

Surname <i>StemUp Model Solution</i>
First name(s)

Centre Number

Candidate Number
0



GCSE

3310U30-1



FRIDAY, 19 MAY 2023 – MORNING

**MATHEMATICS – NUMERACY
UNIT 1: NON-CALCULATOR
INTERMEDIATE TIER**

1 hour 45 minutes

ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.
A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the additional page at the back of the booklet. Question numbers must be given for the work written on the additional page.

Take π as 3.14.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

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

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

In question 1, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

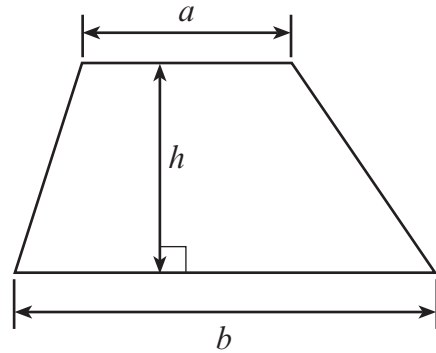
For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	5	
2.	8	
3.	6	
4.	5	
5.	5	
6.	3	
7.	6	
8.	7	
9.	11	
10.	10	
11.	4	
12.	3	
13.	7	
Total	80	



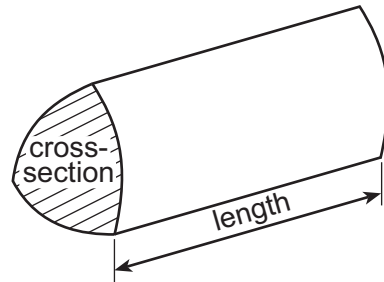
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Formula List – Intermediate Tier

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



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



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



Small bottle
30ml for £1.20



Medium bottle
40ml for £1.56



Large bottle
50ml for £2.25

Katelyn is buying some medicine.
Which size bottle of medicine offers the best value for money?
You must show all your working.

[3 + 2 OCW]

Compare the cost of 10 ml for each size of bottle.

Small: 30 ml for £1.20, so 10 ml costs $£1.20 \div 3 = £0.40$ (40p)

Medium: 40 ml for £1.56, so 10 ml costs $£1.56 \div 4 = £0.39$ (39p)

Large: 50 ml for £2.25, so 10 ml costs $£2.25 \div 5 = £0.45$ (45p)

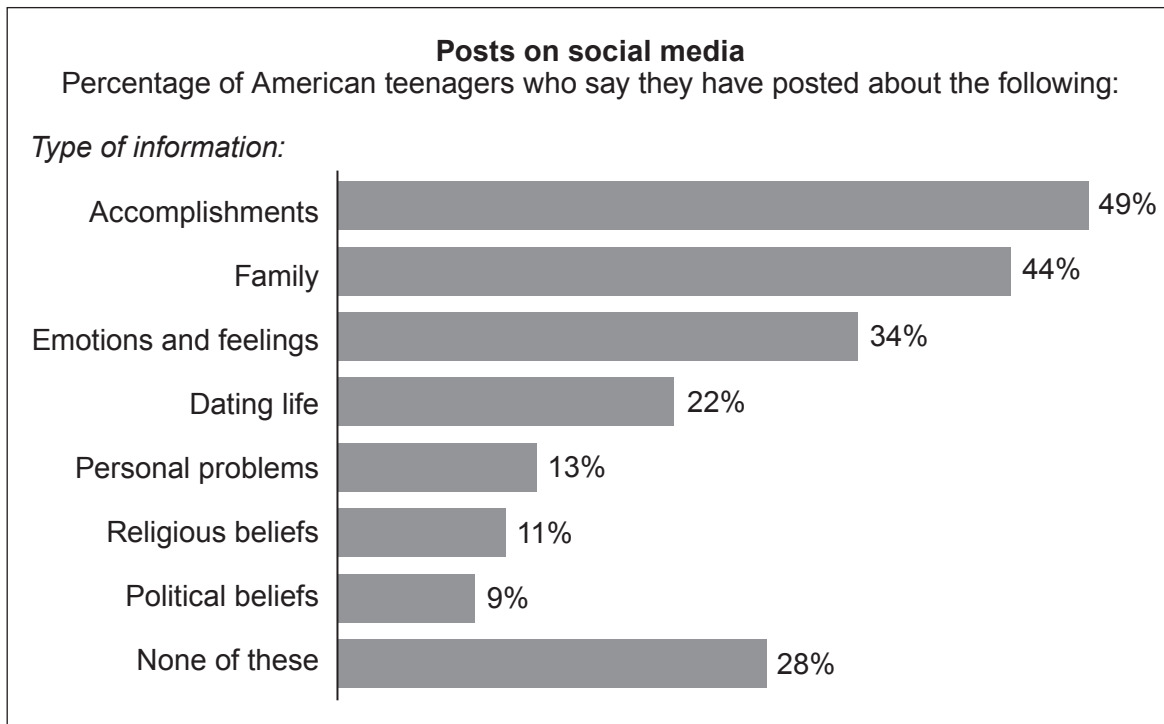
(Working: $156 \div 4 = 39$ and $225 \div 5 = 45$)

Comparing the cost of 10 ml: $39p < 40p < 45p$

Conclusion: the medium bottle (40 ml for £1.56) offers the best value for money, because 10 ml of medicine costs only 39p, which is cheaper than the small (40p) and the large (45p) bottles.



2. A survey was carried out in the U.S.A.
743 teenagers were interviewed.
They were asked what type of information they posted on social media.
The results were displayed on the internet, as shown below.



- (a) How many times bigger is the percentage of the teenagers who posted about their family than the percentage who posted about their religious beliefs? [1]

$$44 \div 11 = 4$$

4 times bigger

- (b) What fraction of these teenagers posted about their emotions and feelings?
Give your answer in its simplest form. [1]

$$34\% = \frac{34}{100} = \frac{17}{50}$$

- (c) Dewi looks at the type of information posted by these teenagers.
What is the modal type of information? [1]

The modal type of information is Accomplishments



- (d) What information would have been needed in the original data so that the following hypothesis could be tested? [1]

In the U.S.A., teenage girls post about family more often than teenage boys.

*The gender of each teenager: the number of girls and boys surveyed
and how many girls and how many boys posted about family.*

- (e) How many of these 743 teenagers posted about their religious beliefs?
You must show all your working. [3]

11% of 743 teenagers:

$10\% \text{ of } 743 = 74.3$

$1\% \text{ of } 743 = 7.43$

$11\% \text{ of } 743 = 74.3 + 7.43 = 81.73$

≈ 82 teenagers posted about their religious beliefs

- (f) Lottie is confused by the data in the diagram.

She says,

This diagram can't be right, as all the bars don't add up to 100%.

The diagram is correct.
Explain why the bars do not add up to 100%. [1]

*Each teenager could post about more than one type of information,
so many teenagers are counted in more than one bar.*



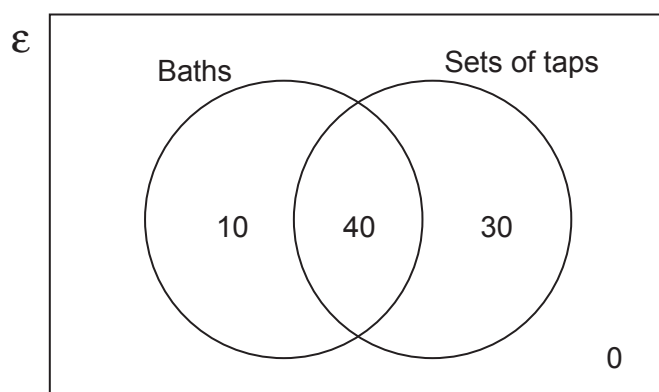
3. HydraDwr is a bathroom and plumbing shop.

(a) HydraDwr sells baths and sets of taps.

One day, 80 customers bought:

- one bath and one set of taps, or
- one bath, or
- one set of taps.

The Venn diagram shows the number of customers who bought these items.



(i) How many baths did these customers buy?

[1]

$$\text{Baths} = 10 + 40 = 50 \text{ baths}$$

(ii) A bath costs £180.
A set of taps cost £60.

Calculate the total cost of the baths and sets of taps bought by these 80 customers.

[3]

$$\text{Number of baths} = 10 + 40 = 50$$

$$\text{Cost of baths} = 50 \times £180 = £9000$$

$$\text{Number of sets of taps} = 40 + 30 = 70$$

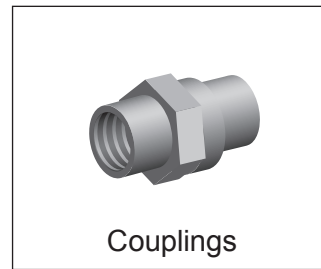
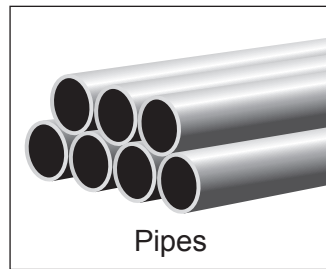
$$\text{Cost of taps} = 70 \times £60 = £4200$$

$$\text{Total cost} = £9000 + £4200$$

$$= £13\,200$$



- (b) HydraDwr also sells pipes and couplings to join the pipes.



