Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3310U60-1

A19-3310U60-1

THURSDAY, 7 NOVEMBER 2019 – MORNING

MATHEMATICS – NUMERACY
UNIT 2: CALCULATOR-ALLOWED
HIGHER TIER

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**9**	
3.	**8**	
4.	**12**	
5.	**9**	
6.	**3**	
7.	**5**	
8.	**5**	
9.	**4**	
10.	**5**	
11.	**8**	
12.	**6**	
Total	**80**	

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** 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 or use the π 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 **4***(a)*(i), the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

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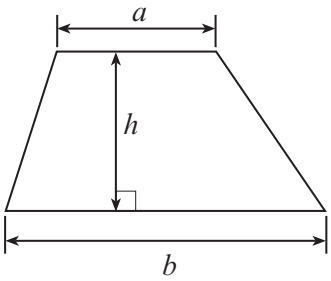
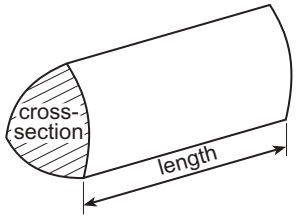
Formula List - Higher Tier

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

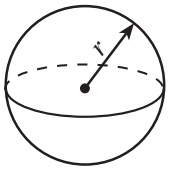


Volume of prism = area of cross-section × length



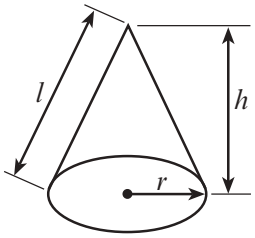
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

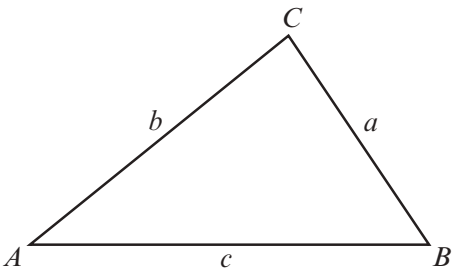


In any triangle ABC

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. Rowan lives in New Zealand.
He is coming to Wales on holiday.
The currency used in New Zealand is the New Zealand dollar ($).
1 New Zealand dollar = 100 cents.

The conversion rate at the exchange shop is $1 = £0.53.
The exchange shop only has £10 and £20 notes.

Rowan only has $550 saved.
He wants to exchange as close to $550 as possible.
He asks for as few notes as possible.

Calculate:
- how many of each British note Rowan gets,
- how much he pays for his currency, correct to the nearest cent.

You must show all your working. [6]

Examiner only

2. The picture shows a solid concrete step.
The step:

- stands on horizontal ground,
- has all of its edges vertical or horizontal,
- has a uniform cross-section.

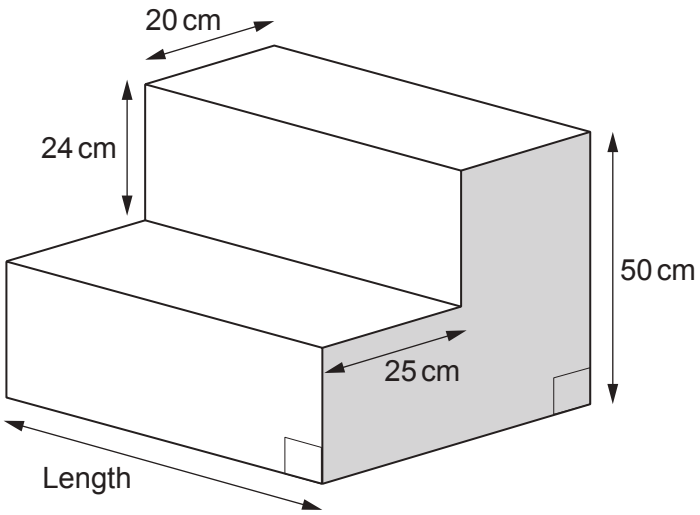


Diagram not drawn to scale

(a) Draw a sketch of the plan view of the concrete step. [1]

(b) The volume of concrete in the step is 66 000 cm^3.

(i) The concrete to make the step costs 39p per litre.

A builder charges a rate of £27 per hour.
Any fraction of an hour is charged as that fraction of his hourly rate.
(For example, half an hour is charged at half of £27.)

It takes him 1 hour 20 minutes to make the step.

There were no other costs.
Calculate the total cost of making the step. [3]

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Examiner only

(ii) Calculate the length of the step.
Give your answer in cm.
You must show all your working. [5]

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3. *(a)* 40 people were asked how many mugs they have in their cupboards. The results are shown below.

