GCSE

3310U50-1

S24-3310U50-1

THURSDAY, 9 MAY 2024 – MORNING

MATHEMATICS – NUMERACY
UNIT 1: NON-CALCULATOR
HIGHER TIER

1 hour 45 minutes

3310U501 01

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

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Formula List – Higher Tier

Area of trapezium $= \frac{1}{2}(a+b)h$
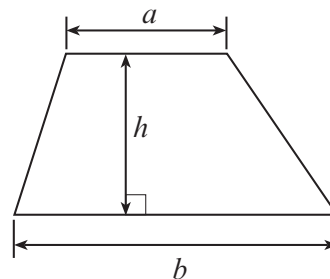
Volume of prism = area of cross-section × length
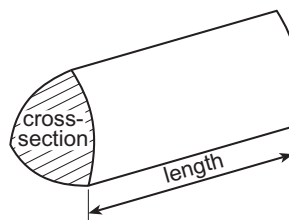
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$
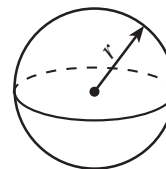
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$
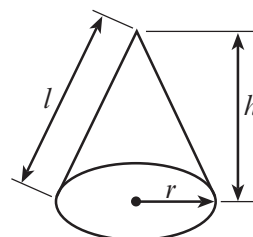
In any triangle ABC

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

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

Area of triangle $= \dfrac{1}{2}ab \sin C$
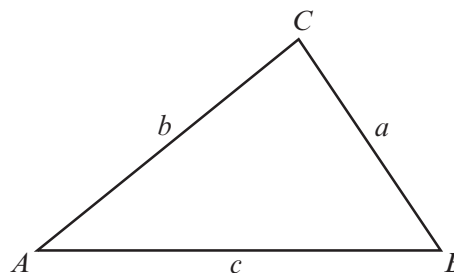
The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $\quad x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \dfrac{i}{n}\right)^n - 1$, where i is the nominal interest rate

per annum as a decimal and n is the number of compounding periods per annum.

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

7200 spectators at a sports event were asked their nationality.
The results are displayed in the pie chart below.
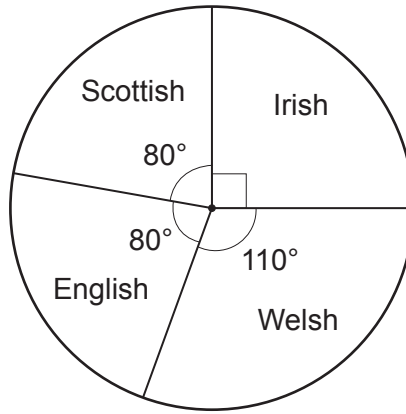
For the Welsh spectators, the ratio of the number of adults to the number of children was 6 : 5.
How many adult Welsh spectators were at the event?
You must show all your working. [4 + 2 OCW]

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Turn over.

2. Some houses in a village have new driveways laid by DriveDown.
The scatter diagram shows the area and cost of each driveway.
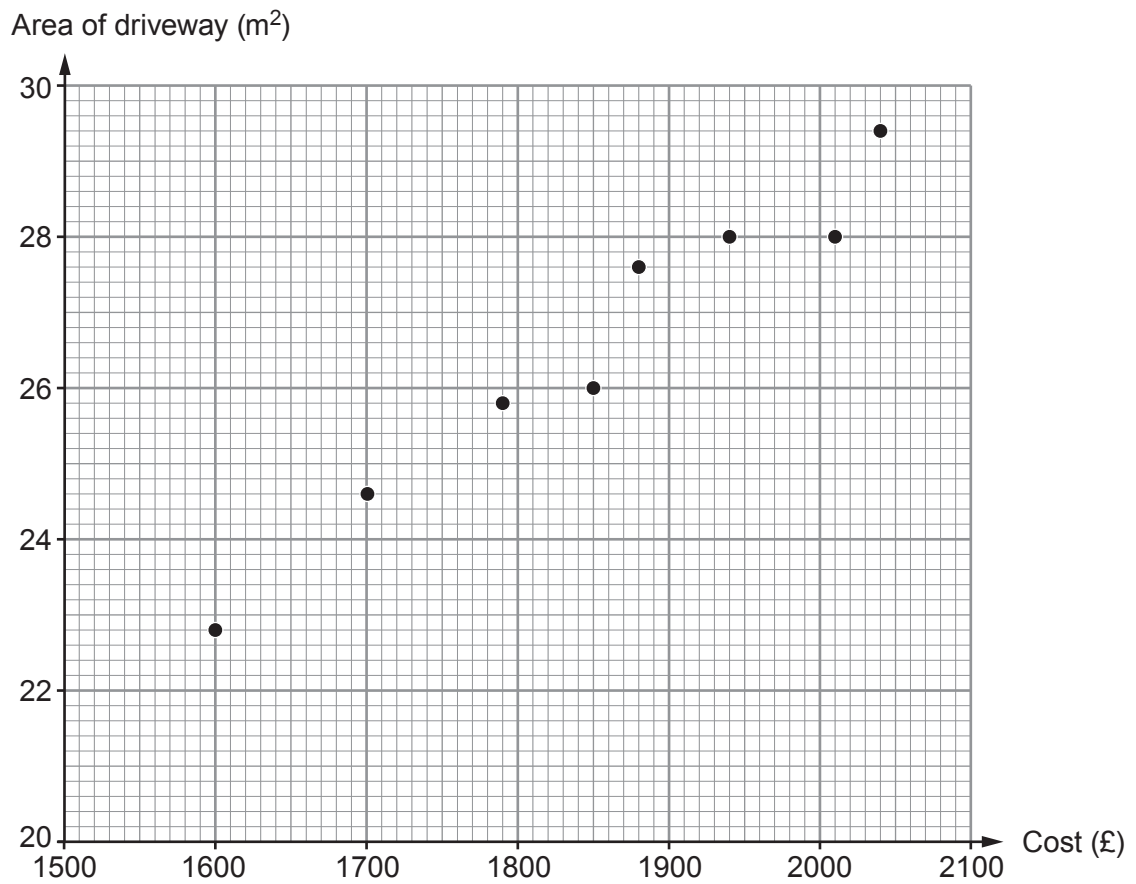
Area of driveway (m²)

