Mathematics

Unit M4
(With calculator)
Higher Tier

[GMC41]   *GMC41*

MONDAY 29 NOVEMBER, 9.15am–11.15am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of
this page.
**You are provided with Higher Tier Additional Support Materials for use with this paper.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.**
Complete in black ink only. **Do not write with a gel pen.**
Answer **all twenty-four** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for
partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to
each question or part question.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

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Formula Sheet

Volume of prism = area of cross section × length

cross section

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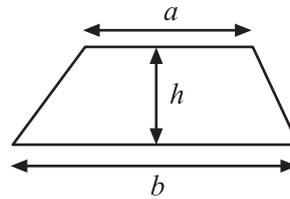
Volume of sphere $= \frac{4}{3}\pi r^3$

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

Quadratic Equation
The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by

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

Area of trapezium $= \frac{1}{2}(a+b)h$
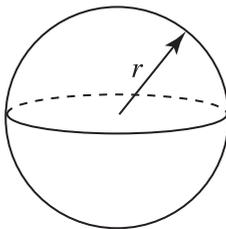
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi rl$

In any triangle ABC

Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle $= \frac{1}{2} ab \sin C$

1 A trapezium is drawn below.

7 cm

5 cm y 5 cm

diagram
not drawn
accurately

11 cm
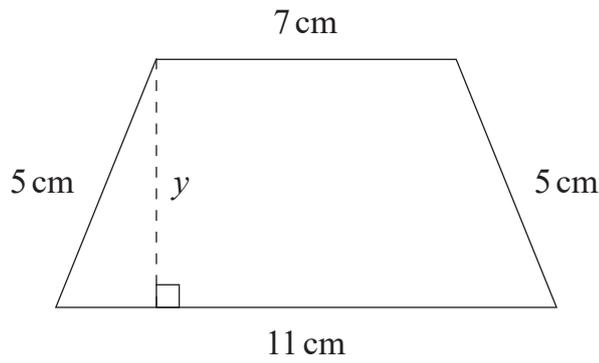
Calculate its height y.

Answer _____ cm [4]

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28GMC4103

2 A number, expressed as a product of its prime factors, is $2^2 \times 3 \times 5^2$

(a) This number is multiplied by 9

Write the new number as a product of its prime factors.

Answer _____ [1]

(b) Is this new number a square number?

You must explain your answer.

Answer _____ because _____

_____ [1]

3 Jane completes a 5 km race in 24 minutes.

Calculate her average speed in km/hr.

Answer _____ km/hr [2]

4 Last year a company made a profit of £152 650

This year the company made a profit of £104 760

Work out the percentage decrease in the company's profit.

Give your answer to 1 decimal place.

Answer _____ % [3]

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28GMC4105

5   James can throw a javelin 49 metres.

His target is to throw it 4% further each year.

If he stays on target, how many years will it be before he can throw the javelin 55 metres?

You must show working to justify your answer.

Answer _____ years [4]

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6 The number of hours of daily sunshine is recorded at a resort during four months.

Hours of daily sunshine	Frequency		
$0 < h \leq 3$	18		
$3 < h \leq 6$	45		
$6 < h \leq 9$	37		
$9 < h \leq 12$	19		
$12 < h \leq 15$	4		

Calculate an estimate of the mean number of hours of daily sunshine at the resort during the four months.

Answer _____ hours [4]

