Instructions

- Use **black** ink or ball-point pen.
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators must not be used.

Information

- The total mark for this paper is 100
- The marks for each question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an asterisk (*) are ones where the quality of your written communication will be assessed.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over
Volume of prism = area of cross section × length

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

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 = \( \pi rl \)

The Quadratic Equation

The solutions of \( ax^2 + bx + c = 0 \) where \( a \neq 0 \), are given by

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

In any triangle \( ABC \)

Sin Rule \( \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \)

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

Area of triangle = \( \frac{1}{2} \ ab \sin C \)
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

You must NOT use a calculator.

1 Using the information that

\[ 6.7 \times 52 = 348.4 \]

find the value of

(i) \[ 6.7 \times 520 \]

(ii) \[ 67 \times 0.52 \]

(iii) \[ 3484 \div 5.2 \]

(Total for Question 1 is 3 marks)

2 Karen got 32 out of 80 in a maths test.
She got 38% in an English test.

Karen wants to know if she got a higher percentage in maths or in English.

Did Karen get a higher percentage in maths or in English?

\[
\frac{32}{80} = \frac{16}{40} = \frac{8}{20} = \frac{4}{10} = \frac{40}{100} = 40\%
\]

Karen scored a higher percentage in maths.

(Total for Question 2 is 2 marks)
Here are the heights, in cm, of 18 children.

Show this information in an ordered stem and leaf diagram.

(Total for Question 3 is 3 marks)
4 Kalinda buys $x$ packs of currant buns and $y$ boxes of iced buns.

There are 6 currant buns in a pack of currant buns.
There are 8 iced buns in a box of iced buns.

Kalinda buys a total of $T$ buns.
Write down a formula for $T$ in terms of $x$ and $y$.

\[ T = 6x + 8y \]

(Total for Question 4 is 3 marks)

5 (a) Solve the inequality $6y + 5 > 8$

\[
\begin{align*}
-5 & \quad -5 \\
6y & > 3 \\
y & > \frac{3}{6} \\
y & > \frac{1}{2}
\end{align*}
\]

(b) Here is an inequality, in $x$, shown on a number line.

\[
-3 < x \leq 4
\]

(Total for Question 5 is 4 marks)
Steve wants to put a hedge along one side of his garden.

He needs to buy 27 plants for the hedge.
Each plant costs £5.54

Steve has £150 to spend on plants for the hedge.

Does Steve have enough money to buy all the plants he needs?

<table>
<thead>
<tr>
<th></th>
<th>500</th>
<th>50</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>10000</td>
<td>1000</td>
<td>80</td>
</tr>
<tr>
<td>7</td>
<td>3500</td>
<td>350</td>
<td>28</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
10000 \\
3500 \\
1000 \\
350 \\
80 \\
\hline \\
\text{\£149.58}
\end{align*}
\]

Steve has enough money

(Total for Question 6 is 4 marks)
7 The diagram shows the plan of a floor.

The area of the floor is 138 m².

Work out the value of $x$.

\[
15 \times 11 = 165
\]

Large rectangle area = 165 m²

\[
165 m^2 - 138 m^2 = 27 m^2
\]

Small rectangle \[3 \times x = 27\]

\[
 x = 9
\]

(Total for Question 7 is 4 marks)
ABC is parallel to EFGH.

\[ GB = GF \]
\[ \text{Angle } ABF = 65^\circ \]

Work out the size of the angle marked \( x \).
Give reasons for your answer.

\[ \hat{BFC} = 65^\circ \quad \text{Alternate angles are equal} \]
\[ \hat{BFC} = 65^\circ \quad \text{Angles at base of isosceles triangle are equal} \]
\[ \hat{BGF} = 50^\circ \quad \text{Angles in a triangle add up to } 180^\circ \]
\[ x = 130^\circ \quad \text{Angles on a straight line add up to } 180^\circ \]

(Total for Question 8 is 4 marks)
Jack wants to find out how far people live from their nearest supermarket. He uses this question on a questionnaire.

<table>
<thead>
<tr>
<th>How far do you live from your nearest supermarket?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 0 to 2</td>
</tr>
<tr>
<td>☐ 2 to 3</td>
</tr>
<tr>
<td>☐ 3 to 4</td>
</tr>
<tr>
<td>☐ 5 to 6</td>
</tr>
</tbody>
</table>

(a) Write down **two** things wrong with this question.