(a) The measurements of Gwenda's driveway are shown below.

Diagram not drawn to scale

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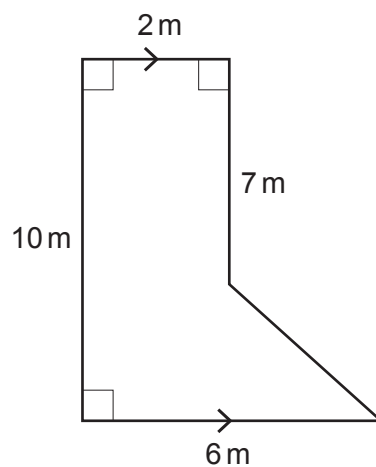
Consider the exact area of Gwenda's driveway.
Calculate an estimate of how much it would cost Gwenda to have a new driveway laid by DriveDown.
You must show all your working. [4]

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(b) Tanya's driveway covers an area of $23\,m^2$.
She decides to have her driveway repaired instead of having a new driveway.

Tanya thinks the repair will cost her 40% of the estimated cost of having a new driveway laid by DriveDown.
She has budgeted £575 for the repair of her driveway.
Will Tanya's budget cover the cost of repairing her driveway?

Yes ☐   No ☐

You must show all your working and give a reason for your answer. [2]

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3. (a) Josif produces a scale drawing to show where he wants a tree planted in his garden.

Scale: 1 cm represents 0·5 m

Hedge

Tree

Wall

Fence

House
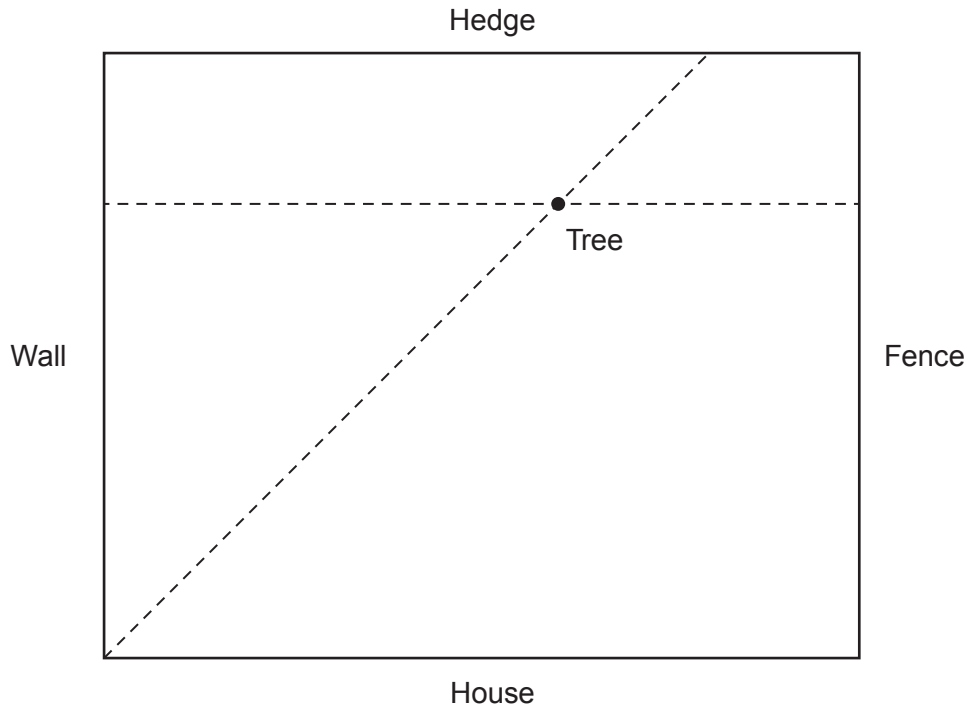
He writes out instructions to show where the tree is to be planted.

