Calculus Lesson #2 Unit 11

Class Worksheet #2

Solids of Revolution

Washers

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

a) sketch the generating region, showing a typical generating rectangle,
b) write an expression for the volume generated by this rectangle,
c) express the exact volume of the solid as a definite integral, and
d) evaluate the integral.

Sample 1a. The region bounded by $y = 10 - x^2$ and $y = 1$ is rotated about the x-axis.

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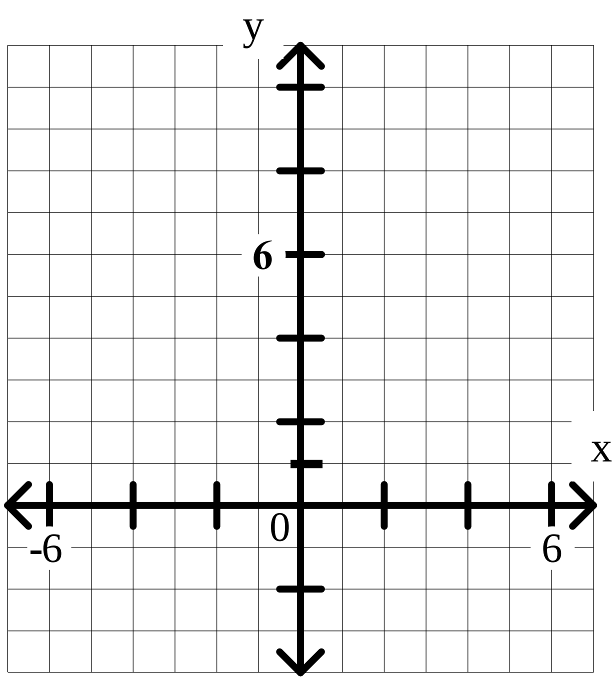

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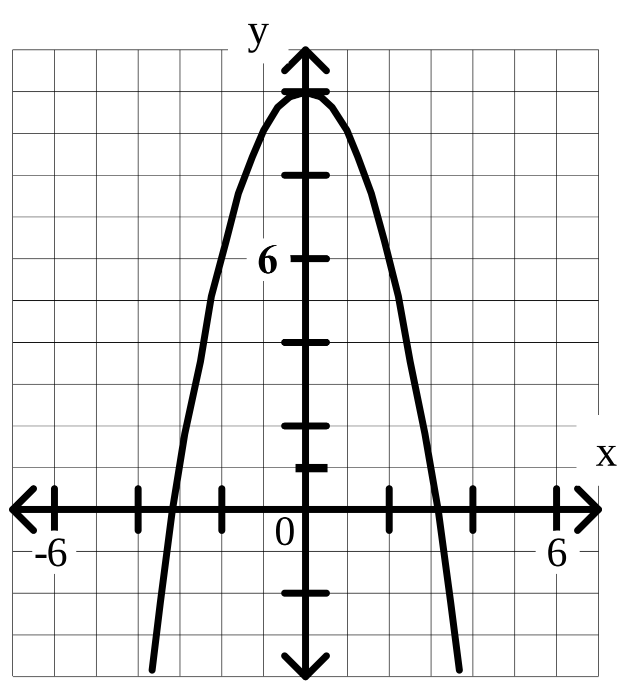

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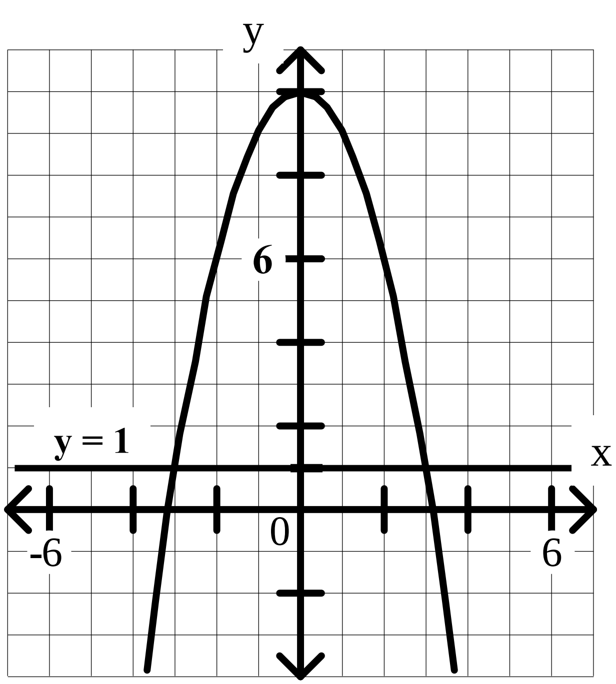

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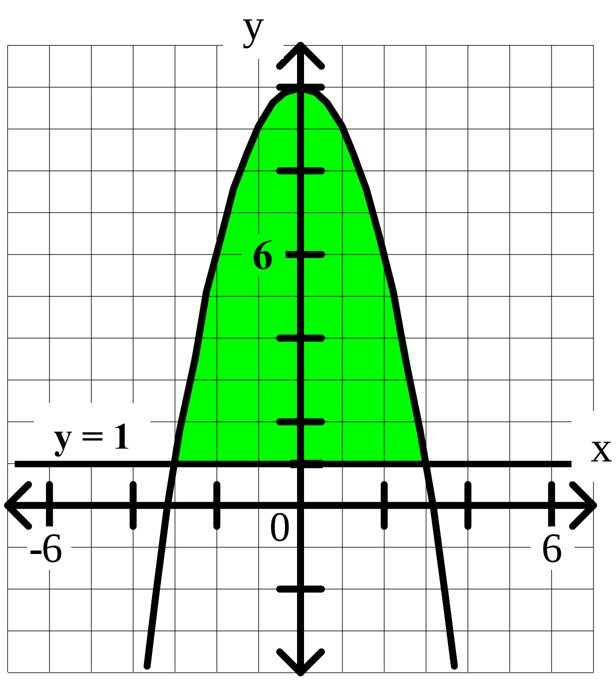

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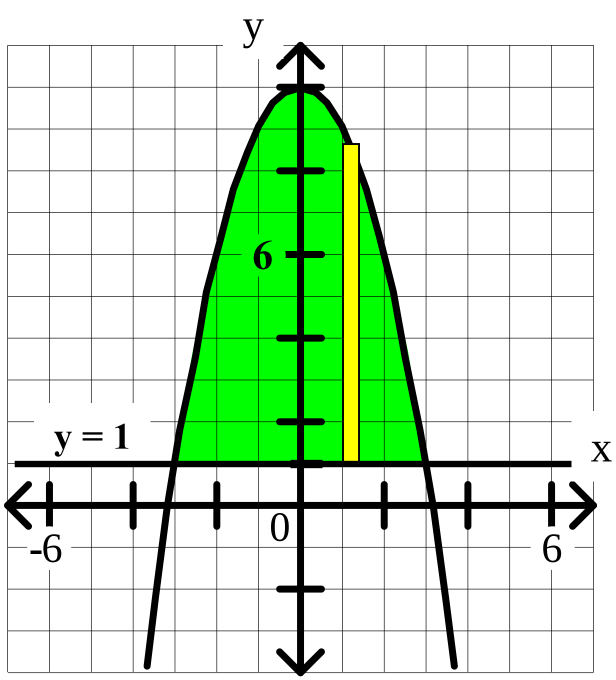

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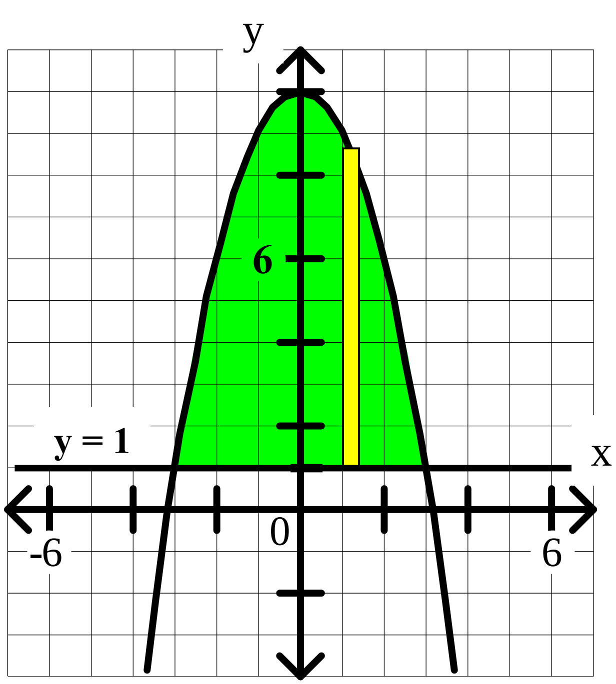

Washers: $V = \pi(R^2$ ï $r^2)h$

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r =

h =

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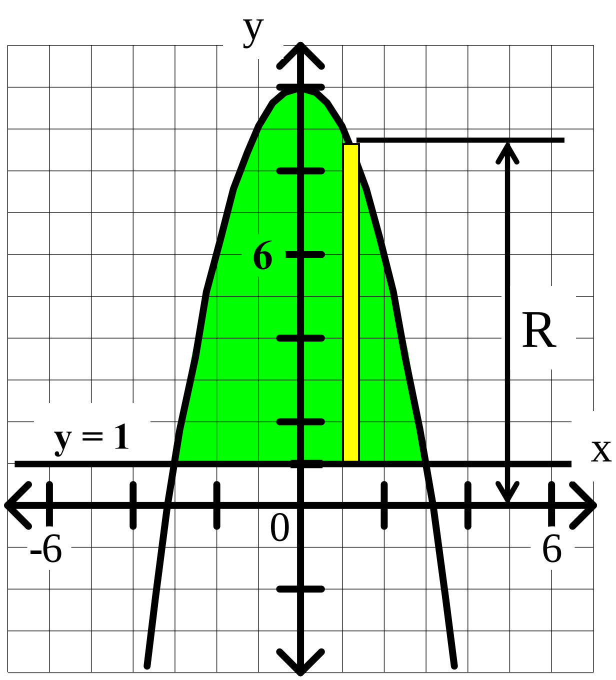

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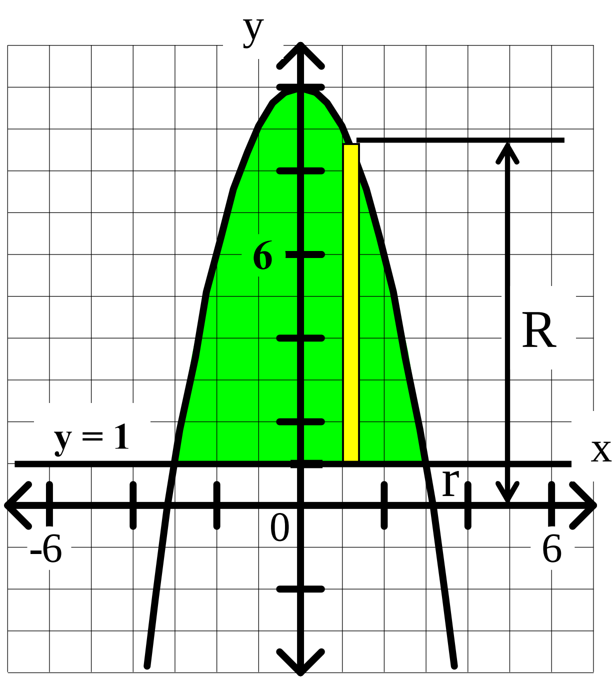

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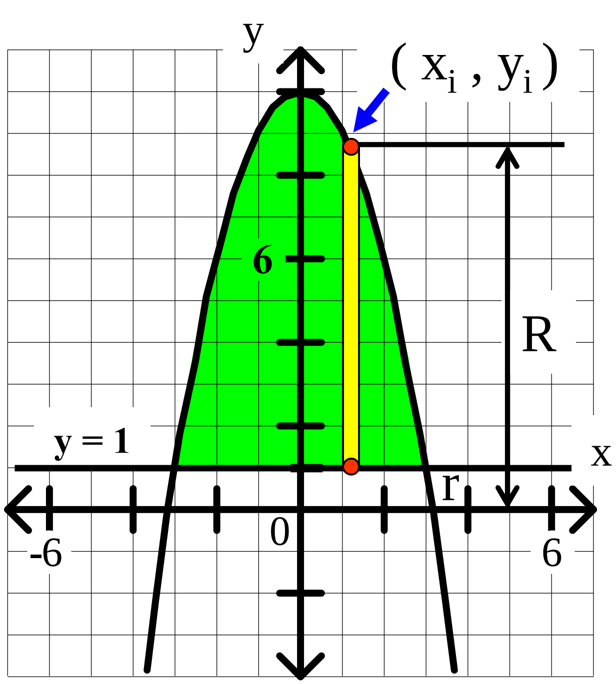

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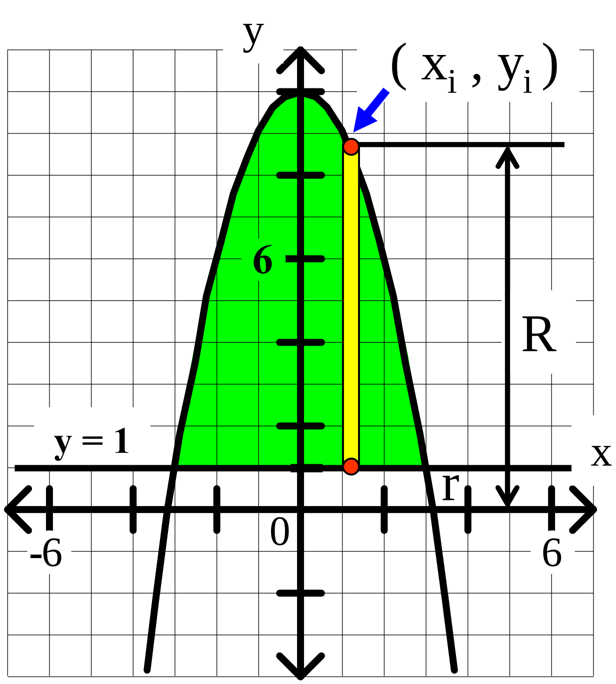

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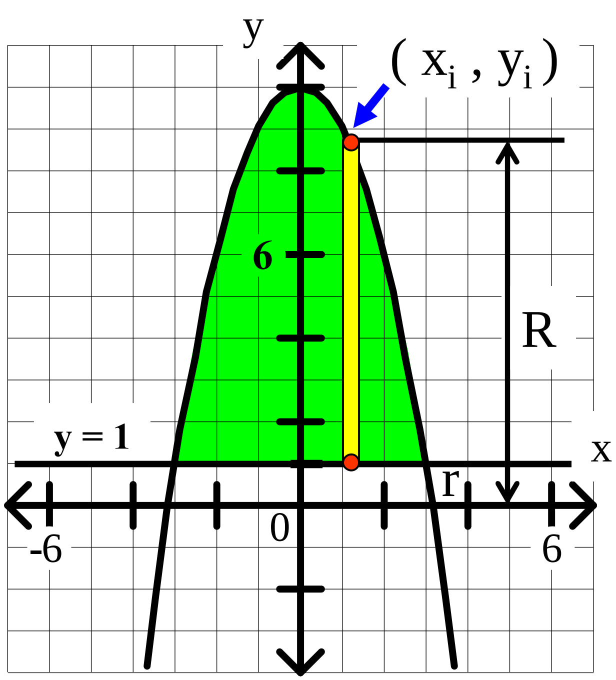

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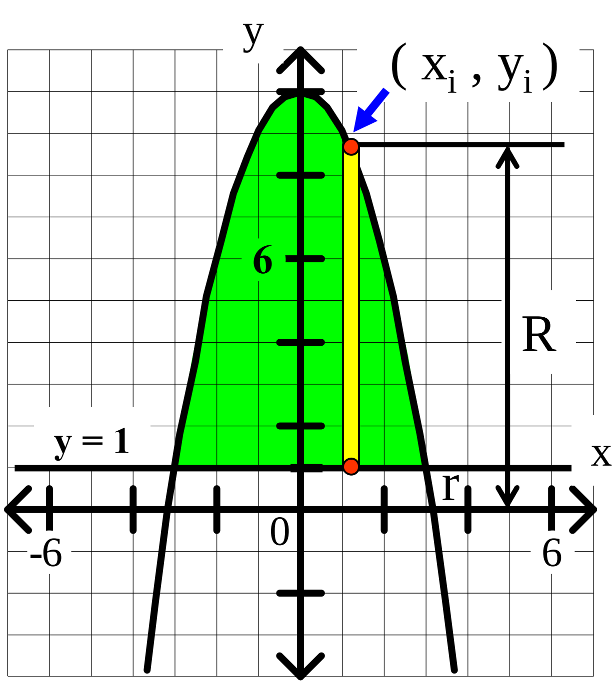

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$h = \Delta x$

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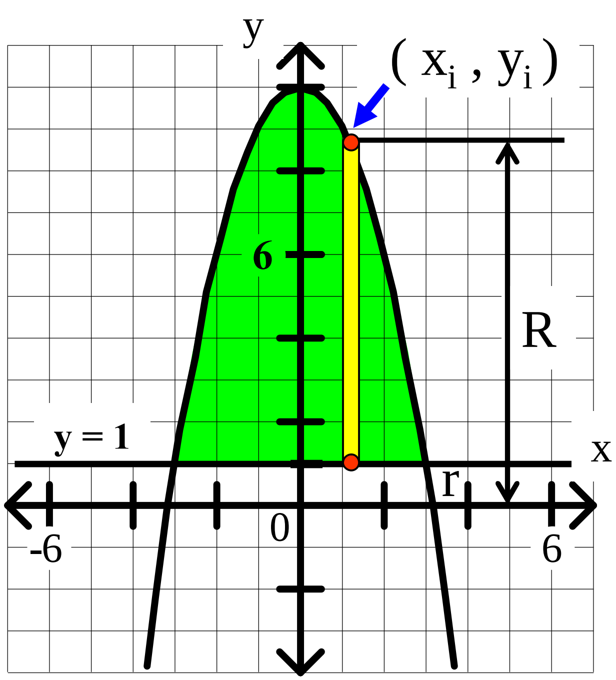

