Antiderivatives & Indefinite Integrals

Undoing things in math is a handy tool when solving equations, getting back to an original equation, etc. We know how to undo things like addition, multiplication, squaring and such, but do we know how to undo a derivative??? We will after today! I know you're excited about this so let's get started. . .

Try this: If $f'(x) = 2x + 5$ find $f(x)$.

Can you think of two more functions with the same derivative?

There is a mathematical symbol (of course). . .

The integral symbol: $\int$

So. . . $\int (2x+5)dx$ means "What is the original function if $2x+5$ is my derivative."

constant of integration

derivative

general antiderivative

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

Let's look at some common derivatives and then find their antiderivatives.

$$\frac{d}{dx}[kx] = k$$

$$\frac{d}{dx}\left[x^n\right] = nx^{x-1}$$

$$\frac{d}{dx}[\sin x] = \cos x$$

$$\frac{d}{dx}[\cos x] = -\sin x$$

$$\frac{d}{dx}[\tan x] = \sec^2 x$$

$$\frac{d}{dx}[\sec x] = \sec x \tan x$$

$$\frac{d}{dx}[\cot x] = -\csc^2 x$$

$$\frac{d}{dx}[\csc x] = -\csc x \cot x$$

$$\frac{d}{dx}\left[e^x\right] = e^x$$

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

"Undo" each derivative to find its antiderivative.

How about these?

$$\int \left(3x^2 + 2x + 4\right)dx$$

$$\int \left(3x^4\right)dx$$

$$\int \left(\frac{1}{x^4}\right)dx$$

$$\int \left(\sqrt{x}\right)dx$$

$$\int (2\sin x)dx$$

$$\int \left(\frac{\sin x}{\cos^2 x}\right)dx$$

How about these?

$$\int\left(\frac{x+1}{\sqrt{x}}\right)dx$$

$$\int\left(\frac{2}{x}\right)dx$$

$$\int\left(3e^{x}\right)dx$$

$$\int\left(-e^{x}+\frac{3}{x}-\cos x\right)dx$$