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|---------------|---------------|------------------|
| Surname       | Centre Number | Candidate Number |
| First name(s) |               | 0                |

**GCSE**

3310U60-1



A24-3310U60-1

**THURSDAY, 7 NOVEMBER 2024 – MORNING**

**MATHEMATICS – NUMERACY**  
**UNIT 2: CALCULATOR-ALLOWED**  
**HIGHER TIER**

1 hour 45 minutes

**ADDITIONAL MATERIALS**

A calculator will be required for this paper.

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  $\pi$  as 3.14 or use the  $\pi$  button on your calculator.

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

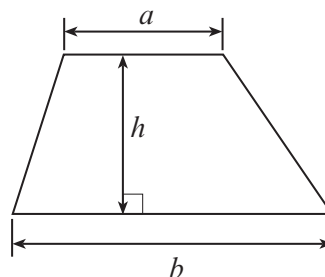
| For Examiner's use only |              |              |
|-------------------------|--------------|--------------|
| Question                | Maximum Mark | Mark Awarded |
| 1.                      | 8            |              |
| 2.                      | 16           |              |
| 3.                      | 8            |              |
| 4.                      | 10           |              |
| 5.                      | 7            |              |
| 6.                      | 7            |              |
| 7.                      | 7            |              |
| 8.                      | 17           |              |
| <b>Total</b>            | <b>80</b>    |              |



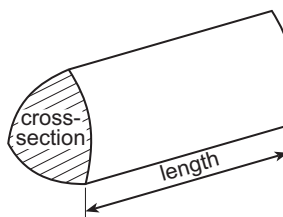
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### Formula List – Higher Tier

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

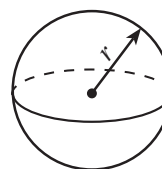


**Volume of prism** = area of cross-section  $\times$  length



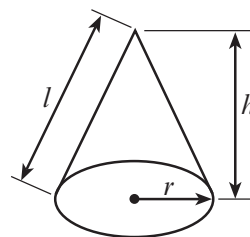
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

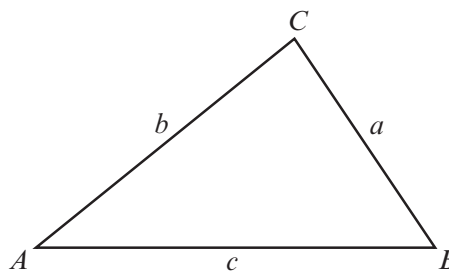


**In any triangle ABC**

**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. (a) Steffan always leaves his fridge-freezer turned on.  
His fridge-freezer uses electricity costing £2.31 per week.  
Electricity costs £0.30 per kWh.  
Calculate the number of kWh of electricity Steffan's fridge-freezer uses **per day**.  
You must show all your working. [3]

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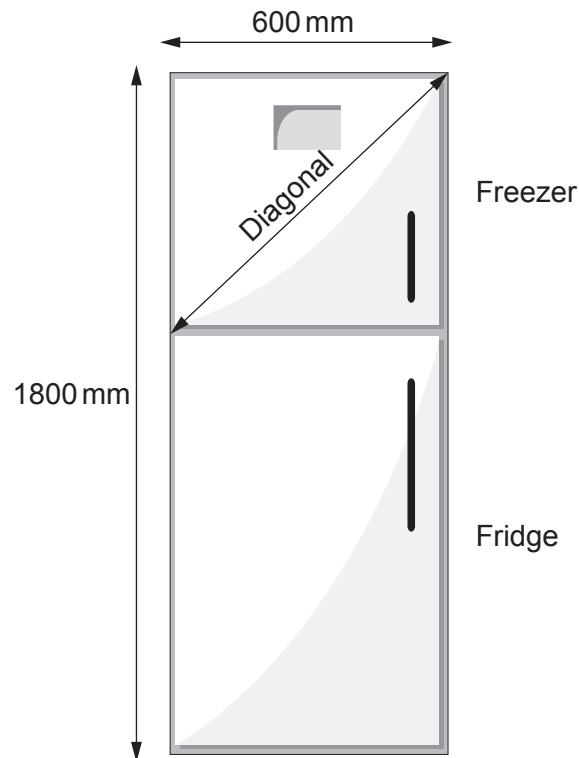
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- (b) Steffan is thinking of buying the fridge-freezer shown below.