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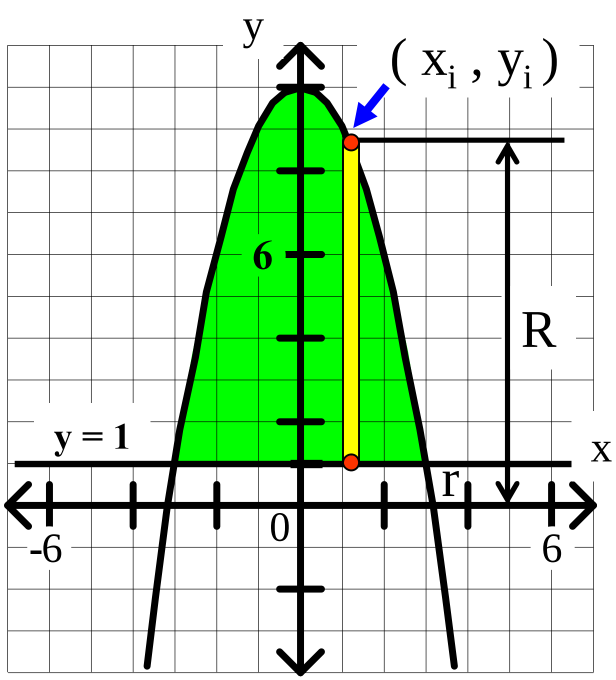

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

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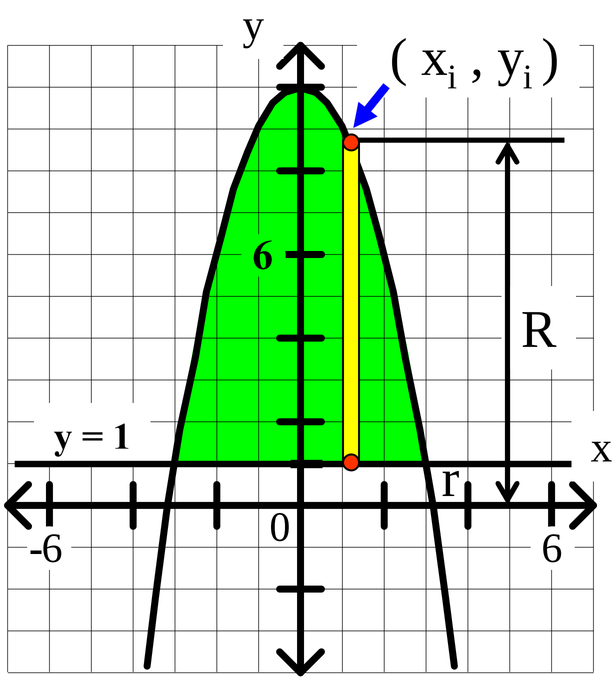

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

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b. $V_i =$

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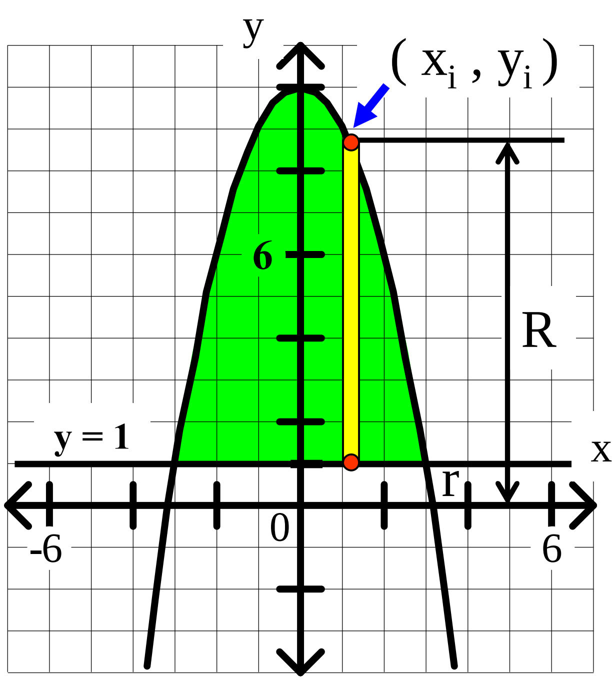

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_i = 10$ ï x_i^2

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b. $V_i = \pi$

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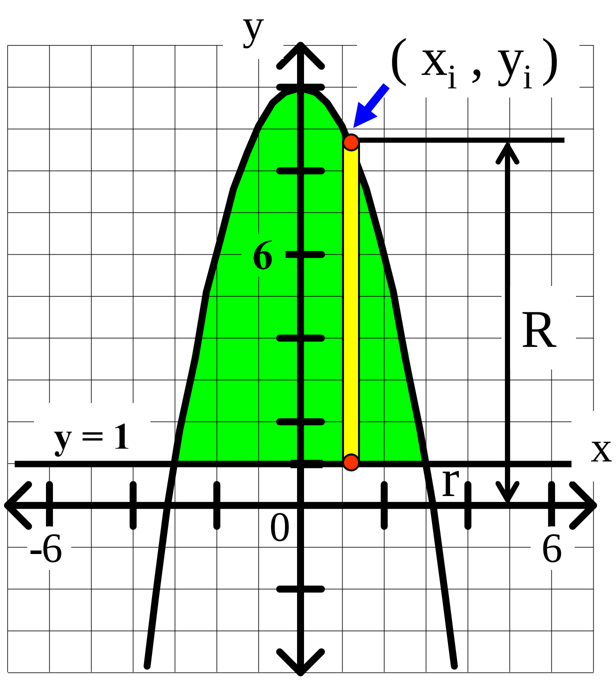

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_i = 10$ ï x_i^2

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10$ ï $x_i^2)$

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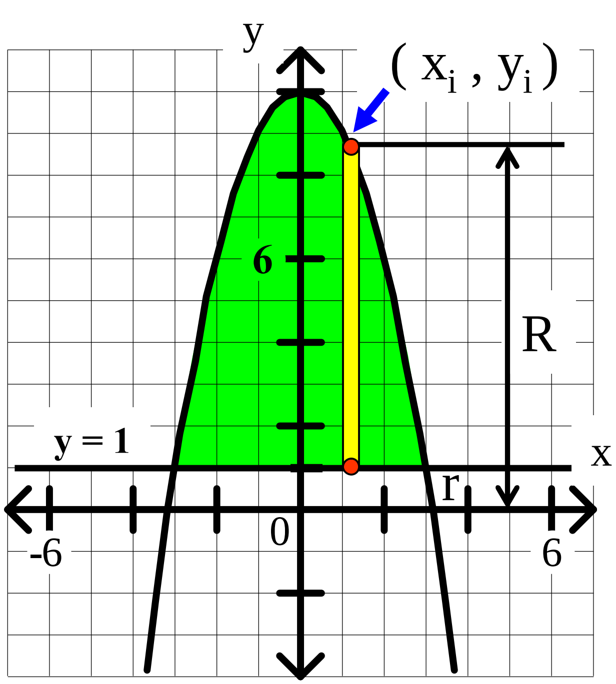

Washers: $V = \pi(R^2 - r^2)h$

$R = y_i = 10 - x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 - x_i^2)^2$

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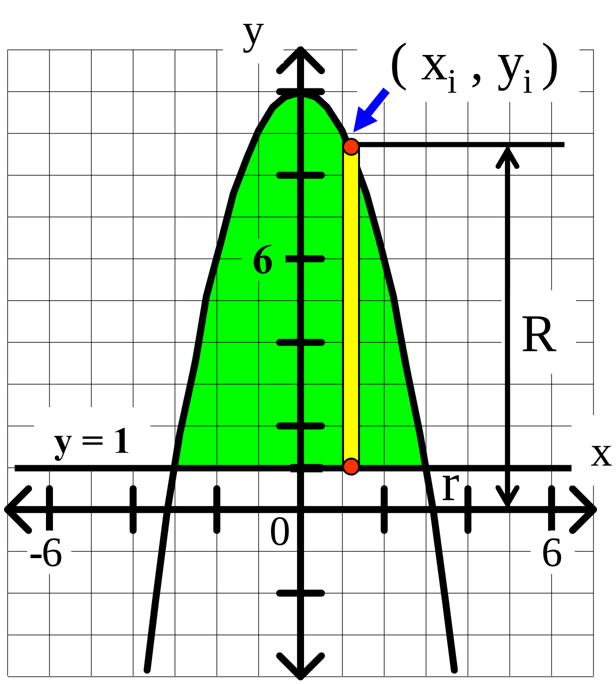

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

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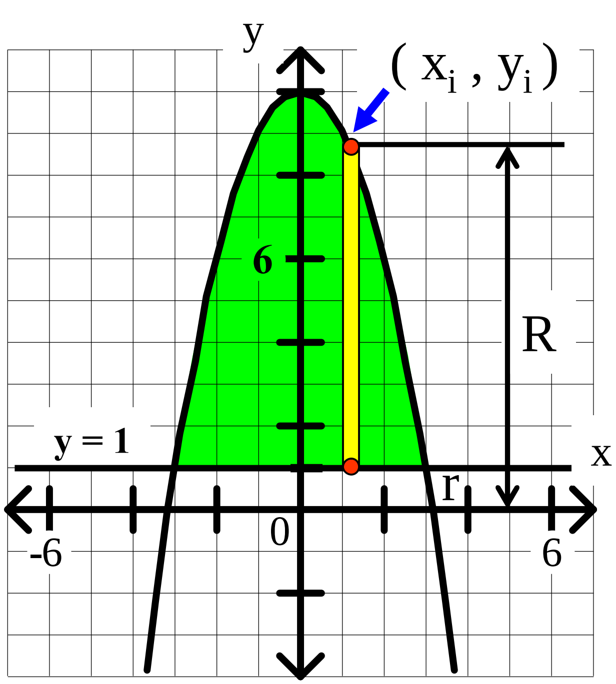

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 \text{ ï } x_i^2)^2 \text{ ï } 1$

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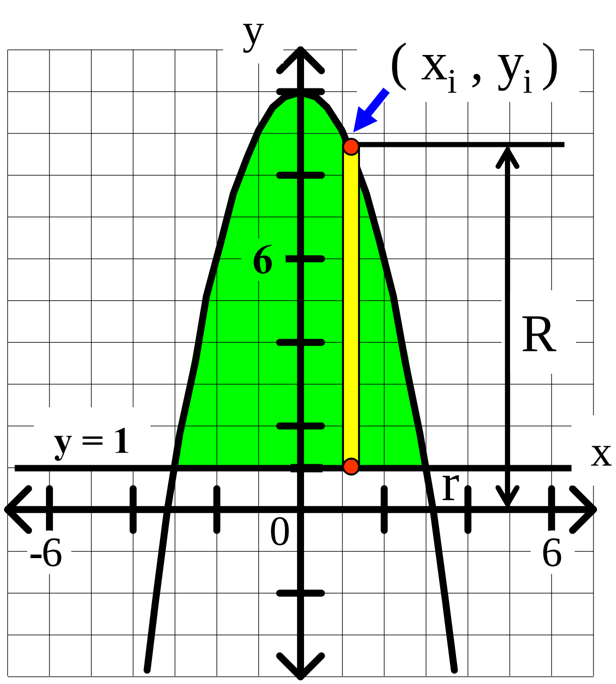

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

$r = 1$

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b. $V_i = \pi((10 \text{ ï } x_i^2)^2 \text{ ï } 1^2$

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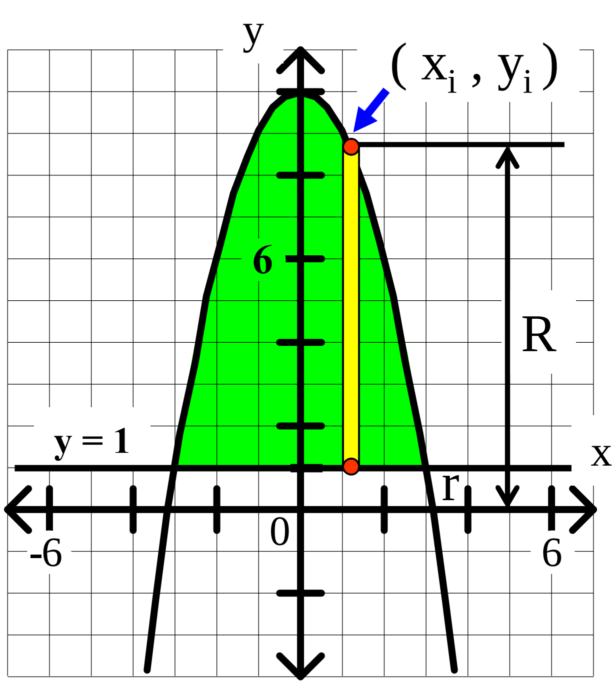

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 \text{ ï } x_i^2)^2 \text{ ï } 1^2)\,\Delta x$

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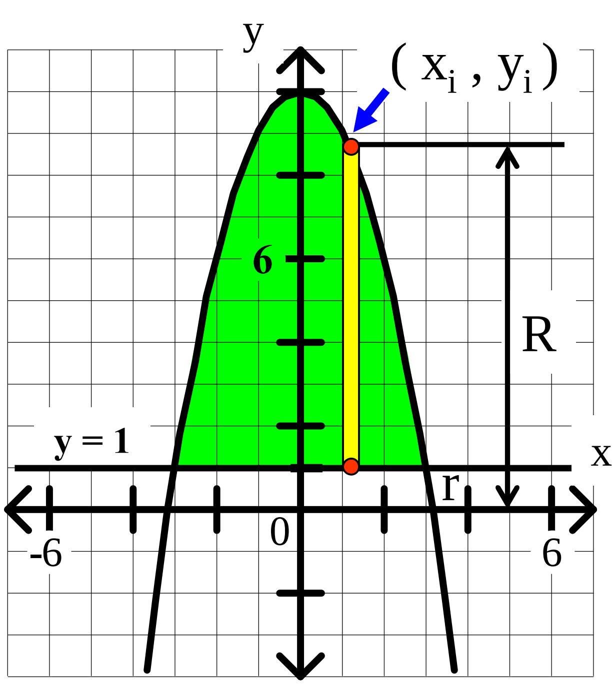

Washers: $V = \pi(R^2 - r^2)h$

$R = y_i = 10 - x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 - x_i^2)^2 - 1^2)\,\Delta x$

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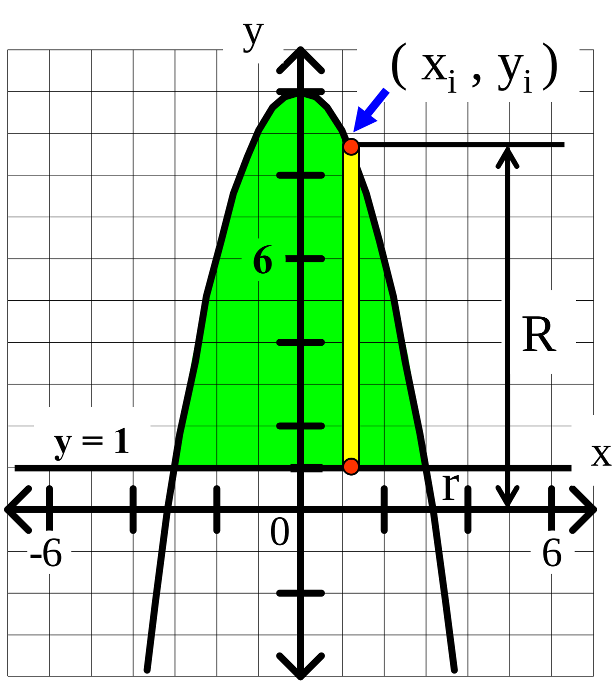

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 \text{ ï } x_i^2)^2 \text{ ï } 1^2)\, \Delta x$

c. $V =$

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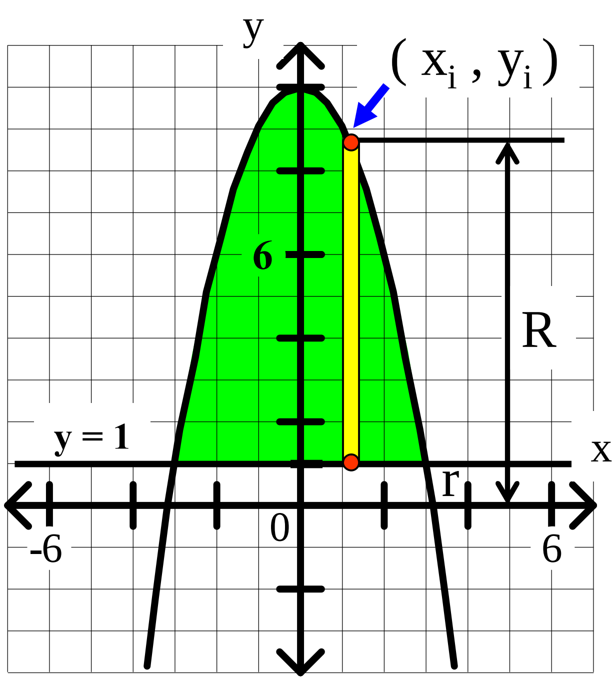