[Turn over

7 Janet sees a scatter graph which displays the age and blood pressure of 10 adults.
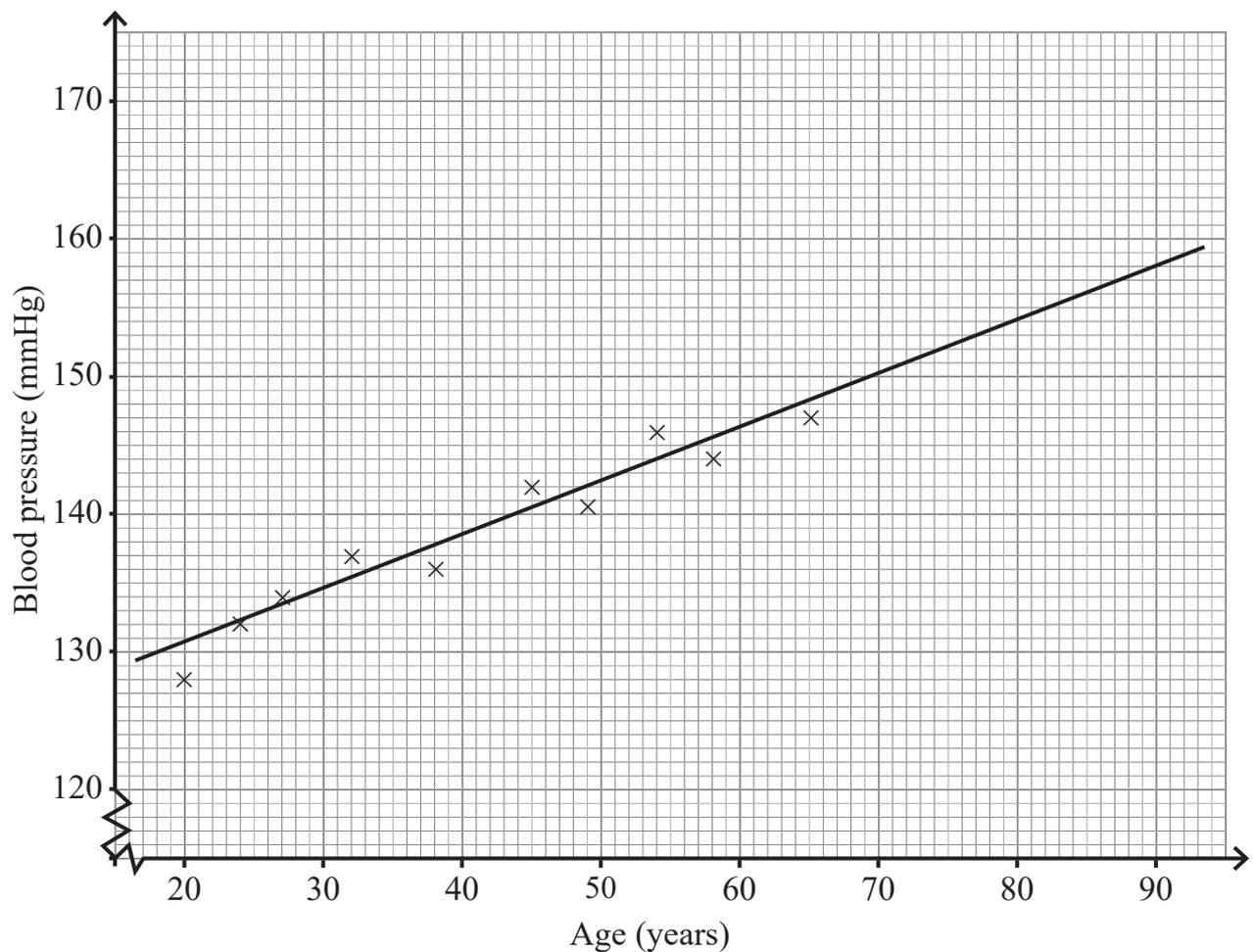
Janet is aged 41 and her father is 84

She comments that a good estimate for her blood pressure would be 139 whilst a good estimate for her father's would be 156

Do you think her estimates are reliable? Explain your reasoning clearly.

