FUN	AP CALCULUS	
1	Topic: 2.5 Topic: 2.6	Applying the Power Rule Derivative Rules: Constant, Sum, Difference, and Constant Multiple

Learning Objective FUN-3.A: Calculate derivatives of familiar functions.

Basic Differentiation Rules

The Constant Rule

The derivative of a constant function is 0. That is, if c is a real number, then

$$\frac{d}{dx}[c] = 0.$$

The Power Rule

If n is a rational number, then the function $f(x) = x^n$ Is differentiable and $\frac{d}{dx}[x^n] = nx^{n-1}$. For f to be differentiable at $x = 0$, n must be a number such that x^{n-1} is defined on an open interval containing 0.

Special Case of the Power Rule

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

Example 1: Find the derivative of each of the following.

a. $f(x) = x^5$

b. $g(x) = \sqrt[4]{x^3}$

c. $y = \frac{1}{x^3}$

The Constant Multiple Rule

If f is a differentiable function and c is a real number, then $c \cdot f$ is also differentiable and

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

Example 2: Find the derivative of each of the following.

a. $y = 2x^7$

b. $g(x) = \frac{3}{x^2}$

c. $f(x) = \frac{\sqrt[6]{x^5}}{8}$

Finding the Derivatives of Polynomials

The Sum and Difference Rules

The sum (or difference) of two differentiable functions is differentiable and is the sum (or difference) of their derivatives.

$$\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x) \qquad \text{SUM RULE}$$

$$\frac{d}{dx}[f(x) - g(x)] = f'(x) - g'(x) \qquad \text{DIFFERENCE RULE}$$

x^{n-1} is defined on an open interval containing 0.

Example 3: Find the derivative of each of the following.

a. $f(x) = \frac{x^3 - 4x + 5}{x}$

b. $g(x) = (x^2 + 1)(x - 3)$

Writing Equations of Tangent Lines (Using the Power Rule)

Example 4: **Writing Equations of Tangent Lines**

a.) Write the equation of a tangent line to the function at the given point.
$f(x) = x - 2x^2, (1, -1)$

b.) Write the equation of a tangent line to the function at the given value of x.
$f(x) = 2\sqrt{x}, x = 1$

Caution

A very common mistake in an Example like **#4** part **a** is to think the slope of the specific tangent line is $1 - 4x$.

It is important that you find the *specific* slope to that point $(1, -1)$.

In this case, the slope is $f'(1) = 1 - 4(1) = -3$.

Example 5: **Finding Locations of Horizontal Tangent Lines**

At what point(s) does the graph of $y = x^2 + 4x - 1$ have a horizontal tangent line?