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$R = y_i = 10 \text{ ï } x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 \text{ ï } x_i^2)^2 \text{ ï } 1^2)\,\Delta x$

c. $V = \pi$

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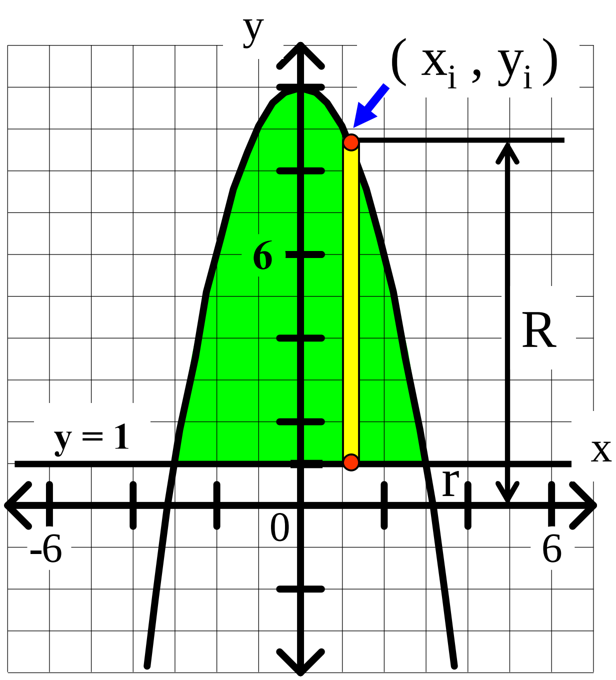

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_i = 10$ ï x_i^2

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10$ ï $x_i^2)^2$ ï $1^2)\ \Delta x$

c. $V = \pi\int$

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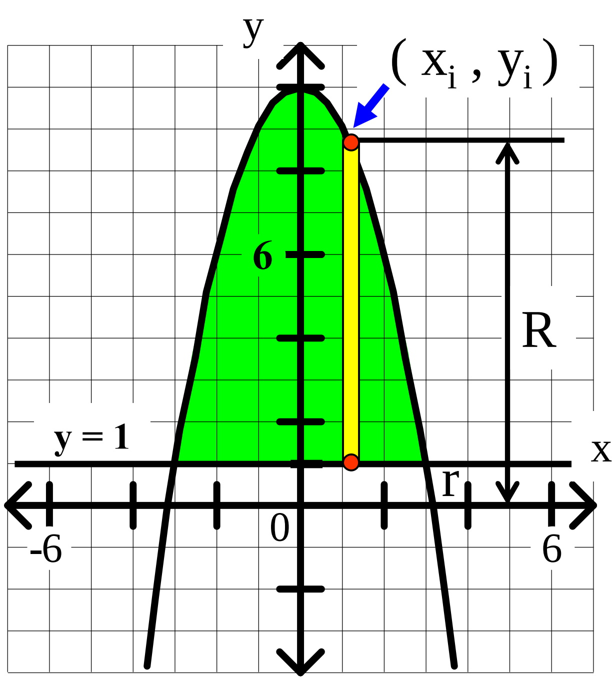

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$r = 1$

$h = \Delta x$

b. $V_i = \pi((10$ ï $x_i^2)^2$ ï $1^2)\,\Delta x$

c. $V = \pi\int((10$ ï $x^2)^2$ ï $1)\,dx$

Calculus   Class Worksheet #2   Unit 11   Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

a) sketch the generating region, showing a typical generating rectangle,
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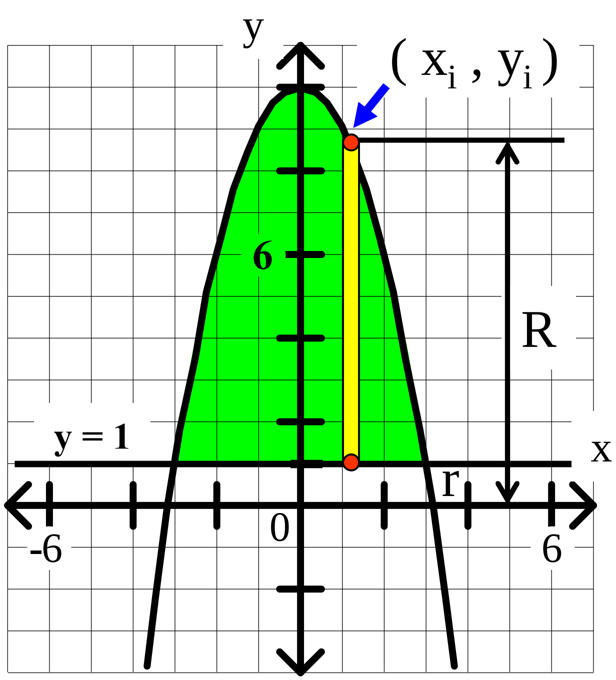
Sample 1a. The region bounded by $y = 10 – x^2$ and $y = 1$ is rotated about the x-axis.

a.



Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_i = 10$ ï x_i^2

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10$ ï $x_i^2)^2$ ï $1^2)\ \Delta x$

c. $V = \pi\int_{-3}$ ((10 ï $x^2)^2$ ï 1) dx

Calculus Class Worksheet #2 Unit 11 Solutions

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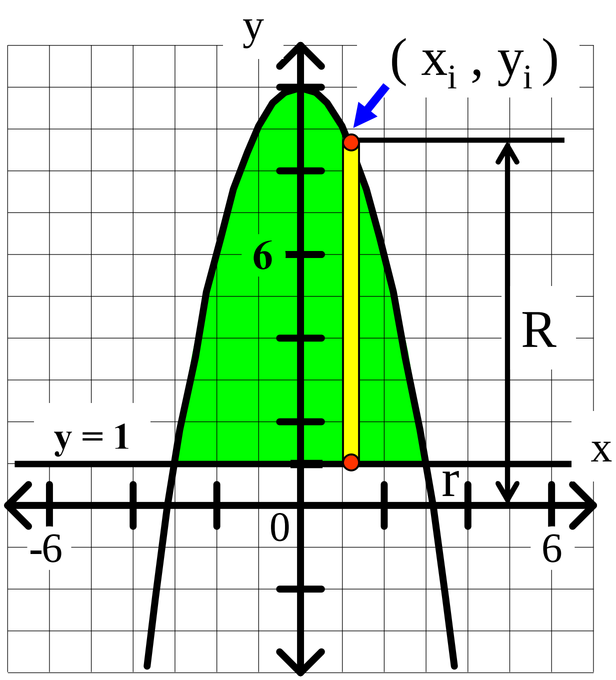

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 \text{ ï } x_i^2)^2 \text{ ï } 1^2)\, \Delta x$

c. $V = \pi\int_{-3}^{3}((10 \text{ ï } x^2)^2 \text{ ï } 1)\, dx$

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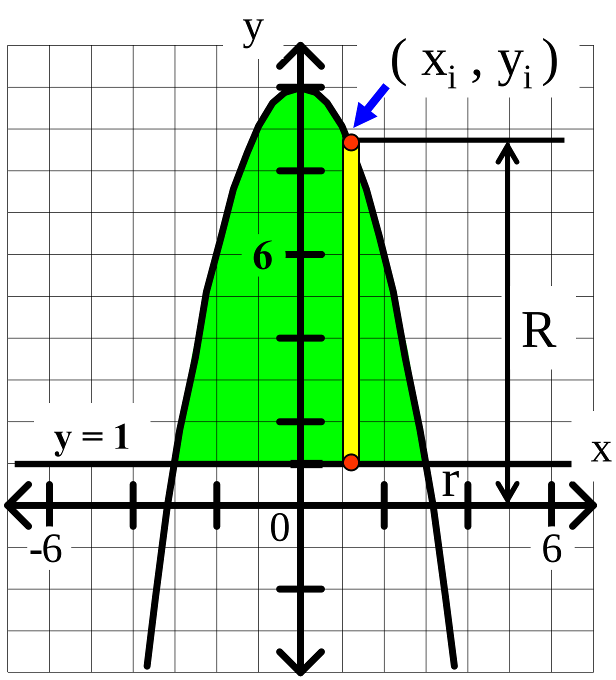

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i = 10 \text{ ï } x_i^2$

$r = 1$

$h = \Delta x$

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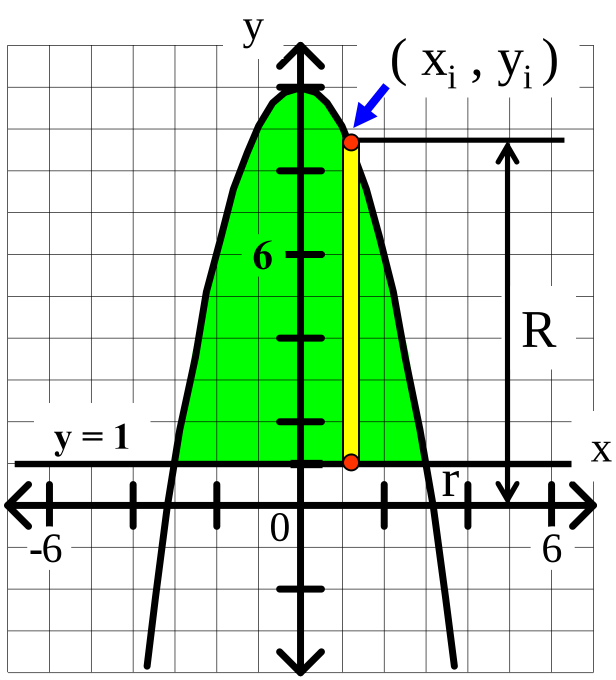

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

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$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 \text{ ï } x_i^2)^2 \text{ ï } 1^2)\ \Delta x$

c. $V = \pi\int_{-3}^{3}((10 \text{ ï } x^2)^2 \text{ ï } 1)\ dx$

$V = \pi\int_{-3}^{3}(x^4 \text{ ï } 20x^2 + 99)\ dx$

Calculus   Class Worksheet #2   Unit 11   Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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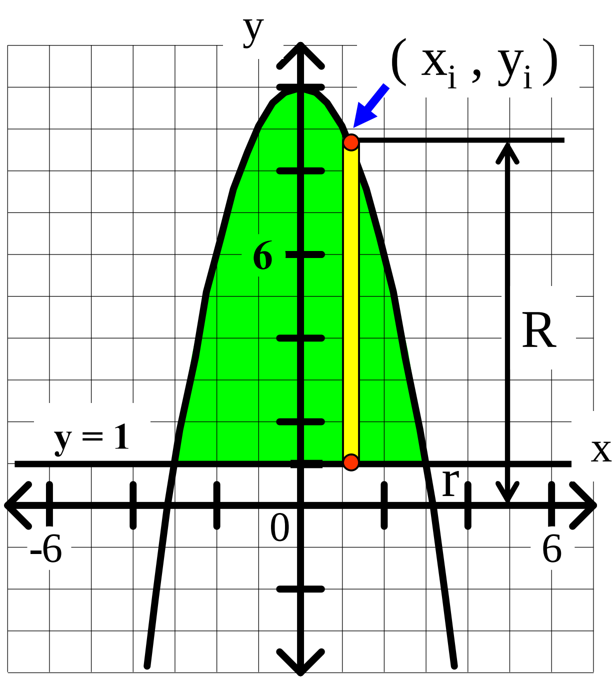

Washers: $V = \pi(R^2 - r^2)h$

$R = y_i = 10 - x_i^2$

$r = 1$

$h = \Delta x$

b. $V_i = \pi((10 - x_i^2)^2 - 1^2)\,\Delta x$

c. $V = \pi\int_{-3}^{3}((10 - x^2)^2 - 1)\,dx$

$V = \pi\int_{-3}^{3}(x^4 - 20x^2 + 99)\,dx$

d. $V \approx$

Calculus   Class Worksheet #2   Unit 11   Solutions

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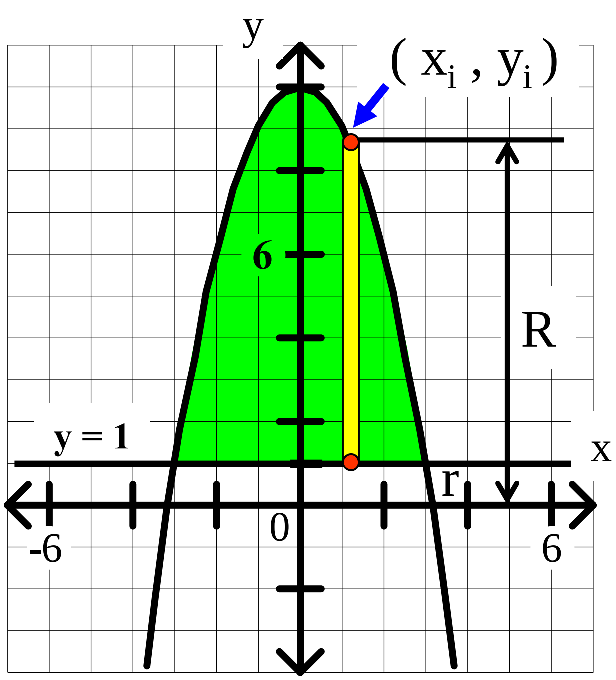

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c. $V = \pi\int_{-3}^{3}((10 \text{ ï } x^2)^2 \text{ ï } 1)\, dx$

$V = \pi\int_{-3}^{3}(x^4 \text{ ï } 20x^2 + 99)\, dx$

d. $V \approx 1040$ cu. units

Calculus   Class Worksheet #2   Unit 11   Solutions

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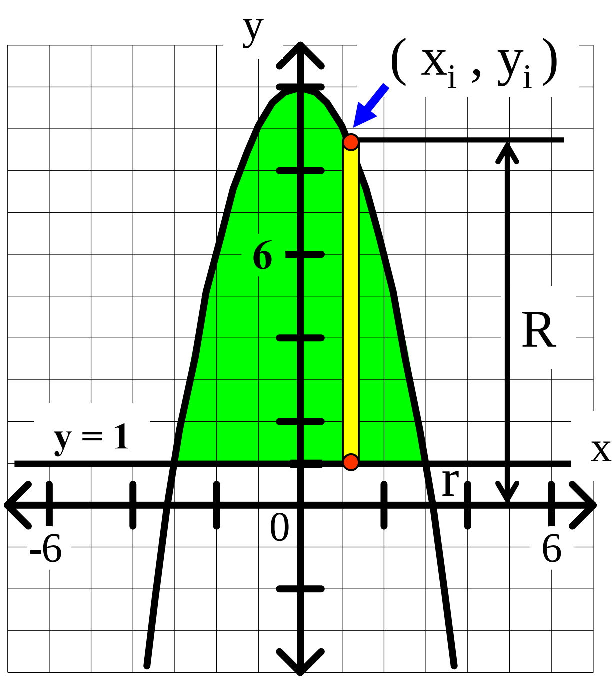

Washers: $V = \pi(R^2 - r^2)h$

$R = y_i = 10 - x_i^2$

$r = 1$

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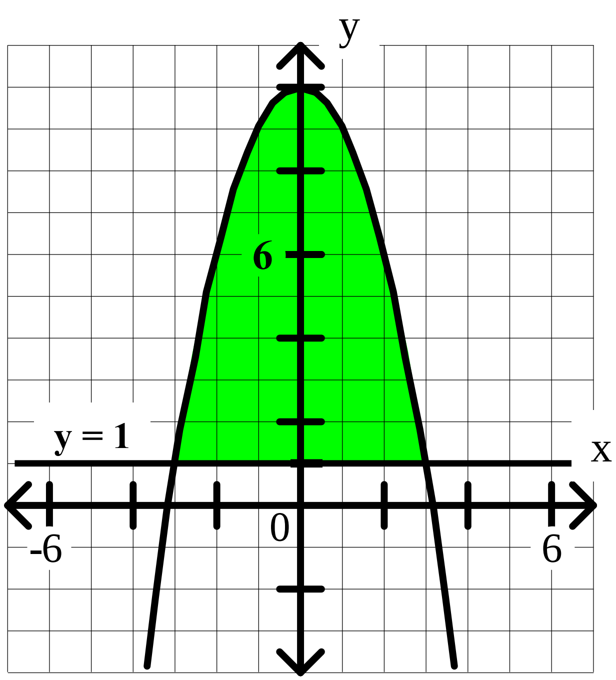

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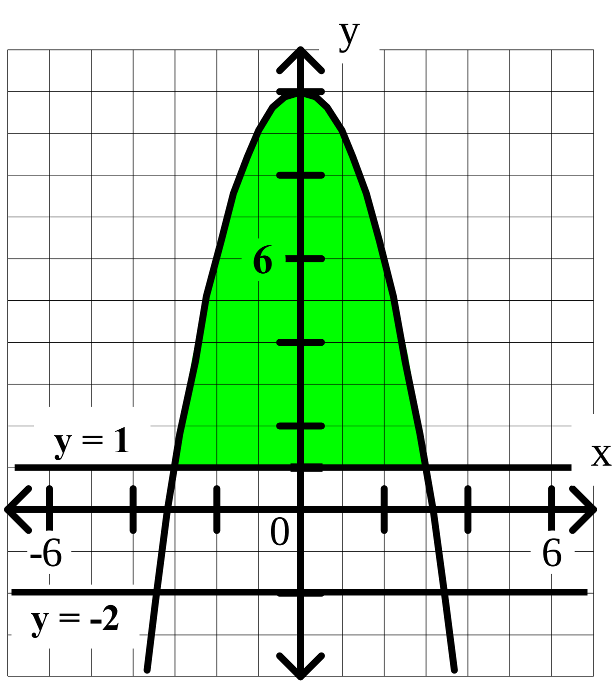

