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| Surname | Centre Number | Candidate Number |
| Other Names | | 0 |



GCSE LINKED PAIR PILOT

4362/02



S16-4362-02-R1

APPLICATIONS OF MATHEMATICS

UNIT 2: Financial, Business and Other Applications HIGHER TIER

P.M. THURSDAY, 16 June 2016

2 hours

| For Examiner's use only | | |
|-------------------------|--------------|--------------|
| Question | Maximum Mark | Mark Awarded |
| 1. | 3 | |
| 2. | 5 | |
| 3. | 9 | |
| 4. | 13 | |
| 5. | 9 | |
| 6. | 8 | |
| 7. | 8 | |
| 8. | 6 | |
| 9. | 4 | |
| 10.(a)(b) | 5 | |
| 10.(c) | 10 | |
| 11. | 6 | |
| 12. | 6 | |
| 13. | 8 | |
| Total | 100 | |

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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.

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.

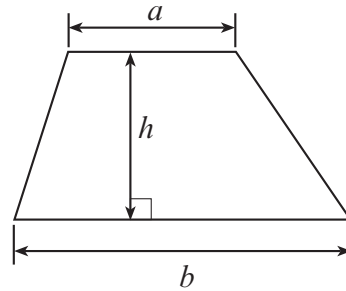
Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

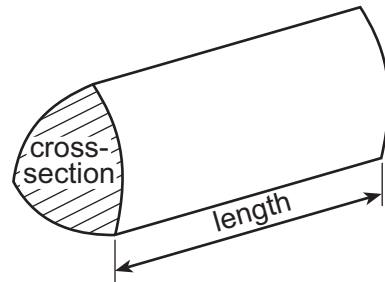
You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question 4(b)(i).

Formula List

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

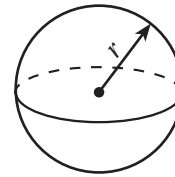


Volume of prism = area of cross-section \times length



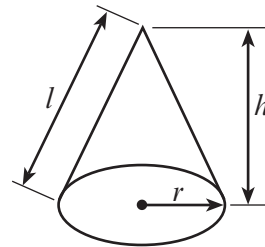
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

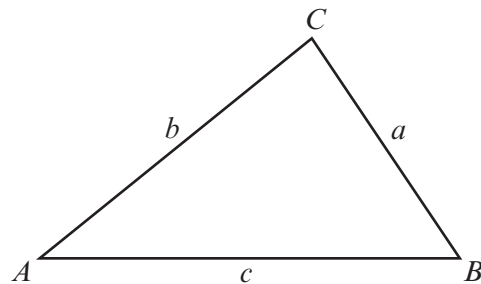


In any triangle ABC

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

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

1. Approximately 1000 bikes are stolen every day across England and Wales.



AlliedWheels Insurance insists that insurance policy holders spend 9% of the value of their bike on purchasing two locks:

- a D-lock for the frame, and
- a flexible lock for the wheels.









Lili's bike is worth £349.

Her bike is insured by AlliedWheels Insurance.

Which two of the following locks should she buy to **exactly** satisfy her insurance company's conditions?

You must show all your working.

[3]

| D-locks | | | |
|---|---|---|---|
|  |  |  |  |
| Lock 1 £16.34 | Lock 2 £17.25 | Lock 3 £14.67 | Lock 4 £20.45 |
| Flexible locks | | | |
|  |  |  |  |
| Lock 5 £12.34 | Lock 6 £15.07 | Lock 7 £6.45 | Lock 8 £4.56 |

