The Fundamental Theorem of Calculus - Handout/Worksheet

1. **The Fundamental Theorem of Calculus I**: If f is continuous on $[a, b]$ and if F is any antiderivative of f on $[a, b]$ then

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

2. **The Fundamental Theorem of Calculus II**: Assume that $f(x)$ is continuous on an open interval I and let $a \in I$. Then the area function

$$A(x) = \int_a^x f(t)dt$$

is an antiderivative of $f(x)$ on I; that is, $A'(x) = f(x)$. Equivalently,

$$\frac{d}{dx}\int_a^x f(t)\, dt = f(x)$$

Furthermore, $A(x)$ satisfies the initial condition $A(a) = 0$.

3. Evaluate the integral using the FTC I.

   (a) $\int_0^2 (12x^5 + 3x^2 - 4x)\, dx$

   (b) $\int_0^4 \sqrt{y}\, dy$

   (c) $\int_1^{27} \dfrac{t+1}{\sqrt{t}}\, dt$

(d) $\int_2^3 e^{4t-3}\, dt$

(e) $\int_2^{10} \dfrac{dx}{x}$

4. Find the formulas for the functions represented by the integrals

(a) $\int_0^x \sin(u)\, du$

(b) $\int_1^{t^2} t\, dt$