AP Calc HW Sols

31. 8π

33. $\pi^2/2$ or 1.571π

34. $\pi^2/8$ or 0.393π

35. $\pi/2 * (e^2-1)$ or 3.195π

36. 15.604π or 49.022

37. 0.627π or 1.970

38. 1.029π or 3.233

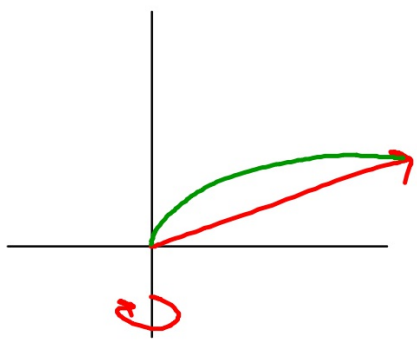
39. 4.906π or 15.411

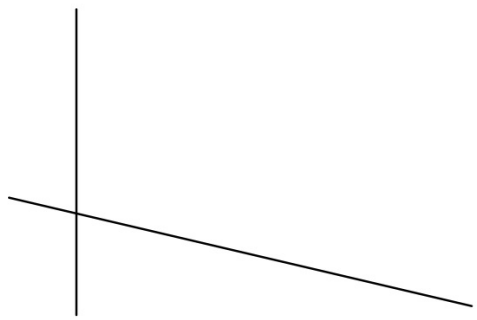
40. 0.952π or 2.991

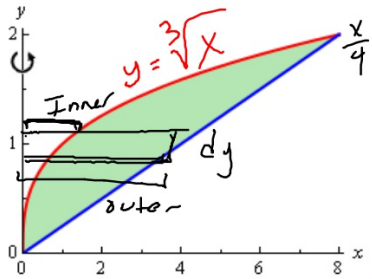
Questions?

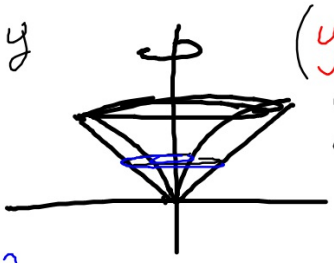
Washer Method Practice

Find the volume of the solid generated by rotation the first quadrant region bound by $y=\sqrt[3]{x}$ and $y=x/4$ about the y-axis.



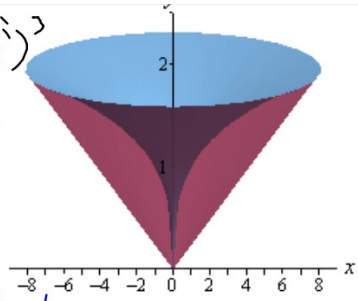






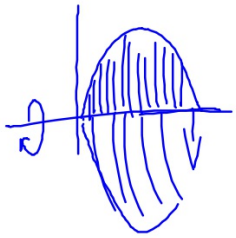
$(y)^1 = (\sqrt[3]{x})^3$

$y^3 = x$



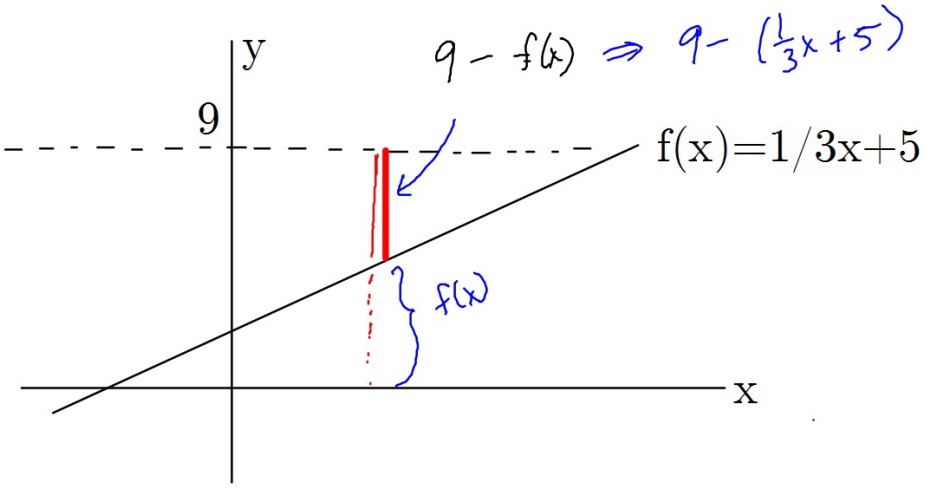
$$V = \pi \int_0^2 (\text{outer})^2 - (\text{inner})^2 \, dy$$

