Math Biology 2024 Graded homework assignment # 1 max 20 pts

Academic Integrity Pledge:

I have neither given nor received any unauthorized help on this assignment:

Name: Tommy Stell

Signature:

Directions:

- You must download this assignment from iCollege, complete all your work, and then upload it back to iCollege as your submission for this assignment.
- Your submission must consist of the completely filled out front page and your solutions
- Your submission must be a single pdf file. Picture files, such as jpeg or png, will not be accepted. Multiple files with all pages scanned separately will not be accepted.
- The assignment is due by **11:30 pm (Tuesday, September 10th).** Late submissions will not be accepted for any reason whatsoever.

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HW #1 - Math Bio - Stell

1.) a.) $x_{n+1} = 3x_n(1-x_n)$ $x^* = 0$

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

$f'(x) = 3(1-2x)$

$f'(x^*=0) = 3(1-2\cdot 0) = 3$

$|f'(0)| > 1$

unstable

$x_n = x^* + y_n$

$x^* + y_{n+1} = f(x^* + y_n) \approx f(x^*) + f'(x^*)y_n$

$y_{n+1} = f'(x^*)y_n$ since $f(x^*) = x^*$

stable if $|f'(x^*)| < 1$

unstable if $|f'(x^*)| > 1$

b.) $x_{n+1} = -x_n^2(1-x_n)$ $x^* = \frac{1+\sqrt{5}}{2}$

$f(x) = -x^2(1-x)$

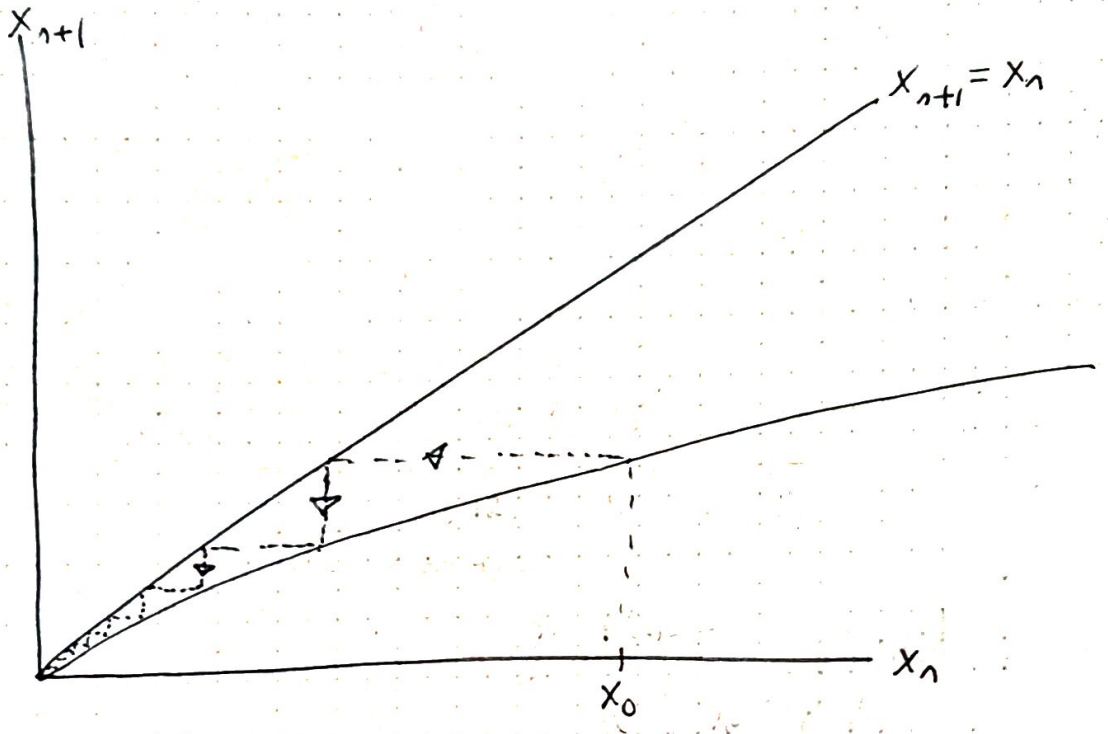
$f'(x) = x(3x-2)$

$f'\left(\frac{1+\sqrt{5}}{2}\right) = \left(\frac{1+\sqrt{5}}{2}\right)\left(3\left(\frac{1+\sqrt{5}}{2}\right) - 2\right) \approx 4.6$

