

Math 155. Homework 7. Sections 3.1 and 3.2.

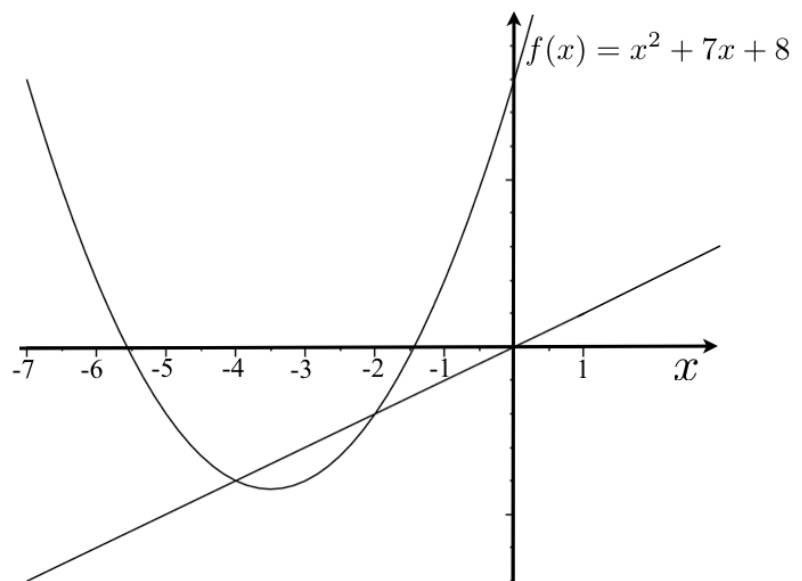
1. Consider the following discrete-time dynamical system:

$$x_{t+1} = x_t^2 + 7x_t + 8$$

(a) Find the equilibria algebraically.

(b) Apply the Stability Test/Slope Criterion to each of the equilibria you found in (a). What can you conclude?

(c) The updating function is graphed below, along with the diagonal. Cobweb for at least 3 steps starting from the initial condition $x_0 = -3.5$. Describe in detail the long-term behavior of this solution.



2. Suppose that the population x_t of octopuses satisfies the discrete-time dynamical system

$$x_{t+1} = \frac{(p-5)x_t}{1+2x_t},$$

where p is a parameter.

(a) Verify algebraically that the equilibria are $x^* = 0$ and $x^* = \frac{p-6}{2}$.

(b) Find the derivative of the updating function.

(c) Use the Stability Criterion/Stability Theorem to find the range of p for which $x^* = 0$ is stable.

(d) Use the Stability Criterion/Stability Theorem to find the range of p for which $x^* = \frac{p-6}{2}$ is *unstable*.