WJEC NUMERACY HIGHER TIER QUESTIONS BY TOPIC, NOVEMBER 2016-

8. A company is designing a new chocolate-covered biscuit in the shape of a square-based pyramid.
The centre of the square base is labelled *O*.
Each biscuit will have base sides of length 3·4 cm, and a vertical height of 2·1 cm.

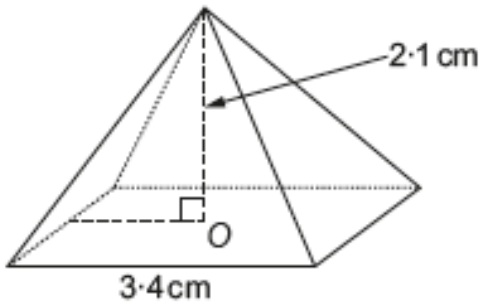

Diagram not drawn to scale

(a) Calculate the angle that one of the triangular faces makes with the base of the pyramid. [4]

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(b) The company knows that it costs 0·08p per cm^2 to apply a chocolate covering.
Calculate the cost of applying a chocolate covering to all 5 faces of a biscuit. [6]

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14. The diagram shows a 5m wide section of road that has a uniform gradient.
The shaded area represents level ground.
Two cyclists, Delyth and Ioan, approach this section of road.

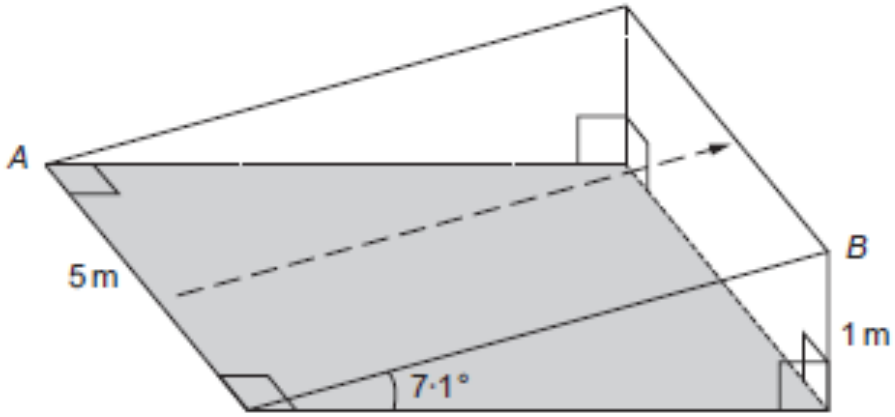


Diagram not drawn to scale

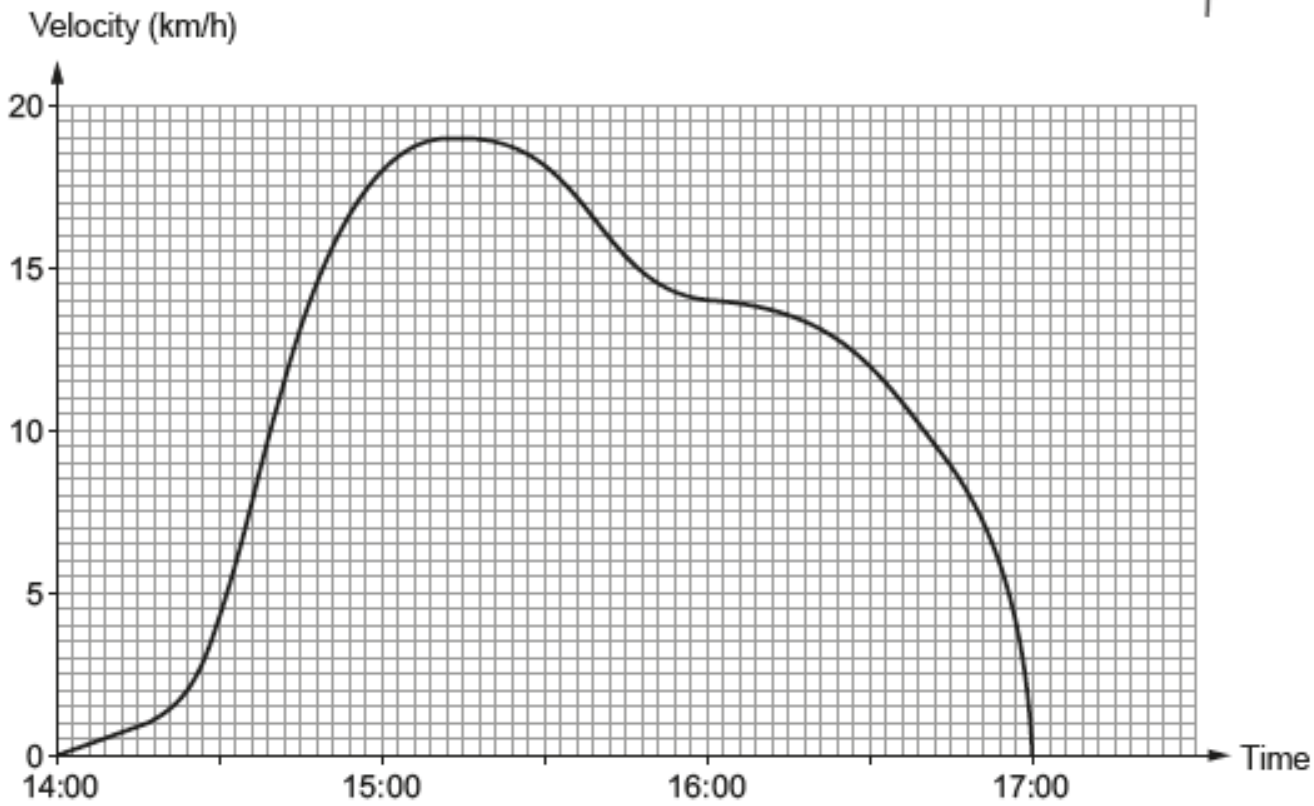
Delyth cycles straight up the middle of the road as shown by the arrow.
Ioan thinks this section of road is too steep to cycle straight up, so he decides to cycle from *A* to *B* in a straight line.

(a) How far does Ioan cycle in going from *A* to *B*? [6]

(b) Show that Ioan's route up this section of road is less steep than Delyth's route.
You must show all your working. [3]

7. Siân went for a ride on her bike.

She started her ride at 14:00.
The graph below shows information about her bike ride.



(a) During which quarter-hour period was Siân's acceleration the greatest? [1]

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(b) At about what time did Siân stop accelerating? [1]

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(c) Siân usually finds cycling at a velocity of 18 km/h very comfortable.
Express 18 km/h in metres per second. [2]

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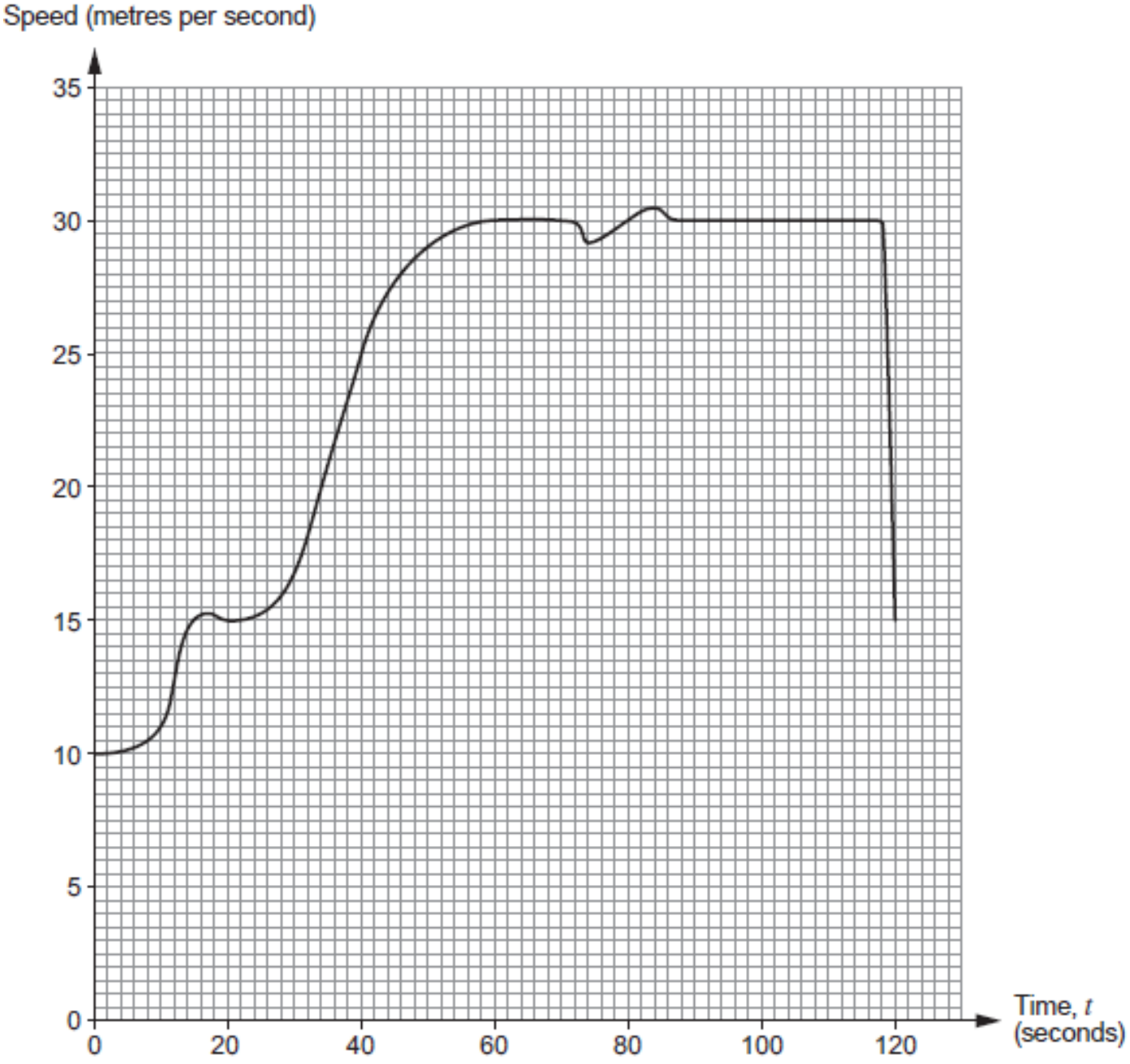
(d) Calculate an estimate for the total distance Siân travelled **between 14:00 and 16:00**.
Use her velocities at 14:00, 15:00 and 16:00. [3]

Distance travelled ..... km

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

Siân estimated the distance she travelled between 16:00 and 17:00 as **5 miles**.
Is Siân's estimate reasonable?
You must justify your answer and show your working. [3 + 2 OCW]

10. The graph below shows a 120-second section of Iestyn's car journey to work this morning.



(a) (i) At $t = 50$ seconds, estimate the acceleration of Iestyn's car in m/s^2. Leave your answer as a fraction. [3]

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(ii) At another time, Iestyn calculated the acceleration of the car to be $0{\cdot}2\dot{4}$ m/s^2.
Write this recurring decimal as a fraction. [2]

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(b) (i) Calculate an estimate of the distance travelled by Iestyn's car in the first 80 seconds of his journey.
You must consider the speed of the car when t = 0, 20, 40, 60 and 80 seconds. [4]

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(ii) Hence, calculate an estimate of the average speed of Iestyn's car for this entire 120-second section of his car journey.
Give your answer in m/s. [4]

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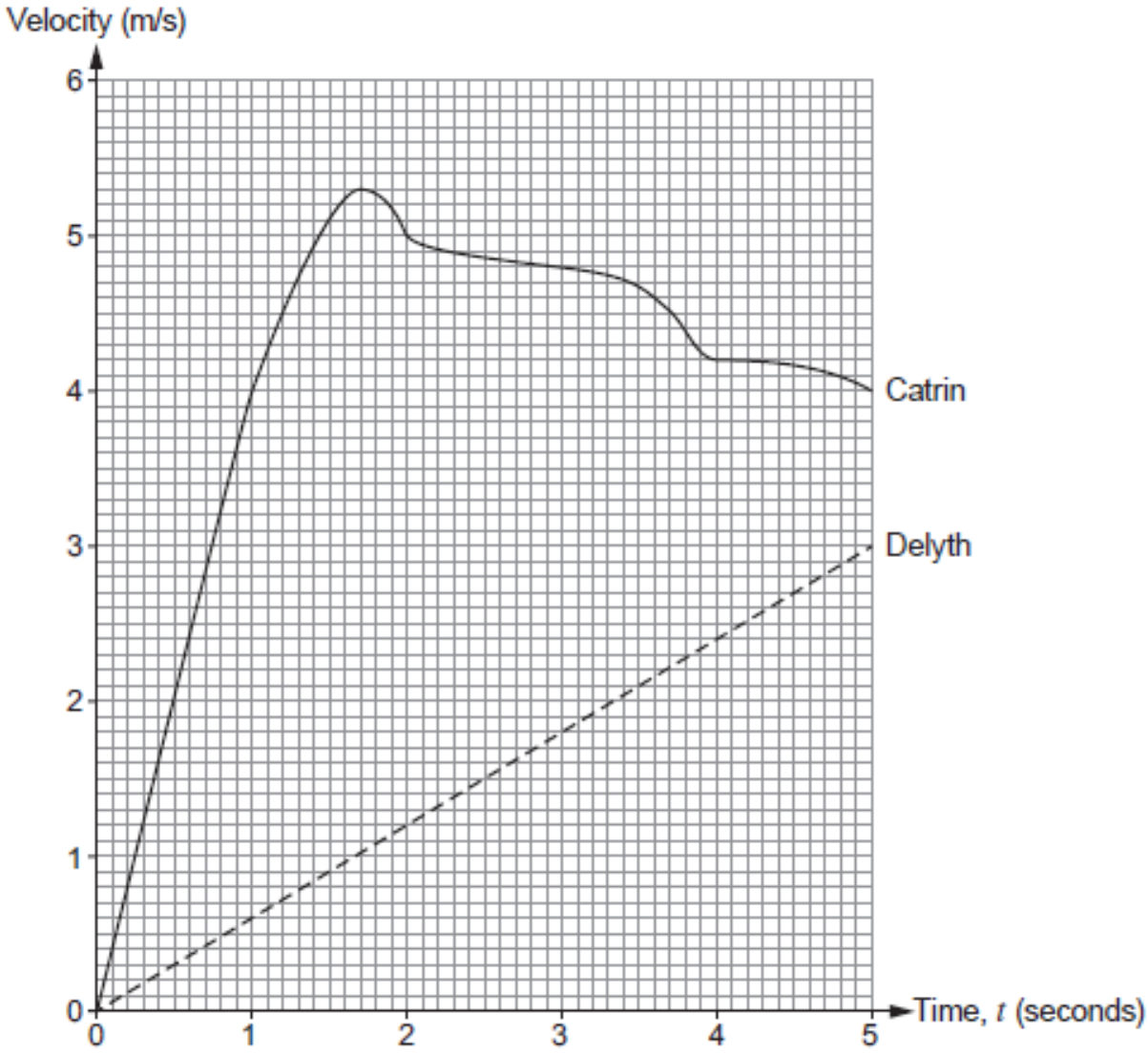
9. Two runners, Catrin and Delyth, start a race at the same time.
The velocity-time graph shows their velocities over the first 5 seconds of the race.



(a) After the start of the race, what was the earliest time that Catrin's acceleration was $0\,m/s^2$? [1]

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(b) Use the trapezium rule to calculate an estimate of the distance Catrin travelled in the first 5 seconds of the race.
Use Catrin's velocities at times $t = 0$, $t = 1$, $t = 2$, $t = 3$, $t = 4$ and $t = 5$.
You must show all your working. [3]

(c) (i) Calculate an estimate of how far Catrin was ahead of Delyth after 5 seconds. [2]

(ii) Explain why your answer to *(c)* (i) is an underestimate. [1]

10. Huw wants to open a savings account.
Here are the details of savings accounts advertised by two local Welsh banks.

Banc Padarn	Banc Teilo
Nominal interest rate of 1·98% per annum Interest paid monthly	AER 1·99%

(a) (i) What is 1·98% as a decimal?
Circle your answer. [1]

0·0198 0·198 1·098 1·98 98·0

(ii) Which of these two banks should Huw choose in order to gain the most interest per annum?
You must show your working. [4]

10. Fatima wants to invest some money in a savings account.
She has picked up leaflets from two building societies advertising their high-interest savings accounts.

'Bannau' account	'Eryri' account
Nominal annual rate of 3·85%	Nominal annual rate of 3·86%
Interest paid monthly	Interest paid every 6 months

By comparing AERs, which account will offer Fatima the better interest rate on her investment?
You must show all your working. [5]

7. Iestyn opened a savings account on 1 August 2017, investing £2800.
On 1 October 2017, he viewed his savings account online.
The table below shows all the transactions that had taken place since he opened the account.

Date	Details	Paid in (£)	Paid out (£)	Balance (£)
01/08/17	Account opened	2800.00		2800.00
31/08/17	Interest	14.00		2814.00
30/09/17	Interest	14.07		2828.07

(a) Calculate the nominal interest rate per annum. [3]

(b) Calculate the AER the account was paying.
Give your answer as a percentage, correct to 2 decimal places. [3]

10. The shaded part of the diagram below shows the top surface of an engine part.

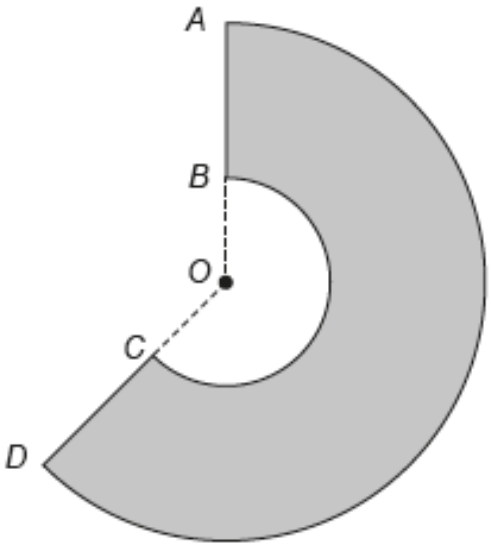

Diagram not drawn to scale

The measurements taken by a motor engineer are:

- reflex angle $B\hat{O}C = 240°$,
- $AO = OD = 6\,\text{cm}$,
- $BO = OC = 3\,\text{cm}$.

(a) The length of the major arc AD is to be sealed by attaching a flexible anti-rust strip.
Each flexible anti-rust strip is of length 35 cm.
What length of the anti-rust strip will be left over after sealing the length of the major arc AD?
Give your answer in terms of π, in its simplest form. [3]

Length of anti-rust strip left over = ... cm

(b) The top surface of the engine part is to be painted.
The paint costs 15p per cm^2.

(i) Calculate the cost of the paint to be used.
Give your answer in terms of π, in its simplest form. [4]

(ii) Using $\pi = 3$, calculate how much it costs to paint the top surface of 20 engine parts.
Give your answer in pounds. [1]

Paint cost is £ .....

11. A company is building a new headquarters.
The diagram below shows the ground plan of the new headquarters.

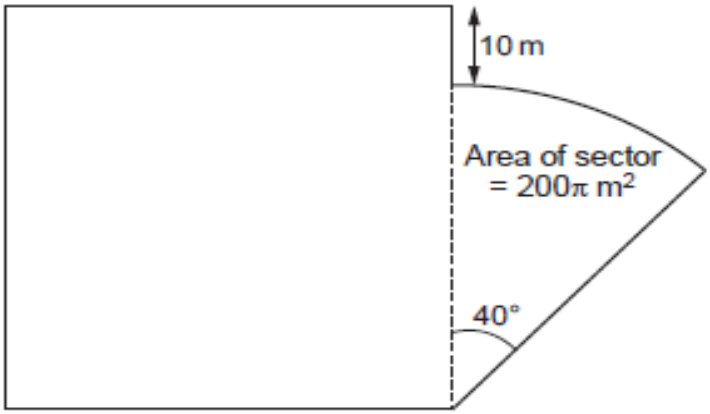

Diagram not drawn to scale

The plan consists of a square and a sector of a circle.

