

UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

Department: Mathematical Sciences

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Mathematical Modeling

Course No : MA 375

Time: 1Hr 45M

QUIZ ONE

ANSWER ALL QUESTIONS

Question 1

- i) What is a critical point ?
- ii) Explain the difference between deterministic and stochastic models

Question 2

For the homogeneous linear system $\dot{x} = Ax$ with $A = \begin{bmatrix} a & 1 \\ 1 & a \end{bmatrix}$

- i) Find the range of the values of **a** for which the critical point will be
 - a) a saddle
 - b) a source node
 - c) a sink node
- iii) Choose a convenient value for **a** for each of the types above, solve and sketch the phase portrait.

Question 3

Give the general solution in the following system of differential equation.

$$\begin{cases} \frac{dx}{dt} = 2x + y \\ \frac{dy}{dt} = -2x \end{cases}$$

- I) Classify the critical points
- II) Write the general solution of the system
- III) Sketch the phase portrait and explain the direction of the rotation

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