Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

A22-3310U50-1

3310U50-1

TUESDAY, 8 NOVEMBER 2022 – MORNING

MATHEMATICS – NUMERACY
UNIT 1: NON-CALCULATOR
HIGHER TIER

1 hour 45 minutes

ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the additional page at the back of the booklet. Question numbers must be given for the work written on the additional page.

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**(a), the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**15**	
2.	**13**	
3.	**8**	
4.	**6**	
5.	**8**	
6.	**6**	
7.	**5**	
8.	**5**	
9.	**11**	
10.	**3**	
Total	**80**	

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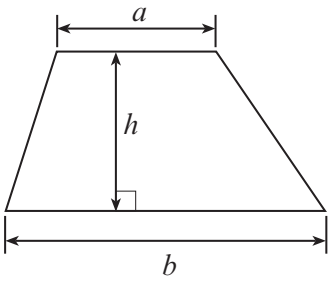
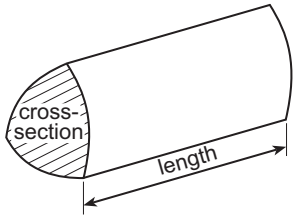
Formula List – Higher Tier

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

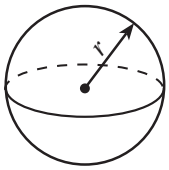


Volume of prism = area of cross-section × length



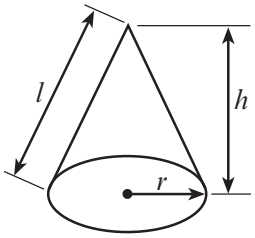
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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

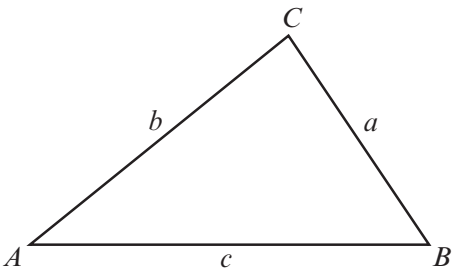


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



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.

Examiner only

1. (a) *In this part of the question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

Malik has two orchards.
He has apple trees and pear trees in his north orchard.
He has pear trees and cherry trees in his west orchard.

In the north orchard,
- Malik has a total of 35 trees
- number of apple trees : number of pear trees = 4 : 3.

In the west orchard,
- Malik has twice as many **pear** trees as he has **pear** trees in the north orchard
- number of pear trees : number of cherry trees = 5 : 11.

How many **cherry** trees does Malik have?
You must show all your working. [5 + 2 OCW]

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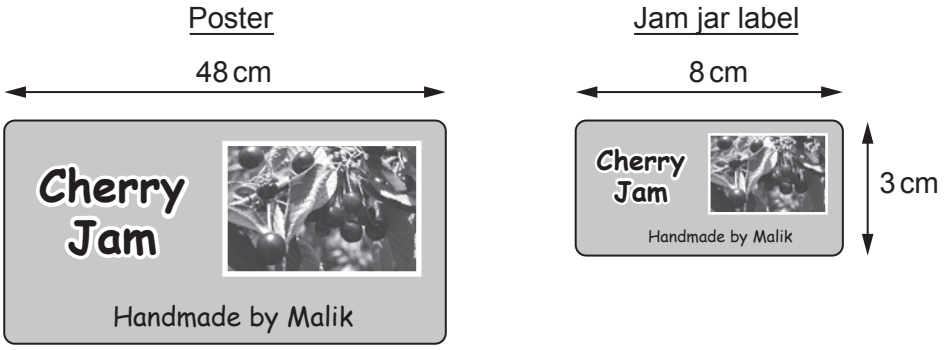
Examiner only

(b) Malik's crop of apples this year has a total mass of 5280 pounds.
He makes apple juice from $\frac{1}{6}$ of the mass of his apple crop.
Malik makes 2 litres of apple juice from every 5 kg of apples.

Calculate the number of litres of apple juice Malik makes. [6]

Examiner only

(c) Malik makes cherry jam using some of the fruit from his trees.
Malik makes a poster to advertise his jam.
He also makes labels for the jars.
The poster and the labels are mathematically similar.