_____

_____

_____ [2]

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8 The diagrams below show a square and an isosceles triangle.

c

c + 3   c + 3

5
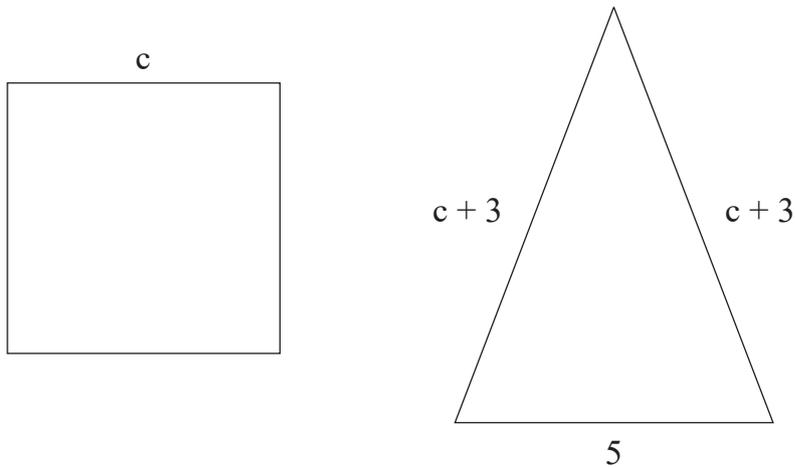
diagrams
not drawn
accurately

They have the same perimeter.

By forming and solving an equation, work out the perimeter.

Answer _____ [4]

9 Calculate the surface area of a sphere with diameter 12 cm.

Answer _____ cm^2 [2]

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10 Calculate the size of the largest angle in the rhombus.

16 cm

30 cm
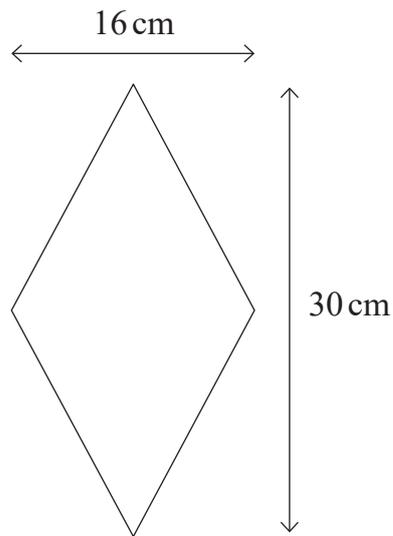
diagram
not drawn
accurately

You must show your working.

Answer _____ ° [4]

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11 Mr Davison's class did a test.

Their scores are shown on the box plot, but the box plot is incomplete.
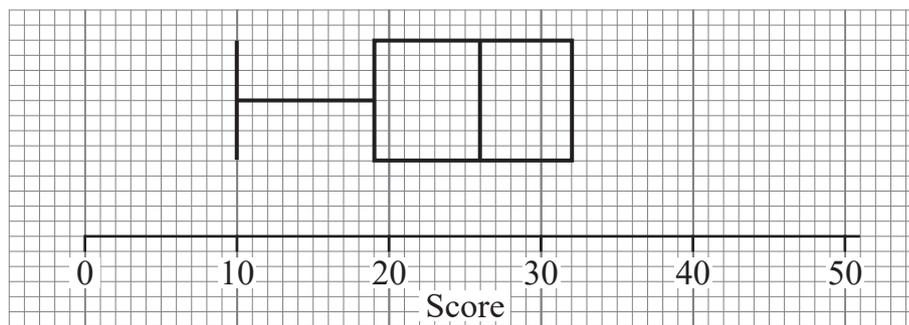
(a) The range of scores is 25 more than the interquartile range.

Use this information to complete the box plot.

[2]

(b) Explain why the interquartile range may be a better measure of spread for this distribution than the range.

_____

_____ [1]

(c) Kevin scored 32 marks in the test.

What percentage of the class scored lower than Kevin?

Answer _____ % [1]

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(d) Mrs Clarke's class did the same test.

Their scores are shown on the box plot below.

