

Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

Candidate signature \_\_\_\_\_

I declare this is my own work.

# GCSE MATHEMATICS

Higher Tier

Paper 2 Calculator

# H

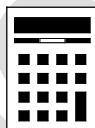
Shadow paper based on November 2021 question paper

Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- a calculator
- mathematical instruments.



## Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

## Advice

In all calculations, show clearly how you work out your answer.

| For Examiner's Use |      |
|--------------------|------|
| Pages              | Mark |
| 2–3                |      |
| 4–5                |      |
| 6–7                |      |
| 8–9                |      |
| 10–11              |      |
| 12–13              |      |
| 14–15              |      |
| 16–17              |      |
| 18–19              |      |
| 20–21              |      |
| 22–23              |      |
| 24                 |      |
| <b>TOTAL</b>       |      |

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

Do not write  
outside the  
box

- 1** Circle the factor of  $x^2 + 2x$  **[1 mark]**

$x + 1$

$-2x$

$x + 2$

$2x$

- 2**  $B$  is one third of  $A$ .  
Work out the ratio  $A : B$   
Circle your answer. **[1 mark]**

$1 : 3$

$3 : 1$

$1 : 4$

$4 : 1$

- 3** The first three terms of a geometric progression are  $\frac{2}{5}$   $\frac{4}{25}$   $\frac{8}{125}$   
Circle the fourth term. **[1 mark]**

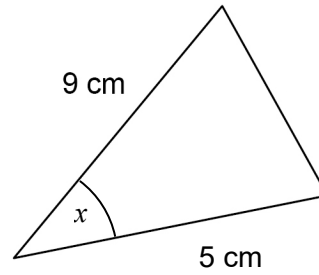
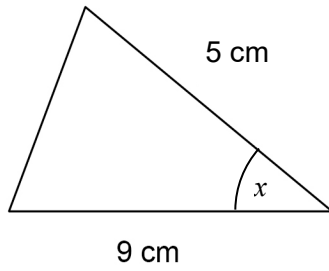
$\frac{10}{625}$

$\frac{12}{625}$

$\frac{16}{625}$

$\frac{32}{625}$

4

Not drawn  
accuratelyDo not write  
outside the  
box

Circle the reason why these triangles are congruent.

[1 mark]

ASA

RHS

SAS

SSS

5

Solve  $12x = 98.8 - 7x$ 

[2 marks]

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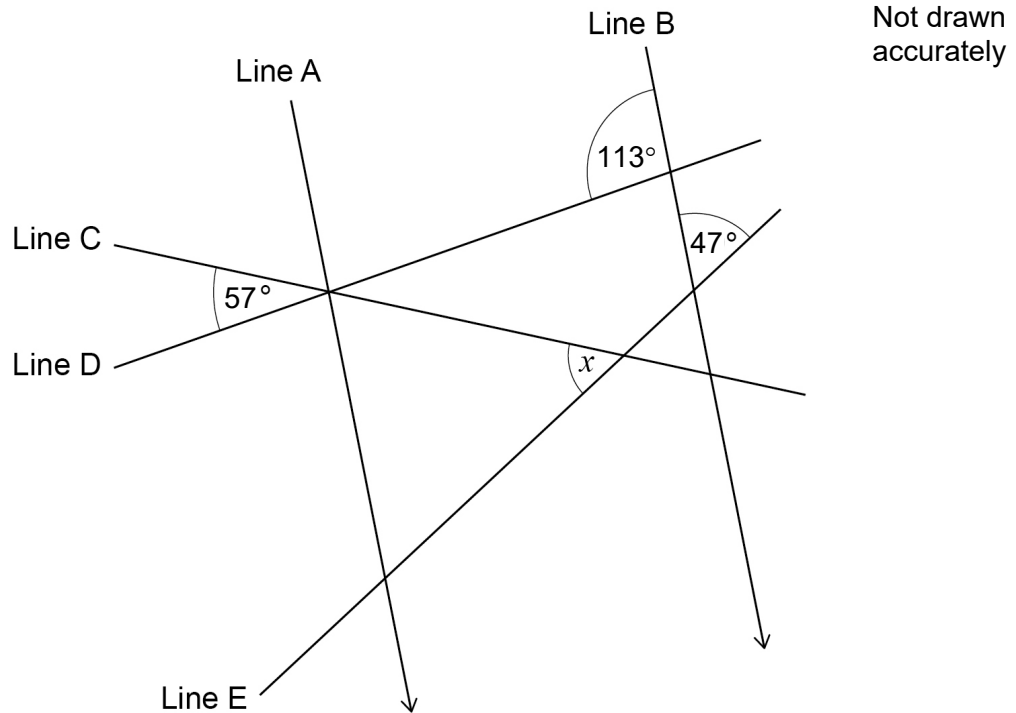
 $x =$  \_\_\_\_\_

Turn over ►

6

Lines A, B, C, D and E intersect as shown.

