

Surname <i>StemUp Model Solution</i>	Centre Number	Candidate Number
First name(s)		0



GCSE

3310U40-1



A20-3310U40-1

THURSDAY, 5 NOVEMBER 2020 – MORNING

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

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

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

You may use a pencil for graphs and diagrams only.

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

Answer **all** 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 all work written on the additional page.

Take π as 3.14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

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

Unless stated, diagrams are not drawn to scale.

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

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

In question 2, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

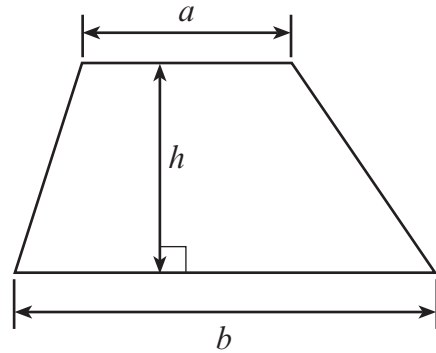
For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	5	
2.	7	
3.	7	
4.	10	
5.	3	
6.	6	
7.	7	
8.	4	
9.	11	
10.	4	
11.	6	
12.	6	
13.	4	
Total	80	



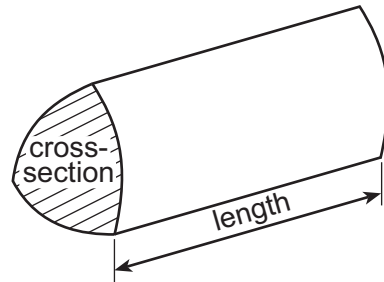
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Formula List – Intermediate Tier

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



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



1. Maldwyn sells flags, scarves and hats outside a stadium.
At the end of a football match, Maldwyn sells his remaining flags, scarves and hats at sale prices.

(a)

Scarf



Was £4.97

Now $\frac{3}{7}$ off in the sale

Flag



£8.50 each

Buy 2 and get **26% off** the total price

- (i) Calculate the sale price of a scarf. [2]

$$\text{Sale price} = (1 - 3/7) \text{ of } £4.97 = 4/7 \times 4.97$$

$$= 4 \times 4.97 \div 7 = 19.88 \div 7$$

$$\text{Sale price of a scarf} = £2.84$$

- (ii) Calculate the cost of buying **two** flags in the sale. [2]

$$\text{Total price of 2 flags} = 2 \times £8.50 = £17.00$$

$$26\% \text{ off, so pay } 74\%: 0.74 \times 17$$

$$\text{Cost of two flags in the sale} = £12.58$$

- (b) Before the sale, a hat cost £3.99.
In the sale, the hat costs £2.66.
By what fraction has the cost of the hat been **reduced**?
Circle your answer. [1]

$$\frac{1}{4}$$

$$\frac{1}{3}$$

$$\frac{2}{3}$$

$$\frac{3}{4}$$

$$\frac{1}{2}$$

$$\text{Reduction} = 3.99 - 2.66 = £1.33, \quad 1.33 \div 3.99 = 0.333... = 1/3$$



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

Huw buys peanuts to feed the birds.

He finds the following prices for buying peanuts.



Bird Feast £16.20 for 12.55 kg	Cheep Feed £32 for 25 kg	Kind to Birds £15.60 for 12 kg
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Which of the above options is the best value for money?
You must show all your working.

[5 + 2 OCW]

I will work out the cost of 1 kg of peanuts for each option.

