Dynamical Modeling HW23 Nikita John-Okayto

Post

1) I got parts (c) and (d) wrong because I struggled with putting the word problem into math. I didn't understand how to format the equation.

FOR (c)

(a) Similar problem #1

The value of $x(n)$ depends on 3 times the value of the previous number times the previous number minus two

(i) discrete time

(ii) $x(n) = 3x(n-1)(x(n-1)-2)$

(iii) $f(x) = 3x(x-2)$

(iv) $x = 3x(x-2)$

$x = 3x^2 - 6x$

$3x^2 - 7x = 0$

$x(3x-7) = 0$

$\boxed{x=0, x=\frac{7}{3}}$

(v) $f'(x) = 6x - 6$ $|f'(0)| > 1, |f'(0)| > 1$, so both points are unstable

$f'(0) = -6$

$f'(\frac{7}{3}) = 8$

(b) Similar Problem #2

The value today depends on the value yesterday times the quantity of 3 times the value yesterday minus one.

(i) discrete time

(ii) $x(n) = x(n-1)(3x(n-1)-1)$

(iii) $f(x) = x(3x-1)$

(iv) $x = 3x^2 - x$ $\boxed{x=0, \frac{2}{3}}$

$3x^2 - 2x = 0$

$x(3x-2) = 0$

(v) $f'(x) = 6x - 1$ $|f'(0)| \not> 1, |f'(\frac{2}{3})| > 1$, so both points are unstable

$f'(0) = -1$

$f'(\frac{2}{3}) = 3$

FOR (b)

Similar Problem #1

(a) The rate of population change is increasing by twice the current population and the quantity of 1 minus the current population

(i) continuous time

(ii) $x'(t) = 2x(t)(1-x(t))$

(iii) $F(x) = 2x(1-x)$

(iv) $0 = 2x(1-x) \Rightarrow \boxed{x=0, 1}$

(v) $F'(x) = 2 - 4x$

$F'(0) = -4$ } both are less than 0, so both are stable

$F'(1) = -3$ }

Similar Problem #2

(b) A population increases at a rate of 3 times the current population times the quantity of the current population minus 2.

(i) Continuous time

(ii) $x'(t) = 3x(t)(x(t)-2)$

(iii) $F(x) = 3x(x-2)$

(iv) $0 = 3x(x-2)$

$\boxed{x=0, 2}$

(v) $F'(x) = 6x-6$

$F'(0) = -6$ $F'(0) < 0$, the point is stable

$F'(2) = 6$ $F'(2) > 0$, the point is unstable