Score
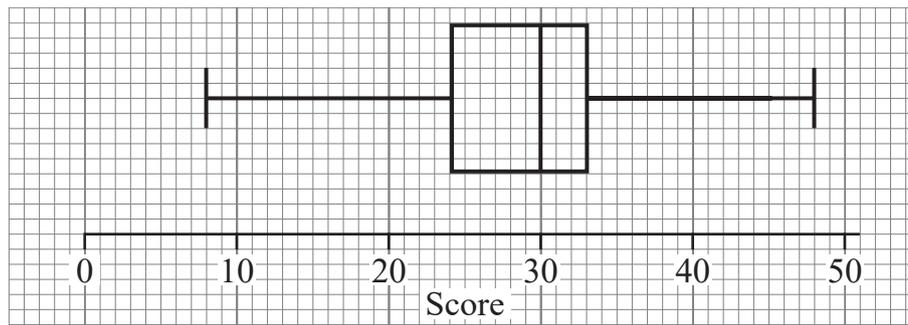
Write two comparisons between the results of the two classes.

_____

_____

_____ [2]

12 A survey was carried out to estimate how many people own a smartphone.

The results of the sample are shown below.

Do own a smartphone	236
Do not own a smartphone	64

(a) Based on this sample, estimate the number of people in a town with a population of 15 000 who might own a smartphone.

Answer _____ [1]

(b) The sample data was obtained from a group of 17 year olds.

Do you think your result in **(a)** is an overestimate or an underestimate for the number of people in the town who own a smartphone?

Explain your reasoning.

Answer _____ because _____

_____

_____ [1]

(c) Outline a better way of obtaining the sample data.

_____

_____ [1]

13 Solve $\dfrac{2x-1}{5} + \dfrac{4x+5}{3} = \dfrac{20}{3}$

A solution by trial and improvement will not be accepted.

Answer _____ [4]

[Turn over

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14 The value of John's house has risen by 3.5%

It is now worth £150 075

What was the original value of John's house?

Answer £ _____ [3]

15 (a) Expand and simplify $(2x - 5)(3x + 2)$

Answer _____ [3]

(b) Simplify $\dfrac{x^2 - 49}{2x - 14}$

Answer _____ [2]

(c) Factorise $8x^2 - 10x - 3$

Answer _____ [3]

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28GMC4117

16 The area of rectangle A is four times the area of square B.

By setting up and solving a quadratic equation, find the value of x.

A solution by trial and improvement will receive no marks.

←————————— 24 cm —————————→

A

8 cm   diagram
        not drawn
        accurately

B

←x cm→

Answer $x =$ _____ [6]

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28GMC4118

17
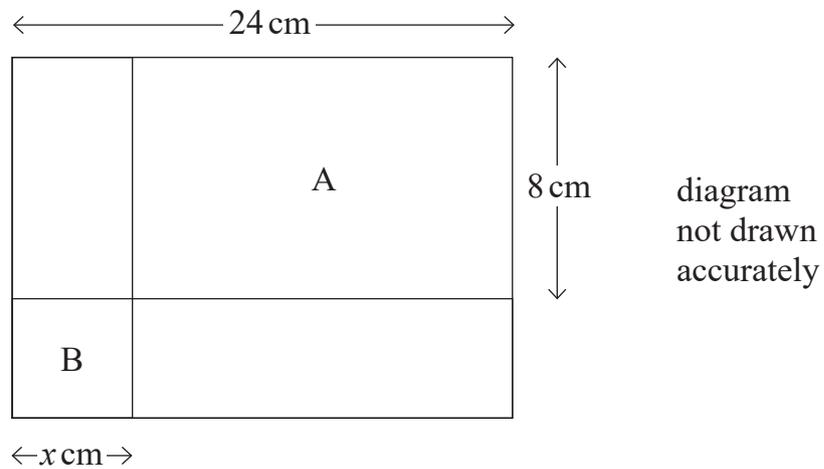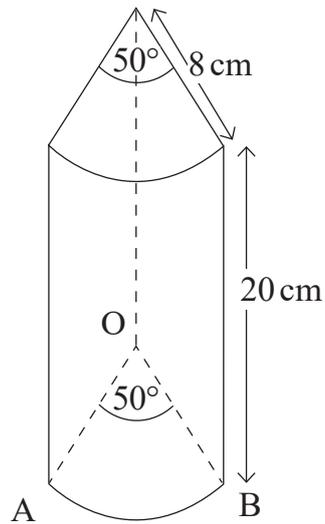
A solid prism has base OAB, the sector of a circle, and height 20 cm.

