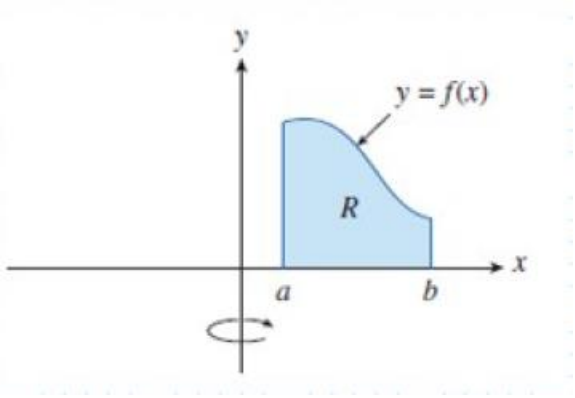
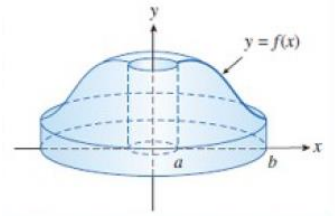
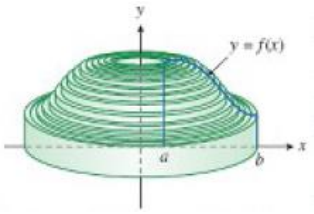
Find Volume Using Cylindrical Shells

Recall: Sometimes volumes are impractical (if not impossible) to find using disk or washer method.







$V_{CYL\ SLICE}$ =

Cylindrical Shell Volume Formula: $V = 2\pi \int_a^b radius \cdot height \; dx$ or dy

ex. Find the volume of solid obtained by rotating about *y*-axis the region between

ex. Find the volume of region bound by

Recall: Disk Method $V = \pi \int_a^b radius^2 \; dx$ or dy

ex. Find the volume of region bound by

Recall: Washer Method $V = \pi \int_a^b \left[\left(r_{outer} \right)^2 - \left(r_{inner} \right)^2 \right] \; dx$ or dy

ex. Find the volume of region *using Washer Method* bound by

ex. Find the volume of region *using cylindrical shells* bound by

Recall: How to Set Up Integral When Region is Revolved Around Something Other than *x*- or *y*-axis:

ex. Find the volume of region *using cylindrical shells* bound by