

## Definite Integration

So far we have differentiated the gradient function and we have found the function. Now we are going to integrate between 2 values which are called the '**limits of integration**'. We are looking for a number as the answer.

*Example 1.* Evaluate  $\int_4^5 2x \, dx$

$$\begin{aligned} &= [x^2]_4^5 \\ &= (5^2) - (4^2) \\ &= 25 - 16 \\ &= 9 \end{aligned}$$

*Example 2.* Evaluate these definite integrals  $\int_1^2 3x^{-2} \, dx$

$$\begin{aligned} &= \left[ \frac{3x^{-1}}{-1} \right]_1^2 \\ &= \left[ -\frac{3}{x} \right]_1^2 \\ &= \left( -\frac{3}{2} \right) - \left( -\frac{3}{1} \right) \\ &= 1.5 \end{aligned}$$

*Example 3.* Evaluate these definite integrals  $\int_0^4 \frac{6}{x^2} \, dx$

$$\begin{aligned} &= \int_0^4 6x^{-2} \, dx \\ &= \left[ \frac{6x^{-1}}{-1} \right]_0^4 \\ &= \left[ -\frac{6}{x} \right]_0^4 \\ &= \left( -\frac{6}{4} \right) - \left( -\frac{6}{0} \right) \\ &= -1.5 \end{aligned}$$

Definite integration is defined as

$$\int_b^a f(x) dx = [f(x)]_a^b = f(b) - f(a)$$

This says you are going to integrate

this shows it is after integration

This is calculating the answer

*Example 3.*

Evaluate  $\int_1^3 \frac{x^3 + 2x^2}{x} dx$

$$= \int_1^3 \frac{x^3 + 2x^2}{x} dx$$

$$= \int_1^3 x^2 + 2x dx$$

$$= \left[ \frac{x^3}{3} + x^2 \right]_1^3$$

$$= \left( \frac{3^3}{3} + 3^2 \right) - \left( \frac{1^3}{3} + 1^2 \right)$$

$$= 18 - 1\frac{1}{3}$$

$$= 16\frac{2}{3}$$