Which **two** of the following instructions describe where the tree is to be planted?

A. The tree must be 2 m from the hedge.
B. The tree must be 1 m from the hedge.
C. The tree must be 6 m from the hedge.
D. The tree must be 3 m from the hedge.
E. The tree must be 1 m from the wall.

F. The tree must be equidistant from the hedge and the fence.
G. The tree must be equidistant from the hedge and the wall.
H. The tree must be equidistant from the wall and the house.
I. The tree must be equidistant from the hedge and the house.
J. The tree must be equidistant from the wall and the fence. [2]

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The two instructions are .... and ....

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(b)   A garden centre buys trees from a grower for £30 each.
      The garden centre sells the trees for £42 each.

   (i)   Calculate the percentage profit the garden centre makes from buying and selling one tree.   [2]

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   (ii)   The garden centre buys 10 of these trees to sell.
          One of the trees gets damaged and cannot be sold.
          The other 9 trees are sold.

          Calculate the overall percentage profit or loss the garden centre makes from selling these trees.
          You must state whether your answer is a profit or a loss.
          You must show all your working.   [4]

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   (iii)   Of the 10 trees bought by the garden centre, what is the minimum number that need to be sold to ensure that the garden centre makes a profit?
           Circle your answer.   [1]

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(3310U50-1)   **Turn over.**

4. (a) On 1st June last year, 200 customers used cash to pay at Shop Lil.
The cumulative frequency diagram represents the time each of these 200 customers waited to be given change at the checkout.

Cumulative frequency
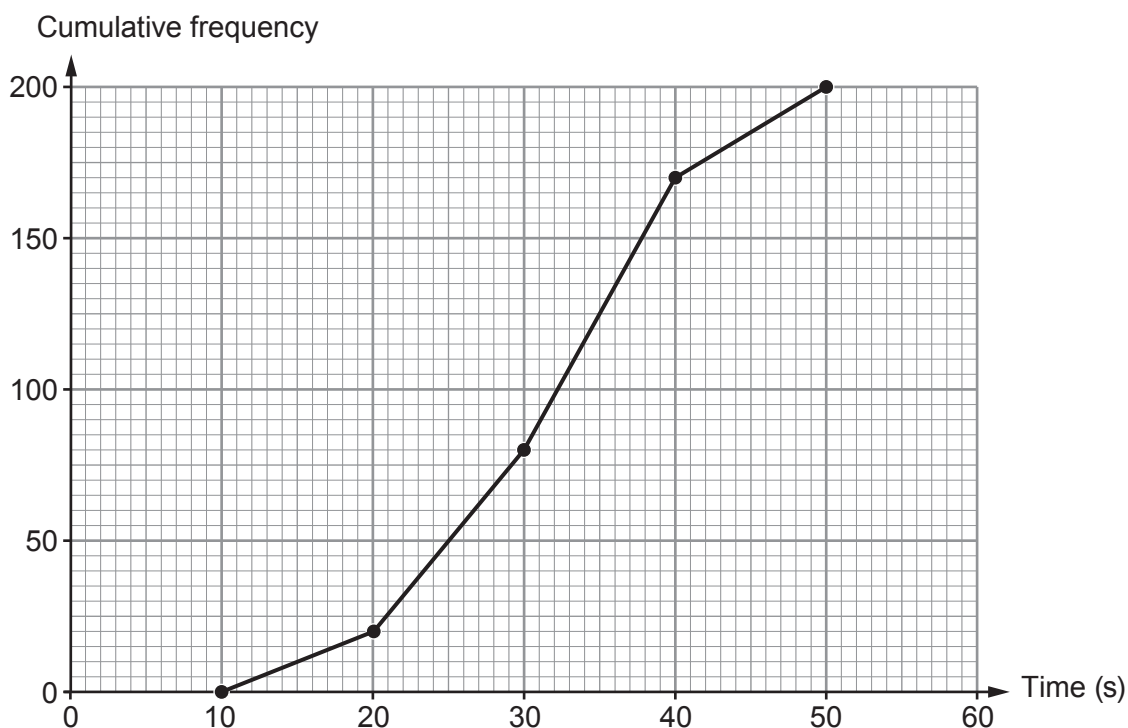
(i) How many of these customers waited between 30 and 50 seconds for their change? [2]

