Math 131 Day 17

My Office Hours: M & W 12:30–2:00, Tu 2:30–4:00, & F 1:15-2:30 or by appointment. **Math Intern** Sun: 12–6pm; M 3-10pm; Tu 2–6, 7–1pm; W and Th: 5-10 pm in Lansing 310. Website: `http://math.hws.edu/~mitchell/Math131S13/index.html`.

Today we will discuss arc length and finish it next time. Review 6.4 on Volume by Shells as needed. and read Section 6.5. Concentrate on Examples 1 through 4. Begin Section 6.6—we will cover only lifting problems: See Examples 2–4.

1. Volume practice: Try page 412ff #27, 29, 31, 35, 39.

2. Show that the exact arc length of $y = f(x) = x$ on $[0, 1]$ is $\sqrt{2}$.

3. Show that the exact arc length of $y = 2 - 3x$ on $[-2, 1]$ is $3\sqrt{10}$. Since this curve is a straight line segment, check your answer by using the distance formula!

4. Arc Length practice: Page 418 #3, 5, 7, 9.

Hand In Monday

Possible answers: $\pi \ln 9$, $2\pi \ln 17$, $\pi \ln 17$, 2π, 4π, $1 + \sqrt{2}$, $1 - \sqrt{2}$, $\ln(1 + \sqrt{2})$, Yes, $\frac{2}{27}(10^{3/2} - 1)$, No, $\frac{1}{4}\ln(-4 + \sqrt{17})$, 511/9, 1022/27, 1024/27

1. **Do by shells:** A small canal buoy is formed by taking the region in the first quadrant bounded by the y-axis, the parabola $y = 2x^2$, and the line $y = 5 - 3x$ and rotating it about the y-axis. (Units are feet.) Find the volume of this buoy.

2. The region bounded by the curves $y = \frac{1}{1+x^2}$, the y-axis, $x = 4$, and the x-axis is revolved around y-axis. Find the volume. One method is easier.

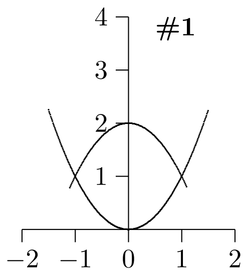
3. Find the length of $f(x) = 2x^{3/2} + 1$ on the interval $[0, 7]$. (Use a u-substitution.)

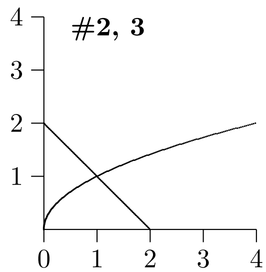
4. Find the arc length of $f(x) = \ln \sec x$ on $[0, \pi/4]$. (Use a trig id.) This is a WeBWorK Day 17 problem.

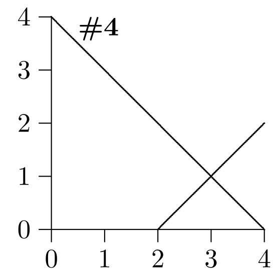
5. Set up the arc length integral for $y = f(x) = x^2$ on $[0, 2]$. Can you do the integration?

0. Remember that there is also a new WeBWorK assignment set `Day17`. And also remember that set `Day16` closes SATURDAY evening.

Math 131 Day 17 Quiz: Name: ____________________







1. Rotation about the x-axis. Let R be the *entire* region enclosed by $y = x^2$ and $y = 2 - x^2$ in the upper half-plane. Rotate R about the x-axis. The resulting volume is given by:

a) $\pi \int_{-1}^{1} (x^2)^2\,dx - \pi \int_{-1}^{1} (2 - x^2)^2\,dx$

b) $\pi \int_{0}^{1} (2 - x^2)^2\,dx - \pi \int_{0}^{1} (x^2)^2\,dx$

c) $\pi \int_{-1}^{1} (2 - x^2)^2\,dx + \pi \int_{-1}^{1} (x^2)^2\,dx$

d) $\pi \int_{-1}^{1} (2 - x^2)^2\,dx - \pi \int_{-1}^{1} (x^2)^2\,dx$

e) $\pi \int_{0}^{1} (\sqrt{y})^2\,dy + \pi \int_{1}^{2} \left(\sqrt{2-y}\right)^2\,dy$

f) None of these

2. Rotation about the x-axis. Let S be the region enclosed by the x-axis, $y = \sqrt{x}$, and $y = 2 - x$. The volume generated by revolving S about the x-axis is:

a) $\pi \int_{0}^{1} \left(\sqrt{x}\right)^2\,dx - \pi \int_{1}^{2} (2 - x)^2\,dx$

b) $2\pi \int_{0}^{1} x(2 - x)\,dx - 2\pi \int_{0}^{1} x\sqrt{x}\,dx$

c) $\pi \int_{0}^{1} \left(\sqrt{x}\right)^2\,dx + \pi \int_{1}^{2} (2 - x)^2\,dx$

d) $\pi \int_{0}^{1} (2 - y)^2 - (y^2)^2\,dy$

e) $\pi \int_{0}^{2} \left(\sqrt{x}\right)^2\,dx - \pi \int_{1}^{2} (2 - x)^2\,dx$

f) None of these

3. Rotation about the y-axis. Let T be the region enclosed by the y-axis, $y = \sqrt{x}$, and $y = 2 - x$ (a different region than in Problem 2). The volume generated by revolving T about the y-axis is:

a) $\pi \int_{0}^{2} (y^2)^2\,dy - \pi \int_{0}^{2} (2 - y)^2\,dy$

b) $2\pi \int_{0}^{1} x(2 - x)^2\,dx - 2\pi \int_{0}^{1} x\left(\sqrt{x}\right)^2\,dx$

c) $\pi \int_{0}^{1} \left(\sqrt{x}\right)^2\,dx + \pi \int_{1}^{2} (2 - x)^2\,dx$

d) $\pi \int_{0}^{1} (2 - y)^2\,dy + \pi \int_{1}^{2} (y^2)^2\,dy$

e) $2\pi \int_{0}^{1} x(2 - x)\,dx - 2\pi \int_{0}^{1} x(\sqrt{x})\,dx$

f) None of these

4. Rotation about the y-axis. Let U be the region enclosed by the y-axis, the x-axis, $y = x - 2$, and $y = 4 - x$. The volume generated by revolving U about the y-axis is:

a) $\pi \int_{0}^{1} (y - 2)^2\,dy + \pi \int_{1}^{4} (4 - y)^2\,dy$

b) $2\pi \int_{0}^{3} x(4 - x)^2\,dx - 2\pi \int_{2}^{3} x(x - 2)^2\,dx$

c) $2\pi \int_{0}^{4} x(4 - x)\,dx - 2\pi \int_{2}^{3} x(x - 2)\,dx$

d) a and c

e) a and b

f) None of these