$$\underbrace{\pi \int_0^2 (4y)^2 - (y^3)^2 \, dy}_{\text{calc it}}$$



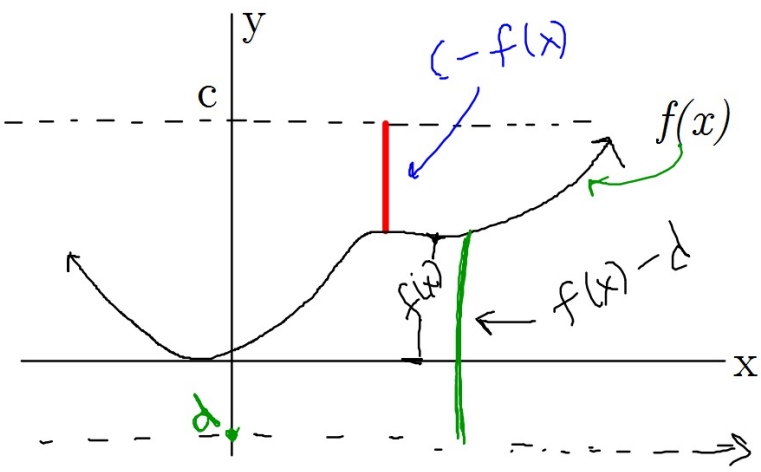
π _____

Baby question: Write an expression for the length of the red bar



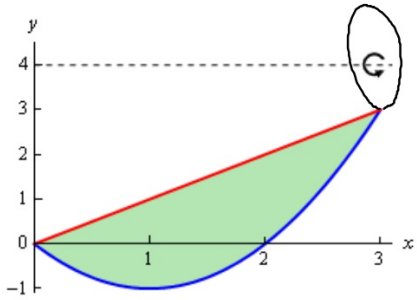
$9 - f(x) \Rightarrow 9 - (\frac{1}{3}x + 5)$

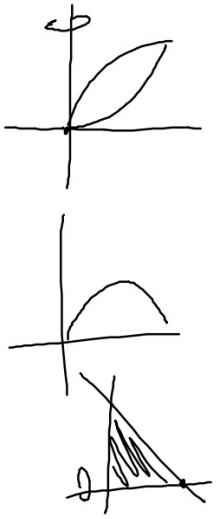
Baby question: Write an expression for the length of the red bar

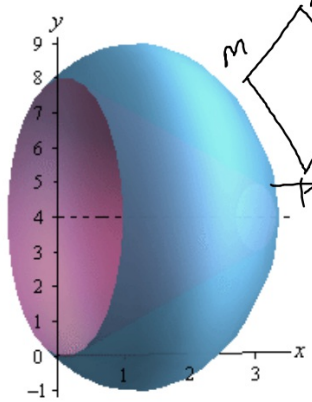


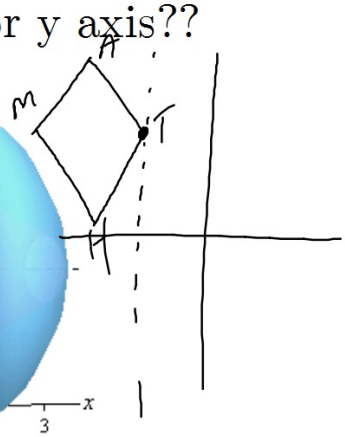
"top minus bottom"

What if the axis of revolution is NOT the x or y axis??