*Diagram not drawn to scale*

Steffan needs to check that the **freezer** compartment of this fridge-freezer has enough room.

The height of the freezer door is  $\frac{2}{5}$  of the total height of the fridge-freezer.

Calculate the length of the **diagonal** of the freezer door.

Give your answer in millimetres.

You must show all your working.

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2. (a) A small packet contains four Caru chocolate cakes.



The four cakes have a total mass of 84 g.

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

The following information is written on the packet:

'Caru chocolate cakes contain 600 calories per 100g.'

Simon aims for a calorie intake of 2400 calories per day.

Today Simon eats **one** Caru chocolate cake.  
What percentage of his daily calorie intake is this cake?  
You must show all your working.

[5 + 2 OCW]

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(ii) Caru chocolate cakes contain only fat, carbohydrate, protein and salt.

The ratio of the masses is  
fat : carbohydrate : protein : salt = 1360 : 2725 : 515 : 4

How many grams of protein are there in an 84 g packet of four cakes?  
Give your answer correct to 2 significant figures.

[3]

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(b) Cheryl keeps fit by running every day.

- (i) Cheryl burns 690 calories per hour when she runs.  
Eating a banana gives Cheryl 92 calories of energy.

Cheryl wants to burn off the energy in this banana.  
For how many minutes would she need to run?  
You must show all your working.

[3]

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- (ii) Cheryl runs at an average speed of 9 km per hour.  
Yesterday morning she ran for 38 minutes.  
Calculate the distance Cheryl ran yesterday morning.

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3. (a) The base of a flagpole is fixed to horizontal ground. It is held vertically by a straight rod of length 3.8 m. The rod is fixed to the ground and to a point 1.5 m from the top of the flagpole. The flagpole and the rod are shown in the diagram below.

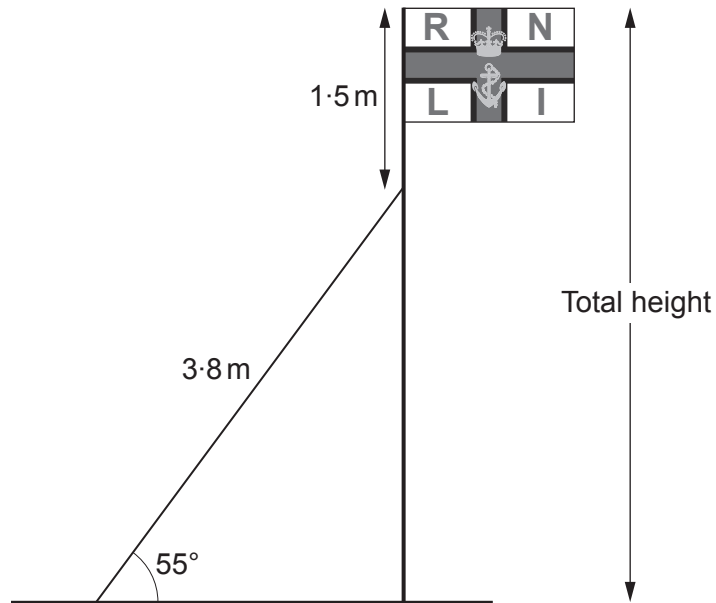


Diagram not drawn to scale

Calculate the **total** height of the flagpole.  
Give your answer correct to the nearest centimetre.