1. there are no units eg miles/km

2. there is no option for over 6

(there is overlap of 2 and 3 appear twice)

Jack also wants to find out how often people go shopping.

(b) Write a question Jack could use on his questionnaire to find out how often people go shopping.

<table>
<thead>
<tr>
<th>How often do you go shopping a week?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 0-1</td>
</tr>
<tr>
<td>☐ 2-3</td>
</tr>
<tr>
<td>☐ 4-5</td>
</tr>
<tr>
<td>☐ 6 or more</td>
</tr>
</tbody>
</table>

6 times 6 times 6 times 6 times

(Total for Question 9 is 4 marks)
10 Use ruler and compasses to **construct** the perpendicular from point $C$ to the line $AB$. You must show all your construction lines.

(Total for Question 10 is 2 marks)
11 Ria is going to buy a caravan.
The total cost of the caravan is £7000 plus VAT at 20%.

Ria pays a deposit of £3000
She pays the rest of the total cost in 6 equal monthly payments.

Work out the amount of each monthly payment.

\[
\begin{align*}
10\% & = 700 \\
20\% & = 1400
\end{align*}
\]

Total cost = 7000 + 1400 = £8400

\[
\begin{align*}
\frac{8400}{\text{take off } \£3000 \text{ deposit}} \\
\frac{5400}{5400}
\end{align*}
\]

£5400 left to pay \[
\frac{5400}{6} = £900 \text{ (a month)}
\]

£900

(Total for Question 11 is 4 marks)
12 (a) Factorise \( 3e^2 + 5e \)

\[ e(3e+5) \]  

(b) Solve \( 7(k - 3) = 3k - 5 \)

\[ 7k - 21 = 3k - 5 \]

\[ 4k - 21 = -5 \]

\[ 4k = 16 \]

\[ k = 4 \]

(c) Expand and simplify \((2x + 3)(x - 8)\)

\[ 2x^2 - 16x + 3x - 24 \]

\[ 2x^2 - 13x - 24 \]

(d) Solve \( \frac{7 - 3f}{4} = 2 \)

\[ 7 - 3f = 8 \]

\[ 7 = 8 + 3f \]

\[ -1 = 3f \]

\[ f = -\frac{1}{3} \]

\[ f = -\frac{1}{3} \]

(Total for Question 12 is 9 marks)
13 (a) Express 180 as a product of its prime factors.

```
  180
   \ /
    2 90
     \ /
      2 45
       \ /
        5 9
         \ /
          3 3
```

\[ 2 \times 2 \times 3 \times 3 \times 5 \]

(3)

Martin thinks of two numbers.

He says,

“The Highest Common Factor (HCF) of my two numbers is 6
The Lowest Common Multiple (LCM) of my two numbers is a multiple of 15”

(b) Write down two possible numbers that Martin is thinking of.

\[ 6, 30 \]

(2)

(Total for Question 13 is 5 marks)
14 Suha has a full 600 ml bottle of wallpaper remover.  
She is going to mix some of the wallpaper remover with water.  
Here is the information on the label of the bottle.

<table>
<thead>
<tr>
<th>Wallpaper remover</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 ml</td>
</tr>
<tr>
<td>Mix $\frac{1}{4}$ of the wallpaper remover with 4500 ml of water</td>
</tr>
</tbody>
</table>

Suha is going to use 750 ml of water.  
How many millilitres of wallpaper remover should Suha use?  
You must show your working.

\[
\begin{align*}
150 \text{ ml wallpaper remover} & \rightarrow 4500 \text{ ml water} \\
\div 10 & \rightarrow 15 \\
\div 3 & \rightarrow 5 \\
\div 5 & \rightarrow 25 \\
\hline
& \rightarrow 750
\end{align*}
\]

\[\frac{1}{4} \text{ of } 600 = 150\]

\[25 \text{ ml} \]

(Total for Question 14 is 4 marks)
The students in a class kept a record of the amount of time, in minutes, they spent doing homework last week.

The table shows information about the amount of time the girls spent doing homework last week.

