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 may 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.

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Without sufficient working, correct answers may be awarded no marks.
1 Tickets for a show are priced at £12.50 for an adult ticket and £7.20 for a child ticket. Find the total cost, in £, for 5 adult tickets and 4 child tickets.

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

(Total for Question 1 is 2 marks)

2 In the diagram \( AQB \) is parallel to \( CRD \) and \( PQRS \) is a straight line. Find the value of \( x \).

\[
\begin{align*}
A & \quad (2x - 40)° \\
Q & \quad (3x + 10)° \\
B & \\
C & \quad (2x - 40)° \\
R & \quad (3x + 10)° \\
D & \\
S & \\
\end{align*}
\]

Diagram NOT accurately drawn

\( x = \) .........................................................

(Total for Question 2 is 2 marks)
3 Solve the equation $5 - \sqrt{x} = \sqrt{x} - 7$

(Total for Question 3 is 2 marks)

4 The bearing of ship $A$ from ship $B$ is $145^\circ$  
Calculate the bearing of ship $B$ from ship $A$.

(Total for Question 4 is 2 marks)

5 A clock loses 3 minutes every day. 
Find the number of seconds the clock loses every hour.

(Total for Question 5 is 2 marks)
6 Expand and simplify \((2x - 3)(3x - 2)\)

(Total for Question 6 is 2 marks)

7 Showing your working clearly, find the Highest Common Factor (HCF) of 72, 162, 270

(Total for Question 7 is 2 marks)

8 \(a = \left(\begin{array}{c} 1 \\ -2 \end{array}\right), \quad b = \left(\begin{array}{c} -1 \\ 4 \end{array}\right)\)

Find \(a - 2b\)

\[a - 2b = \left(\begin{array}{c} \quad \quad \\ \quad \quad \end{array}\right)\]

(Total for Question 8 is 2 marks)
9 A sheet of gold leaf is $1.25 \times 10^{-5}$ cm thick. Find the total thickness of 6000 of these sheets. Give your answer in cm and in standard form.


(Total for Question 9 is 2 marks)

10 Evaluate $\sqrt{\frac{2}{(125^\frac{2}{3} - 81^\frac{1}{3})}}$


(Total for Question 10 is 2 marks)

11 Factorise completely $27x^2 - 12y^2$


(Total for Question 11 is 3 marks)
12 A competition consists of 5 rounds. In each round, the number of matches played is $4n + 1$, where $n$ is the number of the round.

(a) Write down the number of matches played in the 5th round.

..............................................................................

(b) Calculate the total number of matches played in all 5 rounds.

..............................................................................

(Total for Question 12 is 3 marks)

13 A fuel tank on a car contains 68 litres of fuel when full. At the start of a journey, the fuel tank is full. When the car has travelled 612 km, the fuel tank is a quarter full.

Find the number of kilometres travelled per litre of fuel.

.............................................................................. km

(Total for Question 13 is 3 marks)
The numbers in the diagram give the number of elements in the relevant subset.

Find

(a) \( n(A \cap B) \)

..............................................................................

(1)

(b) \( n(A \cup B \cup C) \)

..............................................................................

(1)

(c) \( n(A \cap (B \cup C)') \)

..............................................................................

(1)

(Total for Question 14 is 3 marks)
15 A plot of land is for sale at £24 000. A group of $x$ people decides to buy the land and each person in the group is to pay the same amount of money, £$A$.

(a) Write down a formula for $A$ in terms of $x$.

$$A = \text{..........................................................}$$

(1)

Given that each person pays £1500,

(b) find the number of people in the group.

$$\text{..........................................................}$$

(2)

(Total for Question 15 is 3 marks)

16 (a) Write down the number of lines of symmetry of a regular hexagon.

$$\text{..........................................................}$$

(1)

Each exterior angle of a regular polygon is $30^\circ$.

(b) Find the order of rotational symmetry of this polygon.

$$\text{..........................................................}$$

(2)

(Total for Question 16 is 3 marks)
17 Find the largest integer which satisfies $5x - 2 < 3(5 - x)$

(Total for Question 17 is 3 marks)

18 Triangle $ABC$ is a right-angled triangle with $\angle ABC = 90^\circ$

Given that $\sin \angle BAC = \frac{8}{17}$, find the value of $\tan \angle BAC$ as a fraction.

