Section 5.4

After viewing the lecture videos and reading the textbook, you should be able to answer the following questions:

1. The **Fundamental Theorem of Calculus** states:

   • If f is continuous on $[a, b]$, then $F(x) = \int_a^x f(t)\, dt$ is continuous on $[a, b]$ and differentiable on (a, b) and

   $$F'(x) = \frac{d}{dx}\left(\int_a^x f(t)\, dt\right) = f(x)$$

   • If f is continuous on $[a, b]$ and F is any antiderivative of f on $[a, b]$, then

   $$\int_a^b f(x)\, dx = F(x)|_a^b = F(b) - F(a)$$

   Evaluate:

   a. $\frac{d}{dx}\left(\int_{-2}^x \sqrt{1 + t^4}\, dt\right)$

   b. $\int_1^2 \frac{1}{x}\, dx$

   c. $\int_1^2 \left(\frac{d}{dx}\left(\sqrt{1 + x^2}\right)\right) dx$

2. Area is always a nonnegative quantity. Set up an integral or a sum of integrals to evaluate the area of the region between the curve $y = x^3 - x^2 - 2x$ and the x-axis (see the graph below). (Do NOT evaluate the integral.)