

Differential Equations

MAT187 Student Slides

Geoff McGregor
Arman Pannu
Jason Siefken

Exercise 1

You are observing starfish that made their way to a previously uninhabited tide-pool. You'd like to predict the year-on-year population of these starfish.

You start with a simple assumption

#new children per year \sim size of current population

1.1 Come up with a mathematical model for the number of star fish in a given year. Your model should

- Define any notation (variables and parameters) you use
- Include at least one formula/equation
- Explain how your formula/equation relates to the starting assumption

Exercise 2

Let

(Birth Rate) $K = 1.1$ children per starfish per year

(Initial Pop.) $P_0 = 10$ star fish

and define the model M_1 to be the model for starfish population with these parameters.

2.1 Simulate the total number of starfish per year using Excel.

Exercise 3

Recall the model \mathbf{M}_1 (from the previous question).

Define the model \mathbf{M}_1^* to be

$$P(t) = P_0 e^{0.742t}$$

3.1 Are \mathbf{M}_1 and \mathbf{M}_1^* different models or the same?

3.2 Which of \mathbf{M}_1 or \mathbf{M}_1^* is better?

3.3 List an advantage and a disadvantage for each of \mathbf{M}_1 and \mathbf{M}_1^* .