CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

**SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE
OF BACHELOR OF SCIENCE (APPLIED COMPUTER SCIENCE)**

RESIT EXAM

ACSC 271: MATHEMATICAL METHODS FOR COMPUTER SCIENTISTS

STREAMS: BSC (AAPPLIED. COMP SCI)   **TIME: 2 HOURS**

DAY/DATE: MONDAY 16/11/2020   **8.30 A.M. – 10.30 A.M.**

INSTRUCTIONS
- **Answer any Question ALL Questions**
- **Adhere to the instructions on the answer booklet**

QUESTION ONE

a.   Find the domain and range of the function $f(x) = \sqrt{x^2 + x - 6}$ [4 marks]

b.   Evaluate the following limits:

     i. $\lim\limits_{x \to \infty} \dfrac{x^3}{(x+4)(2x^2+1)}$ [4 marks]

     ii. $\lim\limits_{x \to 4} \dfrac{x^2 - 2x - 8}{x - 4}$ [4 marks]

c.   Given the function defined by $f(x) = \dfrac{2x+5}{x-6}$, Evaluate $f^{-1}(3)$ [4 marks]

d. Find the gradient of the curve $\dfrac{x^2 + 2}{x - 5}$, at the point x = 0   [4 marks]

e. Given that $y = \sin^{-1}(2x+3)$, find $\dfrac{dy}{dx}$ [4 marks]

f. Use the trapezoidal rule with n = 5 to approximate

$$\int_{1}^{2}(x^2+3)dx$$ [6 marks]

QUESTION TWO

a. Solve the differential equation

$$\frac{dy}{dx} = x^{\frac{1}{2}} + 3x, \ given \ \ y(0) = 3$$ [4 marks]

b. Evaluate the angle between the two vectors,
    $a = i - 5j + 4k \quad and \quad b = -4i + j - 2k$ [3 marks]

c. Find the value of t for which the vectors $a = 2ti + 4j + 2k$ and $b = i + 3k - j$ are orthogonal,
    Hence find a unit vector orthogonal to the vectors a and b [5 marks]

d. Discuss the consistency of the following system of equations using row reduction method
    hence solve it if found consistent. [8marks]

$$2x+3y+4z = 11$$
$$x+5y+7z = 15$$
$$3x+11y+13z = 25$$

QUESTION THREE
a. Find the volume of the parallelepiped spanned by the vectors a
    (1 3 -1), b (-2 1 2), c (3 5 -2) [5 marks]

b. Find the determinant, the characteristic equation the Eigen values and Eigen   vectors of the

    matrix $\begin{pmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$ Hence find A^{-1} using Cayley Hamilton theorem [10 marks]

c. Prove the divergence of the series $\displaystyle\sum_{n=1}^{\infty}\frac{n}{3^n}$ by the root test and ratio test [5 marks]