- (i) 3 pipes are joined together using 2 couplings, as shown below.



Diagram not drawn to scale

How many couplings are needed to join 6 pipes?

[1]

Couplings = 6 - 1 = 5 couplings

- (ii) An equation is used to work out the number of couplings needed to join pipes.

P = the number of pipes

C = the number of couplings

Which of the following equations can be used to calculate the number of couplings needed?

Circle your answer.

[1]

$C = 2P$

$C = P + 1$

$C = P - 1$

$C + P = 1$

$C = P$



4. Alice used 400 kWh of electricity.
Electricity was charged at 32p per kWh.
The standing charge was £62.

VAT at 5% is payable on **all** the charges.
Calculate Alice's electricity bill.
You must show all your working.

[5]

$$\text{Cost of electricity} = 400 \times 32\text{p} = 12\,800\text{p} = \text{£}128$$

$$\text{Standing charge} = \text{£}62$$

$$\text{All charges} = \text{£}128 + \text{£}62 = \text{£}190$$

$$\text{VAT at 5\%: } 10\% \text{ of } \text{£}190 = \text{£}19, \text{ so } 5\% \text{ of } \text{£}190 = \text{£}9.50$$

$$\text{Total bill} = \text{£}190 + \text{£}9.50$$

$$= \text{£}199.50$$

$$\text{Alice's electricity bill is } \text{£}199.50$$



5. Lynette is ordering a T-shirt.
She wants her initial, L, printed on the T-shirt.

Details of Lynette's design are given below.

- The height is twice the width.
- The height is 10 cm.

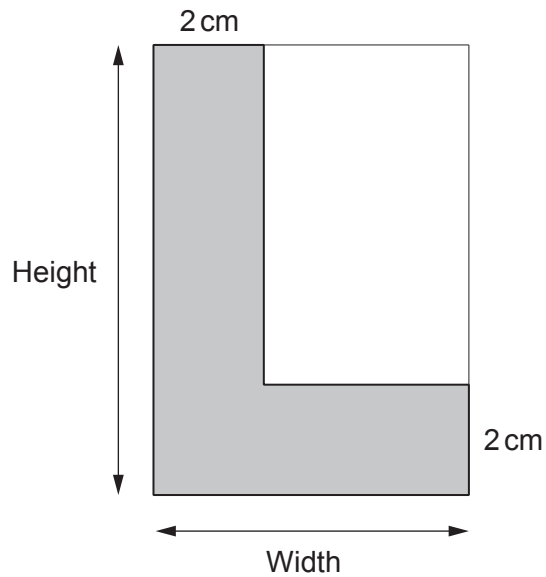


Diagram not drawn to scale

The cost of printing is 50p for an area of 2 cm^2 .

How much will it cost Lynette to have her design printed on a T-shirt?

[5]

Height = 2 × width, so width = $10 \div 2 = 5\text{ cm}$

Split the L into two rectangles:

Upright part = $10 \times 2 = 20\text{ cm}^2$

Bottom part = $(5 - 2) \times 2 = 3 \times 2 = 6\text{ cm}^2$

Total area of L = $20 + 6 = 26\text{ cm}^2$

Number of 2 cm^2 blocks = $26 \div 2 = 13$

Cost = $13 \times 50\text{p} = 650\text{p}$

= £6.50

It will cost Lynette £6.50 to have her design printed.



6. A survey was carried out to find how often primary school children play board games.

A questionnaire was designed for primary school children to answer.
The following two questions were asked.

Q1. Do you live within 5 minutes' walking distance of school?

Q2. How often do you play board games?

Never

1-5 times

5-10 times

More than 10 times

☐
☐
☐
☐

- (a) For each question, give **one** reason why it is **not** suitable. [2]

Q1. *It is not relevant: where you live has nothing*

to do with how often you play board games.

Q2. *The boxes overlap (5 times is in two boxes) and*

no time period is given, e.g. per week or per month.

- (b) The survey was carried out by leaving copies of the questionnaire in the local supermarket.

Give **one** criticism of how the survey was carried out. [1]

Primary school children are unlikely to be in the supermarket, so

the survey does not target them (anyone could fill it in).



7. Mari and Huw share a prize of £2700 in the ratio 4 : 5 respectively.

Mari decides to donate 24% of her share of the prize to charity.
Huw decides to give the same amount of money as Mari to charity.

