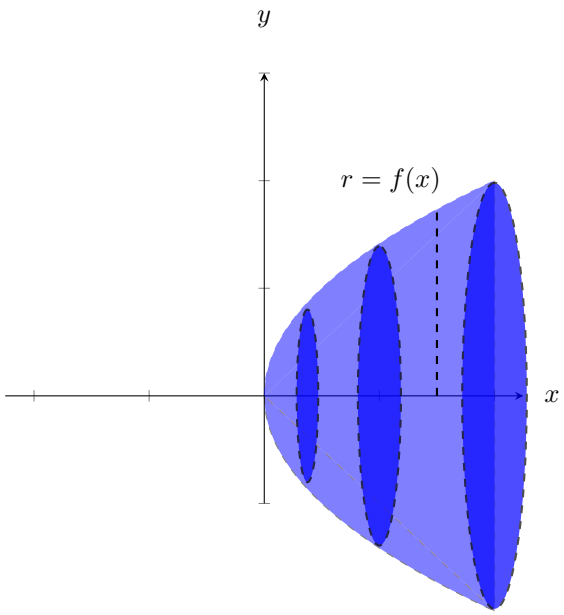
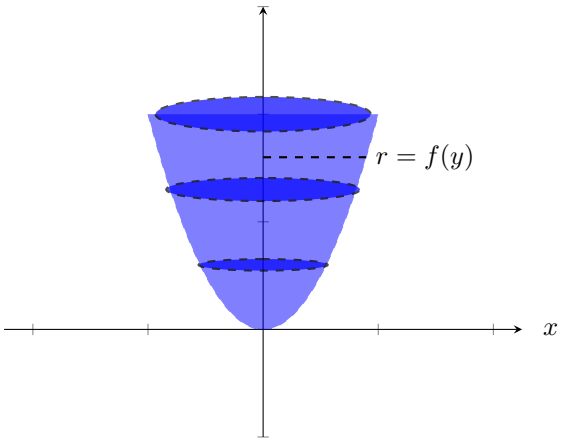
**Disk**

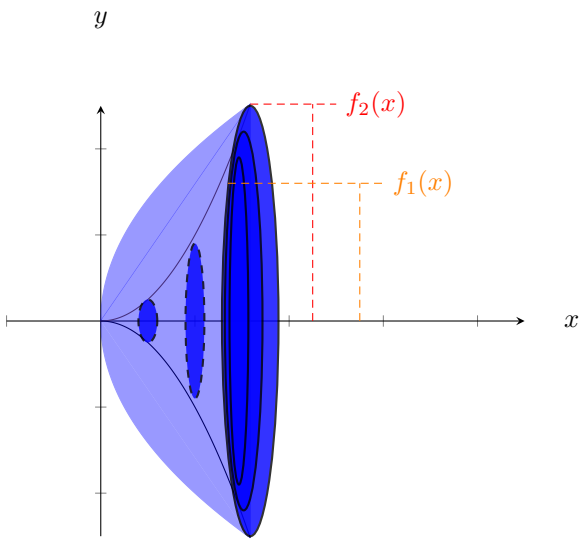



$$\pi \int_a^b r^2 dx = \pi \int_a^b (f(x))^2 dx$$

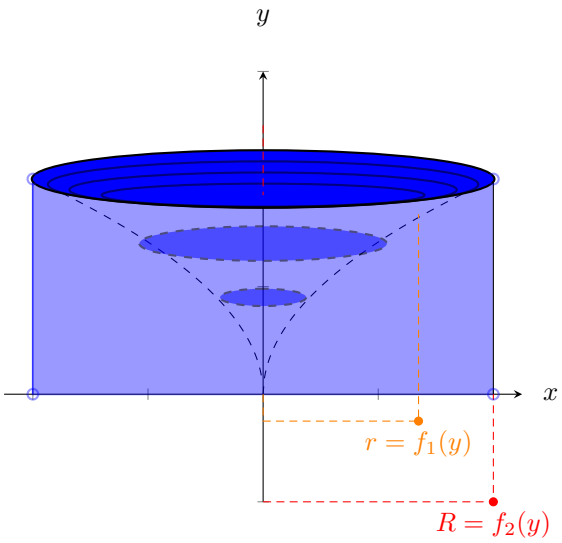



$$\pi \int_a^b r^2 dx = \pi \int_a^b (f(y))^2 dy$$

**Washer**

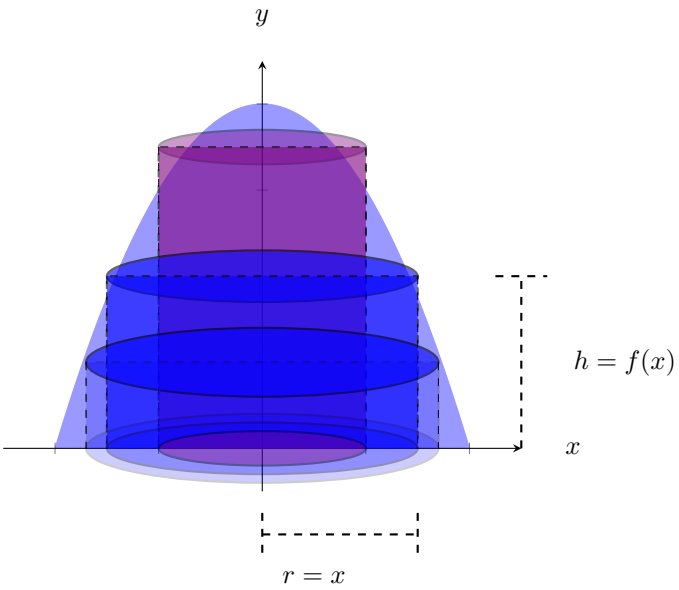



$$\pi \int_a^b (R)^2 - (r)^2 dx = \pi \int_a^b (f_2(x))^2 - (f_1(x))^2 dx$$

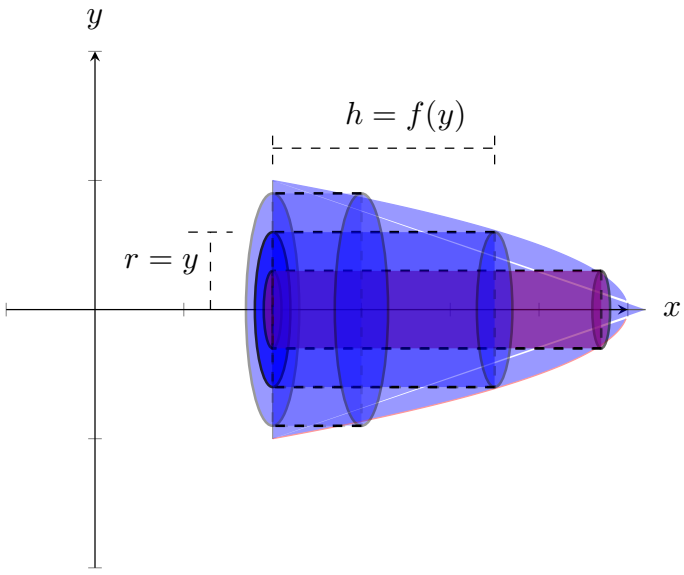



$$\pi \int_a^b (R)^2 - (r)^2 dy = \pi \int_a^b (f_2(y))^2 - (f_1(y))^2 dy$$

**Shell**



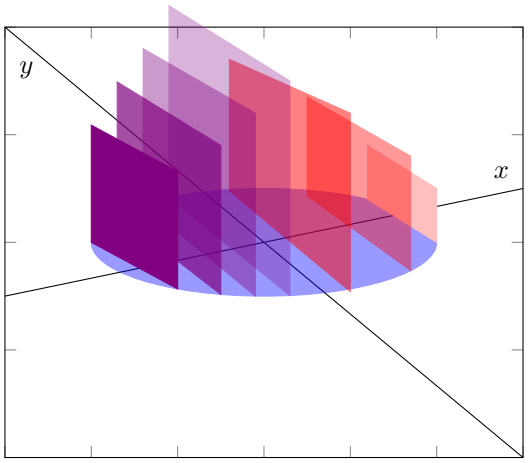

$$2\pi \int_a^b rhdx = 2\pi \int_a^b xf(x)dx$$



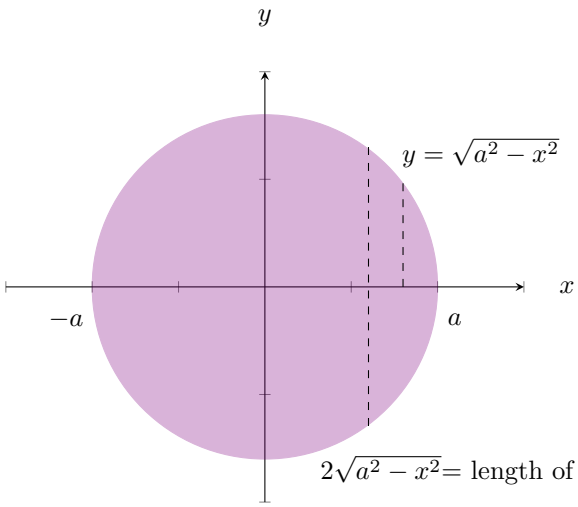

$$2\pi \int_a^b rhdy = 2\pi \int_a^b yf(y)dy$$

**Slicing Visualization Example**

The volume of a solid with a circle base of radius $a$ and the slices parallel to the y-axis are squares.




Bird's eye view of the base.




$2\sqrt{a^2 - x^2}$= length of one side

$(2\sqrt{a^2 - x^2})^2$= area of one square

$2\int_0^a (2\sqrt{a^2 - x^2})^2 dx$