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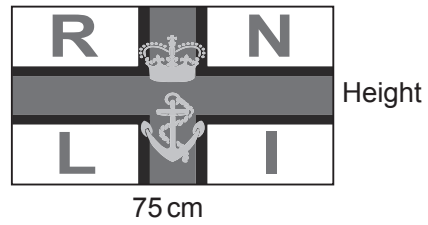
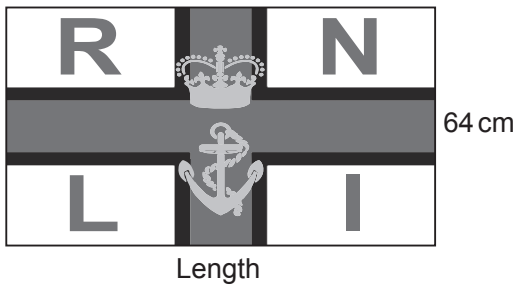
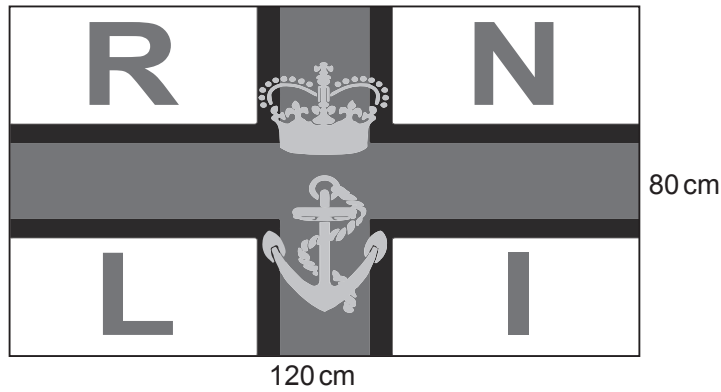
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(b) Mathematically similar large, medium and small flags are made.



Diagrams not drawn to scale

(i) Calculate the length of the medium flag. [2]

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Length of the medium flag is ..... cm

(ii) Calculate the height of the small flag. [2]

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Height of the small flag is ..... cm

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4. Aderyn is a company that makes bird feeders.

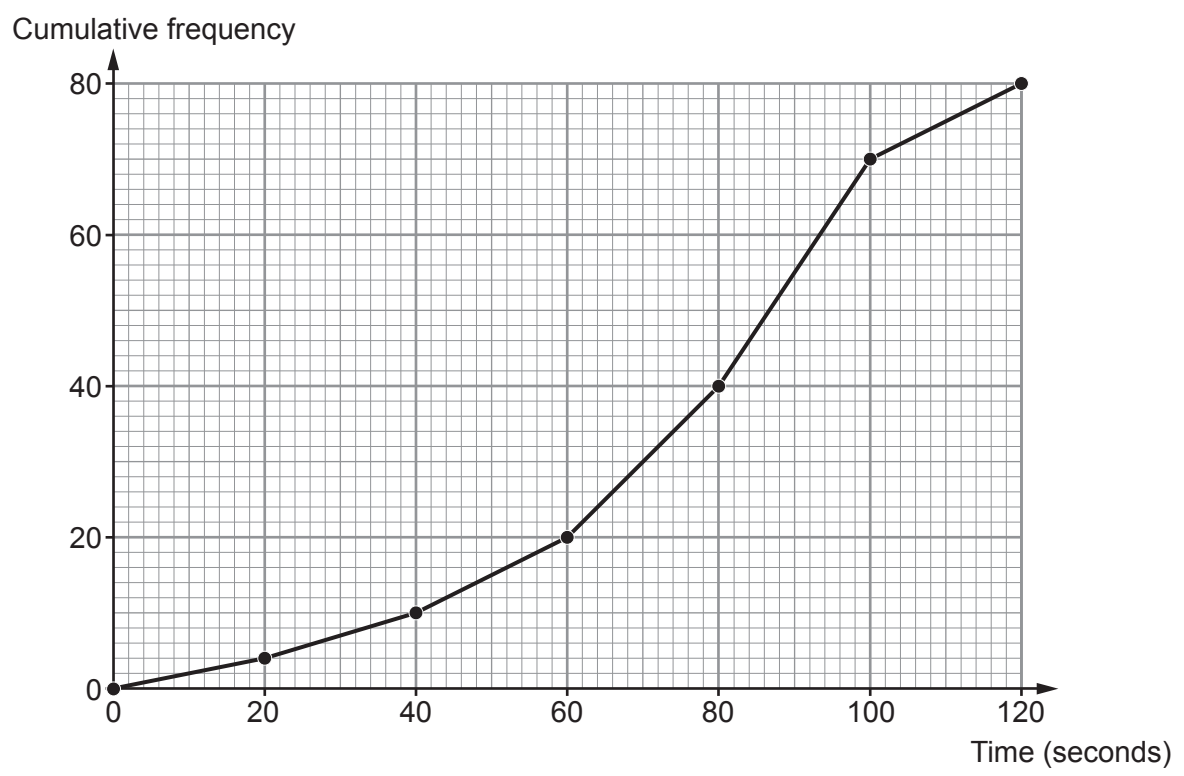
Squirrels often try to steal food from bird feeders.

