



(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

**END OF SEMESTER EXAMINATIONS
FIRST YEAR FIRST SEMESTER
SPECIAL/ SUPPLEMENTARY EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE**

COURSE CODE: MAT 101

COURSE TITLE: BASIC MATHEMSTICS

DATE: 22/07/2022

TIME: 2:00 PM – 4:00 PM

INSTRUCTIONS

Answer Questions ONE and Any other TWO

QUESTION ONE [30MKS]

- a. Define the following terms (3mks)
- A subset
 - A universal set
 - Symmetric difference
- b. Change the logarithmic statement to an equivalent statement using exponents (2mks)
- $\log_3 5 = x$
 - $\ln x = 5$
- c. Find unit vector in the direction of vector $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$ (3mks)
- d. Use the definition of hyperbolic function to show that $\cosh^2 x - \sinh^2 x = 1$ (3mks)
- e. Find the sum of the first 20 terms of the GP with first term 3 and common ratio 1.5. (5mks)
- f. Find $|\vec{a} \times \vec{b}|$, if $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ (4mks)
- g. Suppose that $f(x) = 2x^2 - 3$ and $g(x) = 4x$. Find $(f \circ g)(1)$ (3mks)
- h. Write the fraction with positive exponent in the denominator (3mks)
- $$\left(\frac{5}{\frac{1}{4} - \frac{1}{9}} \right)^{\frac{1}{2}}$$
- i. Let $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, where $U = \{1, 2, 3, \dots\}$. find (4mks)
- A^c
 - $A \Delta B$
 - $A - B$

QUESTION TWO [20MKS]

- a. Solve $2 \tan^2 x + \sec^2 x = 2$ for $0 \leq x \leq 2\pi$ (3mks)
- b. How many terms in the geometric progression (5mks)
- $$1, 1.1, 1.21, 1.331, \dots$$
- will be needed so that the sum of the first n terms is greater than 20? (5mks)
- c. Suppose that in a town, 800 people are selected randomly. 280 go to work by car only, 220 go to work by bicycle only and 140 use both ways – sometimes go with a car and sometimes with a bicycle. (7mks)
- How many people go to work by car only?
 - How many people go to work by bicycle only?
 - How many people go by neither car nor bicycle?
 - How many people use at least one of both transportation types?

v. How many people use only one of car or bicycle?

d. Find the horizontal intercept of $h(t) = t^3 + 4t^2 + t - 6$ (5mks)

QUESTION THREE [20MKS]

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

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

b. Use synthetic division to divide $5x^3 - 2x^2 + 1$ by $x - 3$ (5mks)

c. Find the inverse of the following one-to-one function: (3mks)

$\{(-3, -27), (-2, -8), (-1, -1), (0, 0), (1, 1), (2, 8), (3, 27)\}$

State the domain and the range of the function and its inverse

d. Find the inverse of $y = f(x) = x^2$ if $x \geq 0$. Graph f and f^{-1} . (8mks)

QUESTION FOUR [20MKS]

a. Find the exact value of the expression $\tan 45^\circ - \sin 45^\circ / \cos 45^\circ$ (3mks)

b. Given $\cos \theta = -\frac{4}{5}$ and $90^\circ < \theta < 180^\circ$. Find $\sin \frac{\theta}{2}$ (4mks)

c. Find the area of triangle having the points A(1, 1, 1), B(1, 2, 3) and C(2, 3, 1) as its vertices. (6mks)

Express $\frac{5x^2 + 17x + 15}{(x+1)(x+2)^2}$ as the sum of its partial fractions (7mks)

QUESTION FIVE [20MKS]

a. Use the rule of addition and subtraction of fractions to simplify (3mks)

$$\frac{4}{2x+1} - \frac{2}{x+3}$$

b. Solve the following equations for x (4mks)

i. $e^{-2x+1} = 13$ ii. $8 \times 10^{7x} = 4$

c. State the domain and range of $y = \sqrt{x+4}$ (3mks)

d. Sketch a graph of $f(x) = 6^x$ (5mks)

e. Use polynomial long division to perform the indicated division $(9x^3 + 5) \div (2x - 3)$

(5mks)

Comment[Nyatichi Christine1]: