Inverse of Derivative

=

Antiderivative.

old

Derivative:

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

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 $10x$?

$$5x^2+C$$

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

Noun

$\int \quad dx$

Verb

Integrate

=

Antidifferentiate

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

$F'(x)$

I want $F(x)$

$$\boxed{F(x) = 5x^2 + C}$$

old.

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

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

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

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

same thing

$$\left\{\begin{array}{l} \boxed{}' = 1x^6 \\ \dfrac{d}{dx}\boxed{} = 1x^6 \\ d\,\boxed{} = 1x^6\,dx \end{array}\right.$$

$\boxed{\frac{1}{7}x^7 + C}$

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

$$2 \cdot \int x^6\,dx = 2\left[\frac{1}{7}x^7 + C\right]$$

$$= \boxed{\frac{2}{7}x^7 + C}$$

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

Power Rule (Constant multiple)

$$\int Kx^n\,dx$$

$$\boxed{= \frac{K}{n+1}x^{n+1} + C}$$

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

Polynomial Rule.

Power:

Polynomial Rule.

Break down on the fly

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

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

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

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

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

Power:

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

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

$$\int 2\,dx = \frac{2}{1}x^1 + C$$

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

Try!

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

$$\frac{11}{6}x^6 - \frac{4}{5}x^5 + \frac{2}{4}x^4 - 7x^1 + C$$

add one to exponent.

$\frac{K}{\text{new exponent}}$

Important exception.

Power Rule.

does not work for x^{-1}

b/c $\frac{K}{0}x^0$ no can do

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

Rewrite.

Dos.

Rewrite.

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

$$\frac{1}{x+3} \neq \frac{1}{x} + \frac{1}{3}$$

DOES NOT WORK

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

$$\int x^{-3} dx + \int 3x^{-5} dx$$

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

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

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

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

$F(x)$

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

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

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

$$-1 + c = 0$$

$$c = 1$$

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

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

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

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

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

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

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

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

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

4.1 :

1–42: 3N

43, 45, $\boxed{49^*}$ 51, 53, 55, 57