

## Integrals

### Definitions

**Definite Integral:** Suppose  $f(x)$  is continuous on  $[a, b]$ . Divide  $[a, b]$  into  $n$  subintervals of width  $\Delta x$  and choose  $x_i^*$  from each interval.

**Anti-Derivative :** An anti-derivative of  $f(x)$  is a function,

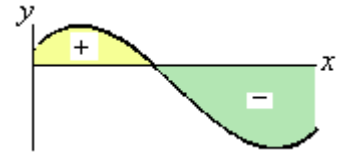
$$\int_a^b f(x) dx = \lim_{n \rightarrow \infty} \sum_{i=1}^n f(x_i^*) \Delta x.$$



Calculus Cheat Sheet

### Applications of Integrals

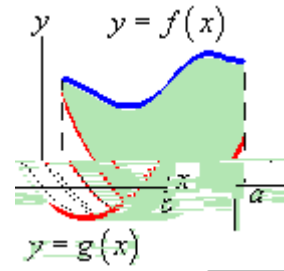
**Net Area :**  $\int_a^b f(x) dx$  represents the net area between  $f(x)$  and the  $x$ -axis with area above  $x$ -axis positive and area below  $x$ -axis negative.



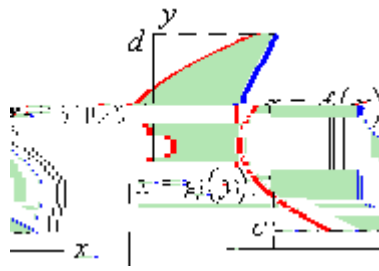
**Area Between Curves :** The general formulas for the two main cases for each are,

$$y = f(x) \quad \text{P} \quad A = \int_a^b \{\text{upper function}\} - \{\text{lower function}\} dx \quad \& \quad x = f(y) \quad \text{P} \quad A = \int_c^d \{\text{right function}\} - \{\text{left function}\} dy$$

If the curves intersect then the area of each portion must be found individually. Here are some sketches of a couple possible situations and formulas for a couple of possible cases.



$$A = \int_a^b f(x) - g(x) dx$$



$$A = \int_c^d f(y) - g(y) dy$$

