GCSE

3310U50-1

FRIDAY, 19 MAY 2023 – MORNING

MATHEMATICS – NUMERACY

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.	8	
2.	7	
3.	10	
4.	4	
5.	3	
6.	7	
7.	9	
8.	6	
9.	9	
10.	10	
11.	7	
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 7 (a) and Question 11.

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

(Turn over)

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

Mari and Huw share a prize of £2700 in the ratio 4 : 5 respectively.

Mari decides to donate 24% of her share of the prize to charity. Huw decides to give the same amount of money as Mari to charity.

continued on the next page . . .

Question 1 continued

What fraction of Huw's share of the prize money does he give to charity?

Express your answer in its simplest form.

You must show all your working.

(Turn over)

(Turn over)

[6 marks + 2 marks OCW]

2. (a) Look at the diagram for Question 2 (a) in the separate Diagram Booklet.

The diagram shows a map.

The direct straight – line distance between Llangollen and the Pontcysyllte Aqueduct is **5•6 km.**

On the map this distance is **5•6 cm.**

continued on the next page . . .

Question 2 (a) continued

What is the scale of the map?

Circle your answer.

1 : 10
1 : 1000
1 : 10 000
1 : 100 000
1 : 1 000 000

[1 mark]

continued on the next page . . .

Question 2 continued

2. (b) The Pontcysyllte Aqueduct was built to carry the Llangollen canal over a valley.

The following facts about the section of the canal over the aqueduct were found on the internet.

- **It has a rectangular uniform cross – section.**
- **It is 300 m in length.**
- **It holds 1 500 000 litres of water.**
- **It takes 2 hours to drain the water.**

continued on the next page . . .

Question 2 (b) continued

2. (b) (i) The section of the canal over the aqueduct is to be drained.

Calculate the number of litres of water that drain from this section of the canal per minute.

You may assume that the water drains from the canal at a constant rate.

You must show all your working.

[3 marks]

Question 2 (b) continued

2. (b) (ii) Calculate the area of the canal's uniform cross – section.

Give your answer in cm^2

[3 marks]

3. (a) A jar contains 300 g of chocolate spread.

In this spread:

- 58% of the mass is pure sugar,
- $\frac{1}{8}$ of the mass is cocoa,
- the mass of the milk powder is $\frac{4}{5}$ of the mass of cocoa,
- the remainder of the 300 g is palm oil.

continued on the next page . . .

Question 3 (a) continued

Calculate the percentage of palm oil in the chocolate spread. You must show all your working.

(Turn over)

20

[7 marks]

continued on the next page . . .

Question 3 continued

3. (b) A different jar contains 840 g of chocolate spread.

The label on the jar says,

‘Offer: includes 20% extra chocolate spread for free.’

How many grams of chocolate spread did a jar contain before the offer started?

[3 marks]

4. Deva Design Service employs 60 people.

Employees were asked to log on to their computer at 9 a.m. on Thursday.

Look at the diagram for Question 4 in the separate Diagram Booklet. The diagram is a cumulative frequency diagram.

The number of employees logged on was recorded every 10 seconds from 9 a.m. The results are displayed in the cumulative frequency diagram shown.

continued on the next page . . .

Question 4 continued

4. (a) Use the cumulative frequency diagram to estimate the median time taken by the employees to log on.

_____ **seconds**

[1 mark]

continued on the next page . . .

Question 4 continued

4. (b) Deva Design Service has a policy that states the following:

‘90% of employees should be logged on to their computer by 9:01 a.m.’

Show that this policy was met on Thursday.

You must show all your working.

[3 marks]

5. Alan Frames is a company that employs 360 people.

6 of these people are to be selected to discuss changes to the company logo.

The manager has decided to use a systematic sampling method.

He has a numbered list of all 360 people.

continued on the next page . . .

Question 5 continued

5. (a) When using systematic sampling, where in the list SHOULD the manager start his selection of the 6 people?

Tick (✓) ONE from the list below.

The 60th name in the list	
At a randomly chosen name	
First person in the list	
Last person in the list	
A name by any multiple of 60 in the list	

[1 mark]

continued on the next page . . .

Question 5 continued

5. (b) The manager actually starts by selecting the 4th name in his list.

Complete the table provided for Question 5 (b) in the separate Diagram Booklet, to give the position in the list of the 6 people who would be selected using systematic sampling.

[2 marks]

6. Dafydd works in a call centre.

On Monday, he made 200 phone calls. He recorded the length of time he spent on each of these phone calls.

Dafydd noted the following about the times spent on each phone call.

- The greatest time was 2 minutes 10 seconds.
- The range of the times was 2 minutes.
- The median time was 85 seconds.
- The upper quartile was 110 seconds.
- The interquartile range was 70 seconds.

Question 6 continued

6. (a) Using the graph provided for Question 6 (a) in the separate Diagram Booklet, draw a box – and – whisker diagram to represent Dafydd's data.

[4 marks]

continued on the next page . . .

Question 6 continued

6. (b) Dafydd was set a target.

He had to complete half of his phone calls in less than 1 minute 30 seconds each.

By how many seconds did Dafydd beat this target?

Circle your answer.

2 seconds
5 seconds
10 seconds
15 seconds
20 seconds

continued on the next page . . .

[1 mark]

continued on the next page . . .

Question 6 continued

6. (c) On Monday, how many of Dafydd's phone calls lasted less than 110 seconds?

_____ **phone calls**

[2 marks]

7. (a) Ask for the model for Question 7 (a). The model is NOT made to scale.

The model represents a carton.

Cartons of soft drink are filled using an automated system.

(i) Each carton is a cuboid that has:

- a base area of exactly $40\ cm^2$
- a height of 13 cm, CORRECT TO THE NEAREST cm.

continued on the next page . . .

Question 7 (a) (i) continued

Calculate the least possible volume of a carton.

[2 marks]

continued on the next page . . .

Question 7 (a) continued

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

The empty cartons, moving on a conveyor belt, pass under a filling gun that pours soft drink into the cartons until they are full.

continued on the next page . . .

Question 7 (a) (ii) continued

Drink is poured into each carton at a rate of 8000 cm^3 per minute, CORRECT TO THE NEAREST 1000 cm^3 PER MINUTE.

Calculate the greatest possible number of cartons that the automated system could fill in an hour.

continued on the next page . . .

Question 7 (a) (ii) continued

You can ignore the time taken in moving from one full carton to the next empty one.

[3 marks]

continued on the next page . . .

Question 7 continued

7. (b) Cartons of a different size are also filled using the same system.

Each of these cartons has:

- **a square base,**
- **a height of exactly 20 cm,**
- **a volume of exactly 960 cm^3**

Calculate the length of the side of the base of one of these cartons.

continued on the next page . . .

Question 7 (b) continued

Give your answer in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible.

(Turn over)

[4 marks]

8. The mass of an atom of hydrogen is about $1{\cdot}7 \times 10^{-24}$ g

The mass of an atom of oxygen is about $2{\cdot}7 \times 10^{-23}$ g

(a) Using a suitable approximation, estimate how many atoms of hydrogen there are in 1000 g of hydrogen.

Give your answer in standard form.

[3 marks]

Question 8 continued

8. (b) A molecule of water consists of two atoms of hydrogen and one atom of oxygen.

Calculate the mass of a molecule of water.

Give your answer in standard form.

[3 marks]

9. (a) Look at the diagram for Question 9 (a) in the separate Diagram Booklet. The diagram is NOT drawn to scale.

The diagram is a simplified 2D diagram of a cocktail glass.

