

Homework 2

Math 469, Spring 2024

This homework is due on Friday, January 26 at 11:30 am. (Turn in your answers – via Gradescope – to questions 1–5.)

0. (*This problem is not to be turned in.*)

- (a) Read Sections 1.1–1.4.
 - (b) Can you use cobwebbing to determine the limiting behavior of first-order, nonlinear difference equations? If not, what should you do instead?
 - (c) Can you use cobwebbing to determine the limiting behavior of second-order, linear difference equations? If not, what should you do instead?
1. Consider a colony of bacteria such that, at each time point, half the population divides, and exactly 200 bacteria die. Write down a difference equation that describes this.
 2. State an example of a second-order, non-homogeneous, linear, non-autonomous difference equation.
 3. Determine the limiting behavior of solutions to the difference equation

$$x_{t+1} = ax_t + b ,$$

where $a, b \in \mathbb{R}$. (How) does your answer depend on a , b , and x_0 (the initial value)?

4. Consider the difference equation

$$x_{t+1} = 5x_t - 1 .$$

- (a) What does the previous problem say about about the limiting behavior?
 - (b) Use cobwebbing to verify the limiting behavior.
5. Consider the difference equation

$$x_{t+1} = 4x_t(1 - x_t) .$$

- (a) Is this difference equation linear?
- (b) Use cobwebbing to determine the limiting behavior.