Materials
For this paper you must have:
• a calculator
• mathematical instruments.

Instructions
• Use black ink or black ball-point pen. Draw diagrams in pencil.
• 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 105.
• The quality of your written communication is specifically assessed in Questions 4 and 15. 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.
Area of trapezium = \( \frac{1}{2} (a+b)h \)

Volume of prism = area of cross section \( \times \) length

Volume of sphere = \( \frac{4}{3} \pi r^3 \)
Surface area of sphere = \( 4 \pi r^2 \)

Volume of cone = \( \frac{1}{3} \pi r^2h \)
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 Here is a sequence of patterns made with squares.

<table>
<thead>
<tr>
<th>Pattern 1</th>
<th>Pattern 2</th>
<th>Pattern 3</th>
</tr>
</thead>
</table>

The rule for working out the number of squares in each pattern is

Square the pattern number and then add 2

1 (a) How many squares are in pattern 7?  

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

1 (b) Which pattern has 123 squares?

Answer ........................................................................
2 (a) Enlarge the triangle by scale factor 2, using point $P$ as the centre of enlargement.

[3 marks]
2 (b) Describe fully the **single** transformation that maps shape A onto shape B. [3 marks]

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3 A family uses 300 units of gas.

Each unit of gas costs 19p without VAT.
VAT of 5% is added to the bill.

Work out the total gas bill. [4 marks]

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Answer £ ....................................................................
Show that $AB$ is \textbf{not} parallel to $CD$. 

\[4\text{ marks}\]

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Turn over for the next question
The pie chart shows information about how people voted in an election.

1800 people voted for D.

How many **more** people voted for C than B? [3 marks]

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Answer ..................................................................................................................
6 (a) Solve \( 6x + 4 = 2(2x - 5) \)  

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\[ x = \] .................................................................................................................................

6 (b) Multiply out \( y(2 - y^3) \)  

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

7 Abby and Judy share some money. Abby gets 25% 

7 (a) Write Abby's share : Judy's share as a ratio. Give your answer in its simplest form.  

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Answer ........................................ : ...................................

7 (b) Judy gets £19.50 How much does Abby get?  

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Answer £ .........................................................................................................................
Work out the length of the hypotenuse.

[3 marks]

Answer ................................................................. cm

Not drawn accurately
Here is information about the scores, $t$, of class A in a test.

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; t \leq 10$</td>
<td>4</td>
</tr>
<tr>
<td>$10 &lt; t \leq 20$</td>
<td>8</td>
</tr>
<tr>
<td>$20 &lt; t \leq 30$</td>
<td>9</td>
</tr>
<tr>
<td>$30 &lt; t \leq 40$</td>
<td>3</td>
</tr>
<tr>
<td>$40 &lt; t \leq 50$</td>
<td>1</td>
</tr>
</tbody>
</table>

The mean score for class B in the same test is 22.

Dan says,

"On average, class A did better than class B."

Is he correct?

You **must** show your working.

[4 marks]

Answer ..........................................................
10 \( a \) and \( b \) are different prime numbers with \( a > b \)

10 (a) Give an example to show that \( a^2 + b^2 \) could be even. [1 mark]

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10 (b) Give an example to show that \( a^2 + b^2 \) could be odd. [1 mark]

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An empty tank is in the shape of a cuboid as shown.

The tank is to be filled with water at 1.25 litres per second.

1 m³ = 1000 litres

Work out the time taken to fill the tank.
Give your answer in hours and minutes.

Answer ................ hours ................. minutes
12 (a) Complete the table of values for \( y = x^3 + 5 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-22</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[2 marks]

12 (b) On the grid, draw the graph of \( y = x^3 + 5 \) for values of \( x \) from -3 to 3

[2 marks]
13. **A and B are similar triangles.**

![Diagram of triangles A and B](image)

13 (a) Circle the scale factor from A to B. [1 mark]

- 6
- \( \frac{2}{5} \)
- \( \frac{5}{2} \)
- 6

13 (b) Work out the perimeter of triangle B. [4 marks]

Answer: \( \text{cm} \)
14 (a) Which calculation works out the total amount after decreasing £50 by 8%? Circle the correct answer.