Diagrams not drawn to scale

Calculate the height of the poster. [2]

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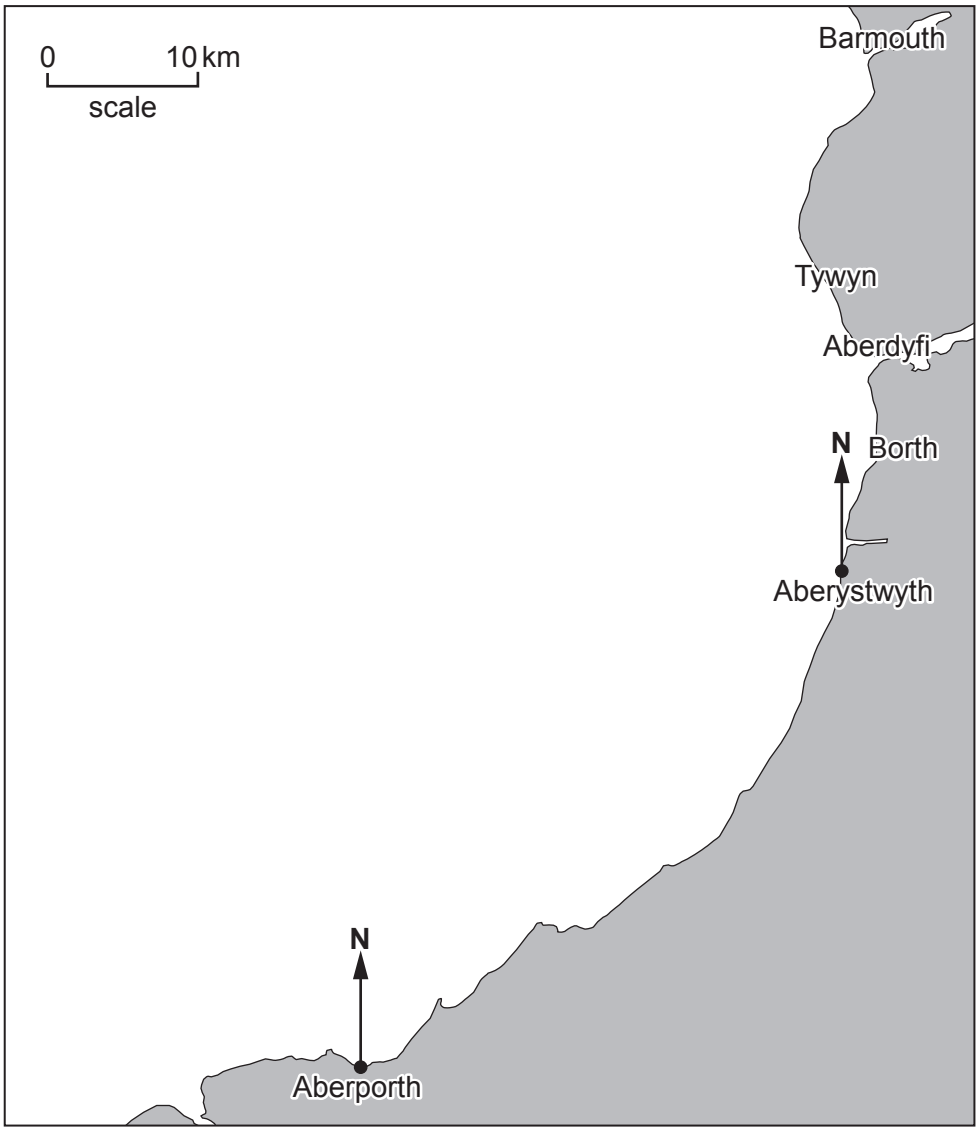
2. Whales are sometimes spotted in the Irish Sea, off the west coast of Wales.

A minke whale was spotted on a bearing of:

- 010° from Aberporth
- 280° from Aberystwyth.



(a) Scientists decide to search for other whales in the Irish Sea.
The search area is the region within 20 km of the position where the minke whale was spotted.

Using the scale given, show this search area on the map above. [4]

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Examiner only

(b) This minke whale has a length of 20 feet.

Remember: 1 inch ≈ 2·5 cm, 1 foot = 12 inches

Use these facts to complete the following statement. [3]

The minke whale has a length of ..... metres.

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(c) The brain of a minke whale has 12·8 billion neocortical neurons.
A female human brain has 19 billion neocortical neurons.