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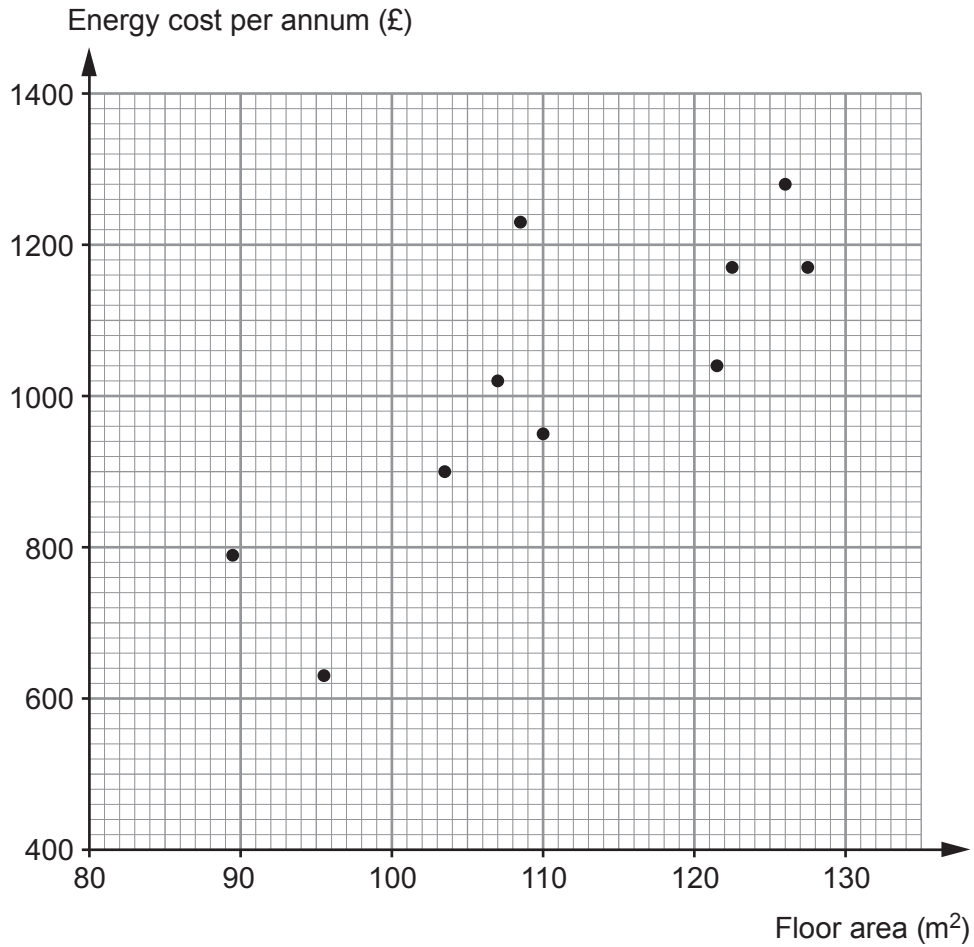
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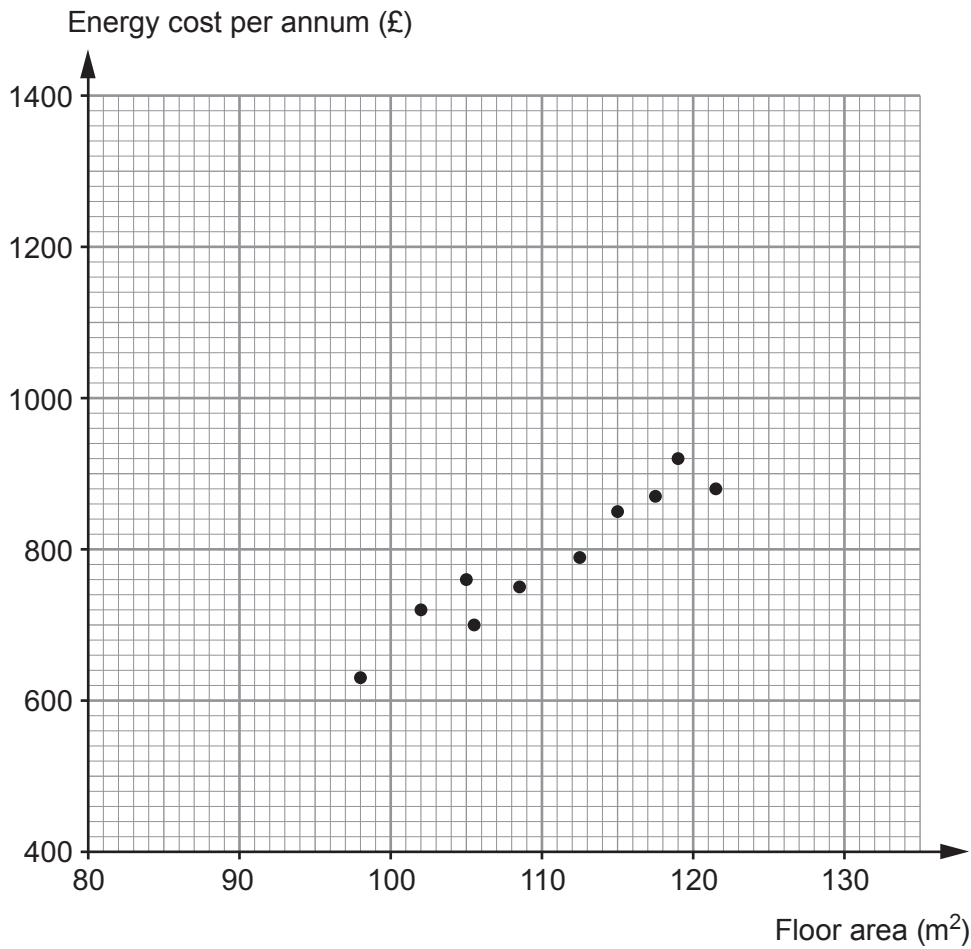
2. Rowena and Wilf each collected information about the floor area of a number of flats in different villages and the related energy cost per annum.