To make this more difficult, Aderyn has designed a **new** bird feeder. Aderyn tests its new feeder to check how long it takes squirrels to reach the food inside.

The results are displayed in the cumulative frequency diagram below.



New bird feeder



(a) Aderyn has the following information about the time it took squirrels to reach the food in its **original** bird feeder.

| Original bird feeder |                  |
|----------------------|------------------|
| Modal group          | 60 to 80 seconds |
| Median time          | 75 seconds       |
| Interquartile range  | 20 seconds       |



Aderyn compared the times squirrels take to reach the food in the original bird feeder and the times they take to reach food in the new bird feeder.

(i) Complete this sentence:

'The modal group for the new bird feeder is between ..... and ..... seconds.'

Does the modal group for the new bird feeder imply that there is an improvement in the times? [1]

Yes

No

(ii) Use the cumulative frequency diagram and the table to give the best estimate to complete each of the following sentences.

I. 'The difference between the median times is ..... seconds.' [1]

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II. 'The difference between the interquartile ranges of the times is ..... seconds.' [2]

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(b) Use the cumulative frequency diagram to give the best estimate to complete the following sentence. [3]

'20% of the squirrels took ..... seconds or more to reach the food in the new bird feeder.'

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Examiner only

(c) The population density of grey squirrels in forests depends on the variety of tree that grows there.

| Variety of tree | Typical population density of grey squirrels per km <sup>2</sup> |
|-----------------|--|
| Oak             | 1200   |
| Chestnut        | 100  |
| Pine            | 45   |



Rhian says,

I know that Maesgwyn forest has only one variety of tree: oak, chestnut or pine.

Maesgwyn forest covers an area of 21 500 m<sup>2</sup>.  
There are 24 grey squirrels living in Maesgwyn forest.

From this information, which variety of tree is most likely to be found in Maesgwyn forest?

You must show working to support your answer.

[3]

Oak       Chestnut       Pine

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5. Morgan is building 2 new houses on a plot of land.