Remember: 1 billion = 1000 million

(i) Calculate an **estimate** for the number of neurons in a minke whale brain expressed as a percentage of the number of neurons in a female human brain.
You must show all your working. [2]

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Approximately ..... %

(ii) 10% of all neocortical neurons are lost over a human lifespan.
Calculate the number of neocortical neurons in a female human brain at the end of a lifespan.
Give your answer in standard form. [4]

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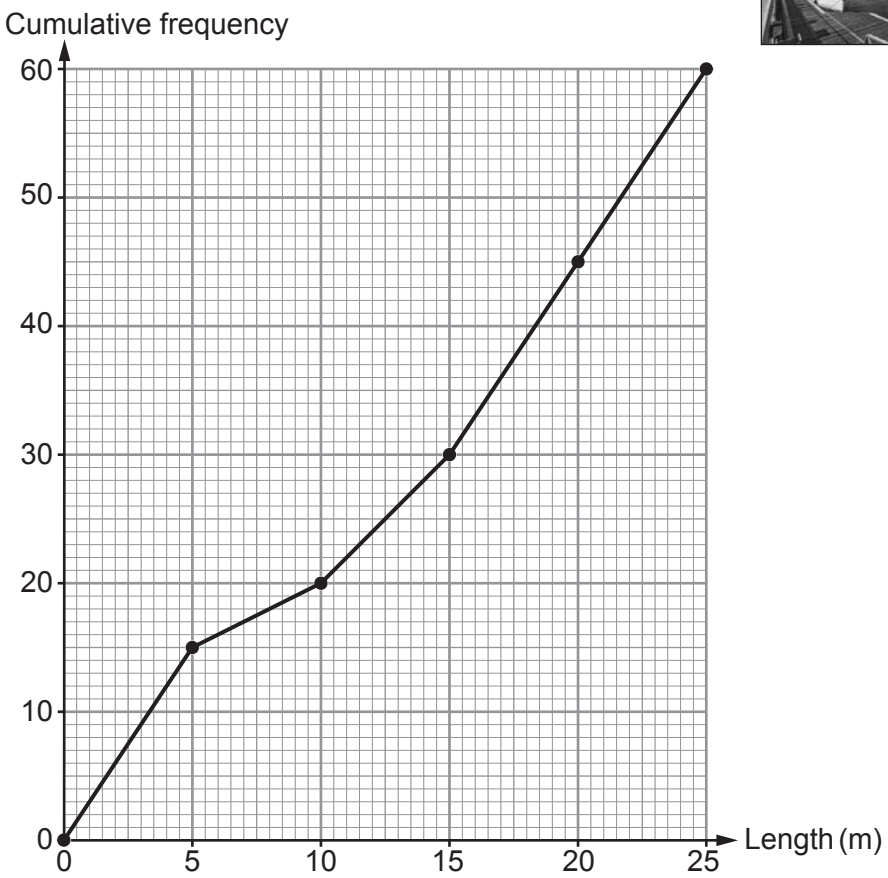
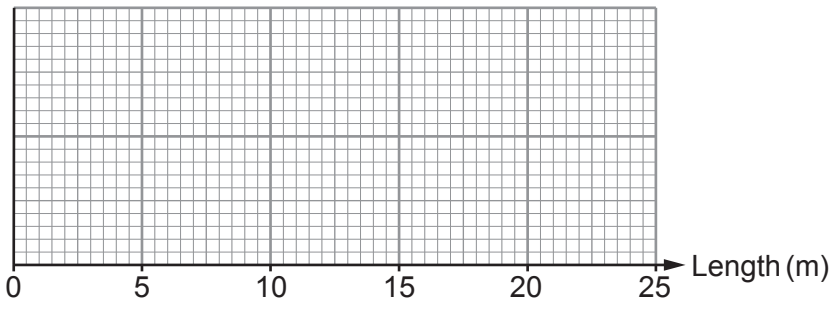
3. (a) The lengths of the 60 yachts in Eog Marina were measured.
The results are shown in the cumulative frequency diagram below.



The shortest yacht has a length of 3 m.
The longest yacht has a length of 22 m.

Use the information above to complete a box-and-whisker diagram on the graph paper below. [3]



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(b) The lengths of the 68 yachts in Clwyd Marina were measured.

For these yachts:
- the lower quartile of their lengths is 10 m
- 25% have lengths greater than 18 m
- the median length is 11·6 m.