Dee – Odd makes cocktail glasses out of thin glass.
One of their cocktail glasses is shown in the diagram.
A hollow hemisphere forms the part of the glass which can hold the drink.

continued on the next page . . .

Question 9 (a) continued

Before each hemisphere is attached to a stem, the surface area on the outside of each hemisphere is given a decorative coating.

The volume of each hemisphere is $\frac{128\pi}{3}$ cm^3

continued on the next page . . .

Question 9 (a) continued

Calculate the surface area that is given a decorative coating. Give your answer in terms of π in its simplest form.

(Turn over)

[6 marks]

continued on the next page . . .

Question 9 continued

9. (b) Look at the diagrams for Question 9 (b) in the separate Diagram Booklet. The diagrams are NOT drawn to scale.

The diagrams are simplified 2D diagrams of another style of cocktail glass.

Dee – Odd also makes another style of cocktail glass in two different sizes. These glasses are mathematically similar.

continued on the next page . . .

Question 9 (b) continued

The ratio of the volume of the smaller glass to the volume of the larger glass is $8 : 27$

The height of the larger glass is 18 cm.

Calculate the height of the smaller glass.

[3 marks]

10. A train completed a 16 000 m journey between two stations.

(a) Here is a description of the journey.

- The train accelerated uniformly from rest to 20 m/s in 40 seconds.
- It then remained at a constant speed of 20 m/s for a period of time.
- The train then decelerated uniformly for 80 seconds until it stopped.

continued on the next page . . .

Question 10 (a) continued

Look at the diagram for Question 10 (a) in the separate Diagram Booklet. The diagram is NOT drawn to scale.

A sketch of the velocity – time graph that represents this journey is shown in the diagram.

continued on the next page . . .

Question 10 (a) continued

10. (a) (i) Calculate the distance the train travelled in the first 40 seconds of the journey.

[2 marks]

continued on the next page . . .

Question 10 (a) continued

10. (a) (ii) Calculate the TOTAL time for this 16 000 m journey. Give your answer in seconds.

(Turn over)

Total time for this 16 000 m journey is

_____ seconds.

[5 marks]

continued on the next page . . .

Question 10 continued

10. (b) When the train begins its next journey, it accelerates uniformly at $1{\cdot}0\dot{8}\dot{1}$ m/s^2

Write this acceleration as a mixed number in its simplest form.

(Turn over)

[3 marks]

11. Ask for the model for Question 11.

The model is NOT made to scale.

The model represents a traffic cone.

Safety Cones is a company that makes traffic cones.

Its traffic cones have a base in the shape of an octagonal prism, with a hollow cone shape sitting on top of the base.

The bases of the traffic cones are symmetrical and have a circular hole in them to allow the traffic cones to be stacked.

continued on the next page . . .

Question 11 continued

Look at the diagrams for Question 11 in the separate Diagram Booklet. The diagrams are NOT drawn to scale.

There are three diagrams.

Diagram 1 shows the dimensions of the octagonal base.

The height of this octagonal base is 5 cm.

continued on the next page . . .

Question 11 continued

Diagram 2 represents the cone that sits on top of the octagonal base.

It has a height of 60 cm and a circular base area of 800 cm^2

Gary is transporting a stack of 10 of these traffic cones in the back of his van.

Diagram 3 represents the 10 traffic cones stacked on top of each other.

continued on the next page . . .

Question 11 continued

Calculate the volume of the space that this stack of 10 traffic cones takes up in the back of Gary's van.

Give your answer in cm^3

You should assume that the space taken up includes the space underneath the bottom traffic cone and any gaps between the cones.

(Turn over)

(Turn over)

[7 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 – NUMERACY

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 2 (a)