Bird Feast: $£16.20 \div 12.55 \text{ kg} = £1.2908... \text{ per kg} \approx £1.29 \text{ per kg}$

Cheep Feed: $£32 \div 25 \text{ kg} = £1.28 \text{ per kg}$

Kind to Birds: $£15.60 \div 12 \text{ kg} = £1.30 \text{ per kg}$

Comparing the costs per kg:

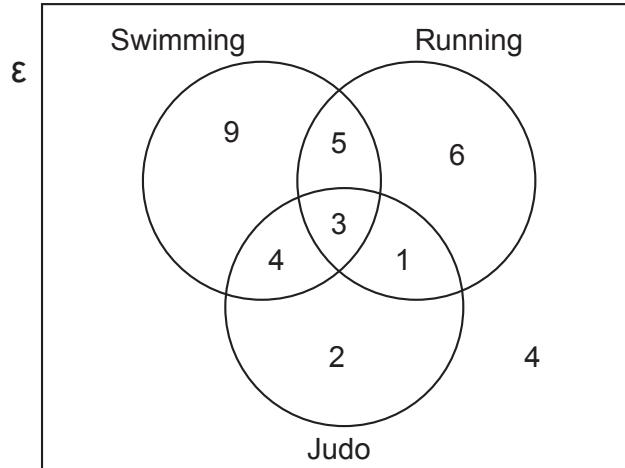
$£1.28 \text{ (Cheep Feed)} < £1.29 \text{ (Bird Feast)} < £1.30 \text{ (Kind to Birds)}$

Cheep Feed has the lowest cost per kilogram, so Cheep Feed

(£32 for 25 kg) is the best value for money.



3. There are 34 pupils in class 10A.
Dewi carried out a survey to find out how many of these pupils take part in swimming, running and judo.
He displayed his results in a Venn diagram, as shown below.



- (a) How many of the pupils in class 10A take part in both judo and running?
Circle your answer.

[1]

1 8 4 3 21

$$\text{Judo and running} = 3 + 1 = 4$$

- (b) How many of the pupils in class 10A take part in swimming?
Circle your answer.

[1]

9 4 14 3 21

$$\text{Swimming} = 9 + 5 + 3 + 4 = 21$$

- (c) How many of the pupils in class 10A **do not** take part in judo?
Circle your answer.

[1]

9 10 20 24 15

$$\text{Not judo} = 34 - (4 + 3 + 1 + 2) = 34 - 10 = 24$$

- (d) Calculate the percentage of the pupils in class 10A who **do not** take part in swimming, running or judo.
Give your answer correct to 1 decimal place.

[4]

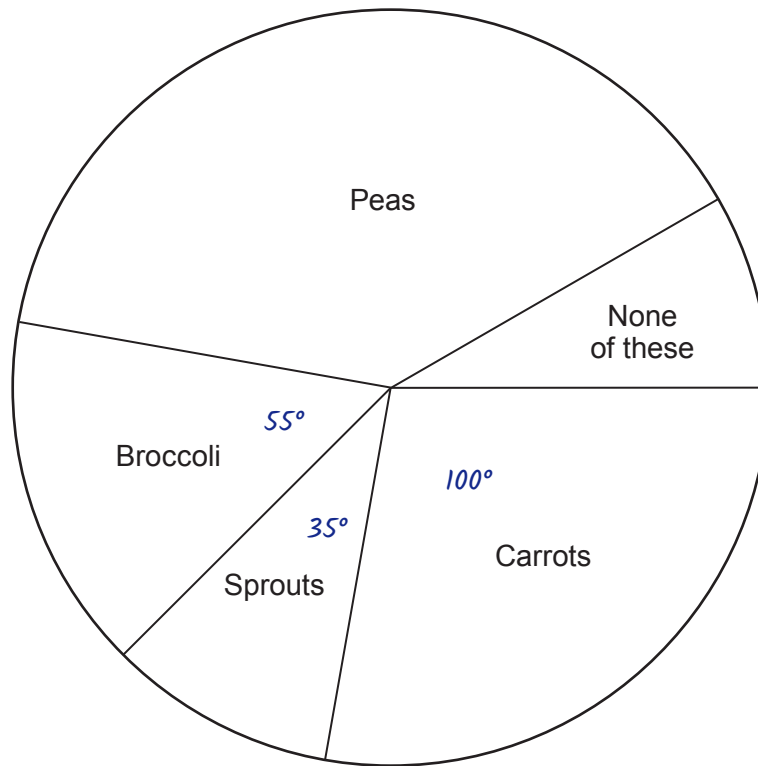
$$\text{Number in none} = 4 \text{ (outside all circles), out of 34 pupils}$$

$$\text{Percentage} = 4 \div 34 \times 100 = 11.7647\ldots\%$$

$$= 11.8\% \text{ (to 1 d.p.)}$$



4. (a) 1080 people were asked to choose their favourite vegetable.
The pie chart shows the results.



