Instructions
● Use black ink or ball-point pen.
● Write your name in the box at the top of this page.
● Answer all questions in the spaces provided.
● Calculators may not be used.
● Diagrams are NOT accurately drawn, unless otherwise indicated.
● You must show all your working out.

Information
● The total mark for this paper is 80.
● The marks for each question are shown in brackets.
  - use this as a guide as to how much time to spend on each question.

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.
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 In a sale, the price of jackets is reduced by 30%.
   Work out the price in the sale of a jacket that normally costs £82.

   £..........................................

   (Total for Question 1 is 2 marks)

2 (a) Work out 30 \times 0.0004

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   (1)

   (b) Work out 0.02\% of 40 million pounds

   £..........................................

   (2)

   (Total for Question 2 is 3 marks)
3 (a) Find a fraction with a value between 0.21 and 0.22
Give your answer in its simplest form.

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(2)

(b) Arrange these fractions in order of size, starting with the smallest.

\[
\frac{1}{4} \quad \frac{6}{25} \quad \frac{11}{40} \quad \frac{13}{50}
\]

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(3)

(Total for Question 3 is 5 marks)
4 Yellow and blue dye are mixed to make a green dye.

This graph is used to determine how much of each dye is used when mixing them.

(a) Using the graph, estimate how much green dye is made when 60 litres of yellow dye is mixed with the correct amount of blue dye.

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litres
(1)

(b) The number of litres of yellow dye is \( Y \) and the number of litres of blue dye is \( B \).

Use the graph to write down a formula connecting \( Y \) and \( B \).

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(2)
(c) Hence, or otherwise, write down the ratio

\[
\text{volume of yellow dye : volume of blue dye}
\]

used when making the green dye.

Give your answer in the form \( p : q \), where \( p \) and \( q \) are integers.

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(1)

(Total for Question 4 is 4 marks)

5 A sports hall is only used for playing badminton or basketball.

When it is used for badminton, the hall receives £15 per hour.
When it is used for basketball, the hall receives £18 per hour.

One week the hall is used for 55 hours.
The ratio of the time it is used for badminton to the time it is used for basketball is 7 : 4

Work out how much the hall receives in total for this week.

£..........................................

(Total for Question 5 is 3 marks)
Abi served on 70 points during a tennis match.

Her first serve was in on 28 of these points.

She won 18 of the points on which her first serve was in.

Altogether she won 40 of the 70 points on which she served.

Complete this frequency tree.

(Total for Question 6 is 2 marks)
The edge of a design consists of 4 identical semicircles and 4 identical quarter-circles.

The radius of the quarter-circles is the same as the radius of the semicircles.

The total width of the design is 24 cm as shown.

Show that the perimeter of the design is $24\pi$ cm.
Martin is making cloches to protect young plants.

He uses square sheets of side 60 cm made from plastic. He uses heat to fold the sheets along two lines parallel to the edges as shown. The folds are each $x$ cm from the nearest edge.

The cloches must be at least 12 cm tall and at least 22 cm wide.

Use algebra to find the set of possible values of $x$. 

(Total for Question 8 is 3 marks)
9 Solve algebraically the simultaneous equations

\[ 4x + 2y = 4 \]
\[ 2x + 3y = 24 \]

\[ x = \boxed{.....} \]
\[ y = \boxed{.....} \]

(Total for Question 9 is 3 marks)

10 For all values of \( x \), \( f(x) = 3x + k \), where \( k \) is a constant.

Given that \( ff(3) = 7 \), find the value of \( k \).
Each part of this question gives a student's estimate for the value of a numerical expression. Decide whether each estimate is too low or too high and explain your answer.

(a) Dave estimates the value of \((11.1)^2\) to be 135.

(b) Ruksana estimates the value of \(\sqrt[3]{980}\) to be 9.5.

(c) Tim estimates the value of \((2.5)^4\) to be 46.