They each displayed their information in a scatter diagram.

Rowena's scatter diagram



Wilf's scatter diagram



- (a) By considering the information collected by both Rowena and Wilf, what is the floor area of the flat with the highest energy cost? [1]

..... m²

- (b) Who drew the scatter diagram showing the strongest correlation?

Rowena Wilf

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

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- (c) Draw, by eye, a line of best fit on Rowena's scatter diagram. [1]

- (d) *Heat-in* is a company that installs insulation.
Heat-in makes the following claim.

Make huge savings on your heating bills by insulating your flat.

Heat-in has insulated the flats in only one of these villages.
One of the scatter diagrams shows flats that have been insulated by *Heat-in*.

- (i) Whose scatter diagram is this more likely to be?
You must give a reason for your answer.

[1]

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- (ii) A newspaper headline says:

The smaller your flat, the more you save by insulating it.

From the information in the scatter diagrams, would you suggest this headline is possibly true or not?

You must give a reason for your answer.

[1]

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3. (a) Tents leave different shapes on the grass when packed away.

- (i) Lowri's tent leaves the shape of a rectangle on the grass.
The length of Lowri's tent is twice its width.
The width of her tent is 2.3 m.



Tom's tent leaves the shape of a square on the grass.

The perimeter of the shape, left on the grass, by each of their tents is the same.

Calculate the length of the shape left by Tom's tent.

[3]

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- (ii) Dewi's tent leaves a circular shape on the grass.
The radius of the shape is 1.8 m.
Calculate the area of the shape left by Dewi's tent.

[2]

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(b)

CAMPING AFON



Camping Afon is due to publish a summary about people and their camping holidays in their annual report.

Five thousand *Camping Afon* customers are asked the 3 questions below.

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| <p>Camping questions</p> <ol style="list-style-type: none"> 1. How old are you? 2. Do you own a tent? 3. How many camping holidays have you had this year? |
|---|

A data-collection sheet is to be used to collect the data.

- (i) Design a data-collection sheet that could be used to collect the customers' responses.
You must plan to group the data as appropriate. [3]

- (ii) Why is grouping data useful when collecting data? [1]

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4.



Latest model of GF22 phone with 16GB now £250

- (a) Aled is saving for a new phone, which normally costs £250 to buy. Here is an extract from Aled's savings spreadsheet.

| | A | B | C | D | E |
|---|----------|----------|-----------|---------|-----------------------------|
| 1 | | Money in | Money out | Balance | Difference from £250 target |
| 2 | 01/03/15 | 134.50 | 0.00 | 134.50 | 115.50 |
| 3 | 18/03/15 | 0.00 | 20.00 | 114.50 | 135.50 |
| 4 | 27/03/15 | 10.00 | 5.00 | 119.50 | 130.50 |
| 5 | 06/04/15 | 62.25 | 1.00 | | |

- (i) Complete the entries for D5 and E5 in Aled's savings spreadsheet. [2]

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- (ii) Which formulae could Aled use to calculate the values in D5 and E5? [3]

Formula for D5

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Formula for E5

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- (b) One option for Aled is to buy the GF22 phone from *H₂O*. He would pay £25 per month for 12 months. If all 12 monthly payments are made on time, *H₂O* will reward him by giving him back 10% of his total payments.

