P425/1

PURE MATHEMATICS

PAPER ONE

OCTOBER 2024

TIME: 2 HOURS

MIRACLE DESTINY HIGH SCHOOL

Uganda Advanced Certificate of Education

SENIOR FIVE 2024

PURE MATHEMATICS

P425/1

PAPER ONE

2 HOURS

INSTRUCTIONS TO CANDIDATES

- *Answer **ALL** questions in section A and section B*
- *Any additional question(s) answered will not be marked.*
- *All necessary working must be clearly shown.*
- *Silent, non-programmable scientific calculators and mathematical table with a list of formulae may be used.*

SECTION A (40 MARKS)

Answer **ALL** questions in this section

1. The coefficients of the first three terms of the expansion of $\left(1+\frac{x}{2}\right)^n$ are in an arithmetic progression (AP). Find the value of $\boldsymbol{n}$. (05 marks)
2. The first term of an arithmetic progression (AP) is equal to the first term of a geometric progression (GP) whose common ratio is $\frac{1}{3}$ and sum to infinity is 9. If the common difference of the AP is 2, find the sum of the first ten terms of the AP (05 marks)
3. Solve for x in: $\log_a(x+3)+\frac{1}{\log_x a}=2\log_a 2$ (05 marks)
4. Solve the equation: $\log_{25} 4x^2=\log_5(3-x^2)$ (05 marks)
5. Prove by induction that: $\sum_{r=1}^{n} 3^{r-1}=\frac{3^n-1}{2}$. where n is a whole number.
6. Express the function $f(x)=2x^2-12x+23$, in the form $a(x-b)^2+c$. Hence, find the minimum value of the function $f(x)$. (05 marks)
7. Show that: $\left(\frac{\left(1+\sqrt{2}\right)^2-\left(1-\sqrt{2}\right)^2}{4\left(1+\sqrt{2}\right)}\right)^2=2\left(3-2\sqrt{2}\right)$ (05 marks)
8. Given that μ and λ are roots of the quadratic equation such that $\mu+\lambda=1$ and $\mu\lambda=-2$. Find the value of $\frac{\mu}{2\lambda-\mu}+\frac{\lambda}{2\mu-\lambda}$. (05 marks)

SECTION B (60 MARKS)

Answer **ALL** questions from this section. All questions carry equal marks

9. Expand $\sqrt{\frac{1+2x}{1-x}}$ up to the term in x^2. Hence, find the value of $\sqrt{\frac{1.04}{0.98}}$ to four significate figures (12 marks)

10. **(a)** Prove by induction $1.3+2.4+\cdots+n(n+2)=\frac{1}{6}n(n+1)(2n+7)$ for all integral values of n. (06 marks)

    (b) A man deposits shs150,000/= at the beginning of every year in a microfinance bank with the understanding that at the end of seven years he is paid back his money with 5% per annum compound interest. How much does he receive? (06 marks)

11. **(a)** Find the first three terms of the expansion $(2-x)^6$ and use it to find $(1.998)^6$ correct to two decimal places. (07 marks)

    (b) Expand $(1-3x+2x^2)^5$ in ascending powers of x as far as the x^2 term. (05 marks)

12. **(a)** Find the coordinates in the form (x, y) such that $x^3-y^3=-4$ and $x-y=2$ (06 marks)

    (b) Prove by mathematical induction that when $k=1,2,3,4,\dots,n$ and $a_k=k^2-2k+1$, then $a_1+a_2+a_3+a_4+\cdots a_n=\frac{n}{6}(n-1)(2n-1)$ (06 marks)