INTEGRATION

When x^2 is differentiated with respect to x the derivative is $2x$.

Reversing this process, if we know that $2x$ is the derivative of some function then the process of finding that function is called **integration**.

The constant of integration

Notice that $2x$ is also the derivative of $x^2 + 3$ and $x^2 - 5$ and so on, or in general $2x$ is the derivative of $x^2 + any\ constant$.

So when we reverse the process and integrate $2x$ we must write $x^2 + c$ where c is an arbitrary constant. c is called the **constant of integration**. (Some text books use k instead of c.)

This is written $\int 2x\,dx = x^2 + c$

$\int$ is the integration symbol (like an elongated letter s) and dx means 'with respect to x'

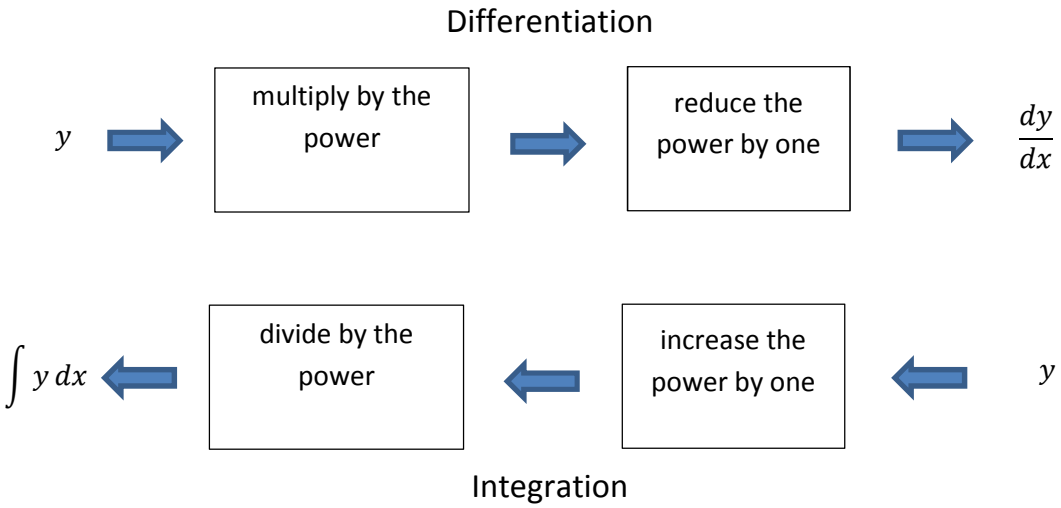
An integral with a constant of integration is called an **indefinite integral**.

A general rule for ax^n

We know that when differentiating if $y = ax^n$ then $\frac{dy}{dx} = anx^{n-1}$

In words, when differentiating we multiply the coefficient by the power and then reduce the power by one.

Reversing this we increase the power by one and then divide by that new power (and add the constant of integration).



So if $y = ax^n$ then $\int y\,dx = \frac{ax^{n+1}}{n+1} + c \qquad (n \neq -1)$

Examples

Find the following integrals

1. $\int 6x^2 \mathrm{d}x$

2. $\int \frac{3}{x^2} \mathrm{d}x$

3. $\int 3 \, \mathrm{d}x$

4. $\int \sqrt{t} \, \mathrm{d}t$