

In-Class Exercises

1. (Clicker) Evaluate the following definite integrals using the FTC Part 2. Which integral is largest?

$$a. \int_0^1 2^x + x^2 dx = \frac{2^x}{\ln 2} + \frac{x^3}{3} \Big|_0^1 = \frac{2}{\ln 2} + \frac{1}{3}$$

$$b. \int_{2\pi}^{4\pi} \sin(x/2) + \cos(2x) dx = -2\cos(x/2) + \frac{1}{2}\sin(2x) \Big|_{2\pi}^{4\pi} = 4$$

$$c. \int_0^2 \frac{2}{x+1} dx = 2 \ln|x+1| \Big|_0^2 = 2 \ln 3$$

2. (Clicker) True or **False**: $\int_{-1}^3 \frac{1}{x^2} dx = -\frac{1}{x} \Big|_{x=-1}^{x=3} = -\frac{4}{3}$.
 you cannot apply the FTC b/c $1/x^2$ isn't continuous on $[-1, 3]$

Defn. The *Indefinite Integral* of a function f is the most general antiderivative of f and is denoted by $\int f(x) dx$. If F is any antiderivative of f , then

$$\int f(x) dx = F(x) + C.$$

3. Evaluate the following indefinite integrals:

$$a. \int \frac{4-z}{\sqrt{z}} dz = \int 4z^{-1/2} - z^{1/2} dz = 8z^{1/2} - \frac{2}{3}z^{3/2} + C$$

$$b. \int \sec^2(-3\theta) d\theta = -\frac{1}{3}\tan(-3\theta) + C$$

$$c. \int \frac{3}{1+x^2} dx = 3 \tan^{-1}(x) + C$$

(3 arctan x)

4. (Clicker) **True** or False: If $F(t)$ is differentiable, then $\int_a^b F'(t) dt = F(b) - F(a)$.
 Follows From FTC Part 2

5. Your upstairs neighbor leaves for work and forgets to turn off his kitchen sink. After it overflows at 7am, water leaks from your ceiling into your kitchen at a rate of $2+5t$ liters/hr, where t is the number of hours after 7am. How much water enters your apartment before you arrive home at 11:30am?

59.625 Liters

6. A house centipede zips along your wall in a straight line with velocity $v(t) = 14 - 4t$ in/s from $t = 0$ to $t = 5$. What is the total displacement of the centipede? What is the total distance travelled by the centipede?

$$\text{displacement} = \int_0^5 14 - 4t dt = 20 \text{ in}$$

$$\text{distance} = \int_0^5 |14 - 4t| dt = \int_0^{14/4} 14 - 4t dt + \int_{14/4}^5 4t - 14 dt = (24.5 + 4.5) = 29 \text{ in}$$

Answer Key

Sept. 7th: 5.3/5.4: FTC Part 2, Indefinite Integrals, & Net Change

Warm Up Exercises

Fill in the following table of antiderivatives:

Function $f(x)$	Antiderivative $F(x)$
$x^a, a \neq -1$	$\frac{x^{a+1}}{a+1}$
e^x	e^x
$b^x, b > 0, b \neq 1$	$\frac{b^x}{\ln b}$
$\frac{1}{x}$	$\ln x $
$\sin x$	$-\cos x$
$\cos x$	$\sin x$
$\sec^2 x$	$\tan x$
$\sec x \tan x$	$\sec x$
$\frac{1}{\sqrt{1-x^2}}$	$\arcsin(x)$
$\frac{1}{1+x^2}$	$\arctan(x)$