

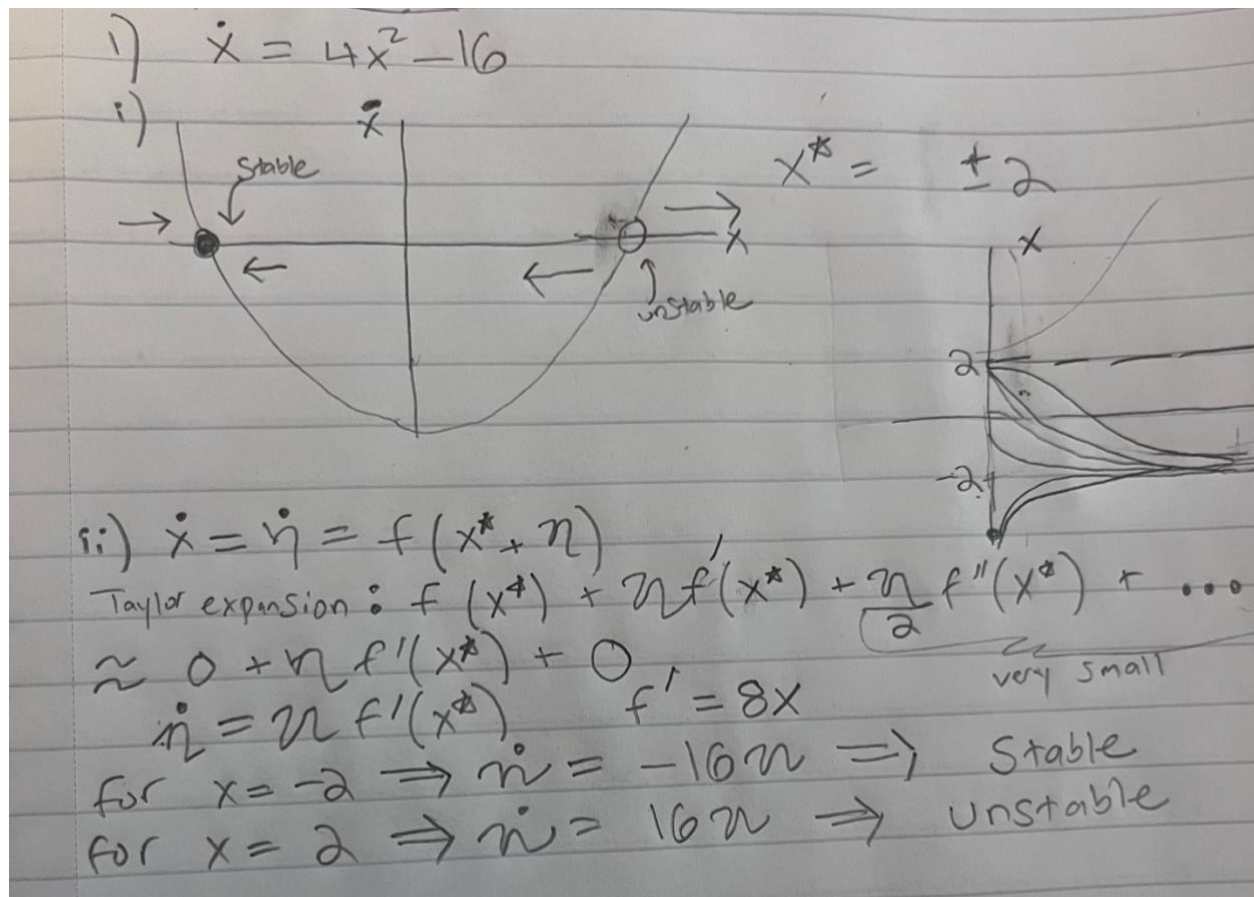
Dynamic Models in Biology

