

The anti-derivative

One way to think of integration is as the inverse of differentiation. In other words, if

$$\int f(x)dx = g(x)$$

then

$$\frac{d}{dx}g(x) = f(x)$$

So an integral is sometimes called the anti-derivative.

Example 1

$$\int \cos(x) dx = \sin(x)$$

because if you differentiate sin, you get cos

But if you differentiate $\sin(x)+2$, you also get $\cos(x)$. In fact this would work for any constant added to $\sin(x)$. So the correct version is

$$\int \cos(x) dx = \sin(x) + C$$

where C is a constant – usually called the **'constant of integration'**.

Example 2

$$\int x^4 dx = \frac{x^5}{5} + C$$

because if we differentiate $x^5/5$, we'll get x^4 .

Example 3

$$\int \sec^2(x) dx = \tan(x) + C$$

because if you differentiate tan, you get \sec^2