Number of mugs	Frequency
1 to 5	3
6 to 10	7
11 to 15	12
16 to 20	18

(i) From this data, which group contains the **median** number of mugs? Circle your answer. [1]

Can't tell 1 to 5 6 to 10 11 to 15 16 to 20

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(ii) Calculate an estimate of the mean number of mugs these people have in their cupboards. [4]

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(b) A cylindrical mug has an inner radius of 4·3 cm and an inner height of 11·8 cm.

Tea is poured into the mug.
The level of the tea is 2 cm below the top of the mug.

Calculate the volume of the tea in the mug. [3]

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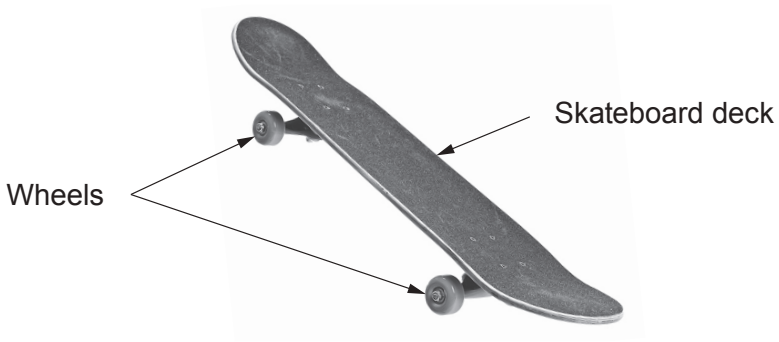
4. Finbar's skateboard is shown below.



(a) The diameter of each wheel on Finbar's skateboard is 6·4 cm.
He uses his skateboard to go to visit his friend Sab.
Sab lives 2340 metres from Finbar.

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

When Finbar visits Sab, how many times will each wheel on Finbar's skateboard rotate? [4 + 2 OCW]

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(ii) What assumption did you make in answering *(a)*(i)? [1]

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Examiner only

(b) A skateboard deck is usually made from one of maple wood, fibreglass or plastic. The density of these materials is given in the following table.

Skateboard deck material	Density (g/cm^3)
Maple wood	0·7
Fibreglass	2·6
Plastic	1·8

Finbar and Sab compare their skateboards.

	Finbar's skateboard	Sab's skateboard
Area of the skateboard deck	1800 cm^2	1600 cm^2
Thickness of the skateboard deck	1·2 cm	1·4 cm
Material used to make the deck	Fibreglass	Maple wood

The wheels and the fittings on both their skateboards are identical.

How much heavier is Finbar's skateboard than Sab's skateboard?
Give your answer in grams.
You must show all your working. [5]

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5. Robyn has 5 planks of wood each of length 2 m and width 10 cm.

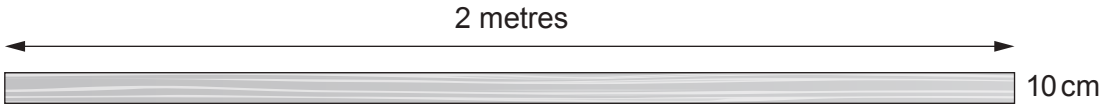

Diagram not drawn to scale

She lays the 5 planks horizontally on the floor. She leaves a **15 cm gap** between each plank, as shown below.

Diagram not drawn to scale

Robyn is planning to make a gate. She uses these 5 planks and one other plank that is to be placed diagonally, as shown below.

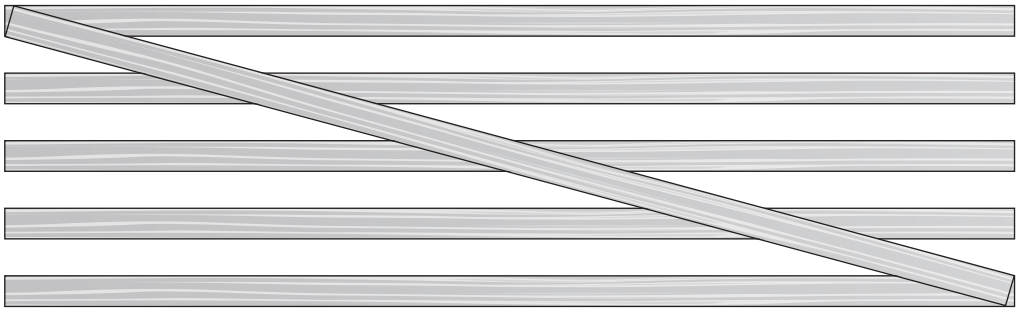

Diagram not drawn to scale

(a) (i) Calculate an estimate of the length of the plank that is to be placed diagonally. Give your answer in metres. [4]

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(ii) What assumption did you make in calculating the length of the plank that is to be placed diagonally? [1]

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(b) Robyn finishes the gate with two end planks of wood.

