

Math 241, Spring 2022 — Graphical analysis

Class on February 1

In this set of problems we will try to understand the behavior of orbits by drawing diagrams in the xy -plane that visualize the fate of an initial seed x_0 .

Problem 1. For each of the following functions, describe the fate of all orbits by drawing some cobweb diagrams. Before making your drawings, find the fixed points using algebra. As you make your drawings, first try making your diagram by hand and then check your work using the `cobweb.m` script posted on the class web page. For your drawings by hand, use different colors for qualitatively different orbits. Assume the state space X is the set \mathbb{R} of all real numbers. Make a conclusion for each function by giving a case by case breakdown of the long term behavior of x_0 for different ranges of x_0 .

1. $F(x) = 2x$

2. $F(x) = \frac{1}{3}x$

3. $F(x) = x^2$

4. $F(x) = -x^3$

Problem 2. Using the examples above as a starting point, can you make any conjectures about the role that slope plays in the behavior of orbits that start near a fixed point?