Alternatively, Aled could buy the same phone from *Scoot*³. The option plan at *Scoot*³ requires a single payment of £100 and 10 further payments of £17.95.

Examiner
only

- (i) *You will be assessed on the quality of your written communication in this part of the question.*

Which of these two options should Aled consider to be the cheaper option, buying the phone from *H₂O* or from *Scoot*³?

You must

- show all your working, and
- give the condition for this being the cheaper option.

[6]

- (ii) Calculate the percentage increase on the original cost of the phone that a customer would pay in selecting the option plan from *Scoot*³. [2]

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5. A magazine has published a table to help readers understand nutrition labels.

| How to read nutrition labels | | | |
|------------------------------|---------------------------------|---------|--------------------------|
| | High | Medium* | Low |
| Total fat | if greater than 17.5 g per 100g | | if 3g or less per 100g |
| Saturated fat | if greater than 5g per 100g | | if 1.5g or less per 100g |
| Sugars | if greater than 22.5g per 100g | | if 5g or less per 100g |
| Salt | if greater than 1.5g per 100g | | if 0.3g or less per 100g |

Medium* is between the High and Low classifications.

- (a) Write a description for Medium **Sugars**. [3]

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- (b) Complete the table for Tortiglioni pasta by stating High, Medium or Low. [1]

| Tortiglioni pasta | | |
|--------------------------|----------|-----------------------|
| Nutrition | per 100g | High, Medium, or Low? |
| Total fat | 1.5g | |
| Saturated fat | 0.3g | |
| Salt | 0.01g | |

(c) Some of the details of total fat, saturated fat, sugars and salt from the label on a tin of baked beans are given in the table below.

(i) Complete the table below by inserting values correct to 1 decimal place. [3]

| Baked beans | per 100 g | per (½ tin) serving |
|---------------|-----------|---------------------|
| Total fat | 0.4 g | g |
| Saturated fat | 0.2 g | g |
| Sugars | 5.7 g | 11.7 g |
| Salt | g | 1.85 g |


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(ii) Use the information in the table above to complete the statement below. [2]

