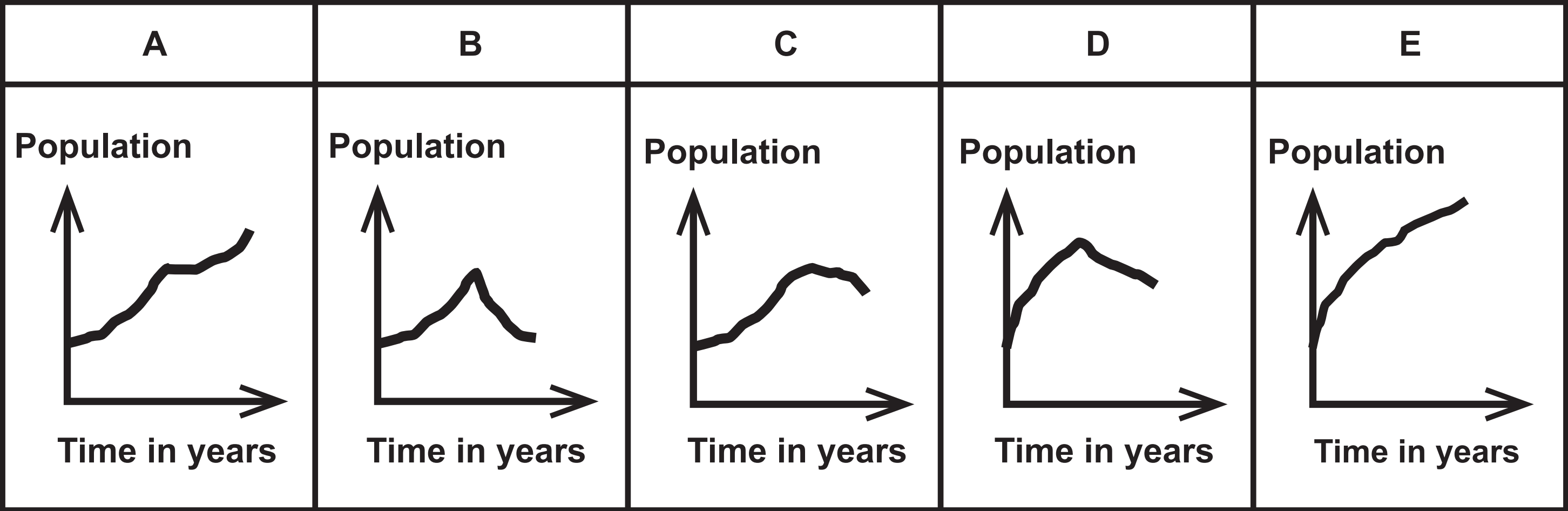
Question 10 (c)

