Question 1

Consider the following population model:
$\frac{dx}{dt} = rx(1 - e^{bx})$
a) Classify the model
b) Find the fixed point(s)
c) Find the stability of these fixed point(s)
d) Assuming that $x(0) = x_0$, what happens to the population over time?

Question 2

$$T = \begin{bmatrix} .9 & .15 & .25 \\ .075 & .8 & .25 \\ .025 & .05 & .5 \end{bmatrix}$$

a) Classify the model
b) Find the fixed points of the model
c) Find the steady-state matrix L.

Question 3

Consider the following population model:
$\frac{dx}{dt} = rx(1 - \frac{y}{k} - \frac{ax}{k})$
$\frac{dy}{dt} = ry(1 - \frac{x}{k})$
a) Classify the model
b) Find the fixed points
c) Determine the stability of each fixed point
d) Describe the solution near each fixed point

Question 4

Consider the following System
$N(t+1) = (1 + \frac{1}{r})N(t)$
Where r is a Bernoulli random variable taking one of the two values r_1, r_2 with probability
$P[r = r1] = p$ and $P[r = r2] = 1 - p$

a) Classify the model
b) Find the fixed point(s)
c) Find the stability of the fixed point(s)
Now assume that r1 = 5, r2 = 2 and p = 0.1. d) Find the fixed point(s)
e) Find the stability of the fixed point(s)

Question 5

Consider the system:
$\frac{dx}{dt} = -(x - y)(1 - x - y)$
$\frac{dy}{dt} = x(2 + y)$
a) Classify the model
b) Find the fixed points
c) Determine the stability of each fixed point
d) Describe the solution near each fixed point

Question 6

Consider the system:
$N(t + 1) = \frac{aN(t)}{1+bN(t)}$
a) Classify the model
b) Find the fixed points
c) Determine the stability of each fixed point