Goals of this recitation

- First order modeling problems.
- Solving non homogeneous linear systems.

Contents

1. First order Modeling

1.1. **Derivative Refresher.**

- If a function is increasing, then its derivative is _____.
- If a function is decreasing, then its derivative is _____.

Let's use these ideas to build intuition on how to make first order differential equations.

- If an action will increase the value of the function, what will its effect on the derivative be?
- If an action will decrease the value of the function, what will its effect on the derivative be?

1.2. **Strategy for modeling first order differential equations.**

In maths, when we have difficult problems, an often used strategy is to break up the pieces into simpler parts based off different behaviour/operations. What do you think the strategy for solving first order differential equations based off your answers above?

1.3. **Creating a first order differential equation.** Let's do an example together.

A tank initially contains 120 L of pure water. A mixture containing a concentration of 4 g/L of salt enters the tank at a rate of 2 L/min, and the well-stirred mixture leaves the tank at the same rate. Find an expression in terms of 4 for the amount of salt in the tank at any time t. Find the limiting amount of salt in the tank as $t \to \infty$

A tank initially contains 200 L of pure water. A mixture containing a concentration of 3 g/L of salt enters the tank at a rate of 5 L/min, and the well-stirred mixture leaves the tank at the same rate. Find an expression for the amount of salt in the tank at any time t. Find the limiting amount of salt in the tank as $t \to \infty$

2. Solving non homogeneous linear systems

2.1. U substitution.

2.2. Integration Factor.

2.3. Reading equations from Matrices.

2.4. **Non homogeneous linear systems.**

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