What fraction of Huw's share of the prize money does he give to charity?
Express your answer in its simplest form.
You must show all your working.

[6]

$$\text{Total number of parts} = 4 + 5 = 9$$

$$1 \text{ part} = £2700 \div 9 = £300$$

$$\text{Mari's share} = 4 \times £300 = £1200$$

$$\text{Huw's share} = 5 \times £300 = £1500$$

Mari donates 24% of £1200:

$$10\% = £120, 20\% = £240, 1\% = £12, 4\% = £48$$

$$24\% = £240 + £48 = £288$$

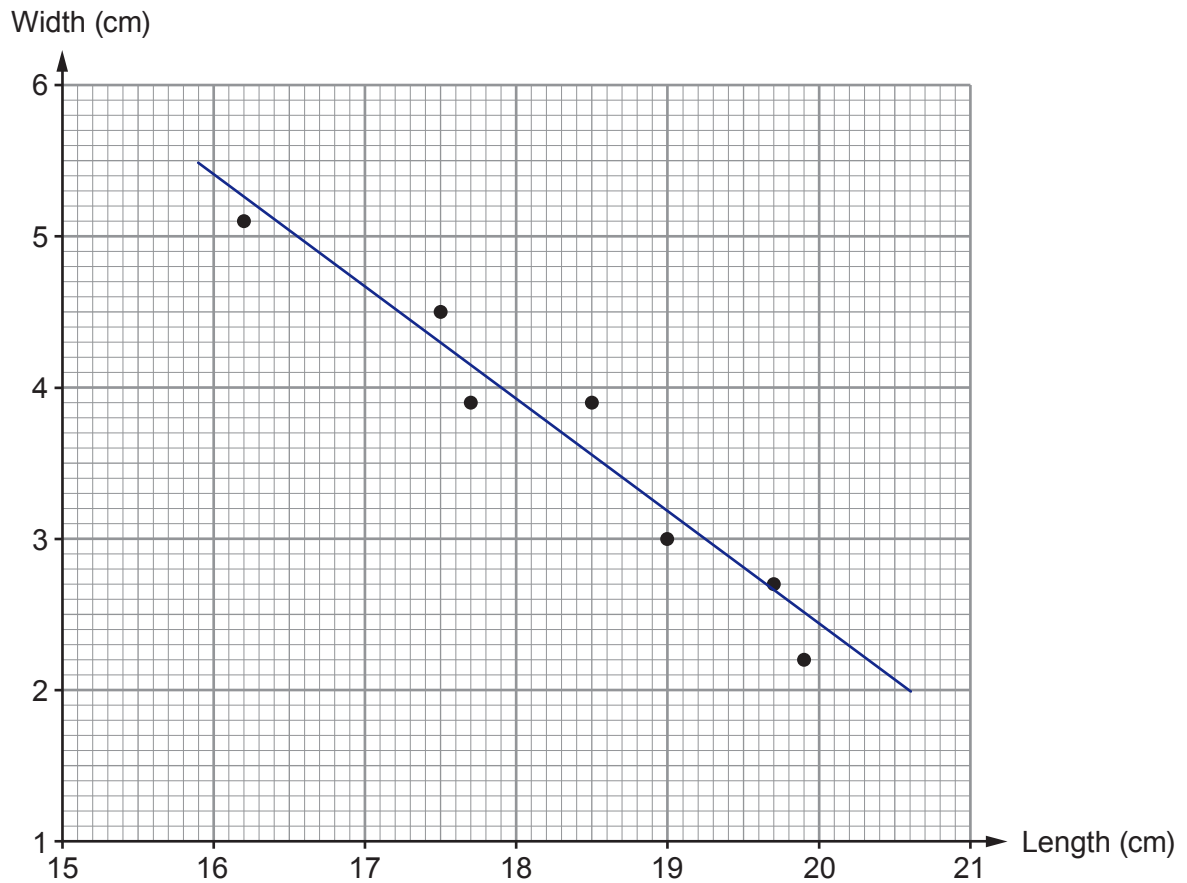
Huw also gives £288 to charity.

$$\text{Fraction of Huw's share} = \frac{288}{1500} = \frac{144}{750} = \frac{72}{375} = \frac{24}{125}$$

Huw gives $\frac{24}{125}$ of his share to charity.



8. The scatter diagram shows the length and width of some television remote handsets.



- (a) Two of the remotes have the same width.
Write down the width and lengths of these remotes.

[2]

Width 3.9 cm

Lengths are 17.7 cm and 18.5 cm.