- (i) How many people chose broccoli as their favourite vegetable?
You must show all your working.

[3]

$$\text{Angle for broccoli (measured)} = 55^\circ$$

$$\text{Number of people per degree} = 1080 \div 360 = 3$$

$$\text{Broccoli} = 55 \times 3 = 165 \text{ people}$$



- (ii) How many more people chose carrots than chose sprouts as their favourite vegetable?

You must show all your working.

[3]

$$\text{Angle for carrots (measured)} = 100^\circ$$

$$\text{Angle for sprouts (measured)} = 35^\circ$$

$$\text{Difference} = 100^\circ - 35^\circ = 65^\circ$$

$$\text{Each degree} = 1080 \div 360 = 3 \text{ people}$$

$$65 \times 3 = 195$$

195 more people chose carrots than sprouts.

- (b) 420 people selected peas as their favourite vegetable.
They were asked which they preferred: fresh peas, frozen peas or tinned peas.

Of these 420 people, $\frac{3}{14}$ said they preferred fresh peas.

Twice as many people preferred frozen peas to tinned peas.

How many of these people preferred frozen peas?

[4]

$$\text{Fresh peas} = \frac{3}{14} \times 420 = 90 \text{ people}$$

$$\text{Frozen and tinned together} = 420 - 90 = 330 \text{ people}$$

$$\text{Frozen : tinned} = 2 : 1, \text{ so 3 parts} = 330$$

$$1 \text{ part} = 330 \div 3 = 110$$

$$\text{Frozen peas} = 2 \times 110 = 220 \text{ people}$$

220 people preferred frozen peas.



5. Each week in Ysgol Derwen, the headteacher calculates the mean attendance for each class. This is the mean number of half-days per week that students have attended school from Monday to Friday.

There are 5 classes in Year 11.

The headteacher has partially completed a table recording Week 1 attendance for each class in Year 11, as shown below.

Class	Number of pupils	Total number of half-days attended in Week 1	Mean attendance for the 10 half-days in Week 1
11A	28	238	8.5
11B	25	185	7.4
11C	32	304	9.5
11D	30	270	9.0
11E	25	165	6.6
Total	140	1162	

Complete the table.

Hence calculate the overall mean attendance for all of Year 11 in Week 1 at Ysgol Derwen. You must show all your working. [3]

$$11B: 25 \times 7.4 = 185, \quad 11C: 32 \times 9.5 = 304, \quad 11E: 25 \times 6.6 = 165$$

$$\text{Total pupils} = 28 + 25 + 32 + 30 + 25 = 140$$

$$\text{Total half-days} = 238 + 185 + 304 + 270 + 165 = 1162$$

$$\text{Overall mean} = 1162 \div 140$$

$$= 8.3 \text{ half-days}$$

Overall mean attendance for all of Year 11 is 8.3 half-days



6. Last year, Simone's total income before tax was €30 000.

The tax bands, taxable income and tax rates last year were as follows:

Band	Taxable income	Tax rate
Personal Allowance	Up to €4000	0%
Basic rate	€4000 to €10 000	15%
Higher rate	over €10 000	22%

- (a) Show that Simone should have paid €900 tax at the basic rate.
You must show all your working.

[2]

$$\text{Income taxed at basic rate} = €10\,000 - €4000 = €6000$$

$$\text{Basic rate tax} = 15\% \text{ of } €6000 = 0.15 \times 6000$$

$$= €900 \text{ (as required)}$$

- (b) Calculate Simone's **total** tax bill last year.
You must show all your working.

