Math 132 - September 20, 2017

6.2-6.3: Volumes

- Volumes by slicing: $V = \int_a^b A(x)\,dx$ (or $A(y)\,dy$)
- Volumes of revolution (shells): $V = \int_a^b 2\pi rh\,dr$
- Volumes of revolution (washers): $V = \int_a^b \pi r^2\,dx$ or $V = \int_a^b \pi r^2\,dy$

Warm-up Problems

1. **Clicker** I have done the following:

   I. Looked at my exam and determined where I made mistakes.

   II. Looked at the histogram of exam scores on line to see where I stand compared to the rest of the class.

   III. If I did poor on the exam, I have developed a plan to do better on the next test.
   (Hint: if you didn't do so well on the exam "work harder" is usually not a plan that works. Most students need a better plan than this.)

   (a) Yes (b) No (c) What???

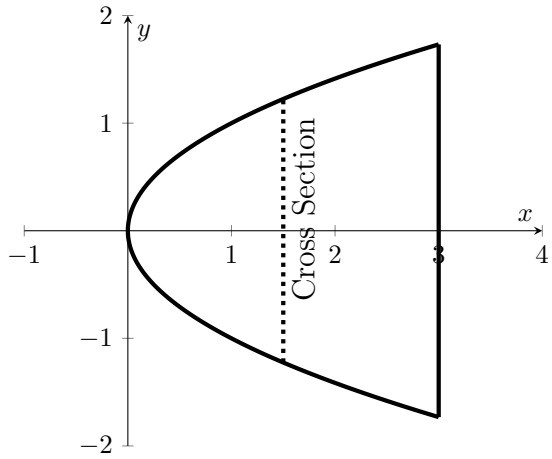
2. Let R_1 be the region in quadrant I, between $y = x^2$, $x = 0$ and $y = 4$. Graph this region.

3. Let R_2 be the region between $y = x^2$ and $y = 2x$. Graph this region.

4. Imagine a mystery solid with a base R_1 from Problem 2 sitting on a cutting board. You take out your large knife/sword and make cuts perpendicular to the x-axis. Each of these cuts results in a square. Draw the solid.

Class Problems

5. **Clicker** Let S be a solid with base enclosed by $x = y^2$ and $x = 3$.
   Vertical cross sections of S are squares perpendicular to the x-axis.



   Find a formula for $A(x)$, the cross sectional area at x.

   (a) 4
   (b) x
   (c) $4x$
   (d) x^2
   (e) $4y^2$

6. Same as in Problem 5 except cross sections are semi-circles. Find $A(x)$.

7. Same as in Problem 5 except cross sections are equilateral triangles. Find $A(x)$.

8. Find the volumes in the previous problems.

9. What do the horizontal cross sections look like in the Problems 5, 6 and 7?

10. Let R_1 be the region from Problem 2.
    (a) Draw this region rotated around the y-axis.
    (b) Set up an integral representing this volume.
    (c) Find the volume.
11. Let R_1 be the region from Problem 2.
    (a) Draw this region rotated around the x-axis.
    (b) Set up an integral representing this volume.
    (c) Find the volume.
12. Let R_1 be the region from Problem 2.
    (a) Draw this region rotated around the line $x = 3$.
    (b) Set up an integral representing this volume.
    (c) Find the volume.
13. Let R_1 be the region from Problem 2.
    (a) Draw this region rotated around the line $y = -2$.
    (b) Set up an integral representing this volume.
    (c) Find the volume.
14. Let R_2 be the region from Problem 3.
    (a) Draw this region rotated around the y-axis.
    (b) Set up an integral representing this volume.
    (c) Find the volume.
15. Let R_2 be the region from Problem 3.
    (a) Draw this region rotated around the x-axis.
    (b) Set up an integral representing this volume.
    (c) Find the volume.
16. Let R_2 be the region from Problem 3.
    (a) Draw this region rotated around the line $x = 3$.
    (b) Set up an integral representing this volume.
    (c) Find the volume.
17. Let R_2 be the region from Problem 3.
    (a) Draw this region rotated around the line $y = -2$.
    (b) Set up an integral representing this volume.
    (c) Find the volume.