Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
• Geometrical instruments
• Tracing paper (optional)
• Scientific or graphical calculator

INSTRUCTIONS TO CANDIDATES

• Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
• Use black ink. HB pencil may be used for graphs and diagrams only.
• Answer all the questions.
• Read each question carefully. Make sure you know what you have to do before starting your answer.
• Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
• Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
• Do not write in the bar codes.

INFORMATION FOR CANDIDATES

• The number of marks is given in brackets [ ] at the end of each question or part question.
• Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
• The quality of written communication is assessed in questions marked with an asterisk (*).
• The total number of marks for this paper is 100.
• This document consists of 20 pages. Any blank pages are indicated.

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

Volume of prism = (area of cross-section) × length

In any triangle \( ABC \)

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

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

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

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

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

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]
1 (a) In the diagram, ABCD is parallel to EFG.
Angle BCF = 55° and angle ABF = 120°.

(ii) Work out $y$.

(a)(ii) ...................................................... ° [2]

(b) Work out the exterior angle of a regular 18-sided polygon.

(b) ...................................................... ° [2]

(c) An angle is measured as 27° correct to the nearest degree.
Write down the smallest possible size of the angle.

(c) ...................................................... ° [1]
The dentists in a surgery keep a record of the waiting time for each patient. The waiting times for one Monday are summarised in the table.

<table>
<thead>
<tr>
<th>Waiting time ($t$ minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; t \leq 5$</td>
<td>12</td>
</tr>
<tr>
<td>$5 &lt; t \leq 10$</td>
<td>15</td>
</tr>
<tr>
<td>$10 &lt; t \leq 15$</td>
<td>16</td>
</tr>
<tr>
<td>$15 &lt; t \leq 20$</td>
<td>9</td>
</tr>
<tr>
<td>$20 &lt; t \leq 25$</td>
<td>5</td>
</tr>
<tr>
<td>$25 &lt; t \leq 30$</td>
<td>3</td>
</tr>
</tbody>
</table>

(a) Calculate an estimate of the mean waiting time.

(b) Draw a frequency polygon to display the waiting times data.

(a) ............................................ minutes [4]

(b) Draw a frequency polygon to display the waiting times data.
(c) Write down the modal class of the waiting times.

............................................. minutes [1]

(d) The dentists have a target of fewer than 25% of patients waiting more than 15 minutes.

Did they meet their target on Monday? Show how you decide.

.................. because ...........................................................................................................
............................................................................................................................................. [2]

3 The diagram shows a parallelogram ABCD.

Work out the area of the parallelogram.

..................................................... cm² [2]
4  (a) Work out.

\[ \sqrt{\frac{2.52 + 4.78}{1.29}} \]

Give your answer correct to three significant figures.

(a) .......................................................... [2]

(b)  (i) Find the value of \( m \).

\[ 2^m \times 2^3 = 4^4 \]

(b)(i) .......................................................... [2]

(ii) In the calculation below \( p \) and \( q \) are integers and \( p > q \).

One pair of values that make this calculation correct is \( p = 3 \) and \( q = 2 \).

Find another pair of values that make the calculation correct.

\[ \frac{3}{5} \times \frac{5}{p} = \frac{q}{2} \]

(ii) \( p = \) ......................  \( q = \) ...................... [2]
Pavel has a pack of cards. Each card has a picture of either a square, a circle or a triangle. Each picture is either black or white. Pavel takes one of the cards from the pack at random. Some probabilities for this are shown in the table.

<table>
<thead>
<tr>
<th></th>
<th>Square</th>
<th>Circle</th>
<th>Triangle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>0.24</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>0.12</td>
<td>0.20</td>
<td>0.08</td>
</tr>
</tbody>
</table>

(i) Complete the table. [2]

(ii) Find the probability that Pavel's card has a picture of a square. [1]

A bag contains red balls, blue balls, yellow balls and green balls.

The probability that a ball taken at random from the bag is red is \( \frac{2}{5} \).

The probability that a ball taken at random from the bag is blue is \( \frac{1}{10} \).

The probability that a ball taken at random from the bag is yellow is \( \frac{3}{8} \).

Find the minimum possible number of balls in the bag. [2]
6  (a) Factorise fully.

\[ 6xy - 9x^2 \]

(a) .......................................................... [2]

(b) Solve.

\[ 8x = 3(x + 7) \]

(b) \( x = \) .......................................................... [3]

(c) Solve this inequality.

\[ 2x - 7 > 5 \]

(c) .......................................................... [2]
A water tank is in the shape of a cylinder. It has diameter 0.44 m and height 1.2 m. Water flows into the tank at a rate of 20 litres per minute. 1 litre = 1000 cm³.

John says that it will take about 10 minutes to completely fill the empty tank. Is he correct? Show calculations to justify your answer.
8 (a) Complete the table for \( y = 3 - \frac{1}{3}x \).

<table>
<thead>
<tr>
<th>( x )</th>
<th>-3</th>
<th>0</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

(b) Draw the graph of \( y = 3 - \frac{1}{3}x \) on the grid below.