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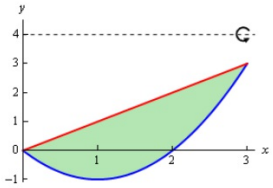
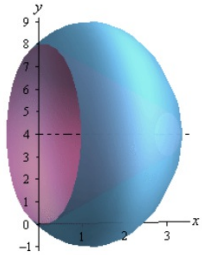


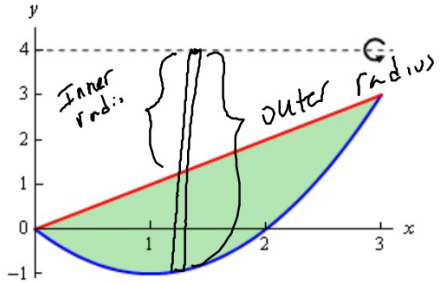


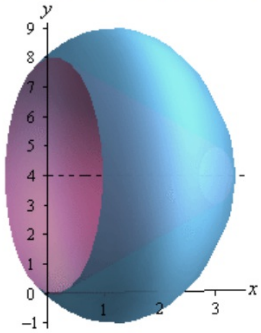
Same Rules apply:

$$V = \pi \int_a^b (\text{outer } \overset{\text{radius}}{\cancel{\text{function}}})^2 - (\text{inner } \overset{\text{radius}}{\cancel{\text{function}}})^2 \, dx$$

***outer and inner are RELATIVE to the revolving axis**

What if the axis of revolution is NOT the x or y axis??



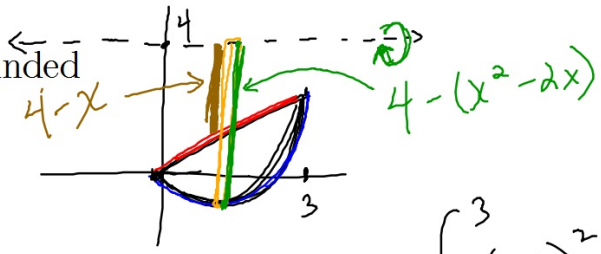


Very important: draw representative rectangles perpendicular and adjacent to the axis of revolution

Determine the volume of the solid obtained by rotating the region bounded by and about the line . $y=4$

$y=x^2-2x$
$y=x$ $\Longrightarrow$ pts of Intersection:

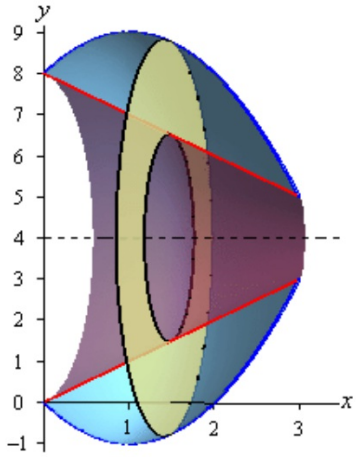
$x=0$ $\quad x=3$

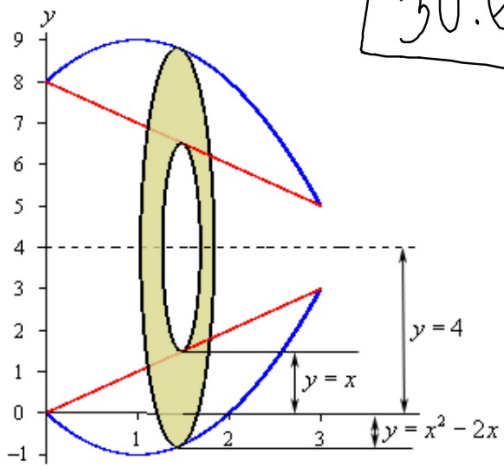


$$V=\pi\int_0^3 \left(\text{out. rad}\right)^2-\left(\text{in rad}\right)^2 dx$$

$$V=\pi\int_0^3 \left(4-(x^2-2x)\right)^2-\left(4-x\right)^2 dx$$

$$\boxed{30.6\pi}$$





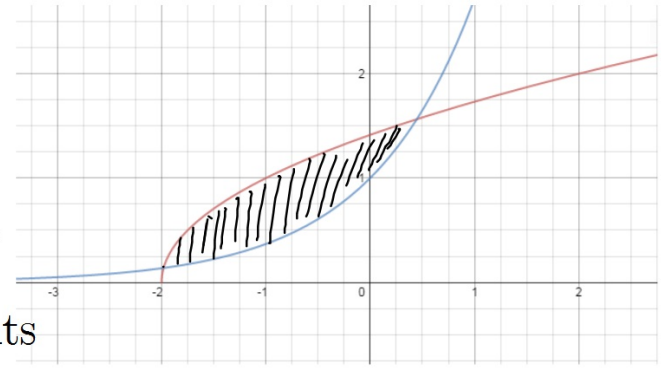
ex 2

Region:

$y = \sqrt{x+2}$

$y = e^x$

{about $y = -2$}



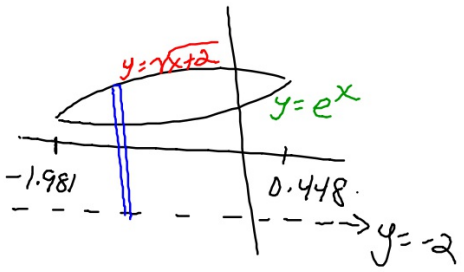
Use a calc.

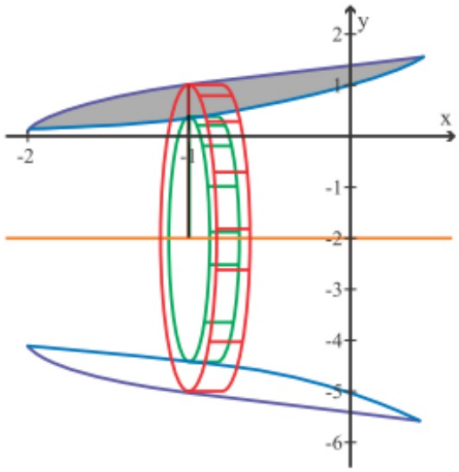
and find the intersection points

(.448 , 1.564)

(-1.981 0.138)

Let's spin around y=-2





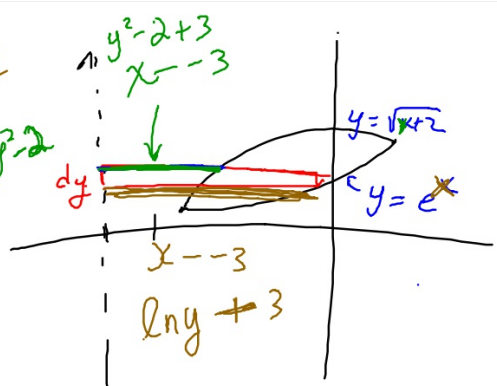
$$= \int_{-1.980974}^{0.44754216} \pi\left(2+\sqrt{x+2}\right)^2 dx - \int_{-1.980974}^{0.44754216} \pi\left(2+e^x\right)^2 dx = 19.724 \text{ or } 19.725.$$

Axis to the left of the region

$y = e^{x} \iff x = \ln y$

$y = \sqrt{x+2} \iff x = y^2 - 2$

about $x = -3$



$(-1.961, 0.138)$
$(0.448, 1.564)$

$$V = \pi \int \left(\text{out. rad}\right)^2 - \left(\text{inner rad}\right)^2 dy \qquad x=-3$$

$$\pi \int_{0.138}^{1.564} \left(\ln y + 3\right)^2 - \left(y^2 - 2 + 3\right)^2 dy = 4.946\pi \approx 15.540$$