- $\int f(x)\,dx$ is called an indefinite integral that is equivalent to finding an antiderivative. Thus, we can see the following;

$$\int f(x)\,dx = F(x) \Rightarrow F'(x) = f(x).$$

- Have a look at the formula for indefinite integrals.

Example1

Find the indefinite integral.

$$\int \left(x^3 - \sec^2 x\right)\,dx.$$

Example2

Verify by differentiation that the formula is correct.

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$$\int \frac{x}{\sqrt{x^2+1}}\,dx = \sqrt{x^2+1} + C.$$

Example3

Evaluate the following definite integral.

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

- The **Net Change Theorem** (reformulation of FTC2)
$$\int_{a}^{b} F'(x)dx = \int_{a}^{b} \frac{dF(x)}{dx}dx = F(b) - F(a).$$

- For the position function $s(t)$ of the particle, its velocity is $s'(t) = v(t)$. So by the **NCT** its displacement from t_1 to t_2 will be
$$s(t_2) - s(t_1) = \int_{t_1}^{t_2} v(t)\, dt.$$

The total distance traveled will be
$$\int_{t_1}^{t_2} |v(t)|\, dt.$$

Example4

A particle moves along a line so that its velocity at time t is $v(t) = 2t - 4$ (measured in meters per second).

1. Find the displacement of the particle during the time period $0 \le t \le 3$
2. Find the distance traveled during this time period.