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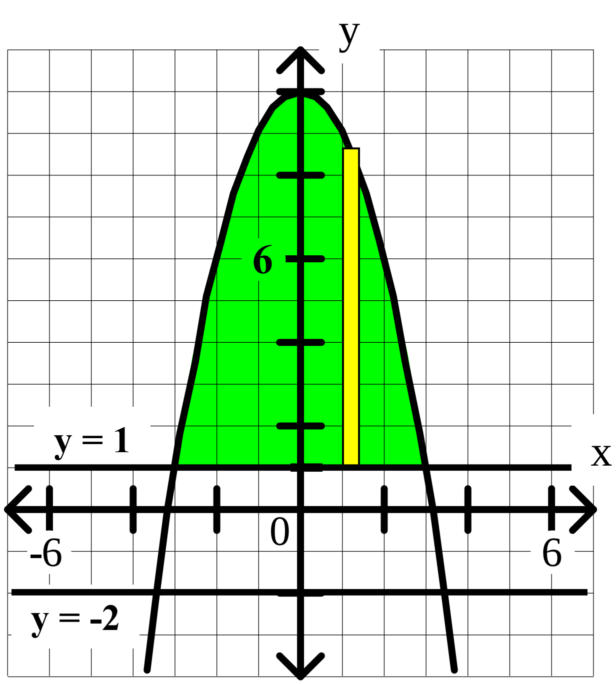

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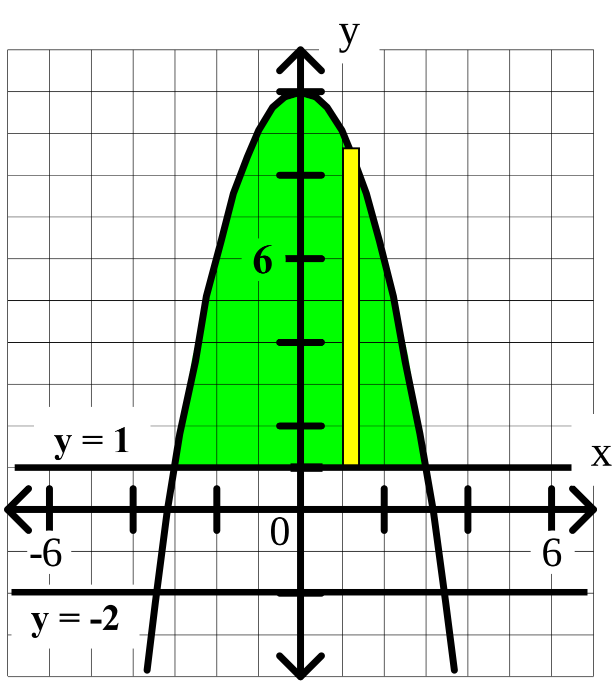

Washers: $V = \pi(R^2$ ï $r^2)h$

R =

r =

h =

Calculus   Class Worksheet #2   Unit 11   Solutions

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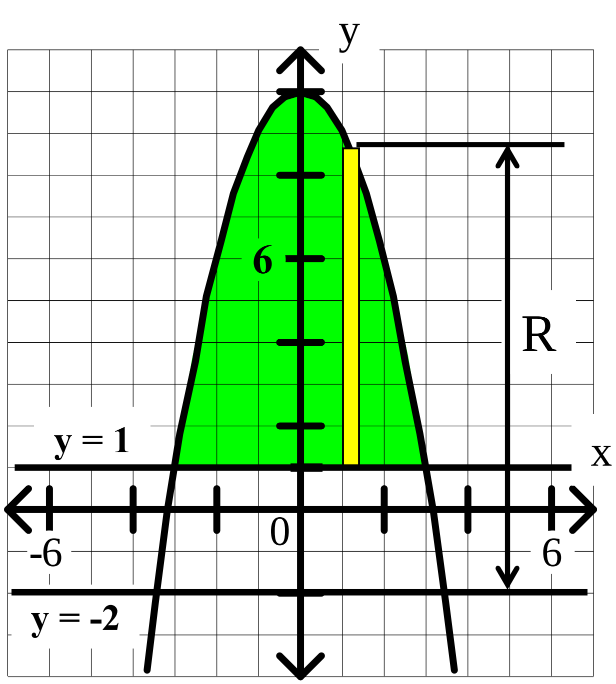

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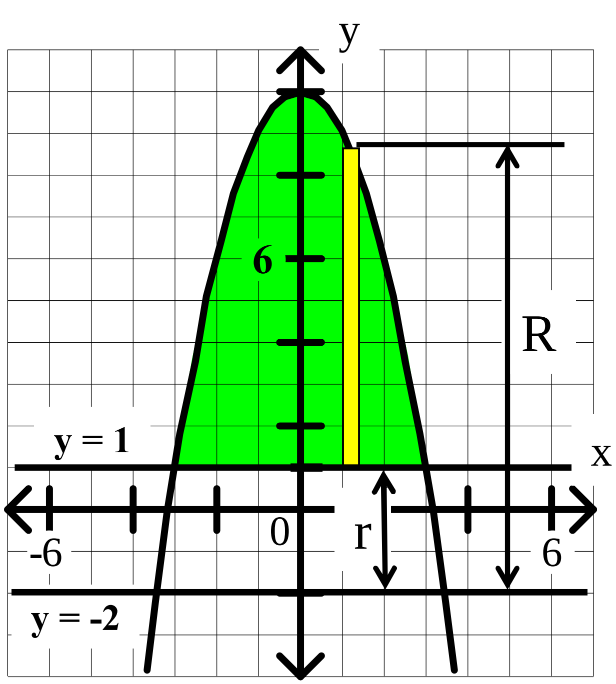

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

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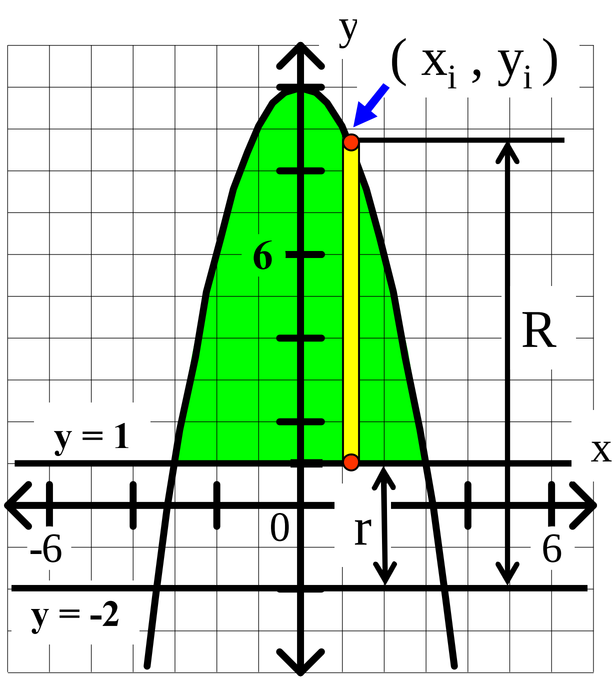

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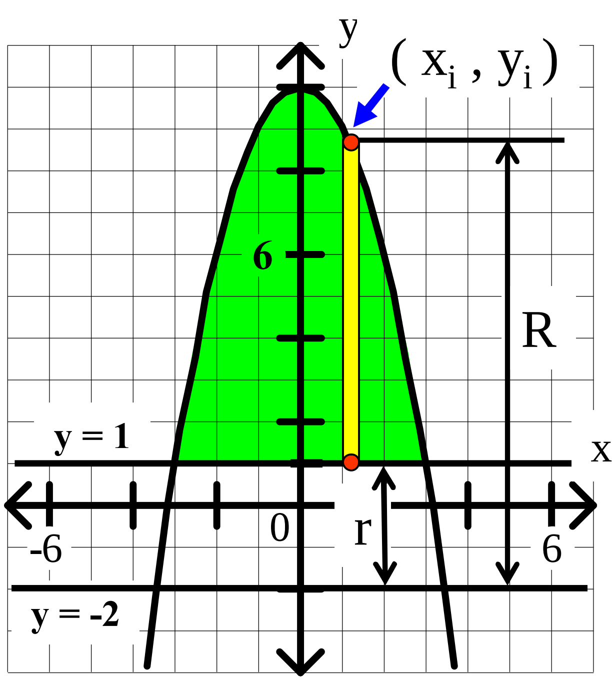

Washers: V = π(R² ï r²)h

$R = y_i + 2$

r =

h =

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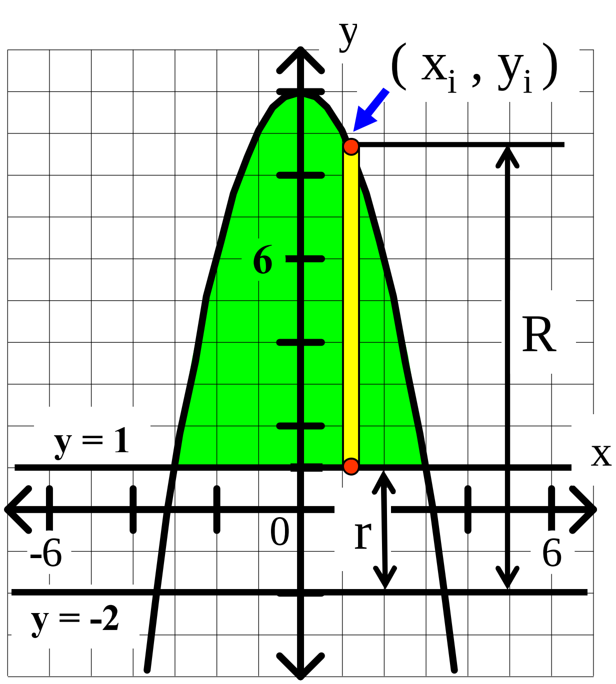

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_i + 2$

$r = 3$

$h =$

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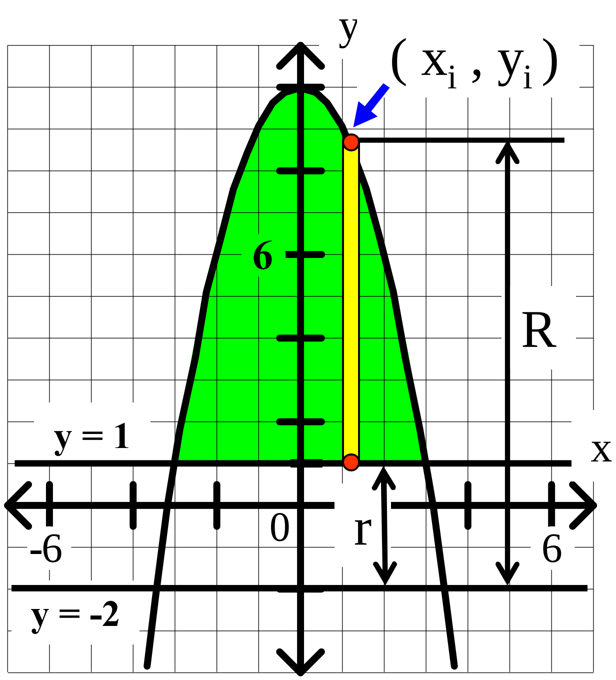

Washers: $V = \pi(R^2 ï\ r^2)h$

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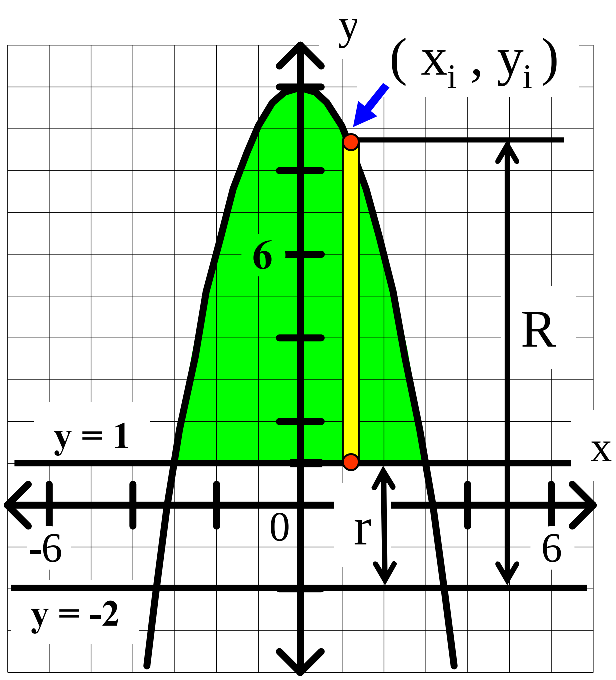

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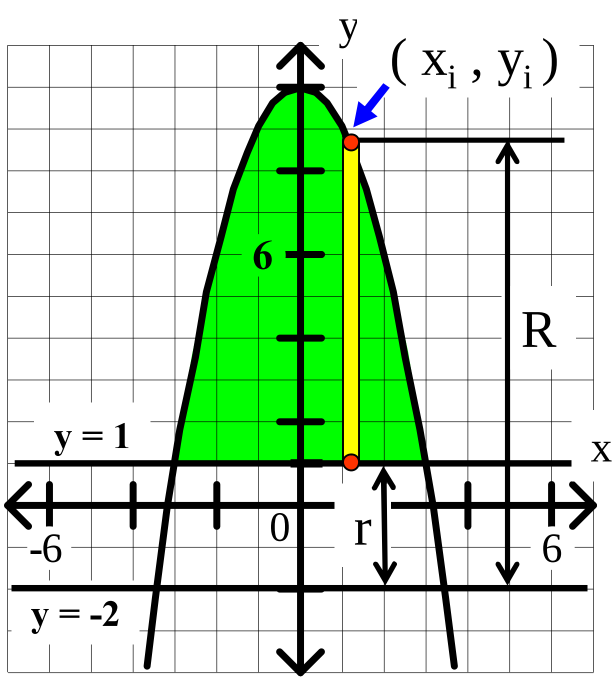

Washers: V = $\pi(R^2$ ï $r^2)h$

R = $y_i + 2 = 12$ ï x_i^2
r = 3
h = Δx

Calculus Class Worksheet #2 Unit 11 Solutions

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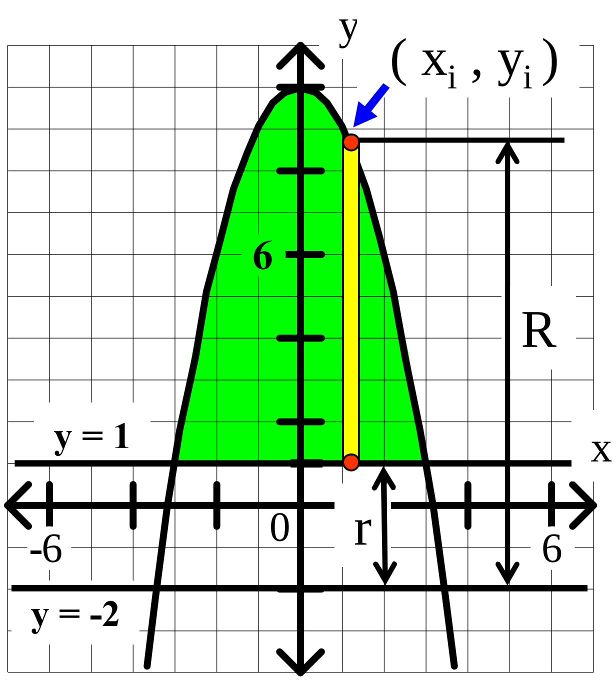

Washers: $V = \pi(R^2$ ï $r^2)h$

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$r = 3$

$h = \Delta x$

b. $V_i =$

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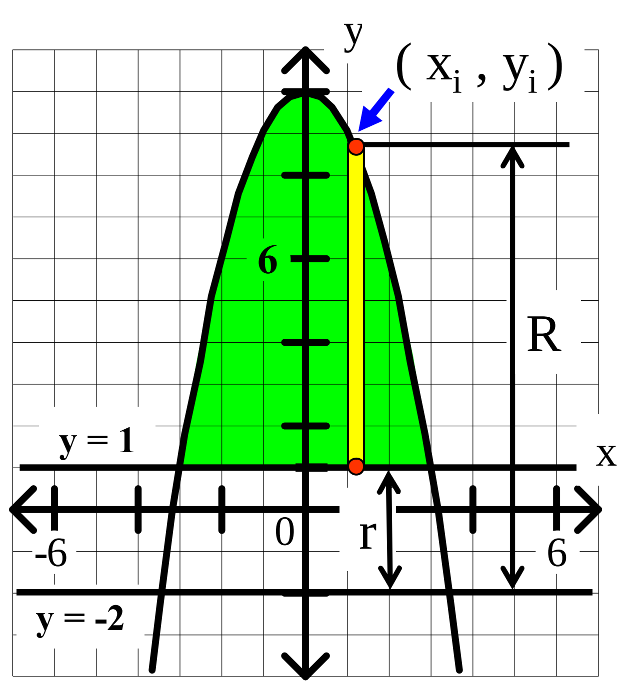

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_i + 2 = 12$ ï x_i^2

$r = 3$

$h = \Delta x$

b. $V_i = \pi$

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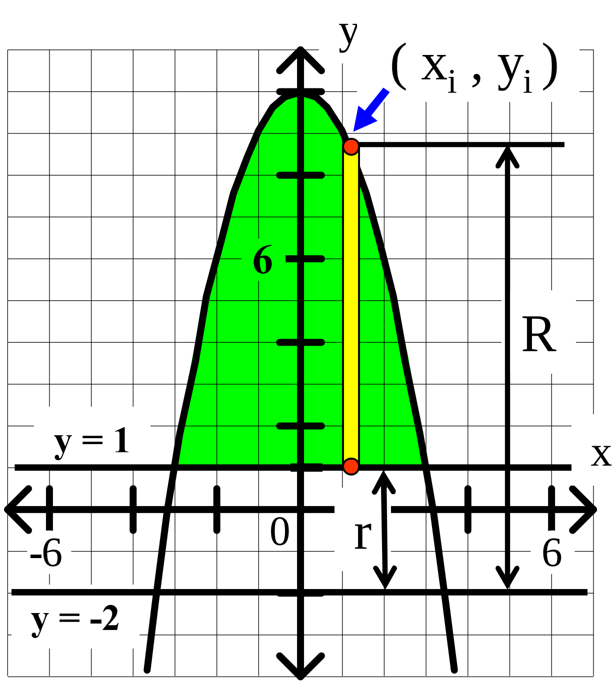

