Lesson 46 - Analytic Solutions I: Separation of Variables

Objectives

- Determine if a differential equation is separable.
- Determine a general solution to a differential equation using separation of variables.
- Determine a particular solution to a differential equation using separation of variables.

READ

- Stewart, Chapter 9.3, pages 580-585 (minus section on "Orthogonal Trajectories", pages 583-584).

THINK ABOUT

- What types of operations are usually not separable?
- What is the meaning of an antiderivative?

MATHEMATICA COMMANDS AND TASKS YOU NEED TO KNOW

Some differential equations can be extremely hard to solve by hand yet there are techniques to do it. We will focus on separation of variables as our first choice in solving equations but when it does not work we will use technology. Mathematica has a differential equations solving command called `DSolve`. Here is an example of how it works.

Given $dy/dx = x^2 + y^2$ and $y(0) = 5$ you can solve this unseparable equation with the command:

$$\texttt{DSolve}[\{y'[x] == x^2 + (y[x])^2, y[0] == 5\}, y[x], x]$$

Where $y(x)$ is your solution, x is your independent variable, y is your dependant variable.

You must use caution when using `DSolve` it is a very fragile command. It will find both general and particular solutions based on what you input into the command.