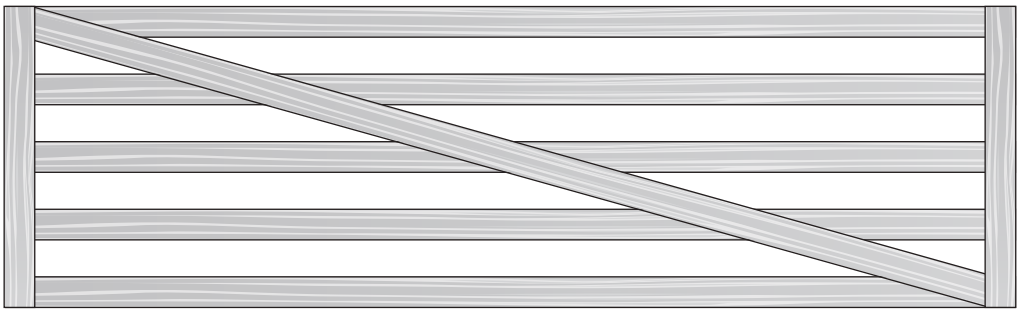

Diagram not drawn to scale

The costs of the different sizes of planks of wood are in the following ratio:

cost of 1 horizontal plank : cost of 1 diagonal plank : cost of 1 end plank

= 3 : 4 : 5

An end plank costs £8.55.
Calculate the total cost of the planks needed to make the gate. [4]

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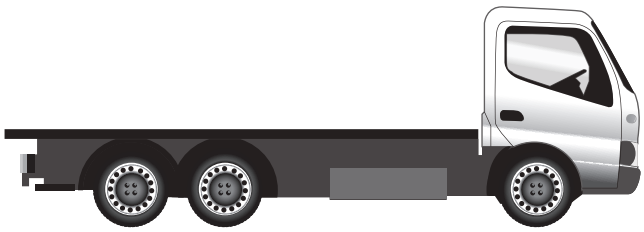
6. Dafydd carries bags of gravel on the back of his lorry.



Each bag of gravel has a mass of 90 kg, correct to the nearest 5 kg.

The maximum mass the lorry can carry without overloading is 7500 kg.
However, this measurement is only correct to the nearest 100 kg.

Calculate the maximum number of bags that the lorry is **guaranteed** to be able to carry without overloading.
You must show all your working. [3]

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Maximum number of bags that the lorry is guaranteed to be able to carry is .....

Examiner only

7. Llinos walks to the summit of Snowdon, passing the lake called Llyn Glaslyn.
Her height above sea level increases by 485 m from Llyn Glaslyn to the summit.

From the summit, she sees two small boats on Llyn Glaslyn.
Both boats are in the same direction from the summit.
The angles of depression of the two boats are 41º and 27º, as shown in the diagram.