Cumulative
frequency

Mathematics test results

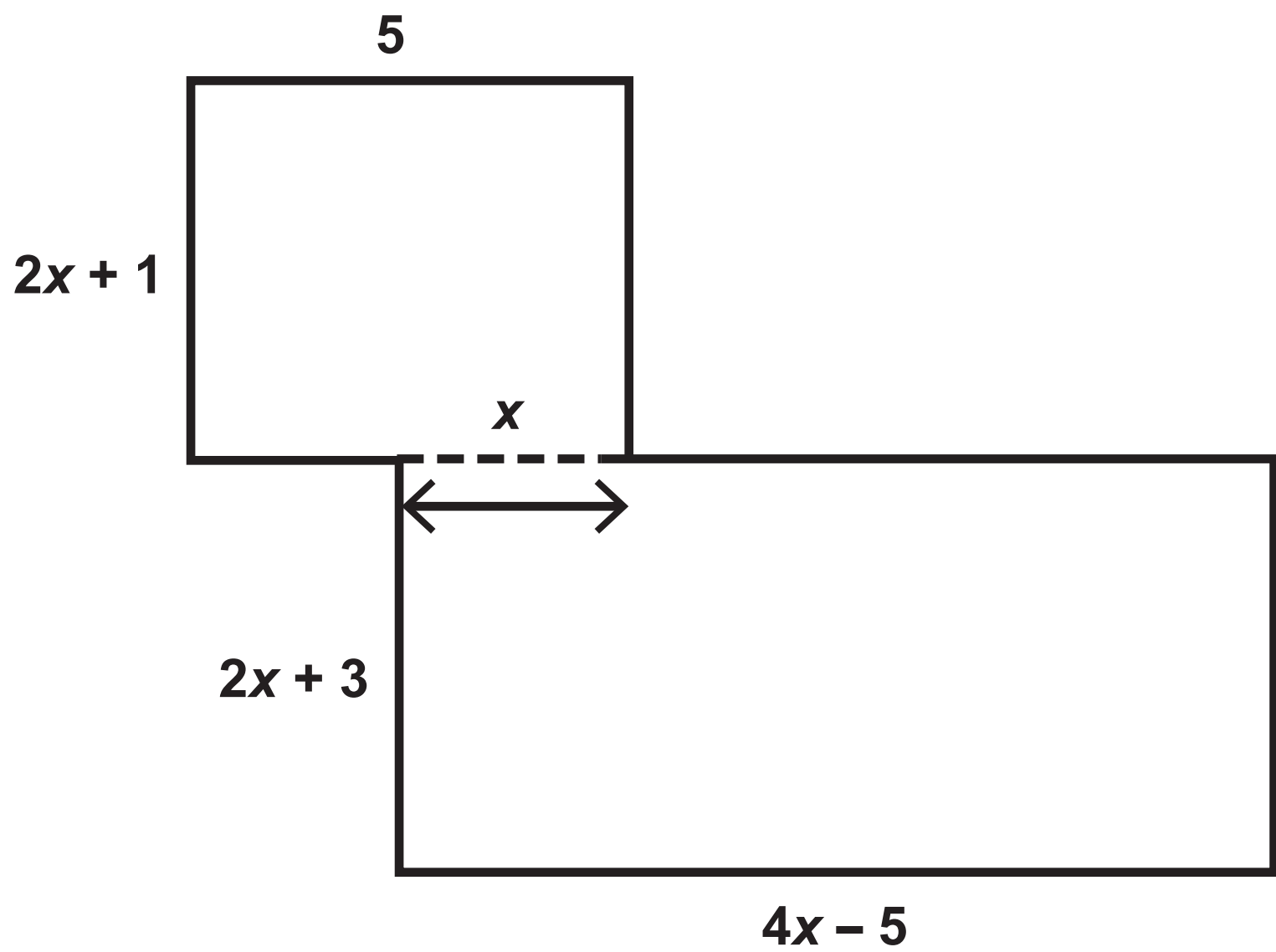


Question 11 (b)