- (b) Consider the remote with a width of 4.5 cm.
Write down the ratio of the width of this remote to its length.
Give your answer in its simplest form. [2]

Width 4.5 cm, length 17.5 cm

$4.5 : 17.5 = 45 : 175 = 9 : 35$

Ratio = 9 : 35

- (c) How is it best to describe the correlation seen in this scatter diagram? [1]

Negative correlation

- (d) Draw a line of best fit on the scatter diagram. [1]

- (e) Is it **certain** that another television remote with length 18.5 cm will have a width in the range 3 cm to 4 cm?

Yes

☐

No

☒

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

No. The diagram only shows a trend from a small sample of remotes.

*Another remote does not have to fit the trend: its width could
be outside 3 cm to 4 cm.*



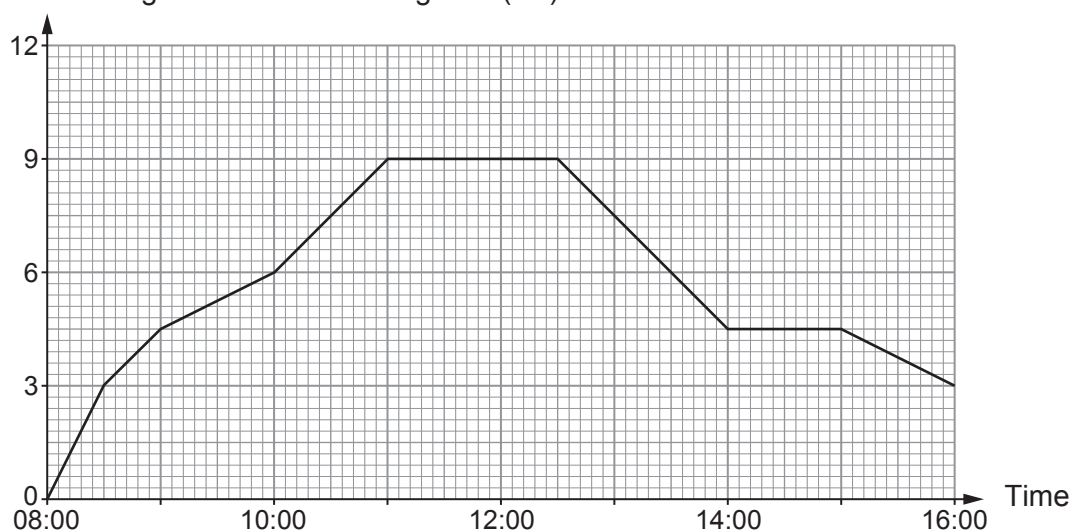
9. (a) Hesta and Walt hire a canal boat in Llangollen for their holiday.

Hesta records their distance along the canal from Llangollen between 8 a.m. and 4 p.m.

This is shown in the travel graph below.



Distance along the canal from Llangollen (km)



- (i) During the day, Hesta and Walt made stops by the side of the canal.
At what time did Hesta and Walt first stop at the side of the canal?

[1]

11:00 (11 a.m.)

- (ii) Between which two times were Hesta and Walt travelling the fastest?
Circle your answer.

[1]

08:00 and 08:30

08:30 and 09:00

10:00 and 11:00

12:30 and 14:00

15:00 and 16:00

- (iii) What is the total distance Hesta and Walt travelled in the boat between 8 a.m. and 4 p.m.?

Circle your answer.

[1]

