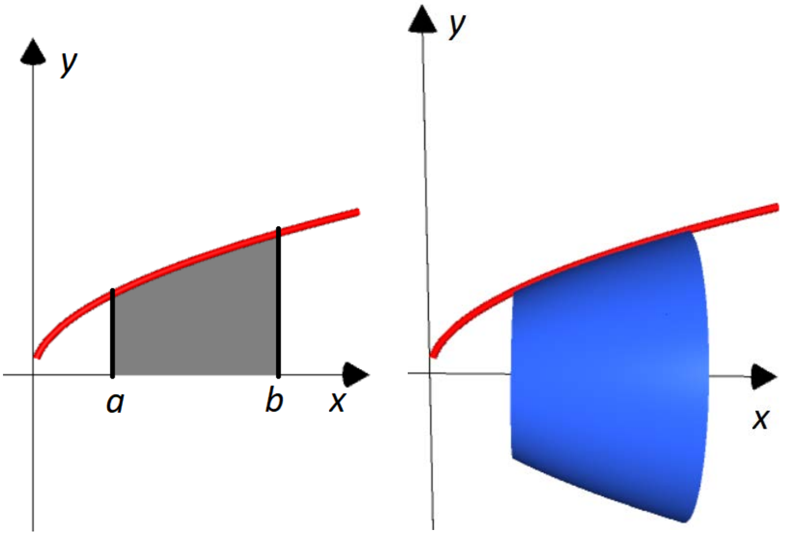
# Volume of Revolution

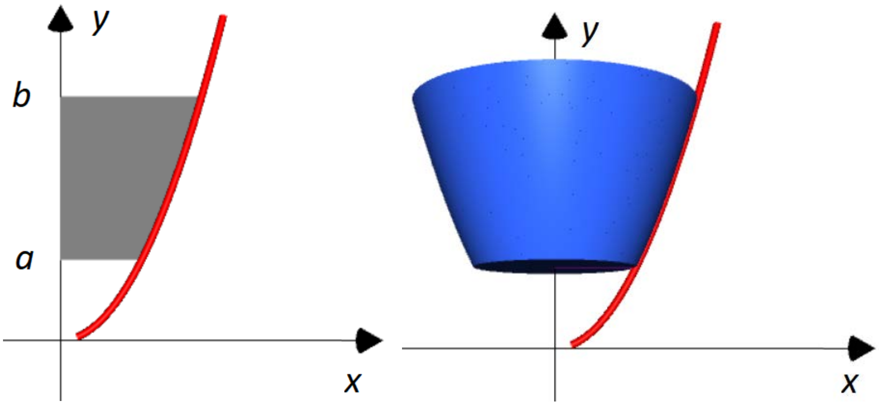
## Rotating $y = f(x)$ about the x axis




The volume generated when the area between the curve $y = f(x)$ and the x axis from $x = a$ and $x = b$ is rotated $2\pi$ radians about the **x axis**

$$V = \pi \int_a^b y^2 dx \text{ or } V = \pi \int_a^b [f(x)]^2 dx$$

## Rotating $x = f(y)$ about the y axis

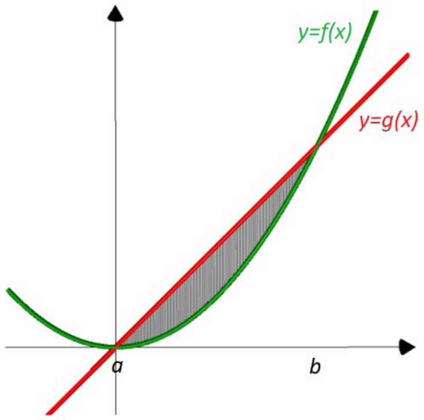


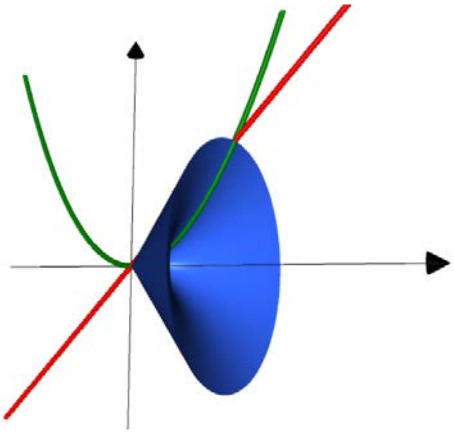

The volume generated when the area between the curve $x = f(y)$ and the y axis from y= $a$ and $y = b$ is rotated $2\pi$ radians about the **y axis**

$$V = \pi \int_a^b x^2 dy \text{ or } V = \pi \int_a^b [f(y)]^2 dy$$

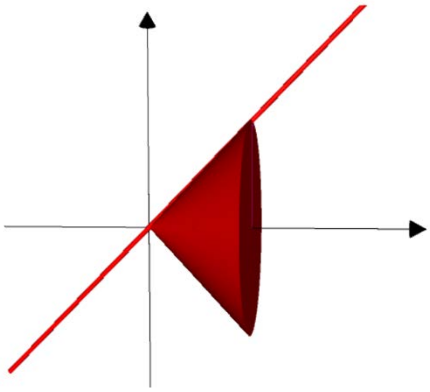
## Rotating region bounded by two graphs

When a region like this is rotated about the x axis, a hollowed out solid is produced

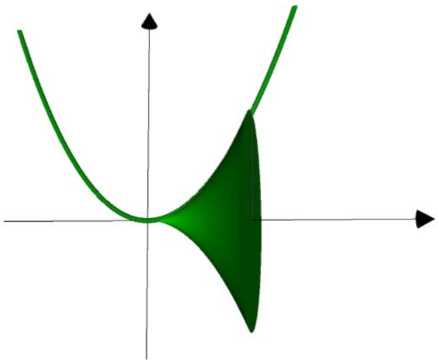


You can find the volume generated under the red line and subtract the volume generated under the green curve



subtract



The volume generated when the area between the curve $y = g(x)$ and $y = f(x)$ from $x = a$ and $x = b$ is rotated $2\pi$ radians about the **x axis**

$$V = \pi \int_a^b [g(x)]^2 dx - \pi \int_a^b [f(x)]^2 dx$$

This can be simplified to

$$V = \pi \int_a^b ([g(x)]^2 - [f(x)]^2) dx$$

…and a similar method can be used if the region is rotated about the y axis