TOPIC: INITIAL VALUE PROBLEMS

Initial Value Problems

◆ A **differential equation** is an equation involving an unknown function and its _____.

► A differential eqn combined with an _____ condition ($y(x_0) = y_0$) is called an **initial value problem** (IVP).

EXAMPLE Solve the initial value problem given by $\frac{dy}{dx} = 3x^2 - 4,\ y(1) = -1$ by finding $y(x)$.

New **Initial Value Problems**

$$\frac{dy}{dx} = 3x^2 - 4$$

Find general solution

Apply Initial Conditions

Write particular solution

◆ To solve a differential equation with higher order derivative $\left(\frac{d^2y}{dx^2}, \frac{d^3y}{dx^3}, \ldots\right)$, apply this same process *multiple* times.

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PRACTICE Solve the following IVP:

$$\frac{dy}{dx} = 2x - 5; y(0) = 4$$

PRACTICE Using the acceleration function below, find the velocity function, if the velocity is $v = 5$ at time $t = 2$.

$$a(t) = -20$$

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PRACTICE Find the function $f(x)$ that satisfies the following differential equation.

$f''(x) = 3x^2; f'(0) = 1; f(1) = 3$

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EXAMPLE Solve the initial value problem given by $\frac{d^2y}{dx^2} = 4x^3 - 10,\ y'(1) = -2,\ y(0) = 3.$

EXAMPLE An object moving along a line is described by the acceleration function $a(t)$. Find the position function $s(t)$ given initial velocity: $v(0) = 9$ and initial position: $s(0) = 0$.

$a(t) = -9.8$