Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3310U50-1

A23-3310U50-1

TUESDAY, 7 NOVEMBER 2023 – 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** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

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 **6**, 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.	**9**	
2.	**4**	
3.	**6**	
4.	**11**	
5.	**4**	
6.	**6**	
7.	**7**	
8.	**6**	
9.	**12**	
10.	**6**	
11.	**9**	
Total	**80**	

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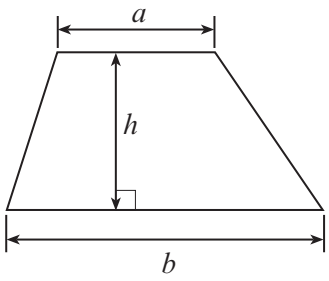
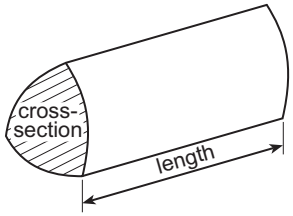
Formula List – Higher Tier

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

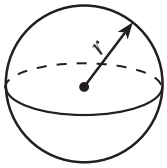


Volume of prism = area of cross-section × length



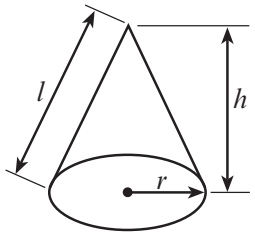
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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

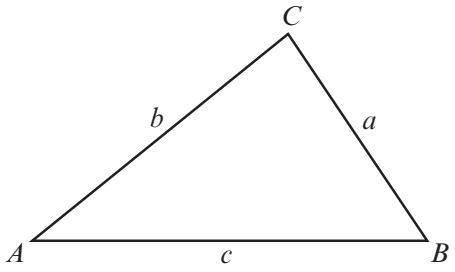


In any triangle ABC

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.

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Examiner only

1. Rhodri is organising a 21st birthday party.

(a) Confetti for the party is packed in small boxes.
Each box is in the shape of a triangular prism.
The cross-section of each box is an isosceles triangle.
The measurements are shown on the diagram below.

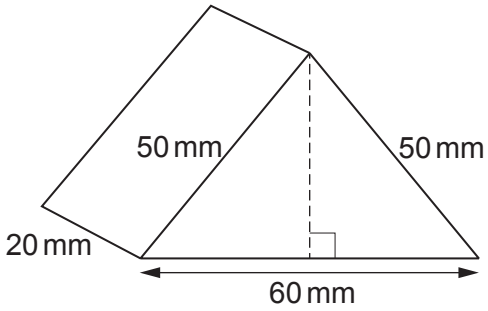

Diagram not drawn to scale

(i) Show that the perpendicular height of the cross-section of a confetti box is 40 mm.
You must show all your working. [3]

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(ii) This is the label on a confetti box..

The volume of this box is at least 20000 mm^3.

Calculate the volume of a confetti box to show that the statement on the label is correct. [3]

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(b) Rhodri finds 2 venues that arrange party nights.

Friar Hall Party night special £105 hall hire charge + £5 per person		Minfelin Lodge Party night special £207 room hire charge + £3 per person

Rhodri calculates the total cost of organising the party at each venue.
He finds that the total costs are the same.
For how many people is Rhodri planning the 21st birthday party?
You must show all your working. [3]

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2. A supermarket sells 2 varieties of washing powder: Dazzle and Sparkle.
Both washing powders are sold in 3·3 kg packets.
The ratio of the prices of the washing powders is as follows.

Dazzle : Sparkle = 9 : 10

The price of a 3·3 kg packet of Sparkle is £4.40.

Calculate the **cost per kilogram** of Dazzle.
You must show all your working. [4]