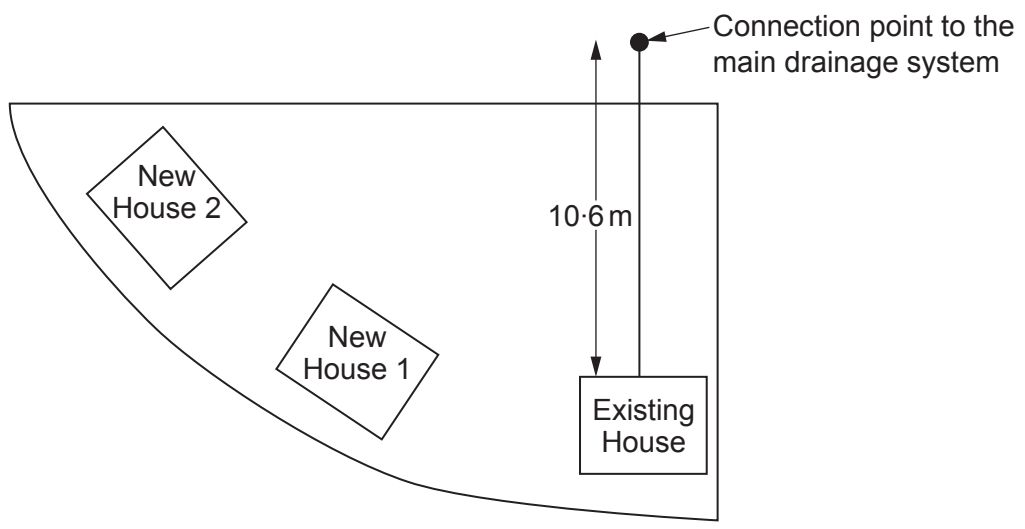


Diagram not drawn to scale

Drainage pipes need to be laid from the 2 new houses to the connection point shown on the diagram.

Morgan cannot measure the lengths of the drainage pipes needed, as he does not have access to the connection point.

He has drawn the following diagram of the drainage pipes, showing some angles and lengths that he has been able to measure.

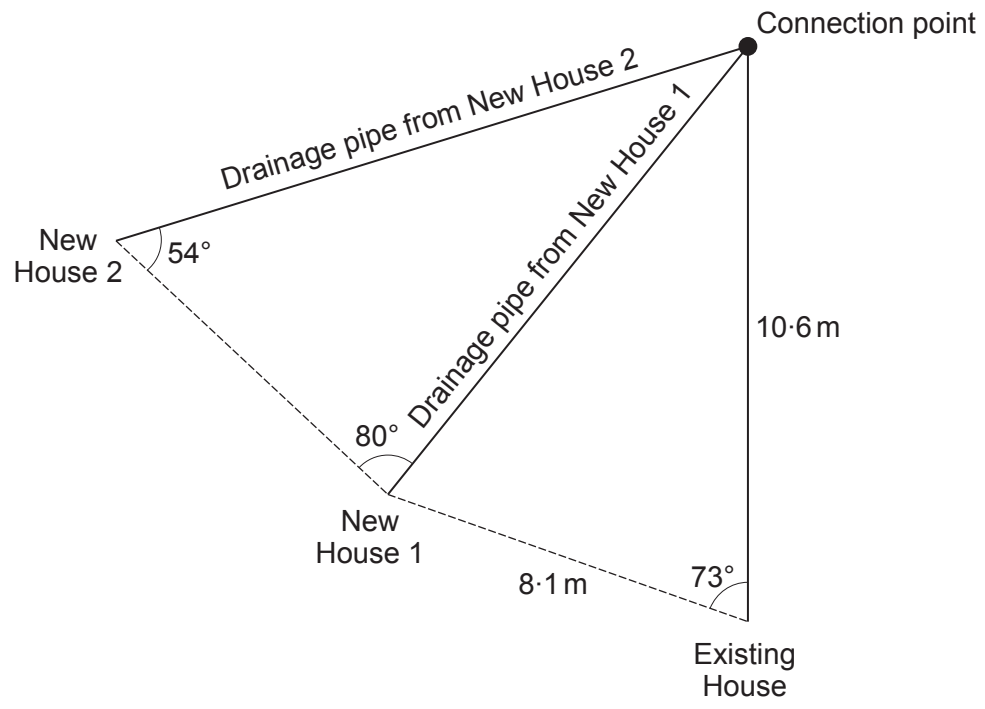


Diagram not drawn to scale





Examiner only

6. Teifion is going to paint the front of his bungalow. He will not be painting the roof, door or window. A diagram of the front of Teifion's bungalow is shown below.