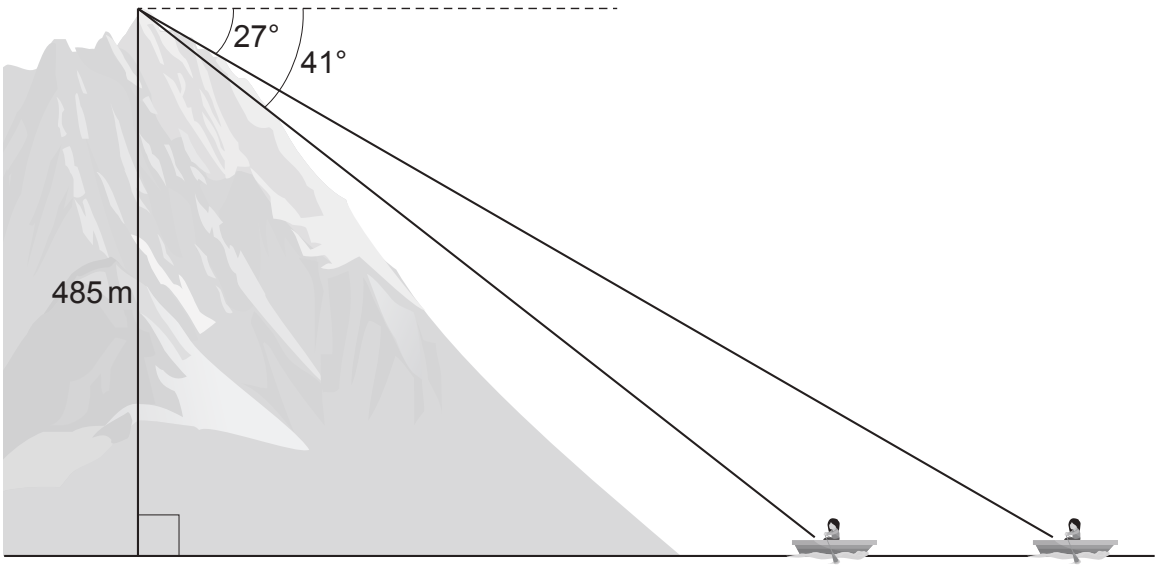

Diagram not drawn to scale

Calculate the distance between the boats. [5]

Examiner only

8. Gary and Carys are fire officers.

Last week, they recorded that 5 engines were able to pump 26 000 gallons of water onto a fire in 3 minutes.

(a) Show that 9 engines would be able to pump 143 000 gallons of water in under 9 minutes 15 seconds. [4]

(b) Give one possible reason why the 9 engines **may not** be able to pump 143 000 gallons of water in under 9 minutes 15 seconds. [1]

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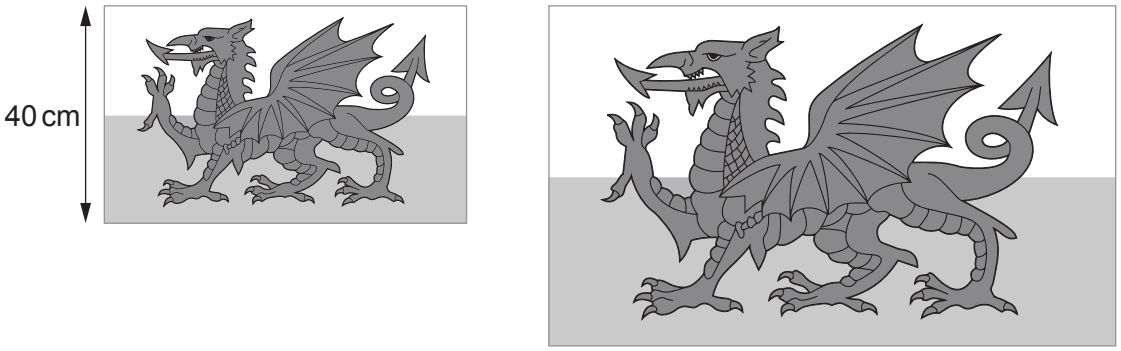
9. A company makes Welsh flags in mathematically similar sizes.
Two of their similar flags are shown.



Diagrams not drawn to scale

The area of the larger flag is 96% greater than the area of the smaller flag.
The height of the smaller flag is 40 cm.

Calculate the height of the larger flag. [4]

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Examiner only

10. On 1st January 2017, Samantha and Dyfan invested money into different savings accounts. They did not make any further payments into their accounts or withdraw any money from their accounts.

(a) Samantha invested £2000 in a savings account that paid interest at a rate of 0·95% every 3 months.

Show that Samantha would have £2038.18 in the account after 6 months. [1]

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(b) Dyfan invested £3000 in a savings account that paid interest at a rate of 1·02% every 3 months.
Interest is paid on the last day of each 3-month period.

Calculate the date when Dyfan will first have over £3600 in his account. [4]

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Date when Dyfan will first have over £3600 in his account is .....

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11. Two farmers have bought some farmland between them.
The farmland is in the shape of a quadrilateral *ABCD*, as shown below.

