Math 132 - September 8, 2017

5.3, 5.4: FTC

I. $\dfrac{d}{dx}\displaystyle\int_a^x f(t)\,dt = f(x)$

II. $\displaystyle\int_a^b F'(x)\,dx = F(b) - F(a)$

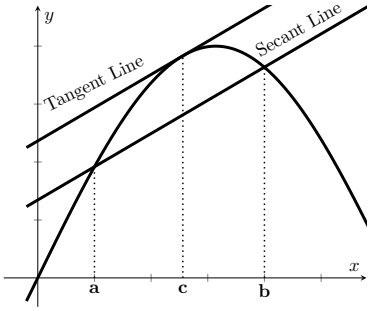
Warm-up Problems

1. **Clicker** Find the derivative

$$\frac{d}{dx}\int_{-x^2}^{e^x} \sin(t^2)\,dt$$

   (a) $e^x \sin(e^{2x}) - 2x\sin(x^4)$
   (b) $e^x \sin(e^{2x}) + 2x\sin(x^4)$
   (c) $\sin(e^{2x}) - \sin(x^4)$
   (d) $e^x \sin(e^{2x})$
   (e) I have no idea

2. Explain the MVT:



Class Problems

3. Find the following indefinite integrals using FTC part 2.

   (a) $\displaystyle\int_{-4}^{12} dx =$
   (b) $\displaystyle\int_1^9 -2\,dx =$
   (c) $\displaystyle\int_1^4 x\,dx =$
   (d) $\displaystyle\int_{-1}^1 x^2\,dx =$
   (e) $\displaystyle\int_0^\pi \sin x\,dx =$
   (f) $\displaystyle\int_1^{10} \frac{1}{x}\,dx =$
   (g) $\displaystyle\int_0^{\pi/4} \sec^2 x\,dx =$
   (h) $\displaystyle\int_1^4 x\,dx =$

4. **Clicker**
(True/False) Any derivative formula gives a corresponding indefinite integral formula?
(a) True (b) False (c) Neither True or False

Review Problems

5. Suppose $\int_1^3 f(x)\,dx = 6$ and $\int_1^3 g(x)\,dx = 2$. What is $\int_1^3 (2f(x) - 3g(x))\,dx$?

6. Suppose $\int_1^4 f(x) = 8$, $\int_1^2 f(x) = 4$, $\int_3^4 f(x) = 2$, what is $\int_2^3 f(x) = 8$?

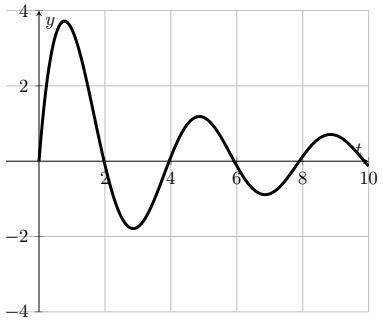
7. Find $\int_0^1 x\left(\sqrt{x} + \sqrt[3]{x}\right)\,dx$

8. If $g(x) = \int_1^{\sqrt{x}} \sin(t^2)\,dt$, find $g'(x)$.

9. **Clicker** Let $g(x) = \int_0^x f(t)\,dt$ where $f(t)$ is the graph below. Determine which of the statements are true:

   (a) g attains an absolute maximum at $x = 2$

   (b) g has a local maximum at $x = 5$

   (c) g has a local minimum at $x = 4$

   (d) g is concave down on $[0, 2]$