$|f'(x^*)| > 1$ unstable

2.) $x_{n+1} = \frac{x_n}{1+x_n}$ $\quad x^* = 0$

$f(x) = \frac{x}{1+x}$ $\quad f'(x) = \frac{1}{(1+x)^2} \rightarrow f'(x^*) = 1$ inconclusive



stable

3.) $x_{n+1} = 3x_n - x_n^3$

a.) $x^* = 3x^* - x^{*3}$ $\quad x^* = 0$

$1 = 3 - x^{*2}$ $\quad x^* = \sqrt{2}$ Note: $x^* = -\sqrt{2}$ has no bio significance

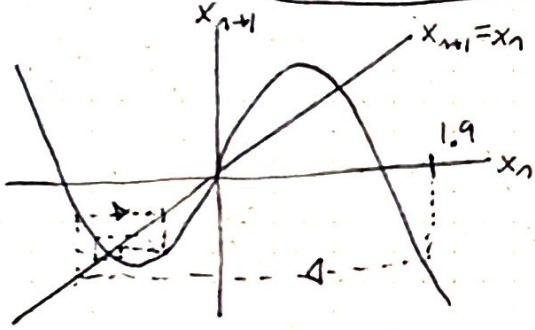
$f(x) = 3x - x^3$

$f'(x) = 3 - 3x^2$

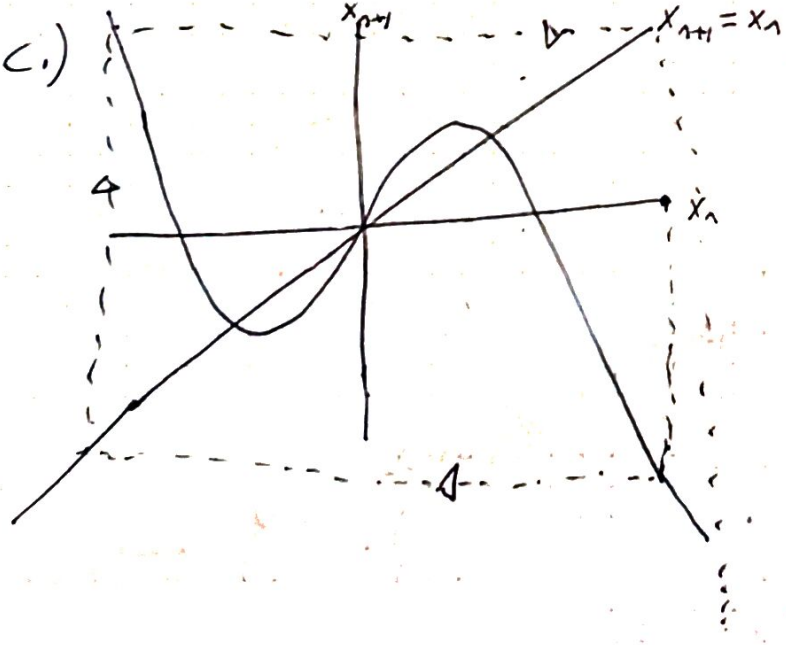
$f'(0) = 3 > 1$ unstable

$f'(-\sqrt{2}) = |-3| > 1$ unstable

b.)



c.)



d.) at $x_0 > 2$ it will spiral to larger & larger values. at $x_0 < 2$, it will stay bounded below infinity.