

**UGANDA ADVANCED CERTIFICATE OF EDUCATION**

**MATHEMATICS PAPER ONE**

**S5 MID-TERM TWO EXAMINATIONS**

**DURATION: 2½ Hrs.**

**INSTRUCTIONS**

- Attempt all the eight questions in section A and any five questions in section B
- All questions in section B carry equal marks
- A silent non-programmable calculator may be used.
- Answers should be easily written and all steps must appear in the answer sheets.

**SECTION A (40 MARKS)**

1. Solve the equations:  
 $2 \log_y x + 2 \log_x y = 5$   
 $xy = 27$
2. Find the coefficient of  $x^{17}$  in the expansion of  $\left(x^3 + \frac{1}{x^4}\right)^{15}$ .
3. Prove by induction that  $8^n - 7n + 6$  is divisible by 7 for all  $n \geq 1$ .
4. Find the remainder when  $x^3 - 5x^2 + 7$  is divided by  $(x - 1)^2$
5. Find the ranges of values of  $k$  for  $9x^2 + kx + 4 = 0$  having two real and distinct roots.
6. In a geometric progression the seventh term is equal to 8 and the ninth term is equal to 18. Find the possible values of the common ratio.
7. Solve  $\sqrt{(x - 3)} + \sqrt{(2x + 1)} = \sqrt{(3x + 4)}$
8. Find the value of  $x$  if;  $9^x - 3^{(x+1)} = 10$

**SECTION B (60 MARKS)**

9. (a) A geometric series has the first term as 27 and common ratio as  $\frac{4}{3}$ . Find the least number of terms the series can have if its sum exceeds 550. (6 marks)
- (b) The first three terms of an arithmetic progression are  $-3\frac{1}{8}$ ,  $-1\frac{7}{8}$  and  $-\frac{5}{8}$ . Find the sum of the first 70 terms of the AP. (6 marks)

10. (a) Expand  $(1 + x)^{1/2}$  using the binomial theorem up to the fifth term in ascending powers of  $x$ .  
hence find  $\sqrt{1.08}$  to four decimal places. (7 marks)
- (b) The coefficient of  $x^2$  in the expansion of  $(1 - 2x)^n$  is 24. Calculate the possible values of  $n$ . (5 marks)
11. (a) Prove by induction that;  
 $\sum_{r=1}^n r^2 = \frac{n}{6}(n+1)(2n+1)$  (6 marks)
- (b) Find the values of  $m$ , for which  $x^2 - 2(1 + 3m)x + 7(3 + 2m) = 0$  has equal and repeated roots. (6 marks)
12. (a) Find the value of  $n$ , if  ${}^nP_4 = 30 {}^nC_5$ . (5 marks)
- (b) A committee of six people is to be chosen from 13 men and 7 women. In how many ways can the committee be selected if it must consist of;
- (i) At least one member of each sex. (3 marks)
- (ii) More men than women. (2 marks)
- (iii) At most two women. (2 marks)
13. (a) The polynomial  $f(x) = 12x^3 + 25x^2 - 4x - 12$ . Show that  $f(-2) = 0$  and factorize  $f(x)$  completely, hence given that;  
 $12x27^y + 25x9^y - 4x3^y - 12 = 0$ , state the values of  $3^y$  and hence find  $y$  correct to 3 significant figures. (6 marks)
- (b) The variables  $x$  and  $y$  satisfy the equation  $x^ny = c$  where  $c$  and  $n$  are constants. When  $x = 1.10$ ,  $y = 5.20$  and when  $x = 3.20$ ,  $y = 1.05$ , find the values of  $n$  and  $c$ . (6 marks)
14. A man started working in 1990, planned an investment for his retirement in 2030 in the following ways, on the first day of each year, from 1990 to 2029 inclusive, he is to place £100 in the investment account. The account pays 10% compound interest per annum and interest is added on 31<sup>st</sup> December of each year of investment. Calculate the value of his investment on 1<sup>st</sup> January 2030 in shillings if 1£ = shs, 5000. (12 marks)
15. (a) solve for  $x$ ,  $y$  and  $z$  if;  
 $x + 2y - z = -1$   
 $3x - y + 2z = 16$   
 $2x + 3y + z = 3$  (6 marks)
- (b) Find the value of  $A$  for which the equation  $\frac{x^2 - x + 1}{x - 1} = A$  has real and repeated roots. (6 marks)
16. (a) Solve for  $\theta$ , given that;  $0 \leq \theta \leq 360^\circ$  in the equation below.  
 $\sin 2\theta + \sin \theta = 0$ . (6 marks)
- (b) Eliminate  $\theta$  in the following case; given that;  
 $y = \cos 2\theta$  and  $x = \sin \theta$ . (6 marks)

**\*\*\*END\*\*\***

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