Washers: V = π(R^2 ï r^2)h

R = y_i + 2 = 12 ï x_i^2

r = 3

h = Δx

b. V_i = π((12 ï x_i^2)

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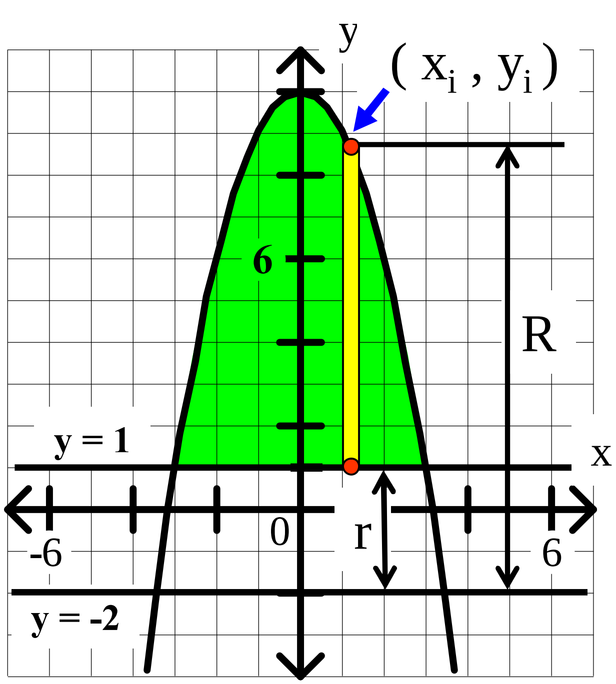

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i + 2 = 12 \text{ ï } x_i^2$

$r = 3$

$h = \Delta x$

b. $V_i = \pi((12 \text{ ï } x_i^2)^2$

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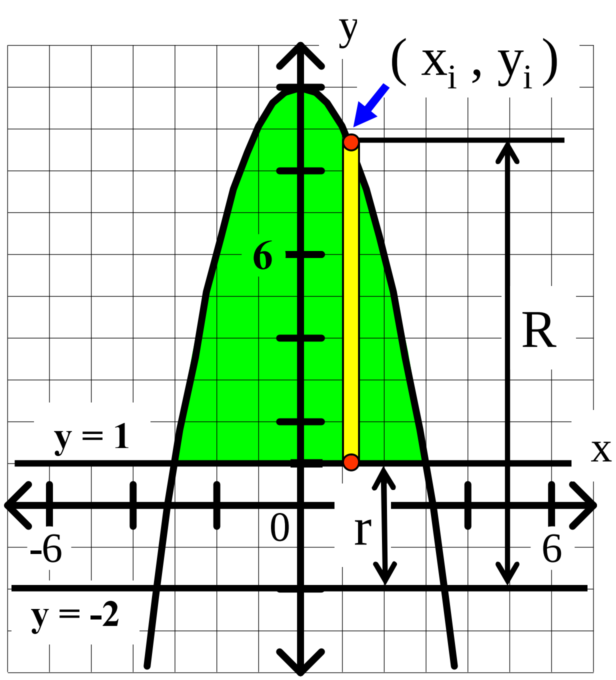

Washers: V = π(R^2 ï r^2)h

R = y_i + 2 = 12 ï x_i^2

r = 3

h = Δx

b. V_i = π((12 ï x_i^2)^2 ï

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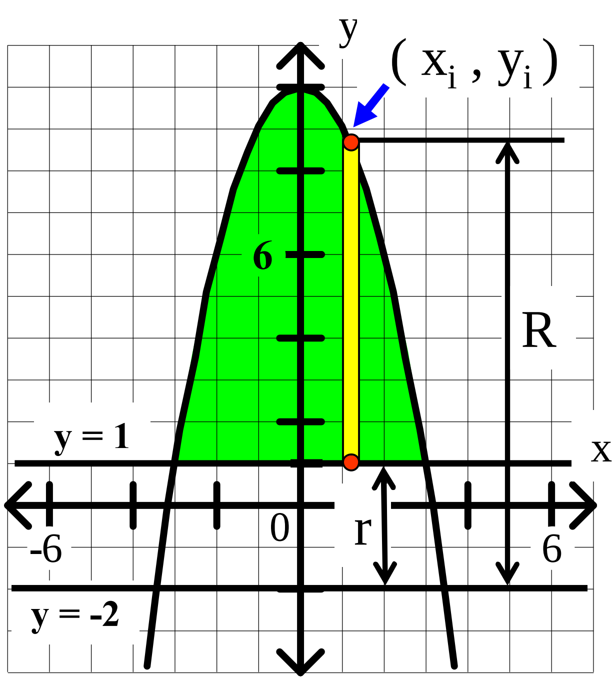

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_i + 2 = 12$ ï x_i^2

$r = 3$

$h = \Delta x$

b. $V_i = \pi((12$ ï $x_i^2)^2$ ï 3

Calculus   Class Worksheet #2   Unit 11   Solutions

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d) evaluate the integral.

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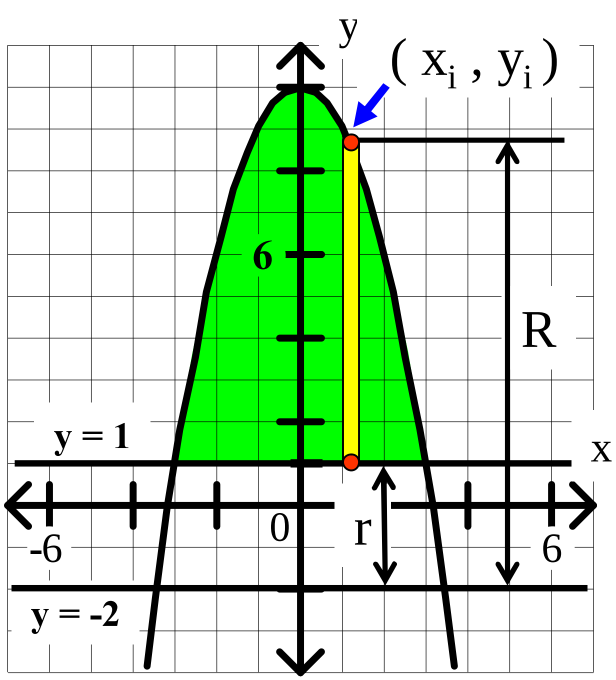

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_i + 2 = 12 \text{ ï } x_i^2$

$r = 3$

$h = \Delta x$

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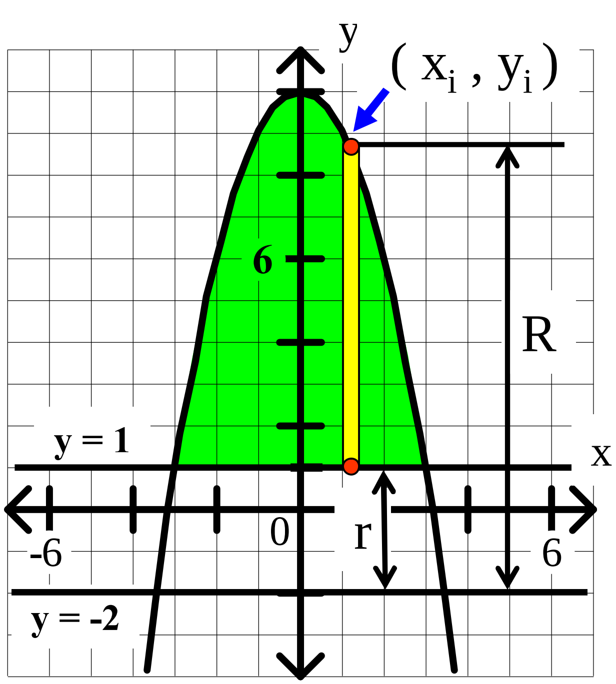

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$r = 3$

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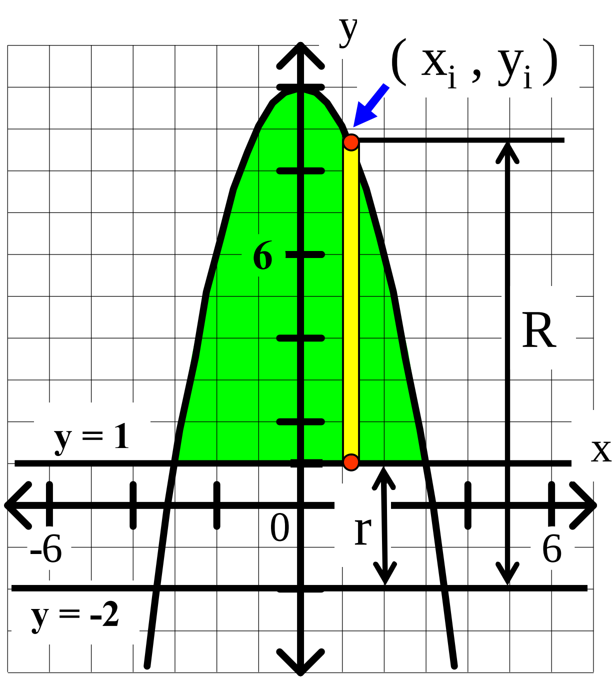

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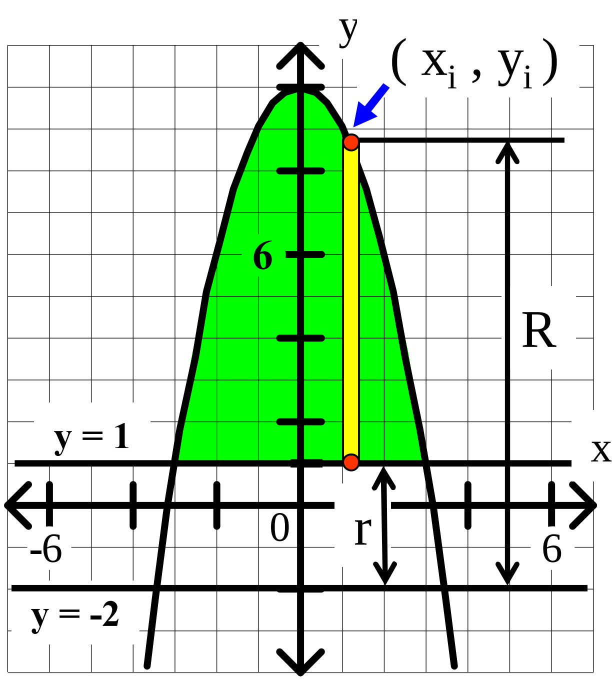

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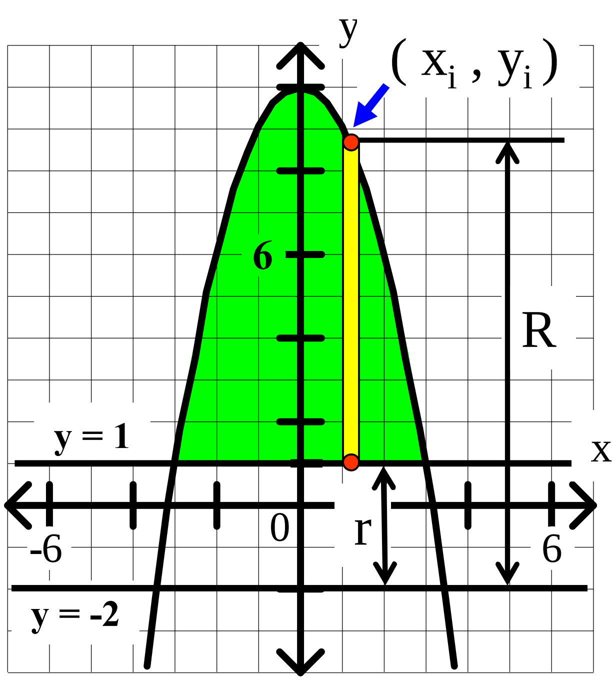

Washers: $V = \pi(R^2$ ï $r^2)h$

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$h = \Delta x$

b. $V_i = \pi((12$ ï $x_i^2)^2$ ï $3^2)\,\Delta x$

c. $V = \pi$

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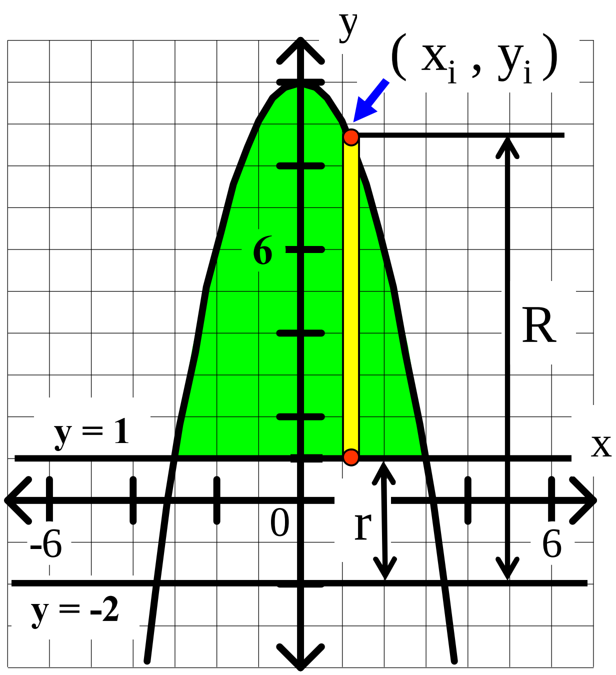

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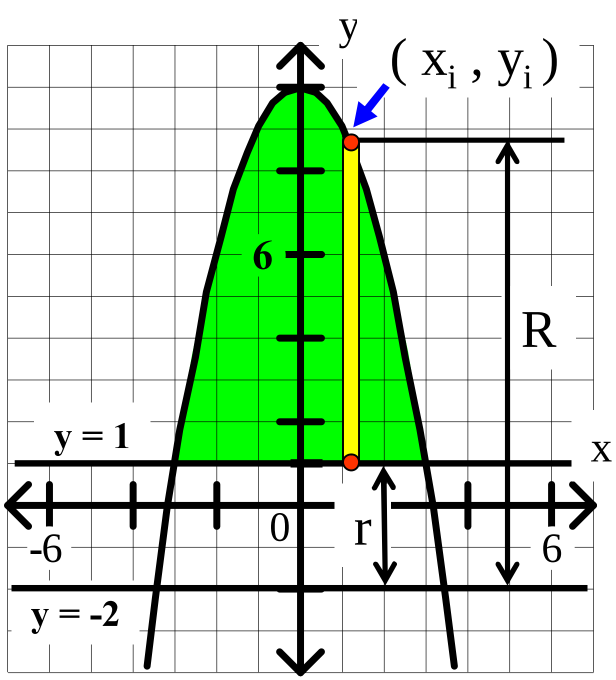

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b. $V_i = \pi((12$ ï $x_i^2)^2$ ï $3^2)\,\Delta x$

c. $V = \pi\int((12$ ï $x^2)^2$ ï $9)\,dx$

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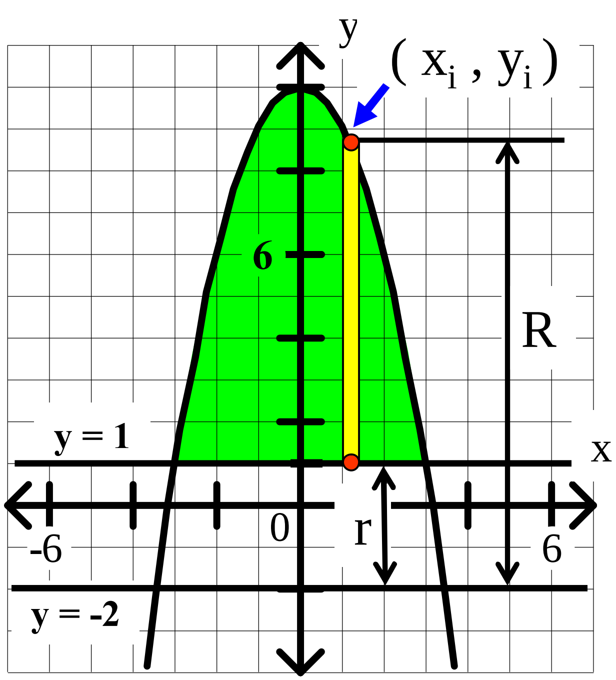

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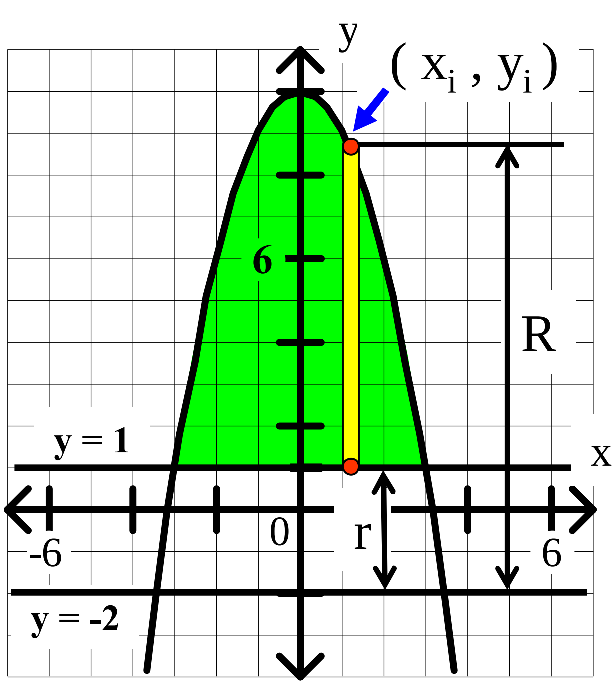