(Total for Question 18 is 3 marks)
19 \[\begin{pmatrix} 1 & -1 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} 1 & a \\ b & 1 \end{pmatrix} = \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\]

Find the values of \(a\), \(b\) and \(\lambda\).

\[a = \ldots\]

\[b = \ldots\]

\[\lambda = \ldots\]

(Total for Question 19 is 3 marks)

20

The diagram shows a quadrilateral \(ABCD\) in which \(\angle A = 54^\circ\)

The sizes of the other three interior angles \(B\), \(C\) and \(D\) are in the ratio \(6 : 7 : 4\)

(a) Calculate the size, in degrees, of the largest angle.

\[\ldots\] 

(b) Give the geometrical name for the quadrilateral \(ABCD\).

\[\ldots\]

(Total for Question 20 is 4 marks)
21 In the summer of 2010, 14% of candidates who sat an examination obtained an A* grade. Given that 15 000 candidates sat the examination,

(a) calculate the number of candidates who obtained an A* grade.

..............................................................................

(2)

In the summer of 2011, the same number of candidates obtained an A* grade. This was 16% of the total number of candidates who sat the examination.

(b) Calculate the number of candidates who sat the examination in the summer of 2011.

..............................................................................

(2)

(Total for Question 21 is 4 marks)

22 Given that \( y \) varies inversely as the square of \( x \) and that \( y = \frac{1}{24} \) when \( x = 60 \), find the value of \( y \) when \( x = 10 \).

\[ y = \] ..............................................................................

(Total for Question 22 is 4 marks)
23 Two similar containers have volumes 0.25 litres and 16 litres. The larger container has a base radius of 24 cm. Calculate the base radius, in cm, of the smaller container.

.............................................................. cm
(Total for Question 23 is 4 marks)

24 The velocity $v$ m/s of a point moving in a straight line at time $t$ seconds is given by

$$v = 4t^3 - t^2 - 2t, \quad t \geq 0$$

(a) Write down the value of $v$ when $t = 3$

$$v = ..............................................................$$

(1)

(b) Find an expression for the acceleration, in m/s$^2$, of the point.

..............................................................

(3)

(Total for Question 24 is 4 marks)
$ABCD$ is a rectangle.

Leaving in all your construction lines, construct the locus of all points inside the rectangle which are

(a) equidistant from $D$ and $C,$

(b) equidistant from the lines $AD$ and $DC.$

The region $R$ consists of all the points inside the rectangle which are closer to $C$ than to $D$ and closer to $AD$ than to $DC.$

(c) Show by shading the region $R.$ Label the region $R.$

(Total for Question 25 is 5 marks)
26 A bag contains 3 red balls and 5 black balls. Two balls are to be taken at random, without replacement, from the bag.

(a) Complete the probability tree diagram.

\[ \text{First ball} \quad \text{Second ball} \]
\[ \begin{array}{c}
\begin{array}{c}
\frac{3}{8} \\
\frac{5}{7}
\end{array}
\end{array} \]

(b) Find the probability that the two balls taken are of the same colour.

\[ \text{Probability of two red balls: } \frac{3}{8} \times \frac{2}{7} = \frac{6}{56} = \frac{3}{28} \]
\[ \text{Probability of two black balls: } \frac{5}{7} \times \frac{4}{6} = \frac{20}{42} = \frac{10}{21} \]

\[ \text{Total probability: } \frac{3}{28} + \frac{10}{21} = \frac{3 + 20}{28 + 56} = \frac{23}{84} \]

(Total for Question 26 is 5 marks)
A hemispherical bowl of radius 34 cm contains water to a depth of 18 cm. Calculate the area, in cm\(^2\) to 3 significant figures, of the surface of the water.

\[ \text{cm}^2 \]

(Total for Question 27 is 5 marks)
28 Solve \( \frac{2}{2x-1} + \frac{3}{x} = 3 \)
An international courier company delivers parcels around the world. The table gives information about the weights of 80 parcels delivered one day.

<table>
<thead>
<tr>
<th>Weight (x kg)</th>
<th>0 &lt; x ≤ 2</th>
<th>2 &lt; x ≤ 4</th>
<th>4 &lt; x ≤ 6</th>
<th>6 &lt; x ≤ 8</th>
<th>8 &lt; x ≤ 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>35</td>
<td>20</td>
<td>13</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

(a) Write down the modal class for this information.

..............................................................................

(1)

Calculate an estimate for

(b) the mean weight of the 80 parcels,

..............................................................................

(3)

(c) the median weight of the 80 parcels.

..............................................................................

(2)

(Total for Question 29 is 6 marks)
A curve $C$ has equation $y = x^3 - x^2$

Find

(a) $\frac{dy}{dx}$,

$$\frac{dy}{dx} = \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots (2)$$

(b) the $x$-coordinates of each point on $C$ at which the tangent is parallel to $y = 5x$.

(Total for Question 30 is 7 marks)

TOTAL FOR PAPER IS 100 MARKS
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