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(ii) Use the graph to estimate the median time these 200 customers waited for their change.
Circle your answer. [1]

24 seconds   32 seconds   38 seconds   80 seconds   100 seconds

(iii) Calculate the fraction of these 200 customers who waited 40 seconds or longer for their change.
Give your answer in its simplest form. [2]

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(b) On 1st June this year, the manager at Shop Lil drew a box-and-whisker plot of the times 200 customers waited for their change at the checkout.
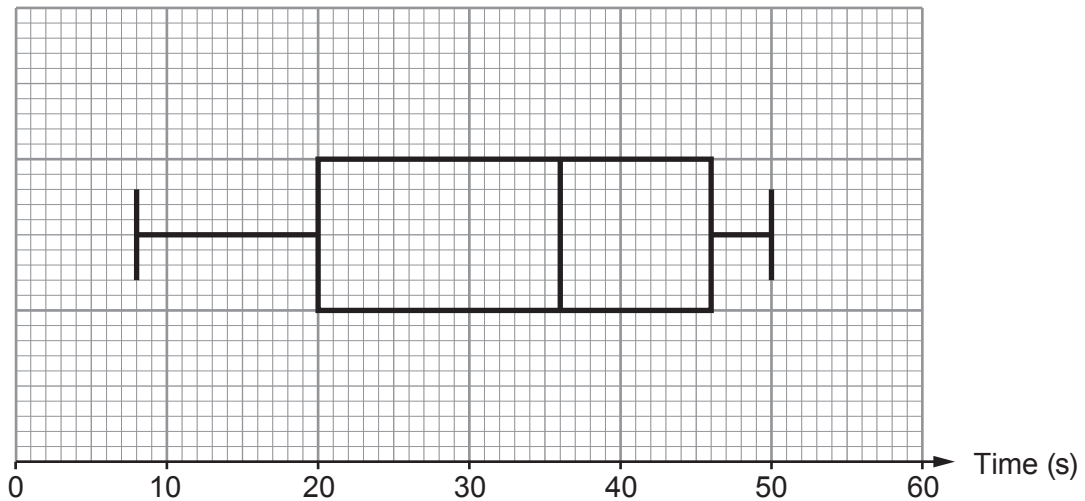
Based on the results of these 200 customers, the manager made the following statements. Complete the statements.

(i) "On 1st June this year, 50% of our customers were given their change in

.... seconds or less." [1]

(ii) "On 1st June this year, the interquartile range of the times taken to give

customers their change was .... seconds." [2]

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(c) Consider the 50 customers waiting the **longest** times to get their change on 1st June last year and this year.
Has the speed of giving change at the checkout improved since last year?

Yes ☐   No ☐

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

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Turn over.

5. (a) The area of Wales is $20\,735\,km^2$.

The table below gives the population of Wales in 1977, 1998 and 2015.

Year	1977	1998	2015
Population	2·8 million	2·9 million	3·1 million

(i) What was the increase in the population of Wales between 1977 and 1998? Circle your answer. [1]

1×10^3 1×10^4 1×10^5 1×10^6 1×10^7

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(ii) Estimate the population density of Wales in 2015. [3]

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Population density of Wales in 2015 was .... people / km^2

(b) Cardiff is the largest city in Wales.
In 2018, the population of Cardiff was approximately 360 000.
The population of Cardiff increased by 20% from 1991 to 2018.
Calculate the population of Cardiff in 1991. [3]

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(c)   DraigYma prints Welsh flags onto stickers.
Three of their mathematically similar Welsh flag stickers are shown below.