(i) Calculate how many of the yachts in Clwyd Marina have lengths greater than 10 m. [2]

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..... yachts

(ii) In which marina, Eog or Clwyd, is the interquartile range of the lengths of the yachts greater?

Eog Marina ☐ Clwyd Marina ☐

You must show all your working. [2]

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(iii) In which marina is the longest yacht?

Eog Marina ☐ Clwyd Marina ☐ Can't tell ☐

You must give a reason for your answer. [1]

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Examiner only

4. Melin is a company that packages flour for sale in supermarkets.
It packages the flour in cylindrical bags.
The area of the cross-section of each of these bags is $25\,cm^2$.

(a) Write down an expression, in terms of π, for **the radius of the base** of each of these bags. [2]

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(b) Each bag has a volume of $500\,cm^3$.

(i) Currently the bags are filled with flour at a rate of $\frac{1}{4}$ of a bag per second.
Complete the following statement. [2]

Melin packages bags of flour at a rate of ..... cm^3 per minute.

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(ii) A new cylindrical bag is designed to have the same capacity and to be more stable.

Melin decides to increase the area of the cross-section of its original bags by 100%.
Calculate the height of this new bag. [2]

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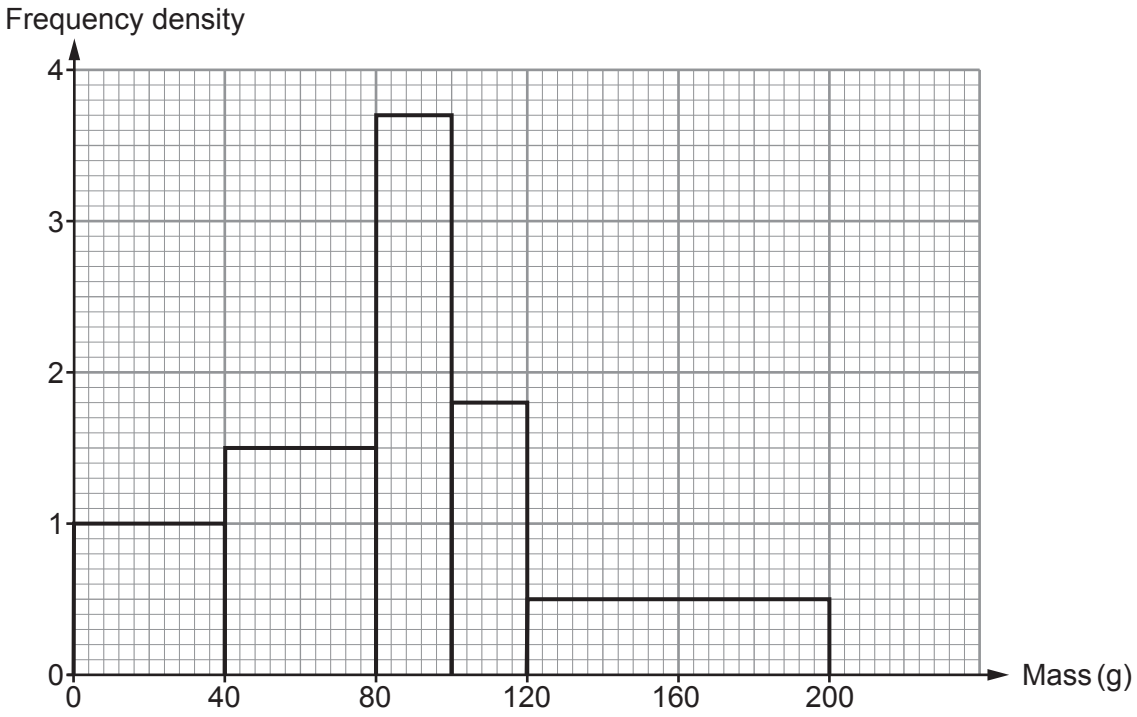
Examiner only

5. Madeleine is researching the effects of waves. She does this at two different beaches, Llanddawel and Abertig.
She measures the masses of pebbles in a sample taken from each beach.

(a) Look at the histogram below. It shows the masses of the pebbles in the sample taken from Llanddawel beach.

