**GCSE MATHEMATICS**

Higher Tier  Paper 3  Calculator

**Exam Date**  Morning  **Time allowed: 1 hour 30 minutes**

**Materials**

**For this paper you must have:**
- a calculator
- mathematical instruments.

**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.
Answer all questions in the spaces provided.

1. Simplify \((x^5)^2\)

Circle your answer.

\[ x^{10}, x^{25} \]  

[1 mark]

2. What is the sum of the exterior angles of any polygon?

Circle your answer.

\[ 180°, 360°, 380°, 540° \]  

[1 mark]

3. The bearing of \(B\) from \(A\) is 070°

Circle the bearing of \(A\) from \(B\).

\[ 110°, 250°, 290°, 610° \]  

[1 mark]
4 \[ y = \frac{5\sqrt{x}}{2} \]

Circle the expression for \( y^2 \) \[ \text{[1 mark]} \]

\[ \frac{25x}{4} \quad \frac{5x^2}{2} \quad \frac{25x^2}{4} \]

5 Paul won a race with a time of 71.3 seconds.
This time, \( t \), is to the nearest tenth of a second.
Complete the error interval due to rounding.

\[ \text{[2 marks]} \]

Answer \( \underline{\text{-----------}} \leq t < \underline{\text{-----------}} \]

Turn over for the next question
6 These two right-angled triangles are similar.

6 (a) Write down the value of \( \tan x \).
Give your answer as a fraction.

[1 mark]

Answer ____________________________

6 (b) Work out the value of \( y \).

[2 marks]

______________________________
______________________________
______________________________
______________________________

Answer ____________________________ cm
At a nursery, the mean age of 4 children is 31 months.
Katy joins the nursery.
The mean age of all 5 children is now 30 months.
Work out the age of Katy.

Answer ________________________ months
John chooses a number at random from the digits 1 to 4
Matt also chooses a number at random from the digits 1 to 4

8 (a) Write down the probability that the **sum** of the two numbers chosen is a two-digit number.

Answer

8 (b) Work out the probability that the **product** of the two numbers chosen is a two-digit number.

Answer
The area of an ellipse, width $a$ and height $b$, is given by

$$\text{Area} = \frac{\pi ab}{4}$$

A rectangular photograph measures 15 cm by 10 cm.

It is put into a frame as shown.

The part of the photograph that can be seen is an ellipse.

Work out the percentage of the photograph that can be seen.

[3 marks]

Answer ___________________________ %
10 At a concert

3 adult and 4 child tickets cost £23
1 adult and 5 child tickets cost £15

Work out the cost of an adult ticket and the cost of a child ticket. [4 marks]

Cost of an adult ticket £ ______________

Cost of a child ticket £ ______________
A doctor claims that the probability of having regular illness is doubled if you have poor sleep rather than good sleep.

In a survey, 16% of people with poor sleep had regular illness.

Here are the results for people with good sleep.

<table>
<thead>
<tr>
<th>Good Sleep</th>
<th>Number of people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular illness</td>
<td>24</td>
</tr>
<tr>
<td>Not regular illness</td>
<td>276</td>
</tr>
</tbody>
</table>

Comment on the doctor's claim.
You must show your working.

[3 marks]
12 A teacher asks Amy and Jack to convert $101\,376$ into standard form.

12 (a) Amy writes $10.1376 \times 10^4$

Criticise Amy’s answer. [1 mark]

12 (b) Jack writes $1.01376 \times 10^{-5}$

Criticise Jack’s answer. [1 mark]

13 At a concert the ratio of men to women is $5 : 3$

The ratio of women to children is $7 : 4$

Show that more than half of the people at the concert are men. [3 marks]
14 Use the quadratic formula to solve \( 5x^2 + 11x - 2 = 0 \)
Give your solutions to 2 decimal places. 

[3 marks]

Answer

Turn over for the next question
The universal set contains the whole numbers 1 to \( n \).

\( n \) is an even number greater than 100.

- O is the set of odd numbers.
- P is the set of prime numbers.
- S is the set of square numbers.

15 (a) Explain why there are no numbers in \( P \cap S \)  

[1 mark]

15 (b) How many numbers are there in \( O \cup P \)?  
Circle your answer.  

[1 mark]

\[
\frac{n}{2} - 1 \quad \frac{n}{2} \quad \frac{n}{2} + 1 \quad n
\]
A calculator gives a value of $\pi$ as 3.14159

An approximation for $\pi$ is $\sqrt[3]{\frac{40}{3}} - \sqrt{12}$

Show that the value of the approximation is within 0.01% of the calculator value.

[4 marks]
The region $R$ satisfies the three inequalities

\[
x > -3 \quad \quad \quad x + y \leq 2 \quad \quad \quad y \geq \frac{x}{2} - 1
\]

Show the region $R$ on the grid.  

[4 marks]
18 Rearrange \( c = \frac{4 - d}{d + 3} \) to make \( d \) the subject. [4 marks]

Answer

19 Which of these points is not 5 units from the point (0, 0)?
Circle your answer. [1 mark]

(−5, 0) (1, 4) (3, 4) (0, 5)
20 The square of $x$ is 7
Circle the value of $x^3$ [1 mark]

\[
\begin{align*}
343 & \quad 3\sqrt{49} & \quad 117649 & \quad 7\sqrt{7}
\end{align*}
\]

21 $w$, $x$ and $y$ are three integers.

$w$ is 2 less than $x$
$y$ is 2 more than $x$

Prove that $wy + 4 = x^2$ [3 marks]
22. ACB is a straight line.
A is the point (0, 8), and B is the point (4, 0)
C is the midpoint of AB.
Line DCE is perpendicular to line ACB.

Work out the equation of line DCE.

[5 marks]

Answer: _________________________________
Kernal is using trigonometry to work out the size of angle $x$.

He assumes that angle $ABC$ is a right angle.

In fact, the size of angle $ABC$ is $85^\circ$.

What is the effect of his assumption on the accuracy of his answer?

You **must** show your working.

[3 marks]
24 **AED** is a straight line.

\[ \vec{AE} = a + 3b \]

\[ \vec{EB} = -a + b \]

Not drawn accurately

![Diagram](image)

24 (a) Work out the vector \( \vec{AB} \) [1 mark]

Answer ____________________________

24 (b) Also \( \vec{ED} = \frac{1}{3} \vec{AE} \) and \( \vec{DC} = -\frac{1}{3} a \)

Prove that \( EC \) is parallel to \( AB \). [3 marks]

Answer ____________________________

Answer ____________________________

Answer ____________________________
The time of each swing of a pendulum, length \( l \) cm, is \( T \) seconds.

\( T \) is directly proportional to the square root of \( l \).

When \( l = 64 \) \( T = 1.6 \)

Work out the value of \( T \) when \( l = 132.25 \)  

[5 marks]

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The graph with equation \( y = x^2 \) is translated by vector \( \begin{pmatrix} 2 \\ 0 \end{pmatrix} \)

Circle the equation of the translated graph.

[1 mark]

\[ y = (x - 2)^2 \quad y = (x + 2)^2 \quad y = x^2 + 4 \quad y = x^2 + 2 \]
Here is a sketch of a speed-time graph for part of a journey.

The average speed from 0 to \(t\) seconds was 7.2 m/s

Work out the value of \(t\).

Answer \(\ldots\) seconds
For all values of \( x \), \( f(x) = \frac{4x - 3}{5} \)

Work out \( f^{-1}(x) \) [3 marks]

Answer

.END OF QUESTIONS