

Integration

- The converse of differentiation.
- 'Integrals' may also be referred to as antiderivatives.

∴ integration is process of finding definite or indefinite integral of a function and it's the inverse of differentiation.

$\int$ → Symbol for "integral"

* Notation and meaning:

• $\int \boxed{2x} \cdot \underline{dx}$
 ↙ integral symbol ↗ function to be integrated (Integrand)
 ↳ integrate with respect to x .

• $\int f(x) dx$ can be written as $\int y dx$

• $\int f(y) \underline{dy}$
 ↳ this says to integrate with respect to y .

Pre-knowledge:

* Derivative rule: $\frac{d}{dx} (ax^n) = anx^{n-1}$

* Exponential laws:

$$\bullet x^m \times x^n = x^{m+n}$$

$$\bullet x^m \div x^n = x^{m-n}$$

$$\bullet (x^m)^n = x^{mn}$$

$$\bullet (x \cdot y)^m = x^m y^m$$

$$\bullet \left(\frac{x}{y} \right)^m = \frac{x^m}{y^m}$$

$$\bullet x^{\frac{1}{n}} = \sqrt[n]{x}$$

$$\bullet x^{-\frac{1}{n}} = \frac{1}{\sqrt[n]{x}}$$

$$\bullet \frac{1}{x^n} = x^{-n}$$

$$\bullet \left(\frac{x}{y} \right)^{-\frac{1}{n}} = \frac{1}{\sqrt[n]{\frac{x}{y}}} = \sqrt[n]{\frac{y}{x}}$$

$$\bullet x^0 = 1$$

The concept of integration

{let's go back to differentiation in order to understand law of integral.

→ Derive the following:

$$\bullet y = x^2 \longrightarrow \frac{dy}{dx} = 2x$$

$$\bullet f(x) = x^2 - 2 \longrightarrow f'(x) = 2x$$

$$\bullet y = x^2 + m \longrightarrow \frac{dy}{dx} = 2x$$

} 3 different functions.
But all derivatives are the same

* Rule 1: Standard integrals

Power rule • $\int x^n \cdot dx = \frac{x^{n+1}}{n+1} + C$

Constant rule • $\int kx^n \cdot dx = \frac{k \cdot x^{n+1}}{n+1} + C$

we must ALWAYS add c (constant) since we saw above that different functions can give same derivative.