3 km

9 km

12 km

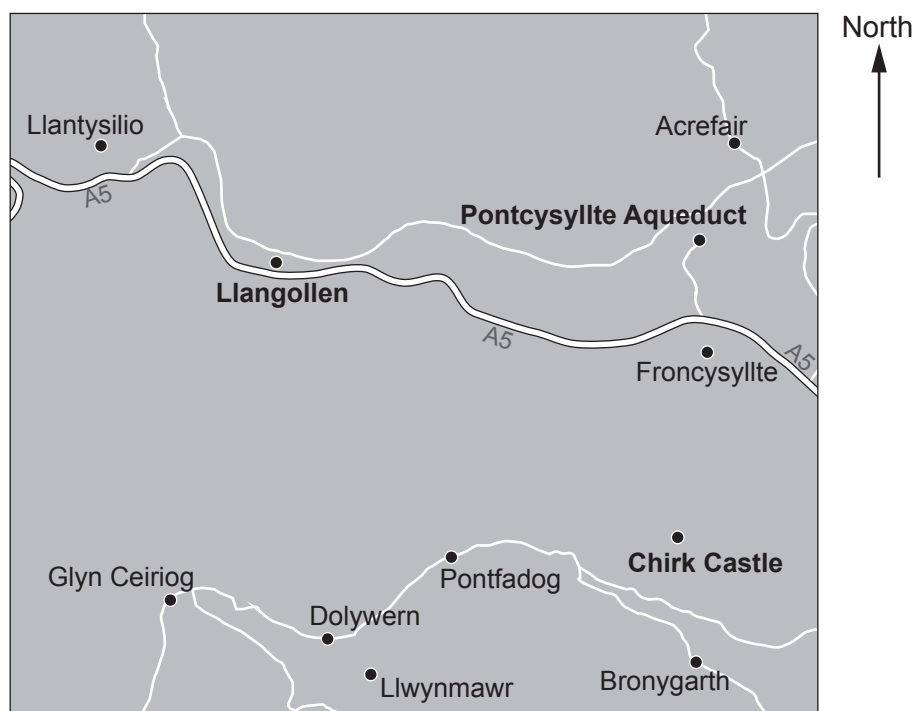
15 km

18 km

9 km out + (9 - 3) = 6 km back, total = 9 + 6 = 15 km



(b) Hesta and Walt visit Chirk Castle.



- (i) Which is the best estimate for the bearing of Llangollen from Chirk Castle?
Circle your answer.

[1]

060° 240° 120° 340° 300°

- (ii) The direct straight-line distance between Llangollen and the Pontcysyllte Aqueduct is 5.6 km.
On the map this distance is 5.6 cm.
What is the scale of the map?
Circle your answer.

[1]

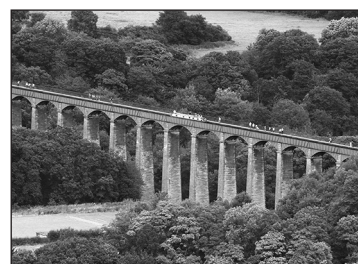
1 : 10 1 : 1000 1 : 10 000 1 : 100 000 1 : 1 000 000

$$5.6 \text{ km} = 560\,000 \text{ cm}, \quad 560\,000 \div 5.6 = 100\,000$$



- (c) The Pontcysyllte Aqueduct was built to carry the Llangollen canal over a valley.

The following facts about the section of the canal over the aqueduct were found on the internet.



- It has a rectangular uniform cross-section.
- It is 300 m in length.
- It holds 1 500 000 litres of water.
- It takes 2 hours to drain the water.

- (i) The section of the canal over the aqueduct is to be drained.

Calculate the number of litres of water that drain from this section of the canal per minute.

You may assume that the water drains from the canal at a constant rate.

You must show all your working.

[3]

$$\text{Time} = 2 \text{ hours} = 2 \times 60 = 120 \text{ minutes}$$

$$\text{Litres per minute} = 1\,500\,000 \div 120$$

$$= 150\,000 \div 12$$

$$= 12\,500 \text{ litres per minute}$$

- (ii) Calculate the area of the canal's uniform cross-section.
Give your answer in cm^2 .

[3]

$$\text{Length} = 300 \text{ m} = 300 \times 100 = 30\,000 \text{ cm}$$

$$\text{Volume} = 1\,500\,000 \text{ litres} = 1\,500\,000 \times 1000 \text{ cm}^3$$

$$= 1\,500\,000\,000 \text{ cm}^3$$

$$\text{Area} = \text{volume} \div \text{length} = 1\,500\,000\,000 \div 30\,000$$

$$= 150\,000 \div 3$$

$$\text{Area of cross-section} = 50\,000 \text{ cm}^2$$



10. (a) A jar contains 300 g of chocolate spread.

In this spread:

- 58% of the mass is pure sugar,
- $\frac{1}{8}$ of the mass is cocoa,
- the mass of the milk powder is $\frac{4}{5}$ of the mass of cocoa,
- the remainder of the 300 g is palm oil.

Calculate the percentage of palm oil in the chocolate spread.
You must show all your working.

[7]

$$\text{Sugar} = 58\% \text{ of } 300 \text{ g} = 0.58 \times 300 = 174 \text{ g}$$

$$\text{Cocoa} = \frac{1}{8} \text{ of } 300 \text{ g} = 300 \div 8 = 37.5 \text{ g}$$

$$\text{Milk powder} = \frac{4}{5} \text{ of } 37.5 \text{ g} = 37.5 \div 5 \times 4 = 7.5 \times 4 = 30 \text{ g}$$

$$\text{Sugar} + \text{cocoa} + \text{milk powder} = 174 + 37.5 + 30 = 241.5 \text{ g}$$

$$\text{Palm oil} = 300 - 241.5 = 58.5 \text{ g}$$

$$\text{Percentage of palm oil} = \frac{58.5}{300} \times 100 = 58.5 \div 3 = 19.5\%$$

The chocolate spread is 19.5% palm oil.