Key: ▭ = A5 road

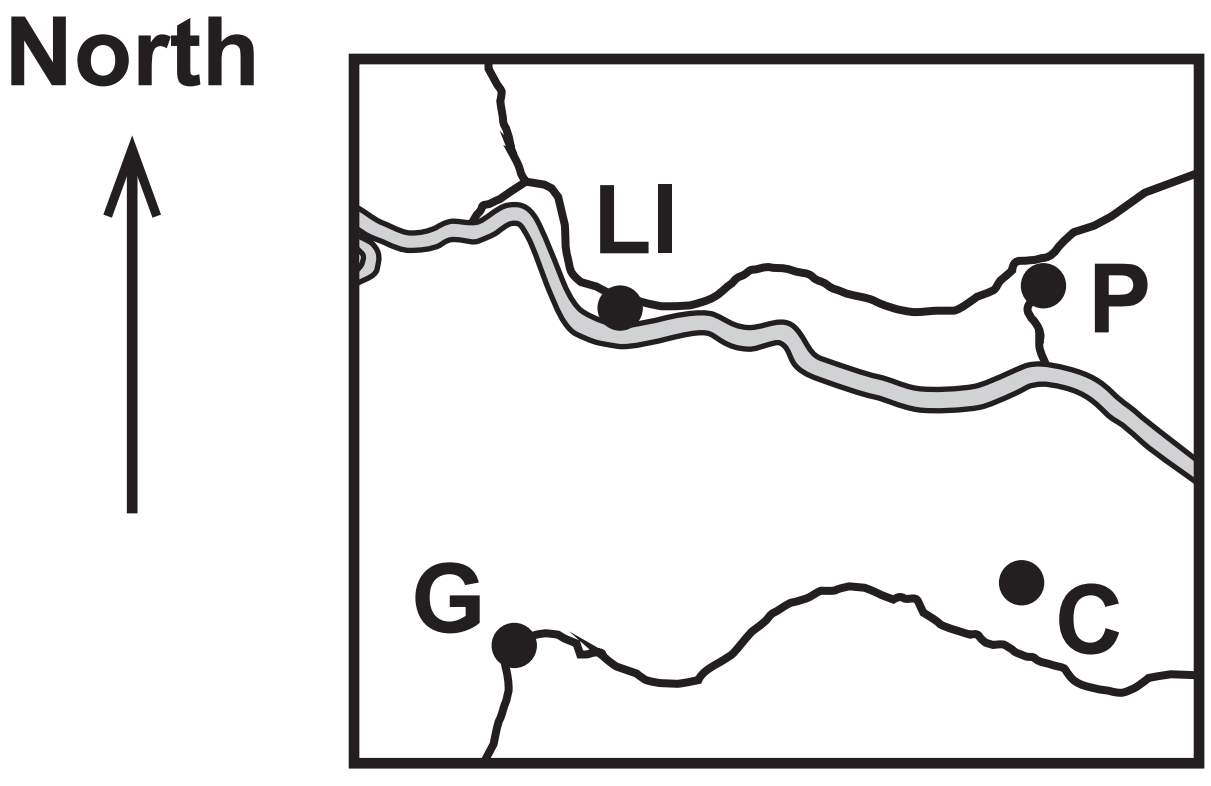
— = minor roads

LI = Llangollen

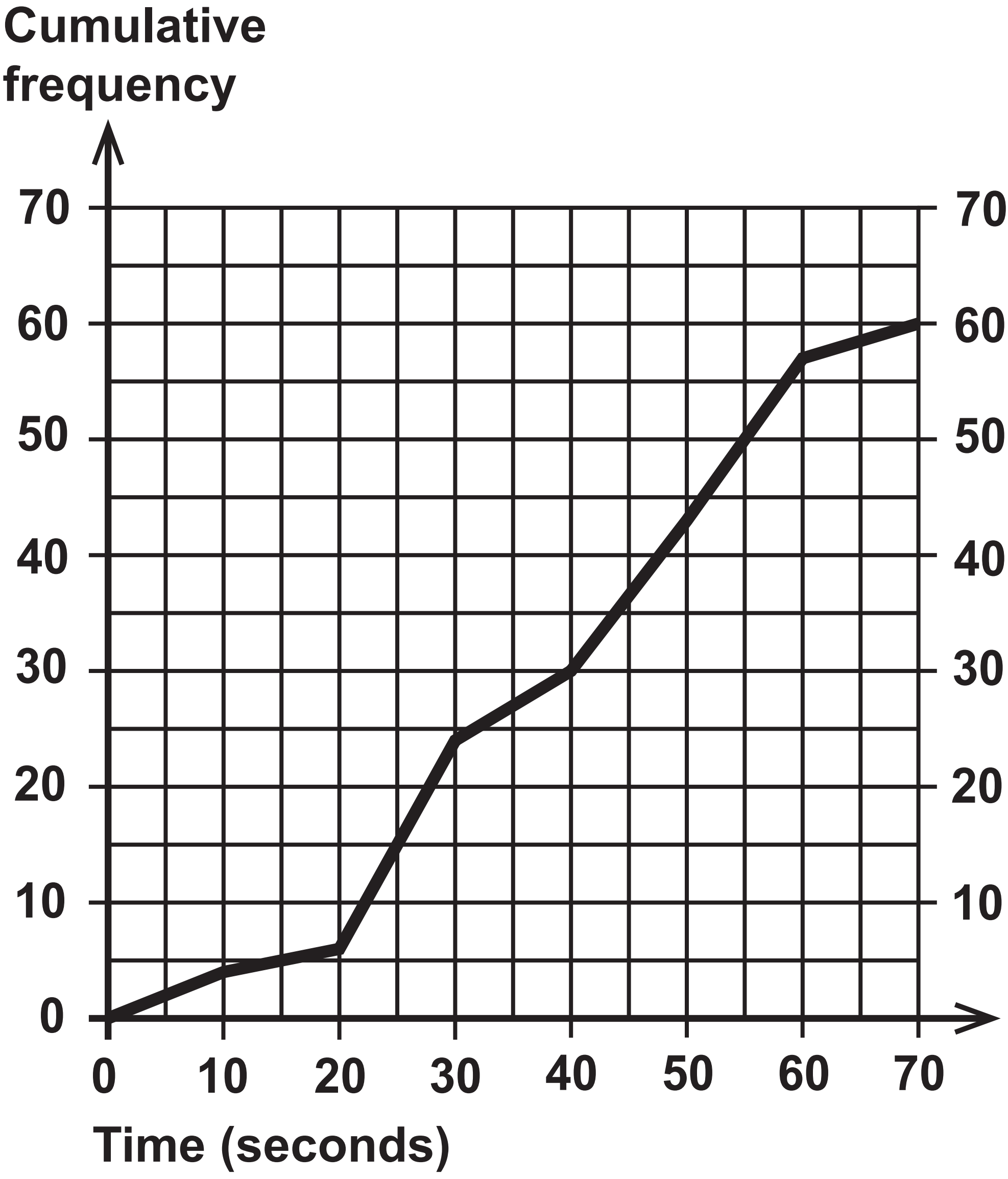
P = Pontcysyllte Aqueduct

C = Chirk Castle

G = Glyn Ceiriog



Question 4


Cumulative frequency
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
Time (seconds)

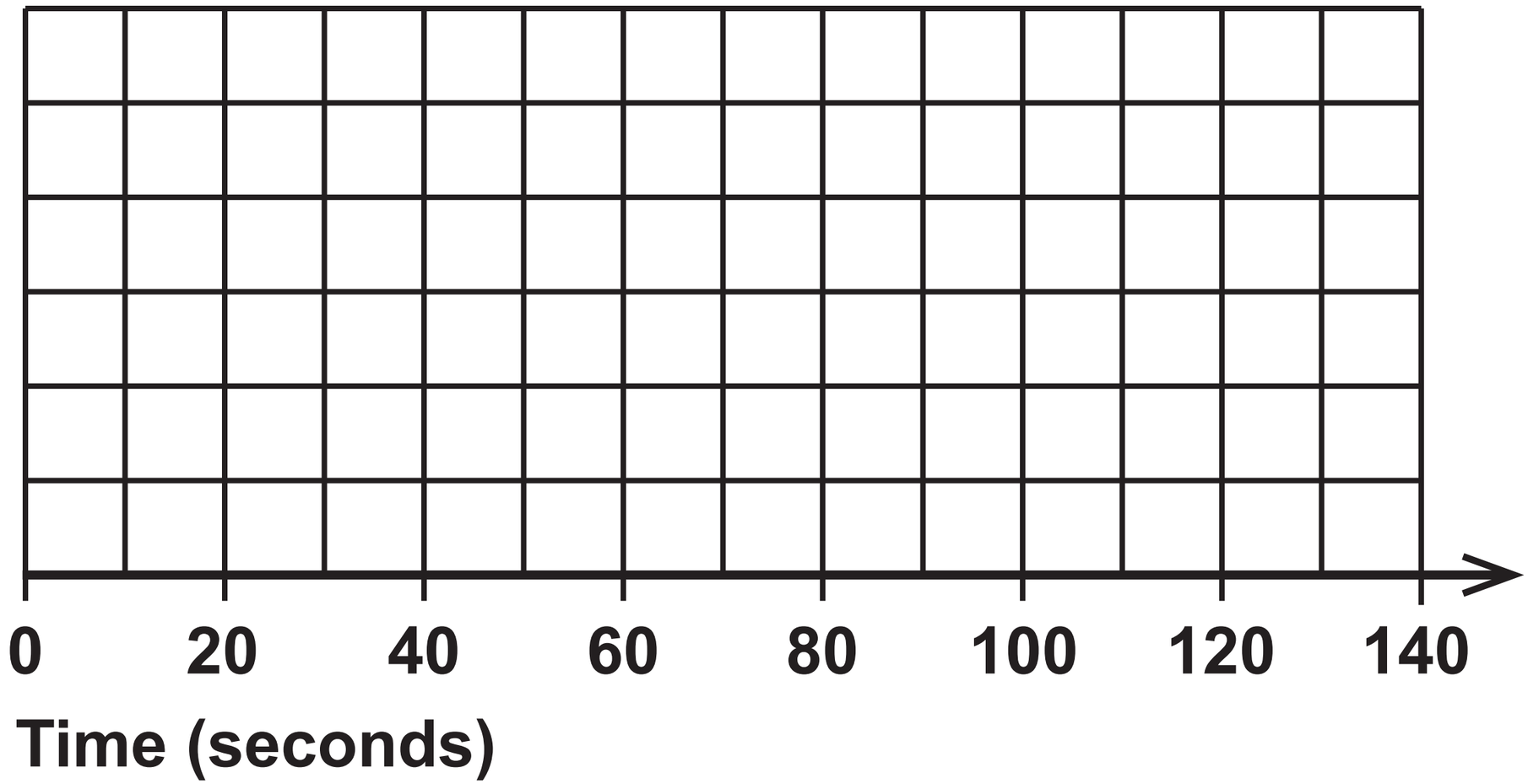
Question 5 (b)