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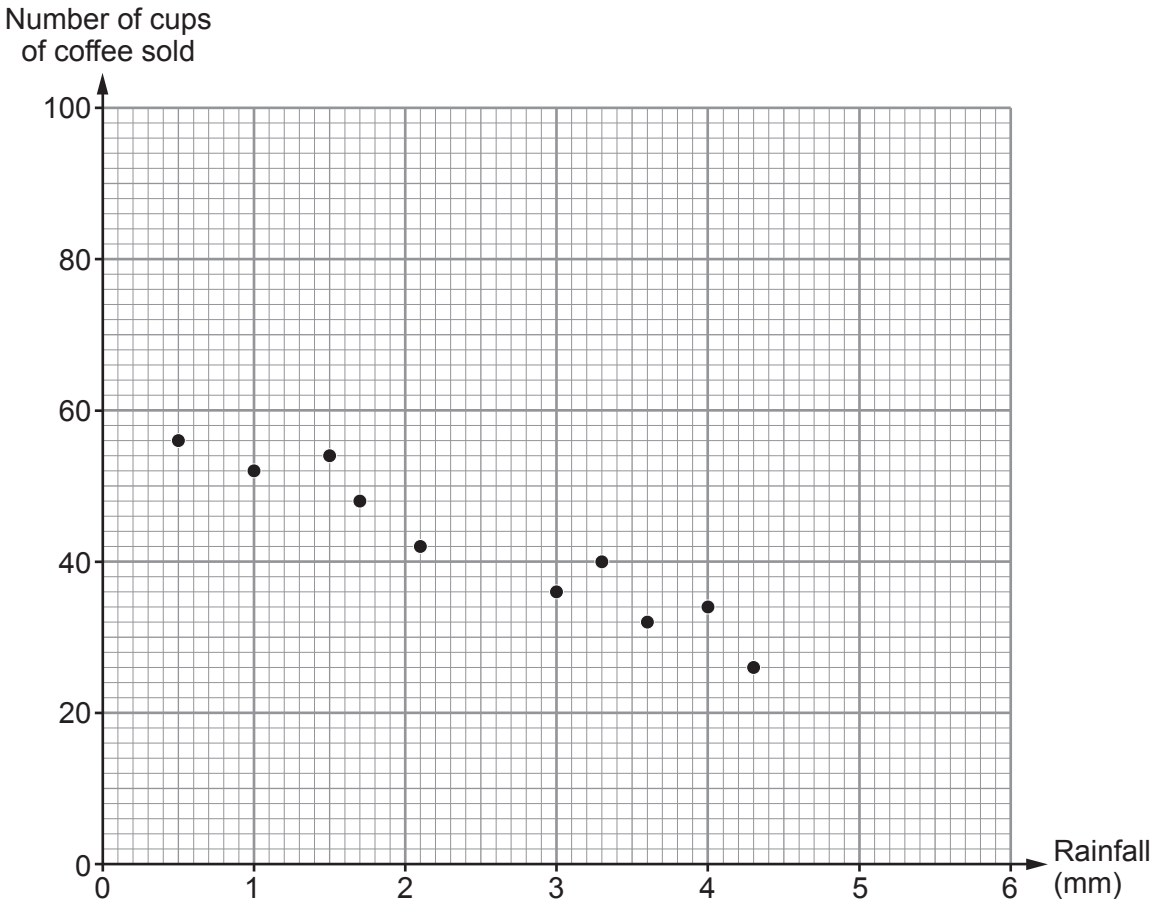
3. Anwen has an outdoor mobile coffee stall.

(a) It rained on each of the last 10 days.
Each day, Anwen recorded the amount of rainfall and the number of cups of coffee she sold.
The scatter diagram below shows her results.



For the last 10 days:

- the mean number of cups of coffee sold per day was 42
- the **total** rainfall was 25 mm.

(i) Give the coordinates of the point through which a line of best fit should be drawn.
Hence, draw a line of best fit on the scatter diagram. [2]

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Coordinates of the point are (..... , ...)

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(ii) Estimate the number of cups of coffee that Anwen expects to sell on a day when the rainfall is 2·0 mm.
Use your line of best fit to find your estimate. [1]

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Number of cups of coffee is .....

(b) Anwen buys her coffee beans in tins.
Each tin has a height of 18 cm, correct to the nearest 1 cm.

Calculate the maximum height of a stack of 5 of these tins. [2]

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(c) The height of the storage space under Anwen's serving counter is 97·5 cm, correct to the nearest 0·5 cm.

Anwen is going to buy a recycling bin of height exactly 97·3 cm.
Can Anwen be certain that she can fit this bin under her serving counter?

Yes ☐ No ☐ Can't decide ☐

You must show working to support your answer. [1]

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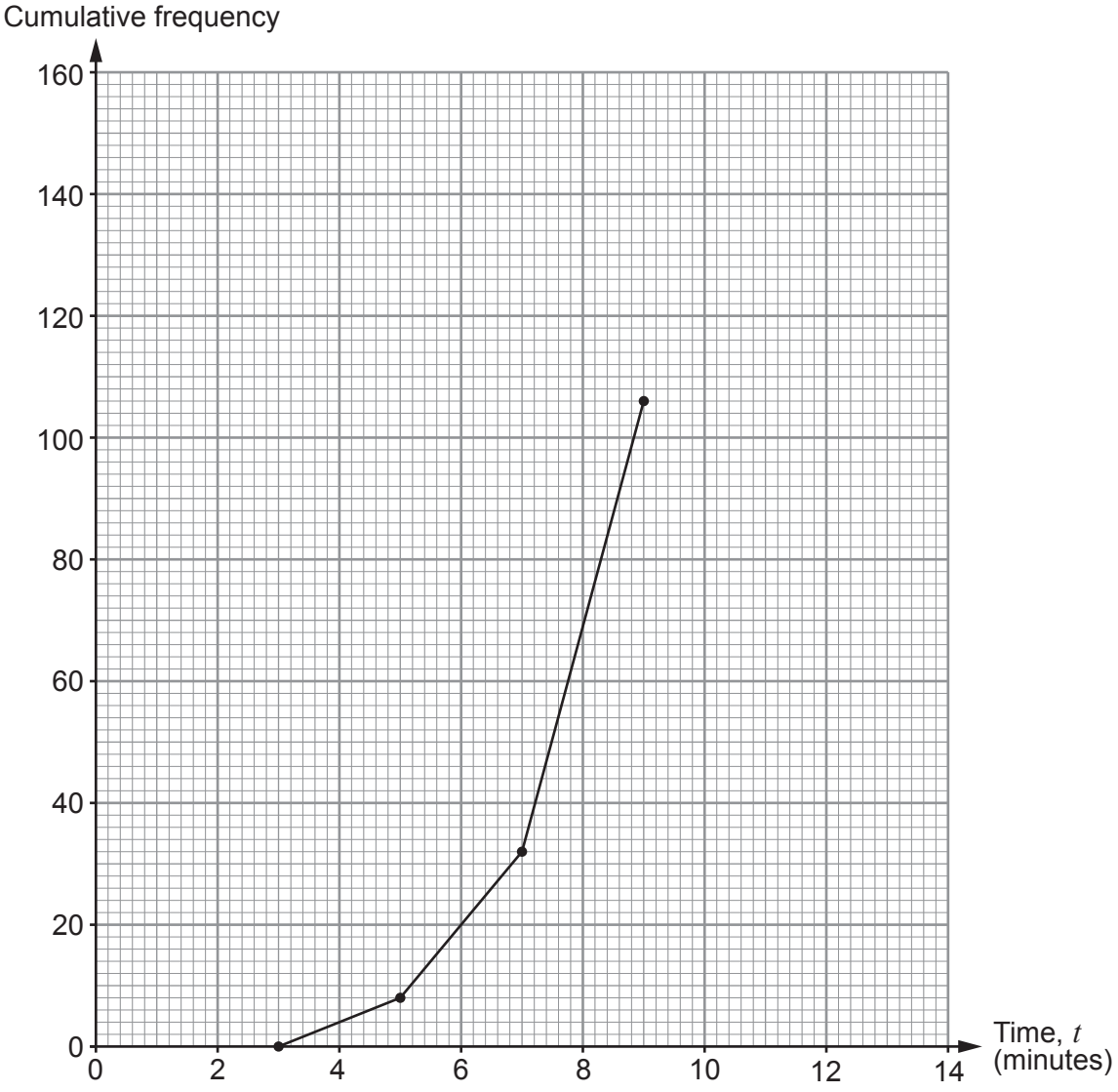
4. Giovanni has a takeaway pizza van. He sells whole pizzas and slices of pizza from his van.

(a) For the last 3 days, he has timed how long it takes to complete the food order for each of his customers.
Giovanni recorded his results in the table below.

(i) Complete the cumulative frequency table **and** the cumulative frequency diagram. [2]

Time, t (minutes)	Frequency	Cumulative frequency
$3 < t \leqslant 5$	8	8
$5 < t \leqslant 7$	24	32
$7 < t \leqslant 9$	74	106
$9 < t \leqslant 11$	40	.....
$11 < t \leqslant 13$	14	.....



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Use your cumulative frequency diagram to give the best estimates for the answers to each of the following questions.

(ii) Find the median time taken to complete a food order. [1]

The median time is ..... minutes.

(iii) Giovanni is concerned that food orders are taking too long to complete.
He says,

"Only 25% of the food orders are completed in under ..... minutes."

Use **one** of the five values below to complete Giovanni's statement. [1]

6·4 6·6 7·2 8 9·6

(iv) Calculate the percentage of orders that were completed in less than 6 minutes. [2]

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(b) For the last 3 days:
- Giovanni spent £180 on ingredients
- he spent £220 on the running costs for the pizza van
- he received a total of £700 from the food orders.