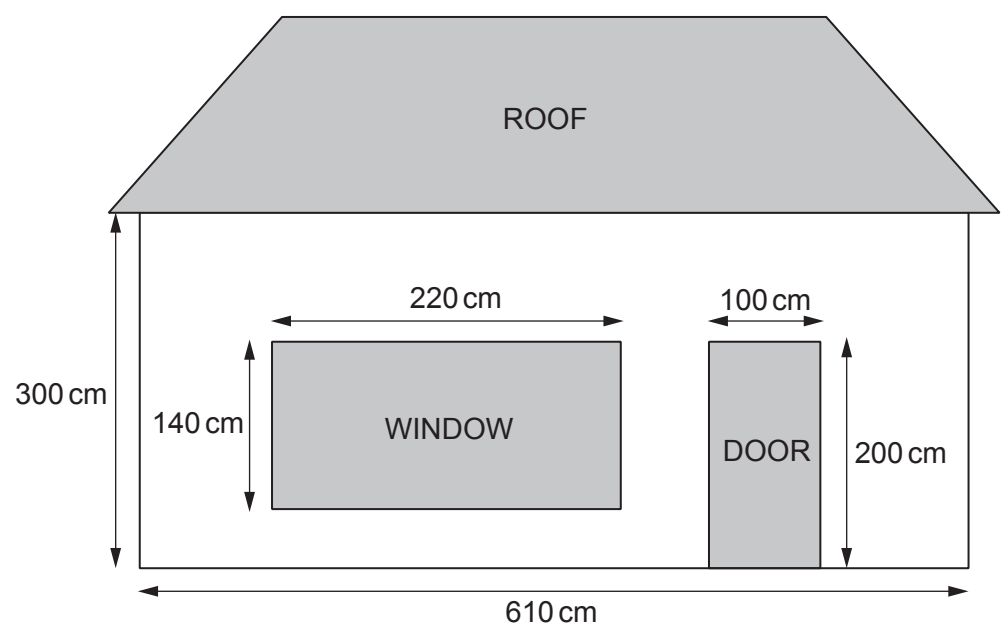


Diagram not drawn to scale

All the measurements on the diagram are **correct to the nearest 10 cm**.  
A litre of paint will cover  $50\,000\text{ cm}^2$ , **correct to the nearest  $10\,000\text{ cm}^2$** .

For a good finish, Teifion needs to paint the front of the bungalow **3 times**.  
Calculate the **smallest possible** number of litres of paint that Teifion could use to paint the front of his bungalow 3 times. [7]

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**Smallest possible** number of litres of paint that Teifion could use to paint the front of  
his bungalow 3 times is ..... litres



Examiner  
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7. Isaac and his sister Mari are both going to open savings accounts.

- (a) Isaac decides to invest some of his savings in the Hereford Saver account. Details of the account are shown below.

**Hereford Saver account**

Monthly interest rate 0.26%

Calculate the AER that the Hereford Saver account offers.  
Give your answer as a percentage.

[2]

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Examiner  
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- (b) Mari invests £3000 in the Silver Plus savings account.  
Details of the account are shown below.

| Account name | Nominal annual rate | Interest paid |
|--------------|---------------------|---------------|
| Silver Plus  | 2.48%               | Quarterly     |

Mari does not withdraw any money or make any further payments into the account.  
Mari closes the account after 10 years.

Calculate the percentage increase in the value of her investment.  
You must show all your working.