(a) Using the information given in the diagram, calculate the radius of the sector of the circle.

Give your answer in the form $a\sqrt{b}$, where a is an integer and b is a prime number. [5]

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(b) The square is to be covered in concrete.

Calculate the area of the square.
Expand any brackets, and simplify your answer. [3]

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11. A company produces metal badges to be worn by its employees.
The badge is made up of two parts.
One part is in the shape of a sector of a circle as shown in the diagram.

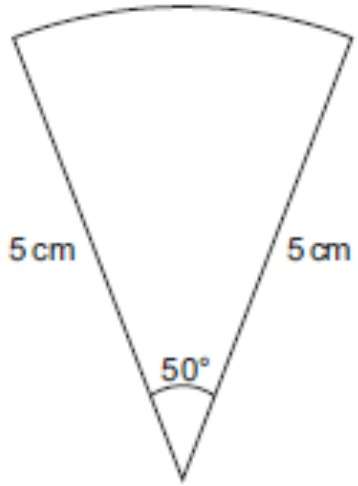

Diagram not drawn to scale

(a) The perimeter of the sector is decorated with a coloured edging strip.
Calculate the length of edging strip needed to decorate the sector. [3]

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(b) The other part is in the shape of a quarter-circle of radius 3 cm.

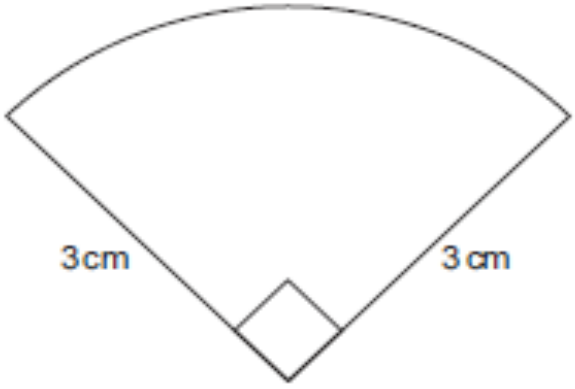

Diagram not drawn to scale

To make the badge, the two pieces are joined together with the sector in front of the quarter-circle, as shown in the diagram.
The badge has a vertical line of symmetry.

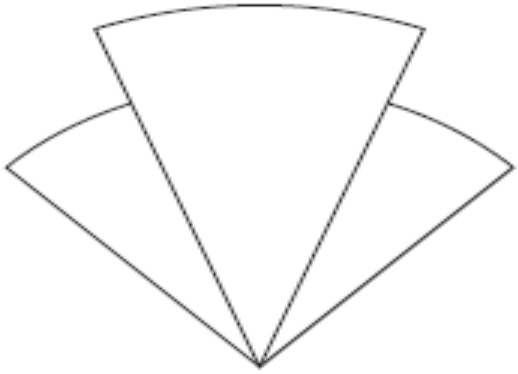

Diagram not drawn to scale

The visible surface of the front of the badge is painted.
Calculate the area that is painted. [5]

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8. A baker makes cake slices to sell in her shop.
All of the cake slices are identical. They have been cut from a cylindrical cake of radius 10 cm and depth 4 cm.

Piped icing is placed on the curved surface of each cake slice, as shown in the diagram.
It connects opposite vertices of this curved surface, and follows the shortest path between these vertices.

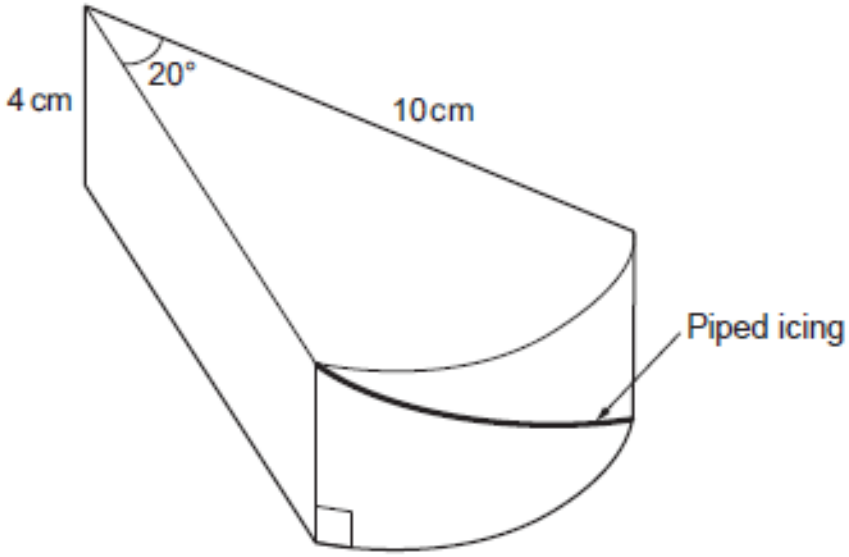

Diagram not drawn to scale

What length of piped icing will be needed to decorate all the slices that make up a whole cylindrical cake? [7]

Length of piped icing needed for a whole cake = ... cm

(c) A television uses 1 unit of electricity every 10 hours.
A unit of electricity costs 9.8p.

(i) Calculate the cost of having a television turned on for 24 hours.
Circle your answer. [1]

£23.52 £2.35 40.83p 23.52p 2.45p

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(ii) On average, Marta watches 4 hours of television each day.
On average, how much **a week** does it cost her to watch television?
Circle your answer. [1]

27.44p £27.44 £39.20 39.2p 10.78p

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4. Megan Pugh's electricity bill is shown below.
It covers the period May, June and July 2017.

Megan Pugh
203 Stryd Bryntor
Maesgwyn

Period	Previous meter reading	Present meter reading	Number of units of electricity used
May, June and July 2017	13450	13900	450

Charge for electricity: 450 units at **20p per unit**	£90.00
Standing charge: 3 months at **£7.60 per month**	£22.80
Total charges:	£112.80

VAT at 5%: 5% of £112.80	£5.64

Amount to pay: £112.80 + £5.64 = **£118.44**

(a) On 1 August 2017, the charge per unit for electricity was increased by 5%.
What is the increased cost per unit of electricity?
Circle your answer. [1]

20.5p 21p 21.5p 22p 22.5p

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

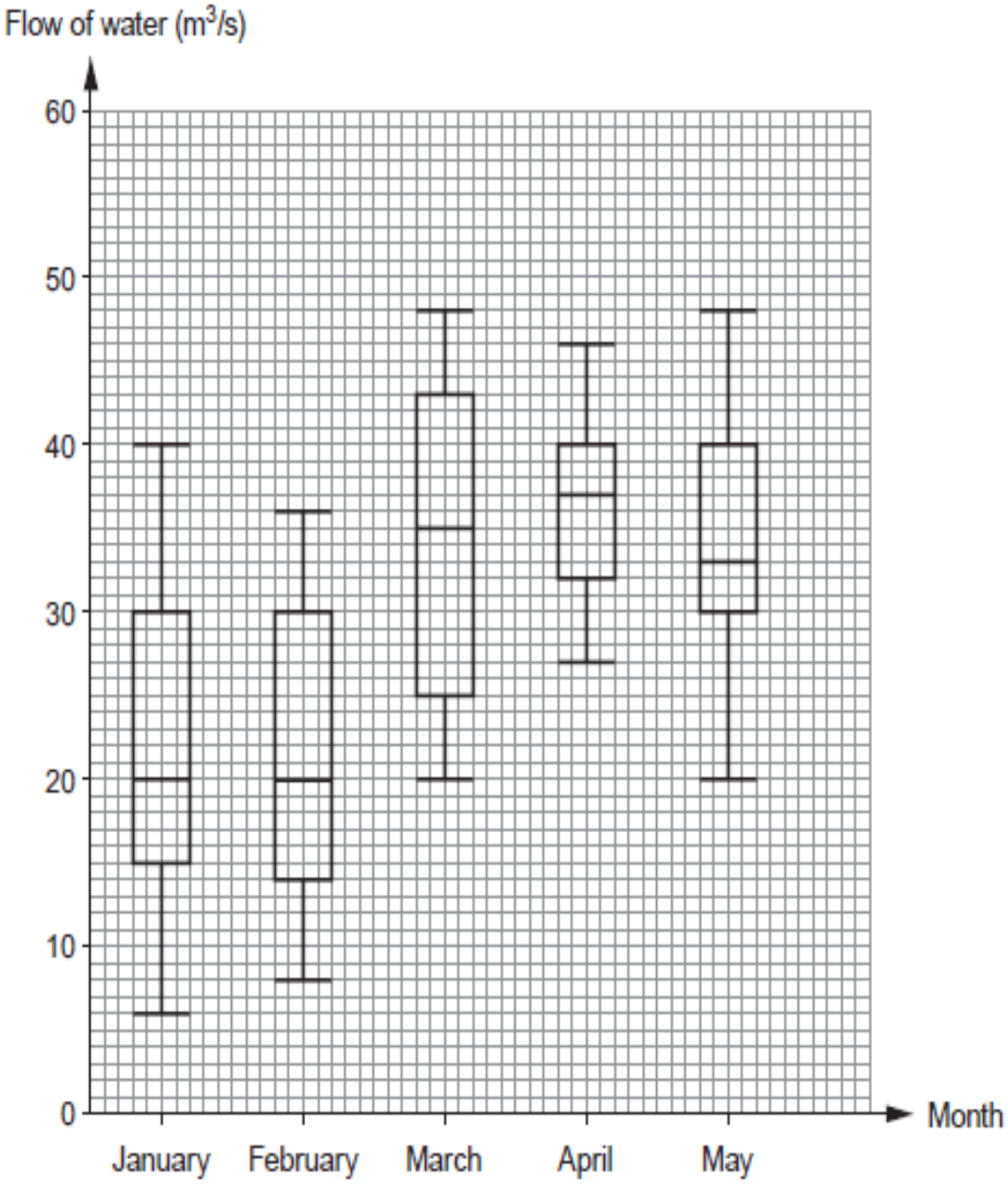
Megan wants to calculate her next 3-monthly electricity bill.
She knows the following:

- Her meter reading on 31 October 2017 was 14400.
- The charge per unit for electricity has increased by 5% since her last bill.
- The standing charge has increased by 20p **per month** since her last bill.
- VAT remains at 5%.

On 31 October 2017, Megan had £470 in her bank account.

After paying her next 3-monthly electricity bill, will Megan be able to buy a new washing machine costing £330?
You must show all your working. [9 + 2 OCW]

6. The following box and whisker plots show the flow of water through a drain, measured in m^3/s. The flow of water was measured at 11 a.m. each day for the first 5 months of the year.



(a) In which of the five months was the median flow of water the greatest? [1]

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(b) In which of the five months was the range of the flow of water the greatest? [1]

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(c) Iona is writing some statements for a report on the flow of water through the drain. Complete each of the statements given below.

(i) 'Both the upper quartiles and medians in the months of .....

and ..... were the same.' [1]

(ii) '25% of the results in March show the flow of water was greater than

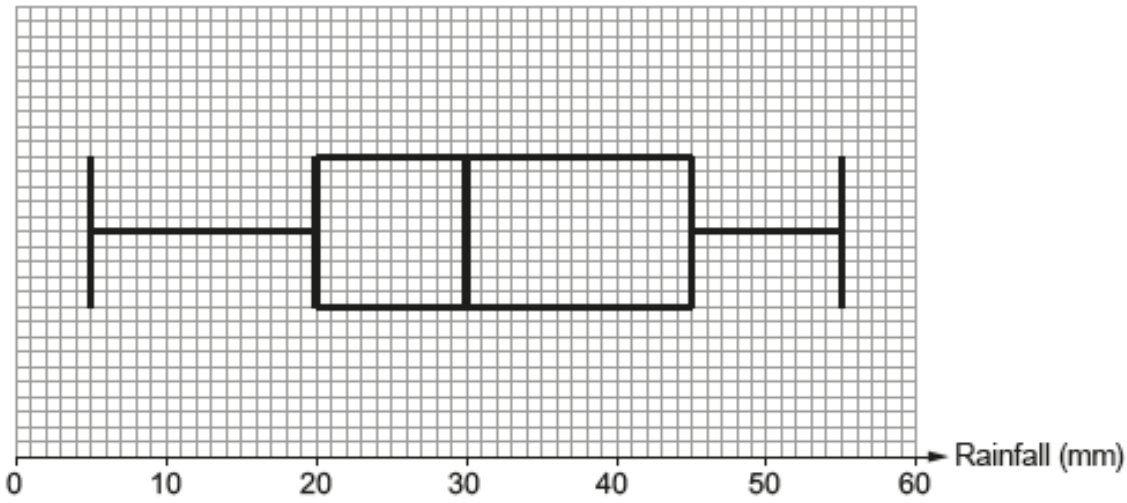
..... m^3/s.' [1]

(d) Circle either TRUE or FALSE for each of the following statements. [2]

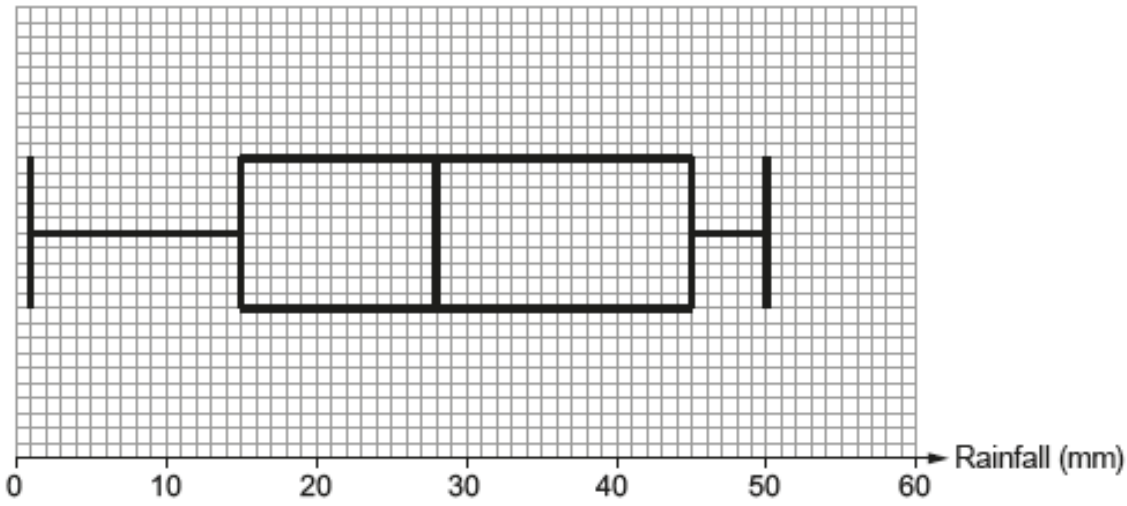
25% of the results in January show the flow of water was less than 6 m^3/s.	TRUE	FALSE
The units, m^3/s, measure the volume of water passing through the drain each second.	TRUE	FALSE
The mean flow of water in April was **certainly** greater than 36 m^3/s.	TRUE	FALSE
The month with the greatest difference between the lower quartile and the median was May.	TRUE	FALSE

6. The following box-and-whisker plots illustrate the daily rainfall for April 2016 in Trefwen and in Nawrby.

April rainfall in Trefwen



April rainfall in Nawrby



(a) Complete the following table. [4]

	Range	Median	Interquartile range
Trefwen	..... mm	..... mm	..... mm
Nawrby	..... mm	..... mm	..... mm

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(b) Iona is going on holiday next April.
She is hoping for good weather, with hardly any rain.
She decides to go to Nawrby.
Give a reason to support Iona's decision.
Include values for both Trefwen and Nawrby. [1]

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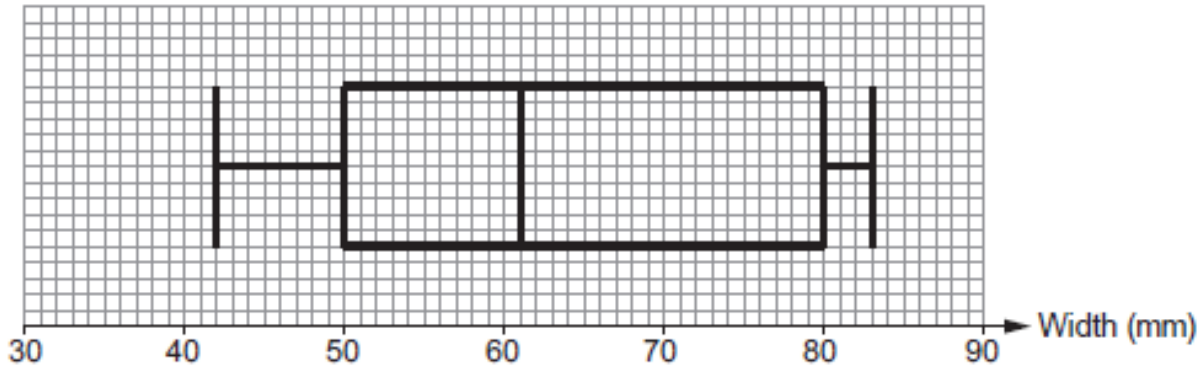
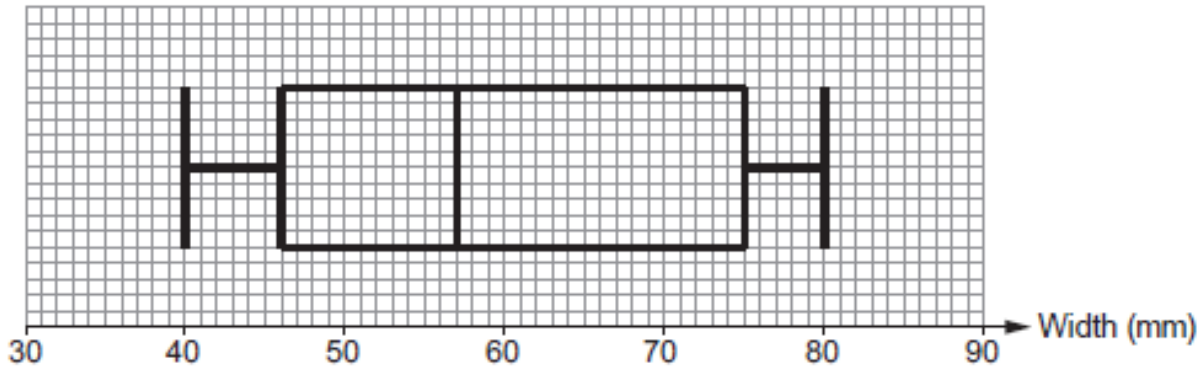
5. Lena has three apple trees in her garden.
She has one Gala apple tree, one Orange Pippin tree and one Pink Lady tree.
She picks 50 apples from each of the 3 trees.
She records the width of each apple, as shown.

Lena constructs box and whisker diagrams for the widths of the apples collected from each of the three trees.

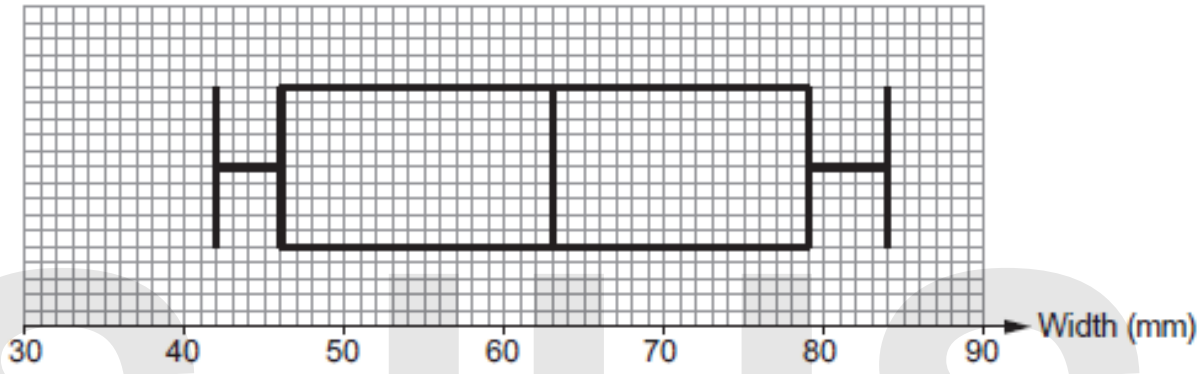
Gala apple tree



Orange Pippin apple tree



Pink Lady apple tree



(a) Complete each of the following statements.