Calculate Giovanni's percentage profit. [3]

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(c) Next year Giovanni intends to charge £8.40 for a basic pizza.
This is an increase of 20% from the current charge.

Calculate how much Giovanni currently charges for a basic pizza. [2]

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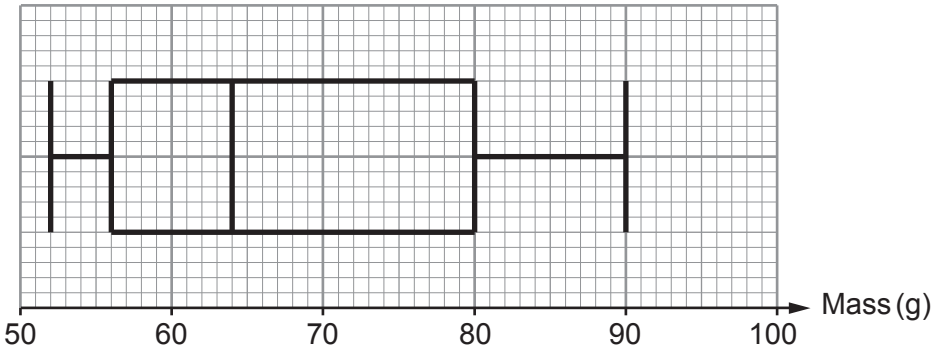
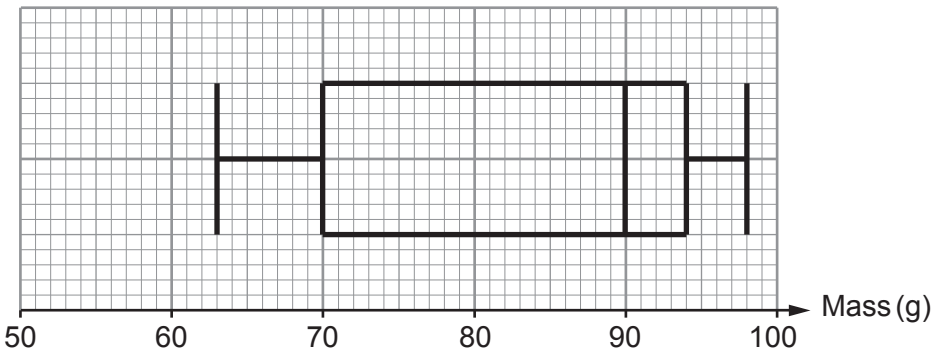
5. Eva grows three varieties of organic potato on her farm: Maris Piper, King Edward and Desiree.
She weighs and records the masses of 400 potatoes of each of the 3 varieties.

Eva constructs box-and-whisker diagrams for the masses of the potatoes weighed.

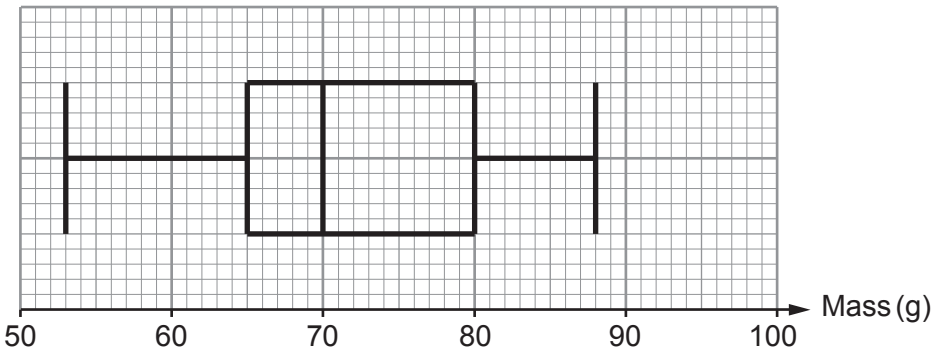
Maris Piper



King Edward



Desiree



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(a) Complete each of the following statements.

(i) The ..... potatoes have the highest median mass.

The median mass of these potatoes is ..... g. [1]

(ii) The range of the masses recorded for the Maris Piper potatoes is ..... g. [2]

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(b) In the future, Eva wants to grow potatoes that are quite similar in size.

Use the box-and-whisker diagrams to advise Eva which of these three varieties of potato she should grow. [1]

Select which variety of potato she should grow.

Maris Piper ☐ King Edward ☐ Desiree ☐

Select the measure you used to help you decide.

