

3.1 Derivatives of Polynomials and Exponential Functions

Objectives: Use the power rule to find derivatives of polynomials; find the derivatives of exponential functions.

Derivatives of Power Functions

Example 1 Find the derivative of $f(x) = c$

Example 2 Find the derivative of $f(x) = x$

Example 3 Find $\frac{d}{dx} x^6$. (Use Pascal's Triangle)

The Power Rule

If n is a positive integer, then

$$\frac{d}{dx}[x^n] = n x^{n-1}$$

Example 4 Find f' for $f(x) = x^{35}$.

The Constant Factor Rule

If c is a constant and $f(x)$ is differentiable, then

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

Example 5 Find $f'(x)$ for $f(x) = 5x^8$.

Sum and Difference Rule

If f and g are differentiable functions, then.

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

Example 6 Find $\frac{d}{dx}[3x^4 - 2x^2 + 5x - 4]$

General Power Rule

If n is any real number, then

$$\frac{d}{dx}[x^n] = n x^{n-1}$$

Example 7 Find $f'(x)$ for $f(x) = \frac{3x^5 - 2\sqrt{x} + 5}{x^3}$.

Example 8 Find the point where $f(x) = \sqrt{x} - 3x$ has a horizontal tangent line.

Derivative of the Natural Exponential Function $f(x) = e^x$



$$\frac{d}{dx}[e^x] =$$

Example 9 Find the point on the graph of $f(x) = e^x - 2x$ where the tangent has a slope of 2.