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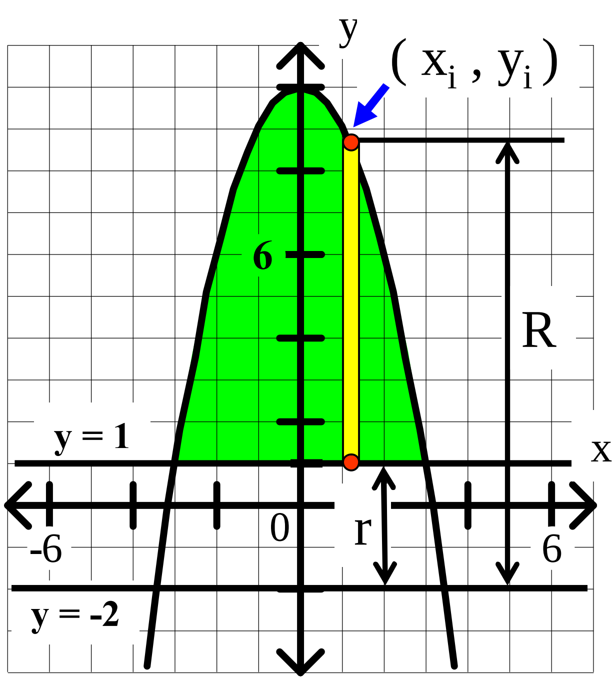

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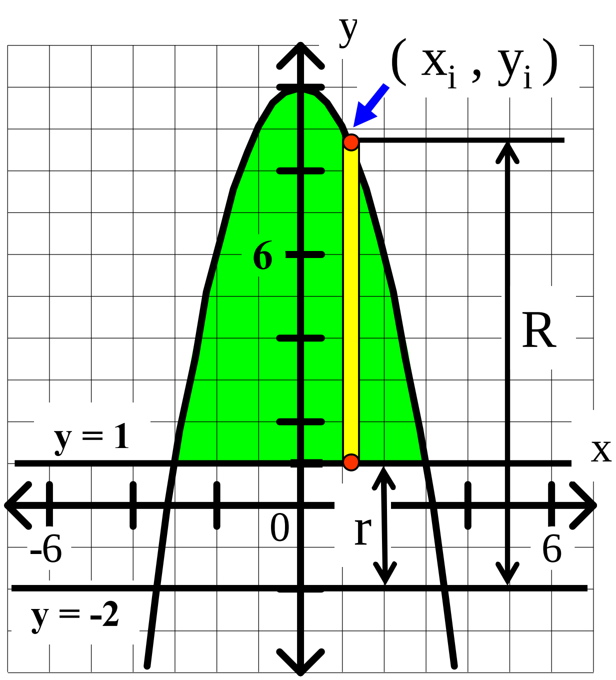

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$V = \pi\int_{-3}^{3}(x^4$ ï $24x^2 + 135)\,dx$

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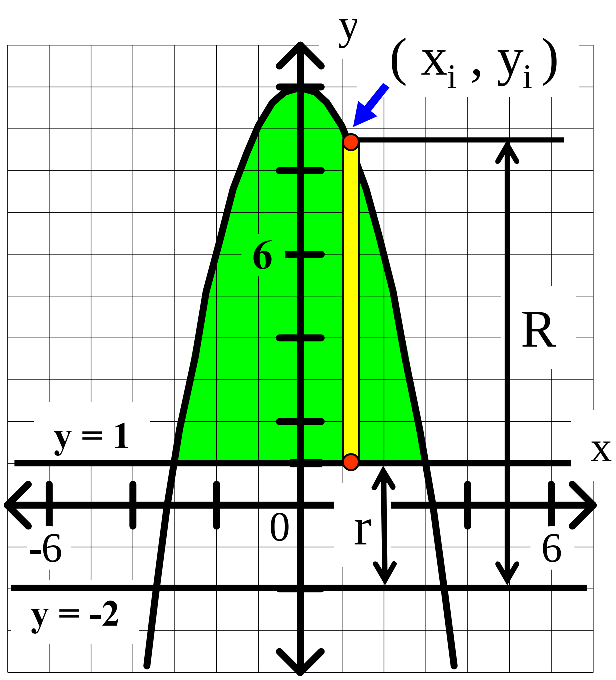

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c. $V = \pi\int_{-3}^{3}((12 \text{ ï } x^2)^2 \text{ ï } 9)\,dx$

$V = \pi\int_{-3}^{3}(x^4 \text{ ï } 24x^2 + 135)\,dx$

d. $V \approx$

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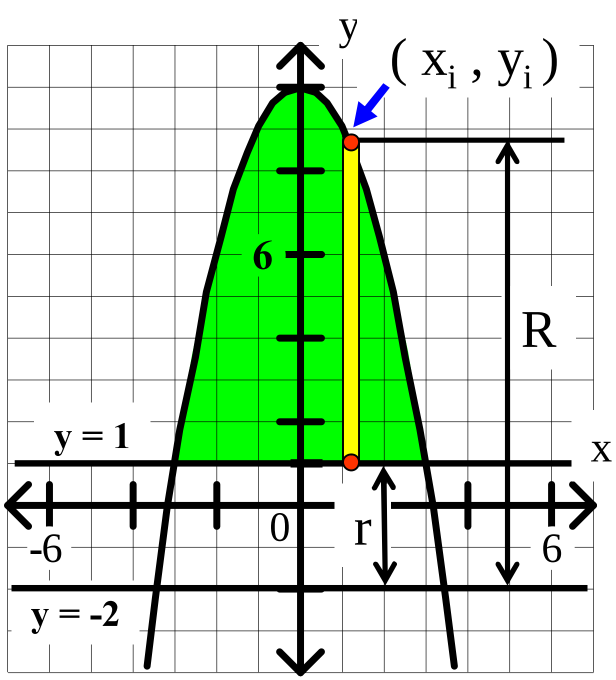

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d. $V \approx 1490$ cu. units

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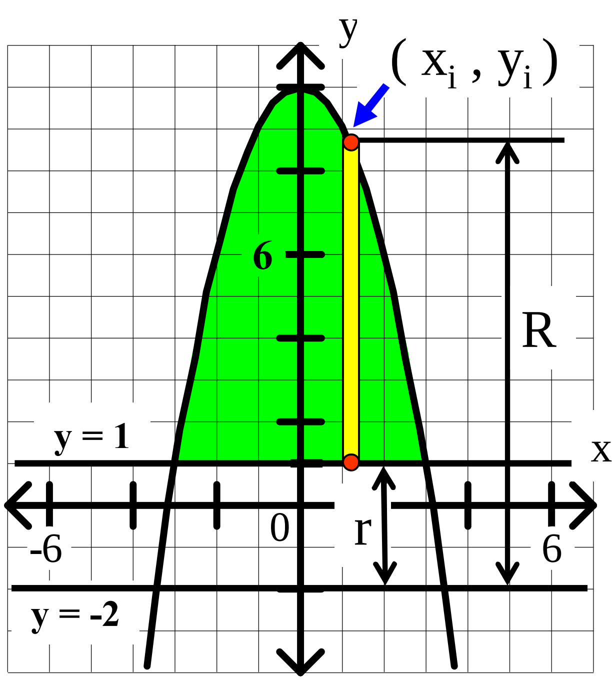

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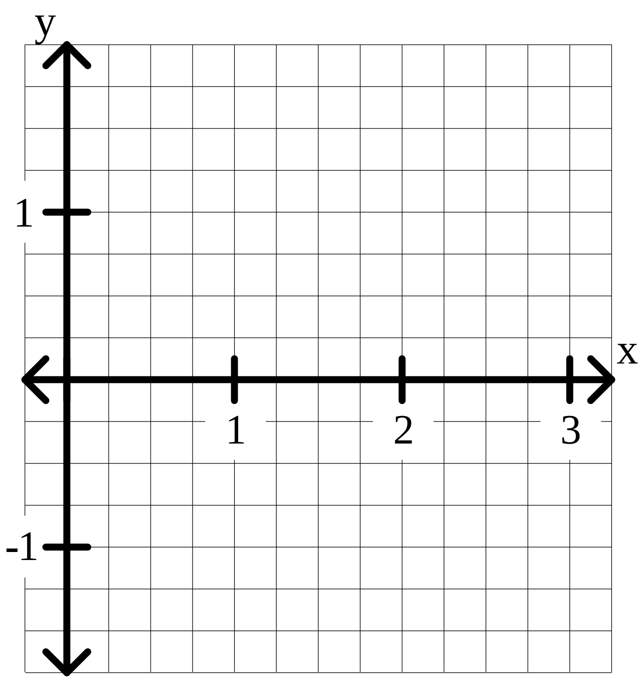

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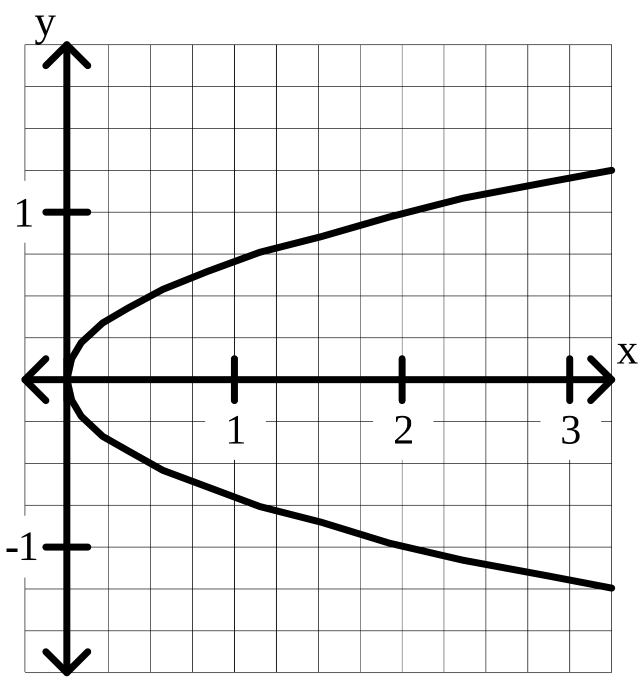

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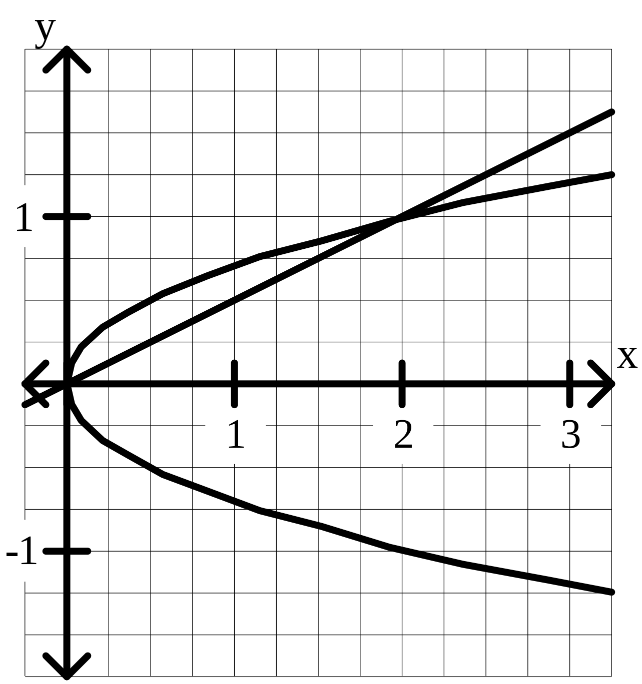

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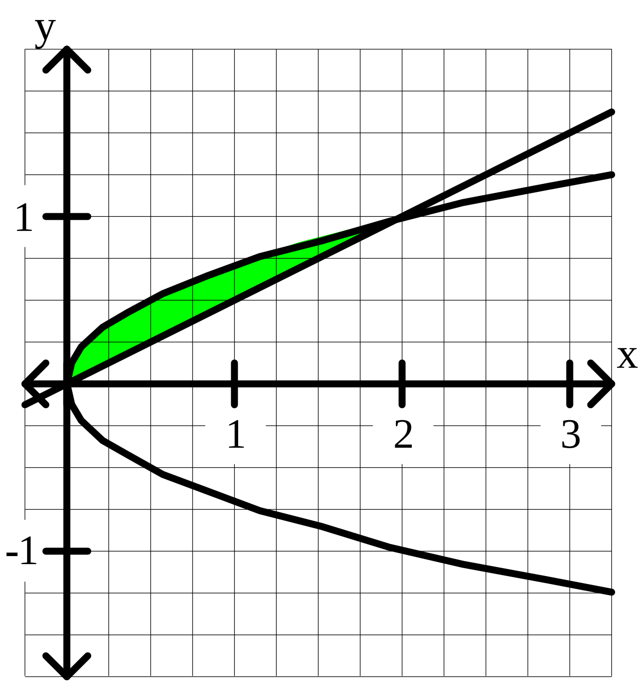

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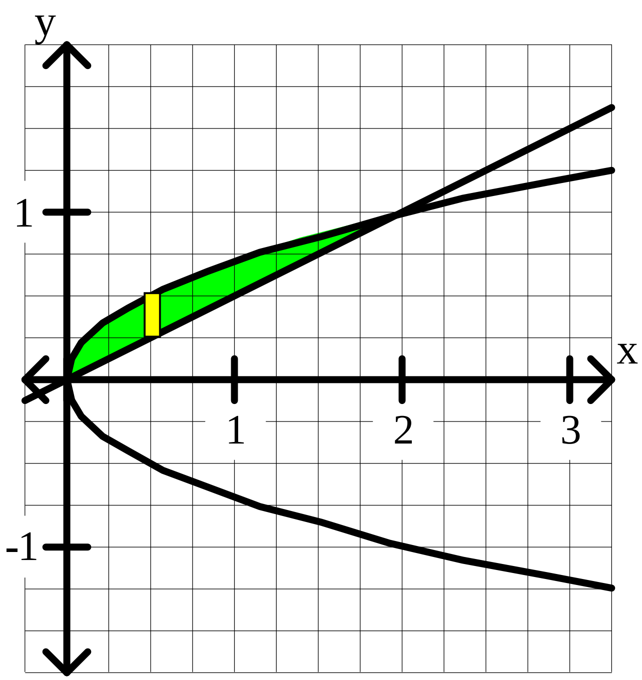

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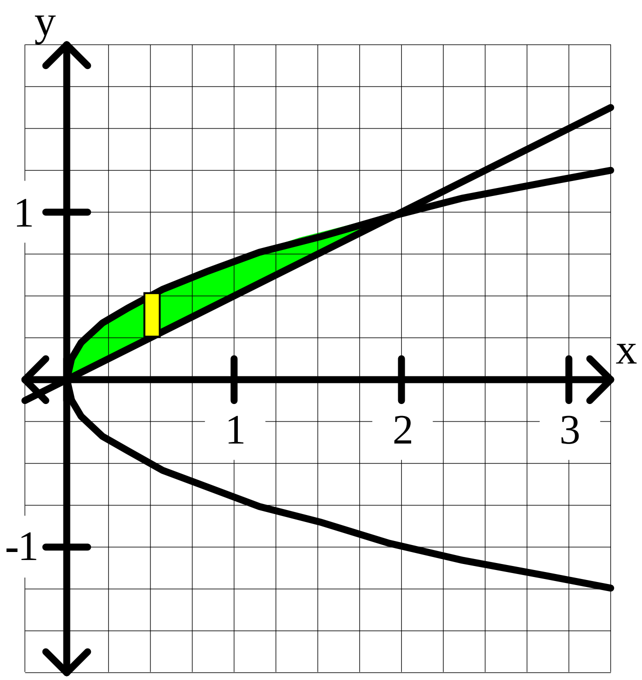

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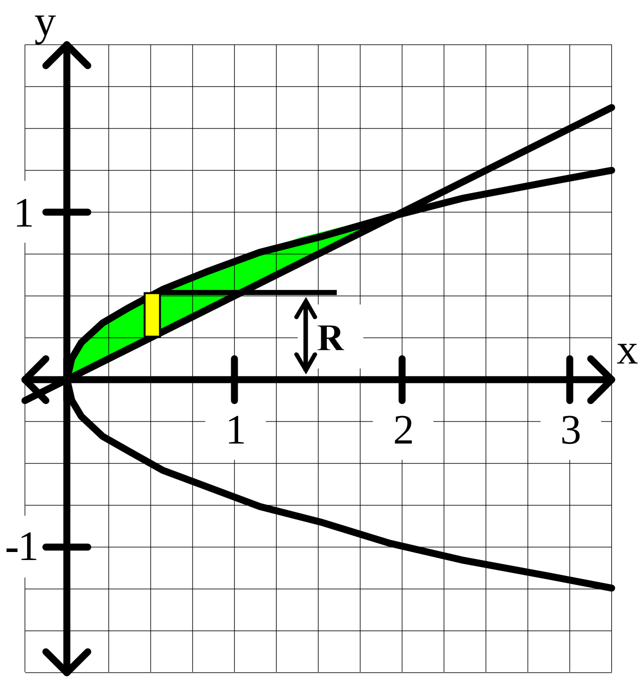

