

Inverse of Derivative=

Antiderivative.

old

Derivative:

$$\boxed{\frac{d}{dx}} \quad 5x^2 = 10x$$

Recall:

Differentials

$$d[5x^2] = 10x \boxed{dx}$$

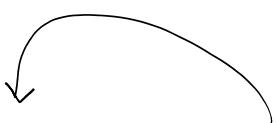
Differentiate:

$$\frac{d}{dx} [5x^2 + 17] = 10x$$

$$\frac{d}{dx} [5x^2 + .00009] = 10x$$

What is the antiderivative of

$$10x? \quad 5x^2 + C$$



$\int \boxed{f(x)} dx$  Integrand      Noun

Verb  
 Integrate  
 =  
 Antidifferentiate

$$\int \underline{10x} dx$$

$F(x)$

= want  $F(x)$

$$F(x) = 5x^2 + C$$

old.

$$\frac{d}{dx} \boxed{F(x)} = F'(x)$$
$$\frac{d}{dx} \boxed{F(x)} = F'(x) dx$$

$$\int F'(x) dx = F(x) + C$$

$$\int 1x^6 dx = \boxed{\frac{1}{7} x^7 + C}$$

*{ same thing }*

$$\begin{aligned} & \boxed{\phantom{00}}' = 1x^6 \\ \frac{d}{dx} & \boxed{\phantom{00}} = 1x^6 \quad \boxed{\frac{1}{7} x^7 + C} \\ d & \boxed{\phantom{00}} = 1x^6 \underline{dx} \end{aligned}$$

$$\int 2x^6 dx = 2 \int x^6 dx$$

$$\begin{aligned} 2 \cdot \int x^6 dx &= 2 \left[ \frac{1}{7} x^7 + C \right] \\ &= \boxed{\frac{2}{7} x^7 + C} \end{aligned}$$

$$\int A \cdot x^6 dx = \boxed{\frac{A}{7} x^7 + C}$$

Power Rule  
(Constant multiple)

try:  $\int 7x^4 dx =$

$$\begin{aligned} \int K x^n dx &= \boxed{\frac{K}{n+1} x^{n+1} + C} \end{aligned}$$

Polynomial Rule.

Power Rule

## Polynomial Rule.

Power

$$\int (5x^2 + 3x + 2) dx$$

Break down  
on the fly

$$\int 5x^2 dx + \int 3x dx + \int 2 dx$$

$$5 \int x^2 dx + 3 \int x dx + 2 \int 1 dx$$

$$5 \left[ \frac{1}{3} x^3 + C \right] + 3 \left[ \frac{1}{2} x^2 + C \right] + 2 \left[ x + C \right]$$

$$\frac{5}{3} x^3 + \frac{3}{2} x^2 + 2x + C$$

~~RE~~

$$\int x^n dx = \frac{1}{n+1} x^{n+1} + C$$

$$\int kx^n dx = \frac{k}{n+1} x^{n+1} + C$$

$$\int 2 dx = 2x + C$$

\* power rule  
only works  
for  $x^n$  where  $n \neq -1$

Try:

$$\int (11x^5 - 4x^4 + 2x^3 - 7) dx$$

$$\frac{11}{6} x^6 - \frac{4}{5} x^5 + \frac{2}{4} x^4 - 7x + C$$

add one to exponent.

$\frac{k}{n+1}$  new exponent

Important exception:

Power Rule.

does not work for  $x^{-1}$

~~b/c  $x^0$  n's can do~~

$$\int \frac{x^2 + 3}{x^5} dx$$

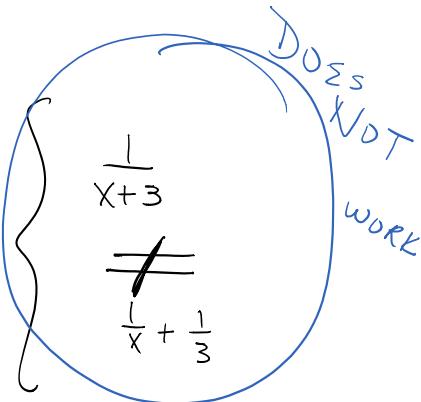
Rewrite.

*Dos.*

Rewrite.

$$\int \left( \frac{x^2}{x^5} + \frac{3}{x^5} \right) dx$$

$$\int \left( \frac{1}{x^3} + \frac{3}{x^5} \right) dx$$



$$\int x^{-3} dx + \int 3x^{-5} dx \\ \Rightarrow \frac{1}{-2} x^{-2} + \frac{3}{-4} x^{-4} + C$$

$$\boxed{-\frac{1}{2x^2} - \frac{3}{4x^4} + C}$$

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Particular Solution:

Find the value of C

Q: Find  $F(x)$  if  $F'(x) = \frac{1}{x^2}$ ,  $x > 0$

given that  $F(1) = 0$ .

(condition use it to find C.)

A.)  $F(x) = \int \frac{1}{x^2} dx = \int x^{-2} dx$

$$F(x) = \underline{\underline{\frac{-1}{-1} x^{-1} + C}}$$

B.) Evaluate  $F @ 1$ , set = 0.

$$-1(1)^{-1} + C = 0 \\ -1 \cdot \frac{1}{1} + C = 0$$

$$-1 + C = 0$$

$$F(x) = -\frac{1}{x} + C$$

$$\int \frac{x+1}{\sqrt{x}} dx$$

$$\int \frac{x}{\sqrt{x}} + \frac{1}{\sqrt{x}} dx$$

$$\int x^{1/2} + x^{-1/2} dx$$

$$\frac{2}{3}x^{3/2} + 2x^{1/2} + C$$

$$\int \frac{\sin x}{\cos^2 x} dx$$

$$\int \frac{\sin x}{\cos x} \cdot \frac{1}{\cos x} dx$$

$$\int \tan x \cdot \sec x dx$$

$$\boxed{\sec x + C}$$

4.1 :

1-42: 3N

43, 45, 49 \* 51, 53, 55, 57