GCSE MATHEMATICS

Higher Tier

Paper 1 Non-Calculator

Tuesday 6 November 2018 Morning Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
• mathematical instruments

You must not use a calculator.

Instructions
• Use black ink or black ball-point pen. Draw diagrams in pencil.
• Fill in the boxes at the top of this page.
• 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. Cross through any work you do not want to be marked.

Information
• The marks for questions are shown in brackets.
• The maximum mark for this paper is 80.
• You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice
In all calculations, show clearly how you work out your answer.
Answer all questions in the spaces provided

1. Simplify \( (5^4)^2 \)
   Circle your answer. [1 mark]
   \[5^6 \quad 5^8 \quad 25^6 \quad 25^8\]

2. Circle the volume, in cm\(^3\), of a cylinder with radius 5 cm and height 8 cm [1 mark]
   \[40\pi \quad 80\pi \quad 200\pi \quad 1600\pi\]

3. Simplify \( 16a^2 + a + 3a \times 2 \)
   Circle your answer. [1 mark]
   \[22a \quad 8a \quad 38a \quad 2a\]
4. Circle the value of \( \cos 30^\circ \) 

\[
\begin{array}{cccc}
1 \quad \frac{\sqrt{3}}{2} & 0 & 1 \\
\frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2}
\end{array}
\]

[1 mark]

5. Work out \( \frac{8}{2} + \frac{3}{2} \) 

Give your answer as a mixed number. 

[4 marks]

Answer: \[
\underline{\text{\hspace{2cm}}}
\]
A ship is sailing in a straight line from its home port. The distance-time graph shows 4 hours of the journey.

Work out the speed of the ship during these 4 hours. [3 marks]

Answer ________________________ mph
The sum of the angles in any quadrilateral is 360°
For example, in a rectangle  $4 \times 90° = 360°$

Zak writes,

$5 \times 90° = 450°$ so the sum of the angles in any pentagon must be 450°

Is he correct?
Tick a box.

[ ] Yes  [ ] No

Show working to support your answer.

[2 marks]
Kim works at an airport in the UK. She records the number of planes landing between 10 am and 2 pm each day. The table shows the data for the first 10 days in January.

<table>
<thead>
<tr>
<th>Day</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of planes</td>
<td>148</td>
<td>151</td>
<td>147</td>
<td>155</td>
<td>153</td>
<td>147</td>
<td>155</td>
<td>102</td>
<td>151</td>
<td>154</td>
</tr>
</tbody>
</table>

(a) The airport was affected by fog on one of the days. Which day do you think it was? Give a reason for your answer. [1 mark]

Day  
Reason

(b) Kim uses the data to predict how many planes will land at the airport in a year. In her method, she uses an estimate of 150 planes in each 4-hour period throughout the day and assumes the same number of planes each day. Work out her prediction. [3 marks]

Answer
8 (c) In fact,

fewer planes land in winter than in summer
fewer planes land at night than during the day.

What does this tell you about Kim’s prediction?
Tick one box.

- Her prediction is too low
- Her prediction is too high
- Her prediction could be too low or too high

Give a reason for your answer. [2 marks]

______________________________
______________________________
______________________________

Turn over for the next question
9. \[ \sqrt{6^2 + 8^2} = 3\sqrt[3]{125a^3} \]
Work out the value of \( a \).

[4 marks]

Answer

10. Work out the percentage increase from 80 to 280

[3 marks]

Answer \______________________________\%


11  Here are four triangles.

A  
\[
\begin{array}{c}
8 \text{ cm} \\
25^\circ \\
56^\circ \\
\end{array}
\]

B  
\[
\begin{array}{c}
8 \text{ cm} \\
25^\circ \\
56^\circ \\
\end{array}
\]

C  
\[
\begin{array}{c}
8 \text{ cm} \\
25^\circ \\
56^\circ \\
\end{array}
\]

D  
\[
\begin{array}{c}
8 \text{ cm} \\
25^\circ \\
56^\circ \\
\end{array}
\]

Which **two** triangles are congruent?
Circle **two** letters below.