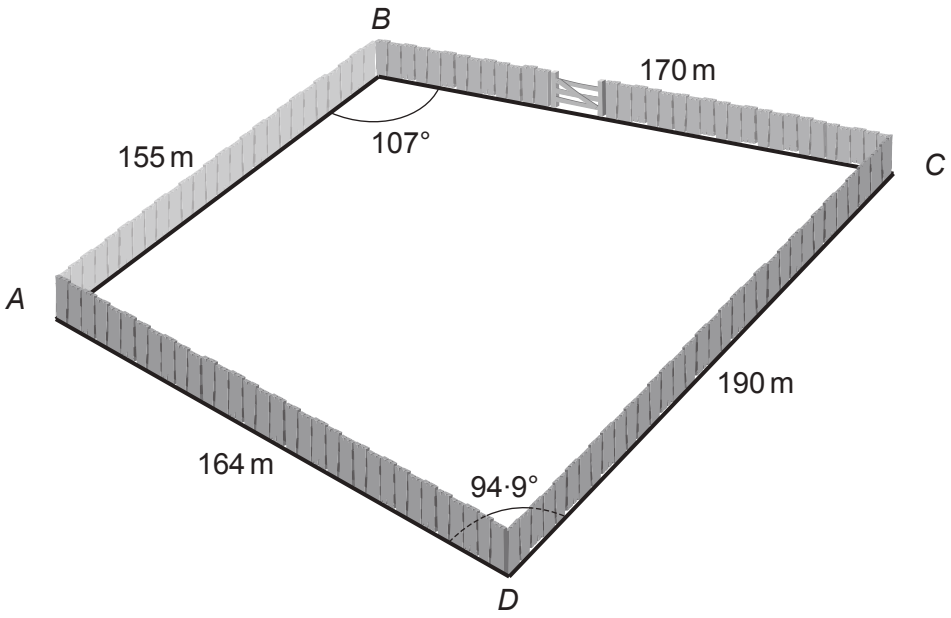

Diagram not drawn to scale

The farmers want to divide the farmland equally by building a straight fence.

(a) One of the farmers has suggested building the fence from *A* to *C*.
Show that this does not divide the farmland equally. [3]

Examiner only

(b) To divide the land equally, the fence is built from *A* to *F* where *CF* = 17·9 m.
To construct the fence, posts are placed at *A* and *F*.
Other posts are then located along *AF*, so that the posts are no more than 3 m apart.

Calculate the smallest number of posts needed, including the posts at *A* and *F*. [5]

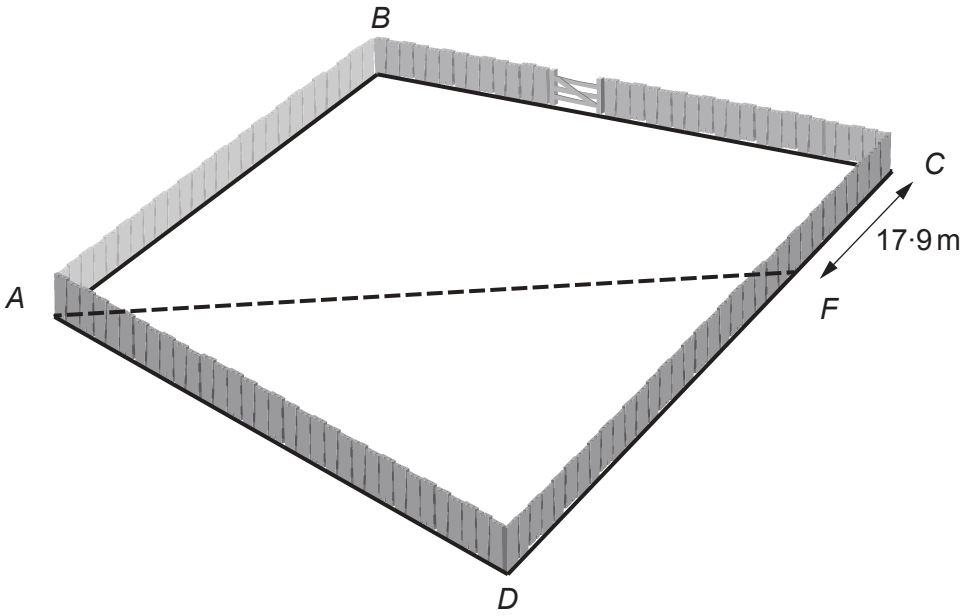

Diagram not drawn to scale

Examiner only

12. Laura and Matthew are buying a house priced at £150 000.
In order to buy the house, they will need to have a mortgage.

A mortgage is a loan that is paid back over a number of years.

They have saved a deposit of £15 000.
They need a mortgage of £135 000.

A bank has offered them a mortgage of £135 000 at an interest rate of 2·4% per annum, with interest added monthly.

To calculate the monthly payments needed in order to pay back the mortgage, they use the following formula:

$$M = \frac{r \times P}{1-(1+r)^{-12n}}$$

where:

M is the amount of each monthly payment,
P is the mortgage needed,
r is the **monthly** interest rate as a decimal,
n is the number of years taken to pay back the mortgage.

(a) The annual interest rate is 2·4%.
What is the monthly rate, as a decimal?
Circle your answer. [1]

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(b) Laura and Matthew are considering whether to take out a mortgage over 25 years or 30 years.

They have correctly calculated their monthly payments to be £598.86 when paying back the mortgage over 25 years.

How much more will it cost **in total** to pay back the mortgage over 30 years than over 25 years? [5]

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