Thursday 25 May 2017 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.
• 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.
### Question 1

Simplify $2^5 \times 2^3$

Circle your answer.

<table>
<thead>
<tr>
<th>$4^8$</th>
<th>$2^8$</th>
<th>$2^{15}$</th>
<th>$4^{15}$</th>
</tr>
</thead>
</table>

\[ \text{[1 mark]} \]

### Question 2

Circle the reason why these triangles are congruent.

SSS SAS ASA RHS

Not drawn accurately

### Question 3

Which of these is a geometric progression?
Circle your answer.

2, 4, 6, 8, 10  
2, 3, 5, 8, 12

2, 6, 18, 54, 162  
2, 6, 10, 14, 18

\[ \text{[1 mark]} \]
4 $a : b = 4 : 3$

Circle the correct statement.  

- $b$ is $\frac{4}{7}$ of $a$
- $b$ is $\frac{3}{7}$ of $a$
- $b$ is $\frac{4}{3}$ of $a$
- $b$ is $\frac{3}{4}$ of $a$

[1 mark]

5 Write 36 as a product of prime factors.

Give your answer in index form.  

[3 marks]

Answer

Turn over for the next question
The table shows information about the times for 10 people to complete a task.

<table>
<thead>
<tr>
<th>Time, ( t ) (minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 0 &lt; t \leq 20 )</td>
<td>1</td>
</tr>
<tr>
<td>( 20 &lt; t \leq 40 )</td>
<td>6</td>
</tr>
<tr>
<td>( 40 &lt; t \leq 60 )</td>
<td>3</td>
</tr>
</tbody>
</table>

These statements are about the mean and range of the actual times. Tick the correct box for each statement.

[4 marks]

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>The mean could be less than 20 minutes</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The mean could be more than 40 minutes</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The mean could be less than 40 minutes</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The range could be more than 40 minutes</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The range could be less than 40 minutes</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The range could be more than 60 minutes</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
7 \( \frac{3}{5} \) of a number is 162

Work out the number. [2 marks]

Answer

8 \( x \text{ km/h} = y \text{ mph} \)

Use \( 8 \text{ km/h} = 5 \text{ mph} \) to write a formula for \( y \) in terms of \( x \). [2 marks]

Answer

Turn over for the next question
9 (a) Density = \( \frac{\text{mass}}{\text{volume}} \)

The mass of solid A is 6 times the mass of solid B.
The volume of solid A is 3 times the volume of solid B.
Complete the sentence.

\[ \text{The density of solid A is } \text{__________ times the density of solid B.} \]  

[1 mark]

9 (b) Average speed = \( \frac{\text{distance}}{\text{time}} \)

If the distance is halved and the time is doubled, what happens to the average speed?
Circle your answer.

\[ \times 2 \quad \times 4 \quad \text{no change} \quad \div 2 \quad \div 4 \]  

[1 mark]
10 Solve the simultaneous equations.

\[ 2x + y = 18 \]
\[ x - y = 6 \]

[3 marks]

Answer ____________________________

Turn over for the next question
Billy wants to buy these tickets for a show.
- 4 adult tickets at £15 each
- 2 child tickets at £10 each

A 10% booking fee is added to the ticket price.
3% is then added for paying by credit card.

Work out the total charge for these tickets when paying by credit card. [5 marks]

Answer £ __________________________
12 Here is a circle touching a square.

The area of the square is 64 cm²

Work out the area of the circle.
Give your answer in terms of $\pi$.

[3 marks]

Answer __________________ cm²

Turn over for the next question
13. Write the number six million five thousand two hundred in standard form. [2 marks]

Answer

14. Solve \(-3x > 6\) [1 mark]

Answer

15. \(\frac{1}{6}, \frac{1}{7}, \frac{1}{8}\) and \(\frac{1}{9}\) are four fractions.

How many of these fractions convert to a recurring decimal?

Circle your answer. [1 mark]

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
A fair spinner has five equal sections numbered 1, 2, 3, 4 and 5.
A fair six-sided dice has five red faces and one green face.

The spinner is spun.
If the spinner shows an even number, the dice is thrown.

16 (a) Complete the tree diagram for the spinner and the dice.

16 (b) Work out the probability of getting an even number and the colour green.
17. A is the point (2, –5)
B is the point (4, –9)

17 (a) Show that the gradient of the straight line passing through A and B is –2

[2 marks]

17 (b) C is the point (–301, 601)

Does C lie on the straight line passing through A and B?
You must show your working.