[1 mark]

A  B  C  D

Turn over for the next question
12 Solve \( x^2 - x - 12 = 0 \)  

[3 marks]

Answer

13 \( e : f = 2 : 3 \) and \( f : g = 5 : 4 \)

Work out \( e : g \)

Give your answer in its simplest form.  

[3 marks]

Answer _____ : _____
A and B are two events.

Some probabilities are shown on the Venn diagram.

\[ P(A' \cup B) \]

[2 marks]

Answer: 

Turn over for the next question
In a survey, queuing times at supermarket checkouts were recorded. One morning, samples of 50 customers were taken at supermarkets A, B, C and D. The box plots represent the results.

15 (a) On average, which supermarket had the lowest queuing times? Give a reason for your answer.

[2 marks]

Supermarket  
Reason  


15 (b) At which supermarket were the queuing times most consistent?
Give a reason for your answer.

<table>
<thead>
<tr>
<th>Supermarket</th>
<th>Reason</th>
</tr>
</thead>
</table>

[2 marks]

16 Circle the number that is closest to the value of \(29^3\)

27 000  90  2700  9000

[1 mark]

17 Work out the exact value of \(\left(\frac{3}{4}\right)^{-3}\)

[2 marks]

Answer

Turn over for the next question
Beth and Mia translate documents from Spanish into English.
A set of documents that would take Beth 8 days would take Mia 10 days.

Beth starts to translate the documents.
After 2 days Beth and Mia both work on translating the documents.

How many more days will it take to complete the work?
You must show your working.

[4 marks]

Answer ____________________ days
19 In a chess club, there are \( x \) boys and \( y \) girls.

19 (a) If 5 more boys and 8 more girls join, there would be half as many boys as girls.

Show that \( y = 2x + 2 \)  

[2 marks]

19 (b) If instead, 10 more boys and 1 more girl join, there would be the same number of boys and girls.

Work out \( x \) and \( y \).  

[3 marks]

\[
\begin{align*}
x &= \\
y &= 
\end{align*}
\]
20. \( P, Q, R \) and \( S \) are points on a circle. 
\( PXR \) and \( QXS \) are straight lines. 
\( PX = SX \) 

Prove that \( QS \) is not a diameter of the circle. 

[4 marks]
Here are the first four terms of a quadratic sequence.

\[
\begin{align*}
11 & \\
26 & \\
45 & \\
68 & 
\end{align*}
\]

Work out an expression for the \( n \)th term.

[3 marks]

Answer

Turn over for the next question
22 Solve \( \frac{x}{x+4} + \frac{7}{x-2} = 1 \)

You must show your working.

\[ x = \]
23 Prisms A and B are similar. The cross sections are shaded.

**Prism A**

- Volume = 480 cm$^3$

**Prism B**

- Length = 30 cm

area of the cross section of A : area of the cross section of B = 4 : 9

Work out the area of the cross section of B.

[5 marks]

Answer \[\text{cm}^2\]
Show that \( \frac{2\sqrt{6}}{\sqrt{5}} - \frac{\sqrt{3}}{\sqrt{10}} \) can be written in the form \( \frac{c\sqrt{d}}{10} \) where \( c \) and \( d \) are integers.

[3 marks]
A quadratic curve intersects the axes at \((-3, 0), (3, 0)\) and \((0, 18)\).

Work out the equation of the curve.

\[ y = ax^2 + bx + c \]

\[ \text{Answer: } y = ax^2 + bx + c \]

Turn over for the next question
The area of this triangle is $25\sqrt{3}$ cm$^2$.

Work out the value of $w$.

Give your answer in the form $a\sqrt{b}$ where $a$ and $b$ are integers greater than 1.

[5 marks]

Answer: __________________________
27 Here is a sketch of $y = \cos x$ for values of $x$ from $0^\circ$ to $360^\circ$

$\alpha^\circ$ is an acute angle.

$\cos \alpha^\circ = k$

27 (a) Circle the value of $\cos (180^\circ - \alpha^\circ)$

1 – $k$ $k$ $-k$ $-1 - k$

27 (b) Circle the value of $\cos (360^\circ + \alpha^\circ)$

$k - 1$ $k + 1$ $-k$ $k$

END OF QUESTIONS