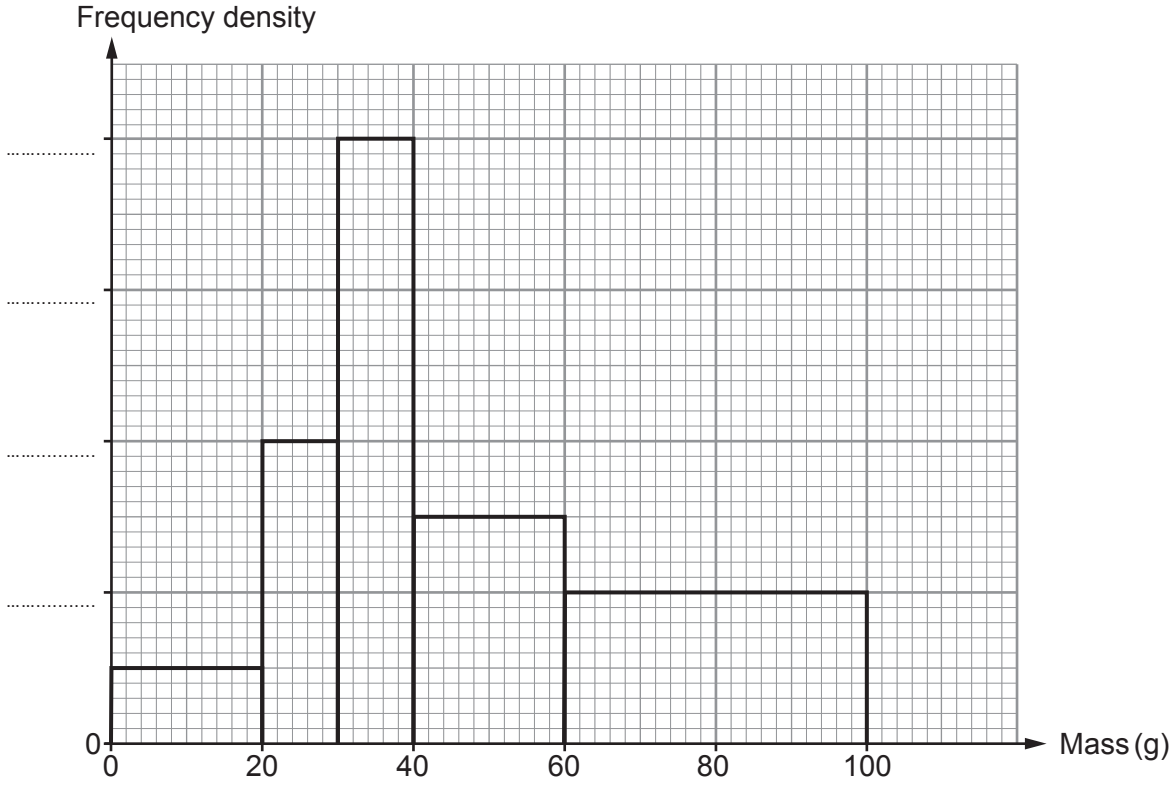


Calculate an estimate for the percentage of pebbles in Madeleine's sample that had a mass of less than 70 g. [5]

Examiner only

(b) Look at the histogram below. It shows the masses of the pebbles in the sample taken from Abertig beach.

The scale on the vertical axis is missing.



(i) 120 pebbles each had a mass of less than 30 g.
Use this fact to complete the frequency density axis above. [2]

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(ii) What was the median mass of the pebbles in the sample taken from Abertig beach?
Circle your answer. [1]

30 g 40 g 45 g 50 g 50·5 g

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Examiner only

6. Luke wants to lay wooden flooring in the living room of his house.
The plan view of his living room floor is shown below.