- (b) A different jar contains 840 g of chocolate spread.

The label on the jar says,

'Offer: includes 20% extra chocolate spread for free.'

How many grams of chocolate spread did a jar contain before the offer started?

[3]

$$840 \text{ g} = 100\% + 20\% \text{ extra} = 120\% \text{ of the original amount}$$

$$1\% = 840 \div 120 = 7 \text{ g}$$

$$100\% = 7 \times 100 = 700 \text{ g}$$

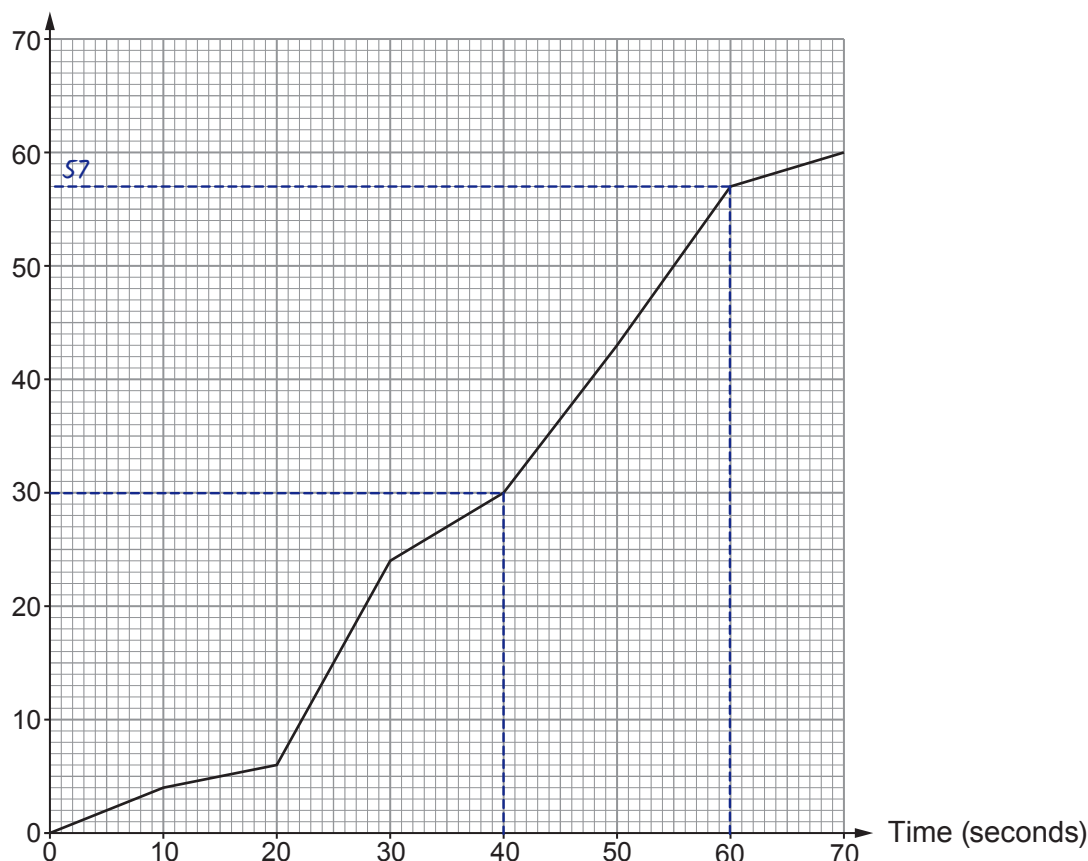
Before the offer the jar contained 700 g



11. Deva Design Service employs 60 people.
Employees were asked to log on to their computer at 9 a.m. on Thursday.

The number of employees logged on was recorded every 10 seconds from 9 a.m.
The results are displayed in the cumulative frequency diagram shown below.

Cumulative frequency



- (a) Use the cumulative frequency diagram to estimate the median time taken by the employees to log on.

[1]

..... 40 seconds

- (b) Deva Design Service has a policy that states the following:

'90% of employees should be logged on to their computer by 9:01 a.m.'

Show that this policy was met on Thursday.

You must show all your working.

[3]

90% of 60 employees = $0.9 \times 60 = 54$ employees

From the graph, by 60 seconds (9:01 a.m.) 57 employees had logged on.