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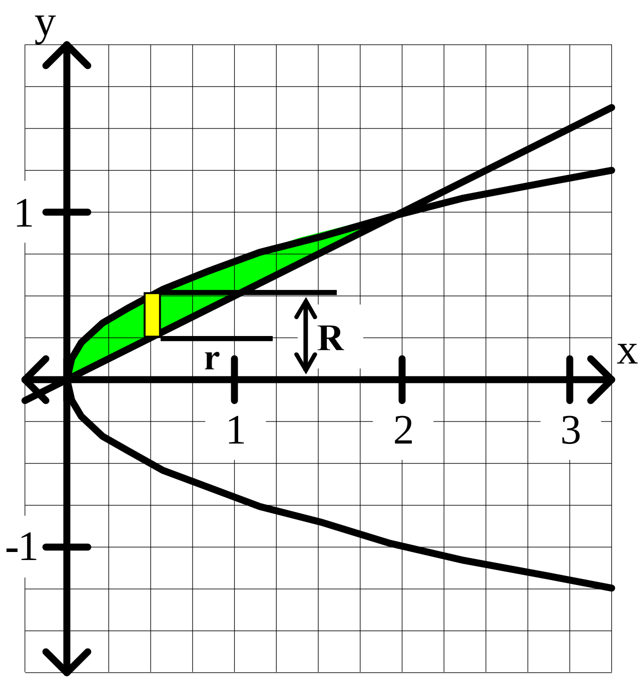

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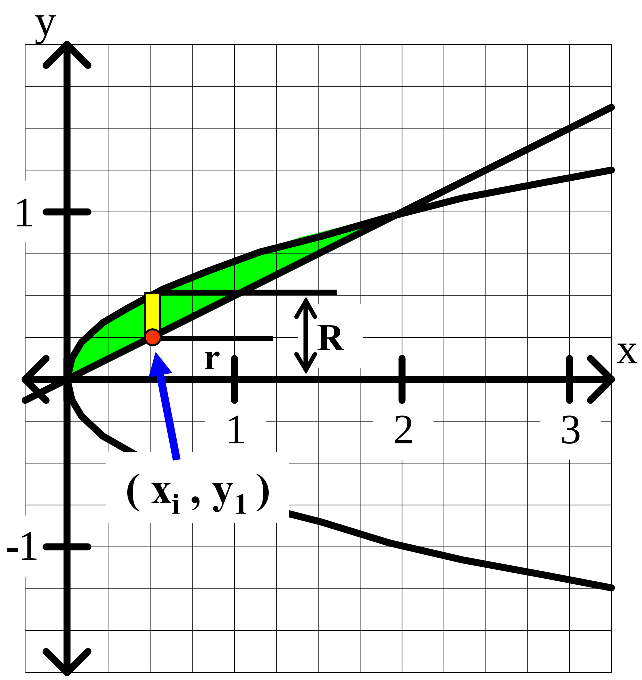

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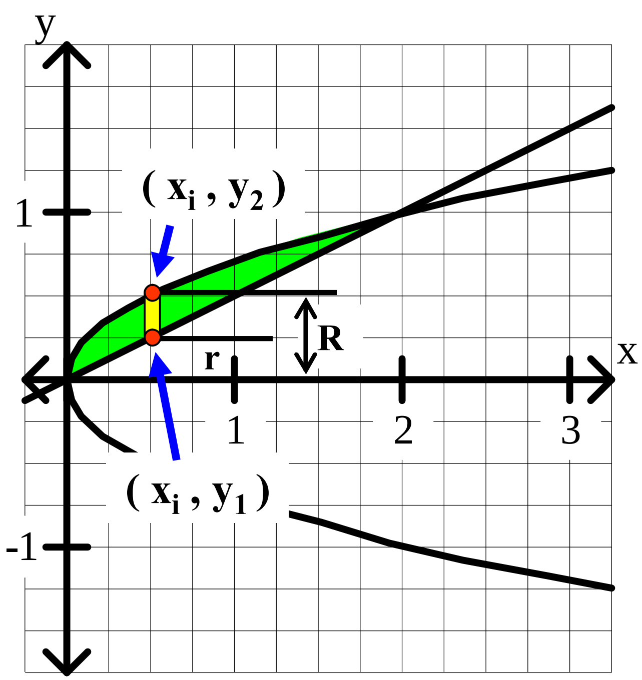

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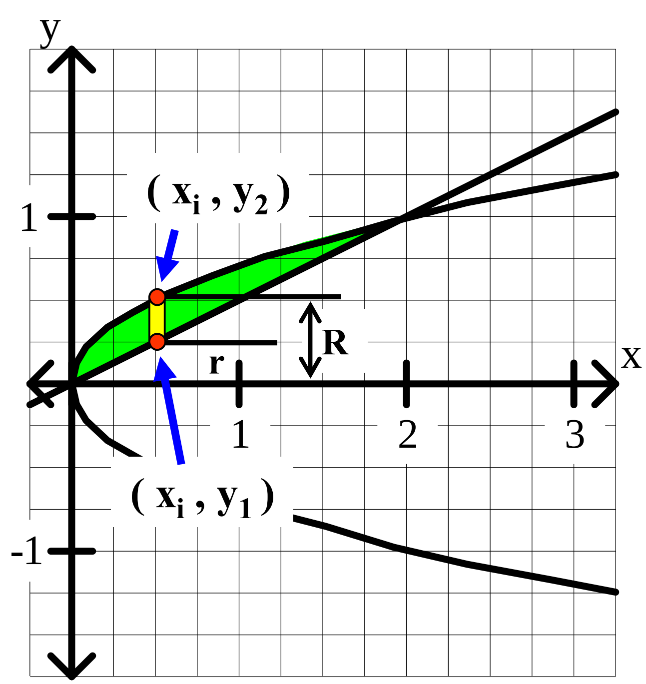

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_2$

$r =$

$h =$

Calculus   Class Worksheet #2   Unit 11   Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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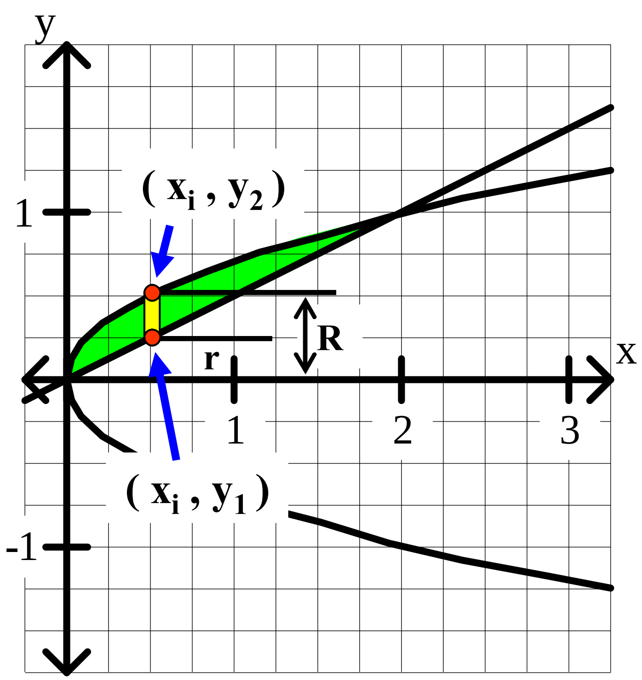

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_2$

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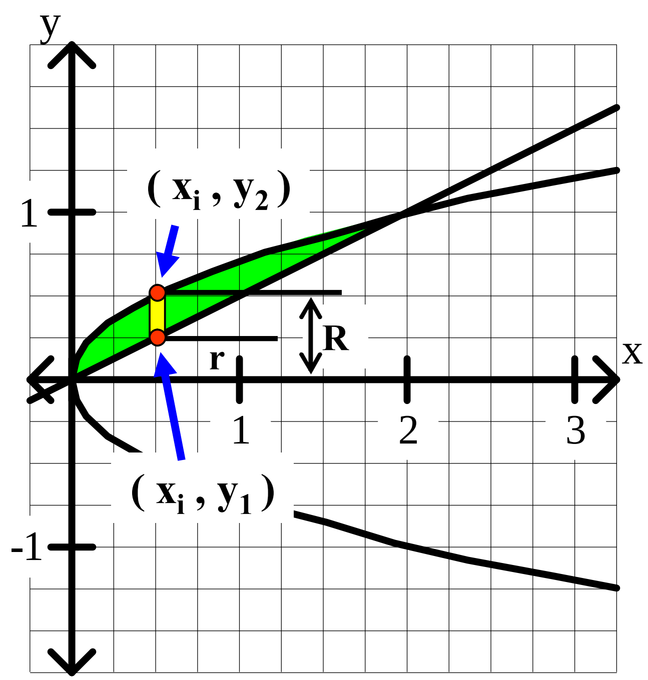

Washers: $V = \pi(R^2 ï r^2)h$

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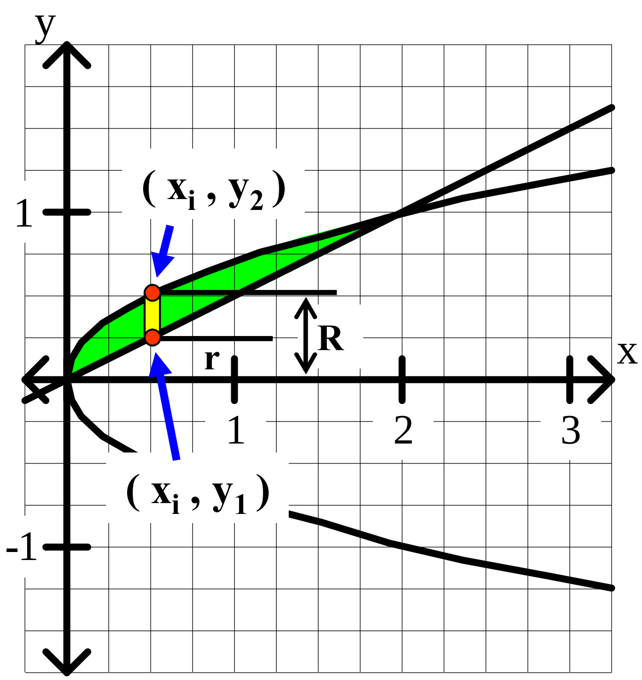

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

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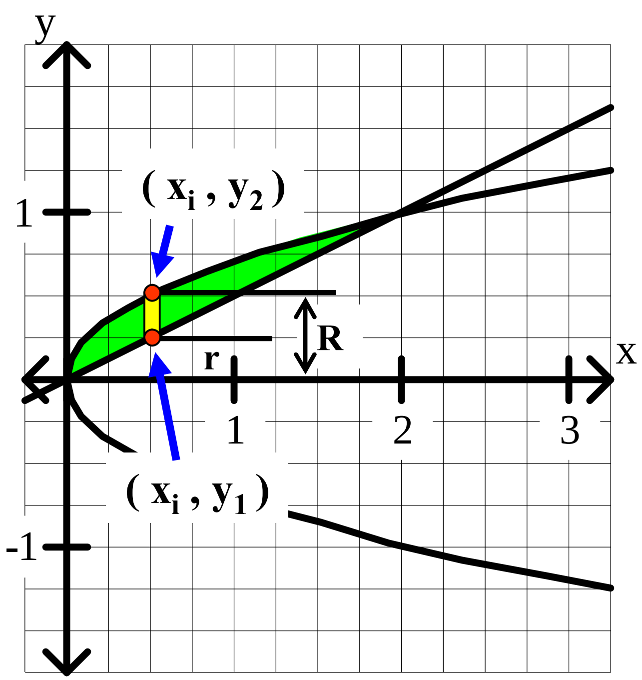

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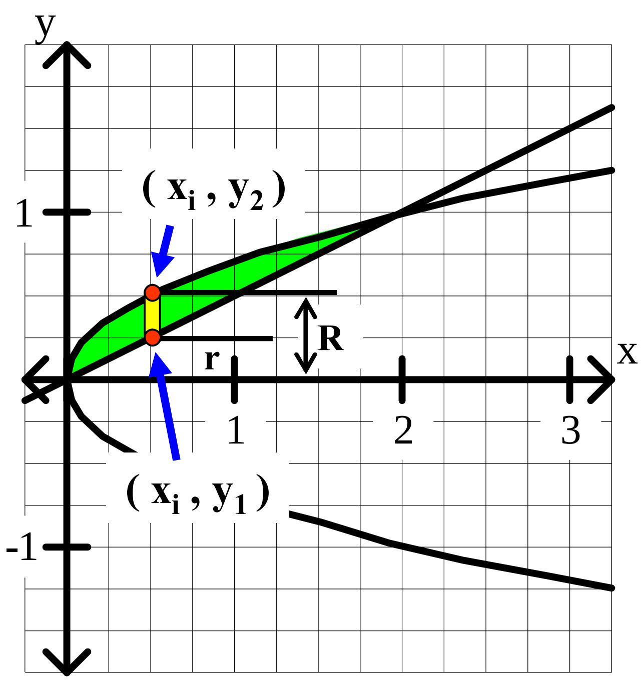

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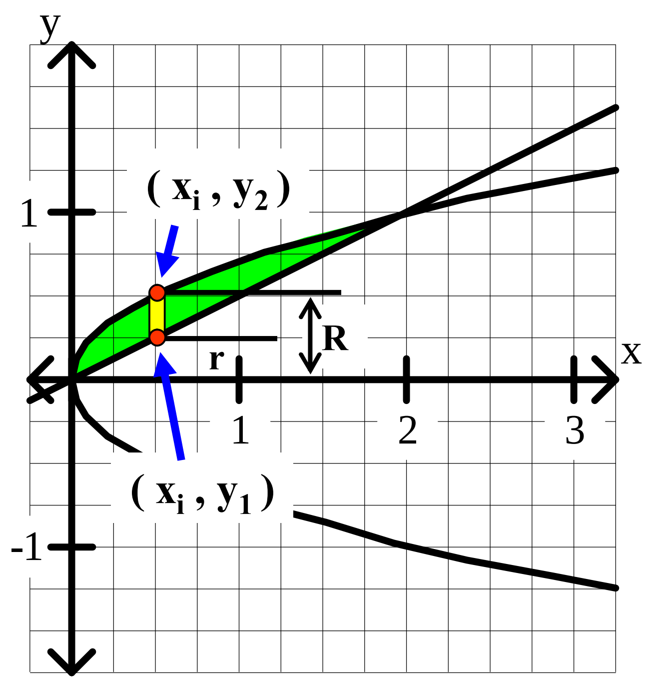

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

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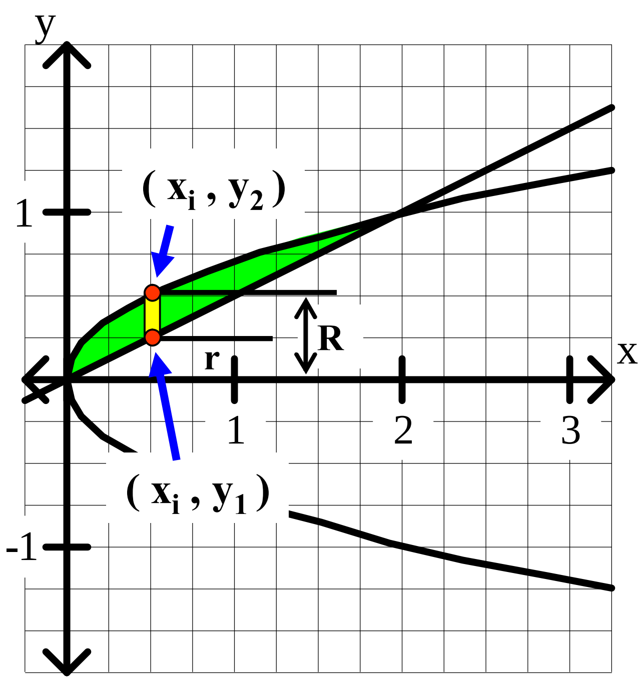

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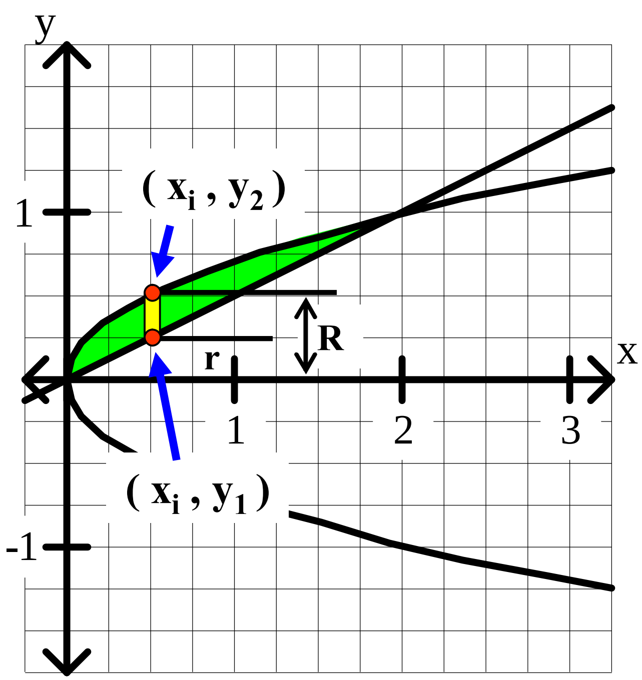

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$r = y_1 = \frac{1}{2}x_i$

$h = \Delta x$

b. $V_i = \pi$

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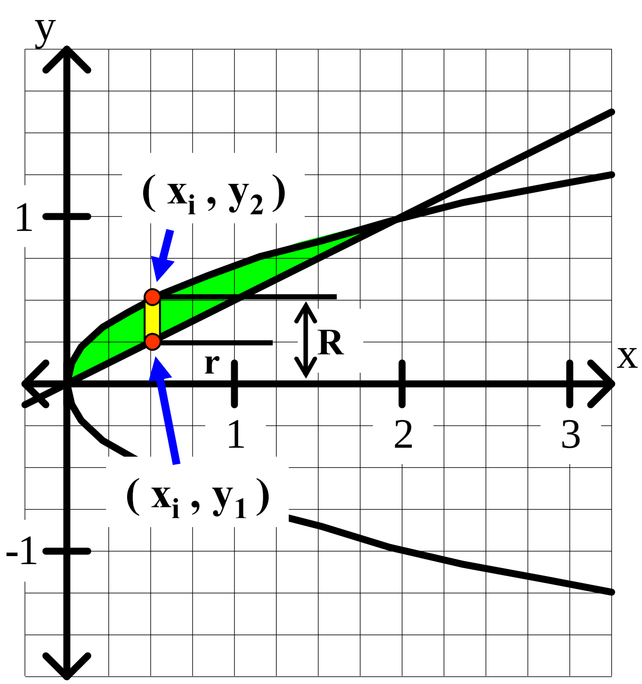