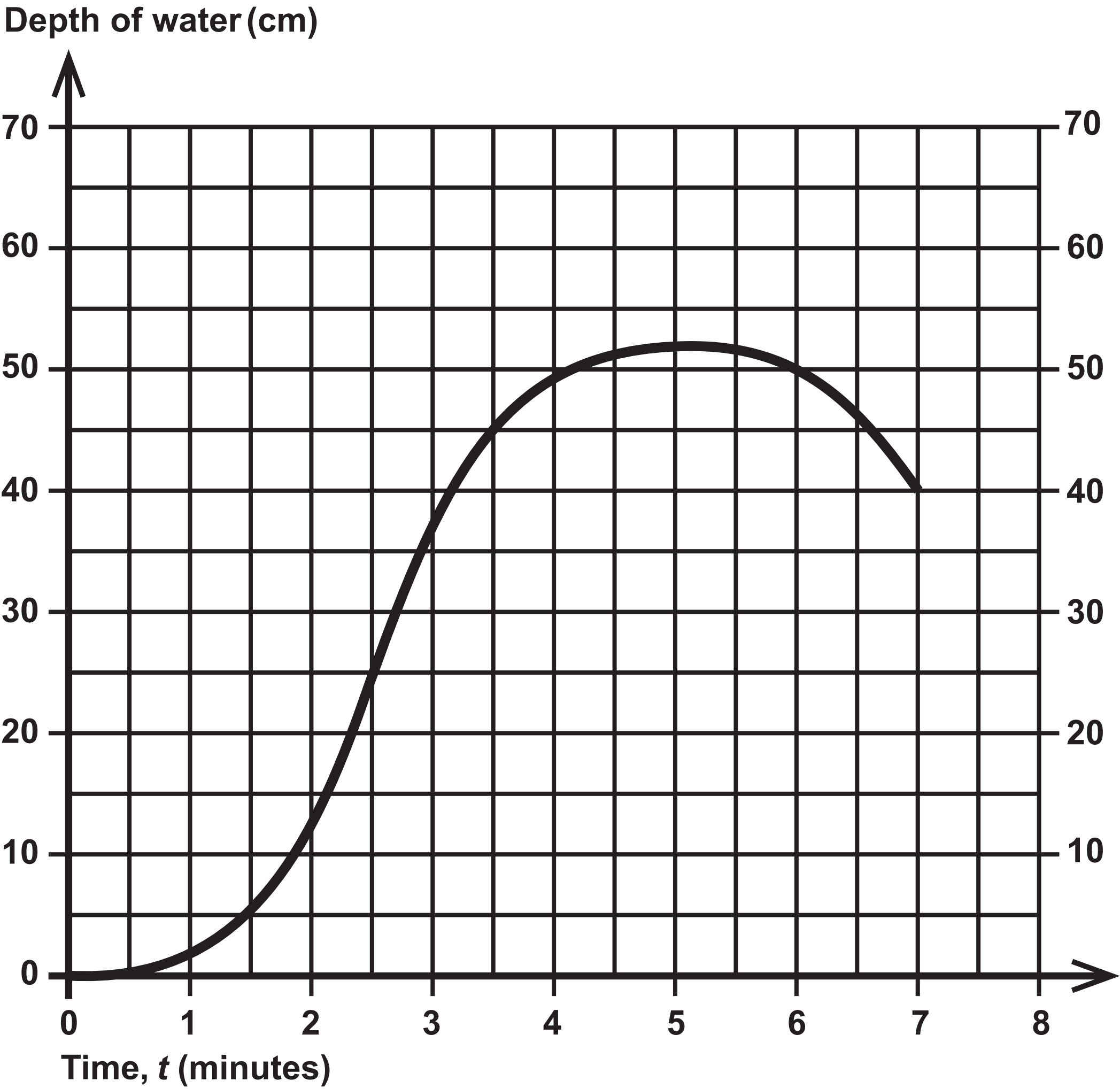


Question 13

Diagram NOT drawn to scale



Question 14



Question 15 (a)

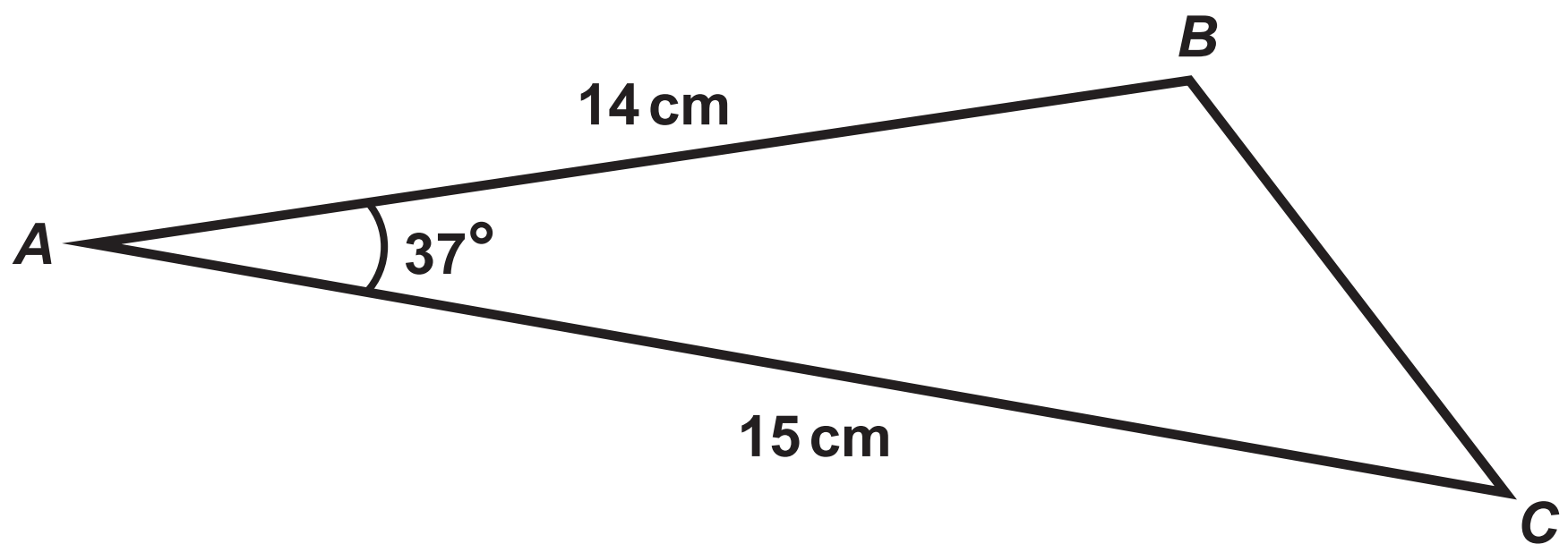
Evaluate $0.\dot{2}0\dot{4}\dot{5} - 0.003$

