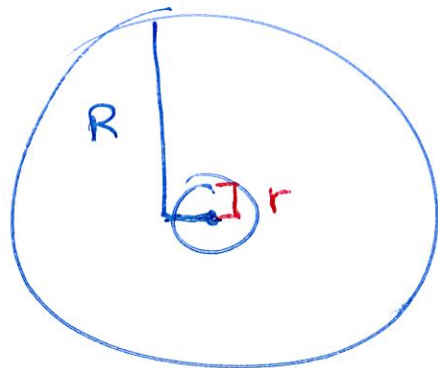
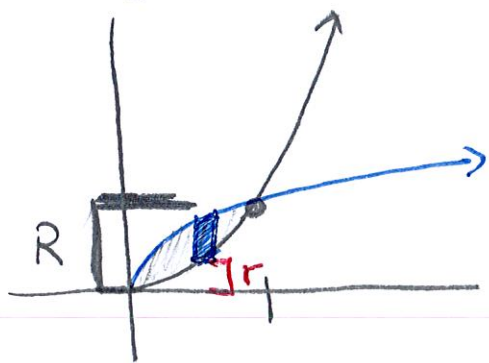


Washer



$$V = \pi \int (R^2 - r^2)$$

Ex: $y = x^2$ and $y = \sqrt{x}$ rotated over x-axis.

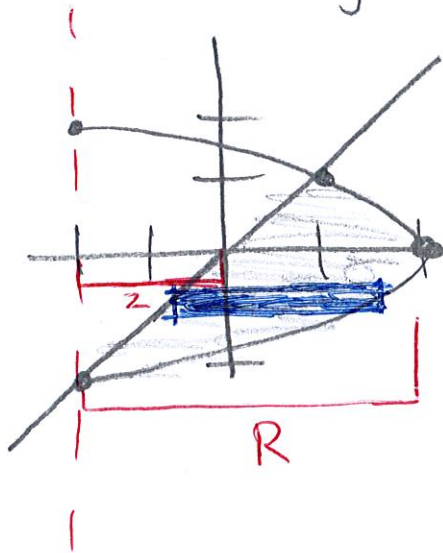


$$A = \pi (R^2 - r^2)$$

$$= \pi ((\sqrt{x} - 0)^2 - (x^2 - 0)^2)$$

$$\pi \int_0^1 (x - x^4) dx = \frac{3\pi}{10}$$

Ex: $x = -y^2 + 2$ and $x = y$ rotated over the line $x = -2$



$$\pi \int_{-2}^1 ((-y^2 + 2 - (-2))^2 - ((y - (-2)))^2) dy$$

$$\pi \int_{-2}^1 ((-y^2 + 4)^2 - (y + 2)^2) dy$$

$$y^4 - 8y^2 + 16 - y^2 - 4y - 4 dy$$

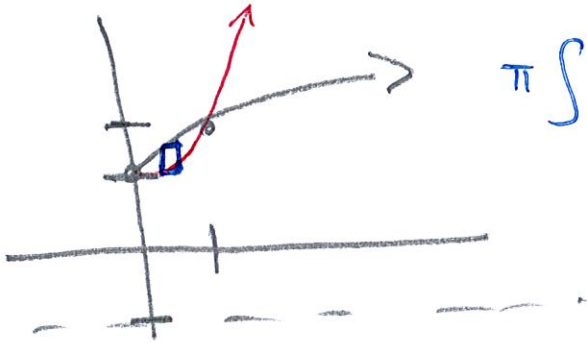
$$\pi \int_{-2}^1 (y^4 - 9y^2 - 4y + 12) dy$$

$$= \frac{108\pi}{5}$$

$$y = \sqrt{x} + 1$$
$$y = x^2 + 1$$

rotated over the ^{line} $y = -1$

$$x=1 \quad x=0$$



$$\pi \int_0^1 ((\sqrt{x} + 1 - (-1))^2 - (x^2 + 1 - (-1))^2) dx$$

$$= \frac{49\pi}{30}$$