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|  | The baked beans in this tin weigh g |
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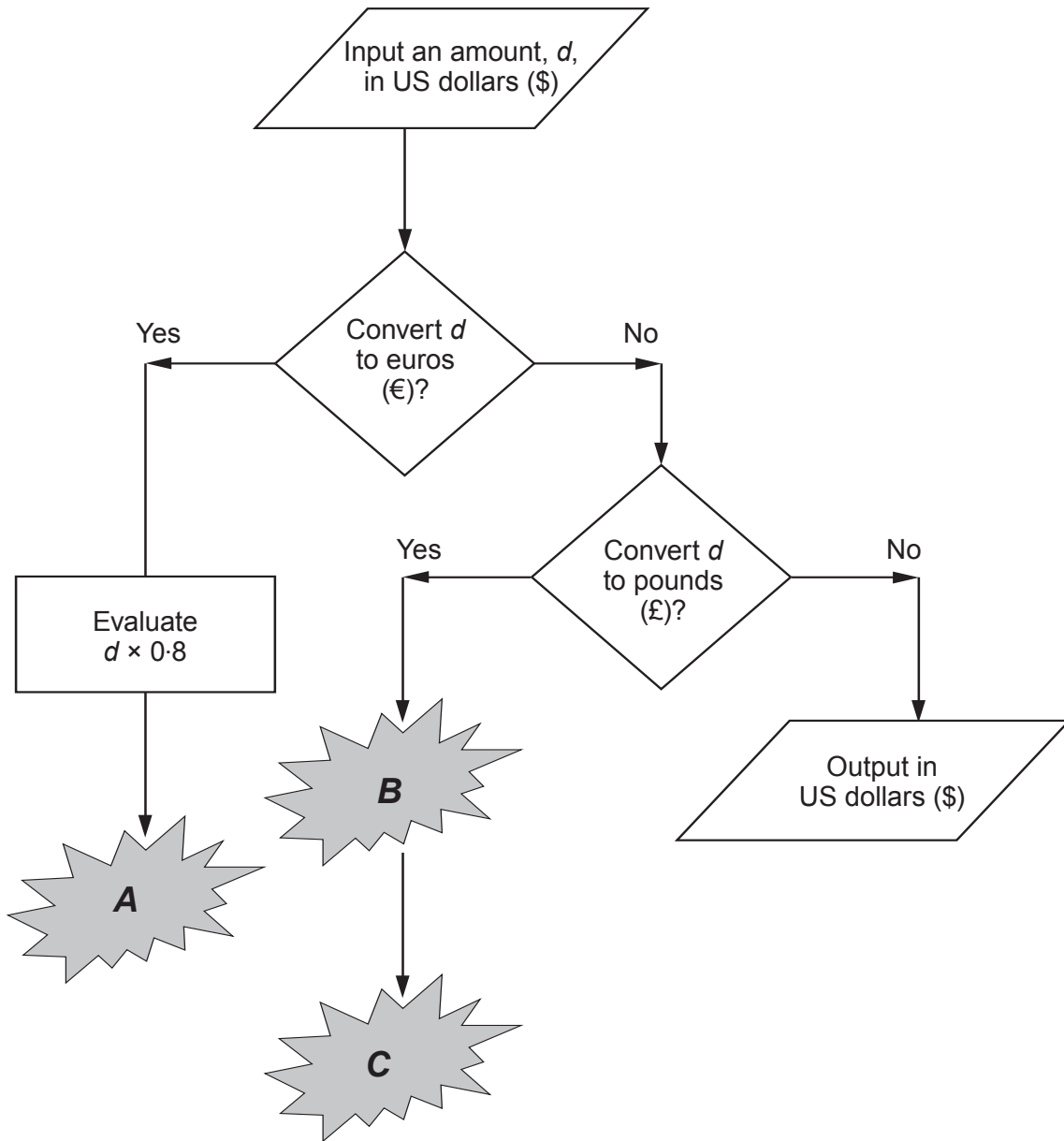
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6. The following is a section of a flowchart.



The exchange rates from US dollars (\$) to pounds (£) and euros (€) are

$$\begin{aligned} \$1 &= \text{£}0.62 \\ \$1 &= \text{€}0.80 \end{aligned}$$

(a) What would this section of a flowchart be used for?

[1]

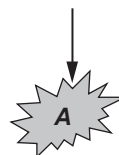
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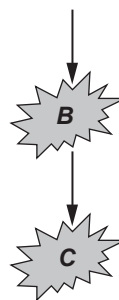
(b) There is a missing flowchart symbol indicated by



Draw the missing flowchart symbol and complete with an appropriate statement. [2]



(c) There are two missing flowchart symbols indicated by



Draw the two missing flowchart symbols and complete with appropriate statements. [3]



(d) Calculate the number of dollars that would be converted to €280. [2]

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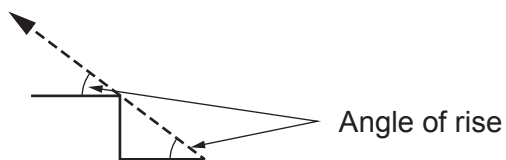
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7. Marged has a large doll's house with an irregular staircase. The staircase has horizontal steps and vertical rises.



The angle of rise is measured from the horizontal upwards.



- (a) The bottom step on a staircase is 28 mm deep with a vertical rise of 12 mm.

