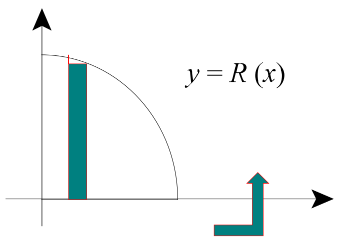
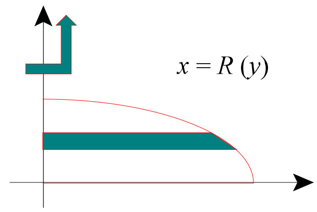
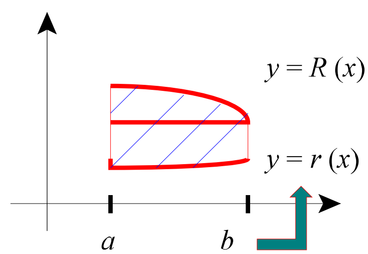
Calculus II, Math 3495
Dr. Abedi, Fall 2010

1. Volume: $V = \pi \int_a^b [R(x)]^2 dx$ $V = \pi \int_c^d [R(y)]^2 dy$ *Disk Method*

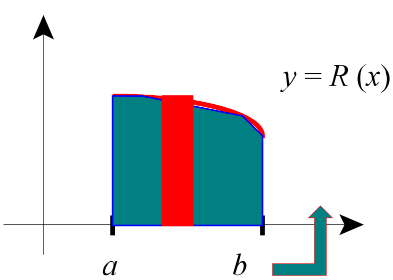


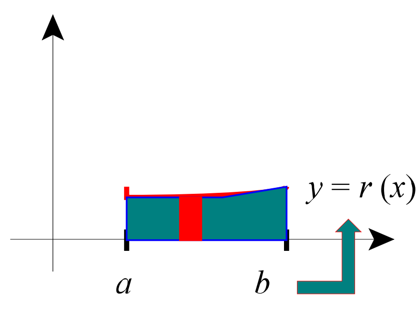


2. $V = \pi \int_a^b ([R(x)]^2 - [r(x)]^2) dx$



Washer Method



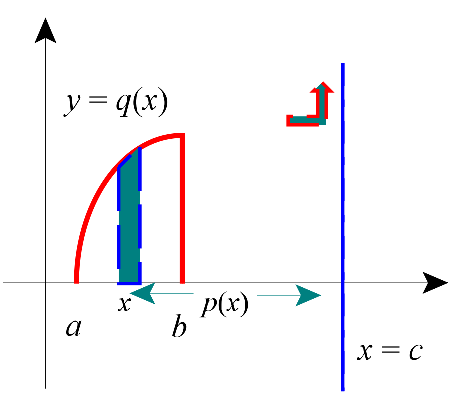


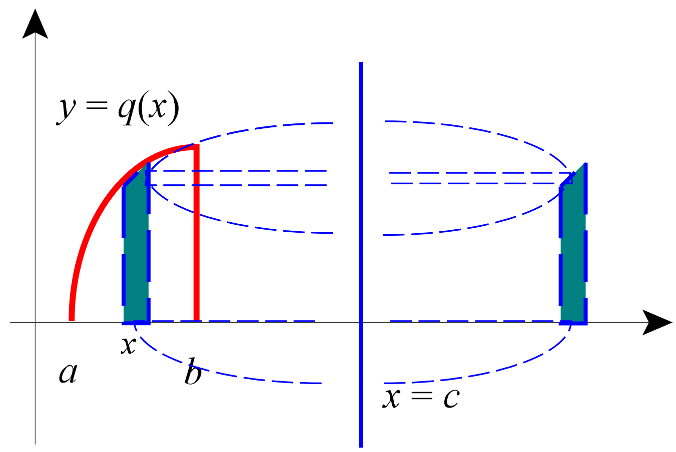
$V_1 = \pi \int_a^b [R(x)]^2 dx$ $V_2 = \pi \int_a^b [r(x)]^2 dx$

3. $V = 2\pi \int_c^d p(y)q(y)\,dy$ $\qquad\qquad$ $V = 2\pi \int_a^b p(x)q(x)\,dx$

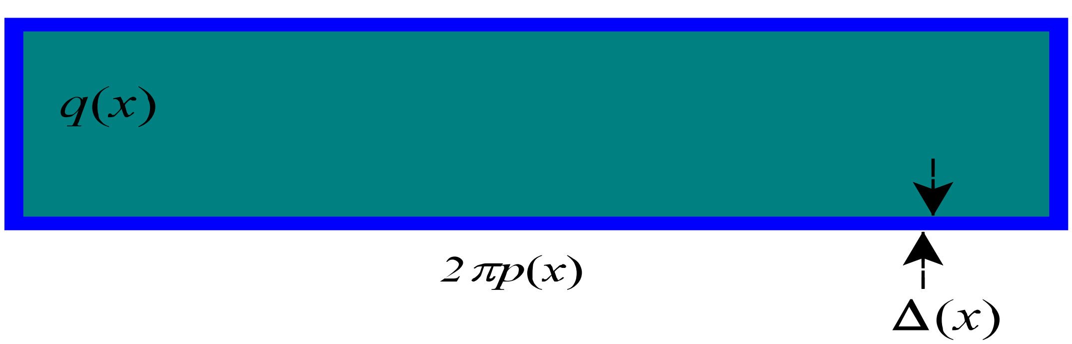
Shell Method

Note that here $\boxed{p(x) = c - x}$





"Cut the above shell open on one side to get the following rectangular sheet with thickness Δx, height $q(x)$, and length $2\pi \cdot p(x)$ (the circumference of the circle)"



4. Arc Length: $s = \int_a^b \sqrt{1+[f'(x)]^2}\,dx$ $\qquad$ $s = \int_c^d \sqrt{1+[g'(y)]^2}\,dy$

5. Arc Length: $\begin{cases} x = f(t) \\ y = g(t) \end{cases} a \le t \le b$; $s = \int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\,dt$

6. Surface Area: $s = 2\pi \int_a^b r(x)\sqrt{1+[f'(x)]^2}\,dx$ $\qquad$ $s = 2\pi \int_c^d r(y)\sqrt{1+[g'(y)]^2}\,dy$

Some Useful Formulas:

1. $\int \frac{du}{\sqrt{a^2 - x^2}} = \arcsin \frac{u}{a} + c$

2. $\int \frac{du}{a^2 + u^2} = \frac{1}{a} \arctan \frac{u}{a} + c$

3. $\int \frac{du}{u\sqrt{u^2 - a^2}} = \frac{1}{a} arc\sec \frac{|u|}{a} + c$

4. $\int \frac{du}{\sqrt{u^2 \pm a^2}} = \ln(u + \sqrt{u^2 \pm a^2}) + c$

5. $\int \frac{du}{a^2 - u^2} = \frac{1}{2a} \ln\left|\frac{a+u}{a-u}\right| + c$

6. $\int \frac{du}{u\sqrt{a^2 \pm u^2}} = -\frac{1}{a} \ln \frac{a + \sqrt{a^2 \pm u^2}}{|u|} + c$