Radius OA = 8 cm and angle AOB = 50°.

Calculate the total surface area of the prism.

Answer _____ cm^2 [7]

18 Find the equation of the straight line which is perpendicular to the line $y = 3x + 2$ and passes through the point (9,1).

Give your answer in the form $y = mx + c$

Answer _____ [3]

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19
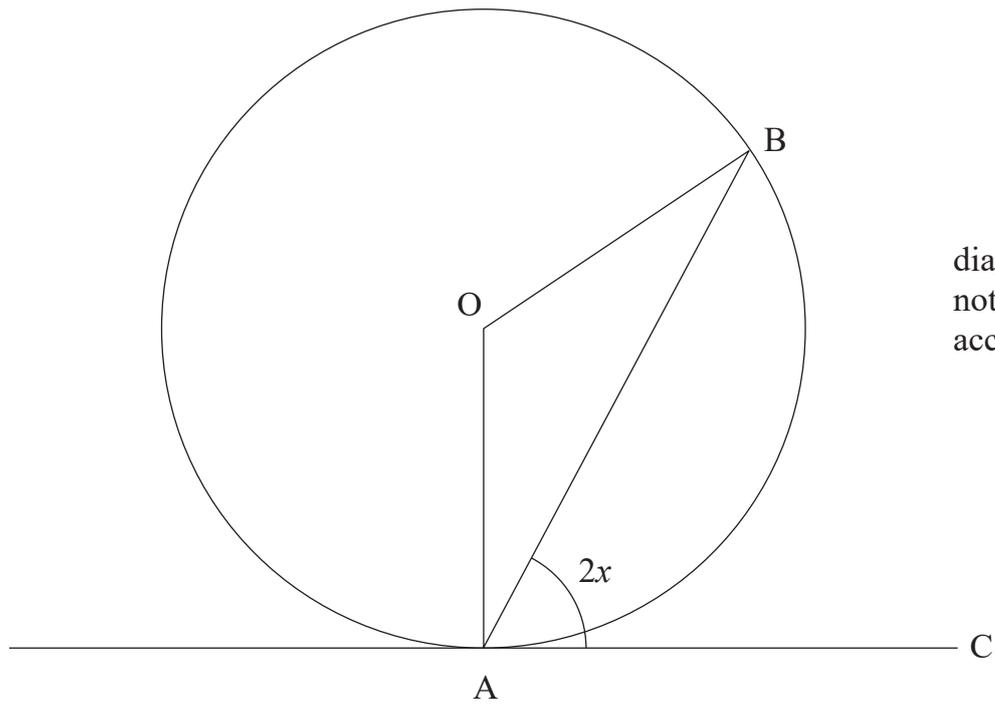
diagram not drawn accurately

A and B are points on the circumference of a circle, centre O.

AC is a tangent to the circle.

Angle BAC = $2x$

Find the size of the angle AOB, in terms of x, giving a reason for each stage of your working.

Answer _____ ° [3]

28GMC4121

20 Factorise $2x^2 - 5xy - 3y^2$

Answer _____ [3]

21 Jack says the distance from Larne to Enniskillen is 110 miles to the nearest 10 miles.

He drove this distance at an average speed of 45 mph to the nearest 5 mph.

Calculate the least amount of time the journey could have taken.

Give your answer in hours and minutes, to the nearest minute.

Answer _____ hr _____ min [4]

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28GMC4123

22 Simplify

$$\frac{ax + 2x - ay - 2y}{x^2 - y^2}$$

Answer _____ [3]

23 Solve the following equation giving your answers to 2 decimal places.

$$\frac{x-3}{x+4} - \frac{2x+1}{x+2} = 3$$

Answer _____ [8]

