

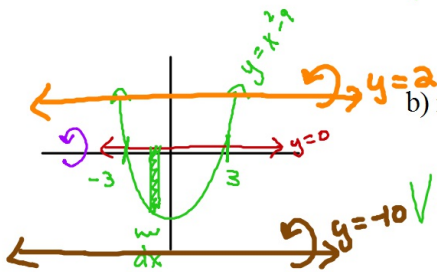
**Warm-up after Sec. 8.3:** Volumes (day 1) Disc / Washer Method

Find the volume generated by rotating each area about the given axis

1)  $y = x^2 - 9$   
 $y = 0$

a) rotate about  $y = 0$

$$V = \pi \int_{-3}^3 \left( \overset{\text{top}}{0} - \underset{\text{bottom}}{(x^2 - 9)} \right)^2 dx$$



b) rotate about  $y = 2$

$$V = \pi \int_{-3}^3 \left[ (2 - (x^2 - 9))^2 - (2 - 0)^2 \right] dx$$

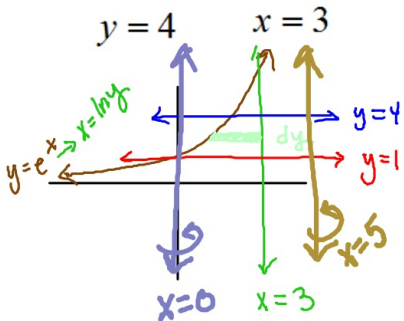
c) rotate about  $y = -10$

$$V = \pi \int_{-3}^3 \left[ (0 - (-10))^2 - ((x^2 - 9) - (-10))^2 \right] dx$$

2)  $y = 1$       $y = e^x$

a) rotate about  $x = 3$

$$V = \pi \int_1^4 \left[ 3 - \ln y \right]^2 dy$$



b) rotate about  $x = 5$

$$V = \pi \int_1^4 \left( (5 - \ln y)^2 - (5 - 3)^2 \right) dy$$

c) rotate about  $x = 0$

$$V = \pi \int_1^4 \left[ (3 - 0)^2 - (\ln y - 0)^2 \right] dy$$

$y = e^x$   
 $\ln y = \ln e^x$   
 $\ln y = x$