1·4 cm

Length

4·2 cm

6·6 cm

Height

9·9 cm
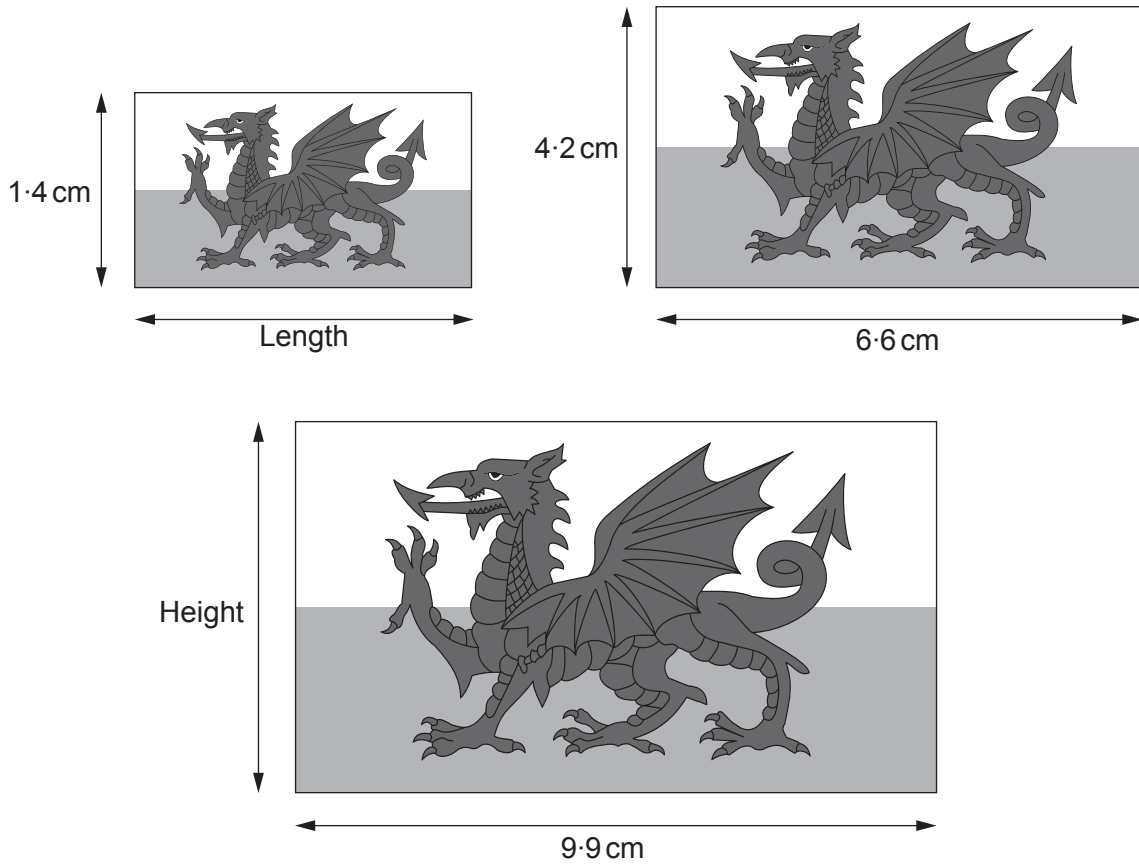
Diagrams not drawn to scale

Calculate the missing length and height in the diagrams.   [4]

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Length is .... cm   Height is .... cm

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6. Most aircraft are held together with metal rivets.

(a) The rivet used on one type of aircraft is shown below. It can be thought of as a cylinder connected to a hemisphere.

6 mm

9 mm
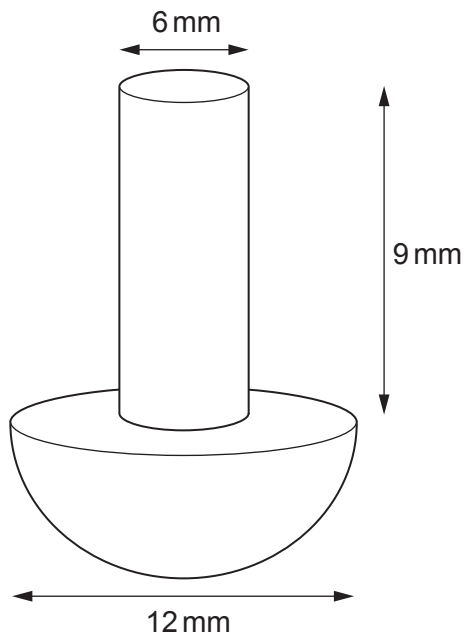
12 mm

Diagram not drawn to scale

The cylinder has a diameter of 6 mm and a length of 9 mm.
The hemisphere has a diameter of 12 mm.

(i) Calculate the volume of the rivet.
Give your answer in terms of π in its simplest form. [4]

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(ii)   The manufacturer plans to reduce the length of the cylindrical part of the rivet from 9 mm to 8 mm.
Calculate the fractional reduction in the volume of a rivet this would produce.   [2]

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Fractional reduction in the volume of a rivet = ...

(b)   For another type of rivet, the manufacturer plans to reduce the volume by $0 \cdot 16\dot{1}$ of its original volume.
Write $0 \cdot 16\dot{1}$ as a fraction.
Give your answer in its simplest form.   [3]

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Turn over.