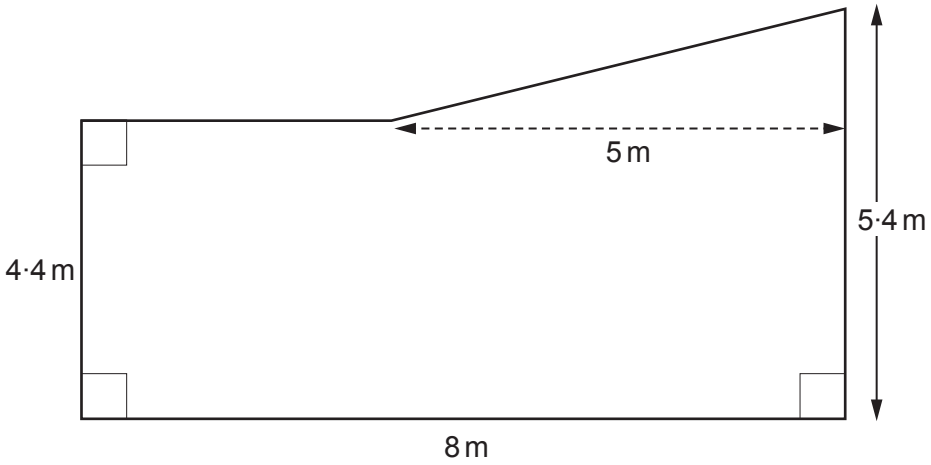

Diagram not drawn to scale

All the measurements shown on the diagram are **correct to the nearest 0·2 m**.

Luke knows that:

- each pack of wooden flooring covers **exactly 3 m^2**
- 10% needs to be added to the area of the floor that is to be covered, to ensure he has enough wooden flooring.

Calculate the minimum number of packs needed to guarantee that Luke has enough wooden flooring to cover his living room floor.
You must show all your working. [6]

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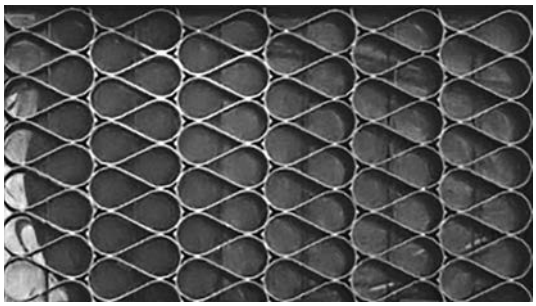
Number of packs is .....

7. Nia saw this bottle rack in her local hotel.



Nia decides to make a smaller bottle rack in the same style.
The front view of her bottle rack is shown below.
Nia made the rack from bending a long sheet of metal.

It has straight sections, each of length 6·6 cm.
It also has curved sections that are all arcs of a circle with radius 4·5 cm and sector angles of 120° or 240°.

