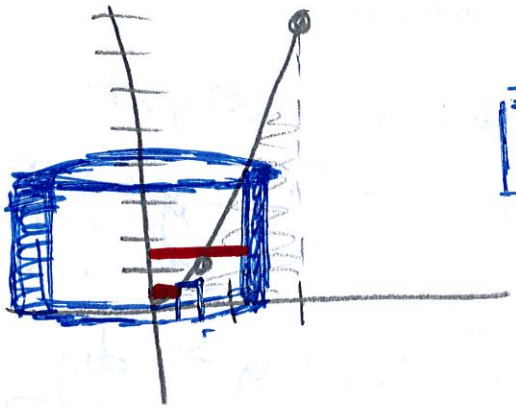
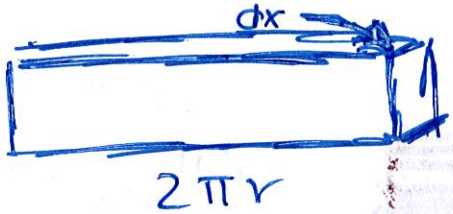
$y = x^3$ $y = 0$ $x = 2$ around y-axis

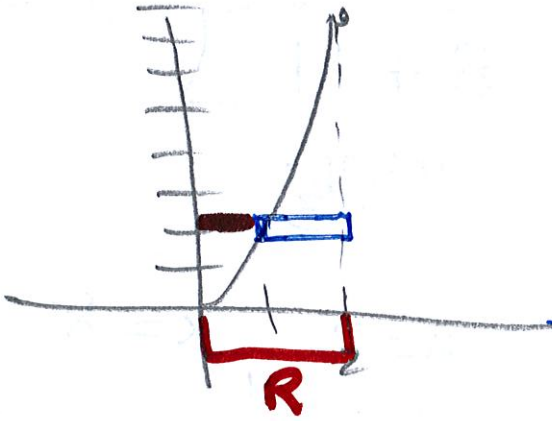




Shells.

$$2\pi \int_0^2 x \cdot x^3 \, dx$$

$$2\pi \left[\frac{1}{5} x^5 \right]_0^2 = \frac{64\pi}{5}$$



$x = \sqrt[3]{y}$ Washer

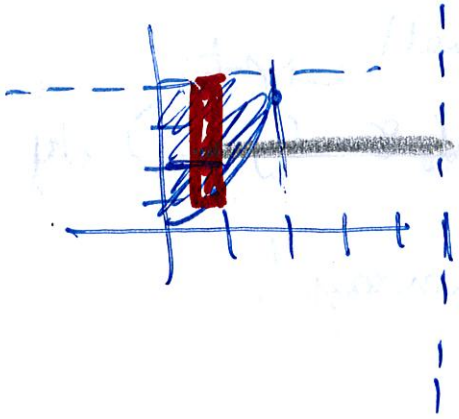
$$\pi \int_0^8 (2-0)^2 - (\sqrt[3]{y} - 0)^2 \, dy$$

$$\pi \int_0^8 4 - y^{2/3} \, dy$$

$$\pi \left[4y - \frac{3}{5} y^{5/3} \right]_0^8$$

$$\pi \left[32 - \frac{96}{5} \right] = \frac{64\pi}{5}$$

Ex: $y = x^2$ $x = 0$ $y = 4$ revolve around $x = 5$



radius height

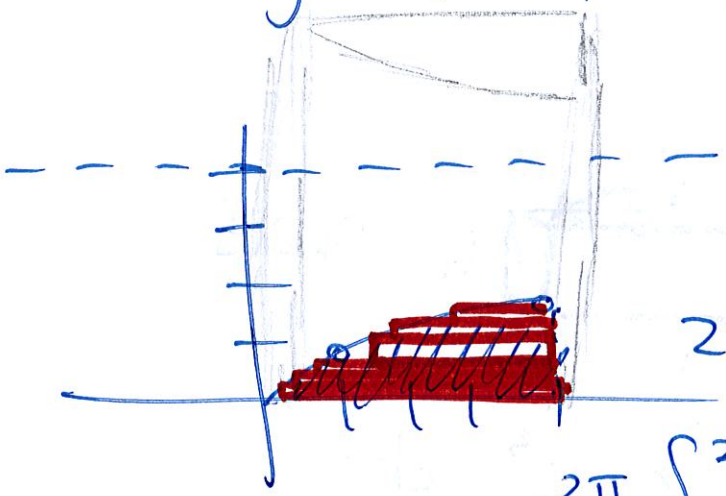
$$2\pi \int_0^2 (5-x)(4-x^2) \, dx$$ Shell

$25 - 10\sqrt{y} + y$

$$\pi \int_0^4 (5-0)^2 - (5 - \sqrt{y}) \, dy$$ washer

$$\pi \int_0^4 25 + 10y^{1/2} + y \quad = \quad \frac{136\pi}{3}$$

Ex: $y = \sqrt{x}$ $x = 4$ $y = 0$ around $y = 4$



Shells

radius height

$$2\pi \int_0^2 (4-y)(4-y^2)\,dy$$

$$2\pi \int_0^2 16 - 4y^2 - 4y + y^3\,dy$$

$$16y - 4/3y^3 - 2y^2 + \tfrac{1}{4}y^4 \Big]_0^2$$

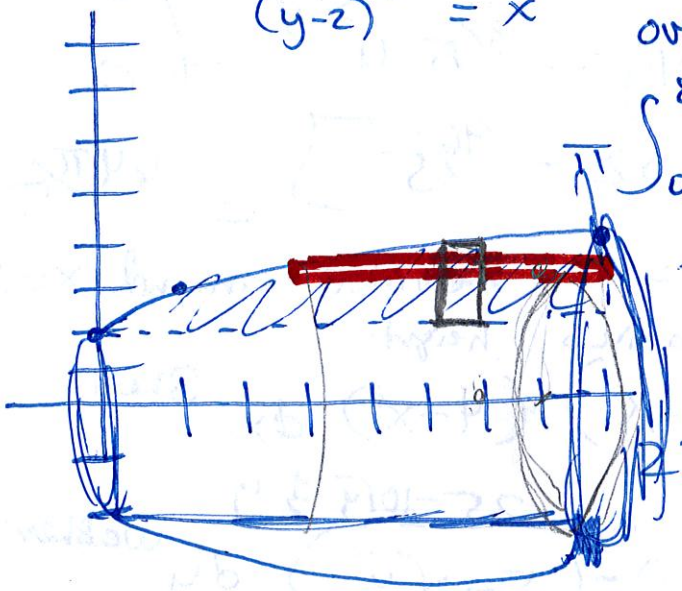
$$2\pi \left[32 - 32/3 - 8 + 4\right]$$

$$104\pi/3$$

Ex: $y = \sqrt[3]{x} + 2$ $y = 2$ $x = 8$

$(y-2) = x^{1/3}$

$(y-2)^3 = x$



over x-axis Washer

$$\pi \int_0^8 \left(\sqrt[3]{x}+2\right)^2 - (2-0)^2\,dx$$

$$\pi \int_0^8 x^{2/3} + 4x^{1/3}\,dx$$

Shell

radius height

$$\pi \int_2^4 (y)\,(8-(y-2)^3)\,dy$$

explain Monday!