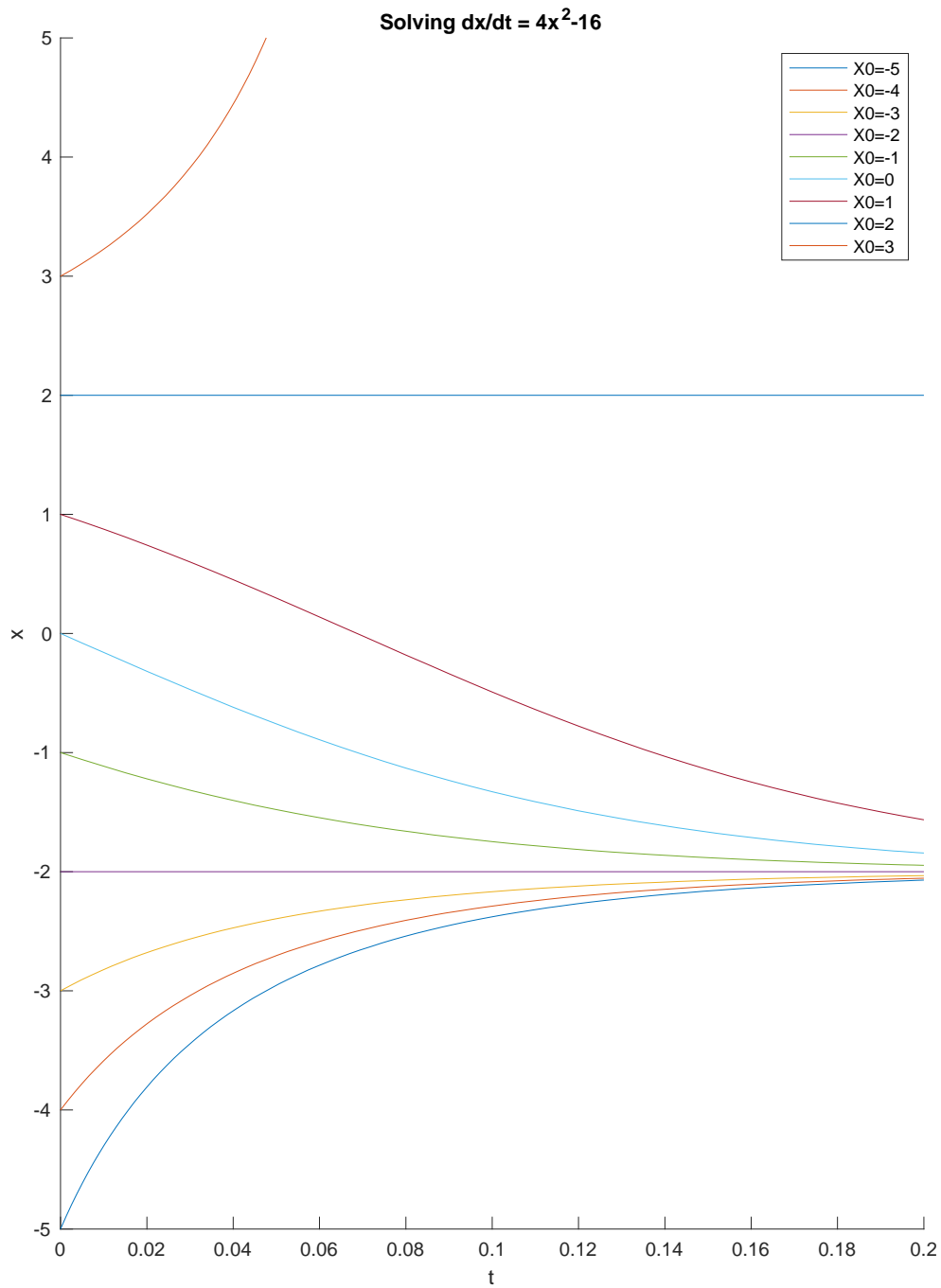
Homework 1

Jonathan Levine

Fall 2023

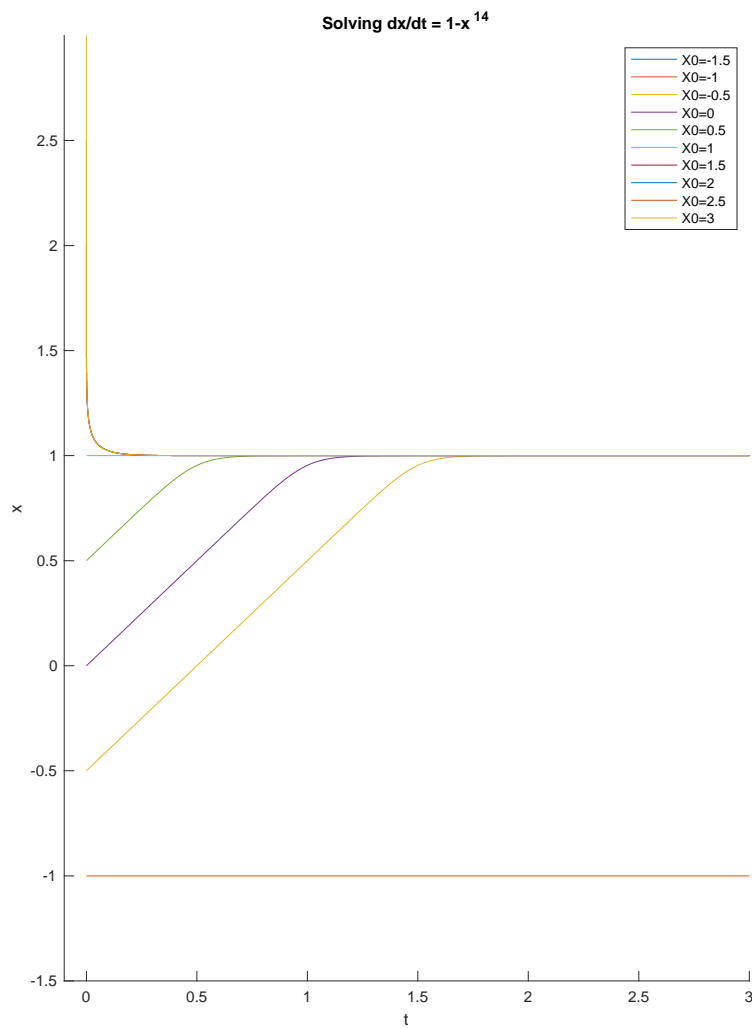
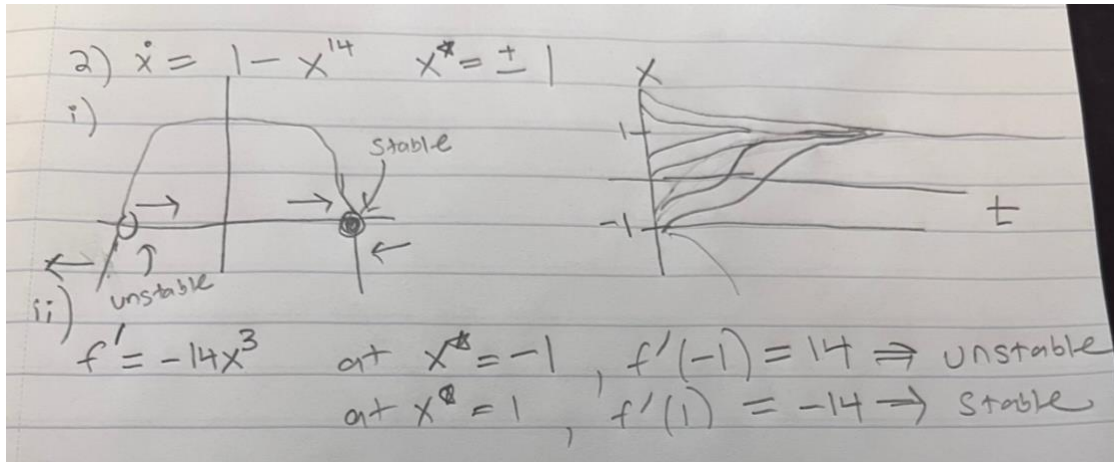
1) $\dot{x} = 4x^2 - 16$