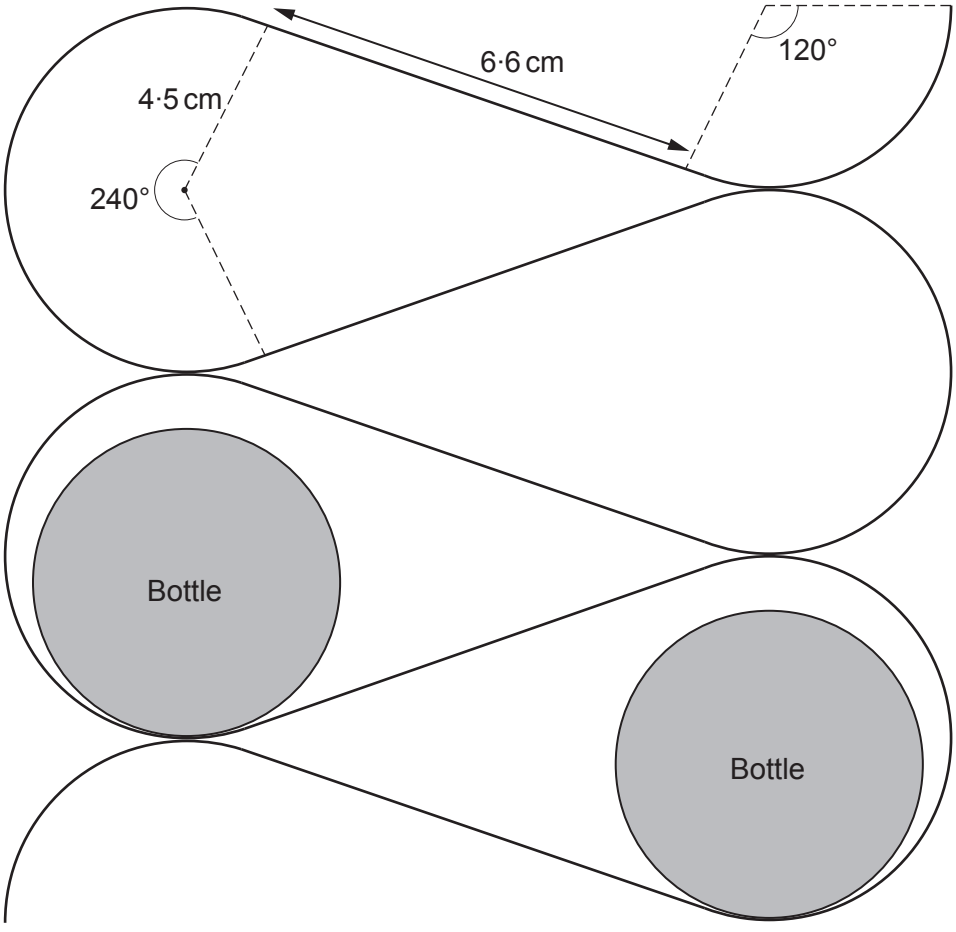


Diagram not drawn to scale

Examiner only

Calculate the length of the sheet of metal that Nia needed for her design.
Give your answer in terms of π, in its simplest form.
You must show all your working. [5]

Length of metal sheet needed = ... cm

Examiner only

8. Emma wants to know how much water is in a pond near her house.
She has taken width measurements of the pond every 3 m along its length.
These width measurements are shown on the plan view of the pond below.

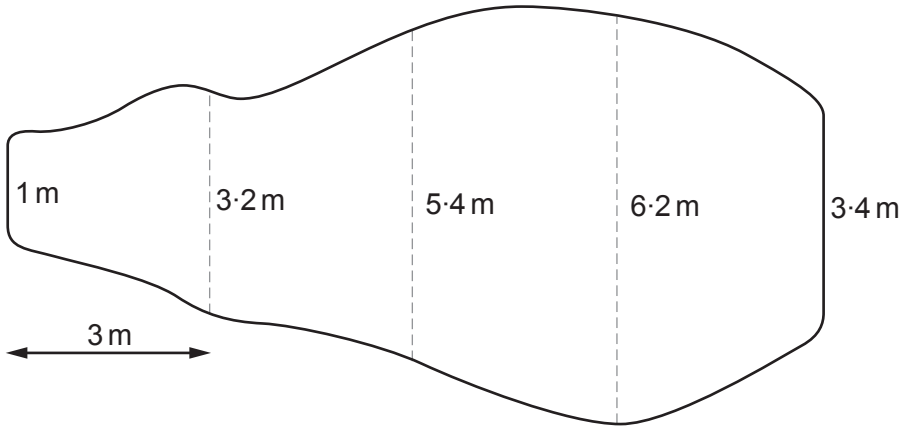


Diagram not drawn to scale

Emma has used these width measurements to sketch the following graph.

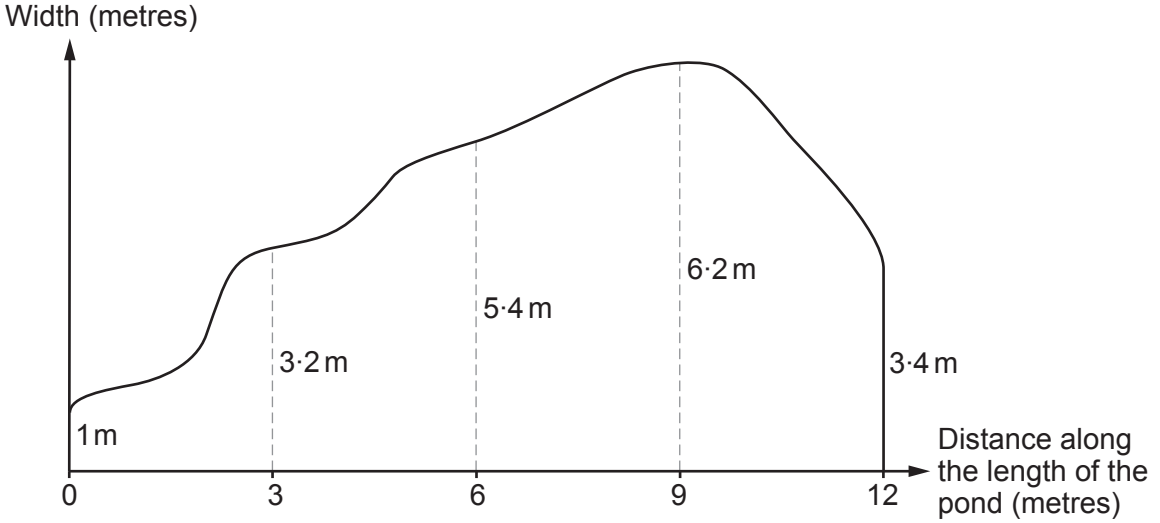


Diagram not drawn to scale

Emma knows that the pond has a uniform depth of 1·2 m.
Use the trapezium rule with 4 strips to calculate an estimate for the volume of water in the pond. [5]

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Examiner only

Estimate of the volume of water in the pond = ... m^3

9. (a) Geralt owns 2 ice cream shops.

