The Fundamental Theorem of Calculus, Part 2

Let f be continuous on $[a, b]$ and let F be *any* antiderivative of f. Then

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

Being able to find antiderivatives is a good thing!

Basic derivative rules where c is a constant and f, g are functions

$$\frac{d}{dx}c = 0$$

$$\frac{d}{dx}x^k = kx^{k-1}$$

$$\frac{d}{dx}e^x = e^x$$

$$\frac{d}{dx}\ln(x) = \frac{1}{x}$$

$$\frac{d}{dx}\sin(x) = \cos(x)$$

$$\frac{d}{dx}\cos(x) = -\sin(x)$$

$$\frac{d}{dx}\tan(x) = \sec(x)^2$$

$$\frac{d}{dx}\sec(x) = \sec(x)\tan(x)$$

$$(c \cdot f(x))' = c \cdot f'(x)$$

$$(f+g)' = f' + g'$$

$$(f \cdot g)' = f' \cdot g + f \cdot g'$$

$$\left(\frac{f}{g}\right)' = \frac{f' \cdot g - f \cdot g'}{g^2}$$

$$\big(f(g(x))\big)' = f'(g(x)) \cdot g'(x)$$

Ground Rules for Group Work

- We all bring different perspectives and have different strengths to contribute
- Mathematics is not a competitive sport
  - In-class work is not a race
  - If you understand, then you should be able to explain your reasoning
  - If you are uncertain, ask questions!
    Mostly likely others have the same questions
- *Listen*
- There is value in productive struggle
- In breakout rooms
  - Introduce yourselves!
  - Have your microphone on, and camera if possible

Evaluate the following integrals & verify your answers by graphing the integrand

1. $\int_{-1}^{1} x^4 - 4x^3 + \pi \, dx$
2. $\int_{-2}^{2} x^3 + x^2 - 2x \, dx$
3. $\int_{0}^{\pi/2} -\sin(2x) \, dx$
4. $\int_{1}^{3} e^x + \frac{1}{x} \, dx$
5. $\int_{1}^{4} 2x\cos(x) - x^2\sin(x) \, dx$
6. $\int_{0}^{1} 3x^2(x^3+3)^5 \, dx$
7. $\int_{-1}^{1} 3\sec(x)^2 \, dx$
8. $\int_{-1}^{1} \sin(x^3) \, dx$