(c) On the same grid, draw the graph of \( x + y = 5 \).

(d) Use your graphs to solve the simultaneous equations \( y = 3 - \frac{1}{3}x \) and \( x + y = 5 \).

(d) \( x = \ldots \) \( y = \ldots \)
9  (a) A website has a 24-hour sale offering 12% off all purchases.

   (i) Dina buys a skirt in the sale.
       The original price of the skirt was £36.
       Calculate the price of the skirt in the sale.

       (a)(i) £ .......................................................... [2]

   (ii) Dina also buys a sweatshirt in the sale.
       She pays £24.20 for the sweatshirt.
       Calculate the original price of the sweatshirt.

       (ii) £ .......................................................... [3]

(b) Ross has a season ticket.
    In 2013 the season ticket cost £65.
    In 2014 the cost of the ticket was increased by 8%.
    In 2015 the cost of the ticket was increased by a further 5%.

    Calculate the cost of the season ticket after the two price increases.

       (b) £ .......................................................... [3]
10 Triangles A and B are drawn on the grid below.

Triangle B is an enlargement of triangle A.

(a) Write down the coordinates of the centre of the enlargement.

(a) ( .................................................. ) [1]

(b) Write down the scale factor of the enlargement.

(b) .......................................................... [1]

(c) Write down the ratio of the area of triangle A to the area of triangle B. Give your answer in its simplest form.

(c) ................................ : ................................ [2]
11 **(a)** Liam describes a graph.

It is a linear graph.
It has a negative gradient.
It passes through the origin.

On the axes below, sketch this graph.

![Linear graph](image1.png)

**[1]**

**(b)** Katy describes a graph.

It is a cubic graph.
When $x$ is positive, $y$ is positive.
The graph only crosses the x-axis once.

On the axes below, sketch this graph.

![Cubic graph](image2.png)

**[2]**
12 (a) Nathan keeps a record of the amount of money that he spends in the supermarket each week. The table shows this information for an 8-week period and some 4-weekly moving averages.

<table>
<thead>
<tr>
<th>Week</th>
<th>Amount spent</th>
<th>Moving average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>£32.80</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>£23.20</td>
<td>£27.40</td>
</tr>
<tr>
<td>3</td>
<td>£29.50</td>
<td>£26.50</td>
</tr>
<tr>
<td>4</td>
<td>£24.10</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>£29.20</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>£21.60</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>£30.50</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>£22.70</td>
<td></td>
</tr>
</tbody>
</table>

(i) Complete the table to show the next three moving averages. [3]

(ii) Describe how the amount Nathan spends on food changes from week to week.

...........................................................................................................................................
........................................................................................................................................... [1]

(iii) Describe the trend in the amount Nathan spends on food.

...........................................................................................................................................
........................................................................................................................................... [1]
(b) The chart below shows the average amount of money spent per week by households in the UK on different items over a number of years.

(i) Estimate the average amount of money spent per week by households in the UK in 2007 on housing, fuel and power.

(b)(i) £ ........................................................... [1]

(ii) Comment on how the total amount of money spent has changed over time.

.................................................................................................................................... [1]
13 The angle of elevation of the top of a building from a point P is 32°. Point P is 25 m horizontally from the base of the building.

Calculate the height of the building.

\[
\text{Not to scale}
\]

\[
P \quad 32° \quad 25 \text{ m}
\]

14 A, B and C are points on the circle, centre O. Angle BAC = 35°.

Find angle OBC.
Give a reason for each step of your working.
15 (a) A candle is in the shape of a cone.
The radius of the base of the cone is 3.5 cm and its height is 10 cm.

Calculate the volume of the candle.

(a) .................................................. cm$^3$ [2]

(b) The mass of a candle is 180 g, correct to the nearest 10 g.
Four of these candles are packed in a box.
The mass of the box is 50 g, correct to the nearest 5 g.

Calculate the upper bound of the total mass of the box of candles.

(b) .................................................... g [3]

16 The population of a town is now 84 100.
The population of the town is predicted to rise by 2% each year.

(a) Write down an expression for the population of the town after $t$ years.

(a) ........................................................ [2]

(b) Find the predicted population of the town after 6 years.

(b) ........................................................ [1]
17 (a) Simplify fully.

\[
\frac{x + 4}{x^2 + 2x - 8}
\]

(a) .................................................. [3]

(b) Complete the missing numbers in this identity.

\[
x^2 + \ldots\ldots x + 14 = (x + 3)^2 + \ldots\ldots
\]

[3]
A lighthouse, L, is due north of a coastguard station, C. A boat, B, is 17 km from the coastguard station on a bearing of 059°. The boat is 35 km from the lighthouse.

Calculate the bearing of the boat from the lighthouse.
19 Solve algebraically these simultaneous equations.

\[ y = x^2 + 5x - 4 \]
\[ y = 8 - 3x \]

Give your answers correct to 2 decimal places.

\[ x = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]
\[ y = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]

\[ x = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \] \[ y = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]  [5]

END OF QUESTION PAPER