[4]

$$\text{Basic rate tax} = €900 \text{ (from part (a))}$$

$$\text{Income taxed at higher rate} = €30\,000 - €10\,000 = €20\,000$$

$$\text{Higher rate tax} = 22\% \text{ of } €20\,000 = 0.22 \times 20\,000 = €4400$$

$$\text{Personal allowance tax} = 0\% \text{ of } €4000 = €0$$

$$\text{Total tax} = €0 + €900 + €4400$$

$$\text{Simone's total tax bill} = €5300$$



7. In May 2018, the population of Wales was approximately 3 150 000.
Of this population, approximately 286 500 people were aged 75 or over.

In May 2018, a survey in Wales found the following:

- 85% of the population of Wales used the internet,
- 99% of people aged 16 to 24 used the internet,
- 40% of people aged 75 or over used the internet.

- (a) In May 2018, how many people in Wales **did not** use the internet?

[2]

$$100\% - 85\% = 15\% \text{ did not use the internet}$$

$$0.15 \times 3\,150\,000 = 472\,500$$

472 500 people did not use the internet.

- (b) Of all the internet users in Wales in May 2018, what percentage were aged 75 or over?
Give your answer correct to 2 significant figures.
You must show all your working.

[5]

$$\text{Internet users aged 75 or over} = 0.40 \times 286\,500 = 114\,600$$

$$\text{All internet users} = 0.85 \times 3\,150\,000 = 2\,677\,500$$

$$\text{Percentage aged 75 or over} = 114\,600 \div 2\,677\,500 \times 100$$

$$= 4.2801\ldots\%$$

$$= 4.3\% \text{ (to 2 s.f.)}$$



8. In Cuba, urban gardens are used for food production.

$$1 \text{ acre} \approx 0.00405 \text{ km}^2$$



35 000 acres of urban gardens in Cuba produced 3.4 million tonnes of food in 2002.

Calculate the number of tonnes of food produced per km^2 in urban gardens in Cuba in 2002.
You must show all your working. [4]

$$\text{Area in km}^2: 35\,000 \text{ acres} \times 0.00405 = 141.75 \text{ km}^2$$

$$\text{Food} = 3.4 \text{ million tonnes} = 3\,400\,000 \text{ tonnes}$$

$$\text{Food per km}^2 = 3\,400\,000 \div 141.75$$

$$= 23\,985.89... \text{ tonnes per km}^2$$

$$\approx 23\,986 \text{ tonnes of food per km}^2$$



9. Formula One cars are some of the fastest racing cars in the world.

The cars' top speeds are up to 375 km/h and their engines are limited to 15 000 rotations per minute.

The Monaco Grand Prix is the shortest Formula One race with 78 laps of the track and a total distance of 260.5 km.

Fernando Alonso won the Monaco Grand Prix in 2007. He completed the race with an average speed of 155.552 km/h.



- (a) Complete the following statement.

'Top speeds of Formula One cars are up to 234.4..... mph.' [2]

5 miles = 8 km, so 1 mile = 1.6 km

$375 \div 1.6 = 234.375 \text{ mph} \approx 234.4 \text{ mph}$

- (b) Calculate Alonso's average lap time for the 2007 Monaco Grand Prix. Give your answer in minutes. You must show all your working. [4]

Length of one lap = $260.5 \text{ km} \div 78 = 3.3397... \text{ km}$

Time for one lap = distance $\div$ speed

$= 3.3397... \div 155.552 = 0.021470... \text{ hours}$

In minutes: $0.021470... \times 60 = 1.2882... \text{ minutes}$

Average lap time = 1.29 minutes (to 2 d.p.)

- (c) Which number from the list below would correctly complete the following statement? Circle your answer. [1]

'Formula One engines are limited to rotations **per second**.'

900 000

250

300

4.17

54 million

$15\ 000 \text{ rotations per minute} \div 60 \text{ seconds} = 250 \text{ rotations per second}$



- (d) Typical exchange rates in 2018 were as follows.
- £1 = 1.38 US dollars
 - £1 = 1.14 euros

In 2018, the average annual cost of running a Formula One race team was 250 million US dollars.

Complete the following statement.

'In 2018, the average **monthly** cost of running a Formula One race team was 17.2..... million euros.'

You must show all your working.

[4]

Annual cost in pounds = $250 \div 1.38 = \text{£}181.1594... \text{ million}$

Annual cost in euros = $181.1594... \times 1.14 = \text{€}206.5217... \text{ million}$

Monthly cost = $206.5217... \div 12 = \text{€}17.2101... \text{ million}$

$\approx 17.2 \text{ million euros per month}$



10. Ruth measures the lengths of 5 square pictures.
The measurements she records are as follows.

21 cm

22 cm

23 cm

24 cm

26 cm

Each of these measurements is **correct to the nearest cm**.

She plans to display all 5 pictures in a line, edge to edge, on a shelf of a bookcase.
The length of the shelf is 120 cm, **correct to the nearest 5 cm**.

Show that the shelf could be 1 cm too short to display all 5 of these pictures.
You must show all your working.

[4]

Upper bounds of the pictures (nearest cm, so add 0.5 cm):

21.5 cm, 22.5 cm, 23.5 cm, 24.5 cm, 26.5 cm

Greatest total length = 21.5 + 22.5 + 23.5 + 24.5 + 26.5

= 118.5 cm

Lower bound of shelf (nearest 5 cm, so subtract 2.5 cm):

120 - 2.5 = 117.5 cm

Difference = 118.5 - 117.5 = 1 cm

So the shelf could be 1 cm too short to display all 5 pictures.



11. (a) In March 2014, there were an estimated 6 550 000 000 two pence coins in circulation.

Calculate the value of these 2p coins in **pounds** (£).

Give your answer in standard form.

You must show all your working.

[3]

$$2p = £0.02$$

$$\text{Value} = 6\,550\,000\,000 \times 0.02$$

$$= £131\,000\,000$$

$$= £1.31 \times 10^8$$

- (b) The 2p coin is made from a mixture of metals.
It has a diameter of 25.9 mm and a thickness of 2.03 mm.

The 2p coin can be considered to be a cylinder.

Calculate the volume of metal in a 2p coin.



[3]

$$\text{Radius} = 25.9 \div 2 = 12.95 \text{ mm}$$

$$\text{Volume} = \pi r^2 h = \pi \times 12.95^2 \times 2.03$$

$$= \pi \times 167.7025 \times 2.03 = 1069.511... \text{ mm}^3$$

$$\text{Volume of metal} = 1069.5 \text{ mm}^3 \text{ (to 1 d.p.)}$$



12. The Leaning Tower of Pisa stands on horizontal ground. The vertical height of the tower on the higher side is 56.7 m. The top of the tower is displaced 3.9 m horizontally.

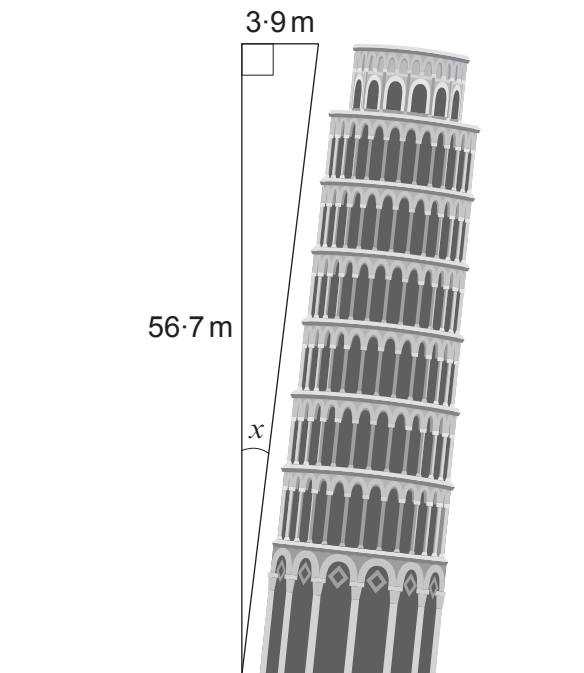


Diagram not drawn to scale

- (a) Calculate the angle, x , at which the tower leans. Give your answer correct to 2 decimal places. You must show all your working.

