INSTRUCTIONS

1. Illegible work, in the opinion of the marker, will earn zero marks.

2. Number your answers clearly and accurately, exactly as they appear on the question paper.

3. **NB**
   - **START EACH QUESTION AT THE TOP OF A NEW PAGE.**
   - **LEAVE 2 LINES OPEN BETWEEN EACH OF YOUR ANSWERS.**

4. **NB**
   Fill in the details requested on the front of the question paper and staple your submission in the following manner:
   - Question paper (on top)
   - Answer pages in order (below).

5. Employ relevant formulae and show all working out. Answers alone may not be awarded full marks.

6. (Non-programmable and non-graphical) Calculators may be used, unless their usage is specifically prohibited.

7. Round off answers to 2 decimal places, where necessary, unless instructed otherwise.

8. If (Euclidean) Geometric statements are made, reasons must be stated appropriately.
QUESTION 1 [ 7 marks ]

CALCULATORS MAY NOT BE USED IN THIS QUESTION

1. Consider the following numbers: \( \sqrt{27}, \sqrt[3]{27}, \sqrt{-27} \). Which one of these numbers is:
   1.1. Irrational
   1.2. Non-real

2. Between which two consecutive natural numbers does \( 3\sqrt{100} \) lie?

Show all your working out.

3. Write \( 5, \frac{23}{5} \) as an improper fraction. Show all working out.

[7]

QUESTION 2 [ 10 marks ]

2.1. Multiply out and simplify as possible:
   2.1.1. \((2x + 3y)(4x^2 - 6xy + 9y^2)\)
   2.1.2. \(-3(2x - 3) - (3x - 5)(2x + 3)\)
   2.1.3. \(2x^\frac{1}{2} \left(x^\frac{1}{2} + 3x^\frac{-1}{2}\right)\)
   2.1.4. \((3^x + 5)(3^x - 1)\)

2.2. If \( \frac{5}{x} - \frac{x}{5} = 6 \), determine the value of \( \frac{25}{x^2} + \frac{x^2}{25} \)

[10]

Page 2 of 6
QUESTION 3 [16 marks]

3.1. Factorise fully:
3.1. \(3a^2 - 12ab\)  
3.2. \(3x^2 + 3px - 2mx - 2mp\)  
3.3. \(-16x^2 + 4x + 30\)  
3.4. \(2x^3 - 5x^2 - 12\)  
3.5. \(2^{x+1} - 3.2^{x-2}\)  
3.6. \(x(x-1) - y(y-1)\)

[16]

QUESTION 4 [17 marks]

4. Simplify fully:
4.1. \(\frac{2x^2-8}{27} \div (x^2 - x - 6)\)  
4.2. \(\frac{x-y}{3} - \frac{x+y}{6}\)  
4.3. \(\frac{10^x \cdot 25^{x+1} \cdot 2 \cdot (\frac{1}{5})^x}{50^{x+1}}\)  
4.4. \(\frac{1 - \frac{x}{y}}{\frac{1}{x} - \frac{1}{y}}\)  
4.5. \(\frac{2^{2x} + 2x - 6}{2^{2x} - 9}\)

[17]
QUESTION 5 [8 marks]

5.1. Given \(-2 < -3x + 4 \leq 7\)

5.1.1 Solve the given inequality for \(x\). (2)

5.1.2 Hence, write your answer to 5.1.1

5.1.2.1 on a number line (1)

5.1.2.2 in interval notation (1)

5.2 Solve for \(a \text{ and } b\)

\[2a - 3b = 5\]
\[3a - 5b - 6 = 0\] (4)

[8]

QUESTION 6 [18 marks]

Solve for \(x\) in the following equations.

6.1 \[12x^2 = 3x\] (3)

6.2 \[(2x - 1)(x + 2) = 25\] (4)

6.3 \[0 = -3 - \frac{4}{x - 5}\] (2)

6.4 \[4 \cdot 2^{3x-2} = \frac{3}{\sqrt{2}}\] without the use of a calculator. (3)

6.5 \[5 \cdot 7^{2x} - 3 = 0\] (2)

6.6 \[5 \cdot x^3 = 10\] (4)

[18]
QUESTION 7 [9 marks]

7.1 Given \(-6; -10; -14; -18; \ldots; -442\)

7.1.1 Determine an expression for the general term of the sequence \(T_n\).

Simplify your expression. \(\text{(3)}\)

7.1.2 Determine the 600th term. \(\text{(2)}\)

7.1.3 Calculate the number of terms in the sequence. \(\text{(2)}\)

7.2. If \(x + 1; 3x - 1; 4x + 1\) are terms of an arithmetic sequence,

calculate the value of \(x\) \(\text{(2)}\)

[9]

QUESTION 8 [9 marks]

8.1 Given that \(\theta = 120^\circ\). Calculate the value of the following.

8.1.1 \(\sin \frac{\theta}{4}\) \(\text{(1)}\)

8.1.2 \(\sin^2 \theta + \cos^2 \theta\) \(\text{(1)}\)

8.1.3 \(\sin \theta + 4\) \(\text{(1)}\)

8.2 Solve for \(\theta\)

8.2.1 \(3 \tan \theta = 2.22\) \(\theta \in (0^\circ; 90^\circ)\) \(\text{(1)}\)

8.2.2 \(\frac{\sin\theta}{4} = \frac{\sin 24^\circ}{6}\) \(\theta \in (0^\circ; 90^\circ)\) \(\text{(2)}\)

8.2.3 \(7^2 = 6^2 + 5^2 - 2.65 \cos 2\theta\) \(2\theta \in (0^\circ; 90^\circ)\) \(\text{(3)}\)

[9]
In the diagram $BC = 120\, m$, $\angle BAD = 20^\circ$, $AD = 176\, m$ and $D\hat{C}B = 90^\circ$

Determine the following.

9.1. the length of $AC$. (3)

9.2. the length of $DC$. (1)

9.3. hence, calculate the size of angle $B\hat{D}C$. (2)

[6]