(i) 'Apples from the ..... apple tree have the least median width.

The median width of apples recorded for this tree is ..... mm.' [1]

(ii) 'The range of the widths of apples recorded for the Gala apple tree

is ..... mm.' [1]

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(iii) 'The ..... apple tree has apples with the greatest interquartile range of widths.

The interquartile range of the widths of apples recorded for this tree

is ..... mm.' [2]

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(b) Which tree has a higher proportion of larger apples?
You must give a reason for your answer. [1]

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1. Mali's scooter depreciated (decreased) in value by 24% in the **first** year.
In all further years, her scooter depreciated by 13% of its previous year's value.
She originally paid £850 for her scooter.
Calculate the value of Mali's scooter after 7 years. [3]

After 7 years, the value of Mali's scooter was £ .....

2. The price of softwood changes each year.
The price has increased by 6% every year for each of the last **5 years**.
Before this, the price had decreased by 2% every year.
Seven years ago the price of softwood was £34 per m^3.

Calculate the current price of softwood. [3]

Current price of softwood is £ ..... per m^3

5. Teleri needs £8000 to pay a deposit for a new house.
She already has £7500.

Teleri decides to invest the £7500 in a bank account that pays interest at a rate of 0·31% every month.
She does not plan to make any further payments into this account.

Calculate the number of months Teleri will need to wait until she has enough money in the account to pay the deposit of £8000. [3]

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1. The scale diagram opposite shows an Eisteddfod camping field.

The camping field is 100 metres long and 80 metres wide.

A river runs along the side *AB*.
There is a hedge along *AD*.
There is a fence along *BC*.
DC is an opening with access to the Eisteddfod camping field.

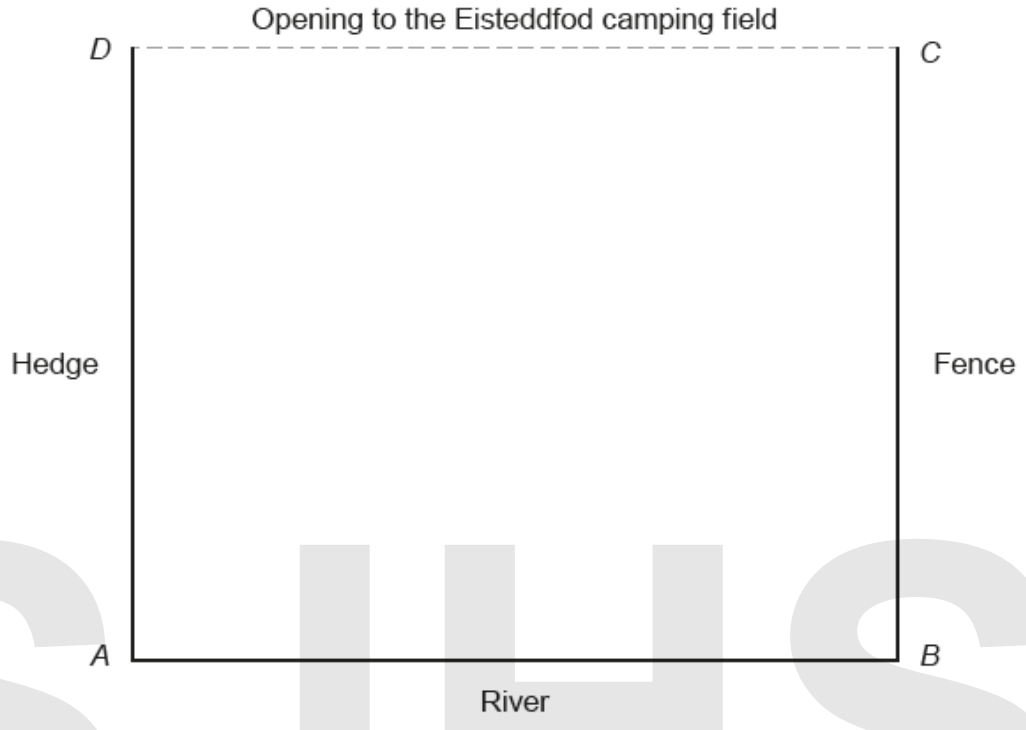
The scale used is **1 cm represents 10 metres**.

A barbecue area is to be built on the camping field.

The barbecue area must be
- nearer to the river than to the opening to the Eisteddfod camping field,
- nearer to the river than to the hedge,
- more than 30 metres from the corner of the field where the hedge meets the river.

Draw suitable lines on the diagram. Shade the region where the barbecue area could be built.
[5]

1 cm represents 10 metres



3. *Organics4U* is planning to have its headquarters in Wales.
The manager has instructed Ffion to look for a site for the headquarters.

Here are the instructions that Ffion has been given by her manager.

'Find the point that is
- an equal distance between Wrexham and Aberporth, and
- an equal distance between Caernarfon and Swansea.

The new headquarters needs to be within 20 miles of this point.'

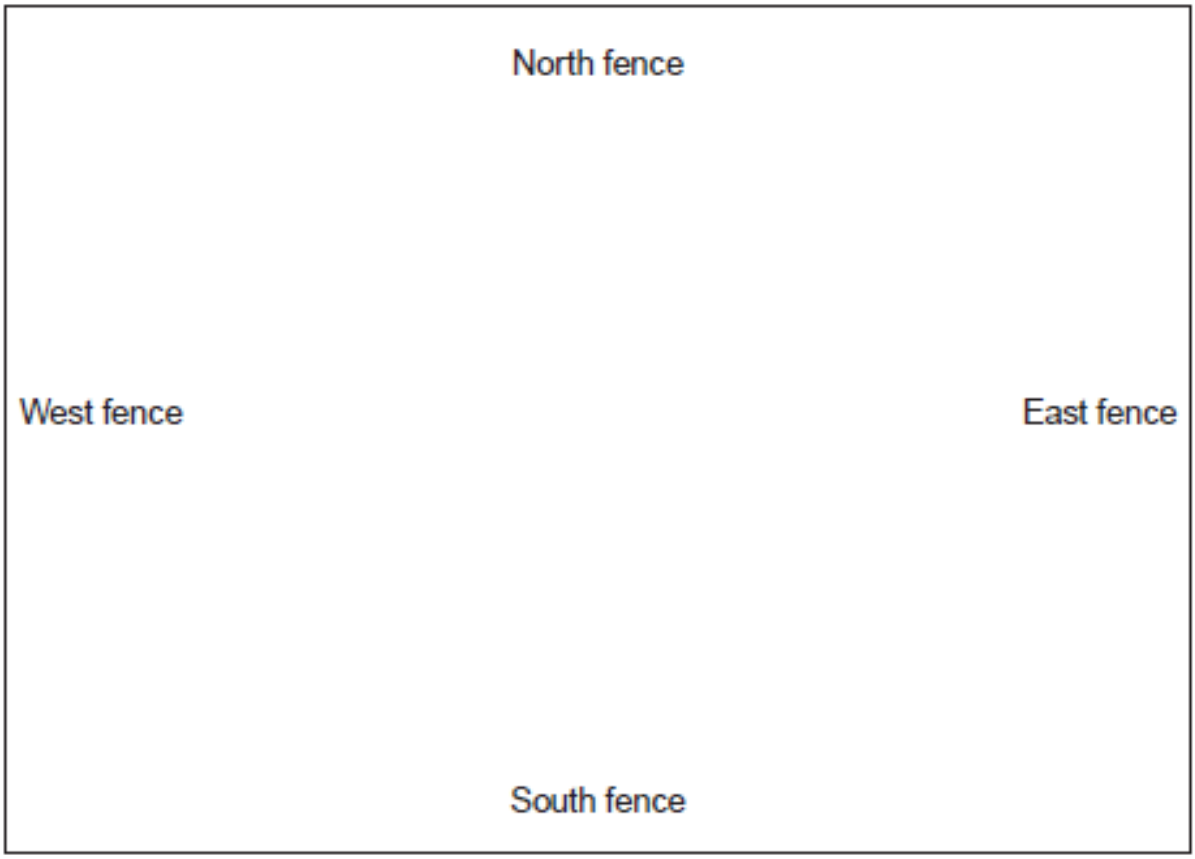
On the map below, shade the region, **in Wales**, that Ffion should identify for her manager. [4]

(b) Bronwen decides to place a cylindrical water container in the small paddock on the farm.

The water container has a diameter of 1·4 metres.

(i) The scale diagram opposite shows the small paddock on the farm.
The small paddock is rectangular, measuring 7 metres by 5 metres.

Scale 2 cm represents 1 m

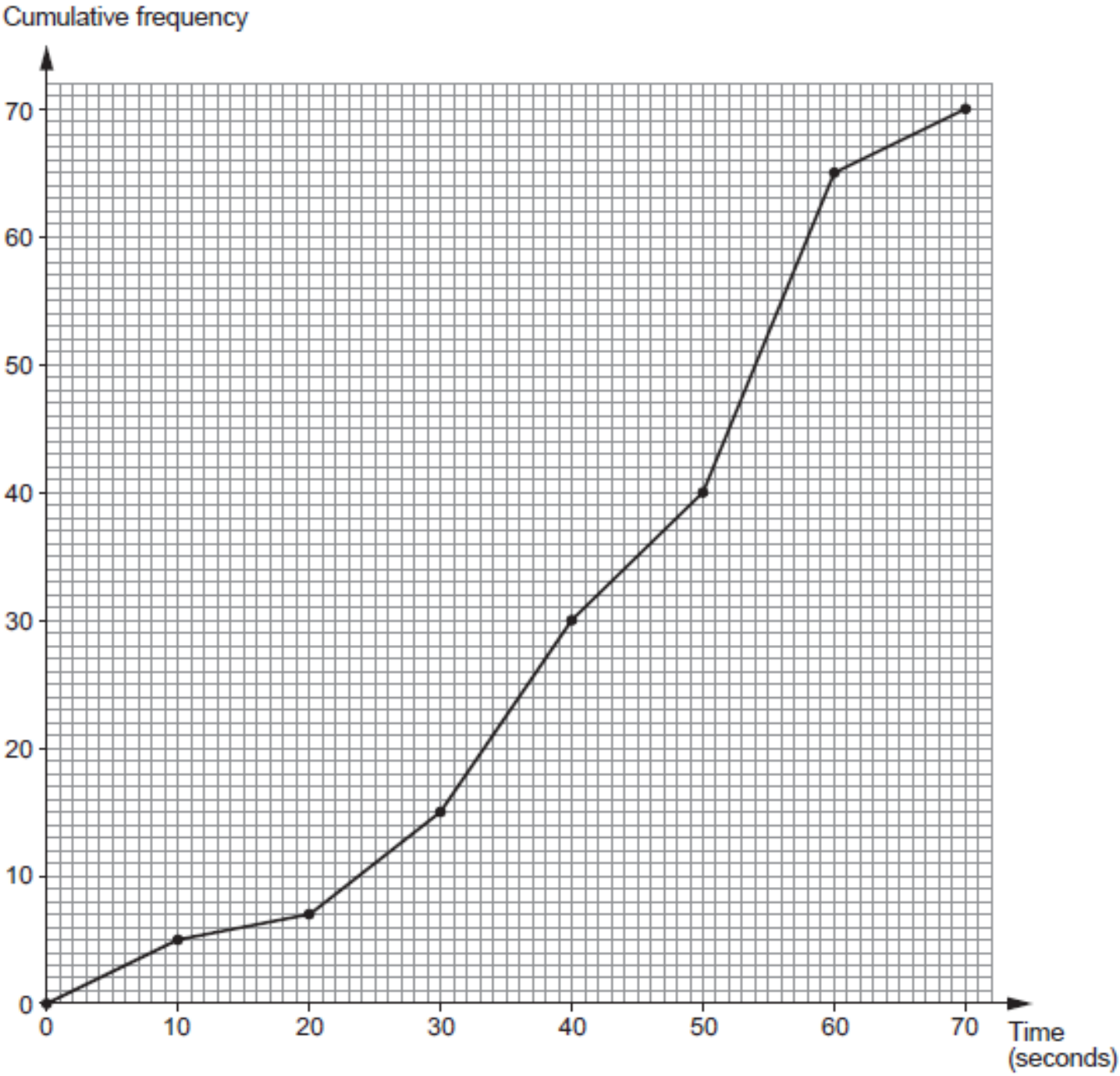


Bronwen decides to place the centre of the water container so that it is:

- equidistant from the south fence and the east fence,
- 3 metres from the south fence.

Show the placement of the water container on the scale diagram of the small paddock above.
Your diagram should include an **accurate plan view** of the **water container**. [4]

5. *Cambria Airlines* has planes that can carry up to 70 passengers.
For safety, the crew practise the emergency exit procedures with a group of 70 passengers.
Every 10 seconds the safety officer records the total number of passengers who have left the plane.
He has displayed the results in the cumulative frequency diagram shown below.



(a) Estimate the median time taken by the passengers to leave the plane. [1]

..... seconds

(b) How many passengers took more than 50 seconds to leave the plane?
Circle your answer. [1]

10 20 30 40 50

(c) *Cambria Airlines* has a policy that states the following.

'In the event of an emergency exit procedure, at least 90% of the 70 passengers must have left the plane within 1 minute.'

Did the practice emergency exit procedure meet the requirements of the airline's policy?
You must show all your working. [4]

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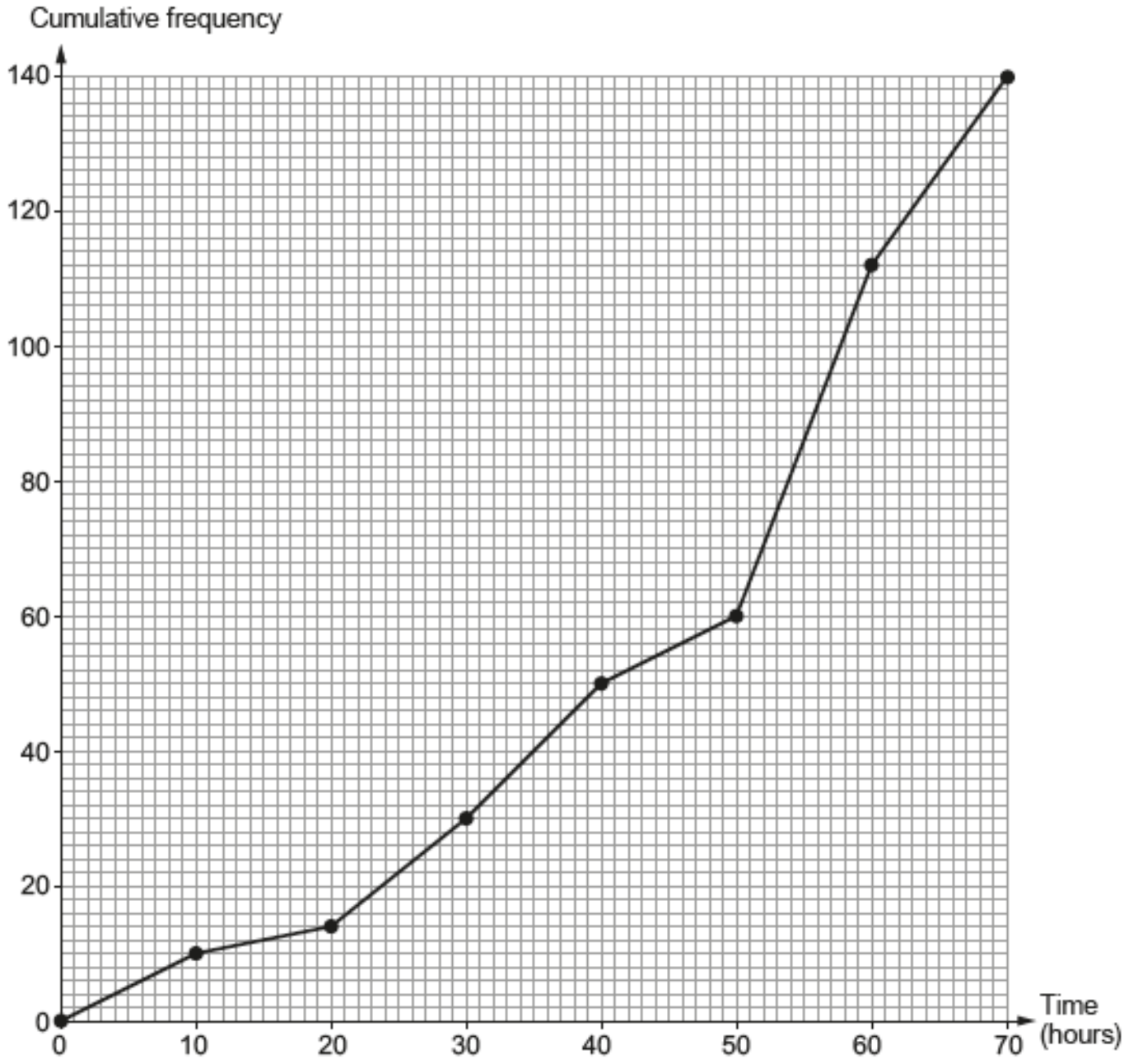
4. *(a)* 140 girls were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram shows the results.



(i) Estimate the median time the girls spent revising.
Circle your answer. [1]

35 hours 40 hours 48 hours 52 hours 70 hours

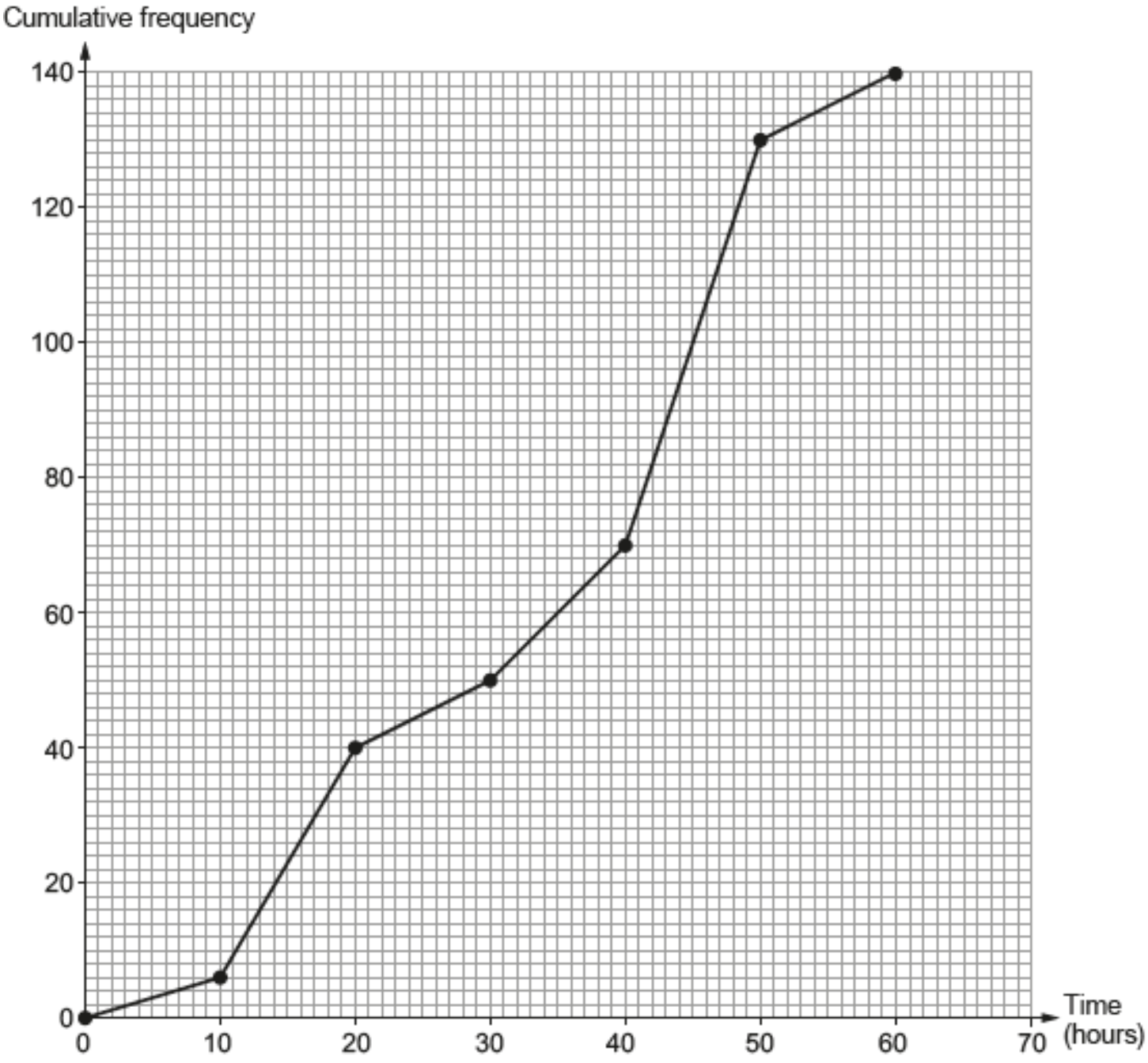
(ii) Calculate the number of girls who spent between 40 and 50 hours revising.
Circle your answer. [1]

0 girls 5 girls 10 girls 15 girls 20 girls

(iii) Circle either TRUE or FALSE for each of the following statements. [2]

25 girls spent between 30 and 50 hours revising.	TRUE	FALSE
No girls spent more than 80 hours revising.	TRUE	FALSE
The modal group is between 50 and 60 hours spent revising.	TRUE	FALSE
20 girls spent more than 60 hours revising.	TRUE	FALSE

(b) 140 boys were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram below shows the results.