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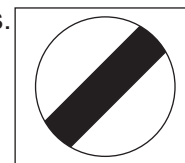
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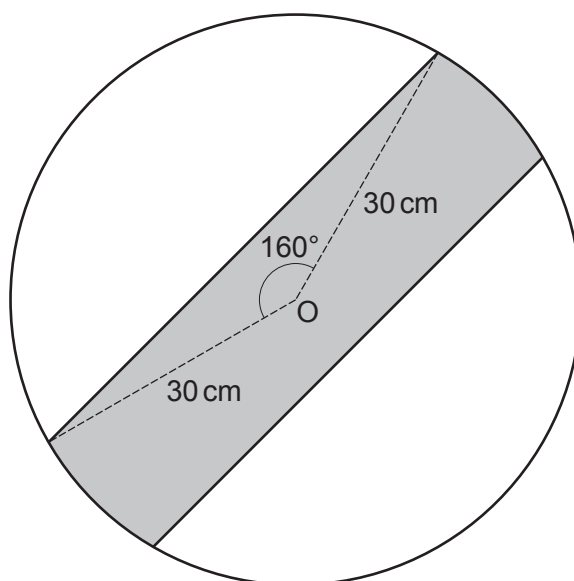
Examiner only

- 8 (a) Signs-R-Us is a company that makes national speed limit signs for roads. The national speed limit sign is white with a black strip across it.



Signs-R-Us needs to calculate the area of a sign that is white and the area that is black.

The diagram below shows some of the dimensions of the national speed limit sign. The sign is a circle of radius 30 cm, centre O. The centre of the black region is also at O. The black region is **not** a rectangle.



*Diagram not drawn to scale*

Calculate the area of the sign that is white.  
Hence, calculate the area of the sign that is black.

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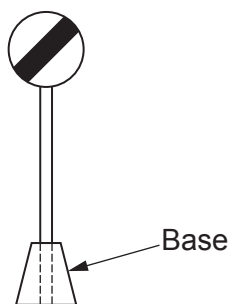
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Area that is white = ..... cm<sup>2</sup>

Area that is black = ..... cm<sup>2</sup>

- (b) Signs-R-Us makes temporary road signs for roadworks.  
 These signs need to be moved easily.  
 For each sign, Signs-R-Us makes a base with a vertical hole drilled through it, so that a pole can be placed inside.



*Diagram not drawn to scale*

Signs-R-Us makes these bases for different-sized poles.  
 The radius of a hole is related to the mass of a base.  
 This is shown by the formula,

$$r = \sqrt[3]{\frac{M}{125(46 - 3\pi)}}$$

where:  
 $r$  is the radius in centimetres, and  
 $M$  is the mass in kilograms.

Rearrange this formula to make  $M$  the subject. [2]

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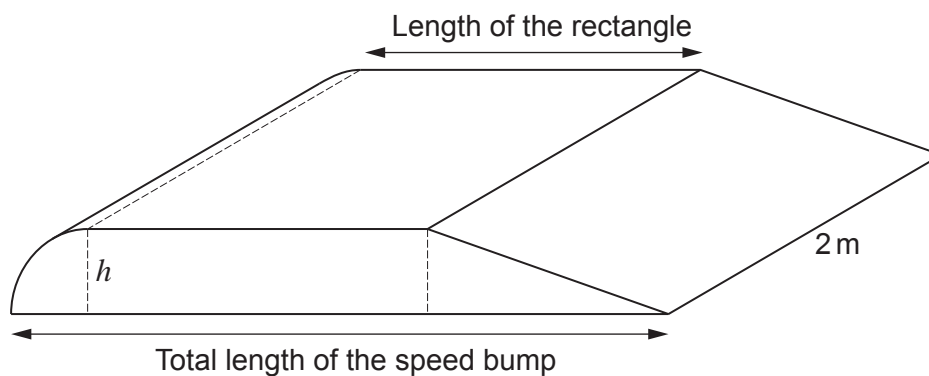
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- (d) Signs-R-Us also makes a speed bump, as shown below. It has a uniform cross-sectional area, consisting of a quarter circle, a rectangle and a right-angled triangle.



*Diagram not drawn to scale*

The height of the speed bump is shown as  $h$  in the diagram above.  
The length of the rectangle is 4 times the height.  
The total length of the speed bump is 8 times the height.

The width of the speed bump is 2 m, and its volume is  $0.1 \text{ m}^3$ .

Calculate the height of the speed bump.

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