Lines A and B are parallel.

Work out the size of angle  $x$ .**[3 marks]**

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Answer \_\_\_\_\_ degrees

The table shows information about the mean amount spent, in pounds, by each person.

|                       | Women | Men   |
|-----------------------|-------|-------|
| Number of people      | 112   | 95    |
| Mean amount spent (£) | 68.50 | 52.40 |

The national mean for clothes spending per person in February was £63.

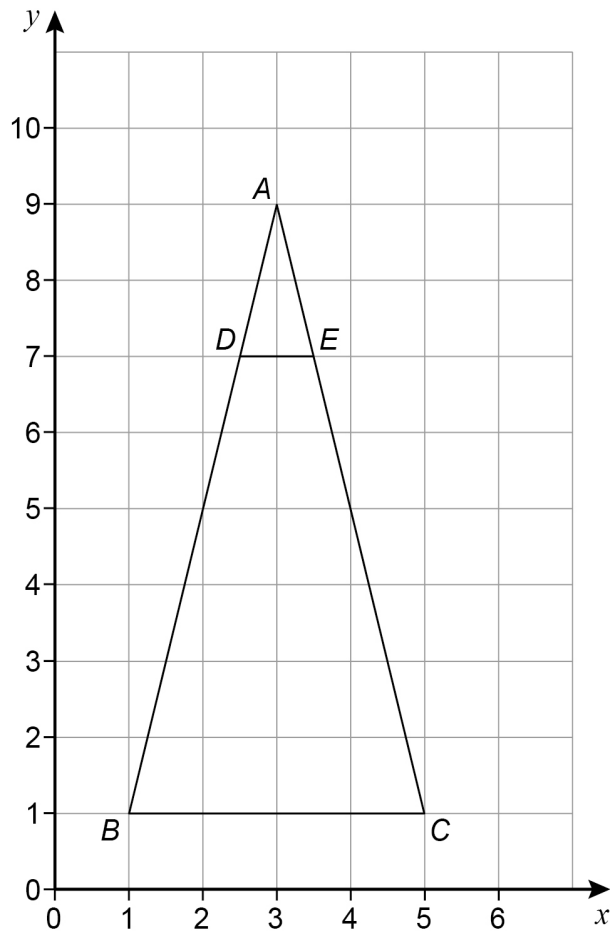
Was the mean spend for the people in Bolton greater than the national mean in February?

You **must** show your working.

**[3 marks]**

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

8



Describe fully the **single** transformation that maps triangle  $ADE$  to triangle  $ABC$ .

[3 marks]

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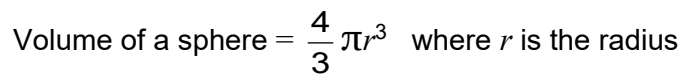
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A ball contains  $3000 \text{ cm}^3$  of air.

The ball is full of air when it becomes a sphere with radius 20 cm



You **must** show your working.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

10

 $a$  is a negative number. $b$  is a negative number.

For each statement, tick the correct box.