Trefor makes two statements.

1. The boys' interquartile range is greater than the girls' interquartile range.

2. On average, boys spent more time revising.

Are both Trefor's statements correct?
Show calculations and give reasons to support your answers. [4]

Statement 1: .....

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Statement 2: .....

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3.

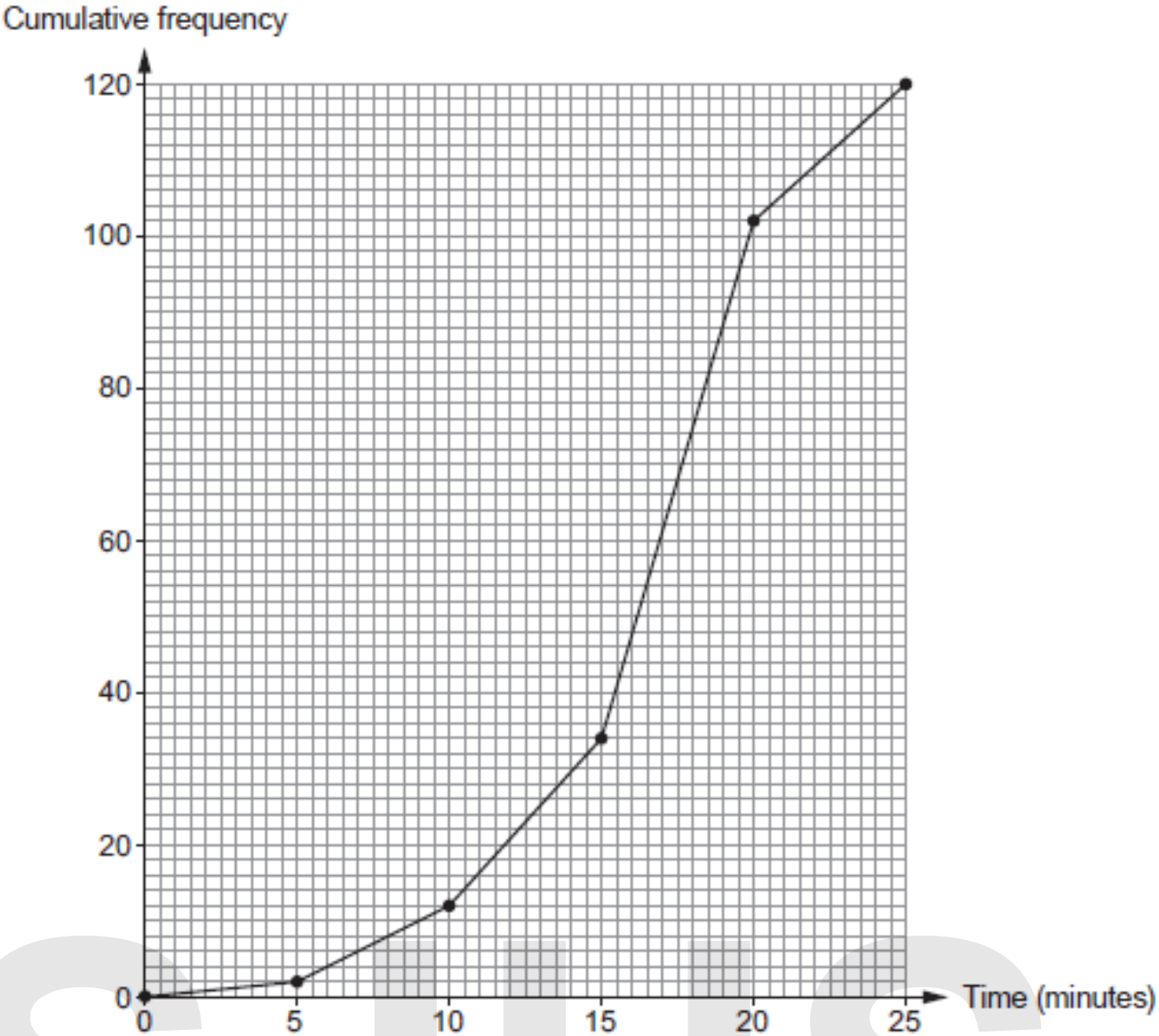
Meirion's Window Cleaning Business

No job too small!

Email: meirion@mwcb.cymru

Meirion is a window cleaner.
From Monday to Friday, he records how long he spends cleaning windows for each of his customers.

He draws a cumulative frequency diagram to display the findings.



(a) (i) Use Meirion's cumulative frequency diagram to find the median and interquartile range of the times he spends cleaning windows for each of his customers. [3]

Median ..... minutes

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Interquartile range ..... minutes

(ii) Meirion looks back at his raw data.
He finds that the median is actually 17 minutes 30 seconds.
Why is there a difference between the median from his cumulative frequency diagram and the actual median from his raw data? [1]

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(b) Meirion is looking at the time it took to clean individual customers' windows.
Find the number of customers whose windows took between 10 and 15 minutes to clean. [2]

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(c) Meirion thinks that for approximately 80% of his customers, he cleaned their windows in less than 20 minutes.
Is Meirion correct?
You must show all your working. [3]

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(c) The currency widely used in Patagonia is the Argentine peso.

Alvaro sells alpaca fleeces from Patagonia.
His fleeces are priced in Argentine pesos.
Tom lives in Wales and buys fleeces from Alvaro.
Tom pays for the fleeces in pounds.

Tom's purchases are shown in the table below.

	Number of fleeces bought	Price per fleece, in Argentine pesos	Exchange rate
January 2015	80	19.20	£1 = 15.47 Argentine pesos
March 2016	20	22.30	£1 = 15.21 Argentine pesos
April 2017	100	24.50	£1 = 14.93 Argentine pesos

For each of Tom's 3 purchases he paid correct to the nearest penny.

How much did Tom pay for these 200 fleeces, in pounds?
Give your answer correct to the nearest penny.
You must show all your working. [4]

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4. Gwenda enjoys road running.

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

She keeps a record of her run each day this week.

Day	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
Distance	4·6 km	5·4 km	2·2 km	6·2 km	7·2 km	2·2 km	3·4 km
Time	26 mins	31 mins	12 mins	35 mins	40 mins	14 mins	22 mins

Last week, her average speed for the week was 9·6 kilometres per hour.
Calculate Gwenda's percentage improvement in her average speed from last week to this week.
You must show all your working. [6 + 2 OCW]

Percentage improvement is ..... %

3.

Stylish computer desk Made of laminate wood. Non-scratch top. **Length is exactly 2000 mm**	

Luc wants this new desk for his bedroom.

The desk is to fit on the straight wall between his wardrobe and his bookcase.

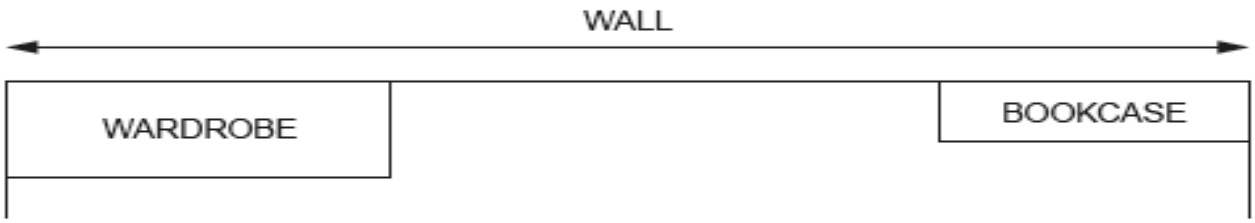

Diagram not drawn to scale

Luc has measured the length of

- the wall, which is 600 cm, correct to the nearest 10 cm,
- the bookcase, which is 147 cm, correct to the nearest 1 cm,
- the wardrobe, which is 250 cm, correct to the nearest 1 cm.

(a) What is the greatest possible length of the wall?
Circle your answer. [1]

600 cm 605 cm 645 cm 610 cm 650 cm

(b) What is the least possible length of the wardrobe?
Circle your answer. [1]

249 cm 249·45 cm 249·49 cm 249·5 cm 250 cm

(c) Can Luc be certain that this desk will fit in the space available?

You must
- show all your calculations,
- give the greatest or least bounds of any measurements used in calculations or comparisons,
- give a reason for your answer. [5]

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7. Here is some information from a 2014 geographical journal:

- Population of the UK: $6{\cdot}5 \times 10^7$, correct to the nearest 1 000 000
- Area of the UK: 244 000 km^2, correct to the nearest 1000 km^2

Using these figures, calculate the greatest possible value for the population density of the UK, in population per km^2. [4]

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2. Sanjay stacks three boxes in a pile.
The heights of the boxes are 25 cm, 36 cm and 47 cm.
They are all measured correct to the nearest centimetre.
What is the greatest possible height of the stack of the three boxes? [2]

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Greatest possible height of the stack of three boxes is ..... cm

12. A plan view of Lowri's garden is shown below.

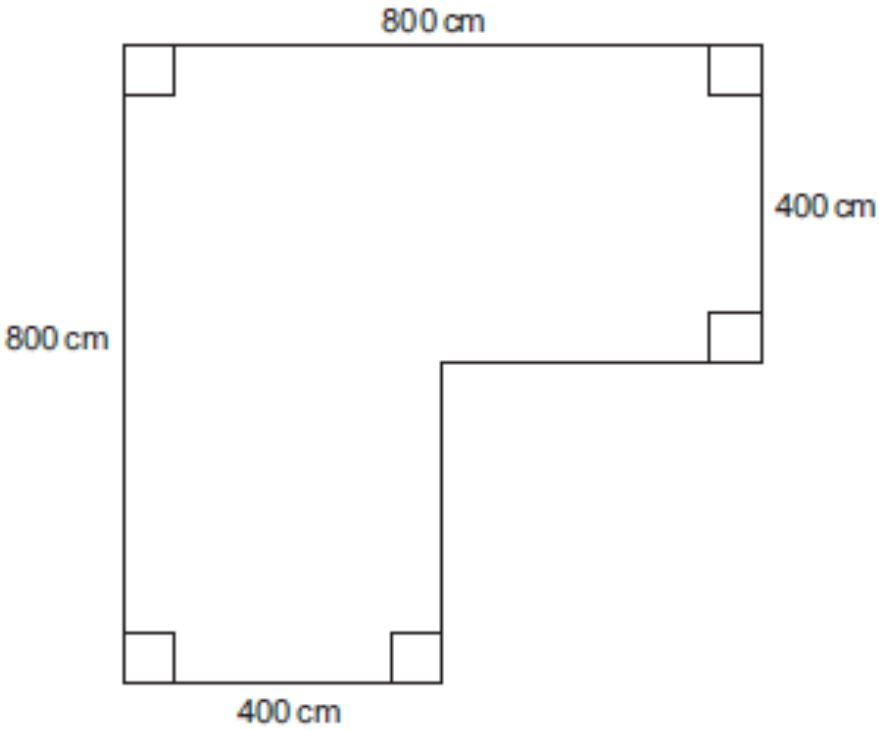


Diagram not drawn to scale

All the measurements are correct to the nearest 10 cm.

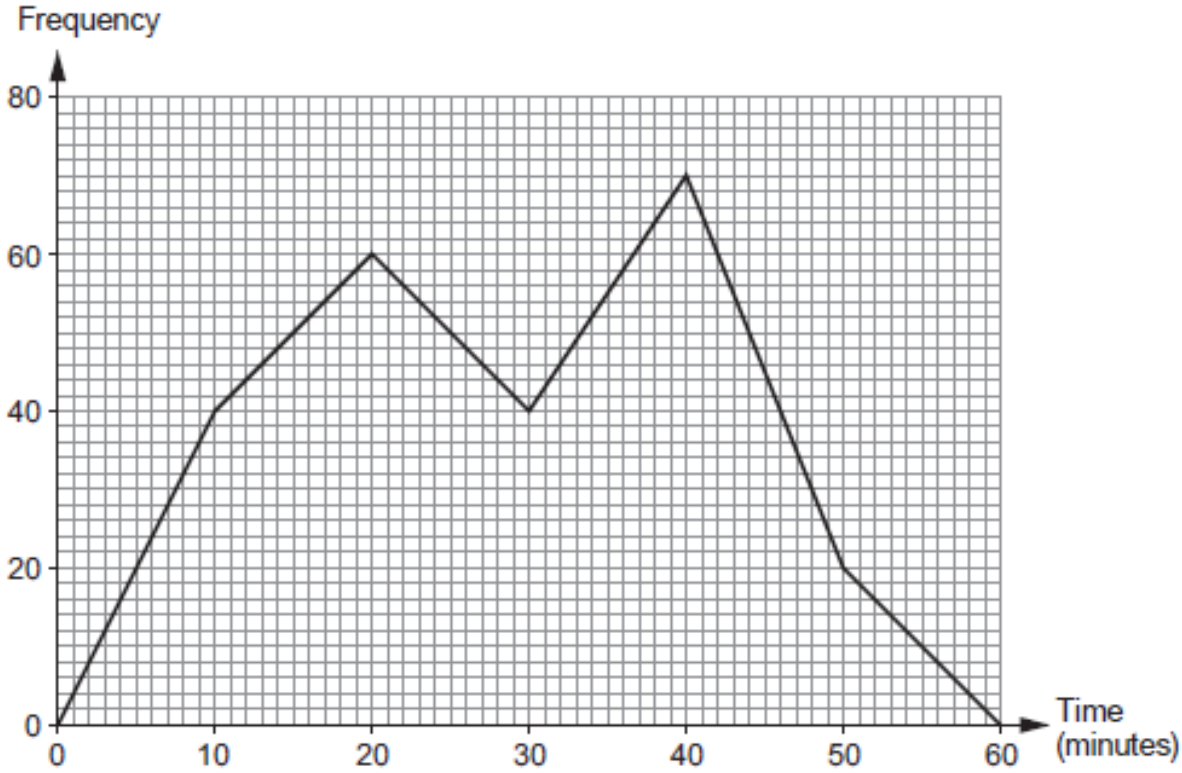
(a) Calculate the greatest possible area of Lowri's garden. [4]

(b) Lowri plans to spread grass seed over her garden using a spreading tool.
Over **each square metre**, the spreading tool spreads 30 g of grass seed, correct to the nearest 5 g.

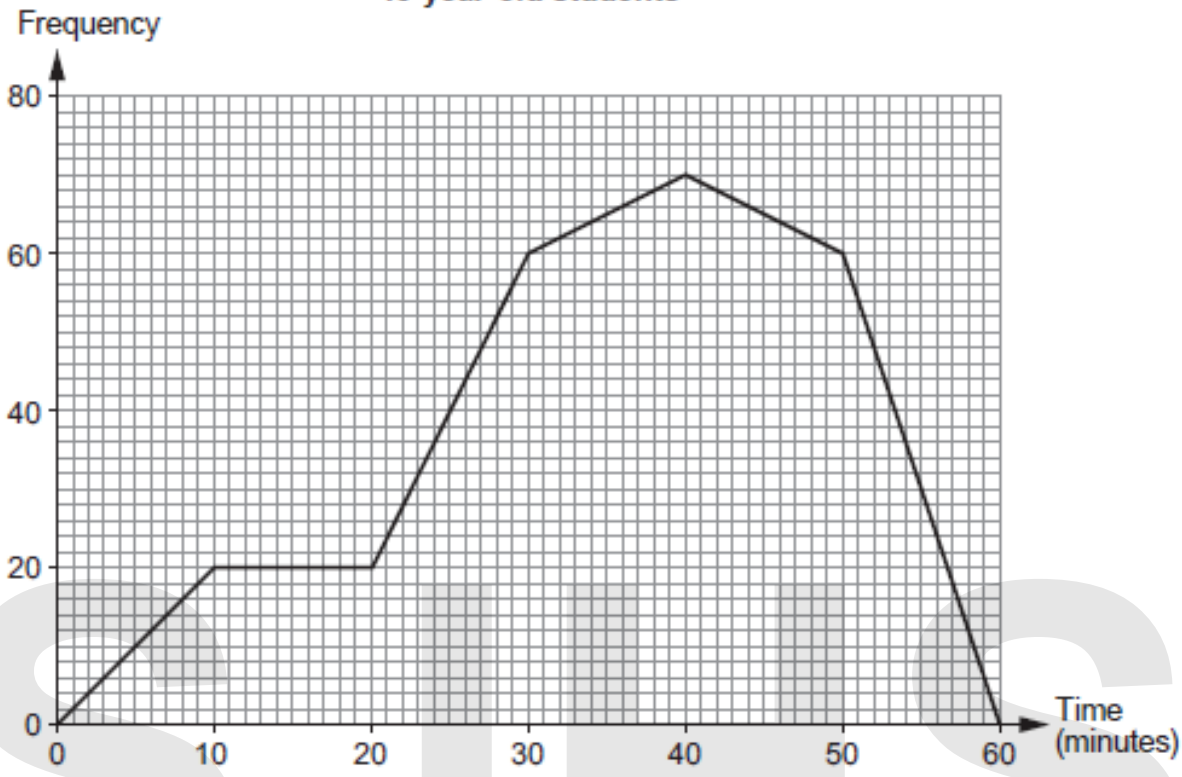
Lowri has exactly 1·5 kg of grass seed.
Can she be **certain** that she has enough grass seed?
You must show all your calculations. [3]

2. A survey was carried out to find how much time a group of 16-year-old students and a group of 18-year-old students spent using social media.
The frequency polygons below, which use equal time intervals, illustrate the results.

16-year-old students



18-year-old students



(a) How many 16-year-old students took part in the survey?
Circle your answer. [1]

60 70 210 230 2300

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(b) How many more 16-year-old students than 18-year-old students spent between 15 minutes and 25 minutes using social media?
Circle your answer. [1]

20 40 60 100 250

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(c) Wesley says,

'The 16-year-old students generally spent about the same time using social media as the 18-year-old students.'