Median ☐ Interquartile range ☐ Lower quartile ☐

Select a reason for your choice of measure.

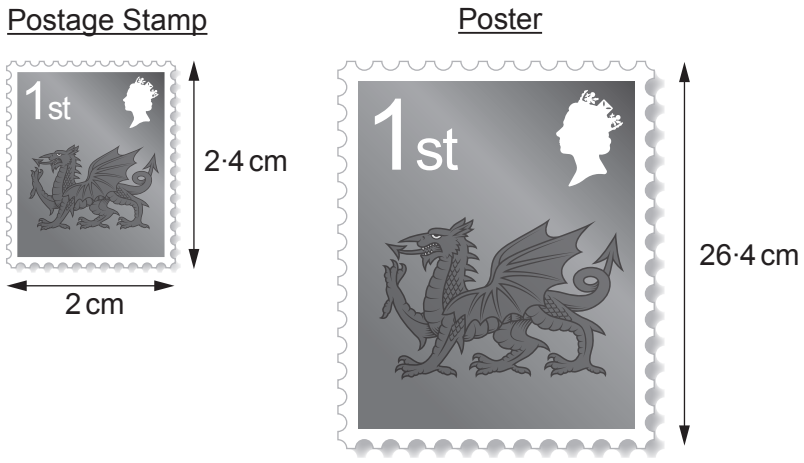
The measure is greater than for the other 2 varieties ☐

The measure is less than for the other 2 varieties ☐

Examiner only

6. *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

An old postage stamp has a width of 2 cm and a height of 2·4 cm.
Frank makes a poster that is **mathematically similar** to the postage stamp, as shown below.



Diagrams not drawn to scale

He places a thin tape along the four edges of the poster.
Calculate the total length of this tape, correct to 1 significant figure.
You must show all your working. [4 + 2 OCW]

Examiner only

7. Trains using electrified railway tracks produce fewer emissions than other trains.

In 2020, the USA had the longest total length of railway track of any country in the world.

	Approximate length of **electrified** railway track (km)	Approximate **total** length of railway track (km)
USA	2×10^3	2×10^5
Rest of the world	$3{\cdot}98 \times 10^5$	$1{\cdot}2 \times 10^6$

Answer the following questions using information from the table.

(a) Calculate the percentage of track in the USA that was electrified in 2020. [2]

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(b) Calculate the fraction of the **whole world's** railway track that was electrified in 2020. Give your answer in its simplest form. [5]

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Examiner only

8. On average, Hywel's car travels a distance of 11 miles **per litre** of petrol used.
The petrol tank in his car can hold 70 **pints** of petrol.
At Hywel's local garage, it would cost him £56 to fill the tank from empty.

Hywel's petrol tank is $\frac{1}{10}$ full.

At his local garage, he spends £28 on petrol.
Calculate the distance Hywel can travel in the car before the tank is empty.
You must show all your working. [6]

Distance Hywel can travel before the tank is empty = ... miles

Examiner only

9. Akago is a food delivery company.

(a) 5 Akago delivery vans can deliver food to 100 houses in 4 hours.

Akago wants to:
- increase the number of deliveries to 240 houses
- shorten the total delivery time to 3 hours.

Calculate the number of delivery vans that would be needed to deliver food to 240 houses in 3 hours.
You can assume that all vans deliver food to all the houses at the same rate. [3]

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Number of delivery vans needed = ...

Examiner only

(b) The design of the company's logo is based on the letter **A**.
It is made from rectangles, connected by sectors of circles.
The company prints its logo on its delivery boxes.
The logo is shown below.