Table

Person selected	Position in the list
1st	4th
2nd	
3rd	
4th	
5th	
6th	

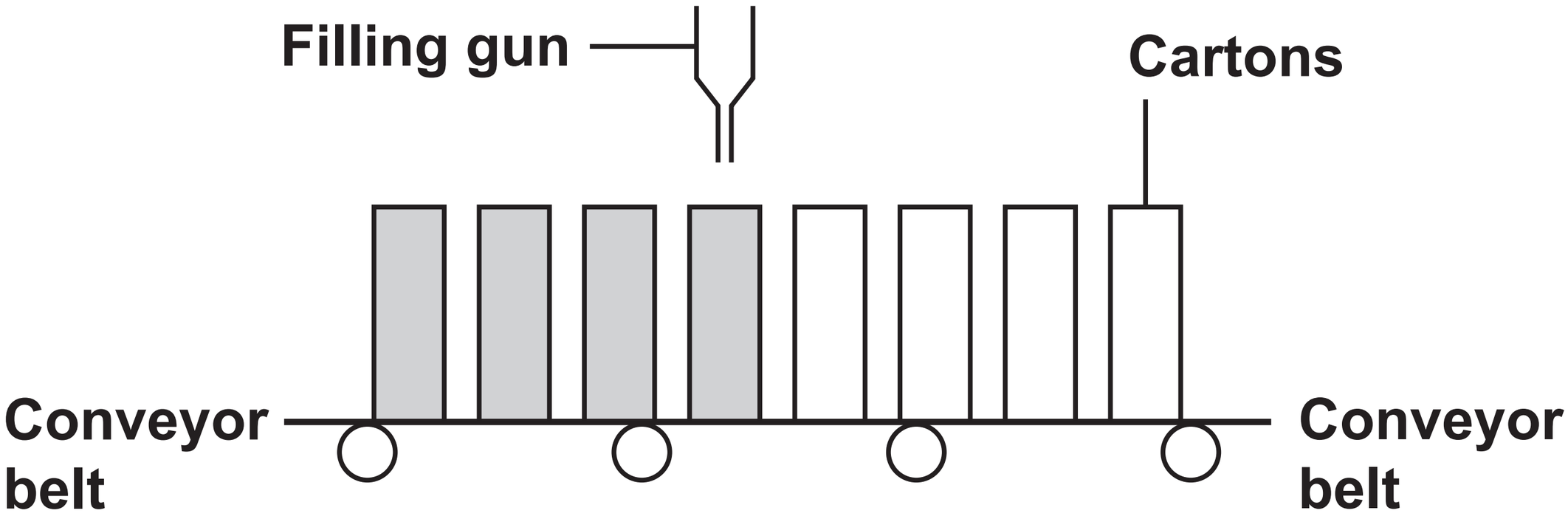
Question 6 (a)

LENGTH OF TIME ON EACH OF 200 PHONE CALLS



Question 7 (a) (ii)

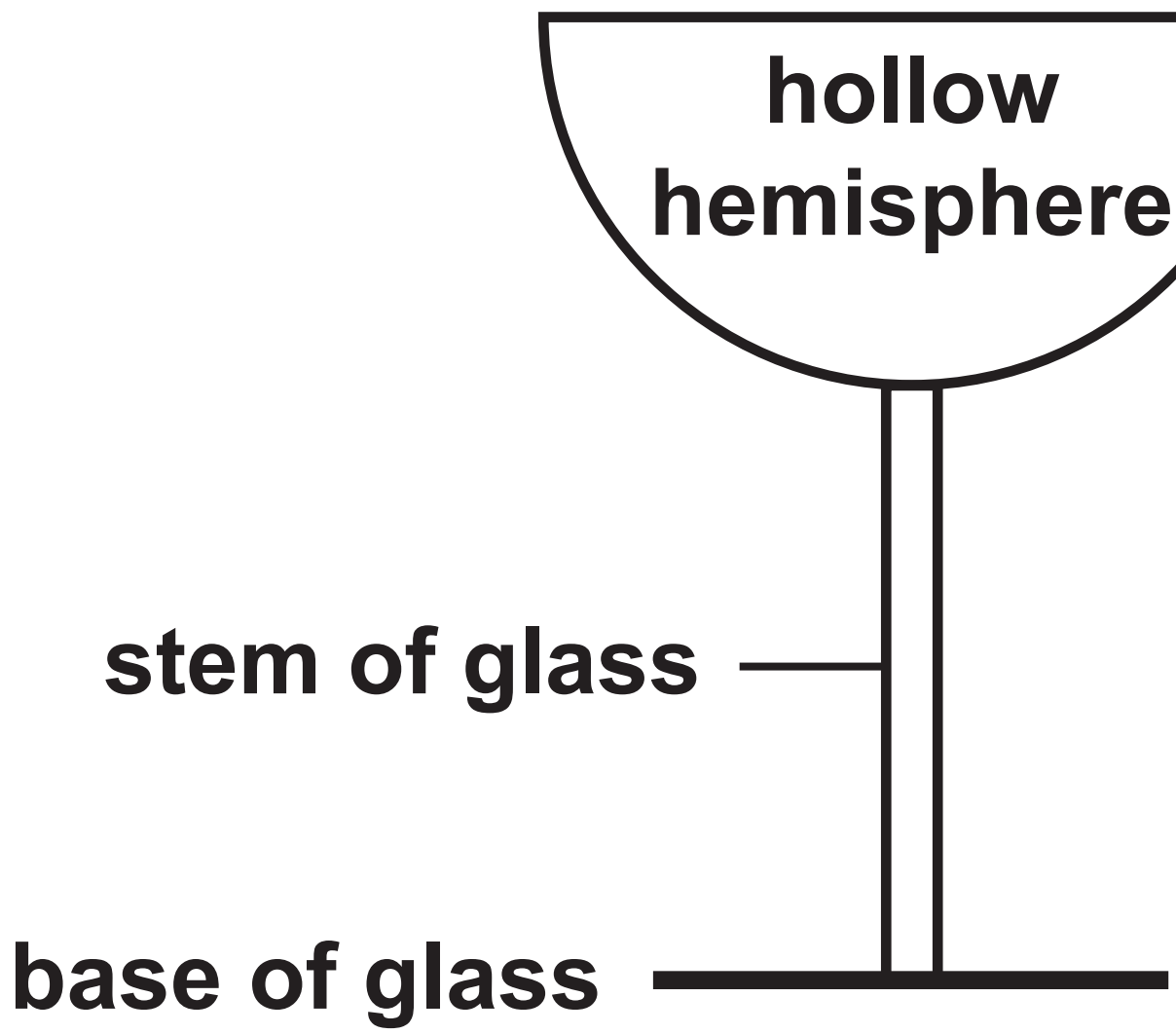
Diagram NOT drawn to scale



Question 9 (a)

