Math 132 - September 18, 2017

Chapter 6: Applications

Integration = Adding things up
Areas and Volumes

6.1: Areas

To find area between curves:

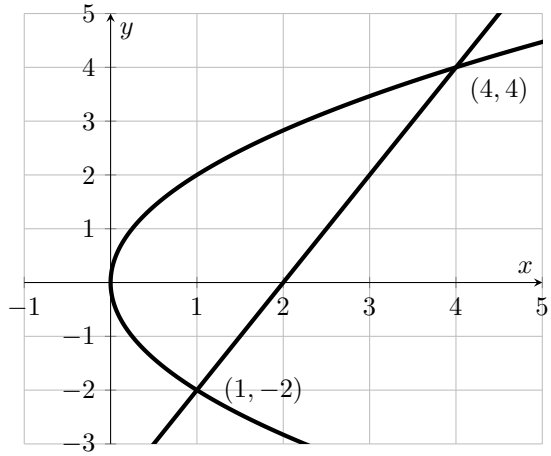
- Graph region, find intersections
- Decide if you are going to integrate dx or dy
- Area $= \int_a^b (\text{Big} - \text{Small})\, dx$

Warm-up Problems

1. Determine where the curves intersect.
   (a) $y = x^2 + x$ and $y = 4x^2 - 20x$
   (b) $x = y^2 - 4$ and $x = 2y - y^2$

Class Problems

2. Find the area between the curves in Problem 1.
3. **Clicker** Given the graphs of the functions below, find integral(s) that represent the area between $y^2 = 4x$ and $y = 2x - 4$.



(a) $\displaystyle\int_{-2}^{4} \left(\frac{y+4}{2} - \frac{y^2}{4}\right)\, dy$

(b) $\displaystyle\int_0^1 2\sqrt{4x}\, dx + \int_1^4 \left(\sqrt{4x} - (2x-4)\right)\, dx$

(c) $\displaystyle\int_0^4 \sqrt{4x} - (2x-4)\, dx$

(d) $\displaystyle\int_{-2}^{4} (4y^2 - 2x + 4)\, dy$

(e) $\displaystyle\int_0^4 \left(\frac{y^2}{4} - (2x-4)\right)\, dx$

4. **Clicker** Find the area between $y = \sin x$ and $y = \cos x$ between $x = 0$ and $x = 2\pi$.

   (a) 0
   (b) 2
   (c) $4\sqrt{2}$
   (d) 4
   (e) $-\infty$

5. Find the area between $y = x^2$ and $y = \sqrt{x}$.
   (Do this in two ways, as a dx integral and as a dy integral.)

6. Find the area between $y = xe^{-x^2}$, $y = x + 1$, $x = 2$ and the y axis.

7. Find the area between $y = 2x^2 + 10$, $y = 4x + 16$, $x = -2$ and $x = 5$.

8. Find the area enclosed by the graphs of $y = 8 - x^2$, $y = 7x$ and $y = 2x$ in the first quadrant.