- Assignment #6 due on January 28.
- Test 3 on February 5.

- The Fundamental Theorem of Calculus
  - TODAY: Part 1
  - WEDNESDAY: Part 2
    - **Watch Videos 8.5, 8.6**
    - Supplementary Video: 8.7

True or False

Let f be a continuous function with domain $\mathbb{R}$.
Let G be an antiderivative of f.
Which of the following statements must be true?

1. $G(x) = \displaystyle\int_0^x f(t)dt$.

2. There exists $C \in \mathbb{R}$ such that $G(x) = C + \displaystyle\int_0^x f(t)dt$.

3. There exists $C \in \mathbb{R}$ such that $G(x) = C + \displaystyle\int_1^x f(t)dt$.

4. If $f(0) = 0$, then $G(x) = \displaystyle\int_0^x f(t)dt$.

5. If $G(0) = 0$, then $G(x) = \displaystyle\int_0^x f(t)dt$.

Fill in the blanks

Let G be an antiderivative of f.

$$G(x) = \boxed{} + \int_a^x f(t)dt$$

Write $\int_a^b f(t)dt$ entirely in terms of G:

$$\int_a^b f(t)dt = \boxed{}$$

Examples of FTC-1

Compute the derivative of the following functions

1. $F_1(x) = \int_0^1 e^{-t^2} dt$.

2. $F_2(x) = \int_0^x e^{-\sin t} dt$.

3. $F_3(x) = \int_1^{x^2} \frac{\sin t}{t^2} dt$.

4. $F_4(x) = \int_x^7 \sin^3\left(\sqrt{t}\right) dt$.

5. $F_5(x) = \int_{2x}^{x^2} \frac{1}{1+t^3} dt$.

Creative guess 'n check - 1

1. $\dfrac{d}{dx}[x \sin x] =$

2. $\dfrac{d}{dx}[\cos x] =$

Use the previous answers to calculate

3. $\displaystyle\int x \cos x \, dx =$

1. $\dfrac{d}{dx}\left[xe^x\right] =$

2. ???

3. $\displaystyle\int xe^x\, dx =$

1. $\dfrac{d}{dx}\left[x^2 e^{-x}\right] =$

2. ???

3. ???

4. $\displaystyle\int x^2 e^{-x}\, dx =$

1. $\dfrac{d}{dx}[x \ln x] =$

2. ???

3. $\displaystyle\int \ln x \, dx =$

$$\int x \, e^x \cos x \, dx \; = \; ???$$