**[4 marks]**

|                            | Always true              | Sometimes true           | Never true               |
|----------------------------|--------------------------|--------------------------|--------------------------|
| $a + b$ is positive        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| $a - b$ is positive        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| $a^2 + b^2$ is positive    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| $a^3 \div b^3$ is positive | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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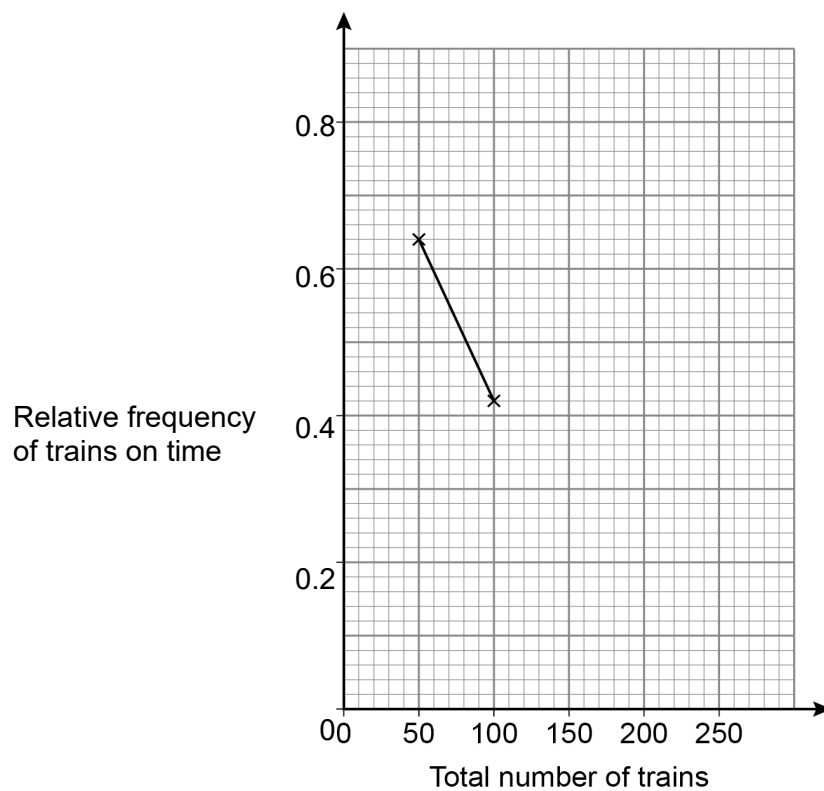
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- 11** 250 trains arrived at a station.  
The number of trains that were on time was recorded after every 50 trains.  
The table shows some information about the results.

|                                             |      |      |     |     |     |
|---------------------------------------------|------|------|-----|-----|-----|
| <b>Total number of trains</b>               | 50   | 100  | 150 | 200 | 250 |
| <b>Total number of trains on time</b>       | 32   | 42   | 108 | 160 | 185 |
| <b>Relative frequency of trains on time</b> | 0.64 | 0.42 |     |     |     |

- 11 (a)** Complete the relative frequency graph.

[3 marks]



- 11 (b)** Write down the best estimate of the probability that a train arriving at the station is on time.

[1 mark]

Answer \_\_\_\_\_

$A$ ,  $B$  and  $C$  are three points on a circle.  
The radii from  $A$ ,  $B$  and  $C$  are shown.

A diagram showing two concentric circles. A line segment from the center to the outer circle is divided into three parts by a line segment from the center to the inner circle. The segments are labeled with expressions:  $x$ ,  $5x + 30^\circ$ , and  $2(2x + 25^\circ)$ . The points on the outer circle are labeled A, B, and C.

**[3 marks]**

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.

13

A straight line

has gradient 5

and

passes through the point (3, 11)

Work out the equation of the line.

Give your answer in the form  $y = mx + c$ **[3 marks]**

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Answer \_\_\_\_\_

**Turn over for the next question**

**14** The population of moths in a park is 5800

**14 (a)** Assume that the population increases by 15% each day.

Show that after 12 days the population would be greater than 30 000

**[2 marks]**

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**14 (b)** In fact, the population  
increases by 17% each day for 11 days  
then  
**decreases** by 9% for 1 day.

After the 12 days, is the actual population greater than 30 000 ?

Tick a box.

☐

Yes

☐

No

Show working to support your answer.

**[2 marks]**

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- 14 (c)** The expected number of visitors to the park each day depends on the temperature.

| Temperature    | Expected number of visitors each day |
|----------------|--------------------------------------|
| Less than 20°C | 500                                  |
| 20°C or more   | 700                                  |

On each of the 31 days in July

the park is open

the probability that the temperature is less than 20°C is 0.3

Work out the **total** number of expected visitors to the park in July.

**[3 marks]**

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Answer \_\_\_\_\_

- 15**  $y$  is inversely proportional to  $x^2$   
 $y = 6$  when  $x = 2$

- 15 (a)** Work out an equation connecting  $y$  and  $x$ .

**[3 marks]**

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Answer \_\_\_\_\_

- 15 (b)** Work out the value of  $y$  when  $x = 5$

**[2 marks]**

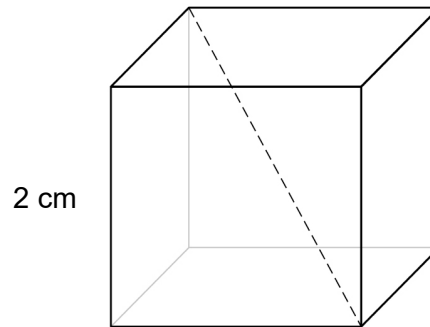
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Answer \_\_\_\_\_

- 16** Here is a cube with edge length 2 cm  
One diagonal is shown.