Choose the correct answer from the following:

A	B	C	D	E
$0.\dot{2}0\dot{1}\dot{5}$	$0.\dot{2}01\dot{5}$	$0.\dot{2}0\dot{4}\dot{5}$	$0.\dot{2}01\dot{5}\dot{4}$	$0.\dot{2}01\dot{5}\dot{1}$

Question 16

Diagram NOT drawn to scale



C300UA0-1A

WEDNESDAY, 6 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:**

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

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

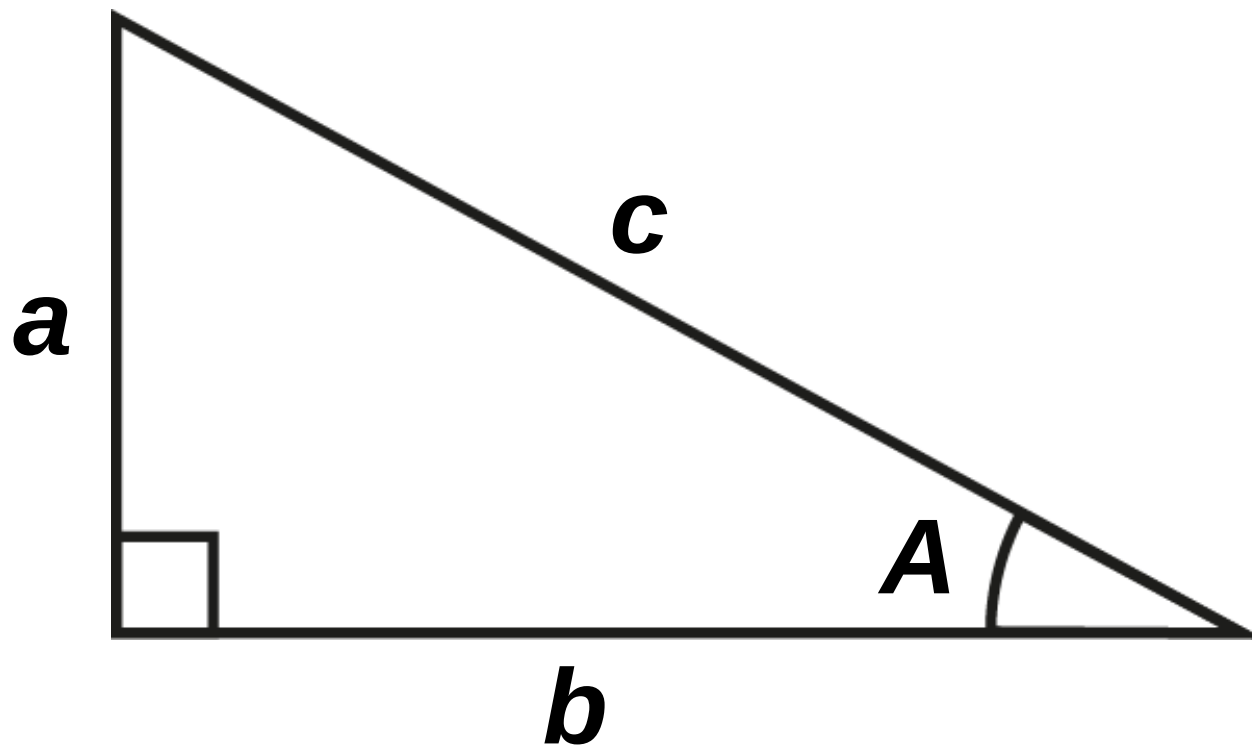