[2 marks]

Answer ___________________________
18 Bottles of drink are for sale at three shops.
The normal price of a bottle is the same at each shop.

**Shop A**
Buy 1 bottle
Get 2 more bottles at half price

**Shop B**
Buy 2 bottles
Get 3 more bottles at half price

**Shop C**
30% off a bottle

What is the cheapest way to buy **exactly** 8 bottles?
You can buy from more than one shop.
You **must** show your working.

[3 marks]

Answer

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Turn over ➤
Here is some information about the marks of 60 students in a test.

<table>
<thead>
<tr>
<th>Mark, $m$</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$40 &lt; m \leq 50$</td>
<td>9</td>
</tr>
<tr>
<td>$50 &lt; m \leq 60$</td>
<td>16</td>
</tr>
<tr>
<td>$60 &lt; m \leq 70$</td>
<td>20</td>
</tr>
<tr>
<td>$70 &lt; m \leq 80$</td>
<td>8</td>
</tr>
<tr>
<td>$80 &lt; m \leq 90$</td>
<td>7</td>
</tr>
</tbody>
</table>

On the grid, draw a cumulative frequency graph.

[3 marks]
19 (b) Use your graph to estimate the lowest mark of the top 20% of students. [2 marks]

Answer

20 Work out the diameter of the circle \( x^2 + y^2 = 64 \)
Circle your answer. [1 mark]

8 16 32 128

Turn over for the next question
21 (a) The diagram shows rectangles A and B.

Rectangle A can be mapped to rectangle B by a single transformation.

Javed says, “The only single transformation is a reflection in the y-axis because the rectangles are on opposite sides of the y-axis.”

Is he correct?

Tick a box.

Yes [ ] No [ ]

Give a reason for your answer. [1 mark]
This diagram shows triangles $CDE$ and $PQR$.

$CDE$ is mapped to $PQR$ by combining two single transformations. The first is a rotation of $90^\circ$ anticlockwise about $E$.

Describe fully the second transformation.

[3 marks]
22 \hspace{1cm} PRT and QRS are similar triangles.

\begin{center}
\begin{tikzpicture}
\draw (-2,0) -- (0,-2) -- (2,2) -- cycle;
\draw (-2,0) node[below] {$R$} -- (0,-2) node[below] {$S$} -- (2,2) node[above] {$P$} -- cycle;
\end{tikzpicture}
\end{center}

Which of these is equivalent to \( \frac{QR}{PR} \)?

Circle your answer.

\begin{align*}
\frac{RS}{ST} & \quad \frac{QS}{PT} \\
\frac{PT}{QS} & \quad \frac{RT}{RS}
\end{align*}

[1 mark]
23 Here is a velocity-time graph of a motorbike for 25 seconds.

23 (a) After how many seconds was the acceleration zero?

Answer _______________ seconds

[1 mark]

23 (b) Work out the distance travelled in the last 15 seconds.

Answer _______________ metres

[2 marks]
24 (a) Work out \( \sqrt{12 \frac{1}{4}} \) as an improper fraction.

[1 mark]

Answer

24 (b) Work out \( \sqrt[3]{16} \) as a power of 2

[2 marks]

Answer
25 In an office there are twice as many females as males.

\[ \frac{1}{4} \] of the females wear glasses.

\[ \frac{3}{8} \] of the males wear glasses.

84 people in the office wear glasses.

Work out the number of people in the office.

[4 marks]

Answer ________________________________

Turn over for the next question
Expand and simplify \((x - 4)(2x + 3y)^2\) [4 marks]

Answer __________________________________________________
27 \( P (-1, 4) \) is a point on a circle, centre \( O \)

Work out the equation of the tangent to the circle at \( P \).

Give your answer in the form \( y = mx + c \)

[4 marks]

Answer ________________________________________
Volume of cone = \( \frac{1}{3} \pi r^2 h \) where \( r \) is the radius and \( h \) is the perpendicular height.

A cone has a
- horizontal base of radius 5 cm
- height of 15 cm

The cone contains water to a depth of 9 cm

Work out the volume of the water, in cm³

Give your answer in terms of \( \pi \).

[4 marks]
Simplify \( \frac{2 \sin 45^\circ - \tan 45^\circ}{4 \tan 60^\circ} \)

Give your answer in the form \( \frac{\sqrt{a} - \sqrt{b}}{c} \) where \( a, b \) and \( c \) are integers.

[4 marks]

Answer ________________________________
There are no questions printed on this page
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