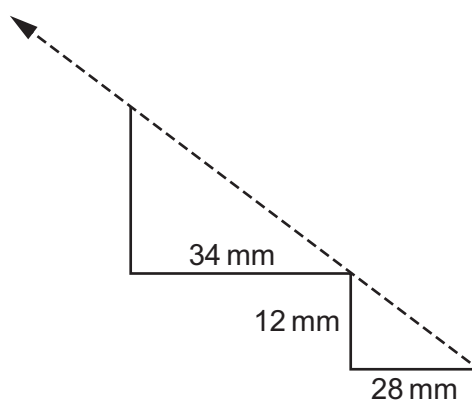


Diagram not drawn to scale

- (i) **Use trigonometry** to calculate the angle of rise of the bottom step. [3]

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- (ii) The second step in this staircase is 34 mm deep and has the same angle of rise. **Use trigonometry** to calculate the vertical rise of the second step in millimetres. [3]

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- (b) A different doll's house has a staircase with steps as shown below. There is a different angle of rise for this staircase.

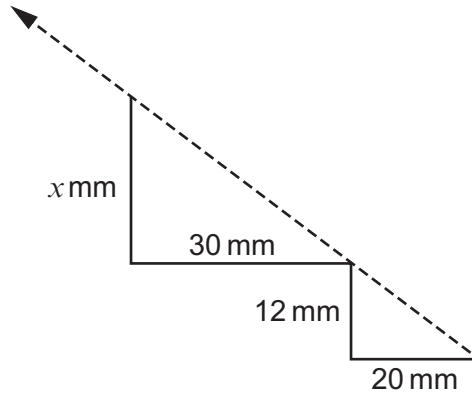


Diagram not drawn to scale

Without using trigonometry, calculate the rise x mm.
You must show your working.

[2]

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9.

| Account | Nominal interest rate | AER Annual Equivalent Rate, correct to 2 decimal place |
|---------------|--------------------------|---|
| Premium Saver | 2.6% p.a. paid quarterly | % |

In the table above, complete the AER column, correct to 2 decimal places, for the Premium Saver account using the following information.

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.

[4]

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10. Silk is a natural fibre.
It is produced as a result of silkworms eating mulberry leaves.



(a)

Facts

104 kg of mulberry leaves, eaten by 3000 silkworms, will produce 1 kg of silk.

This means that:

208 kg of mulberry leaves, eaten by 6000 silkworms, will produce 2 kg of silk.

Use these facts to complete the statement below by inserting values correct to 3 significant figures. [3]

..... kg of mulberry leaves are eaten by silkworms to produce 745 kg of silk.

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- (b) The typical width of a fibre of silk is 1 micrometre (μm).

$1 \mu\text{m} = 1$ millionth of a metre

Express $1 \mu\text{m}$ in metres in standard form.

[2]

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- (c) Production values of silk are usually compared in American dollars, US\$.

| World silk production in 2005 | | |
|---------------------------------------|-------------------------|-------------------------|
| Country | Production (in 1000 kg) | Production value (US\$) |
| People's Republic of China | 290 003 | 978 013 |
| India | 77 000 | 259 679 |
| Uzbekistan | 17 000 | 57 332 |
| Brazil | 11 000 | 37 097 |
| Iran | 6 088 | 20 235 |
| Thailand | 5 000 | 16 862 |
| Vietnam | 3 000 | 10 117 |
| Democratic People's Republic of Korea | 1 500 | 5 059 |

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- (i) In 2005, according to the information given,
- which country's silk was the most valuable per 1000 kg, and
 - which country's silk was the least valuable per 1000 kg?

[3]

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| 2005, silk production | Country | Value per 1000 kg (US\$) |
|-----------------------|---------|--------------------------|
| Most valuable silk | | |
| Least valuable silk | | |

- (ii) In reality, by looking at the information given for 2005, why do you think this might not be true?

[1]

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- (iii) In 2005, The People's Republic of China produced 54% of the world's silk. Complete the statement below.

[3]

In 2005, India produced % of the world's silk.

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- (iv) Does the table indicate the total world production of silk?
You must show your calculations to justify your answer.

[3]

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11. In an experiment with an artificial fibre, stretch tests were carried out. This was done by pulling at each end of a fibre and then releasing the ends. It was found that, after stretching, the fibre did not return to its original length.

It was found that with

a stretch to $x\%$ of the original length,
the fibre returned to $(x - 8)\%$ of its original length,
provided $108 \leq x < 130$.

For example, given a stretch to 120% of the original length, the fibre returned to 112% of its original length.