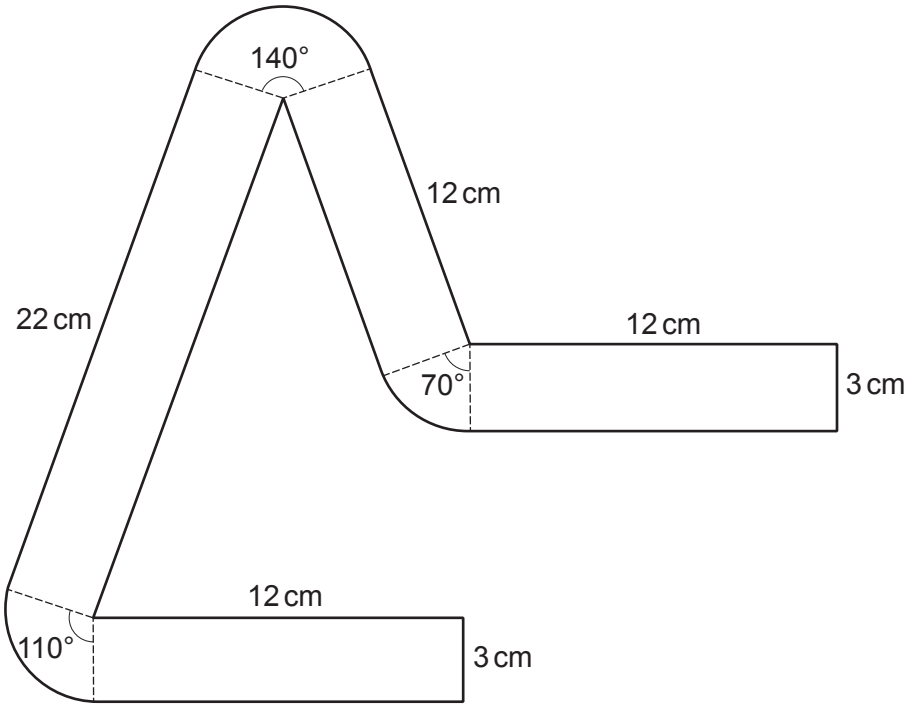

Diagram not drawn to scale

Calculate the area of the logo that is printed on the company's delivery boxes.
Give your answer in terms of π in its simplest form. [6]

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Area of the logo = ... cm^2

(c) Akago has decided to add two squares to its logo, to represent two stacked food boxes being delivered to your door.

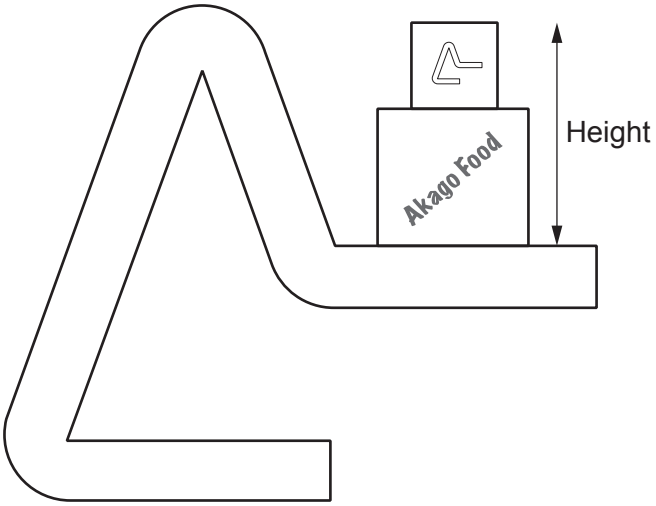

Diagram not drawn to scale

The larger square has an area of 45 cm^2.
The smaller square has an area of 5 cm^2.
Calculate the total height of the two stacked food boxes, as shown in the diagram.
Give your answer in the form $a\sqrt{b}$, where a and b are integers, and b is as small as possible. [3]