QUADRATIC FORMULA

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

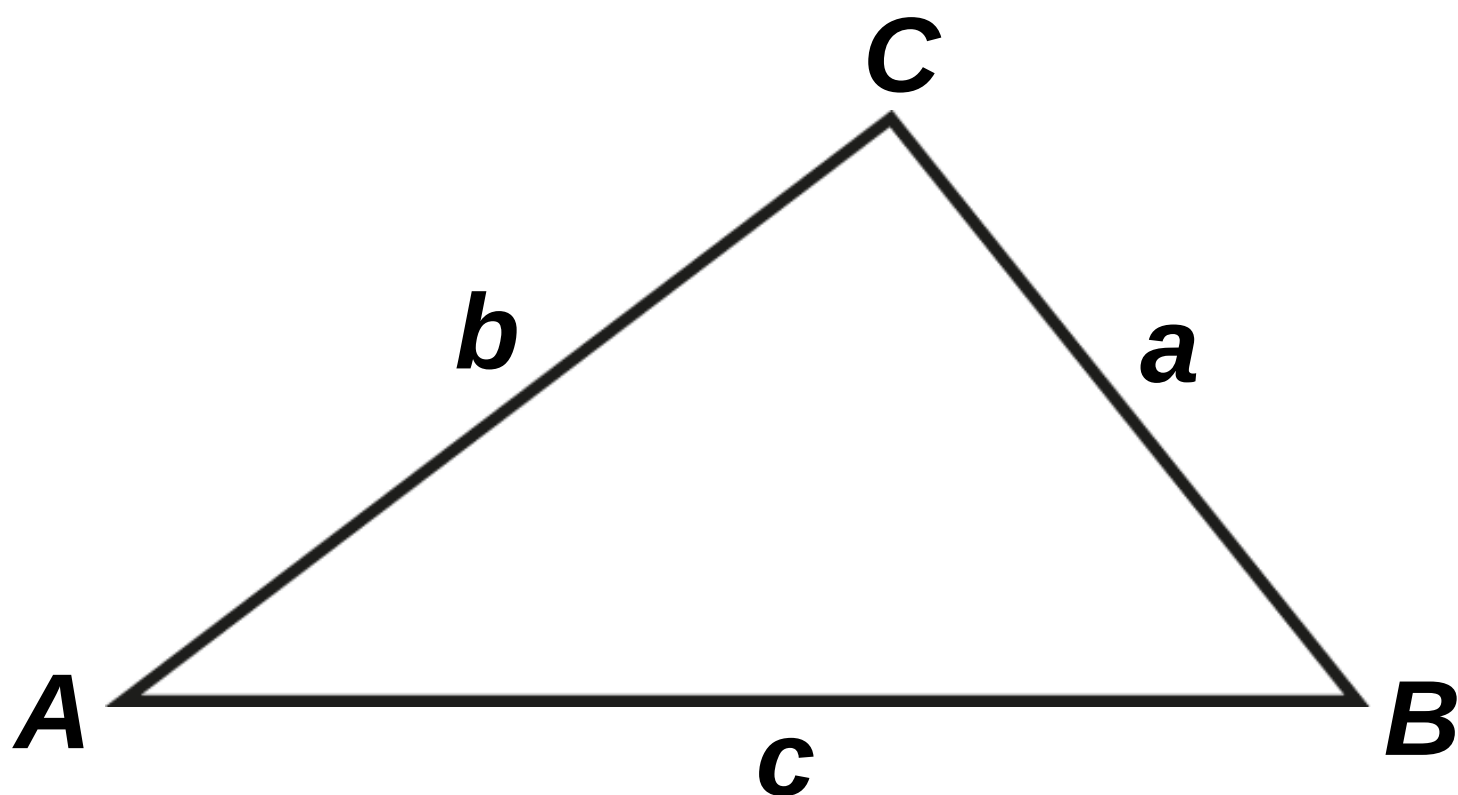


In any right – angled triangle where a , b and c are the length of the sides and c is the hypotenuse:

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

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:

$$v = u + at$$

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

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