For this paper you must have:
• mathematical instruments.

You must not use a calculator.

Time allowed
• 1 hour 30 minutes

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.
• Do all rough work in this book.

Information
• The marks for questions are shown in brackets.
• The maximum mark for this paper is 70.
• The quality of your written communication is specifically assessed in Questions 5, 19 and 21. These questions are indicated with an asterisk (*).
• You may ask for more answer paper, tracing paper and graph paper. These must be tagged securely to this answer book.

Advice
• In all calculations, show clearly how you work out your answer.
Formulae Sheet: Higher Tier

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

Volume of prism = area of cross-section × 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 = \( \pi rl \)

In any triangle \( ABC \)
Area of triangle = \( \frac{1}{2} ab \sin C \)

Sine rule \( \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \)

Cosine rule \( a^2 = b^2 + c^2 - 2bc \cos A \)

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 (a) Multiply out $5(3x + 7)$

<table>
<thead>
<tr>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>............................................................................................................................................</td>
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</table>

1 (b) Make $w$ the subject of the formula $z = w + 3$

<table>
<thead>
<tr>
<th>Answer</th>
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1 (c) Factorise fully $4y^2 + 6y$

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<tr>
<th>Answer</th>
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</tbody>
</table>

Answer all questions in the spaces provided.
2. Draw the graph of $y = 3x - 2$ for values of $x$ from $-3$ to $3$ [3 marks]
These instructions are on a bottle of lawn feed.

‘Mix 200 millilitres of lawn feed with 10 litres of water.’

How many millilitres of lawn feed should be mixed with 3 gallons of water?
Use 1 gallon = 4.5 litres

[3 marks]

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Answer ........................................................ millilitres

Turn over for the next question
The table shows information about water used in a household. The value for April is missing.

<table>
<thead>
<tr>
<th>Month</th>
<th>Water used (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>16.2</td>
</tr>
<tr>
<td>February</td>
<td>18.1</td>
</tr>
<tr>
<td>March</td>
<td>15.9</td>
</tr>
<tr>
<td>April</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>17.8</td>
</tr>
<tr>
<td>June</td>
<td>21.0</td>
</tr>
</tbody>
</table>

The mean monthly water used for the six months is 18 m$^3$

Work out the value for April.

[3 marks]

Answer ................................................................. m$^3$
**5 Which has the greater area?**

Use $\pi = 3.1$

You **must** show your working.

[3 marks]

Answer ..............................................................................................................
6. A rhombus is reflected in a mirror line as shown. 
   \( PQR \) is a straight line.

Work out the size of angle \( y \).
You must show your working which may be on the diagram.

\[ y \]

Answer ...................................................... degrees

7. The first buses to X and Y leave a bus station at 7 am

   - Buses to X leave every 25 minutes.
   - Buses to Y leave every 20 minutes.

When will the buses to X and Y next leave at the same time?

Answer ...........................................................
Six whole numbers have

- a median of 10
- a mode of 11
- a range of 4

Work out a possible set of six numbers.
Write the numbers in order.

Answer ........, ........, ........, ........, ........, ........
A fishing lake contains thousands of fish.
The fish are Carp, Bream or Roach.

10 fish are caught.
The table shows some of the results.

<table>
<thead>
<tr>
<th></th>
<th>Carp</th>
<th>Bream</th>
<th>Roach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative frequency</td>
<td></td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

9 (a) Complete the table.  

[3 marks]

9 (b) The owner uses the results to estimate the proportion of Carp in the lake.

How can she make her estimate more reliable?  

[1 mark]

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10 Here is a linear sequence.

46     40     34     28     22     .....  

Work out the $n$th term of the sequence.  

[2 marks]

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Answer ...............................................................................................................................


You will need a ruler and a pair of compasses to answer this question.

Construct the perpendicular from point $P$ to the line $L$. You must show your construction arcs.

[3 marks]
12 In this question all lengths are in centimetres.

A rectangle has length \( l \) and width \( w \).

\[
\begin{align*}
\text{Not drawn accurately}
\end{align*}
\]

12 (a) \( w \) and \( l \) are such that

\[
\begin{align*}
1 & \leq w \leq 9 \\
\text{and} \quad w + l &= 10
\end{align*}
\]

Show this information on the graph.

[2 marks]
12 (b) Use the graph, or otherwise, to work out the value of \( w \) when \( l = 3w \)
You must show your working.

[2 marks]

Answer


13 Triangles \( ABC \) and \( PQR \) are similar.

Work out the length \( QR \).

[2 marks]

Answer


Not drawn accurately
14. $ABCD$ is a trapezium.

Work out the length of $BC$.
You must show your working.

[4 marks]

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Answer ................................................................. cm
Work out the smallest integer value that satisfies the inequality

\[ 5x + 2 > 3x + 7 \]

[3 marks]

Answer

16 (a) Line M has the equation \( 3x + 2y = 7 \)

Circle the gradient of line M.

[1 mark]

-3  \(-\frac{3}{2}\)  3  \(\frac{3}{2}\)

16 (b) Line N has the equation \( y = 5 - \frac{3}{4}x \)

Circle the gradient of a line that is perpendicular to line N.

[1 mark]

\(-\frac{4}{3}\)  \(\frac{3}{4}\)  \(\frac{4}{3}\)  3
Dan is a vet. In February he saw 250 customers.

- 82 were dog owners.
- 107 were cat owners.
- 61 were owners of other pets.

Dan wants to survey a sample of customers. He chooses a sample of 50, stratified by the type of pet.

Complete the table.

<table>
<thead>
<tr>
<th></th>
<th>Dog owners</th>
<th>Cat owners</th>
<th>Owners of other pets</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of customers</strong></td>
<td>82</td>
<td>107</td>
<td>61</td>
<td>250</td>
</tr>
<tr>
<td><strong>Number in sample</strong></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>
18 Simplify \[ \frac{9a^2 - b^2}{3a - b} \] [2 marks]

Answer ........................................................................................................

Turn over for the next question
19. AC is a diameter of a circle, centre O.
CTS is a tangent to the circle.
B is a point on the circumference of the circle such that BC = BT
Angle BTS = \( y \)

**19 (a)** Prove that angle \( CAB = 180^\circ - y \)
Give reasons for any angles you write down or calculate.

[3 marks]
19 (b) You are given that angle $ACB = 20^\circ$

Work out the value of $y$.
You must show your working which may be on the diagram.

[2 marks]

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Answer ........................................................ degrees

Turn over for the next question
20 (a) Simplify fully \[ \frac{m^3 \times m^5 \times m}{m^2 \times m^4} \] [1 mark]

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Answer ................................................................................................................................

20 (b) Expand and simplify \((3 + \sqrt{2})(5 - \sqrt{2})\) [2 marks]

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Answer ................................................................................................................................

20 (c) Work out the value of \[ 25^{-\frac{1}{2}} \times 81^{\frac{3}{4}} \] [3 marks]

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Answer ................................................................................................................................

\[ m^3 \times m^5 \times m \]
\[ m^2 \times m^4 \]
21 The square and the rectangle have the same area. All lengths are in centimetres.

21 (a) Show that \(36x^2 - 65x + 25 = 0\)  

[2 marks]

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21 (b) \(36x^2 - 65x + 25 = 0\)

Work out the value of \(x\).  

[4 marks]

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\(x = \)  

END OF QUESTIONS
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ANSWER IN THE SPACES PROVIDED
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