

# Volumes Using Disks and Washers

## (6.3)

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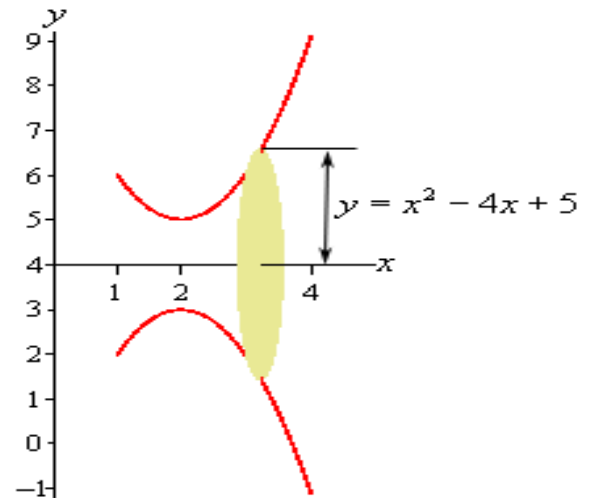
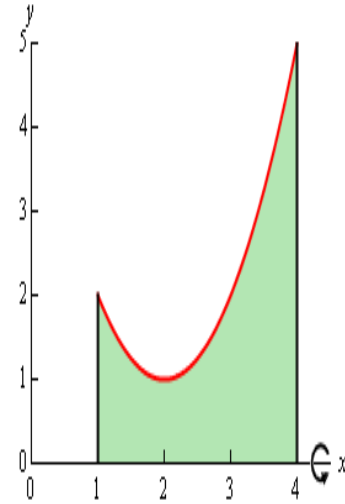
1.  $y = x^2 - 4x + 5$ ,  $x = 1$ ,  $x = 4$  and the  $x$ -axis about the  $x$ -axis.

$$V = \int_1^4 \pi \left[ (x^2 - 4x + 5)^2 \right] dx$$

$$V = \pi \int_1^4 (x^4 - 8x^3 + 26x^2 - 40x + 25) dx$$

$$V = \pi \left( \frac{x^5}{5} - 2x^4 + \frac{26x^3}{3} - 20x^2 + 25x \right) \Big|_1^4$$

$$V = \boxed{\frac{78}{5} \pi}$$



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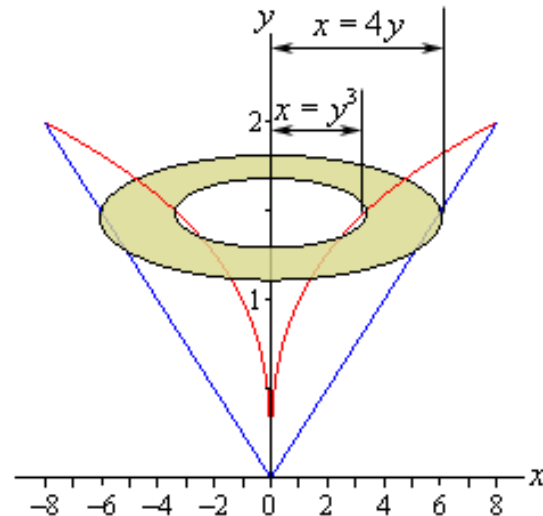
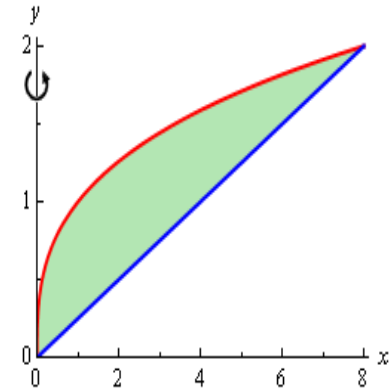
2.  $y = \sqrt[3]{x}$  and  $y = \frac{x}{4}$  that lies in the first quadrant about the  $y$ -axis.

$$x = y^3, \quad x = 4y$$

$$V = \int_0^2 \pi \left[ (4y)^2 - (y^3)^2 \right] dy$$

$$V = \left( \frac{16y^3}{3} - \frac{y^7}{7} \right) \pi \Big|_0^2$$

$$V = \frac{512}{21} \pi$$



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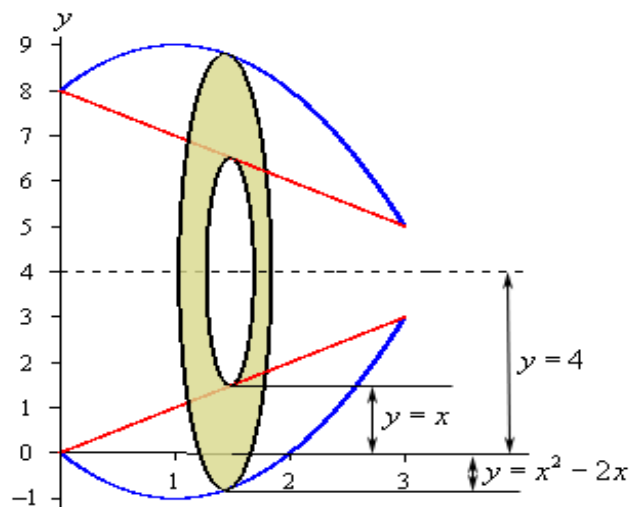
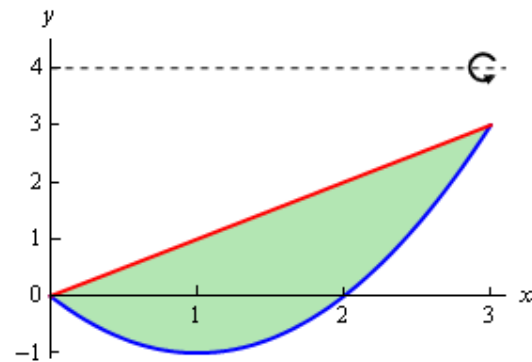
3.  $y = x^2 - 2x$  and  $y = x$  about the line  $y = 4$

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

$$V = \int_0^3 \pi \left( x^4 - 4x^3 - 5x^2 + 24x \right) dx$$

$$V = \pi \left( \frac{x^5}{5} - x^4 - \frac{5x^3}{3} + 12x^2 \right) \Big|_0^3$$

$$V = \frac{153\pi}{5}$$



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4.  $y = 2\sqrt{x-1}$  and  $y = x-1$  about the line  $x = -1$ .

$$V = \int_0^4 \pi \left[ (y+1-(-1))^2 - \left( \frac{y^2}{4} + 1 - (-1) \right)^2 \right] dy$$

$$V = \pi \int_0^4 \left( 4y - \frac{y^4}{16} \right) dy$$

$$V = \pi \left( 2y^2 - \frac{y^5}{80} \right) \Big|_0^4$$

$$V = \boxed{\frac{96\pi}{5}}$$