Using the frequency polygons, how would you explain to Wesley that his statement is not true? [1]

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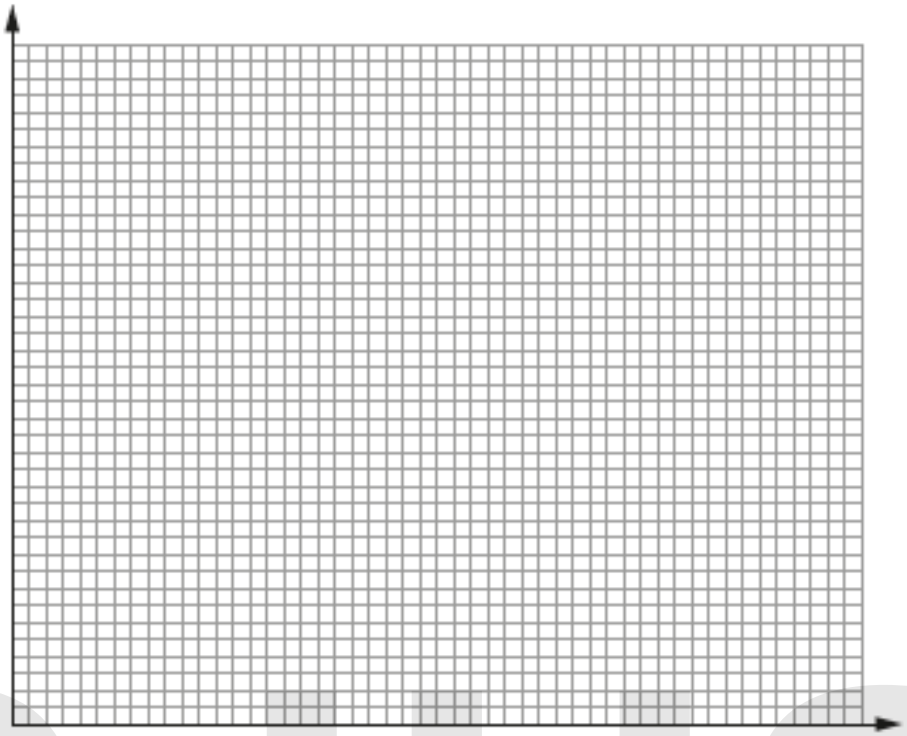
5. Petra is organising a prom for her year group.
The number of people attending the prom is likely to be between 20 and 80.

The cost of holding the prom at *Hotel Afonwen* would be as follows.

- Hire of the room: £100
- Food: £15 per person
- Welcome drink on arrival: £3 per person
- Decorations: £2 per person

(a) Draw a graph to illustrate the total cost of holding the prom for between 20 and 80 people.
Use the graph paper below. [4]



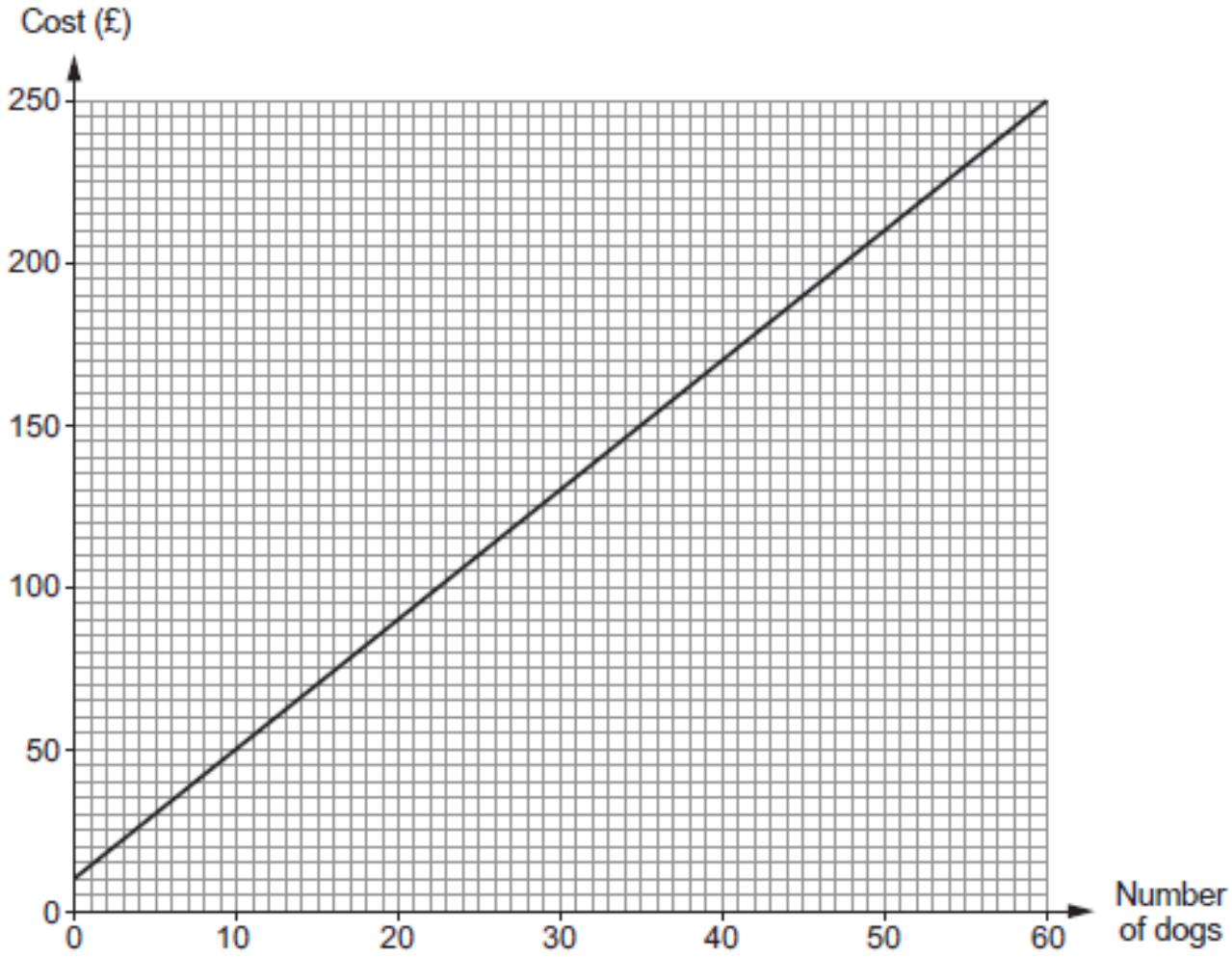
(b) Petra decides to share all the costs equally between the people attending.

- Let £P be the price paid per person.
- Let N be the number of people attending the prom.

Write a formula for P, in terms of N. [3]

(c) Hiring a larger room at *Hotel Afonwen* costs £200.
The cost per person for food, welcome drinks and decorations remains the same.
If the total cost is £2240, how many people attend? [2]

2. William owns and runs dog kennels.
His costs depend on the number of dogs in the kennels.
The running costs for one day are shown on the graph below.



(a) Why does the graph not pass through (0, 0)? [1]

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(b) What is the increase in the daily running costs for each additional dog that is kept in the kennels? [2]

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(c) (i) Freda also runs a dog kennels.
The cost of keeping 20 dogs in her kennels for one day is £130.
She knows that as the number of dogs increases, the overall cost increases at the same rate as in William's kennels.

Display this information on the graph paper opposite. [2]

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(ii) Find the cost of keeping 30 dogs for one day in Freda's kennels. [1]

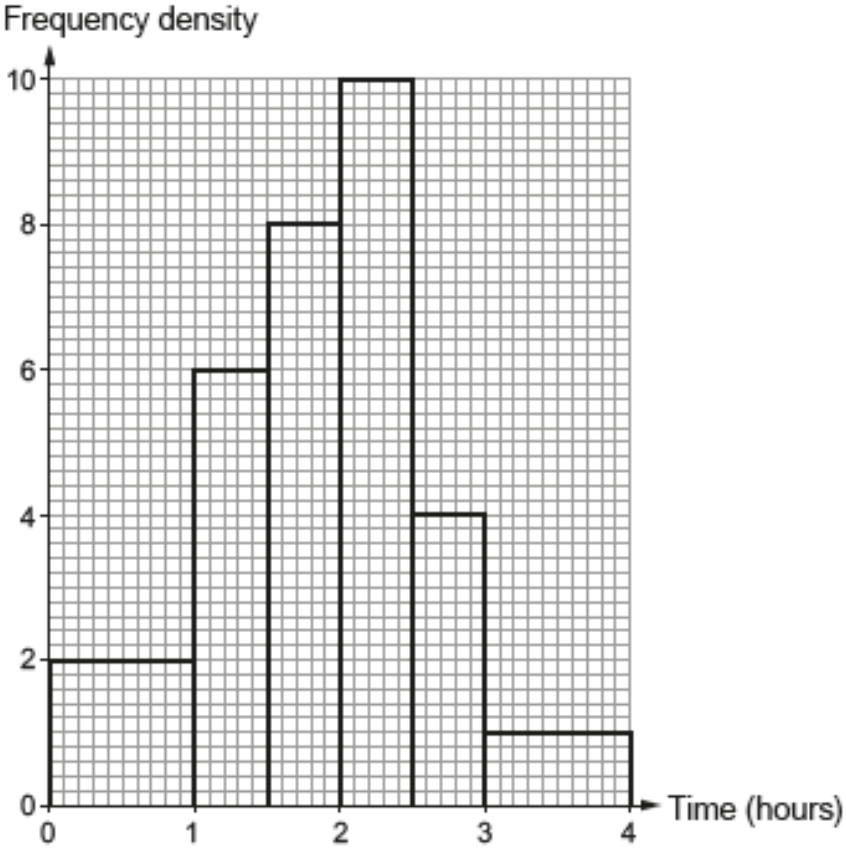
£ .....

8. The *Big Fish Cymru* annual fishing competition is held on the west coast of Wales.

Information about **last year's** competition is displayed in the *Big Fish Cymru* booklet. A section of this booklet is shown below. (An angler is someone who goes fishing).

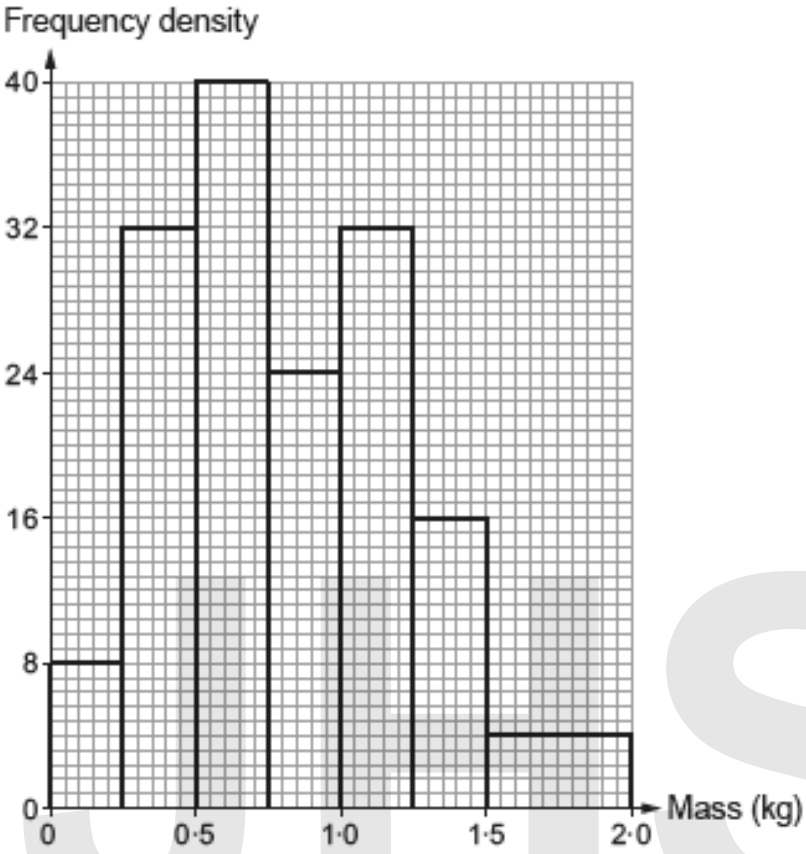
The competition organisers recorded the time taken for **each** angler to catch their **first** fish.

This is shown in the histogram on the right.



The competition organisers also recorded the mass of every fish caught.

This is shown in the histogram on the right.



(a) Last year, how many of the fish caught had a mass of less than 250 g? [1]

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(b) Last year, the final angler to catch their first fish did so after $3\frac{1}{2}$ hours.

How many **other** anglers took more than 3 hours to catch their first fish? [1]

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(c) The number of anglers taking part this year was three times as many as took part last year.
How many anglers took part in the competition this year? [4]

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Number of anglers this year was .....

(d) The median mass of the fish caught this year was 0·9 kg.

What is the difference, in kg, between the median mass of the fish caught this year and the median mass of the fish caught last year? [5]

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Difference in mass is ..... kg

(e) Approximately 10% of the anglers this year caught their first fish within 1 hour.

(i) How does this percentage compare with last year's percentage?
You must show all your working. [3]

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(ii) Do you think it is fair to compare last year's competition results with this year's competition results?
You must give a reason for your answer. [1]

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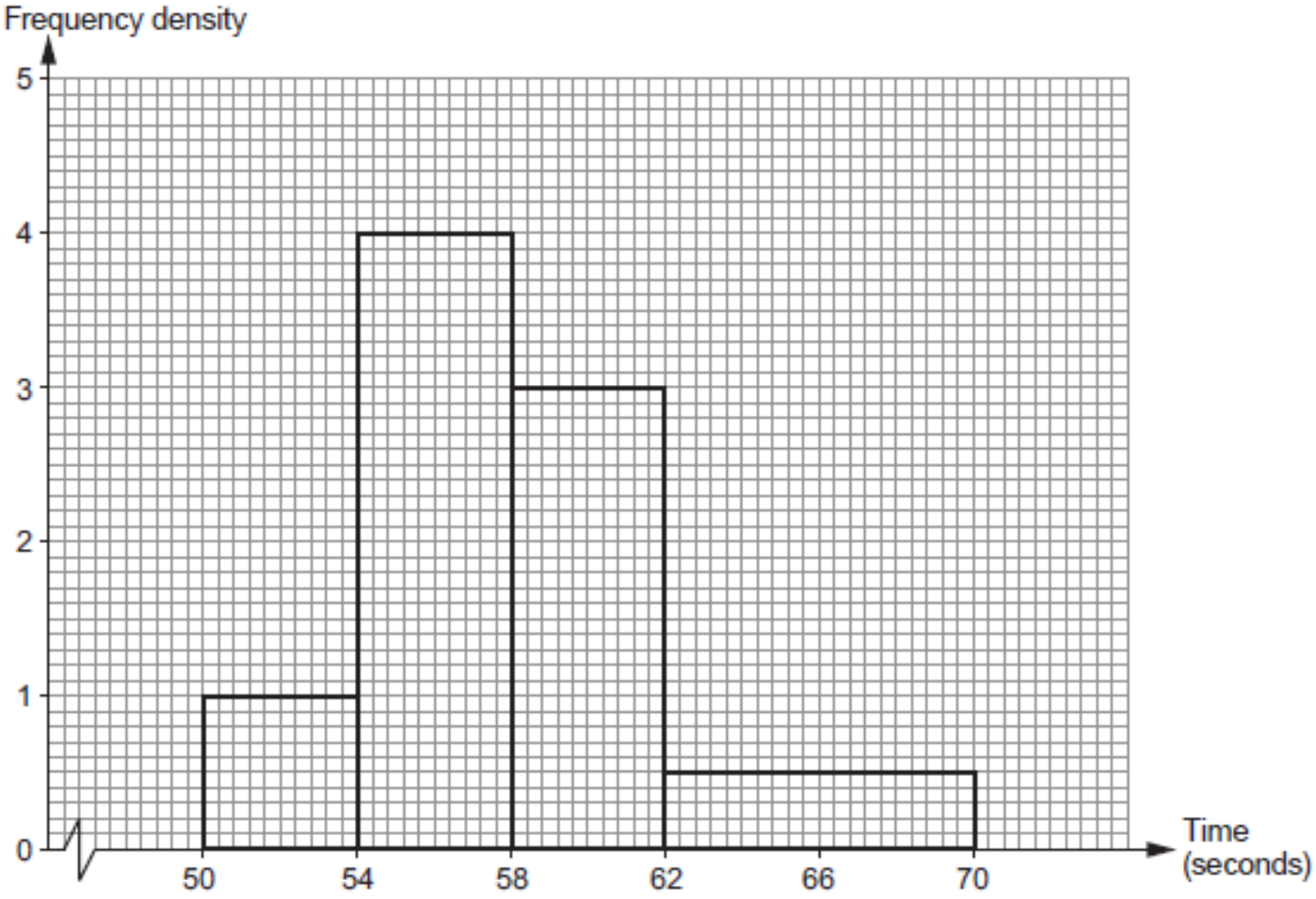
9. The time taken to run 400 m was recorded for each member of a running club.

(a) A histogram of the results for the members who are under 30 years of age is shown below.



(i) Calculate how many members of the running club are under 30 years of age. [2]

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(ii) Calculate an estimate of the median time taken by the under-30s to run 400 m. [4]

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(b) The frequency table below shows the results for the members who are 30 years of age or over.

Time, t (seconds)	$50 < t \leqslant 54$	$54 < t \leqslant 58$	$58 < t \leqslant 60$	$60 < t \leqslant 62$	$62 < t \leqslant 70$
Number of people	4	10	16	18	12
Frequency density					

Complete the table, and draw a histogram to illustrate this data on the graph paper below. [4]

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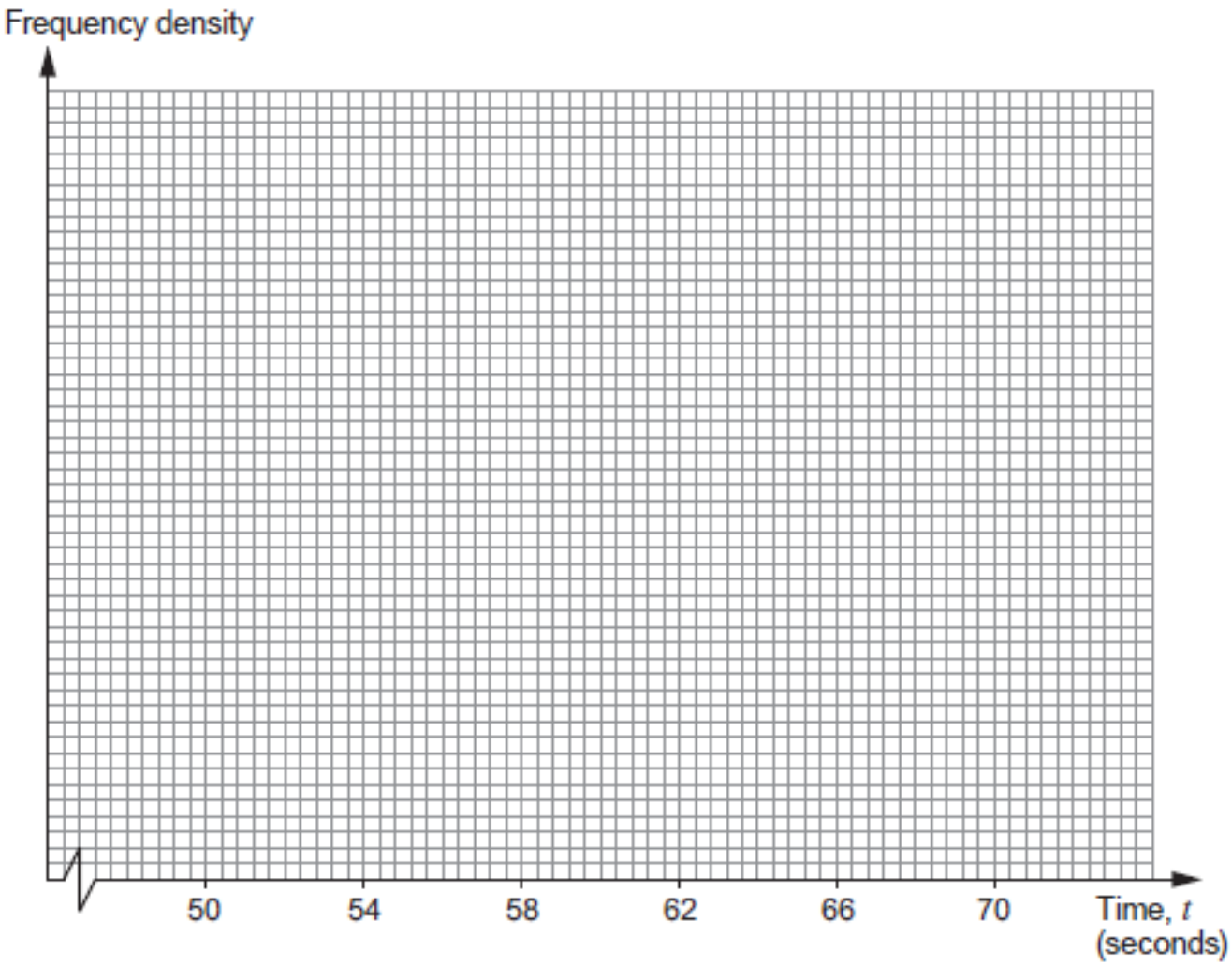

