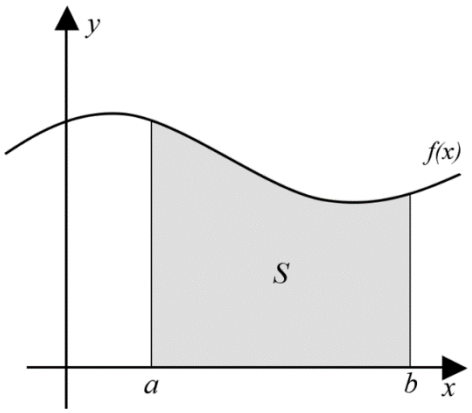
Definite Integrals, **AREA**, and the **Fundamental Theorem of Calculus**

Integrals occur frequently in Engineering, Science and Economics.

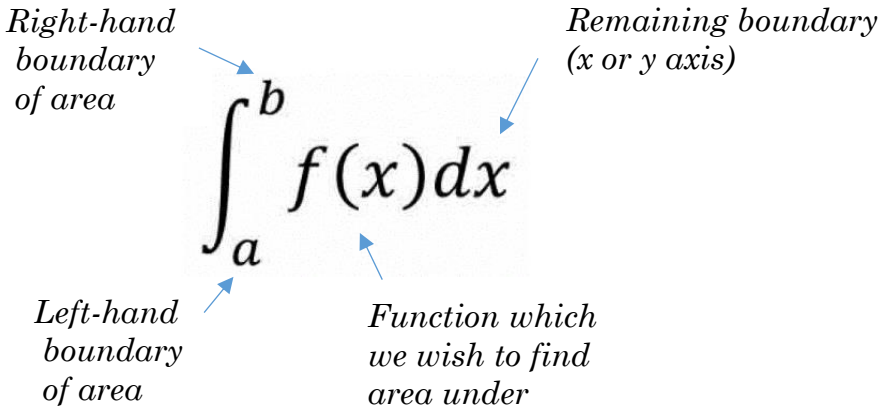
In these situations, integrals usually appear as ***definite integrals****. Definite integrals are integrals with* ***boundaries****.*

When we calculate ***definite*** *integrals we are calculating the* **area** *between a particular function and the x-axis (but only between two boundaries such as* ***a*** *and* ***b*** *–see diagram below).*

Determining **areas** *is a useful procedure necessary for common calculations in Science, Mathematics and Science.*



Notation of a definite integral:



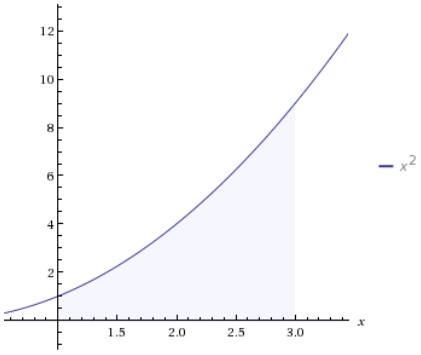
Fundamental Theorem of Calculus

(how evaluate a **Definite** integral)

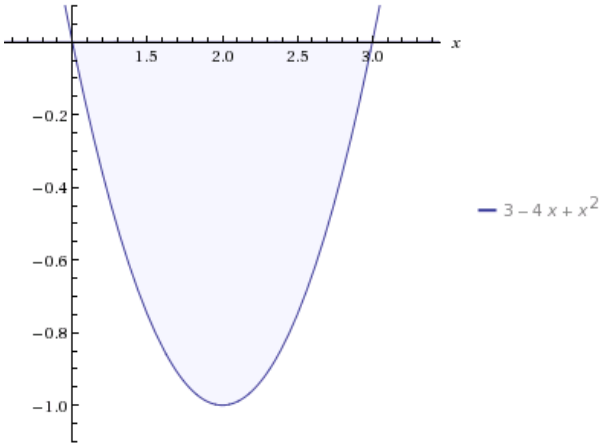
$$\text{Area} = \int_a^b f(x)\,dx = F(b) - F(a)$$

IMPORTANT!!! Capital **F** indicates: Antiderivative of *f(x)*

Ex. 1 $\int_1^3 x^2 \, dx$

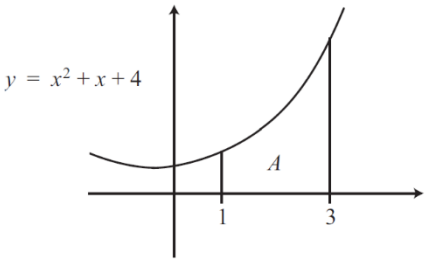


Ex. 2 $\int_1^3 x^2 - 4x \, + 3 \, dx$



Ex. 3

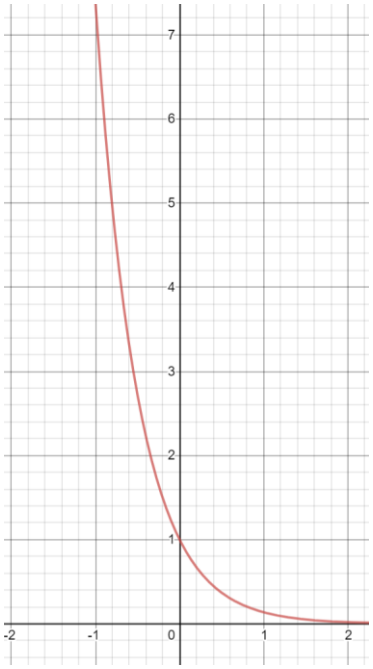
Find the area bounded by the curve $y = x^2 + x + 4$, the x-axis and the ordinates $x = 1$ and $x = 3$.



Ex. 4

Find the area expressed by the following definite integral

$$\int_{-1}^{1} e^{-2x}\, dx$$



Ex. 5

Find the area expressed by the following definite integral

$$\int_{0}^{\pi} \sin\left(\frac{x}{2}\right)\, dx$$