1. Write your class, class number in the spaces provided on this cover.

2. This paper consists of TWO sections, A and B. Section A and Section B carries 80 marks and 40 marks respectively.

3. Attempt ALL questions in this paper. Write your answer in the spaces provided in this Question-Answer Book.

4. Write the question numbers of the questions you have attempted in Section B in the spaces provided on this cover.

5. Unless otherwise specified, all working must be clearly shown.

6. Unless otherwise specified, numerical answers should either be exact or correct to 3 significant figures.

7. The diagrams in this paper are not necessarily drawn to scale.

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SECTION A : Short questions. (80 marks)

Answer ALL questions in this section.

1. Simplify \( \frac{\frac{4}{a^5}}{\sqrt[4]{a^4}} \) with positive index. (6 marks)

2. Solve
\[
\begin{align*}
    x - y &= 3 \\
    \log x + \log y &= 1
\end{align*}
\]
(8 marks)

3. Let \( P(x) = 2x^3 - 5x^2 + x + 2 \).
   
   (a) Find the value of \( P(2) \).
   
   (b) Hence, or otherwise, factorize \( P(x) \) completely. (7 marks)
4. Solve \(2\sin \theta \cos \theta + \sin \theta = 0\) for \(0^\circ \leq \theta < 360^\circ\). (7 marks)

5. In Figure 1, \(ABC\) is a triangle with \(BC = 14\) cm, \(AC = 15\) cm and \(AB = 8\) cm. Find \(\angle B\) correct to 3 significant figures. (7 marks)

6. In Figure 2, \(TP\) is the tangent to the circle at the point \(A\). If \(\overparen{AB} : \overparen{BC} : \overparen{CA} = 3 : 2 : 4\), find \(\angle CAP\). (7 marks)
7. **Figure 3** shows the graph of the equation \( y = ax^2 + bx + c \). Find the values of \( a \), \( b \) and \( c \).

(7 marks)

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8. In a joint variation, \( x \) varies directly as \( \sqrt{y} \) and inversely as \( z \), and \( x = 2.7 \) when \( y = 9 \) and \( z = 4 \).

(a) Express \( x \) in terms of \( y \) and \( z \).

(b) Find \( x \) when \( y = 25 \) and \( z = 6 \).

(8 marks)
9. If \( \tan \theta = -3 \) where \( 0^\circ \leq \theta < 360^\circ \), find the value of \( \frac{3 \sin \theta - 2 \cos \theta}{2 \sin \theta + \cos \theta} \). (7 marks)

10. **Figure 4** shows the graph of \( y = a \sin(x - b^\circ) \) for \( 0^\circ \leq x < 390^\circ \), where \( 0 < b < 90 \).

(a) Find the values of \( a \) and \( b \).

(b) Find the minimum value of \( y = a \sin(x - b^\circ) \) and the corresponding value of \( x \). (8 marks)

11. In **Figure 5**, John walks from town A at a speed of 2 km/h in the direction N45°E. Mary walks from town B at a speed of 2.5 km/h in the direction N0°W. The distance between towns A and B is 9 km. After walking for 4 hours, they meet at town R. Find

(a) the distances RA and RB,

(b) the value of \( \theta \) correct to 3 significant figures. (8 marks)
SECTION B: Long questions. (40 marks)
Answer ALL questions in this section.

12.

In Figure 6, $ABCD$ is a square with sides 12 cm and $BPC$ is a semicircle with centre $O$. $RP$ is a tangent to the semicircle and $APQR$ is a straight line.

Suppose $RC = x$ cm.

(a) Show that $\triangle OPR \sim \triangle ABR$. (5 marks)

(b) Hence, deduce that $PR = \left(\frac{12 + x}{2}\right)$ cm. (5 marks)

(c) Show that $\triangle PRC \sim \triangle BPR$. (5 marks)

(d) Find the lengths of $BR$ and $PR$. (5 marks)
13. In Figure 7, boat \( A \) is in the direction S45°W of boat \( B \) which is 1.5 km apart from \( A \). The bearings of boat \( A \) and boat \( B \) from lighthouse \( P \) are S30°W and S75°E respectively.

\[
\begin{align*}
\text{figure 7} \\
\end{align*}
\]

(a) Find \( OA \) and \( OB \) to the nearest metre. \hspace{1cm} (7 marks)

(b) The angle of elevation of \( P \) from boat \( A \) is 28°. Find the angle of elevation of \( P \) from boat \( B \). \hspace{1cm} (6 marks)

(c) At \( 01:00 \), boat \( A \) starts to sail to meet ship \( B \) with a speed 0.8 m/s. When will boat \( A \) be the closest to the lighthouse \( P \)? (Give the answer correct to the nearest minute.) \hspace{1cm} (7 marks)
\[ z = (z^2 + 1)(z + 2) \]
\[ \sigma = z^2 + 1 \]
\[ \sigma = \sigma^2 + 1 \]

\[ \frac{z + 1}{z - 1} \]
\[ (\frac{2}{3} - x)^2 + (x + \frac{4}{3})^2 = 1 \]

\[ (\frac{2}{3} - x)^2 + (x + \frac{4}{3})^2 = 1 \]

\[ \text{(a) Find } x \text{ when } y = 1 \text{ and } z = 2. \]

\[ \text{(b) Express } x \text{ in terms of } y \text{ and } z. \]

\[ \text{In a joint variation, } x \text{ varies directly as } y \text{ and inversely as } z. \]

\[ k = x \]
(a) Find the area of \( \triangle ABC \). 

(b) Find the length of \( BC \). 

(c) Find the length of \( AB \). 

(d) Find the length of \( AC \). 

(e) Find the length of \( AD \). 

(f) The distance from \( A \) to \( B \) in the direction of \( AB \) is given by \( \overrightarrow{AB} \). 

10. The diagram shows the graph of \( f(x) = \sin x \). 

(3 marks)
\[ x = \frac{7}{3} \]

\[ y = \frac{2}{1} \]

\[ z = \frac{2}{3} \]

\[ \frac{x}{2 + x} = \frac{7}{10} \]

\[ \frac{2 + x}{y} = \frac{12}{5} \]

\[ \frac{y}{z} = \frac{2}{3} \]

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