- (a) A fibre of length 5.4 cm is stretched to 126% of its original length. What is the length of this fibre after releasing it from its stretch? [2]

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- (b) What do you think may be the risk in the experiment if $x \geq 130$? [1]

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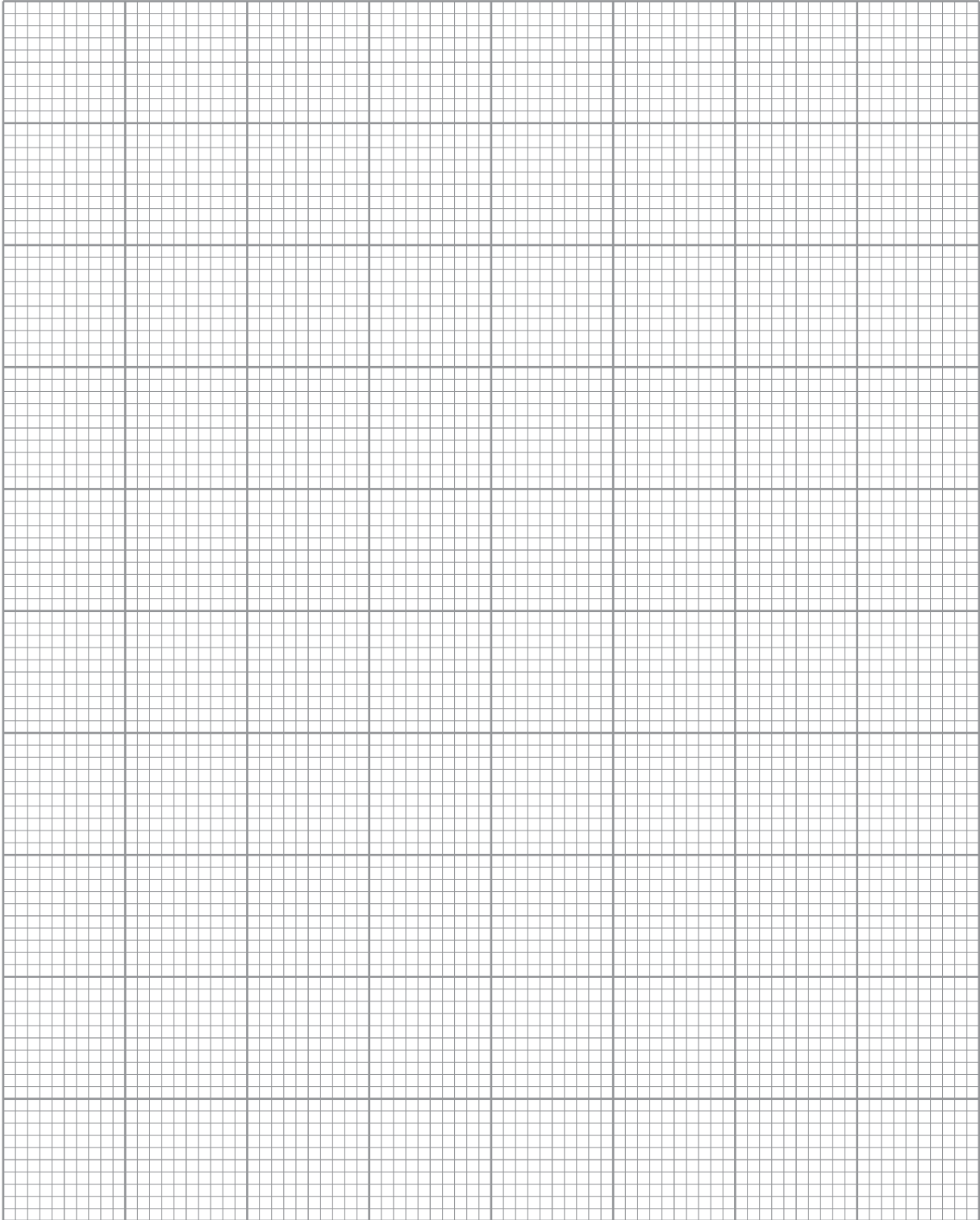
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- (c) Consider a fibre with an original length of 100 cm. Use the graph paper opposite to illustrate all the possible total stretch lengths and return lengths for this fibre. [3]

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12. A hotel is planning to buy some new desks and chairs for their conference room. The desks cost £125 each and chairs cost £50 each.