Diagram NOT drawn to scale

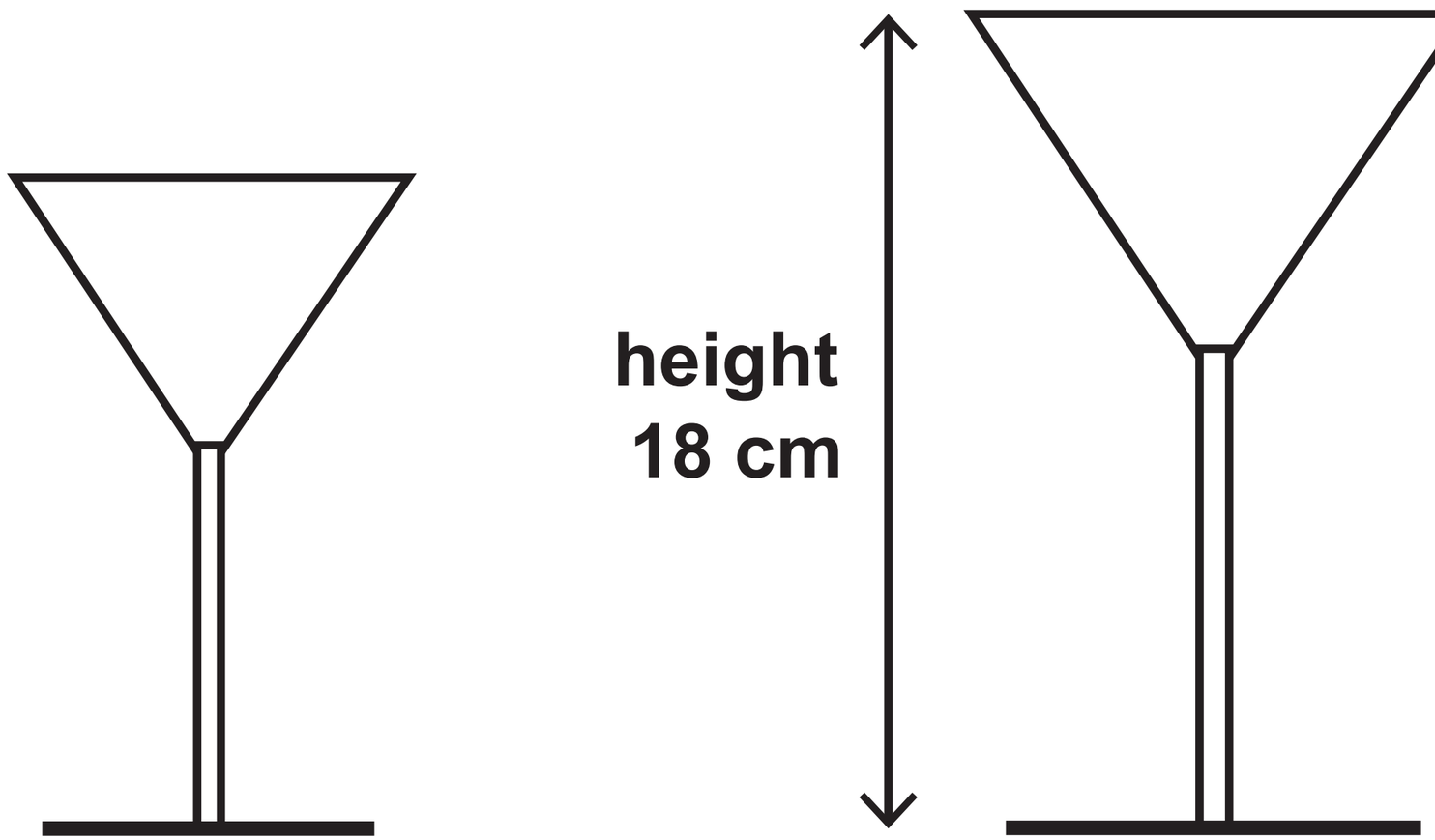
Simplified 2D diagram of a cocktail glass



Question 9 (b)

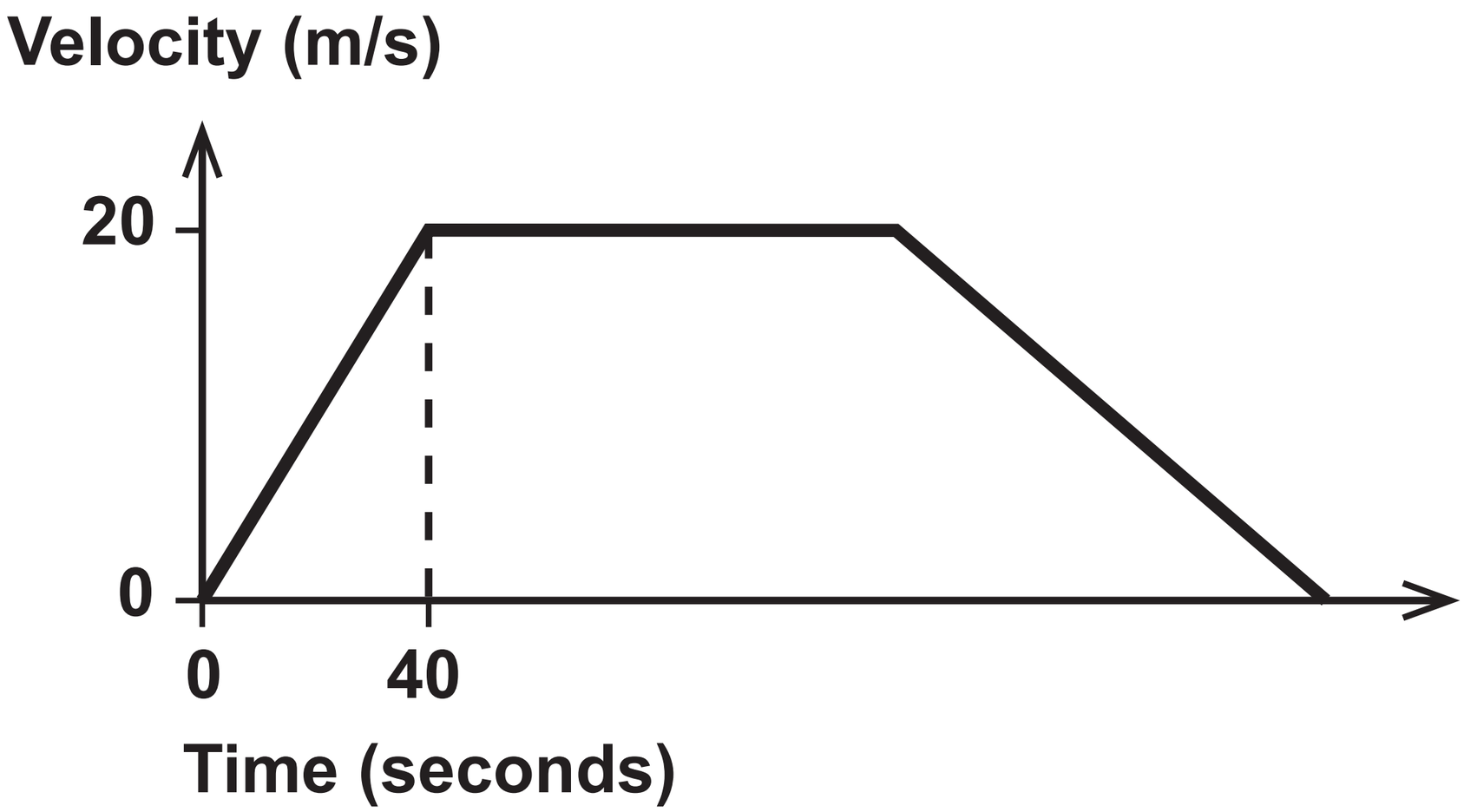
Diagrams NOT drawn to scale

Simplified 2D diagrams of another style of cocktail glass



Question 10 (a)