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24 The histogram below shows the prices of televisions sold online one month.
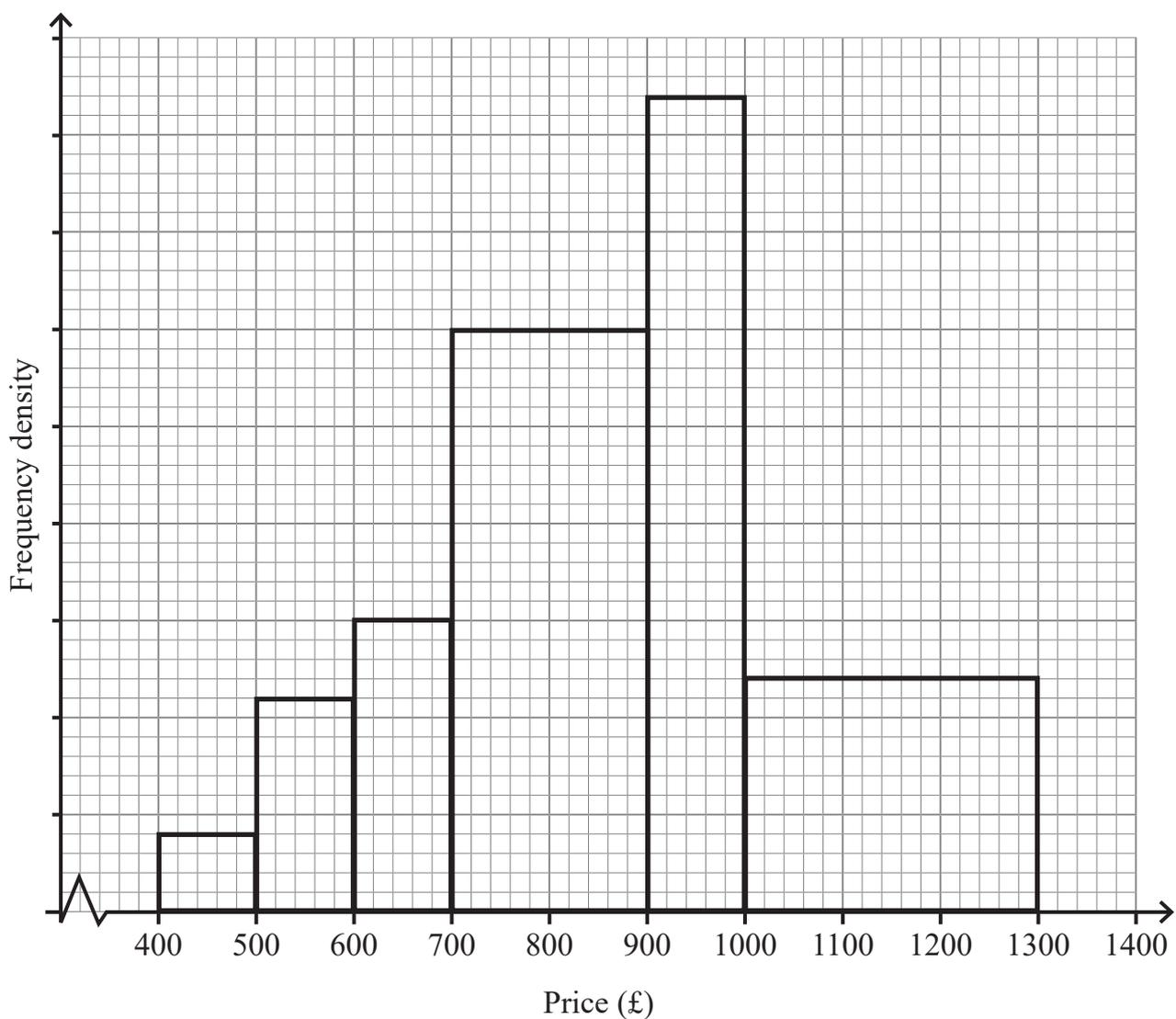
150 televisions cost less than £600

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(a) Calculate the number of televisions costing between £900 and £1200

Answer _____ [4]

(b) A stratified sample is taken.

Given that 11 televisions are sampled from the £500–£600 group, find the number of televisions in the sample.

Answer _____ [4]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

28GMC4128