Understanding Integration

Introduction

What is integration?

• Reverse differentiation (anti-differentiation)

Why use it?

- Used to find volumes, area and central points.
 - (1) Calculating areas under graphs (adding slices to find the whole)

Application example: equations of motion

• <u>Equations</u> for **position/displacement**, **velocity** and **acceleration** are all related through differentiation and integration:



If we integrate the function with respect to x (written as $\int f(x) dx$), then we write

$$\int f(x)dx = f'(x) \quad [Apostrophe = prime]$$

$$\rightarrow \quad \int (2x^3 + x^2 + 7x)dx$$

We focus on the variable x and its **exponents** to **reverse differentiate by one order**:

STEP 1:	Add 1 to each exponent,
STEP 2:	Divide the constant by the new order.

(1)
$$\int (2x^{(3+1)} + 1x^{(2+1)} + 7x^{(1+1)})dx$$

(2)
$$\int \left((2 \div 4) x^4 + (1 \div 3) x^3 + (7 \div 2) x^2 \right) dx$$

$$= \therefore f'(x) = \frac{1}{2}x^4 + \frac{1}{3}x^3 + \frac{7}{2}x^2$$

IMPORTANT NOTE:

You can check your answer by finding its derivative!



What is the area under y = f(x)?