Section 9.11: Differential Equations: Separation of Variables

Differential Equations

A differential equation can most basically be described as a function where derivatives of some function are appearing. We will only be dealing with **first order differential equations** meaning that only the **first derivative** will be present. A solution to a first order differential equation is some function, usually $y(t)$, that satisfies the differential equation.

Differential equations are often used to describe physical phenomena such as radioactive decay, chemical reactions, population growth, and Newton's Law of Cooling.

We will learn the technique of separation of variables to find solutions for these first order differential equations.

Examples

Let's do some examples.

Example 1.

(a) Find the *general solution* of $y' = \dfrac{t^2}{y}$

(b) Find the *general solution* of $y' = \dfrac{6\cos(\pi t)}{y}$

(c) Find the *constant solutions* for $y' = \dfrac{y^2 - 9}{t^3}$.

(d) Find the *particular solution* that satisfies $yy' - e^x = 0$ with the initial value $y(0) = 4$.

(e) Find the *particular solution* that satisfies $\sqrt{t} + \sqrt{y}y' = 0$ for the initial value $y(1) = 4$.

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