

Section 7.1: Modeling with Differential Equations

What is a differential equation? It is an equation that relates an unknown function, such as $y(x)$, with one *or more* of its derivatives and the independent variable x .

Examples:

- $y' = 30x + 13$

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- $y' = 2(5 - y)$

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- $y' + 4x^2 = 4$

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Definition: The *order* of a differential equation is

_____.

Definition: A function is said to be a _____ of a differential equation if the function satisfies the equation for all _____.

Note:

- **Models of Population Growth**

- _____ growth: DE:

- **Interpretation:** The rate of growth $\frac{dP}{dt}$ is _____ to its size.

- **General Solution:** _____

- _____ growth: DE:

- **Interpretation:**

- _____

- _____

- **Equilibrium Solution:**

- **Example:** Match the following DE's with possible solutions:

Differential Equations	Solutions
(a) $y'' = y$	(1) $y = \cos(x)$
(b) $y' = -y$	(2) $y = \cos(-x)$
(c) $y' = 1/y$	(3) $y = x^2$
(d) $y'' = -y$	(4) $y = e^x + e^{-x}$
(e) $x^2y'' - 2y = 0$	(5) $y = \sqrt{2x}$