7. The headteacher of Ynysgorwen School wants to know how long it takes pupils to travel to school.
The results for a sample of 120 pupils are shown in the table below.

Time taken, t (minutes)	Frequency	Frequency density
$0 < t \leqslant 10$	34	3·4
$10 < t \leqslant 20$	40	....
$20 < t \leqslant 35$	24	....
$35 < t \leqslant 50$	18	....
$50 < t \leqslant 70$	4	....

(a) (i) Complete the frequency density column. [3]

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(ii) Draw a histogram to display this data. [2]

Frequency density
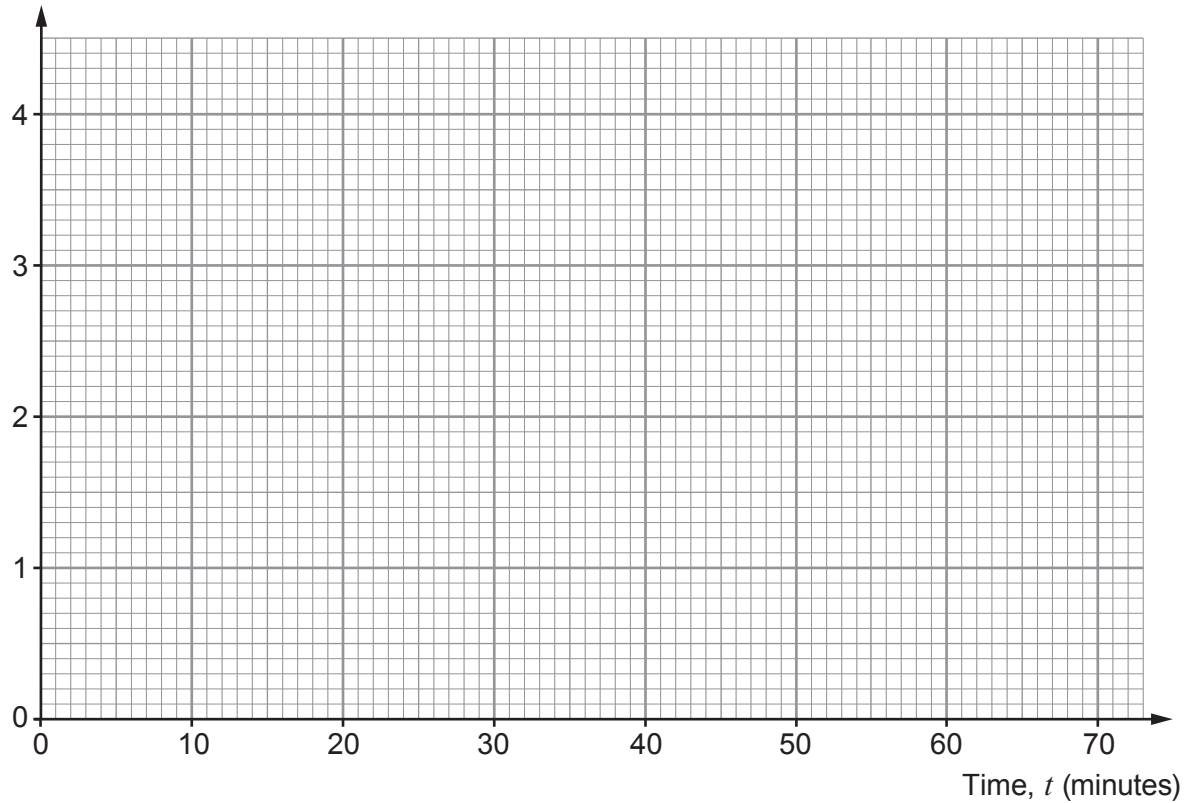
(b) (i) Calculate an estimate of the median travel time for the sample of pupils. [4]

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(ii) What is the greatest possible median travel time for the sample of pupils? [1]

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8. Sian ran a 100-metre race.

The graph below shows Sian's speed over the **first** 8 seconds of the race.
Sian then ran the rest of the race at a constant speed of 8 m/s.