(Total for Question 11 is 4 marks)
The speed-time graph shows the journey of a tram between two stops.

The distance between the stops is 513 metres.

Work out the value of $T$. 

(Total for Question 12 is 3 marks)
A bucket contains the 4 types of balls shown above. Each ball can be small or large in size. Each ball can be white or black in colour.

The ratio of small to large balls in the bucket is \(3:7\)

The ratio of white to black balls in the bucket is \(5:7\)

(a) Jaime says

“There must be at least 60 balls in the bucket.”

Is Jaime correct?

Show working to justify your answer.
(b) Find one possible value for the number of small white balls when there are 62 large black balls in the bucket.

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(3)

(Total for Question 13 is 6 marks)
14 (a) Describe fully a transformation under which the points (3, 3) and (3, 6) do not move.

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(1)

(b) Describe fully a transformation under which the points (–1, 6) and (2, 0) do not move.

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(3)

(Total for Question 14 is 4 marks)
$A$ is the point $(0, -4)$ and $B$ is the point $(0, 10)$.

$AB$ is a diameter of a circle which passes through the point $C(p, 0)$ where $p$ is positive.

Find the exact value of $p$.

Give your answer in its simplest form.
The vectors $a$, $b$, $c$, $d$ and $e$ are shown on the grid.

(a) Express $c$ in terms of $a$.

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(1)

(b) Express $d$ in terms of $a$ and $b$.

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(2)

(c) Express $e$ in terms of $a$ and $b$.

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(2)

(Total for Question 16 is 5 marks)
17 The Venn diagram shows information about a box of chocolates.

\[ \xi = \text{chocolates in the box} \]

\[ M = \text{milk chocolates} \]

\[ N = \text{chocolates with nuts in} \]

When a chocolate is picked at random from the box, the probability that it is a milk chocolate is 3 times the probability that it contains nuts.

(a) Find out how many chocolates are in the box.

(b) A chocolate is picked at random from the box.

The chocolate has nuts in.

Work out the probability that it is not a milk chocolate.

(Total for Question 17 is 6 marks)
Seb asks 30 people in a coffee shop how many hot drinks they have on average per week. The table shows his results.

<table>
<thead>
<tr>
<th>Number of drinks ($N$)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 \leq N &lt; 10$</td>
<td>6</td>
</tr>
<tr>
<td>$10 \leq N &lt; 15$</td>
<td>4</td>
</tr>
<tr>
<td>$15 \leq N &lt; 20$</td>
<td>10</td>
</tr>
<tr>
<td>$20 \leq N &lt; 30$</td>
<td>7</td>
</tr>
<tr>
<td>$30 \leq N &lt; 50$</td>
<td>3</td>
</tr>
</tbody>
</table>

Seb used these results to draw this histogram.

(a) Write down two mistakes that Seb made.
Seb assumes that his data will be representative of the whole UK population.

(b) The UK population is approximately 65 million.

Using Seb's assumption, calculate an estimate for the number of people in the UK who drink less than 10 hot drinks on average per week.

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(2)

(c) Comment on Seb's assumption and how it affected the value you calculated in part (b).

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(2)

(Total for Question 18 is 6 marks)
19 Work out the value of

(a) \(36^{-\frac{1}{2}}\)

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(1)

(b) \(2^{23} \times 3^{21} \times 6^{-19}\)

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(2)

(Total for Question 19 is 3 marks)

20 Show that

\[
\frac{3}{x-3} - \frac{4}{x+1} = \frac{15-x}{(x-3)(x+1)}
\]

(Total for Question 20 is 2 marks)
The points $A$, $B$, $C$ and $D$ lie on the circumference of a circle.

Prove that

$$\text{angle } ABC + \text{angle } ADC = 180^\circ$$
22  Solve the equation

\[ x^2 - 8x - 3 = 0 \]

giving your answers in the form \( a + b \sqrt{c} \), where \( a, b \) and \( c \) are integers.

(Total for Question 22 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS