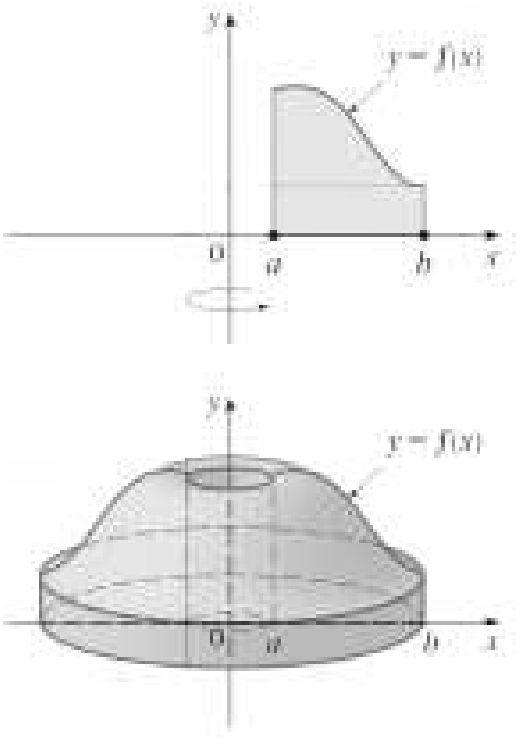
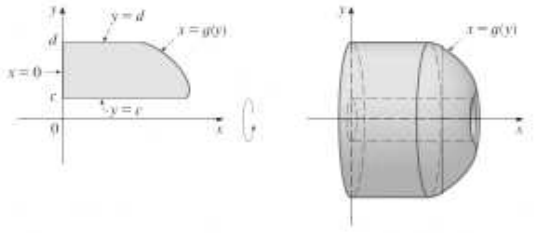
Section 7.3: Volumes by Cyndrical Shells

The Method of Cylindrical Shells:

Revolution around the y-axis: $V = \int_a^b 2\pi x f(x)\,dx$



Revolution around the x-axis: $V = \int_c^d 2\pi y g(y)\,dy$



1. Find the volume of the solid obtained by rotating the region bounded by $y = \frac{1}{x}$, $y = 0$, $x = 1$, $x = 10$ about the y axis.

2. Find the volume of the solid obtained by rotating the region bounded by $y = x - x^2$, $y = 0$, about the y axis.

3. Find the volume of the solid obtained by rotating the region bounded by $y^2 = x$, $x = 0$, $y = 2$, $y = 5$ about the x axis.

4. Find the volume of the solid obtained by rotating the region bounded by $y = \sqrt{x}$, $y = 0$, $x + y = 2$, about the x axis.

Rotation around lines

5. Find the volume of the solid obtained by rotating the region bounded by $y = x^2$, $y = 0$, $x = 1$, $x = 2$ about the line $x = 3$.

6. Find the volume of the solid obtained by rotating the region bounded by $y = 3x^2$, $y = 0$, $x = 0$, $x = 2$ about the line $x = -1$.

7. Find the volume of the solid obtained by rotating the region bounded by $y = \cos x$, $x = 0$, $x = \dfrac{\pi}{2}$, $y = 0$, about the line $y = 1$. Do not evaluate the integral.

Choosing a method Often times, more than one method can be used to find the volume.

8. Consider the region bounded by $y = x^2$ and $y = 4x$. Rotate this region about the x axis. Set up the integral to find the volume using both washers and shells. Do not evaluate either integral.

9. Consider the region bounded by $y = \cos x$, $x = 0$, $x = \dfrac{\pi}{2}$, $y = 0$. Rotate this region about the y axis. Set up the integral to find the volume using both disks and shells. Do not evaluate either integral.