- 16 (a)** Circle the length, in centimetres, of the diagonal.

[1 mark]

|            |            |             |   |
|------------|------------|-------------|---|
| $\sqrt{6}$ | $\sqrt{8}$ | $\sqrt{12}$ | 8 |
|------------|------------|-------------|---|

- 16 (b)** The total length, in centimetres, of the edges of a different cube is a multiple of 24  
Circle the correct statement.

[1 mark]

|                                                 |                                                            |                                                              |
|-------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------|
| The length of each side<br>is a<br>whole number | The length of each side<br>is <b>not</b> a<br>whole number | The length of each side<br><b>might</b> be a<br>whole number |
|-------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------|

Turn over for the next question

- 17** 30 people were asked which public transport they used more often, bus or train.  
The table shows the results.

|        | Bus | Train |
|--------|-----|-------|
| Male   | 4   | 10    |
| Female | 9   | 7     |

- 17 (a)** One male and one female are chosen at random.

Work out the probability that **exactly** one of them said bus.

**[3 marks]**

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Answer \_\_\_\_\_

- 17 (b)** Two males are chosen at random.

Work out the probability that they **both** said train.

**[2 marks]**

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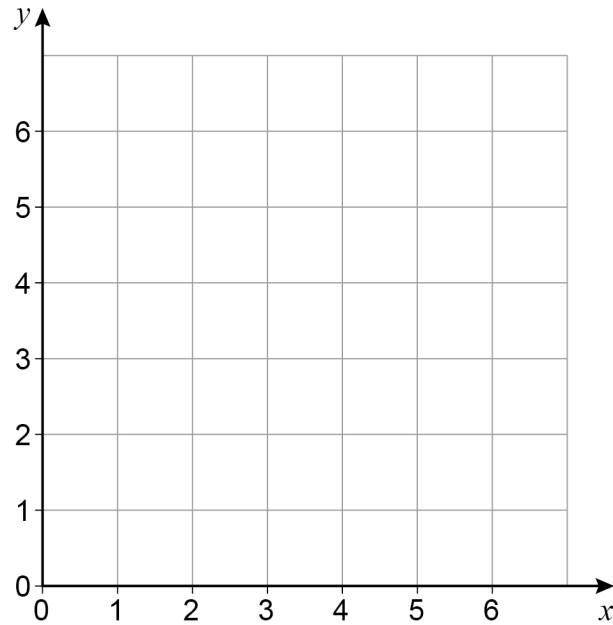
Answer \_\_\_\_\_

**18** On the grid, identify the region represented by

$$x \leq 4 \quad y < 6 \quad x + y \geq 6$$

Label the region R.

