1 6.4-The Fundamental Theorem of Calculus

**Fundamental Theorem of Calculus, part I:** Given $f$ is a continuous function on $[a, b]$ and $g(x) = \int_{a}^{b} f(x) \, dx$, proof that $g$ is differentiable.

**Fundamental Theorem of Calculus, part II:**
Examples:

Find $F'(x)$ given:

$$F(x) = \int^{x}_\pi \frac{\sin t}{t} \, dt$$

$$F(x) = \int_{x^3}^{3} \sqrt{1 + t^3} \, dt$$

Compute $\int_{1}^{2} \left( x + \frac{1}{x^2} \right)^2 \, dx$
Compute \( \int_{0}^{\pi} (\sin x + x^3 - e^x) \, dx \)

\( f(x) = \frac{2}{1 + x^2} \) from \( x = 0 \) to \( x = \sqrt{3} \).

On Your Own: Find the exact area under the graph of \( f(x) = \frac{2}{1 + x^2} \) from \( x = 0 \) to \( x = \sqrt{3} \).