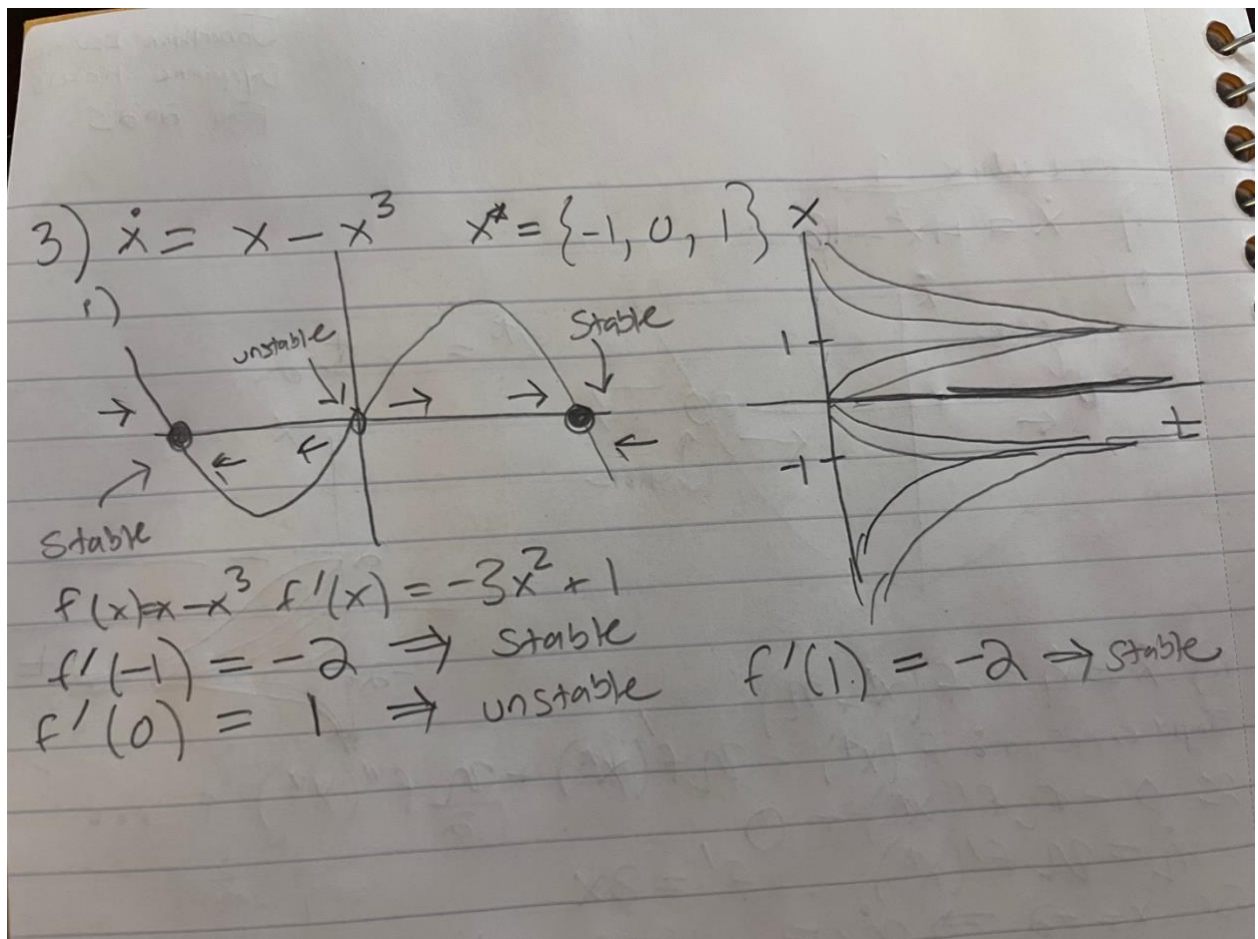
Simulation is mostly similar to the sketch, although initial values of X under the fixed point at -2 move towards the asymptote of -2 more steeply than those initial conditions between -2 and 2 .

