Please write clearly in block capitals.

Centre number  ___________________  Candidate number  ___________________

Surname  ____________________________________________

Forename(s)  ____________________________________________

Candidate signature  ____________________________________________

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**GCSE**

**MATHEMATICS**

Higher Tier  Paper 1  Non-Calculator

Date of Exam  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.
### Answer all questions in the spaces provided.

1. What is the area, in cm\(^2\), of a semicircle of radius 6 cm?
   
   Circle your answer.  
   
   [1 mark]  
   
   \[6\pi, 12\pi, 18\pi, 36\pi\]

2. Expand \(3x^2(2x - 5)\)
   
   Circle your answer.  
   
   [1 mark]  
   
   \[-9x, 6x^3 - 5, 5x^3 - 8x^2, 6x^3 - 15x^2\]

3. Circle the solution of \(2x + 8 > 4\)
   
   [1 mark]  
   
   \(x > -6, x > -2, x > 2, x > 6\)
4 Circle the calculation that increases 50 by 200%

\[
\begin{array}{cccc}
50 \times 1.2 & 50 \times 2 & 50 \times 2.2 & 50 \times 3 \\
\end{array}
\]

[1 mark]

5 Solve \( \frac{x}{3} - 9 = 12 \)

[2 marks]

\[
x = \\
\]

Turn over for the next question
6 The air pressure in a tyre measures 7.2 bar.
    Air is leaking out at the rate of 0.2 bar per day.

6 (a) Assume that the air continues to leak at the same rate.
    After how many days will the pressure measure 4.8 bar?  [2 marks]

   Answer

6 (b) In fact, the rate that the air leaks out increases each day.
    How does this affect your answer to part (a)?  [1 mark]
7. \( ABDE \) is a parallelogram.

\[ AB = AC \]

Show that \( x = 22^\circ \) 

[3 marks]
8 (a) Here are the fourth and fifth terms of a Fibonacci-type sequence.

\[ \_ \_ \_ \_ \_ \_ \quad 28 \quad 43 \]

Each term is the sum of the previous two terms.

Show that the first term is 2

[2 marks]

8 (b) Here are the first and third terms of a different Fibonacci-type sequence.

\[ a \quad \_ \_ \_ \_ \_ \quad b \quad \_ \_ \_ \_ \_ \]

Each term is the sum of the previous two terms.

Work out an expression in terms of \( a \) and \( b \) for the fifth term.

[3 marks]

Answer
Noah is attempting to work out the base of different right-angled triangles.

Here is his method with the working for $y = 10$ and $x = 6$

Work out the value of $y^2$

$10^2 = 100$

Work out the value of $x^2$

$6^2 = 36$

Work out the value of $y^2 - x^2$

$100 - 36 = 64$

The base is $\sqrt{y^2 - x^2}$

$\text{base} = \sqrt{64}$

Tick the correct statement.

- The method will **always** give an answer which is a whole number. [ ]
- The method will **sometimes** give an answer which is a whole number. [ ]
- The method will **never** give an answer which is a whole number. [ ]

Show working to support your answer.
The diagram shows three routes, A, B and C, between two towns, X and Y. The distance and average speed for each route is shown.

Route A
25 miles at 50 mph

Route B
20 miles at 30 mph

Route C
30 miles at 40 mph

10 (a) Which of the three routes takes the longest time?

Assume the average speeds given.

You must show your working.

[4 marks]
10 (b) Jon and Matt take the same time to travel from X to Y.

Jon travels along route B at 10 mph faster than the average speed.

Matt travels along route C.

Does Matt travel faster or slower than the average speed for route C, and by how much? You must show your working.

[3 marks]

Tick a box.

Faster    Slower

Answer mph

Turn over for the next question
11 Two ordinary fair dice are rolled.

11 (a) Complete the tree diagram. [1 mark]

11 (b) Circle the probability that both dice land on 4 [1 mark]

11 (c) Work out the probability that at least one of the dice does not land on 4 [2 marks]

Answer
12 \[ A = \frac{(x - 4)(x + 3)}{x(x - 1)} \]

12 (a) Work out the value of \( A \) when \( x = -1 \) [1 mark]

Answer

12 (b) When \( 2 < x < 4 \) Circle your answer. [1 mark]

\( A \) is positive \( A \) is zero

\( A \) is negative \( A \) could be positive or negative or zero

Turn over for the next question
13 (a)  \( AC \) is a diagonal of kite \( ABCD \).
\( A \) is the point \((1, 5)\)
\( C \) is the point \((3, 1)\)

The diagonals of the kite intersect at \( M \), the midpoint of \( AC \).

\[
AM = BM
\]

\[
BM : MD = 1 : 2
\]

Work out possible coordinates of \( B \) and \( D \).

[2 marks]

\[
B ( \, , \, ) \quad \text{and} \quad D ( \, , \, )
\]
13 (b) \( \vec{XY} \) is the vector \( \begin{pmatrix} 3 \\ 2 \end{pmatrix} \) on this square grid.

Write down a vector that is

the same size as \( \vec{XY} \)

and perpendicular to \( \vec{XY} \)

[2 marks]

Answer \( \begin{pmatrix} \_ \_ \\ \_ \_ \end{pmatrix} \)

Turn over for the next question
14. Estimate the value of $19.4^2 + 30\sqrt{104}$ [3 marks]

Answer

15. Circle the expression that is equivalent to $\frac{2x^2 + 1}{x}$ where $x$ is not equal to 0 [1 mark]

- $2x + 1$
- $2x^2 + \frac{1}{2}$
- $2x + \frac{1}{x}$
- $4x + \frac{1}{x}$
One of these is a sketch of \( y = \cos x \) for \( 0^\circ \leq x \leq 180^\circ \)

Which one?
Circle the correct letter.

[1 mark]
17 Naz buys a fridge from a shop for £189

The cost of delivery is proportional to the distance from the shop.

For 15 miles, the cost is £9

Naz lives 24 miles from the shop.

Is the total cost more than £200?

You must show your working.

[4 marks]

Answer
The graph of $y = 2x$ is shown.

By drawing the graph $y = 3x^2 - 4$ on the grid, work out approximate solutions to $3x^2 - 4 = 2x$.

[4 marks]

Answer
19 (a) Work out the value of $\left(\sqrt{2}\right)^4$ [1 mark]

Answer

19 (b) Expand and simplify $(\sqrt{2} + 3)^2$ [2 marks]

Answer

20 Work out the value of $9^{\frac{1}{2}}$ [2 marks]

Answer
21 The diagram shows a triangle $ABE$ and a rectangle $BCDE$.

\[ \text{area } ABE = \text{area } BCDE \]

$BC$ is 2 cm shorter than $BE$.

Work out the length of $BE$.

[4 marks]

Answer \______________ cm
The histogram shows information about the times some students revised for a test. The first bar represents students who revised for less than 10 minutes.

Estimate the number of students who revised for less than 45 minutes.

Answer
23 Work out the value of \( \frac{5}{\sqrt{3}} - \sqrt{\frac{3}{4}} \)
Give your answer in the form \( k \sqrt{3} \) [4 marks]

Answer

24 Convert 0.2\( \hat{5} \) to a fraction.
Give your answer in its simplest form. [3 marks]

Answer
25 In the Venn diagram

\[ \xi = 295 \text{ students in a college} \]
\[ A = \text{students who take Art} \]
\[ G = \text{students who take Geography} \]

\[ \begin{array}{c}
\xi \\

\begin{array}{c}
A \\
25 \\
14 \\
29 \\
G
\end{array}
\end{array} \]

25 (a) One student is chosen at random.
Work out the probability the student takes Art.

[1 mark]

Answer

25 (b) One student who takes Geography is chosen at random.
Work out the probability the student also takes Art.

[1 mark]

Answer
In this Venn diagram

\[ \xi = 295 \text{ students in the college} \]

\[ H = \text{students who take History} \]

\[ E = \text{students who take English} \]

One-half of the students who take History also take English.
The number who take English is twice the number who take History.

Work out the value of \( x \).

[3 marks]
26 A and $B$ are points on the circle with equation $x^2 + y^2 = 25$

A is (3, 4)

$B$ is a point on the $y$-axis.

$PA$ and $PB$ are tangents.

26 (a) Show that the coordinates of $B$ are (0, −5) [1 mark]

26 (b) Give a reason why $PA = PB$ [1 mark]
26 (c)  \( P \) is the point \((a, b)\)

Work out the values of \(a\) and \(b\). [4 marks]

\[ a = \]

\[ b = \]

END OF QUESTIONS