[4]

$$\tan x = \text{opposite} \div \text{adjacent} = 3.9 \div 56.7$$

$$\tan x = 0.068783\dots$$

$$x = \tan^{-1}(3.9 \div 56.7)$$

$$x = 3.93478\dots^\circ$$

$$x = 3.93^\circ \text{ (to 2 d.p.)}$$



- (b) Ceri plans to make a poster that is mathematically similar to the Leaning Tower of Pisa.

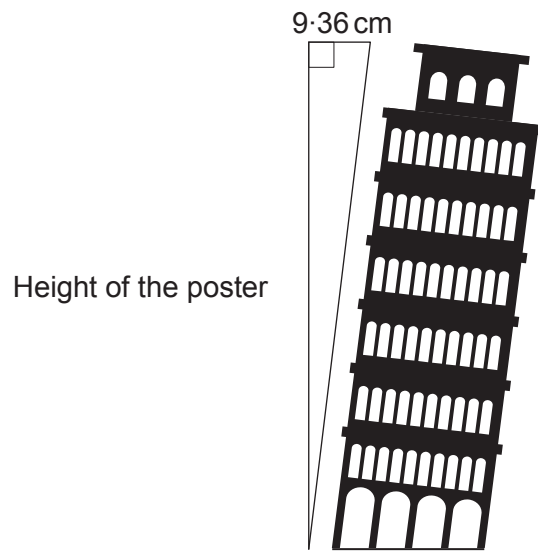


Diagram not drawn to scale

Calculate the height of the poster Ceri plans to make.

[2]

