(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS

FIRST YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: **MAT 101**

COURSE TITLE: **BASIC MATHEMSTICS**

DATE: 03/02/2022 **TIME:** 9:00 AM – 11:00 AM

INSTRUCTIONS

Answer **Questions ONE a**nd Any other **TWO**

QUESTION ONE [30MKS]

a. Define the following terms (3mks)
   i. A set
   ii. A singleton set
   iii. Complement of a set A

b. Identify the symbols as used in set theory (3mks)
   i. Δ ii. $\cap$ iii. A^c

c. Out of forty students, 14 are taking English Composition and 29 are taking Chemistry., use Venn diagram (4mks)
   i. If five students are in both classes, how many students are in neither class?
   ii. How many are in either class?

d. Find the exact value of the expression tan 45° − sin 45°/ cos 45° (3mks)

e. Find the exact value of each logarithmic expression without using a calculator (4mks)

i. $\log_4\left(\frac{1}{64}\right)$ ii. $\log_2 8$

f. Find the values of x, y and z so that the vectors $\vec{a} = x\hat{i} + 2\hat{j} + z\hat{k}$ and $\vec{b} = 2\hat{i} + y\hat{j} + \hat{k}$ are equal. (2mks)

g. Simplify the following exponential expression: $3^x - 3^{x+2}$ (3mks)

h. Find the sum of the first 50 terms of the sequence (4mks)

1, 3, 5, 7, 9, . . .

i. Evaluate each of the expression. (4mks)

i. $27^{-\frac{2}{3}}$ ii. $\left(\frac{a^{3/2}b^{2/3}}{a^2}\right)^3$

QUESTION TWO [20MKS]

a. A boy sees a bird sitting on a tree at an angle of elevation of 20°. If a boy is standing 10 miles away from the tree, at what height bird is sitting? (4mks)

b. Sketch the graph of $y = 2\sin x$. state its amplitude and period (6mks)

c. Find the angle θ between the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ (5mks)

d. Express $\frac{3x}{(x-1)(x+2)}$ as the sum of its partial fractions (5mks)

QUESTION THREE [20MKS]

a. Let $U = \{a, b, c, d, e, f, g, h\}$

$A = \{a, b, c, e, h\}$

$B = \{c, e, g\}$ *and*

$C = \{a, c, d, g, e\}$

Find each set (7mks)

a. B^c b. $A \cap B^c$ c. $B \cup (C \cap A)$ d. $(C \cup A)^c$

b. In a college, 200 students are randomly selected. 140 like tea, 120 like coffee and 80 like both tea and coffee. (7mks)

i. How many students like only tea?

ii. How many students like only coffee?

iii. How many students like neither tea nor coffee?

iv. How many students like only one of tea or coffee?

v. How many students like at least one of the beverages?

c. The sum of the first 20 terms of an arithmetic series is identical to the sum of the first 22 terms. If the common difference is -2, find the first term (6mks)

QUESTION FOUR [20MKS]

a. Determine whether the following functions are even, odd or neither (6mks)

i. $f(x) = x^2 + 4$

ii. $f(x) = x^2 - 3x + 4$

iii. $f(x) = x^3 - 2x$

b. Suppose that $f(x) = x^2 + 3x - 1$ *and* $g(x) = 2x + 3$. Find: (6mks)

(a) f ∘ g (b) g ∘ f

c. Find the inverse of $f(x) = 2x + 3$. Graph f and f^{-1} on the same coordinate axes. (8mks)

QUESTION FIVE [20MKS]

a. Solve the following equations for x (3mks)

$$8 \cdot 10^{7x} = 4$$

b. Find the factors of $2x^3 - x^2 - 7x + 2$ (5mks)

c. Given $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ *and* $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$, show that (5mks)

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$$

d. Find the area of a parallelogram whose adjacent sides are given by the vectors (7mks)
$\vec{a} = 3\hat{i} + \hat{j} + 4\hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$