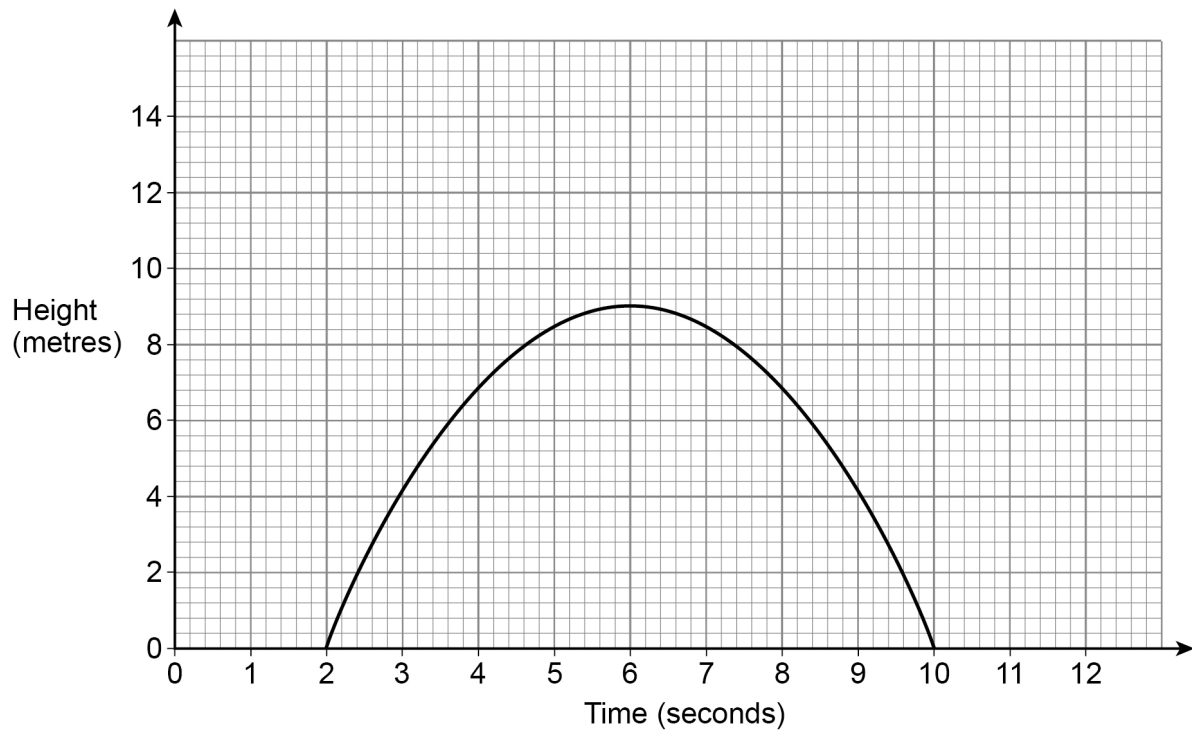
**[3 marks]**



**Turn over for the next question**

**Turn over ►**

- 19** The graph shows the height above ground of a toy rocket for 10 seconds.



- 19 (a)** For how long is the rocket in the air?  
Circle your answer.

**[1 mark]**

10 seconds

8 seconds

5 seconds

2 seconds

- 19 (b)** Using the graph, estimate the speed of the rocket after 4 seconds.  
State the units of your answer.

**[3 marks]**

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Answer \_\_\_\_\_

- 20** A square has an area of 1.44 square centimetres.  
Circle the length, in **millimetres**, of one side of the square.

**[1 mark]**

1.2 mm

12 mm

120 mm

1200 mm

**Turn over for the next question**

$x$  is an integer.

Prove that  $(3x - 1)^2 - 2x(4x + 2) + 24$  is a square number.

**[4 marks]**

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

She knows the rule that

the second digit is a factor of 18

the third digit is a square number.

Maria tries at random a password that matches the rule.

Work out the probability that this is the correct password.

**[4 marks]**

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

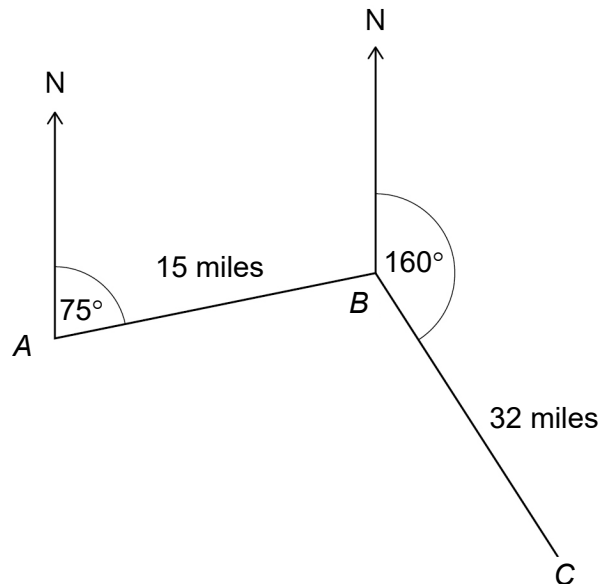
Answer

**23**

A ship sails from  $A$  to  $B$  and then from  $B$  to  $C$ .

$B$  is 15 miles from  $A$ , on a bearing of  $075^\circ$

$C$  is 32 miles from  $B$ , on a bearing of  $160^\circ$



Not drawn  
accurately

Work out the direct distance from  $A$  to  $C$ .

**[4 marks]**

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Answer \_\_\_\_\_ miles

The journey of a train was in two stages.  
The table shows information about the journey.

|                  | Distance (km) | Speed (km/h) | Time (hours)         |
|------------------|---------------|--------------|----------------------|
| <b>1st stage</b> | 306           | $x - 16$     | $\frac{306}{x - 16}$ |
| <b>2nd stage</b> | 550           | $x$          | $\frac{550}{x}$      |

Work out the value of  $x$ .

**[5 marks]**

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be a standard notebook page or a sheet of stationery.

Answer

25 The equation of a curve is  $y = x^2 - 12x + 32$

By completing the square, work out the coordinates of the turning point.

You **must** show your working.

[3 marks]

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Answer ( \_\_\_\_\_ , \_\_\_\_\_ )

**END OF QUESTIONS**

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outside the  
box*

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ANSWER IN THE SPACES PROVIDED**

[illegible]

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8300/2H

| Question number | Additional page, if required.<br>Write the question numbers in the left-hand margin. |
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