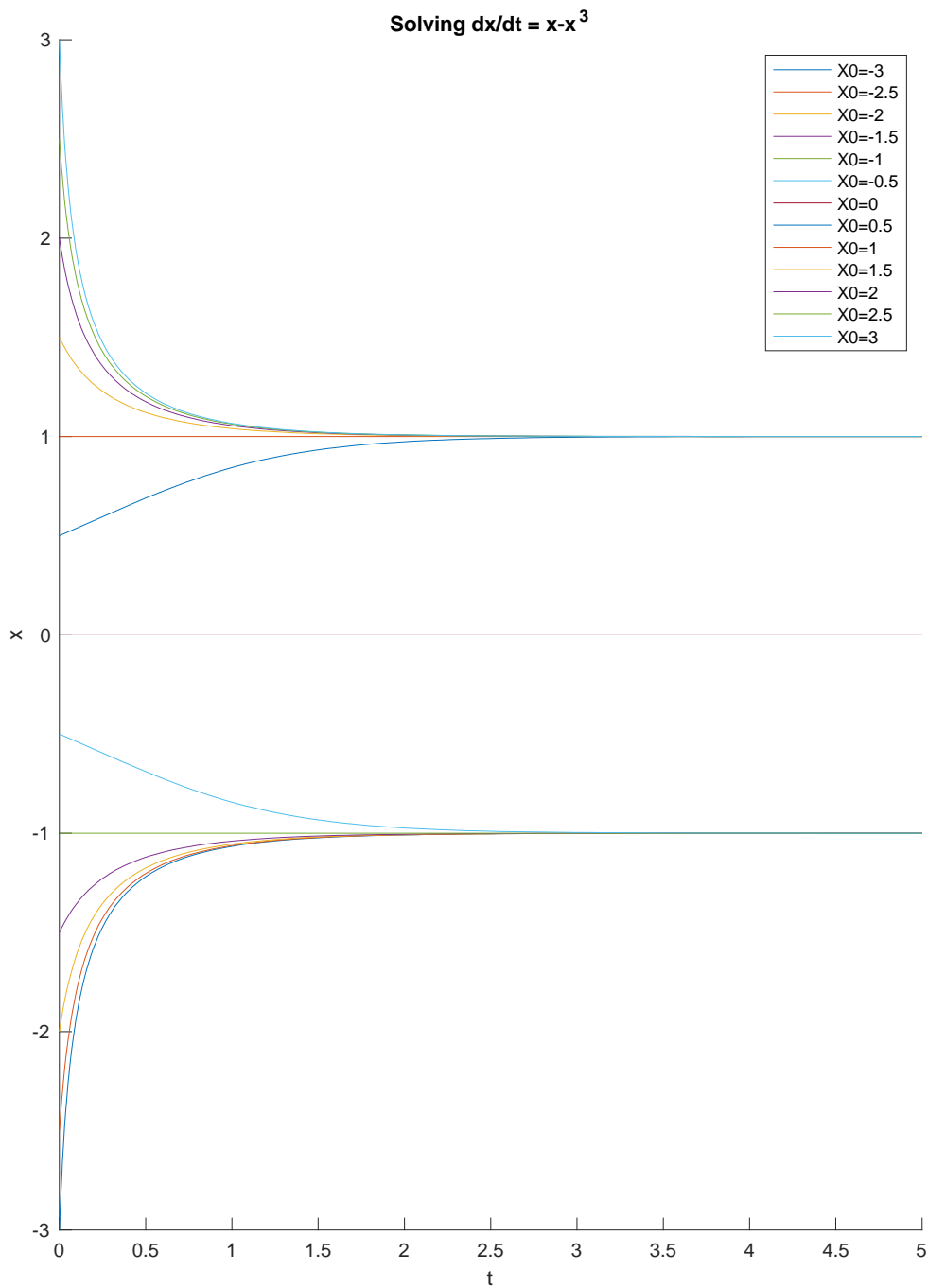
2) $\dot{x} = 1 - x^{14}$



Similar to the sketch, but initial values above 1 move very steeply towards 1 while those initial values between -1 and 1 move more slowly.