(c) On average, which of the two groups was faster at running 400 m?
Give a reason for your answer.
Your reason must be based on your interpretation of the histograms. [1]

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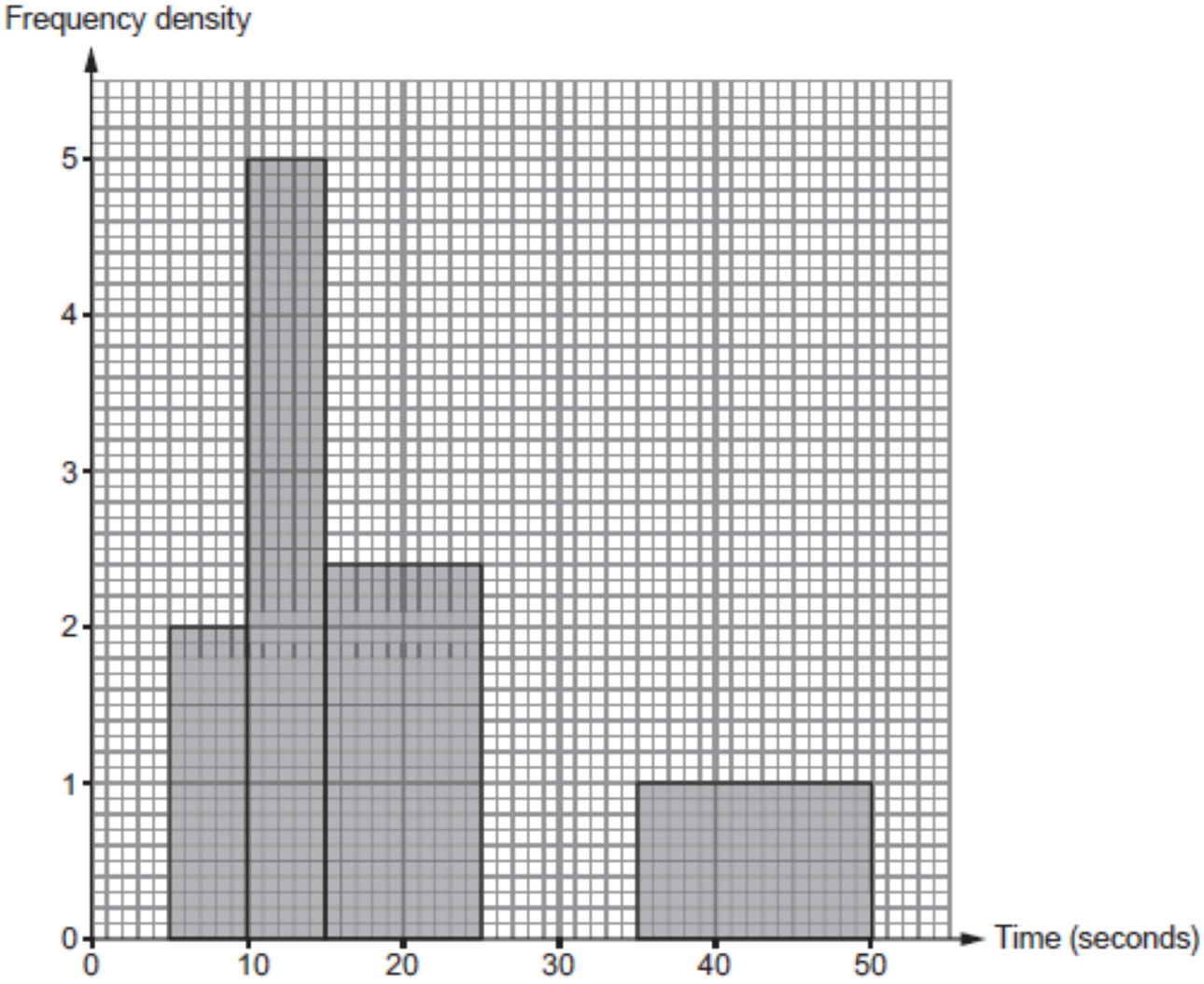
7. The times taken by a group of pupils to answer a numeracy question were recorded. The histogram below shows some of the results.



(a) The remaining 16 pupils took between 25 and 35 seconds to answer the question. Complete the histogram. [1]

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(b) What is the greatest possible range of times taken by the pupils to answer the question? Circle your answer. [1]

50 seconds 4 seconds 40 seconds 45 seconds 35 seconds

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(c) Calculate the total number of pupils that were in the group. [2]

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(d) Gareth was one of the pupils in the group.
He says,

"The time I took to answer the question was 18 seconds. This means I was in the fastest 50% of the pupils."

(i) Explain how Gareth's statement could be true.
You must use calculations to justify your answer. [3]

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(ii) Explain how Gareth's statement could be false. [1]

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5. Rhodri has carried out an experiment to measure the diameters of 20 spherical dust particles, in microns.

Here are his results.

Diameter, d (microns)	Frequency
$1 \leqslant d < 2$	2
$2 \leqslant d < 4$	6
$4 \leqslant d < 5$	8
$5 \leqslant d < 9$	4

(a) (i) Calculate an estimate of the mean diameter of a dust particle. [4]

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(ii) Rhodri measures the diameters of another 25 dust particles.

Rhodri is told,

'The ratio of dust particles with diameters less than 4 microns to those with diameters greater than or equal to 4 microns is 7 : 8.'

He finds this fact is true when he considers all 45 dust particles.

How many of the extra 25 dust particles have a diameter of less than 4 microns? You must show your working. [3]

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(b) Yesterday morning, Simon only managed to sample 10 people.
He calculated the mean hand span of these 10 people to be 22·8 cm.

Yesterday afternoon, Simon recorded the hand spans of a **further** 20 people.

The results for these 20 people are shown in the frequency table below.

Hand span, to the nearest mm	Frequency
20·0 cm to 20·8 cm	2
20·9 cm to 21·7 cm	3
21·8 cm to 22·6 cm	10
22·7 cm to 23·5 cm	5

Calculate an estimate of the mean of all 30 **hand spans** that Simon measured yesterday. [6]

(c) What could Simon do to improve his estimate of the mean hand span of people in Wales? [1]

1. Alptai is a ski resort.
The daily snowfall for January is given in the table below.

Daily snowfall, s (cm)	Number of days
$0 \leqslant s < 5$	10
$5 \leqslant s < 10$	16
$10 \leqslant s < 20$	4
$20 \leqslant s < 30$	0
$30 \leqslant s < 50$	1

(a) Calculate an estimate for the mean daily snowfall for the 31 days of January. [4]

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(b) Circle either TRUE or FALSE for each of the following statements. [2]

The table above shows that there definitely was snowfall on each of the 31 days in January.	TRUE	FALSE
There were 16 days when the daily snowfall was less than 10 cm.	TRUE	FALSE
There was only 1 day with snowfall greater than or equal to 20 cm.	TRUE	FALSE
The modal group also contains the median daily snowfall.	TRUE	FALSE

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(c) For the 28 days of February, the mean daily snowfall in Alptai was 9 cm.
On 1st February, the snowfall recorded in Alptai was 63 cm.
Calculate the mean daily snowfall for the 27-day period 2nd to 28th February. [3]

(b) The selling price of the smaller road sign is £12.00.
This selling price was calculated from the cost price by:

- adding a profit of 25%,
- then adding VAT at 20%.

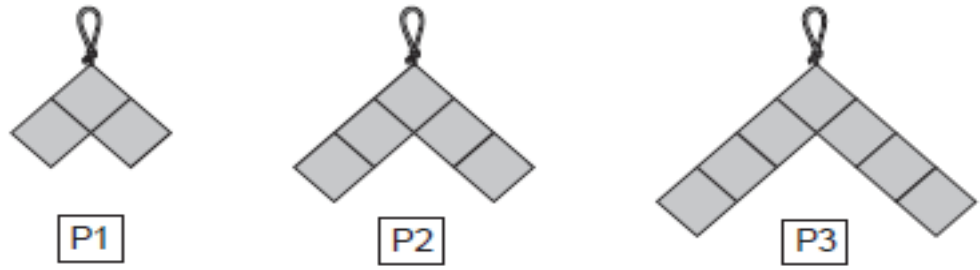
Calculate the cost price of the smaller road sign.
You must show all your working. [4]

(b) The television was reduced in the sale by 26% of its original price.
It cost Marta £710.40 in the sale.
What was the original price of the television? [2]

Original price £ .....

4. Josef has a job in a workshop that makes decorations.

He has made the following three decorations using small squares of stained glass.



Josef labels these patterns P1, P2 and P3 in order.

Josef continues to make decorations following the pattern he has started.

(a) How many **more** squares would he need to make pattern P22 than to make pattern P18? [1]

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(b) Josef has 22 squares.

Josef states,
'I think I can make one complete decoration using **all** 22 squares, with none left over.'

Is Josef correct?

Yes ☐ No ☐

Give a reason for your answer. [1]

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(c) Each small square of stained glass measures 0·5 cm by 0·5 cm.
The perimeter of one of Josef's decorations is 10 cm.
Complete the label that Josef would use for this decoration. [2]

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2. *(a)*

Lotty and Rafael decide to enter a prize draw.
They agree to share any money they win in the ratio 2 : 3 respectively.
After winning a total of £2000, they think again and decide that Lotty's share should be increased by 30%.

(i) Rafael thinks that his share will be reduced by 30%.
Without any calculation, explain why Rafael's thinking is incorrect. [1]

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(ii) Calculate the amount of money Lotty wins after the decision is made to increase her share. [4]

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(iii) Find the ratio that is now used to share the money between Lotty and Rafael.
Express your answer in its simplest form. [3]

Lotty's winnings : Rafael's winnings = ... : .....

(b) In another prize draw, it was planned to give £5000 as the first prize.
To make it more popular, the organisers decide to increase this first prize by 26%.

The most efficient method of calculating the amount of the increased first prize is

$$1{\cdot}26 \times 5000.$$

The second prize was planned to be £3000, but it is now decided to decrease this prize by 6%.

Write down the most efficient method of calculating the amount of the decreased second prize.
You do not have to work out the answer. [1]

1.

(a) Jasmine entered herself, Sophie and Bryn as a group in a talent contest.
Bryn only had a minor part.

Bryn, Sophie and Jasmine won the contest.
They shared the prize money in the ratio 2 : 6 : 7, with Bryn getting the smallest share.
Jasmine won £560, the largest share.

How much money did Bryn and Sophie each win? [4]

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Bryn receives £ .....

Sophie receives £ .....

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

The talent contest is held once a year.
Every year, the cost of putting on the talent contest increases by 10% of the previous year's cost.
In summer 2014 the cost was £6600.

Calculate the cost of putting on the summer 2017 talent contest.
You must show all your working. [3 + 2 OCW]

6. Daniel has made a pizza to share with some friends.

After he has taken his share, he calculates that he has $0{\cdot}8\dot{3}$ of the pizza left.
Daniel shares what he has left equally between 3 of his friends.
Calculate the fraction of the whole pizza that each of these 3 friends will have.
Give your answer as a fraction in its lowest terms. [4]

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

Handmade socks, knitted using pure cashmere wool, are very expensive to buy.

Rowena buys cashmere wool in 20 g balls.
Each ball of cashmere wool costs her £1.42.
She pays her sister £8 to knit each pair of socks.
135 g of cashmere wool is used to knit each pair of socks.

Rowena sells 40 pairs of cashmere socks for £18.95 per pair.
What is her percentage profit?
Give your answer correct to 2 significant figures.
You must show all your working.

[7 + 2 OCW]

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8. On a new housing estate, teams of painters paint the walls and ceilings of houses once they are built.

(a) It takes a team of 5 painters 10 hours to paint a house that has a total wall and ceiling area of 500 m^2.

A new house on the estate has a total wall and ceiling area of 600 m^2.
This house has to be painted in 8 hours.

Calculate the least number of painters needed.
You must show all your working. [4]

(b) What assumption have you made in answering part *(a)*? [1]

3. Bethan builds a rectangular sheep pen.

(a) The perimeter fence of the sheep pen is 18 m long.
The length of Bethan's sheep pen is two times its width.
Find the length and width of this sheep pen.
You must show your working. [2]

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Length is ..... metres

Width is ..... metres

(b) Bethan decides to build a new sheep pen.
The perimeter fence of the new sheep pen is 16 m long.
The length of the new sheep pen is 3 metres longer than the width.

Form an equation and solve it to find the dimensions of this new sheep pen. [3]

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Length is ..... metres

Width is ..... metres

2. *(a)* Bronwen and Alvaro decide to keep some alpacas on their farm in Patagonia.

Alvaro knows it is possible to keep between 4 and 6 alpacas on each acre of suitable farmland.
They have 13 hectares of farmland that they want to use to keep the alpacas.
Bronwen knows that 1 acre is 4046·86 m^2 and that 10 000 m^2 = 1 hectare.

Use this information to advise Bronwen and Alvaro on the number of alpacas they could keep on their farmland.
State any assumption that you make.
You must show all your working. [6]

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Assumption:

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3. The wire window guard shown below is to be made.

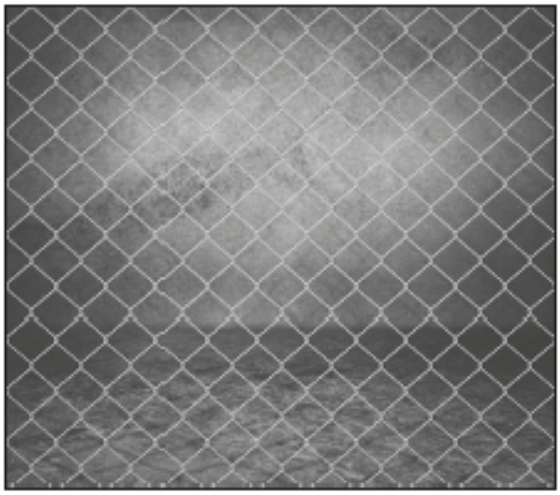


Diagram not drawn to scale

The length of the sides of each small wire square shown is 3·3 cm.

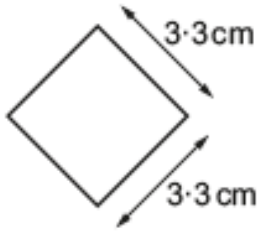


Diagram not drawn to scale

Llinos considers the length of the diagonal of each small square.

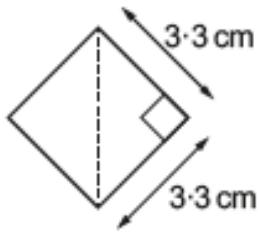


Diagram not drawn to scale

She says,

The height of the window guard is equal to 9·5 diagonals of the square.
The width of the window guard is equal to 11 diagonals of the square.

(a) Calculate the length of the diagonal of a small square.
Give your answer correct to 1 decimal place. [3]

(b) Calculate the area of the **window guard**.
You must show all your working. [3]

5. Marta buys a new television.

(a) Marta wants to fit the television in a bookcase on the wall.
In the shop she forgot to write down the length of the television.
She did write down the height and the diagonal of the screen.

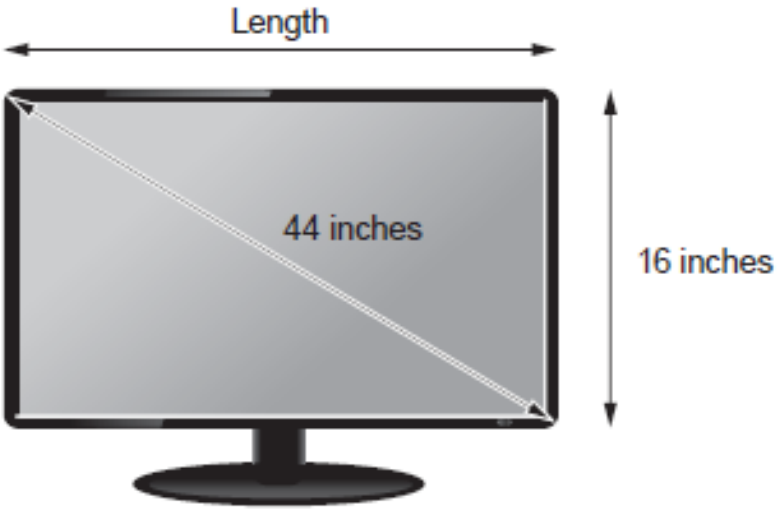


Diagram not drawn to scale

Marta needs to know the length of the screen before she opens the box, in case she wants to return the television.
Calculate the length of the screen.
Give your answer correct to 2 significant figures. [4]

Length is _____ inches, correct to 2 significant figures.

4. Bethan has a plan of her rectangular lawn, which she has labelled *ABCD*.
She wants to cut out a triangular flowerbed from her lawn, labelled *GHD*.
Bethan decides that *AG* : *GD* should be 1 : 2 and that *DH* = *HC*.

She has made a sketch shown below.

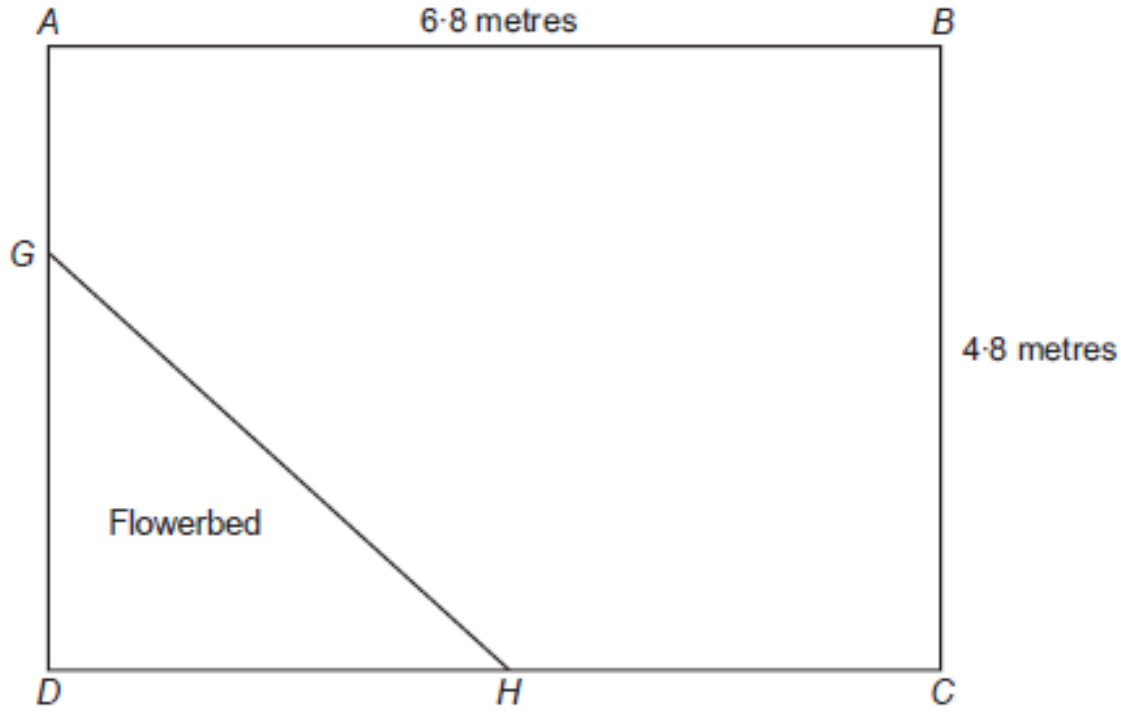


Diagram not drawn to scale

(a) Calculate the length of *GH*. [4]

(b) The flowerbed, *GHD*, is to have a flexible edging strip placed around its perimeter. The edging strip costs £3.50 per metre and can only be bought in strips of complete metres.

- How much will the edging strip cost Bethan?
- What length of strip will be left over? Give your answer in centimetres. [4]

Cost £ .....

..... cm left over

1. *(a)* Ysgol Fron Isa and Ysgol Caewen are two very different high schools.
One school is large, and in a rural area. The other is a small school in a town.
The town in which the small school is situated has many traffic-free cycle routes.

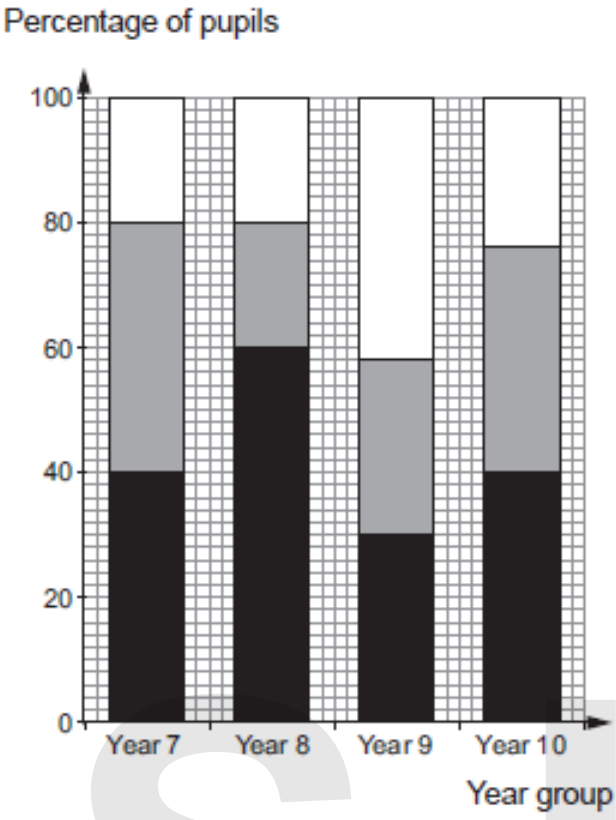
All of the pupils in Years 7 to 10 were surveyed in both of these schools.
They were asked the following questions.

Do you cycle to school?	Yes ☐	No ☐
If you answered 'no', would you like to cycle to school?	Yes ☐	No ☐

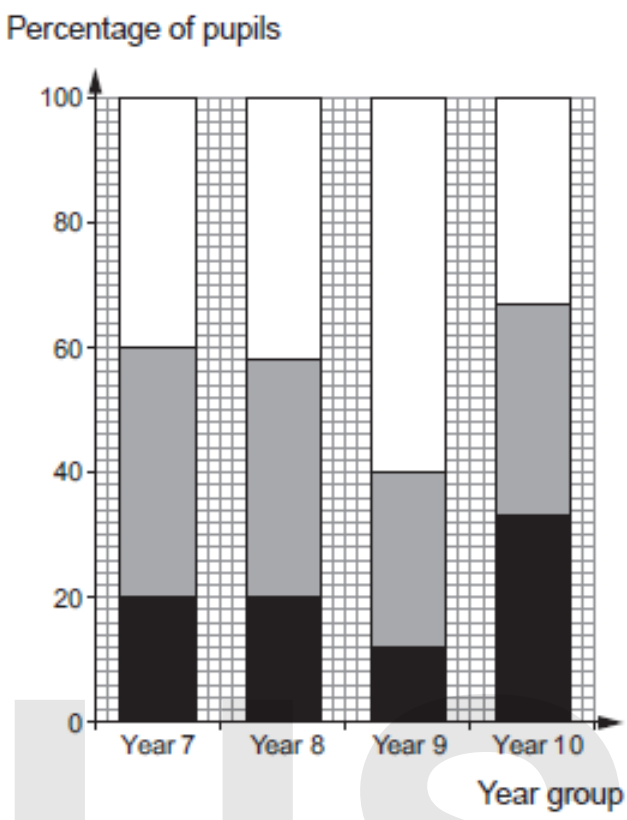
The results were displayed in graphs, as shown below.

Key: Cycle; Would like to cycle; Others

Ysgol Fron Isa



Ysgol Caewen



(i) Which school and year group has an approximately equal split between the 3 categories:
- pupils who cycle to school,
- pupils who would like to cycle to school, and
- other pupils? [1]

School: ..... Year Group: .....

(ii) Circle either TRUE or FALSE for each of the following statements. [3]

There are definitely more pupils in Ysgol Fron Isa who cycle to school than in Ysgol Caewen.	TRUE	FALSE
Both schools have pupils in each year group with no interest in cycling to school.	TRUE	FALSE
The questions asked were biased.	TRUE	FALSE
Approximately 20% of the pupils surveyed in Ysgol Caewen cycle to school.	TRUE	FALSE
It is more likely that it is Ysgol Fron Isa that is the small school situated in a town.	TRUE	FALSE

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(b) In January 2011, there were 1200 miles of National Cycle Network (NCN) routes in Wales. In January 2016, there were 1400 miles of NCN routes in Wales.

(i) If the number of miles of NCN routes in Wales were to continue to increase by the same number of miles per year, how many miles of cycle routes would there be in January 2018? [2]

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(ii) Why is your answer in (i) unlikely to be an accurate estimate of the number of miles of NCN routes in Wales in January 2018? [1]

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9. Circle TRUE or FALSE for each of the following statements. [2]

Selecting the first name on each class register will give a random sample.	TRUE	FALSE
The ratio of boys to girls in a school is 2 : 3. The pupil committee of 30 pupils is selected using a gender stratified sample. There are 10 boys and 20 girls on the school committee.	TRUE	FALSE
A telephone survey is carried out to find which political party people support. The sample of people surveyed is **not** a random sample of the whole population.	TRUE	FALSE
A stratified sample always considers proportions according to given criteria.	TRUE	FALSE
A random sample of people means everyone has an equal chance of being selected.	TRUE	FALSE

7. Simon plans to make gloves.

(a) One morning, Simon decided to carry out a survey to find the mean hand span of people in Wales.

He decided to sample systematically.
He decided to sample from the first 240 people who pass him in the street during the morning.

He wanted to take 20 people's hand span measurements.
Explain how Simon could use systematic sampling to obtain 20 measurements. [1]

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6. Porth Ifan Hospital has made some changes to improve patient care.
A survey is to be used to find out the views of the hospital staff.

(a) The table shows the total number of staff in each job type.

Job type	Doctor	Nurse	Management	Clerical
Number of staff	120	320	56	144

The survey is to be given to a sample of 75 staff.

Use a stratified sampling method to calculate the number of staff from each job type that should be asked to complete the survey.
You must show your working. [4]

Job type	Doctor	Nurse	Management	Clerical
Number in sample				

(b) The hospital decides to take a random sample of its 120 doctors to select those needed for the survey.
Use the following list of random numbers to select the first **5 doctors**.
You must start with the first number in the list. Explain clearly how you are using the numbers to select the sample. [3]

032	520	021	924	152	627	351	295	081	495
542	708	339	557	396	949	417	235	962	261
837	783	983	493	876	924	032	421	205	740
055	491	806	415	158	392	441	521	105	342
782	398	923	729	968	244	119	480	451	780

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9. The table shows the number of Year 11 pupils attending schools in Cwmifan.

School	Cwrt Haf	Cwmifan High	Henclwyd
Number of Year 11 pupils	307	239	144

In total there are 690 Year 11 pupils attending these three schools.

A new youth theatre has been set up in Cwmifan.
On the opening night, a total of 80 Year 11 pupils from these three schools are going to be invited to attend.

Use a stratified sampling method to calculate the number of Year 11 pupils from each school who should be invited.
You must show all your working. [3]

School	Cwrt Haf	Cwmifan High	Henclwyd
Number that should be invited			

9. An engineering company employs 85 staff.
The company plans to carry out a survey on staff health.
It will conduct the survey using a sample of 15 of its staff, stratified by job type.

(a) Circle either TRUE or FALSE for each statement given below. [2]

STATEMENT		
Choosing every 4th person on an alphabetical list of office staff is a suitable method of randomly choosing the office staff required for the sample.	TRUE	FALSE
Numbering the cleaning staff, placing the numbers in a hat and drawing out numbers at random is a suitable method of choosing the cleaners required for the sample.	TRUE	FALSE
There are 9 managers employed by the company. The calculation to find the number of managers in the sample is $\frac{9}{85} \times 15 = 1{\cdot}59$. This answer means there will **definitely** be 2 managers in the sample.	TRUE	FALSE
The proportion of the staff in each job type in the sample will be **exactly** the same as the proportion of the staff in each job type in the company as a whole.	TRUE	FALSE

(b) 50 engineers are employed by the company.
Use the following extract from a table of random digits to choose 9 engineers for the sample.
You must start with the first number in the list.
Describe clearly how you are using the numbers to select the sample. [3]

29974 55479 07248 33999 17038 02475 49979 01218

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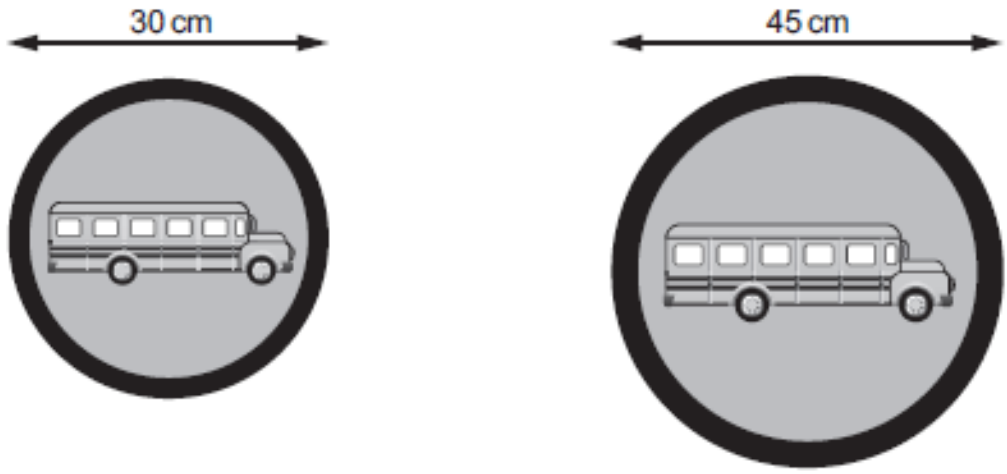
8. A company produces two **similar** road signs.



Diagrams not drawn to scale

(a) The cost of the paint needed for the smaller road sign is £1.60.
Calculate the cost of the paint needed for the larger sign. [4]

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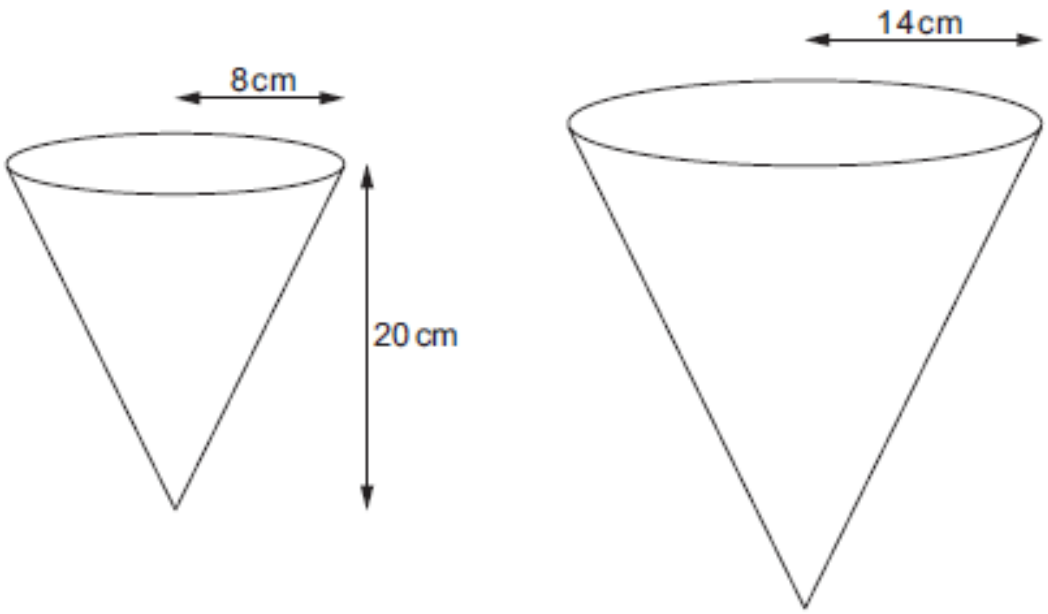
10. The diagram below shows two **similar** flasks for measuring liquid.



Diagrams not drawn to scale

The flasks are in the shape of cones.
The smaller flask has a base radius of 8 cm and a vertical height of 20 cm.
The larger flask has a base radius of 14 cm.

(a) Calculate the vertical height of the larger flask. [2]

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(b) The larger flask is now partly filled with liquid up to a vertical height of 15 cm.

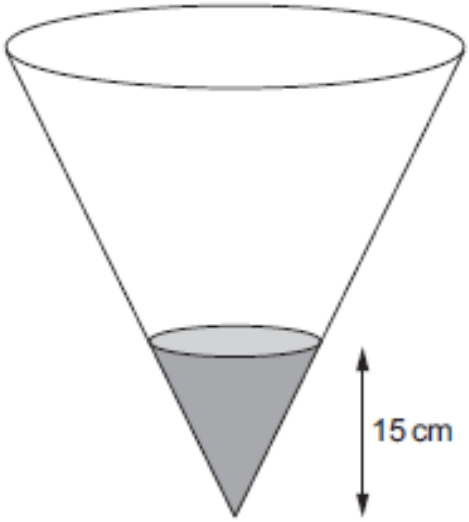

Diagram not drawn to scale

Calculate the volume of liquid in the flask.
Give your answer in terms of π. [4]

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1. *(a)* The Headteacher of Ysgol Bro Gwyn is building a new bike shed.

Bike sheds are built on a rectangular base of width x metres and length y metres.

The Headteacher is given a formula for working out the number of bikes, b, that can be stored in a bike shed that has a base of width x metres and length y metres.

He is told the formula only works when
- x and y are whole numbers
- x is greater than 3
- y is greater than 5

The formula is as follows:

$$b = \frac{6xy}{5}$$

What is the formula for calculating the length, y metres, of a bike shed x metres wide that can hold b bikes?
Use the details the Headteacher has been given.
Circle your answer. [1]

$y = \frac{b-5}{6x}$ $\quad$ $x = \frac{6b}{5y}$ $\quad$ $y = \frac{b+5}{6x}$ $\quad$ $y = \frac{5b}{6x}$ $\quad$ $y = \frac{6x}{5b}$

(b) The Headteacher decides to place signs around the school site to stop pupils using their bikes on grassed areas.

He introduces a new sign to pupils in the school newsletter.
The size of the sign in the newsletter is shown below.

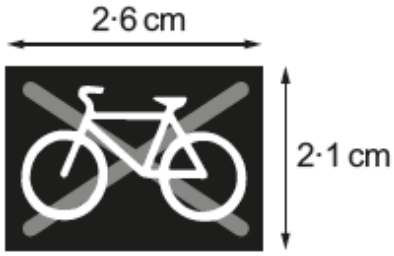

Diagram not drawn to scale

A mathematically similar new sign is placed near the side of the playing field.

Diagram not drawn to scale

It is 33·6 cm high.
How wide is this sign? [2]

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9. A metal round-headed nail can be thought of as a cone sitting on top of a cylinder, which sits o top of a hemisphere.
A company produces round-headed nails of different sizes, but made of the same metal.
Each nail has the following dimensions:

- height of cone = $9r$,
- height of cylinder = $15r$,
- radius of the hemisphere = $12r$,

where r is the radius of the cylinder and the base radius of the cone.

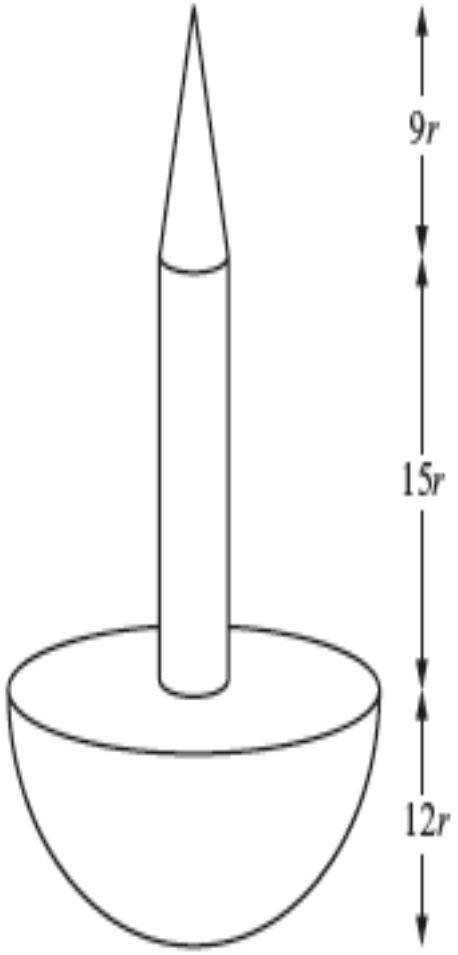

Diagram not drawn to scale

A metal cuboid of volume 18000 mm^3 is melted down, and re-cast to form round-headed nail of size A, where r = 0·4 mm.

(b) Circle either TRUE or FALSE for each statement given below. [2]

STATEMENT		
A nail double the height of a size A nail will have a total height of 28·8 mm.	TRUE	FALSE
A nail double the height of a size A nail will be 8 times the weight of a size A nail.	TRUE	FALSE
A nail 3 times the height of a size A nail will have a total surface area 6 times that of a size A nail.	TRUE	FALSE
When r = 0·8 mm, the number of nails that could be produced from the same metal cuboid will be double the number of size A nails.	TRUE	FALSE

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13. The front views of two mathematically similar milk cartons are shown below.

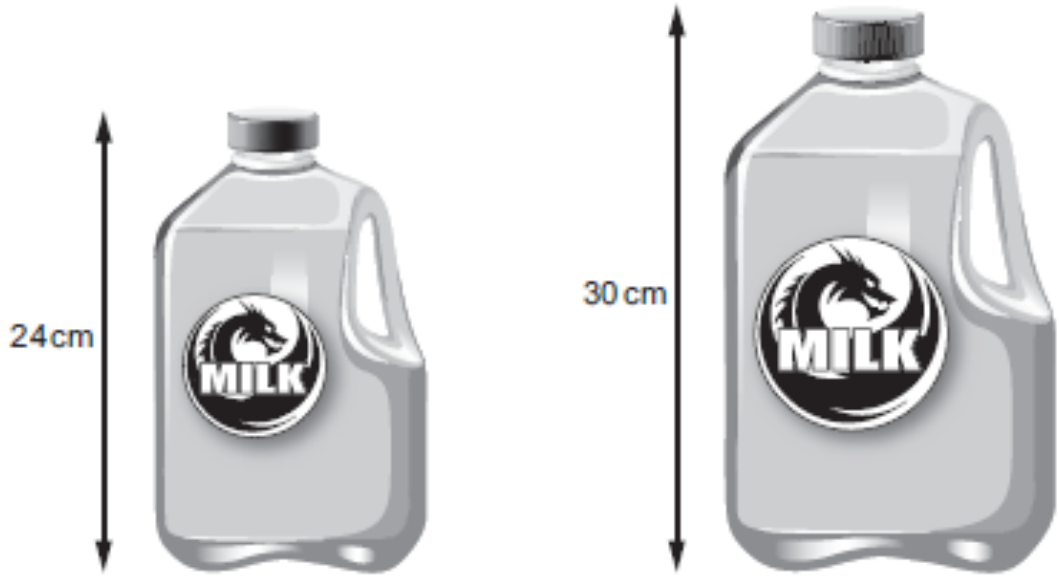

Diagram not drawn to scale

(a) Circle either TRUE or FALSE for each statement given below. [1]

STATEMENT		
The ratio of the lengths of the cartons is the same as the ratio of the heights of the cartons.	TRUE	FALSE
The ratio of the volumes of the cartons is the same as the ratio of the heights of the cartons.	TRUE	FALSE

(b) It is claimed that the larger carton contains double the amount of milk contained in the smaller carton.
Show that this claim is not true.
Explain your answer. [3]

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(c) Another similar milk carton has a label with an area that is one quarter of the area of the label on the carton of height 24 cm.