Diagram NOT drawn to scale



Question 11

Diagrams NOT drawn to scale

Diagram 1

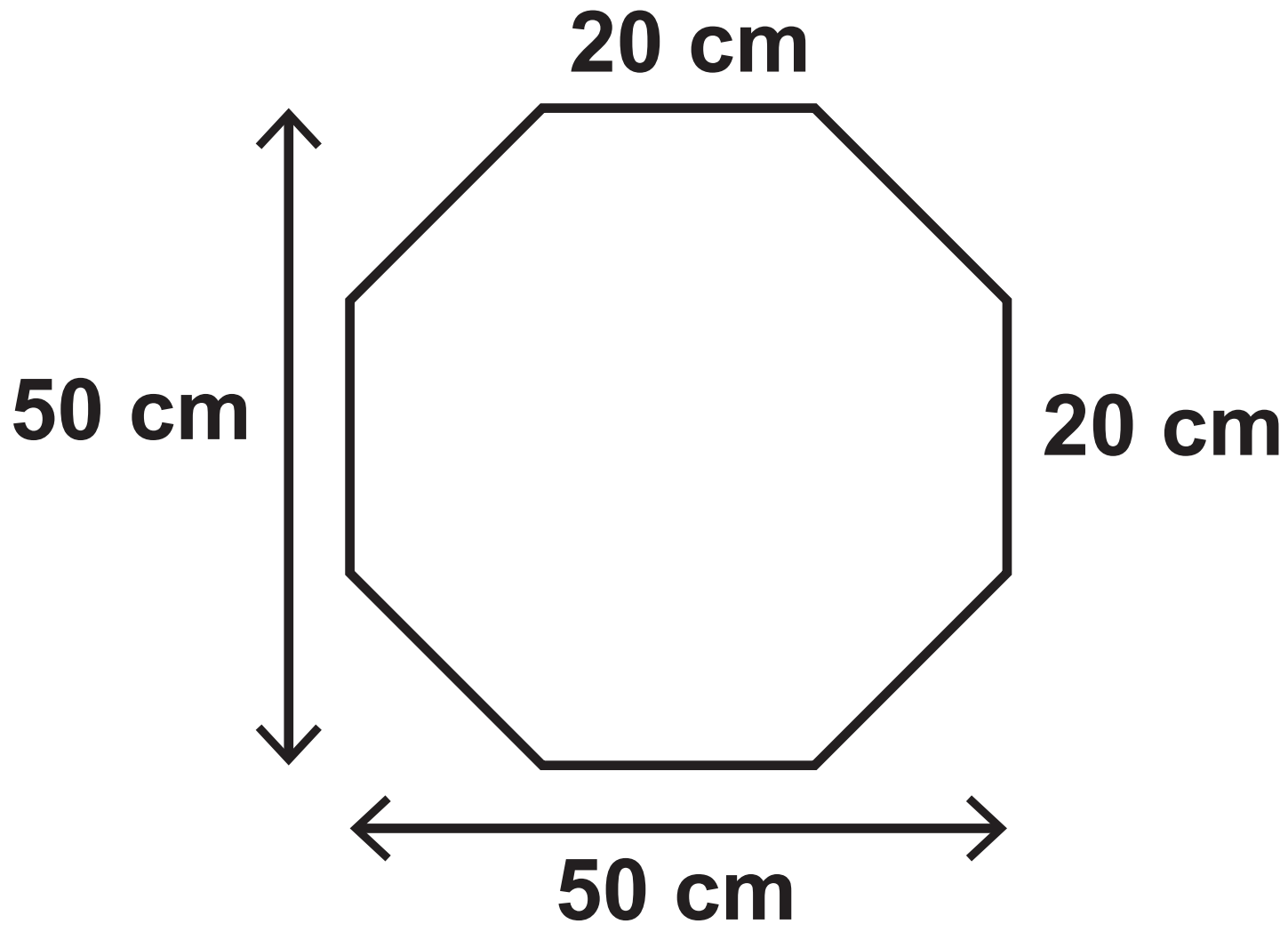
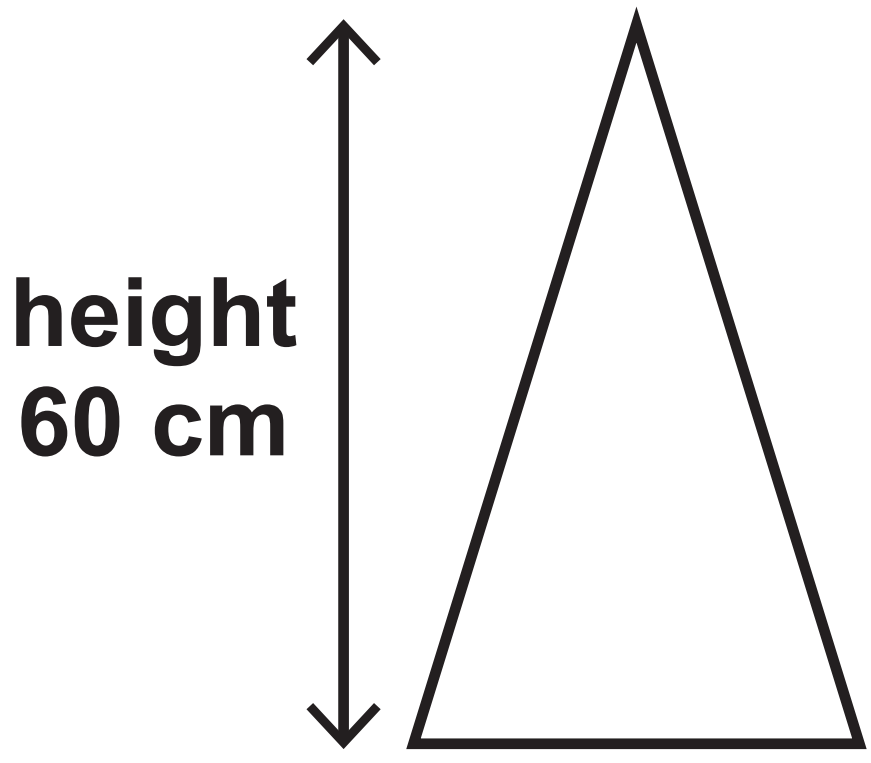