57 > 54 (57 out of 60 = 95%, more than 90%), so the policy was met.



12. Alan Frames is a company that employs 360 people.
6 of these people are to be selected to discuss changes to the company logo.

The manager has decided to use a systematic sampling method.
He has a numbered list of all 360 people.

- (a) When using systematic sampling, where in the list **should** the manager start his selection of the 6 people?
Tick (✓) **one** of the boxes.

[1]

The 60th name in the list

☐

At a randomly chosen name

☒

First person in the list

☐

Last person in the list

☐

A name by any multiple of 60 in the list

☐

- (b) The manager actually starts by selecting the 4th name in his list.
Complete the table below to give the position in the list of the 6 people who would be selected using systematic sampling.

[2]

$360 \div 6 = 60$, so select every 60th name

4, $4 + 60 = 64$, $64 + 60 = 124$, 184, 244, 304

Person selected	1st	2nd	3rd	4th	5th	6th
Position in the list	4th	64	124	184	244	304



13. Dafydd works in a call centre.
On Monday, he made 200 phone calls.
He recorded the length of time he spent on each of these phone calls.

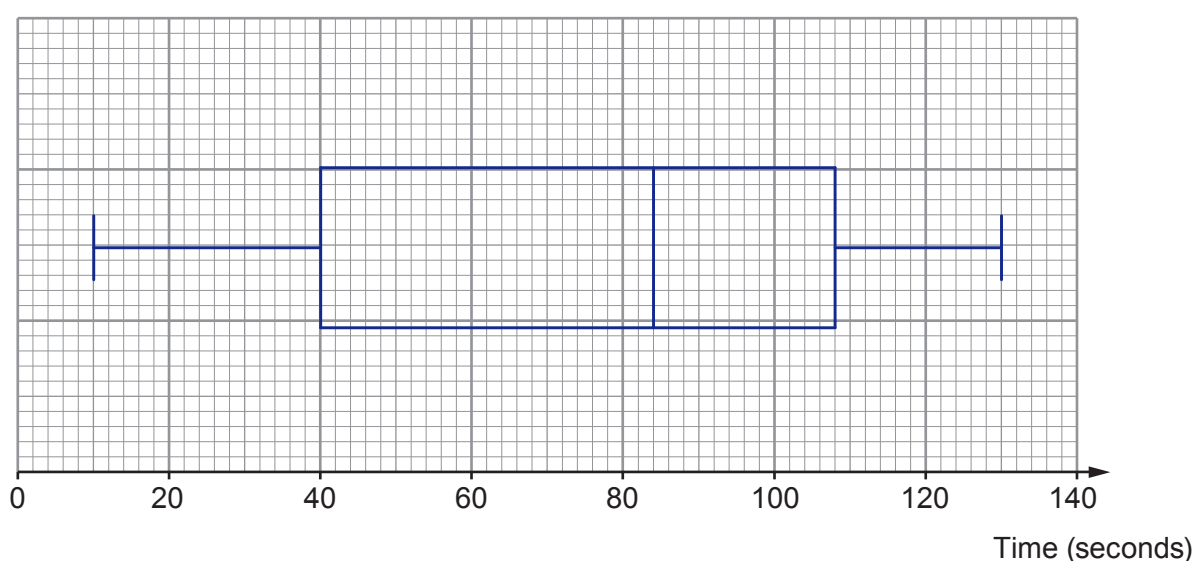
Dafydd noted the following about the times spent on each phone call.

- The greatest time was 2 minutes 10 seconds.
- The range of the times was 2 minutes.
- The median time was 84 seconds.
- The upper quartile was 108 seconds.
- The interquartile range was 68 seconds.

- (a) Use the graph paper to draw a box-and-whisker diagram to represent Dafydd's data. [4]

Lowest = $130 - 120 = 10$ s, $LQ = 108 - 68 = 40$ s

Length of time on each of 200 phone calls



- (b) Dafydd was set a target.
He had to complete half of his phone calls in less than 1 minute 30 seconds each.
By how many seconds did Dafydd beat this target?
Circle your answer. [1]

4 seconds 6 seconds 10 seconds 12 seconds 18 seconds

1 min 30 s = 90 s, median = 84 s, $90 - 84 = 6$ seconds

- (c) On Monday, how many of Dafydd's phone calls lasted less than 108 seconds? [2]

108 s is the upper quartile, so 75% of calls were less than 108 s

75% of 200 = $\frac{3}{4} \times 200 = 150$

150 phone calls



[illegible]

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