<table>
<thead>
<tr>
<th>Minutes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Least amount of time</td>
<td>60</td>
</tr>
<tr>
<td>Range</td>
<td>230</td>
</tr>
<tr>
<td>Median</td>
<td>170</td>
</tr>
<tr>
<td>Lower quartile</td>
<td>100</td>
</tr>
<tr>
<td>Upper quartile</td>
<td>220</td>
</tr>
</tbody>
</table>

\[60 + 230 = 290\]

(a) On the grid, draw a box plot for the information in the table.

(2)

The box plot below shows information about the amount of time the boys spent doing homework last week.

(b) Compare the amount of time the girls spent doing homework with the amount of time the boys spent doing homework.

*The median amount of time by the boys was higher*

\[190 > 170\]

*The girls had a higher inter-quartile range*

\[120 > 100\]

(Total for Question 15 is 4 marks)
There are 200 workers at a factory.

The cumulative frequency table gives information about their ages.

<table>
<thead>
<tr>
<th>Age (a years)</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; a ≤ 20</td>
<td>25</td>
</tr>
<tr>
<td>0 &lt; a ≤ 30</td>
<td>70</td>
</tr>
<tr>
<td>0 &lt; a ≤ 40</td>
<td>138</td>
</tr>
<tr>
<td>0 &lt; a ≤ 50</td>
<td>175</td>
</tr>
<tr>
<td>0 &lt; a ≤ 60</td>
<td>186</td>
</tr>
<tr>
<td>0 &lt; a ≤ 70</td>
<td>194</td>
</tr>
<tr>
<td>0 &lt; a ≤ 80</td>
<td>200</td>
</tr>
</tbody>
</table>

(a) On the grid opposite, draw a cumulative frequency graph for this information. (2)

(b) Graham says,

“10% of workers at the factory are older than 65”

Is Graham correct?
You must show how you get your answer.

\[
\text{There are 200 workers. } \quad 10\% = 20
\]
\[
\text{Only 10 employees are over 65 (from c.f. graph)}
\]
Cumulative frequency

Age (years)

(Total for Question 16 is 4 marks)
Diagram NOT accurately drawn

$ABCDEFGH$ is a regular octagon.
$BCKFGJ$ is a hexagon.

$JK$ is a line of symmetry of the hexagon.
Angle $BJG = \angle CKF = 140^\circ$

Work out the size of angle $KFE$.
You must show all your working.

\[
\text{Angles at base of isosceles triangle are equal} \quad \frac{180 - 140}{2} = 20^\circ
\]

\[
\text{Exterior angle of octagon} = \frac{360}{8} = 45^\circ
\]

\[
\text{Interior angle} = 180 - 45 = 135^\circ
\]

\[
135 - 90 - 20 = 25^\circ
\]

\[
\boxed{25^\circ}
\]

(Total for Question 17 is 4 marks)
ABCD and AEFG are mathematically similar trapeziums.

AE = 5 cm
EF = 12 cm
BC = 18 cm

(a) Work out the length of AB.

Scale factor 1.5

\[ 5 \times 1.5 = 7.5 \text{ cm} \]

(b) Work out the area of the shaded region.

Scale factor for area = \( 1.5^2 = \left(\frac{3}{2}\right)^2 = \frac{9}{4} \)

Area of trapezium \( ABCD = 36 \times \frac{9}{4} = 81 \text{ cm}^2 \)

\[ 81 - 36 = 45 \text{ cm}^2 \]

(Total for Question 18 is 5 marks)
19 (a) Complete the table of values for \( y = \frac{4}{x} \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>0.5</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>5</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>( \frac{4}{5} = 0.8 )</td>
<td>0.5</td>
</tr>
</tbody>
</table>

(b) On the grid, draw the graph of \( y = \frac{4}{x} \) for \( 0.5 \leq x \leq 8 \)

(Total for Question 19 is 4 marks)
The diagram shows a solid shape. 

The solid shape is made from a cylinder and a hemisphere. 
The radius of the cylinder is equal to the radius of the hemisphere.

The cylinder has a height of 10 cm. 
The curved surface area of the hemisphere is $32\pi$ cm$^2$.

