NAME _____ DATE _____ PERIOD _____

Study Guide

Derivatives and Antiderivatives

The derivative of a function $f(x)$ is another function, $f'(x)$, that gives the slope of the tangent line to $y = f(x)$ at any point. The following are some of the rules used to find the derivatives of polynomials.

Constant Rule:	The derivative of a constant function is zero. If $f(x) = c$, then $f'(x) = 0$.
Power Rule:	If $f(x) = x^n$, where n is a rational number, then $f'(x) = nx^{n-1}$.
Constant Multiple of a Power Rule:	If $f(x) = cx^n$, where c is a constant and n is a rational number, then $f'(x) = cnx^{n-1}$.

Finding the **antiderivative** $F(x)$ of a function $f(x)$ is the inverse of finding the derivative. The following are some of the rules used to find the antiderivative of a function.

Constant Multiple of a Power Rule:	If $f(x) = kx^n$, where n is a rational number other than -1 and k is a constant, the antiderivative is $F(x) = k \cdot \frac{1}{n+1}x^{n+1} + C$.
Sum and Difference Rule:	If the antiderivatives of $f(x)$ and $g(x)$ are $F(x)$ and $G(x)$, respectively, then the antiderivative of $f(x) \pm g(x)$ is $F(x) \pm G(x)$.

Example 1 **Find the derivative of each function.**

a. $\boldsymbol{f(x) = x^5}$

$$f'(x) = 5x^{5-1} \quad \textit{Power Rule}$$
$$= 5x^4$$

b. $\boldsymbol{f(x) = 3x + 2}$

$$f(x) = 3x + 2$$
$$= 3x^1 + 2 \quad \textit{Rewrite } x \textit{ as a power.}$$
$$f'(x) = 3 \cdot 1x^{1-1} + 0 \quad \textit{Constant Multiple of a Power Rule, Constant Rule, and Sum Rule}$$
$$= 3x^0$$
$$= 3 \quad x^0 = 1$$

Example 2 **Find the antiderivative of $\boldsymbol{f(x) = 6x^2 - 10x + 4}$.**

$$f(x) = 6x^2 - 10x + 4$$
$$= 6x^2 - 10x^1 + 4x^0 \quad \textit{Rewrite the function so that each term has a power of } x.$$

Use the Constant Multiple of a Power and Sum and Difference Rules.

$$F(x) = 6 \cdot \frac{1}{2+1}x^{2+1} + C_1 - \left(10 \cdot \frac{1}{1+1}x^{1+1} + C_2\right) + 4 \cdot \frac{1}{0+1}x^{0+1} + C_3$$
$$= \frac{6}{3}x^3 - \frac{10}{2}x^2 + \frac{4}{1}x^1 + C \quad \textit{Let } C = C_1 - C_2 + C_3.$$
$$= 2x^3 - 5x^2 + 4x + C$$