The Definite Integral
and
The Fundamental Theorem of Calculus

For special case $f(x) \geq 0$, $\int_a^b f(x)\,dx =$ the **area** under the graph of f from a to b

The Fundamental Theorem of Calculus

If f is continuous of $[a,\ b]$ and F is any antiderivative of f, then
$\int_a^b f(x)\,dx = F(b) - F(a)$

Properties of The Integral

$\int_a^b c\,dx = c(b-a)$ where c is any constant

$\int_a^b c f(x)\,dx = c\int_a^b f(x)\,dx$ where c is any constant

$\int_a^b [f(x) \pm g(x)]\,dx = \int_a^b f(x)\,dx \pm \int_a^b g(x)\,dx$

$\int_a^a f(x)\,dx = 0$

$\int_a^b f(x)\,dx = -\int_b^a f(x)\,dx$ if $a > b$

$\int_a^b f(x)\,dx = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx$