

### Exercise #1

MB&B 361/562

Due: before class on Tuesday, January 23, 2024

Please upload it to Canvas to hand it in (title: 'LastnameFirstname\_Exercise1').

Write all code in Live Script

Scan any handwritten parts.

0. Read the lecture notes. They contain additional examples that may be useful later. Just know that they are there.

1. Read Chapter 1 **section 1.1** of the Strogatz book: *Nonlinear dynamics and Chaos* which is uploaded. (Note that we are not going to discuss Chaos in this class, which I think is irrelevant for biology – happy to talk more about this). Do you feel that you have enough background in physics to get the gist of what he is saying?

2. Fitting bacterial growth curve. With this exercise is a Matlab script that plots data of bacterial growth over time. Convert the code to Live Script by opening it (double-click) while pressing “option”.

By hand, find an exponential time constant and amplitude (change the parameters in the program) that fit this data reasonably well and turn in the Live Script pdf (Export/Export to pdf ...).

3. A protein is created at a constant rate and is degraded at a rate proportional to its concentration. It's concentration therefore obeys the equation:

$$\dot{x} = a - bx$$

(a) What is the steady state concentration of  $x$ ?

(b) If  $a=0$ , what is the half-life of  $x$ ? That is, what is the time it takes for  $x$  to decay by a factor of 2?