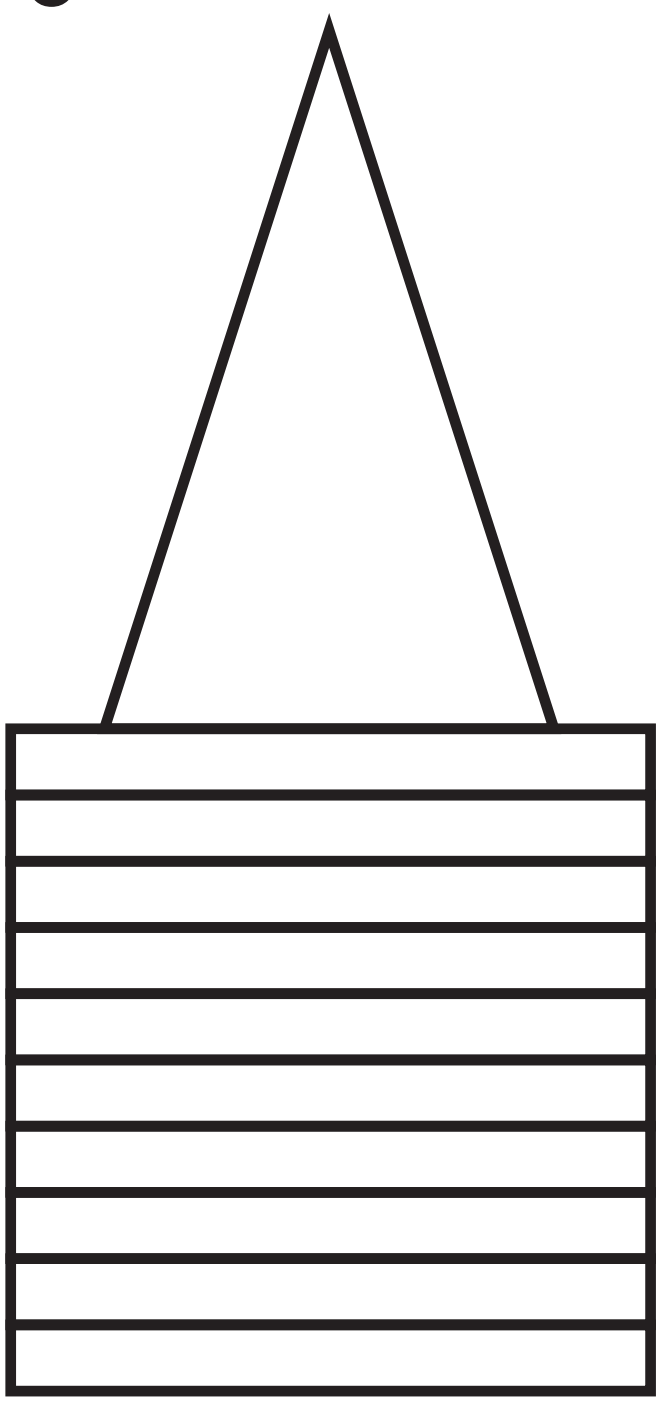
Diagram 2



Question 11

Diagram NOT drawn to scale

Diagram 3



GCSE
MATHEMATICS
and
NUMERACY

FORMULA LIST

HIGHER TIER

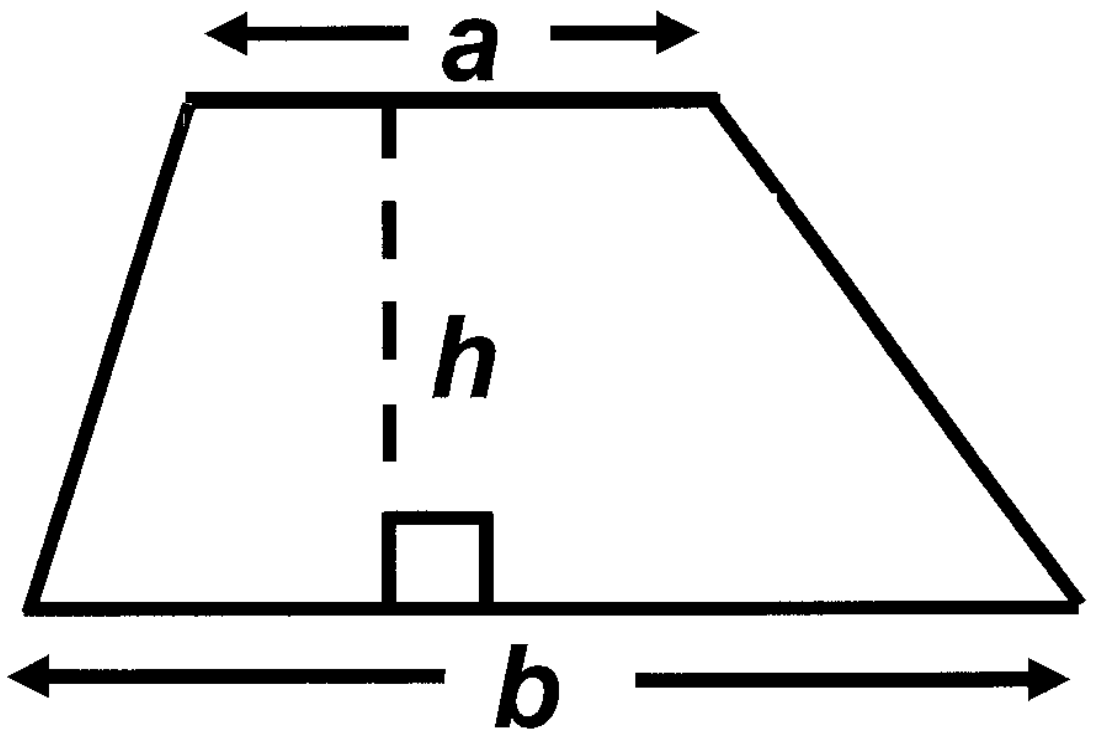
GCSE

You must not write on these formula pages.