Work out the total surface area of the solid shape. 
Give your answer in terms of $\pi$.

\[
\text{Surface area of sphere} = 4\pi r^2 \\
\therefore \quad 32\pi = 2\pi r^2 \quad (\text{hemisphere}) \\
16 = r^2 \\
r = 4
\]

\[
\text{Area of circle} = \pi r^2 \\
= \pi \times 4^2 \\
= 16\pi
\]

\[
\text{Area of curved part of cylinder} = 2\pi rh \\
= 2\pi (4)(10) = 80\pi
\]

\[
32\pi + 16\pi + 80\pi = 128\pi \\
= 128\pi \quad \text{cm}^2
\]

(Total for Question 20 is 5 marks)
21 Expand \((1 + \sqrt{2})(3 - \sqrt{2})\)
Give your answer in the form \(a + b\sqrt{2}\) where \(a\) and \(b\) are integers.

\[
\begin{align*}
3 - \sqrt{2} + 3\sqrt{2} - \sqrt{4} \\
3 + 2\sqrt{2} - 2 \\
1 + 2\sqrt{2}
\end{align*}
\]

(Total for Question 21 is 2 marks)
22 (a) Simplify fully $(3e)^0$

(b) Simplify fully $\left( \frac{64x^6}{25y^2} \right)^{\frac{1}{2}}$

\[
\left( \frac{25y^2}{64x^6} \right)^{\frac{1}{2}} = \frac{5y}{8x^3}
\]

(c) Write $\frac{5}{x - 3} - \frac{4}{x + 3}$ as a single fraction in its simplest form.

\[
\frac{5(x + 3)}{(x + 3)(x - 3)} - \frac{4(x - 3)}{(x + 3)(x - 3)} = \frac{5(x + 3) - 4(x - 3)}{(x + 3)(x - 3)} = \frac{5x + 15 - 4x + 12}{(x + 3)(x - 3)} = \frac{x + 27}{(x + 3)(x - 3)}
\]

(Total for Question 22 is 6 marks)
Paul has 8 cards.
There is a number on each card.

2 3 3 4 5 5 5 5

Paul takes at random 3 of the cards.
He adds together the 3 numbers on the cards to get a total $T$.

Work out the probability that $T$ is an odd number.

\[
P(O, O, O) \\
P(E, O, E) \\
P(O, E, E) \\
P(E, E, O)
\]

\[
\frac{\frac{5}{8} \times \frac{5}{7} \times \frac{5}{6}}{28} = \frac{5}{14} = \frac{10}{28}
\]

\[
\frac{\frac{2}{8} \times \frac{6}{7} \times \frac{1}{6}}{28} = \frac{1}{28}
\]

\[
\frac{\frac{1}{8} \times \frac{5}{7} \times \frac{1}{6}}{28} = \frac{1}{28}
\]

\[
\frac{\frac{2}{8} \times \frac{1}{7} \times \frac{5}{6}}{28} = \frac{1}{28}
\]

\[
\frac{10}{28} + \frac{1}{28} + \frac{1}{28} + \frac{1}{28}
\]

\[
\frac{13}{28}
\]

(Total for Question 23 is 4 marks)
*24 A is the point with coordinates (1, 3)
B is the point with coordinates (4, −1)
The straight line L goes through both A and B.

Is the line with equation \(2y = 3x - 4\) perpendicular to line L?
You must show how you got your answer.

\[
\text{gradient} = \frac{\text{change in } y}{\text{change in } x} = \frac{3 - (-1)}{1 - 4} = \frac{4}{-3} = \frac{4}{-3} \times \frac{3}{3} = -1
\]

perp gradient would be \(\frac{3}{4}\)

\(2y = 3x - 4\)
\(y = \frac{3}{2}x - 2\)
\(m = \frac{3}{2}\)

The lines are not perpendicular. The line's gradient is \(\frac{3}{2}\), not \(\frac{3}{4}\).

(Total for Question 24 is 4 marks)
The diagram shows part of the curve with equation \( y = f(x) \).
The coordinates of the minimum point of this curve are \((3, -4)\)

Write down the coordinates of the minimum point of the curve with equation

(i) \( y = f(x) + 3 \)

\((\ldots, \ldots)\)

(ii) \( y = f(2x) \)

\((\frac{3}{2}, -4)\)

(iii) \( y = f(-x) \)

\((-3, -4)\)

(Total for Question 25 is 3 marks)

TOTAL FOR PAPER IS 100 MARKS