



Chapter 1

In the first chapter (which corresponds to the first week of class), we will learn basics about differential equations. In particular, we will motivate the study of ODEs, learn some qualitative methods of studying a differential equation, and learn some basic solution techniques.

From the book:

Many of the principles, or laws, underlying the behavior of the natural world are statements or relations involving rates at which things happen. When expressed in mathematical terms, the relations are equations and the rates are derivatives. Equations containing derivatives are called **differential equations**.

A differential equation that describes some physical process is often called a **mathematical model** of the process. There are three main goals in this class:

1. Learn how to model physical situations with an ODE;
2. Learn how to analyze ODEs using a variety of methods (e.g. looking at direction fields, solving the equation explicitly, solving the equation numerically);
3. Understand what the analysis of the ODE says about the physical situation it is modeling.



A Falling Object

Suppose an object is falling toward the earth. Derive an ODE that models this situation.



A Falling Object



A Falling Object



Field Mice and Owls

Consider a population of field mice in some rural area. If there is a population of owls that kills γ mice per day, determine a differential equation that models this situation. Draw a direction field for this model.