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

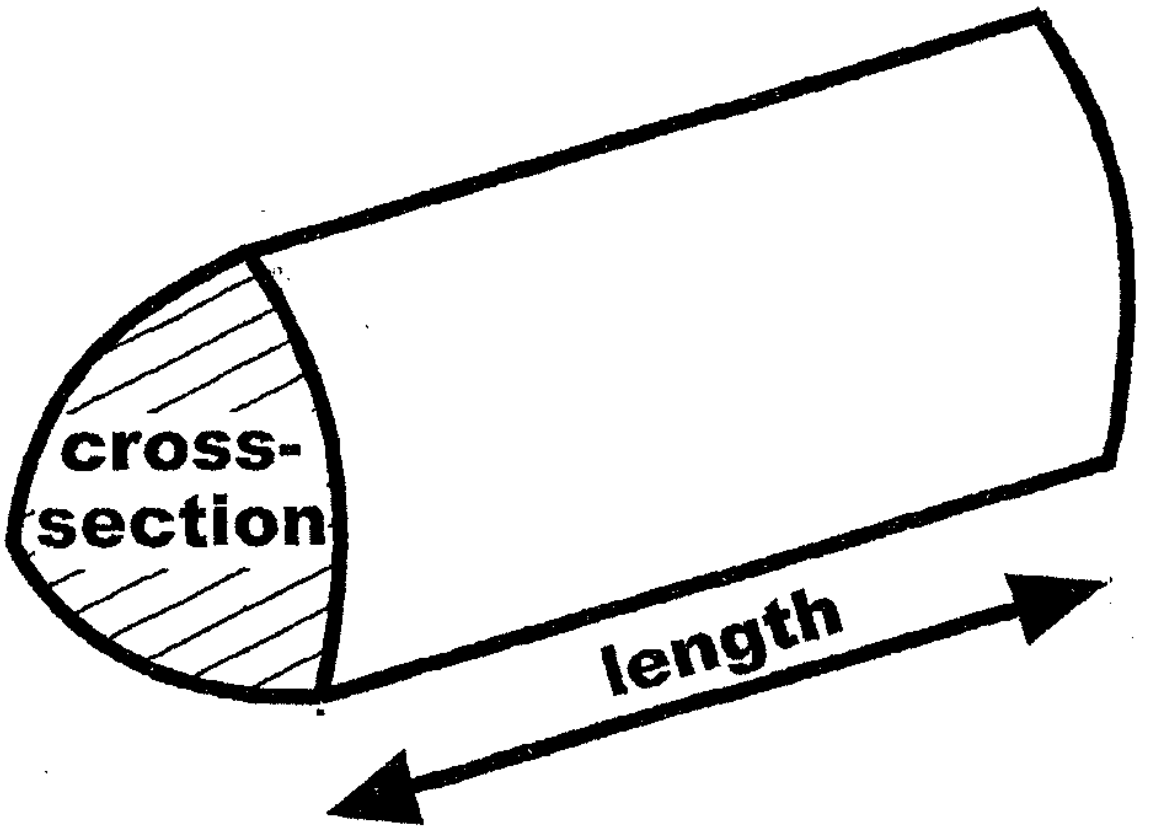
Formula List – Higher Tier

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



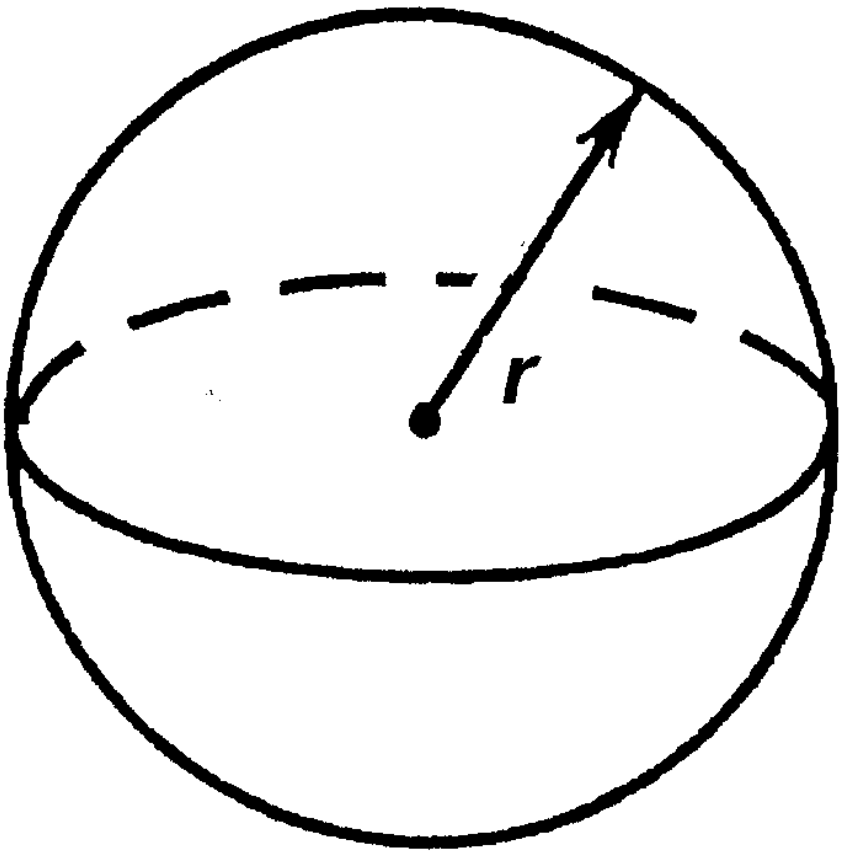
Volume of prism =

area of cross – section × length



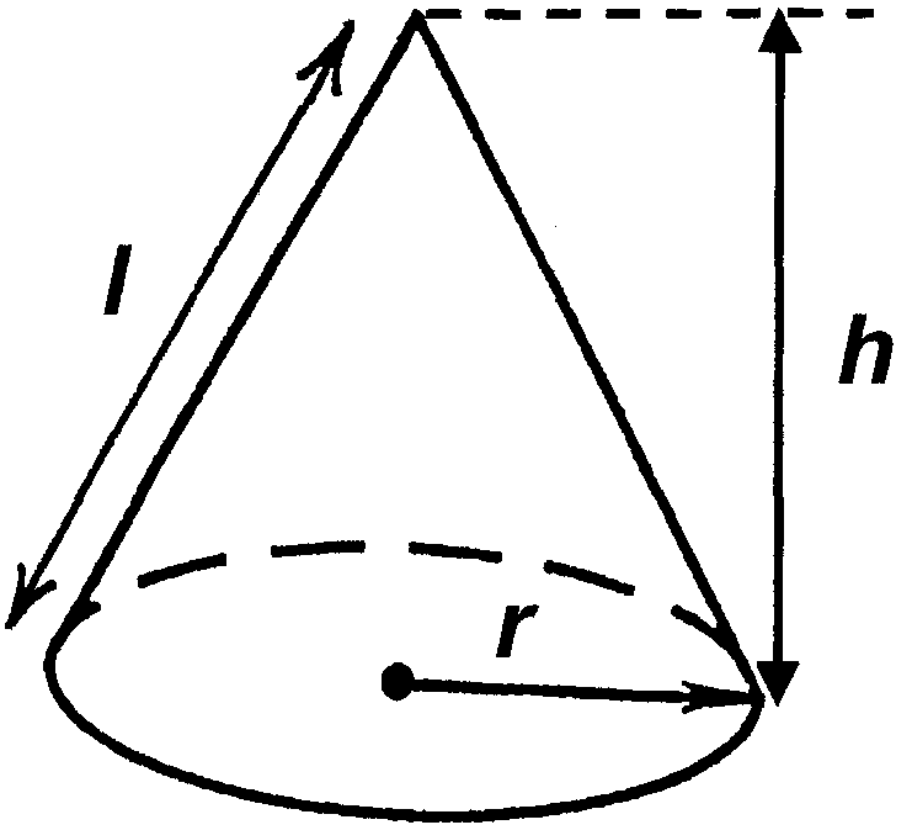
Volume of sphere $= \frac{4}{3}\pi r^3$

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

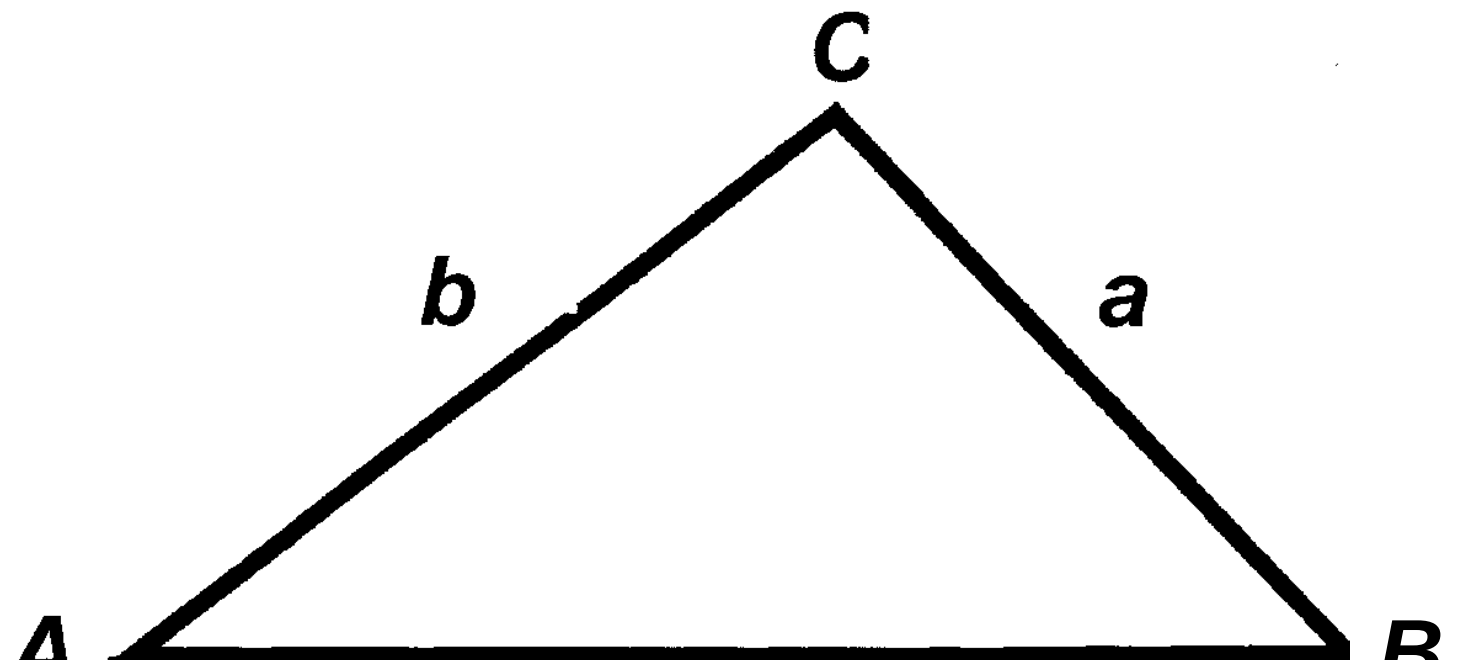


Volume of cone $= \frac{1}{3}\pi r^2 h$

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.