CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

RESIT/SPECIAL EXAMINATION

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN APPLIED COMPUTER SCIENCE

ACSC 271: MATHEMATICAL METHODS FOR COMPUTER SCIENTISTS

STREAMS: BSC (APPLIED COMPUTER SCIENCE) **TIME: 2 HOURS**

DAY/DATE: THURSDAY 04/02/2021 **2.30 P.M – 4.30 P.M.**

INSTRUCTIONS

- **Answer any Question ALLQuestions.**
- **Adhere to the instructions on the answer booklet.**

QUESTION ONE

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

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

c. Evaluate the following limits:

i. $\lim_{x\to\infty} \frac{x^3}{(x+4)(2x^2+1)}$ (4marks)

ii. $\lim_{x\to 4} \frac{x^2-2x-8}{x-4}$ (4marks)

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

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

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

$$\int_1^2 (x^2+3)dx$$ (6marks)

QUESTION TWO

a. Solve the differential equation

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

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

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 (5marks)

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 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 (10marks)

b. Prove the divergence of the series $\sum_{n=1}^{\infty}\frac{n}{3^n}$ by the root test and ratio test (5marks)

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