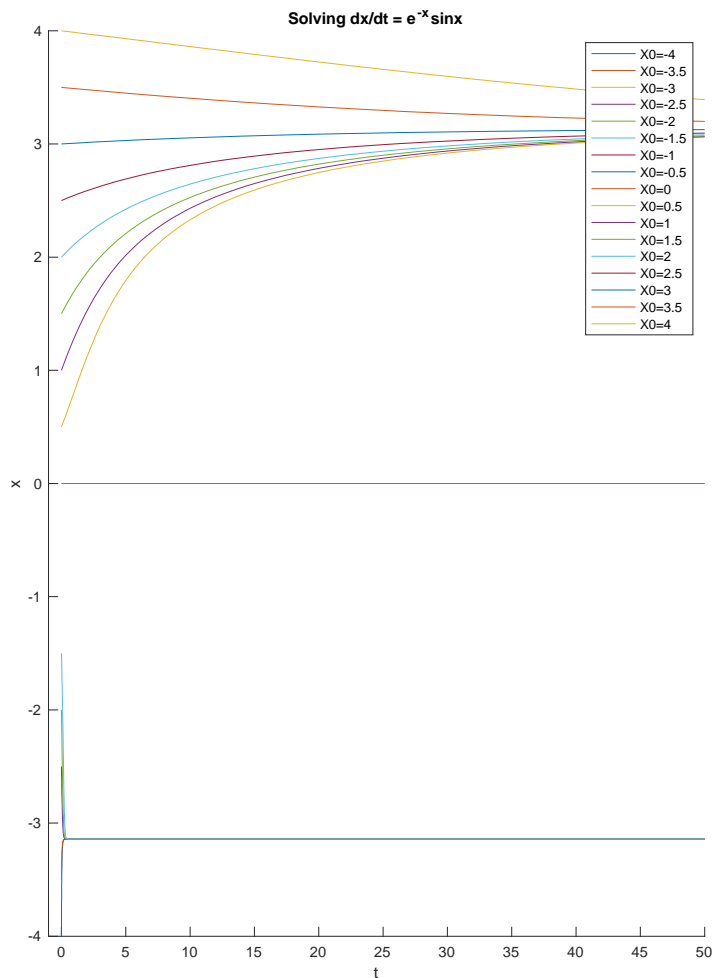
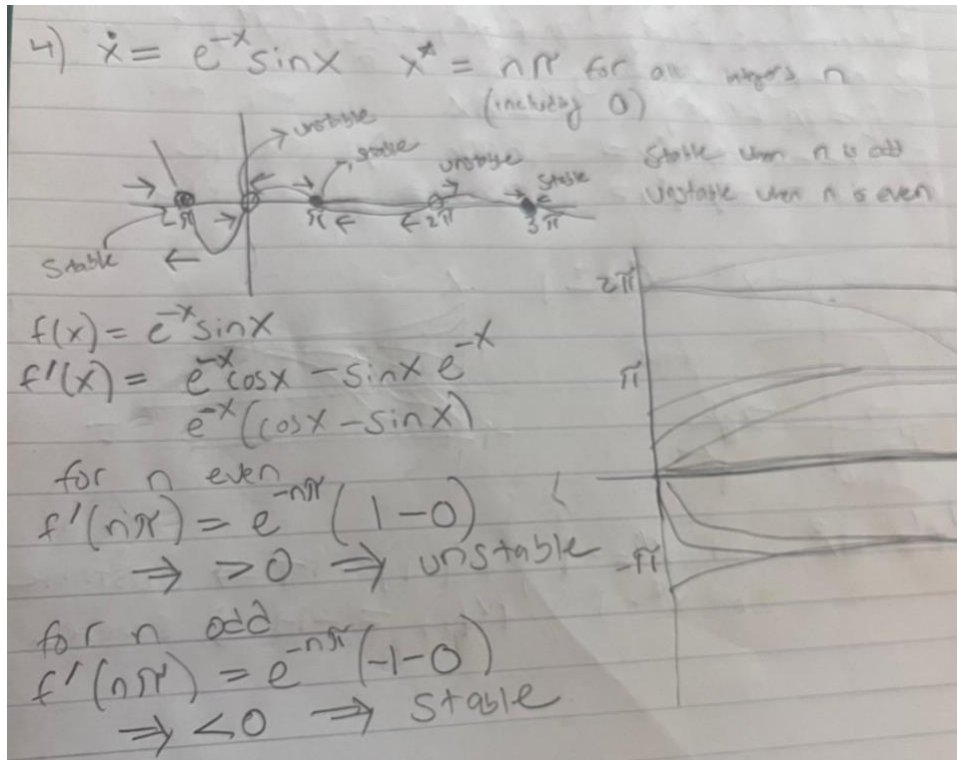
3) $\dot{x} = x - x^3$