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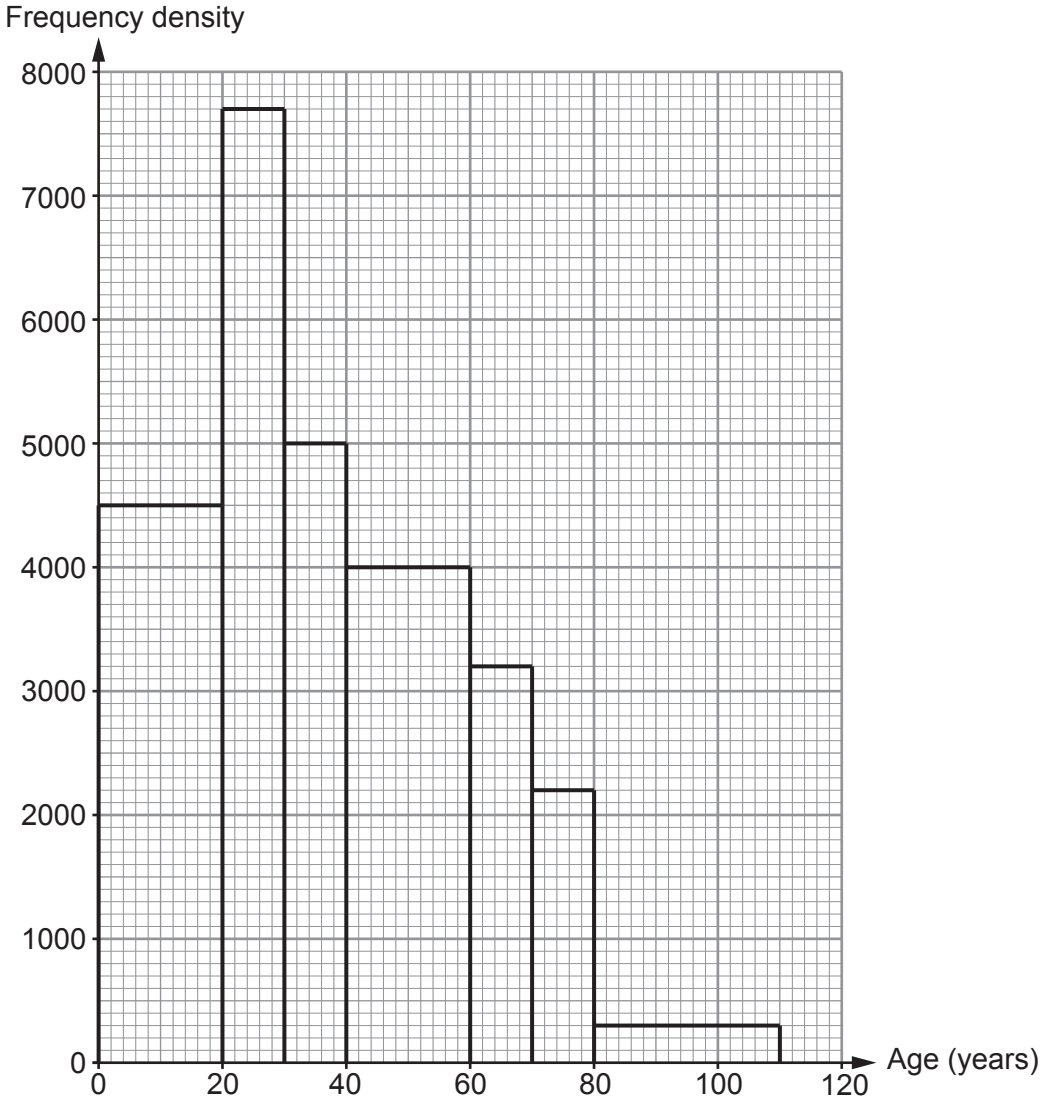
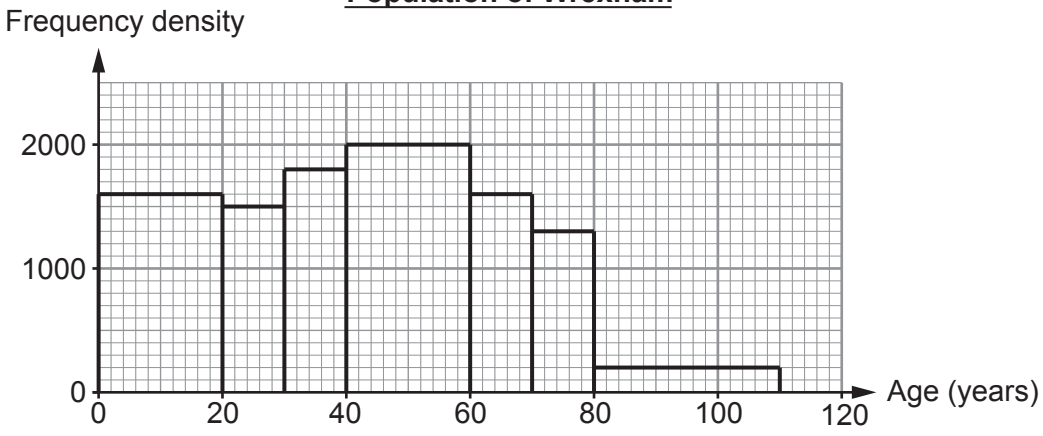
10. Anisa is comparing the ages of the populations of Cardiff and Wrexham in July 2019. She has used published data to draw these two histograms.

Population of Cardiff



Population of Wrexham



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(a) In July 2019, the biggest difference between the populations of Cardiff and Wrexham was in the number of 20- to 30-year-olds.
Calculate how many more 20- to 30-year-olds there were in Cardiff than there were in Wrexham. [2]

(b) Anisa has used her histograms to carry out data analysis.
Some of her results are shown in the table below.

