A Modular Presentation System for the Calculus Sequence

3.1 Derivatives of Polynomials and Exponential Functions

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Derivative of a Constant Function

Derivative of a Constant Function

$$\frac{d}{dx}(c) = 0$$

Power Rule for Positive Integers

The Power Rule

If n is a positive integer, then

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

The Power Rule (General Version)

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If n is any real number, then

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

Constant Multiple Rule

The Constant Multiple Rule

If c is a constant and f is a differentiable function, then

$$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}f(x)$$

Derivative Sum Rule

The Sum Rule

If f and g are both differentiable, then

$$\frac{d}{dx}[f(x) + g(x)] = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$$

Differentiating Polynomials

EXAMPLE: Find the derivative of

$$y = x^3 + 9x^2 - 4x + 1$$

EXAMPLE: Find the derivative of

$$y = \frac{x^7 - 5x}{x}$$

Finding Horizontal Tangents

EXAMPLE: Determine the location of any horizontal tangents of

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

Differentiating Exponential Functions

PROBLEM: Compute the derivative of $f(x) = a^x$ by applying the limit definition of derivative.

Definition of the Number e

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e is the number such that

$$\lim_{h \to 0} \frac{e^h - 1}{h} = 1$$

Derivative of the Exponential Function

Derivative of the Natural Exponential Function

$$\frac{d}{dx}(e^x) = e^x$$