TOPIC: INDEFINITE INTEGRALS

Introduction to Indefinite Integrals

◆ Recall: If $f(x)$ is the derivative of a function $F(x)$, then $F(x)$ is an antiderivative of $f(x)$.

► Finding the indefinite integral of a function is the _____ as finding the antiderivative.

New **Indefinite Integrals**

$$\int f(x)\,dx = F(x) + C$$

$f(x)$: integrand

dx: _____ of integration

$F(x)$: antiderivative

C: _____ of integration

EXAMPLE Find the indefinite integral of the following functions.

(A) $\int 0\,dx$

New $\int 0\,dx =$ ____

(B) $\int 3\,dx$

New $\int k\,dx =$ _____

(C) $\int 3x^2\,dx$

◆ Just like with antiderivatives, you can check your answer to an indefinite integral by taking the derivative of it.

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PRACTICE Find the following indefinite integral.

$$\int -300\ dx$$

PRACTICE Find the following indefinite integral.

$$\int 4x^3\ dx$$

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PRACTICE Find the following indefinite integral.

$$\int 100x^{99}\,dx$$

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Power Rule for Indefinite Integrals

◆ Recall: To find the **derivative** of a power fcn $f(x) = x^n$, *multiply* by original exponent, then *decrease* exponent by 1.

► To find the **integral** of a power fcn $f(x) = x^n$, _____ exponent by 1, then _____ by the new exponent.

Recall

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

Power Rule for Derivatives

RULES OF INTEGRATION		
Name	**Rule**	**Example**
Power	$\int x^n \, dx = \frac{x}{\quad} + \_\_\_, \quad n \neq -1$	$\int x^6 \, dx = \frac{x}{\quad} + \_\_\_ = \frac{x}{\quad} + \_\_\_$

EXAMPLE Find the indefinite integral of $g(t) = t^4$.

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PRACTICE Find $h(x)$ by evaluating the following indefinite integral.

$$h(x) = \int x^8 \, dx$$

PRACTICE Find $h(x)$ by evaluating the following indefinite integral.

$$h(x) = \int x^{100} \, dx$$

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PRACTICE Find $h(x)$ by evaluating the following indefinite integral.

$$h(x) = \int 25x^4 \, dx$$

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Additional Rules for Indefinite Integrals

◆ The same rules that apply to the sum, difference, or constant multiple of a derivative also apply to integrals.

RULES OF INTEGRATION		
Name	**Rule**	**Example**
Sum & Difference	$\int [f(x) \pm g(x)]\,dx = \int f(x)\,dx \quad \int g(x)\,dx$	$\int (x+6)\,dx = \int \_\_\,dx + \int \_\_\,dx =$
Constant Multiple	$\int [k \cdot f(x)]\,dx = \_\_ \cdot \int f(x)\,dx$	$\int 5x^3\,dx = \_\_\_ \cdot \int \quad dx =$

◆ Use *multiple* rules together to find integrals of more complicated functions.

EXAMPLE Find the indefinite integral of $f(x) = x^2 - 3x + 6$.

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PRACTICE Find $f(x)$ by evaluating the following indefinite integral.

$$f(x) = \int (100x^2 - 35x - \frac{13}{2})dx$$

PRACTICE Find $f(x)$ by evaluating the following indefinite integral.

$$f(x) = \int (8x^7 + 10x - 20)dx$$