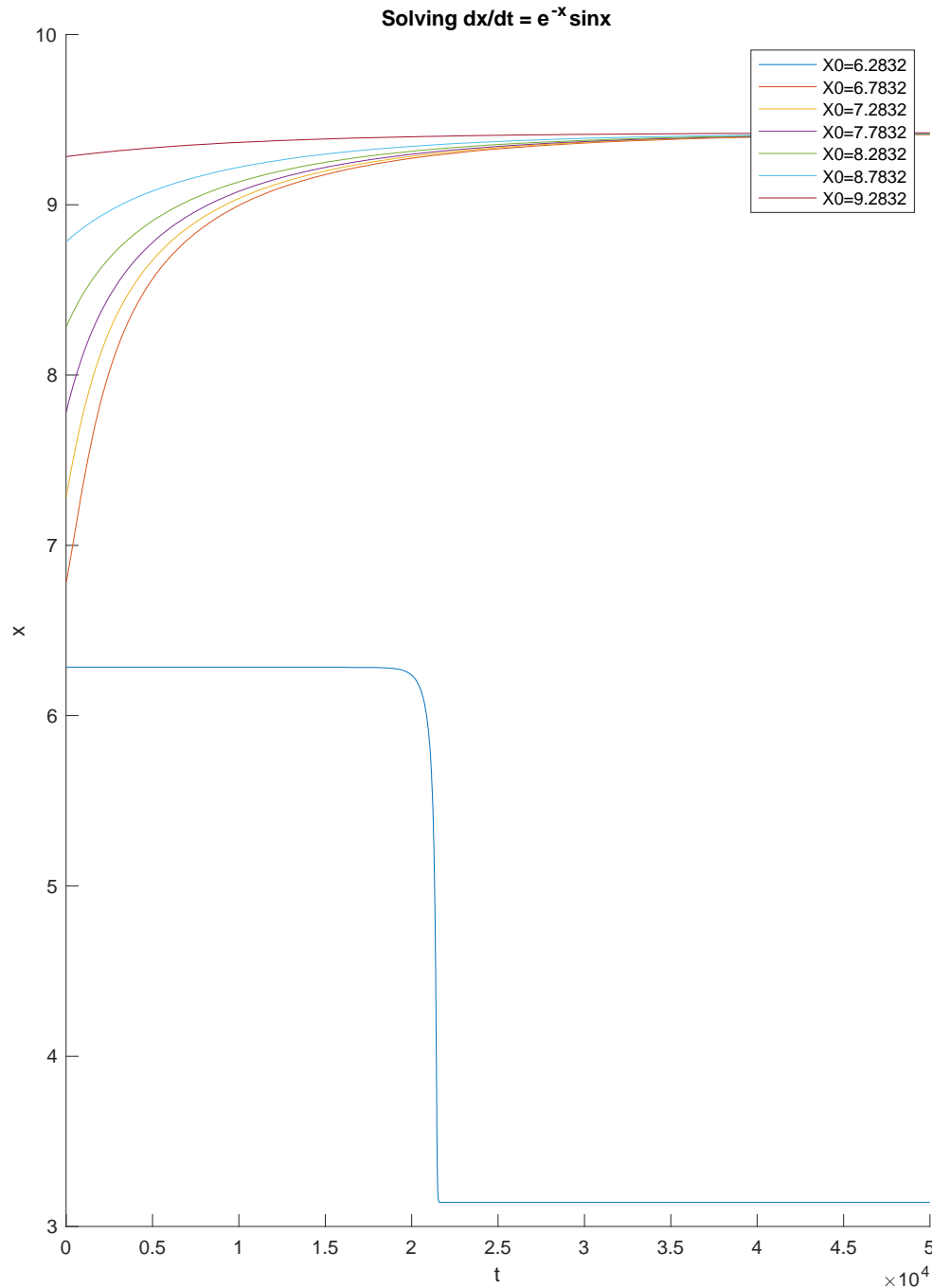




Pretty much identical to sketch, although initial conditions between 0 and the two fixed points converge more slowly than initial conditions with absolute value greater than 1.

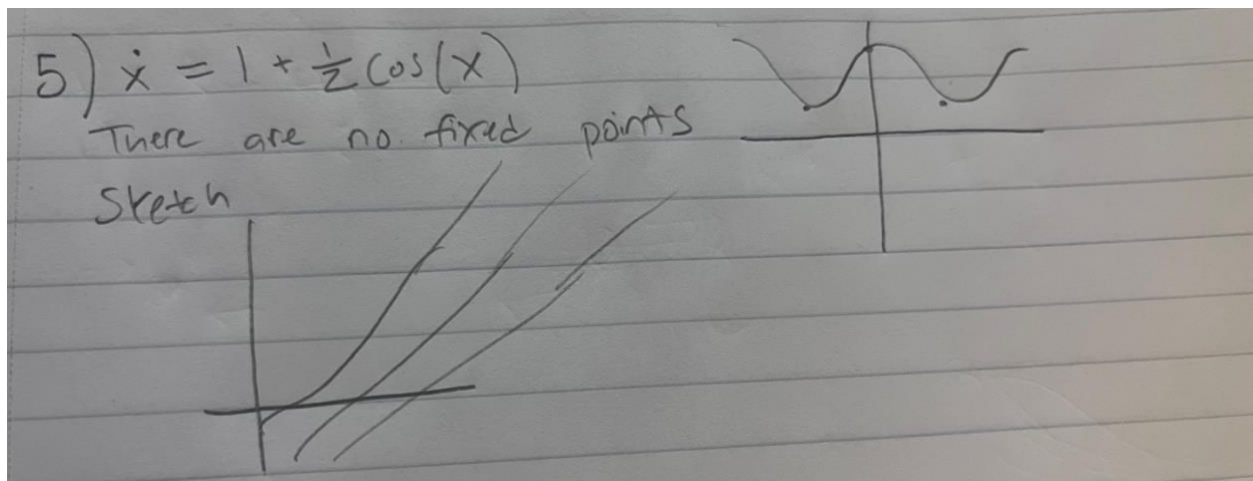
4) $\dot{x} = e^{-x} \sin(x)$





I did the simulations in 2 parts, since smaller initial values converge a lot more quickly than larger ones in this system. Initial conditions below 0 converged very quickly, while those between 0 and 4 converged to π a bit slower. An initial value just under 2π converged to π at a longer time scale (although that may have been an artifact of the simulation due to the precision of MATLAB's representation of π), while initial values between 2π and 3π converge to π very slowly (see the time axis $\times 10^4$).

$$5) \dot{x} = 1 + \frac{1}{2} \cos(x)$$



Does not
converge
since there
are no
Fixed points