Speed (m/s)

By first using the trapezium rule with 4 strips of equal width for the first 8 seconds, estimate the total time it took Sian to run the 100-metre race.
You must show all your working. [5]

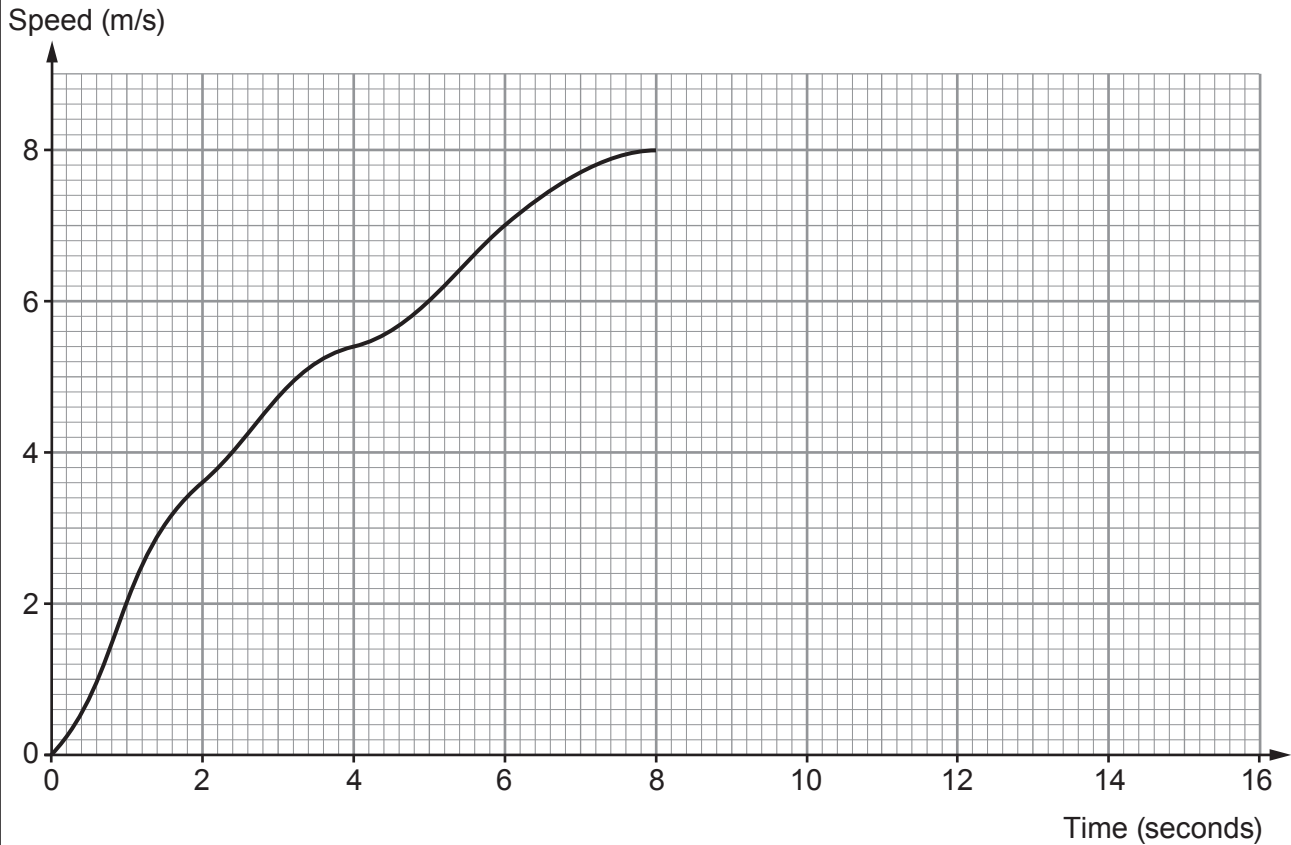..

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Sian's total time to run the 100-metre race = ... seconds

9. (a) Geraint has bought a new front cog for his bike.
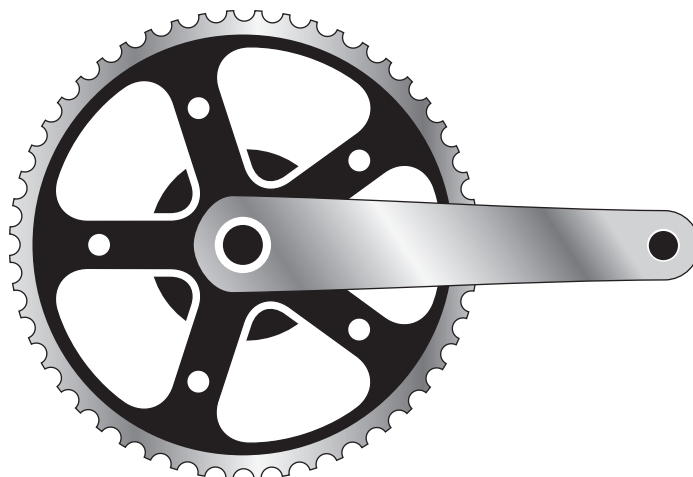
The cog has a mass of 150 g, **correct to the nearest 10 g**.
The cog has been made from a metal that has a density of 3 g/cm^3, **correct to the nearest g/cm^3**.
Calculate the maximum possible volume of the cog. [3]

