



**First year entrance exam
GCE Specialization**

**Mathematics test
Duration : 3 Hours 30 min**

Exercise 1 : 9 marks

1. i. Given that 3, x , y , 15 are four consecutive terms of an AP,
 - a) Find the values of x and y
Given that the sum of the first ten terms of this AP is 170,
 - b) Show that the first term is -1
 - c) Find the tenth term
- ii. Expand $(x - \frac{1}{2x^2})^9$ in ascending powers of x up to an including the term in x^3 (3,2,1,3 mks)

Exercise 2 : 12 marks

2. i. Show that the equation $x \ln x + x - 3 = 0$ has root between 1 and 2
Given that $x = 3/2$ is the first approximate root, use one iteration of Newton-Raphson procedure to obtain a second approximate root of this equation.
- ii. A class is made up of 5 boys and 8 girls. Find the number of ways in which a mixed delegation of 4 students can be chosen from the class if it must include at least 2 boys.
- iii. Two statements p and q are defined as follows:
 p : The workers will go on strike. q : The will be no salary
Write the following in correct English.
 - a) $q \rightarrow p$
 - b) $\neg q \rightarrow \neg p$
 - c) $p \wedge q$(5, 4, 3 marks)

Exercise 3 : 12 marks

3. A small company produces two types of armchair. The cost of labour and materials for the two types is shown in the table below

	Labour	Materials
standard	30,000	25,000
Deluxe	40,000	50,000

The total spent on labour must be more than 1,150,000 fcfa and the total spent on materials must not be more than 1,250,000fcfa. The profit on a standard chair is 70,000fcfa and the profit on deluxe chair is 100,000fcfa

- a. Write down the four inequalities involving x and y
 - b. Write down an equation for the total profit p .
 - c. On a graph paper, shade so as to leave unshaded the region represented by the inequalities in a
 - d. How many chairs of each type should be maximize the profit?
 - e. Find the maximum profit.
- (3, 2,3,2,2 marks)

Exercise 4 : 10 marks

4. Express $\cos x + \sqrt{3} \sin x$ in the form $R \cos(x - \lambda)$ where λ is acute and $R > 0$ hence find
- The general solution of the equation $\cos x + \sqrt{3} \sin x = \sqrt{3}$
 - The maximum and minimum values of $\cos x + \sqrt{3} \sin x + 2$ (4,3,3 marks)

Exercise 5 : 9 marks

5. Express $\frac{x}{(x+1)(x+2)}$ in partial fractions. Hence, solve the differential equation $(x+1)(x+2) \frac{dy}{dx} = x(y+1)$ for $x > -1$, given that $y = \frac{1}{2}$ when $x = 1$, expressing the solution in the form $y = f(x)$. (4,5 marks)

Exercise 6 : 8 marks

6. i. The complex number z is given by $z = \frac{3-i}{2+i}$ express z in the form $a + ib$, where a, b real
 ii. Given that $z = \cos \alpha + i \sin \alpha$, show that $z^3 + z^{-3} = 2 \cos 3\alpha$. Hence find the general solution of $z^3 + z^{-3} = \sqrt{2}$ (3, 5 marks)

Exercise 7 : 10 marks

7. i. Given that one of the roots of the quadratic equation $x^2 - 8x + k = 0$ is three times the other, find the value of the constant k .

Hence solve the equation $x^2 - 8x + k = 0$

ii. A relation R is defined on the set of integers Z by aRb if $a + 2b$ is a multiple of 3. Show that R is an equivalent relation.

iii. Find the value of x for which $y = 2 \log_2 x$ and $y + 4 = \log_2 2x$ (3, 4, 3 marks)

Exercise 8 : 10 marks

8. i. Find the coordinates of the centre and the length of the radius of the circle $x^2 + y^2 - 3x - 4 = 0$. Show that the line $3x + 4y - 17 = 0$ is a tangent to the circle.

ii. M is a 3×3 matrix given by

$$M = \begin{pmatrix} 3 & 4 & 0 \\ 1 & x+2 & 1 \\ 2x-4 & 4 & x-4 \end{pmatrix} \text{ Given that } M \text{ is a singular}$$

matrix, show that $3x^2 - 2x - 36 = 0$ (6,4 marks)