	Cardiff	**Wrexham**
Total population (people)	360 000	140 000
Estimate of the median age (years)		42·5

Use Anisa's histogram to calculate an estimate of the median age of the population of Cardiff in July 2019. [4]

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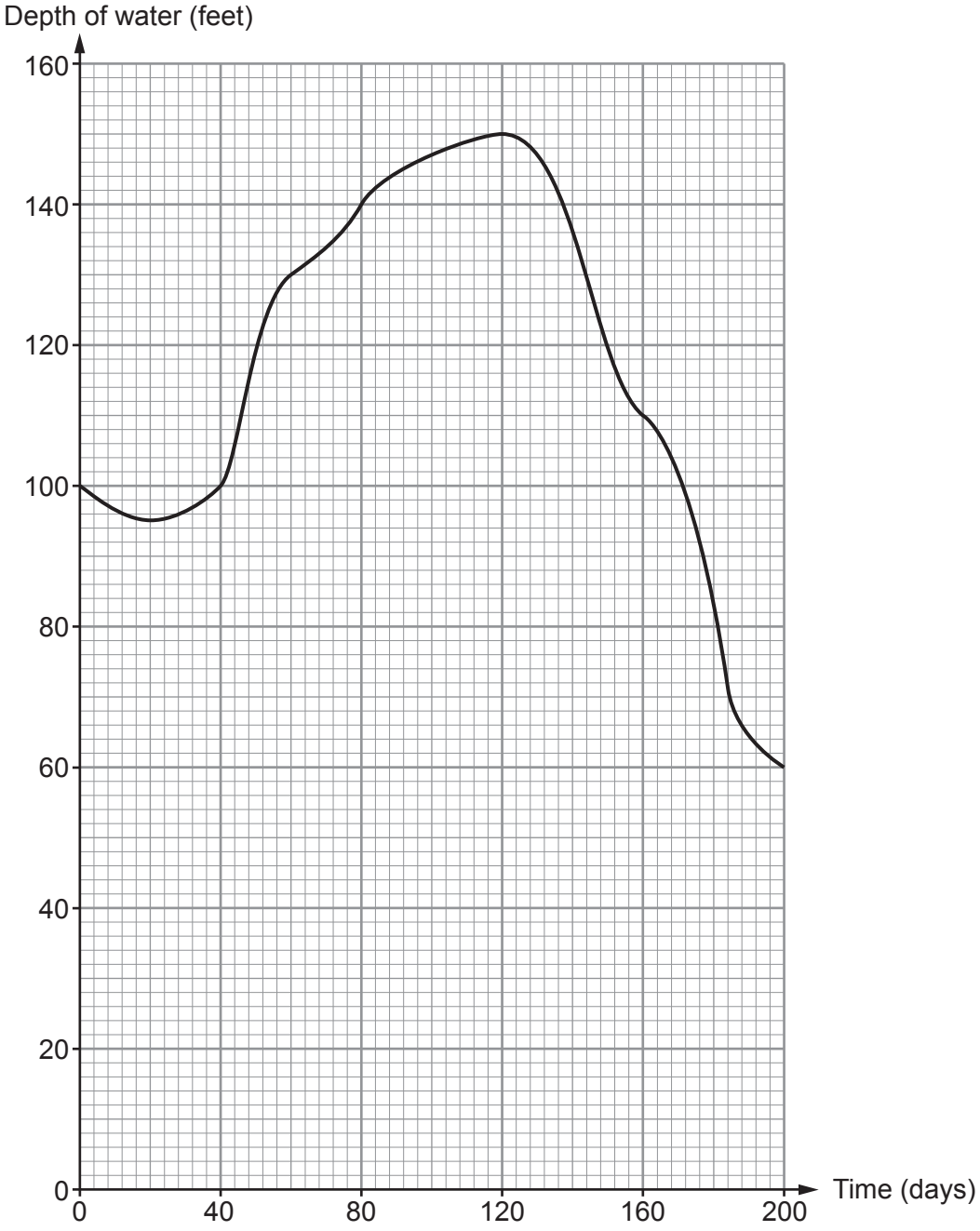
11. The graph below shows the depth of water in a reservoir during a 200-day period.



(a) For approximately how many of the 200 days was the depth of water in the reservoir decreasing?
Circle your answer. [1]

120 days 200 days 80 days 100 days 40 days

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(b) Use 5 strips of width 40 days to estimate the area under the curve.
Hence, calculate an estimate of the average depth of the water during this 200-day period. [5]

Average depth of water = ... feet

(c) Estimate the rate of increase in the depth of the water on the 60th day of this period.
Give your answer in its simplest form. [3]

END OF PAPER

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

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