Diagram not drawn to scale

Calculate the height of this new carton. [3]

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7. *(a)* A standard piece of A4 paper is usually 0·08 mm thick.
What is 0.08 mm written in **metres** in standard form?
Circle your answer. [1]

8×10^{4} 8×10^{-4} 8×10^{-3} 8×10^{3} 8×10^{-5}

(b) A piece of card is 1 mm thick.
A stack of these pieces of card is 3×10^{-2} metres high.

(i) Calculate how many pieces of card there are in the stack. [2]

(ii) What assumption have you made in answering *(b)*(i)? [1]

(c) In 2012 it was recorded that

- the total mass of the paper used for printing newspapers, in the world, was $2{\cdot}88 \times 10^7$ **tonnes**,
- the world population was approximately $7{\cdot}2 \times 10^9$ people.

Use this information to calculate the mass of paper per person used to print newspapers in 2012.
Give your answer in **kg per person**. [4]

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(b) Interest earned from savings is taxable, according to the table below.

Tax rates for savings	
Basic rate taxpayer	20% on annual interest earned above £1000
Higher rate taxpayer	40% on annual interest earned above £500

Matthew is a higher rate taxpayer.
Any savings interest he earns over £500 within a year is taxed at 40%.

On 1st May 2016, he invested £150 000 in a savings account that pays interest at a rate of 1·98% **per annum**.

(i) What is this interest rate **per month**, written as a decimal?
Circle your answer. [1]

0·0033 0·00495 0·00165 0·0099 0·0066

Savings interest is added at the end of every month.

(ii) Calculate the date when the interest that Matthew earned went above his annual tax-free limit. Calculate the amount of tax he would have to pay on this interest if he had closed the account on this date. [5]

(b) The diagram shows the cross-section of one part of her run.

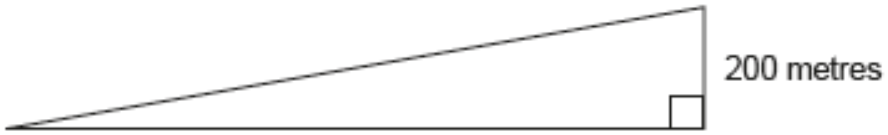

Diagram not drawn to scale

Calculate the angle of elevation of the road. [3]

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(c)

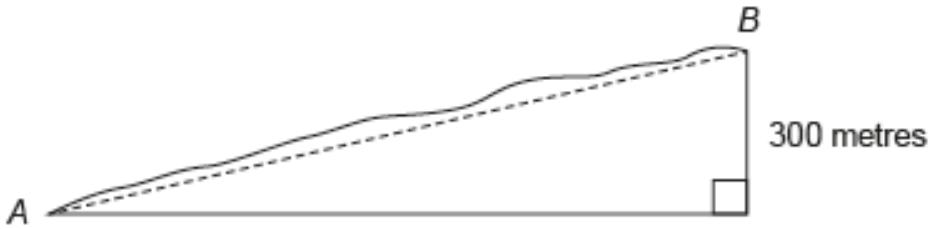

Diagram not drawn to scale

Gwenda runs on another section of uneven road from *A* to *B*.
The rise in this section of the road is 300 metres.
The angle of elevation of *B* from *A* is 10°.

(i) Calculate an estimate of how far Gwenda has run.
State any assumption you have made. [4]

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Assumption: .....

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(ii) What is the impact of your assumption on your answer? [1]

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4.

Ursula is lying on her surfboard 180 metres away from the foot of a vertical cliff.
The height of the cliff is 146 metres.

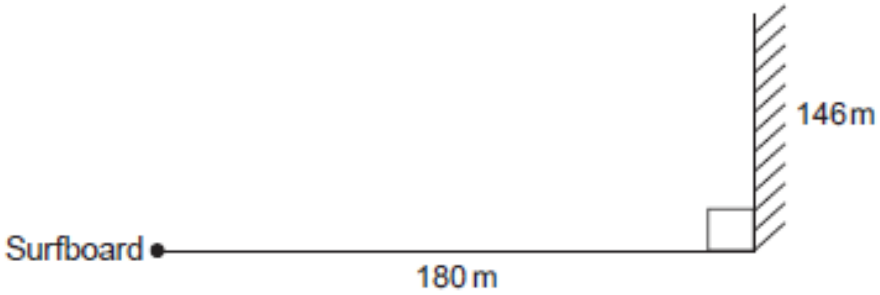

Diagram not drawn to scale

Ursula was told that if the angle of elevation of the top of the cliff from her lying position is between 42° and 45°, it is safe for her to attempt to stand on her surfboard.

Calculate the angle of elevation of the top of the cliff from Ursula's position lying on her surfboard.

State whether it is

- safe for Ursula to attempt to stand, or
- not safe as she is too near the cliff, or
- not safe as she is too far out at sea. [4]

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8. The diagram below shows where Levi wants to attach a string of lights to his house.

Levi wants to attach a single string of lights from *B* to *A* and then from *A* to *C*.
The diagram below shows the measurements Levi has taken.

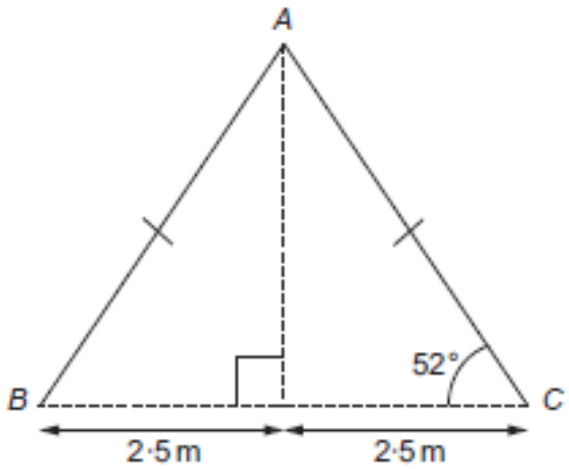

Diagram not drawn to scale

He spends £410 at the electrical store buying a string of lights.
After putting up the lights, Levi finds he has 6 metres of the string of lights left over at one end.

How much did the electrical store charge Levi, per metre, for the string of lights? [6]

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6. The diagram below shows the locations of the ports of Lindat, Molk and Nuir.
Lindat is due south of Nuir, and Nuir is due west of Molk.

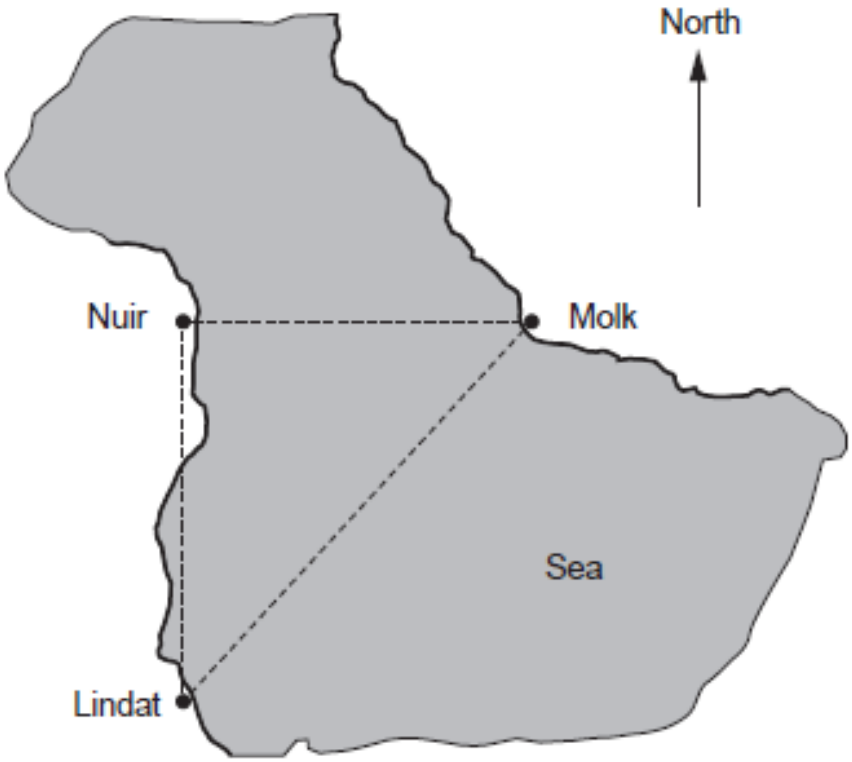

Diagram not drawn to scale

Agnetha lives in Molk.
She travels from Molk to Lindat by ship.

- Lindat is 24 km due south of Nuir.
- The ship sails directly to Lindat on a bearing of 211°.
- The ship has an average speed of 20 km/h.
- The ship leaves at 11:45 a.m.

Calculate Agnetha's arrival time in Lindat. [7]

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11. The diagram below shows a wooden end-piece for a curtain pole.
It is in the shape of a cone with measurements as shown in the diagram.

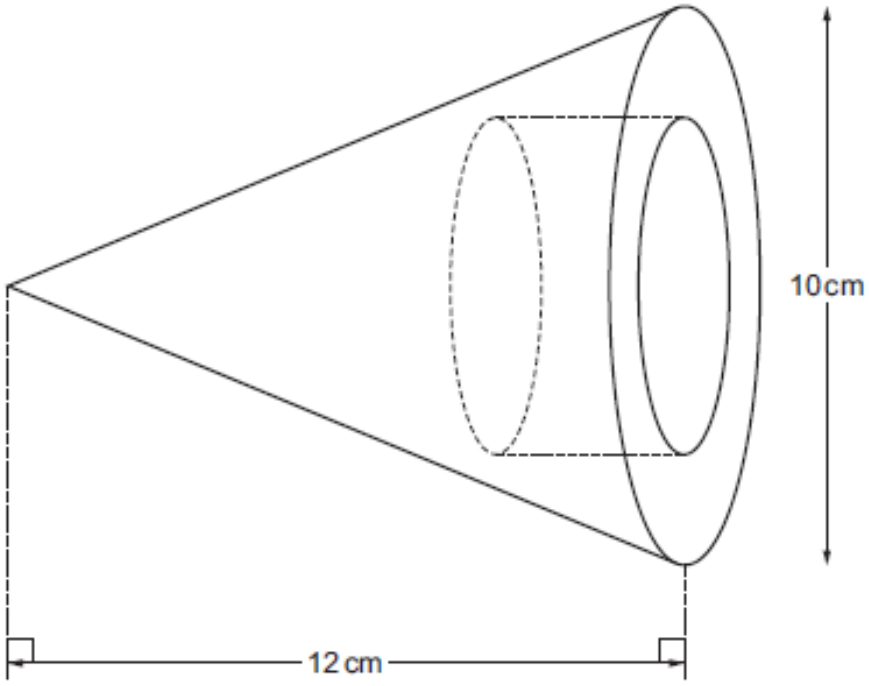

Diagram not drawn to scale

The curtain pole sits in a cylindrical hole that has been drilled into the end-piece.
The hole is of radius 3 cm and depth 4 cm.

(a) Show that the volume of wood that remains is $64\pi\,\text{cm}^3$. [4]

(b) The surface area of the end-piece is to be painted, except for the area inside the hole.
Calculate the surface area that is to be painted.
Give your answer in terms of π. [6]

(b) Rhodri studies a cylindrical cell under his microscope.
The height of the cell is 2 microns.
The circumference of the cell is 5 microns.

Calculate the volume of the cell he sees under the microscope.
Give your answer in microns^3, correct to 1 significant figure. [5]

Volume is ..... microns^3

9. A metal round-headed nail can be thought of as a cone sitting on top of a cylinder, which sits on top of a hemisphere.
A company produces round-headed nails of different sizes, but made of the same metal.
Each nail has the following dimensions:
- height of cone = $9r$,
- height of cylinder = $15r$,
- radius of the hemisphere = $12r$,

where r is the radius of the cylinder and the base radius of the cone.

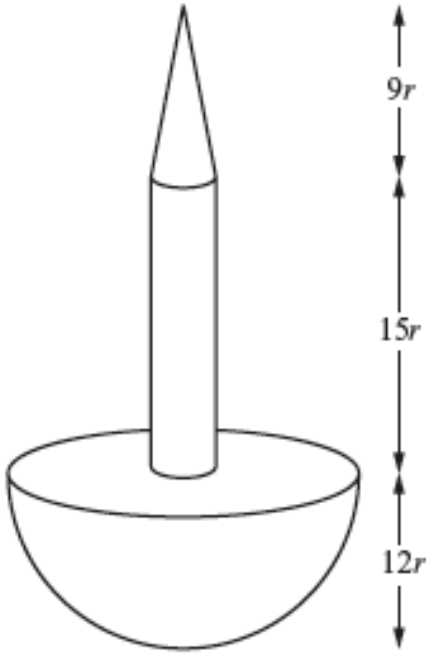

Diagram not drawn to scale

A metal cuboid of volume 18000 mm^3 is melted down, and re-cast to form round-headed nails of size A, where r = 0·4 mm.

(a) Calculate the greatest number of round-headed nails of size A that can be produced. [6]

Elin's old fish tank is leaking.

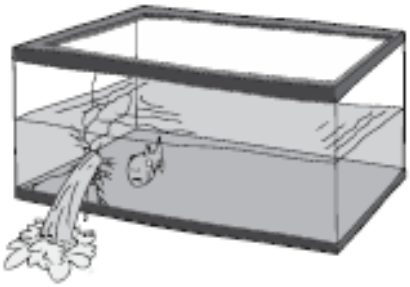

Diagram not drawn to scale

This old fish tank is in the shape of a cuboid.
The base of this tank measures 60 cm by 40 cm.
Before the leak, the height of the water level in Elin's old fish tank was 45 cm.

Elin decides to replace her fish tank with a cylindrical one.

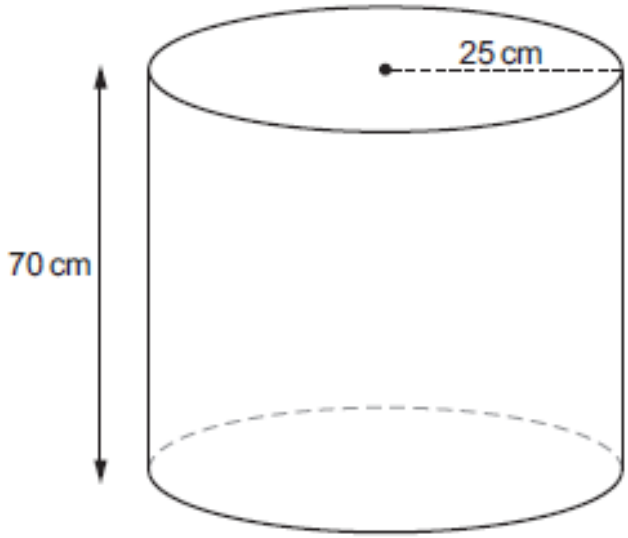

Diagram not drawn to scale

She selects a new cylindrical fish tank that has a radius of 25 cm and a height of 70 cm.

Will all the original contents, including the water and the fish, fit into this cylindrical tank?
You must show all your working. [4 + 2 OCW]

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(b) Bronwen decides to place a cylindrical water container in the small paddock on the farm.

The water container has a diameter of 1·4 metres.

(ii) The water container holds 900 litres of water when full.
Calculate the height of the water container in centimetres. [4]

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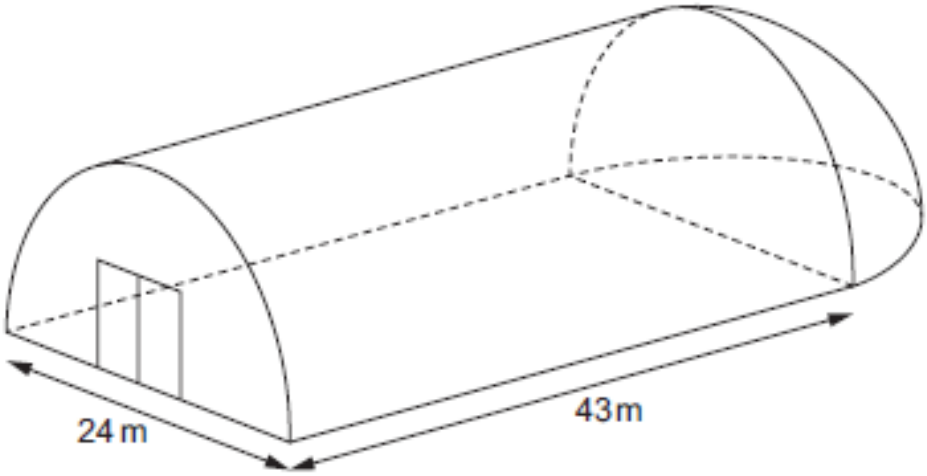
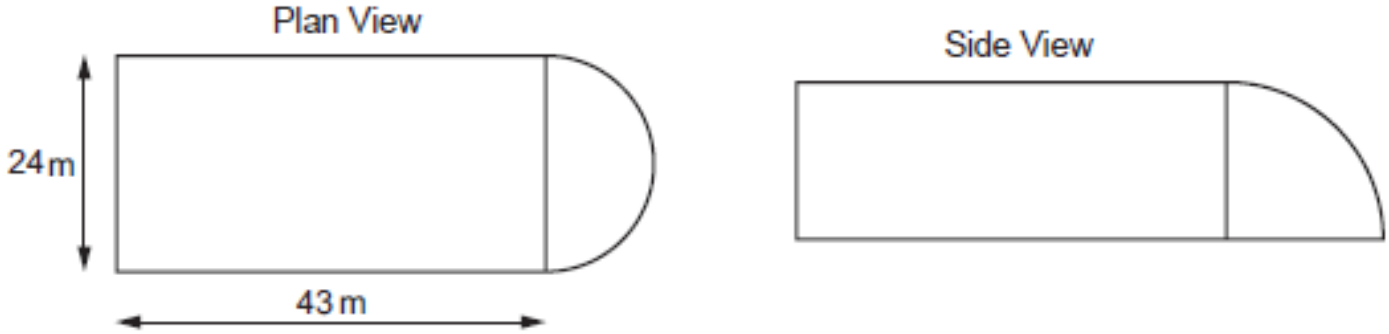
The height of the water container is ..... cm

(c) The engineering company has a storage building, as shown below.
The building is in the form of half a cylinder, with half a hemisphere attached at one end.





Diagrams not drawn to scale

The company needs to paint all the exterior surfaces of the building, including the doors.

The measurements on the diagram are given **correct to the nearest metre.**
The paint comes in tins that cover an area of 40 m^2, **correct to the nearest m^2.**

Calculate the smallest number of tins that would guarantee having enough paint to cover these exterior surfaces. [8]

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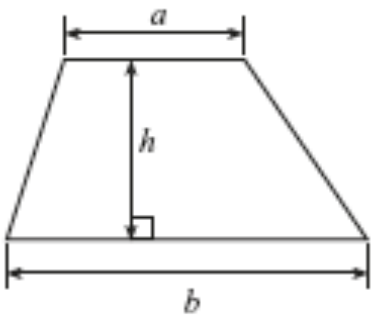
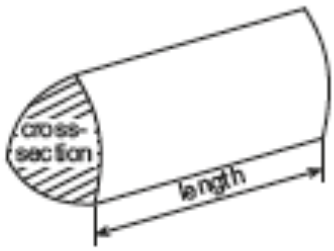
Area of trapezium = $\frac{1}{2}(a+b)h$



Volume of prism = area of cross-section × length

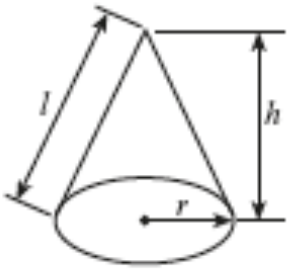


Volume of sphere = $\frac{4}{3}\pi r^3$

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

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

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

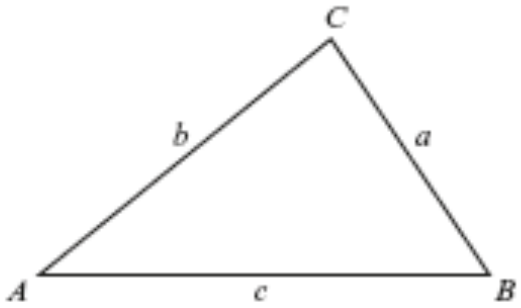


In any triangle ABC

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.