£50 × 0.08 £50 × 0.92 \[\frac{£50}{0.08}\] \[\frac{£50}{1.08}\]

[1 mark]

14 (b) Adrian is going on holiday.
He has two bags.
The mass of one bag is 9 kg
This is 45% of the total mass of the two bags.
What is the mass of his other bag?

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Answer .................................................................. kg
A cycle track has two identical semi-circular ends and two straight sides as shown.

A cyclist completes one lap.

Her average speed is 18 m/s
Her target time to complete one lap is 30 seconds.

Does she beat her target?
You must show your working.

[4 marks]

Answer .............................................................................
An ordinary fair dice is rolled.

16 (a) Complete the tree diagram for the dice landing on 4 [1 mark]

First spin

Second spin

\[
\begin{array}{c}
\frac{1}{6} \\
4 \\
\ldots \ldots \\
\ldots \ldots \\
\ldots \ldots \\
not 4 \\
\ldots \ldots \\
4
\end{array}
\]

\[
\begin{array}{c}
\ldots \ldots \\
not 4 \\
\ldots \ldots \\
\ldots \ldots \\
\ldots \ldots \\
not 4 \\
\ldots \ldots \\
not 4
\end{array}
\]

16 (b) Work out the probability of the dice landing on 4 both times. [2 marks]

Answer 

\[
\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}
\]
17. PAQ and PB are tangents to the circle.

\[ AC = BC \]

Work out the size of angle \( x \).

You must show your working which may be on the diagram.

[4 marks]

\[ \frac{\text{Answer}}{\text{degrees}} \]
18 (a) Work out the size of angle $x$.

Answer $\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ degrees
18 (b) Work out the length $y$.

[3 marks]

Answer .................................................. cm

Turn over for the next question
The cumulative frequency diagram shows information about the distances, in miles, that 120 students travel to school.

19 (a) Work out the interquartile range. [2 marks]

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Answer ............................................................. miles
19 (b) A sample of 25 students is taken from the 120 students. The sample is stratified by distance travelled using the intervals below.

| Distance, x, miles | $0 \leq x < 1$ | $1 \leq x < 2$ | $2 \leq x < 4$ | $4 \leq x < 8$ |

Work out the number of students in the sample who are in the $2 \leq x < 4$ interval. [4 marks]

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

Turn over for the next question
20 (a) Expand and simplify $(5x - 2y)(x + 2y)$

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

20 (b) Solve $x^2 - 2x - 2 = 0$
Give your answers to 1 decimal place.

Answer .................................................................
20 (c) Simplify \[ \frac{3x^2 - x - 10}{x^2 - 4} \] [3 marks]

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

21 You are given that \( x^2 + ax + b \equiv (x - 5)^2 + 7 \)

Work out the values of \( a \) and \( b \). [3 marks]

\( a = \) .................................................................................

\( b = \) .................................................................................
22 70 people gave information about the number of hours they worked in one week. The table and histogram show some of that information.

<table>
<thead>
<tr>
<th>Number of hours, $n$</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; n \leq 10$</td>
<td>21</td>
</tr>
<tr>
<td>$10 &lt; n \leq 20$</td>
<td>$x$</td>
</tr>
<tr>
<td>$20 &lt; n \leq 40$</td>
<td>$y$</td>
</tr>
<tr>
<td>$40 &lt; n \leq 50$</td>
<td>17</td>
</tr>
</tbody>
</table>

$x : y = 3 : 5$

Complete the histogram. Remember to label the **scale** on the frequency density axis. [6 marks]
23 Solve the simultaneous equations

\[ y = 4x + 1 \]
\[ y = 2x^2 + 7x - 1 \]

[5 marks]
24. \( x = 400 \) to 1 significant figure.
   \( y = 25 \) to 2 significant figures.

Work out the maximum integer value of \( \frac{x}{y} \).  

[3 marks]

Answer: ...........................................................................................................
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