

**Instructions to candidates**

**Duration:** 02 hours

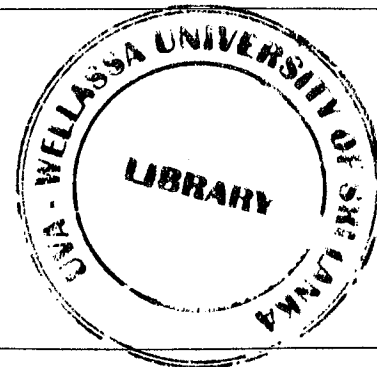
**Number of questions:** 4 Essay Questions

**Mark allocation:** 100 mark

Use standard symbols without definition.

Scientific calculators are allowed.

**Answer all questions**



1.

a. Draw the graph of the following function.

(10 mark)

$$f(x) = \begin{cases} 2x - 1; & \text{if } x < 2 \\ 3 & ; \text{if } x \geq 2 \end{cases}$$

b. Simplify the following expression,  $\left(\frac{x^3 y^{-2}}{z^4 y^4}\right)^{\frac{1}{6}}$ .

(5 mark)

c. Solve the following expression for  $x$ ;  $4^{2x-1} = 16$ .

(5 mark)

d. Solve the following equation for  $x$ .

(5 mark)

$$\log_2 5 + \log_2 3 = \log_2 x$$

2.

a. Prove the following Trigonometric identities.

i.  $\sec^2 x + \operatorname{cosec}^2 x = \sec^2 x \operatorname{cosec}^2 x$

(5 mark)

ii.  $\tan^2 x + \tan x \sec x + 1 = \frac{1 + \sin x}{\cos^2 x}$

(5 mark)

- b. Solve the following inequality and represent the solution obtained on a number line.  
 $3 \leq 4x - 5 < 15$  (10 mark)

- c. Using Binomial theorem, expand  $(3x - 1)^6$ . (5 mark)

3.

- a.  
i. Derive the formula for the solutions to the quadratic equation,

$$ax^2 + bx + c = 0; a \neq 0. \quad (10 \text{ mark})$$

- ii. Solve,  $x^2 - 3x - 28 = 0$ . (5 mark)

- b. Solve the following expression and find the values of  $x$  and  $y$ . (5 mark)

$$(3 - 5i)z = (2 - 7i); z = x + iy$$

- c. Find the modulus of,  $(3 - \frac{1}{5}i)$ . (5 mark)

4.

- a. Find the partial fractions of,  $\frac{x^2+5x-1}{(x+2)(x+1)^2}$ . (10 mark)

- b. Let  $A = \begin{bmatrix} 1 & 5 & 0 \\ -1 & 2 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 3 & -2 \\ 0 & 1 & 1 \\ 2 & 4 & 0 \end{bmatrix}$ . Then find  $AB$ . (5 mark)

- c. There are 12 boys and 14 girls in a mathematics class. Find the number of ways that teacher can select a team of 3 students (the team is to consist of 1 girl and 2 boys) from the class to work on a group project. (10 mark)