The manager says that the hotel needs more than 100 chairs. She has a maximum of £8000 to spend.

Let D represent the number of desks.

Let C represent the number of chairs.

- (a) Write down two inequalities, in terms of D and C , that satisfy the information given by the hotel manager. [2]

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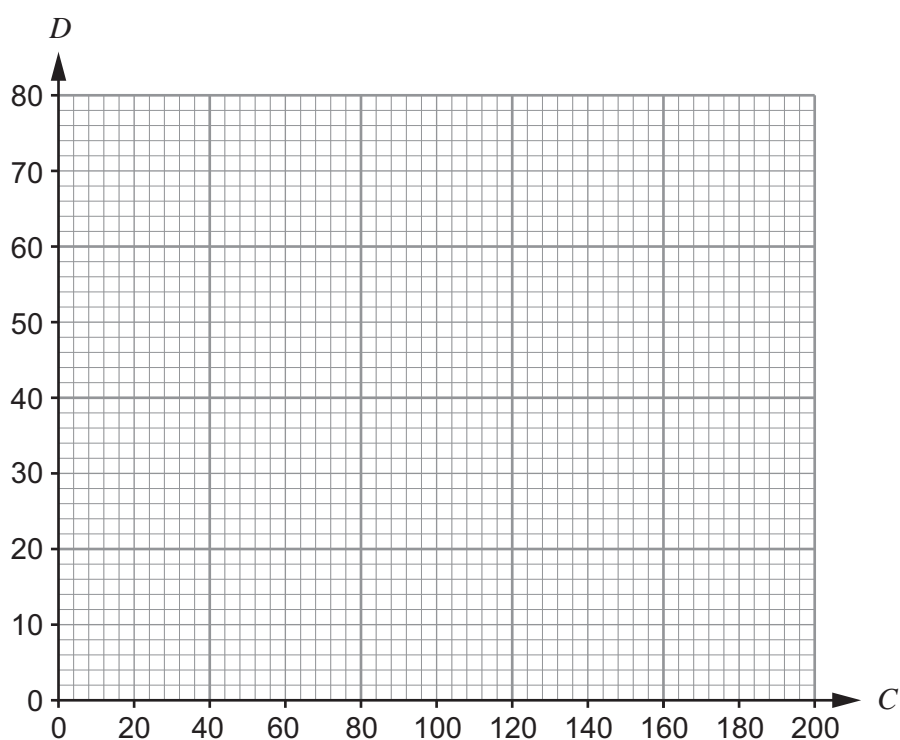
- (b) Use the graph paper opposite to find a region that is satisfied by your inequalities. You must clearly indicate your region. [3]

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(c) Here is a statement made by the manager.

We could buy 150 chairs and 10 desks, or we could buy 110 chairs and 15 desks.

Use your graph to complete the following table to indicate whether each part of the statement could be true or not.

You **must show on your graph** how you justify your decisions.

[1]

| | True or False? |
|---------------------------------------|----------------|
| We could buy 150 chairs and 10 desks. | |
| We could buy 110 chairs and 15 desks. | |

13.



The diagram below shows the uniform cross-section of a child's suitcase. It is a semi-circle joined to a rectangle.

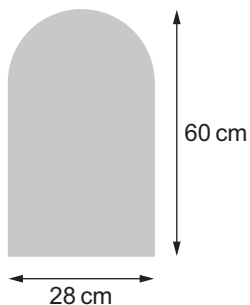


Diagram not drawn to scale

The suitcase has a depth of 10 cm.

- (a) Calculate the volume of this suitcase correct to the nearest litre. [5]

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- (b) A similar larger suitcase is to be made. This one will have an overall height of 75 cm, instead of the original overall height 60 cm. All the dimensions of the suitcase are enlarged to make the larger suitcase mathematically similar to the original suitcase. Calculate the volume of the larger suitcase correct to the nearest litre. [3]

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