$$\text{Scale factor} = 9.36 \div 3.9 = 2.4$$

$$\text{Height of poster} = 56.7 \times 2.4$$

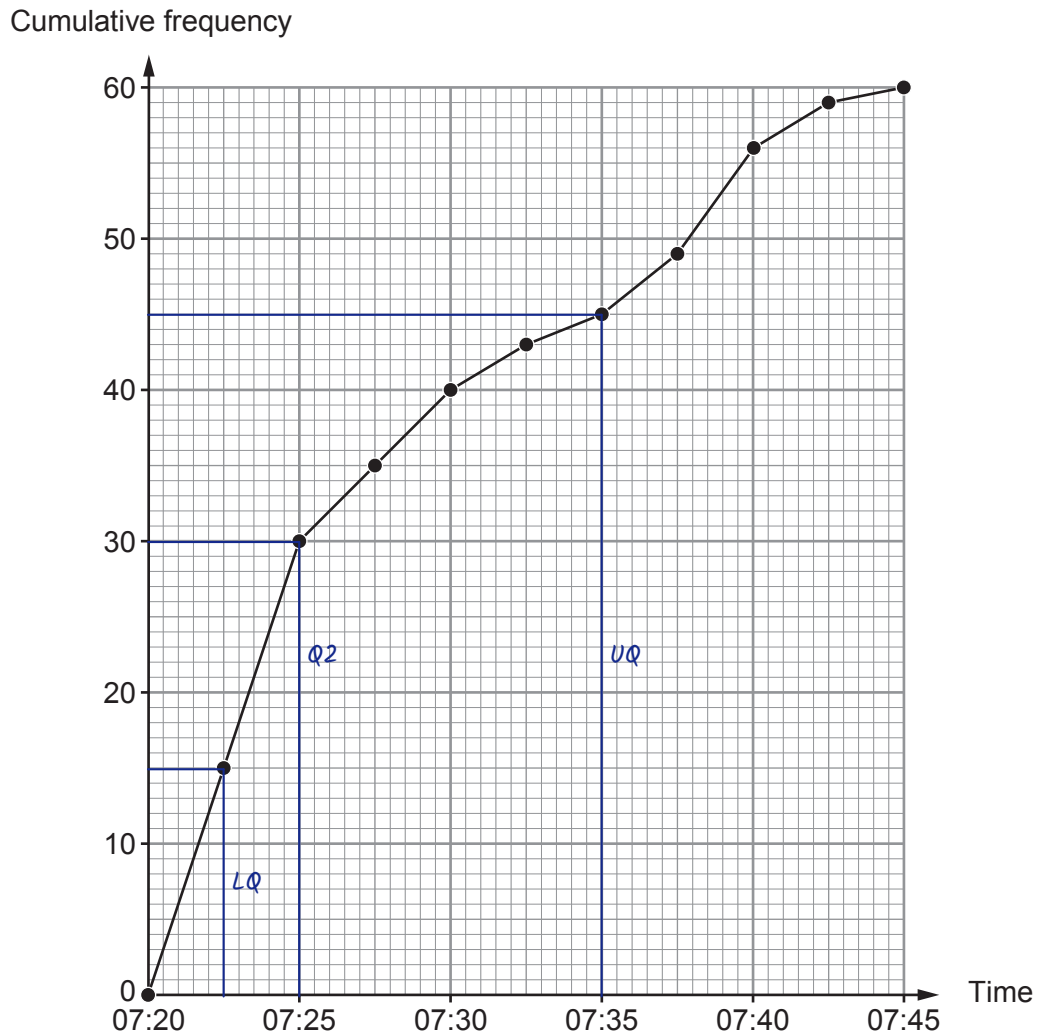
$$= 136.08 \text{ cm}$$

$$\text{Height of the poster} = 136.08 \text{ cm}$$



13. On Wednesday, there were no cars in a car park when it opened at 7:00 a.m. From 7:00 a.m., the number of cars entering the car park was recorded.

The cumulative frequency diagram has been drawn from the results.



- (a) How many cars had entered the car park by 7:35 a.m.?

[1]

Read across from 07:35 on the graph: 45 cars

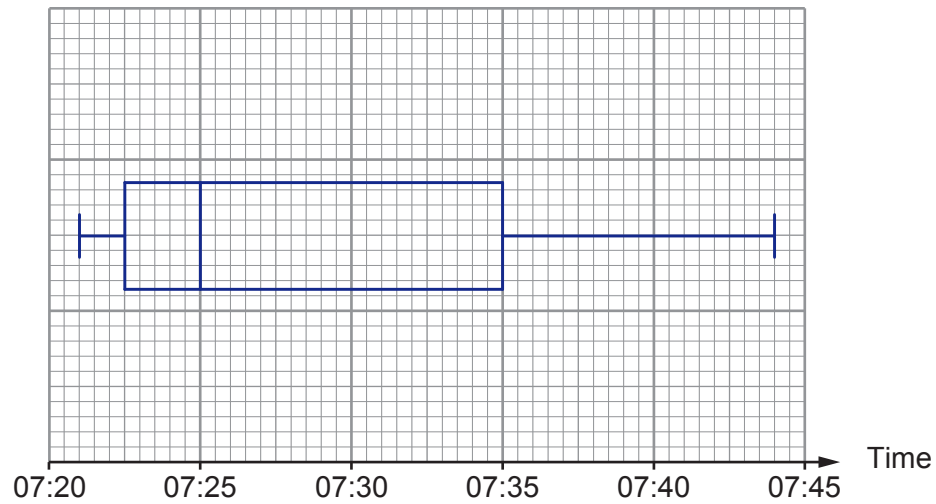
60 cars: LQ = 15th car, median = 30th car, UQ = 45th car

LQ = 07:22.5, median = 07:25, UQ = 07:35



- (b) The first car entered the car park at 7:21 a.m.
The last car entered the car park at 7:44 a.m.

Draw a box-and-whisker plot using this information and the data from the cumulative frequency diagram. [3]



Min 07:21, LQ 07:22.5, median 07:25, UQ 07:35, max 07:44

END OF PAPER



[illegible]