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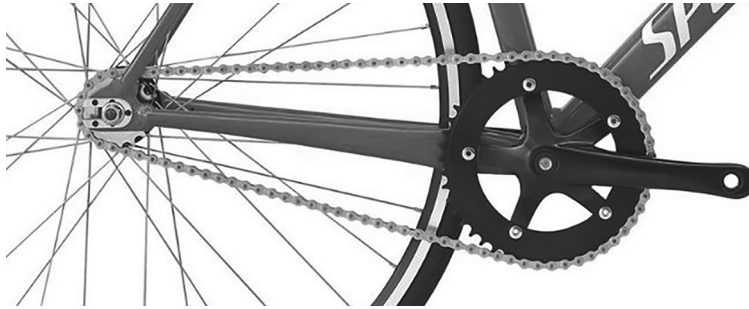
(b) This picture shows part of Geraint's bike.

A simplified diagram of the cogs and the chain is shown below.
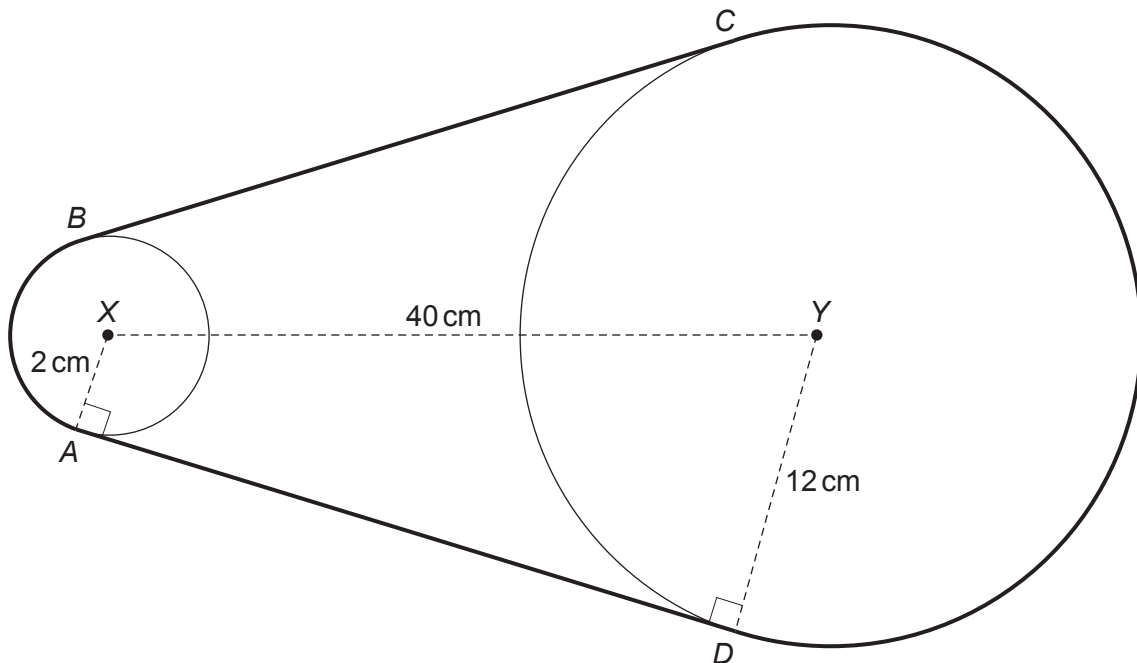
Diagram not drawn to scale

X and Y are the centres of the cogs and XY is a line of symmetry.
BC and AD are straight sections of the chain.

The larger cog has a radius of 12 cm.
The smaller cog has a radius of 2 cm.

(i) Use Pythagoras' theorem to show that the length of AD is $10\sqrt{15}$ cm.
You must show all your working. [3]

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(ii)

Diagram not drawn to scale

$A\hat{X}B$ = 150°, reflex $C\hat{Y}D$ = 210°, $BC = AD = 10\sqrt{15}$ cm.

Calculate the total length of the chain.

Give your answer in the form $a\sqrt{15} + b\pi$, where a and b are rational numbers.　　　　[5]

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10. 7 water pumps can fill a swimming pool in 12 hours.
These 7 water pumps work together at the same rate.

When the pool is empty, the 7 pumps are turned on.
After working for 3 hours, 2 of the pumps are turned off.
The other pumps carry on working until the swimming pool is full.

Calculate how long in total it takes for the swimming pool to be filled.
Give your answer in hours and minutes. [4]

Total time taken for the pool to be filled = ... hours .... minutes

END OF PAPER

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

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