CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE

MATH 100: GENERAL MATHEMATICS

STREAMS: BSC   **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 11/08/2021   **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS:

- Answer question **ONE** and **TWO** other questions.
- Write your answers legibly and use your time wisely.

QUESTION ONE: (30 MARKS)

(a) Define the following types of number system; give an example in each case.

  i.   Integers

  ii.   Rational numbers

  iii. Irrational numbers

  iv.   Complex numbers   (4 marks)

(b) Using examples justify the following statements

(i)   All Natural numbers are Integers but all integers are not Natural numbers   (1 marks)

(ii)   An integer is a rational number.   (1 marks)

(c) (i) Find the simplest value of $243 \times (27)^{-\frac{4}{3}}$ without use of the calculator   (2 marks)

  (ii) Given $\log x = 6$, $\log y = -2$ and $\log z = 4$. Find the value of $\log\left(\frac{x^4 y^5}{z^3}\right)$

                                                                              (3 marks)

(d) A boy had some sweets in his school bag. When he removed twelve of them instead of adding the same number to the bag, he was left with thirty sweets. What should have been the correct number of sweets? (3marks)

(e) (i) The function f is defined by $f(x) = x + \dfrac{3}{x}$. Evaluate f (-3) (2 marks)

(ii) If $f(x) = ax + \dfrac{b}{x}$ and if $f(2) = 9$ and $f(3) = 16$. Find the general expression for $f(x)$. Hence find the values of x for which $f(x) = 0$ (6 marks)

(f) Using the first principle of differentiation, show that the derivative of the function $y = 3x^2 - 5$ is $6x$. (4 marks)

(g) The mean age of 20 patients in a male ward is 30 years. It was later observed that while calculating the mean, the ages of two patients were wrongly taken as 31 and 30 instead of 25 and 29 years. Find the correct mean age. (4 marks)

QUESTION TWO: (20 MARKS)

(a) Solve for x
(i) $2x^3 + x^2 - 13x + 6 = 0$ (5 marks)

(ii) $log_5(2x - 3) = 2$ (3 marks)

(b) Given $log\ x = a$, $log\ y = b$ and $log\ z = c$, express $log\left(\dfrac{x^9 y^5}{z^3}\right)$ in terms of a, b and c (3 marks)

(c) The functions $x^3 - 7x - 4$ and $3x^3 - 3x^2 + bx + 14$ have the same remainder when divided by $(x - 3)$. What is the value of b? Use any of the functions to confirm your answer using the long division method (5 marks)

(d) Show that $(m + n)^2 - (n + p)^2 + (m - p)^2 = 2(m + n)(m - p)$ (4 marks)

QUESTION THREE: (20 MARKS)

(a) Find $\dfrac{dy}{dx}$ using method of choice or the indicated technique in the bracket

(i) $y = \dfrac{1}{x^3} + \sqrt[4]{x}$ (3 marks)
(ii) $y = (-2x^2 + 2)(x^3 - 3)$ (Product rule) (3 marks)

(iii) $y = \dfrac{x^2 + 5x}{4x - 1}$ (Quotient rule) (3 marks)

(iv) $y = (7x^4 - 3)^{-2}$ (Chain rule) (3 marks)
(b) Evaluate $\lim\limits_{x \to 0}\left(\dfrac{x^2 + 5x}{2x}\right)$ (3 marks)

(e) Find which of the two curves $y = x^3 + 2x + 3$ and $y = x^3 - 2x^2 + 1$ is steeper at $x = 2$

(2 marks)

(c) Given that $g(x) = \begin{cases} x^2 + 3 & if\ x \le -2 \\ -1 & if\ -2 < x \le 0 \\ 2 - x & if\ x > 0 \end{cases}$

Evaluate: $(i) g(-1) (ii) g(-4) (iii)\ g(2)$ (3 marks)

QUESTION FOUR: (20 MARKS)

(a) Given the function defined by $f(x) = 25 - x^2$ and $g(x) = \sqrt{x}$

Evaluate $(f \circ g)(3)$ (4 marks)

(b) Given that $f(x) = 5x - 3$ and $g(x) = x + 4$
Evaluate

(i) $(f + g)(-2)$ (2marks)

(ii) $f(2x) - 4g(x)$ (3marks)

(iii) $f^{-1}(7)$ (3marks)

(c) Using the functions $f(x)$ and $f(x)$ in (b) above show that $(f \circ g)(x) \ne (g \circ f)$ (3 marks)

(d) When the price of an item was increased by sh.5, I bought 2 items fewer with sh.200. What is the current price of the item? (5 Marks)

QUESTION FIVE: (20 MARKS)

(a) Distinguish the following terms as used in statistical data collection
(i) Sampling and Census
(ii) Primary data and Secondary data (4 marks)

(b) The table below shows the frequency distribution table of masses (kg) of 60 form three students that were tested positive with pregnancy as a result of the one month teachers' strike in Chuka Igambang'ombe constituency.

Mass(kg)	60-64	65-69	70-74	75-79	80-84	85-89	90-94
Frequency	2	4	8	22	18	5	1

Using the data, determine
(i) Mean mark (3marks)

(ii) Mode (3marks)

(iii) The lower quartile (3marks)

(iv) 80th percentile (3 marks)

(v) The standard deviation (4 marks)