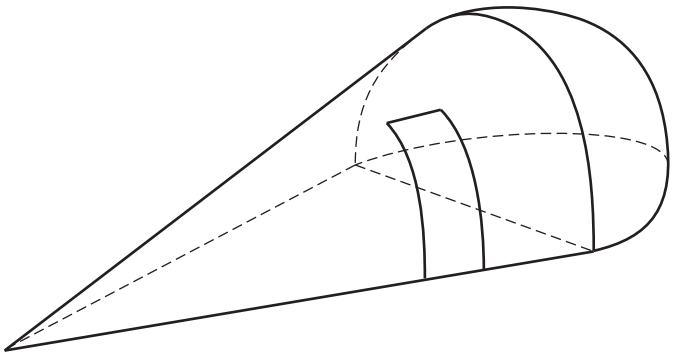
On a sunny Saturday, Geralt sold 400 ice creams in total in 4 hours in the 2 shops.

Geralt is considering opening another ice cream shop.
He expects the sales per hour in each of the 3 shops to be the same.

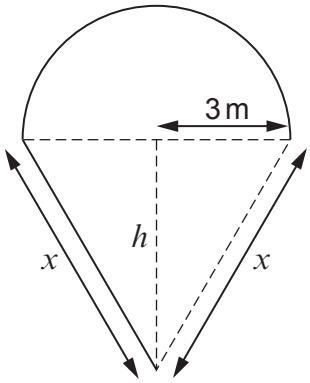
His ice cream shops will be open for 5 hours a day.
Calculate how many ice creams Geralt would expect to sell in total on a sunny Saturday in 5 hours in the 3 shops.
You must show all your working. [3]

Examiner only

(b) Geralt has decided to open a new ice cream shop at his local seafront.
He has designed his new ice cream shop to look like half an ice cream cone.
The design consists of half a hollow cone connected to half a hollow hemisphere, as shown below.



Plan view



Diagrams not drawn to scale

The radius of the base of the half hemisphere is 3 m.
The perpendicular height of the cone is shown as h on the diagram above.

Geralt designed the shop so that the volume of the half cone is equal to the volume of the half hemisphere.

Calculate the length x. Give your answer in the form $a\sqrt{b}$, where a and b are both integers and b is as small as possible. [8]

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Examiner only

Examiner only

10. A rubber ball is dropped from a height of 8 m onto horizontal ground.
After each bounce, the ball reaches a maximum height that is 17% lower than the maximum height reached after its previous bounce.

The diagram below shows the path of the ball for the first few bounces.

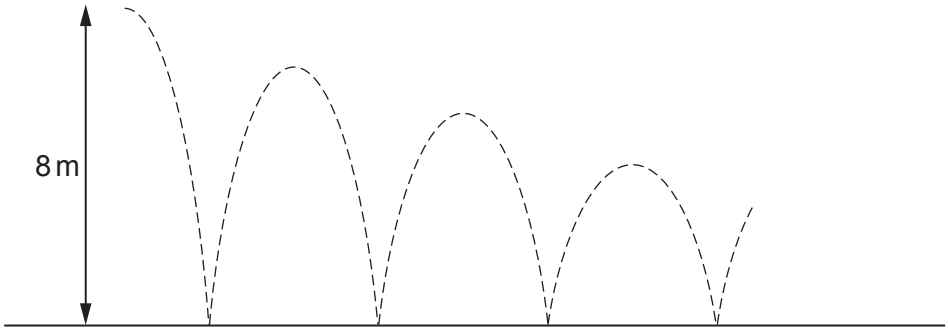

Diagram not drawn to scale

Write a **formula** for the maximum height, H, in metres, reached by the ball after n bounces.

[3]

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END OF PAPER

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

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