Science-1

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Contents

Chapter 1

Lecture 1

1.1 Maps

A map is a mathematical function $f : \mathbb{R} \leftarrow \mathbb{R}$

$f(x) = c \leftarrow$ Constant Map

$f(x) = mx \leftarrow$ Linear Map (We should also consider shift but for the properties we are going to look at, only scale matters)

Repeated Iteration: $x_0, f(x_0), f(x_1), \ldots f(x_{n-1}) : x_n = f(f(f \ldots f(x_0)))$

For a linear map, $x, mx, m.mx, m.m^2x, \ldots, m^nx$

The properties of f depend on m but not that much on x as $n \leftarrow \infty$
Cases:

1. $m = 0 : x, 0, 0, \ldots$
2. $m = 1 : x, x, x, \ldots$
3. $m = -1 : x, -x, x, \ldots$
4. $m \in (1, \infty) : x(1, m, m^2, \ldots, m^n)$ the scale blows up to ∞.
   Behavior: Diverging, Monotonic
5. $m \in (0, 1) : x(1, m, m^2, \ldots, m^n)$ the function occilates with decreasing value of $|m|$
   Behavior: Converging, Ossillatory
6. $m \in (-1, 0)$: the function occilates with increasing value of $|m|$
   Behavior: Diverging, Ossilattory
7. $m \in (-\infty, -1)$ the function blows up to $-\infty$
   Behavior: Diverging, Monotonic

Exercise: m is a complex number. $m = a + ib$.