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_2 = \sqrt{\frac{x_i}{2}}$

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b. $V_i = \pi[(\sqrt{\frac{x_i}{2}} \quad)$

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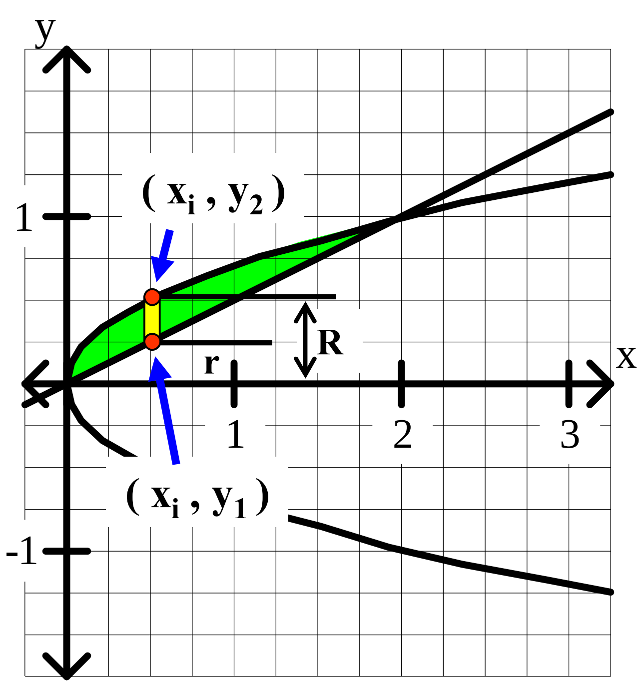

Washers: $V = \pi(R^2 - r^2)h$

$R = y_2 = \sqrt{\frac{x_i}{2}}$

$r = y_1 = \frac{1}{2}x_i$

$h = \Delta x$

b. $V_i = \pi[(\sqrt{\frac{x_i}{2}})^2$

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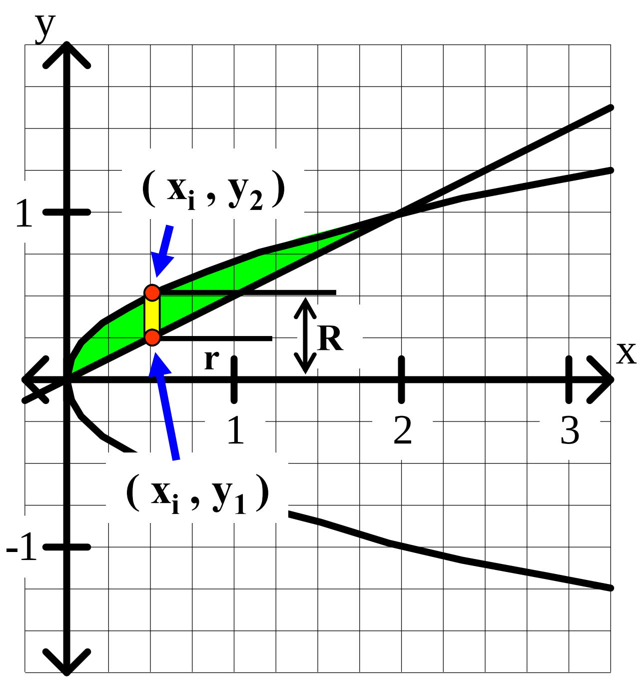

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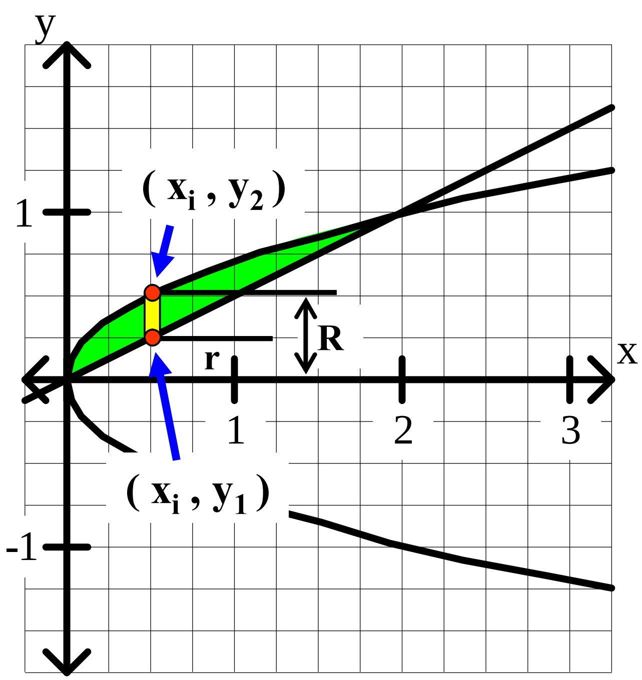

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b. $V_i = \pi[(\sqrt{\frac{x_i}{2}})^2 \text{ ï } (\frac{1}{2}x_i)$

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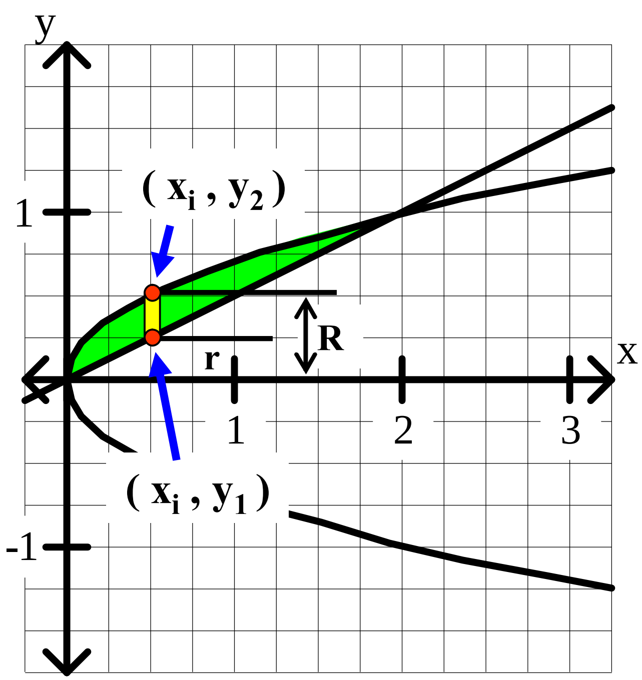

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$R = y_2 = \sqrt{\frac{x_i}{2}}$

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$h = \Delta x$

b. $V_i = \pi[(\sqrt{\frac{x_i}{2}}\,)^2$ ï $(\frac{1}{2}x_i)^2$

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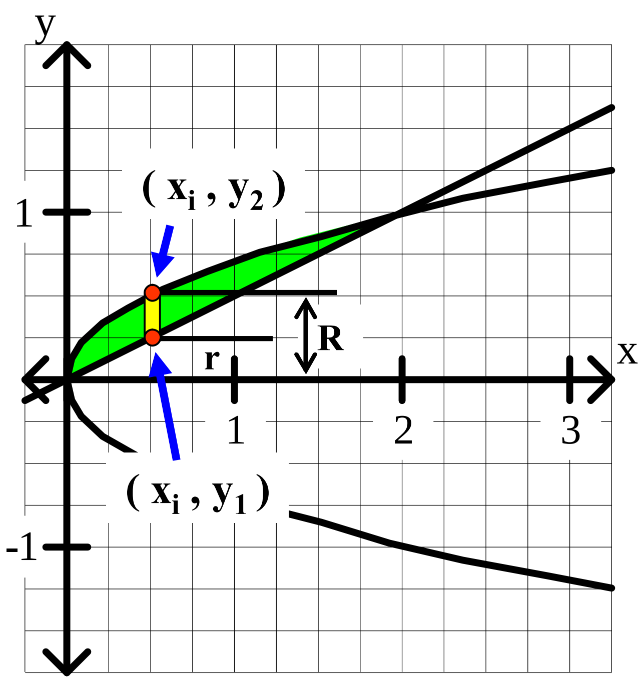

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b. $V_i = \pi[(\sqrt{\frac{x_i}{2}}\;)^2 \text{ ï } (\frac{1}{2}x_i)^2]\,\Delta x$

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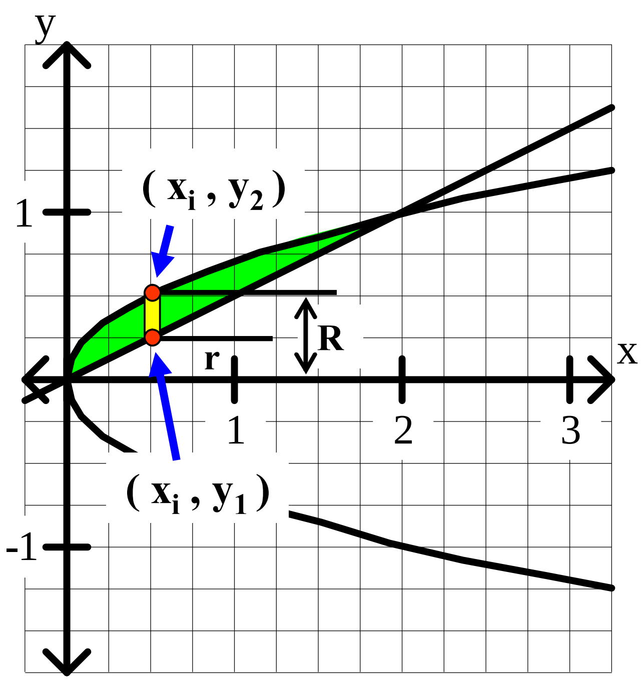

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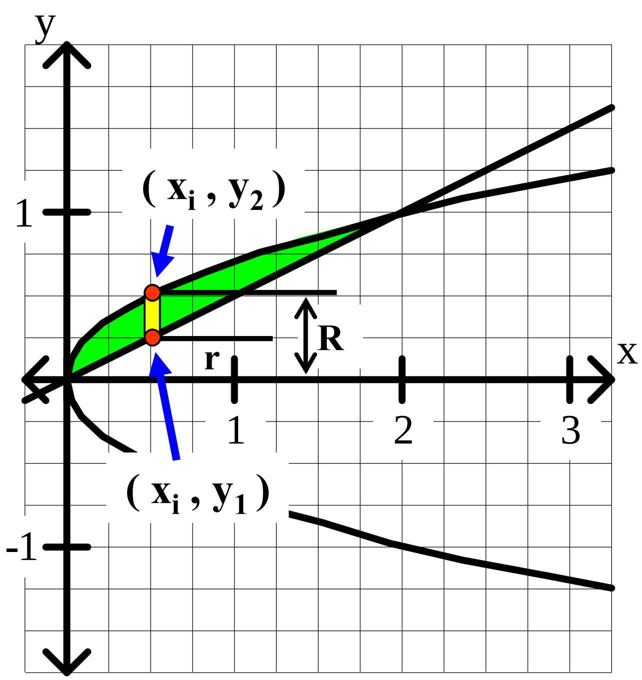

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$h = \Delta x$

b. $V_i = \pi[(\sqrt{\frac{x_i}{2}})^2\ ï\ (\frac{1}{2}x_i)^2]\ \Delta x$

c. $V =$

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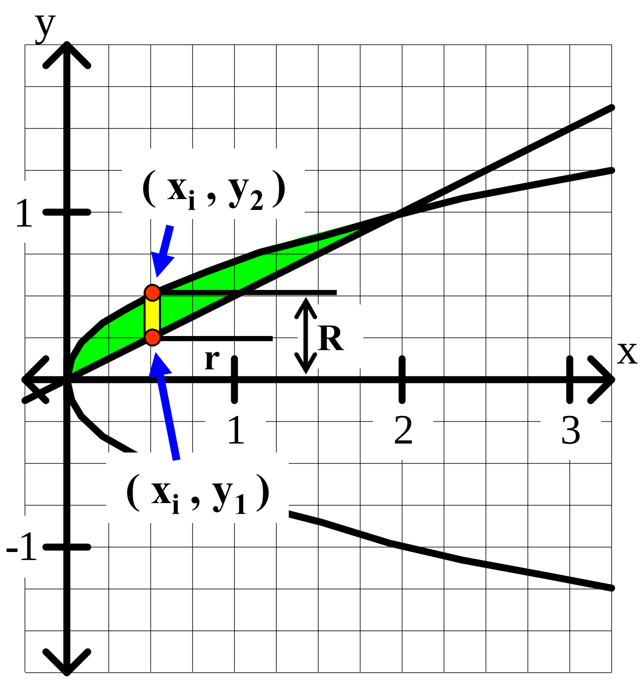

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b. $V_i = \pi[(\sqrt{\frac{x_i}{2}})^2$ ï $(\frac{1}{2}x_i)^2]\,\Delta x$

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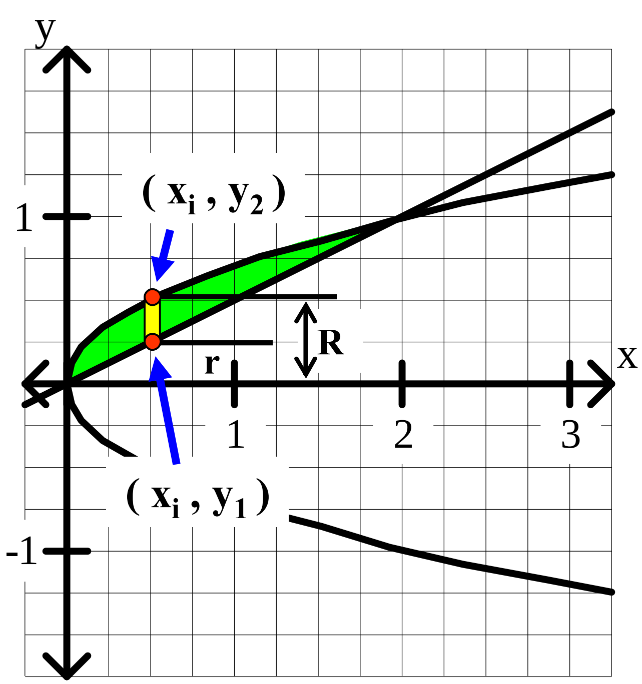

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b. $V_i = \pi[(\sqrt{\frac{x_i}{2}})^2 \text{ ï } (\frac{1}{2}x_i)^2]\,\Delta x$

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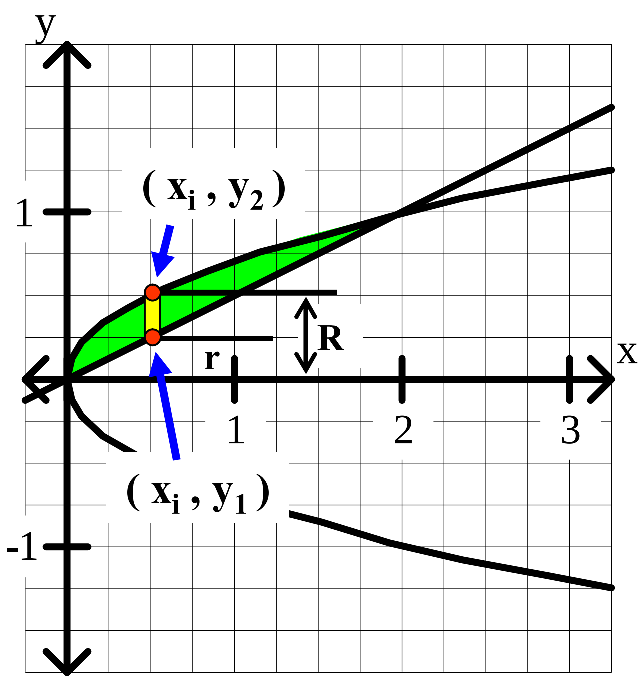

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b. $V_i = \pi[(\sqrt{\frac{x_i}{2}})^2 \text{ ï } (\frac{1}{2}x_i)^2]\,\Delta x$

c. $V = \pi\int(\frac{1}{2}x \text{ ï } \frac{1}{4}x^2)\,dx$

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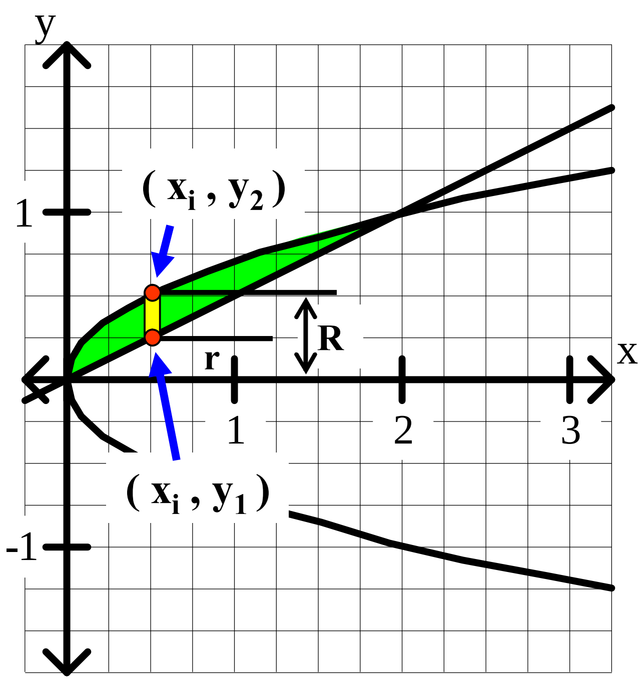

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b. $V_i = \pi\left[\left(\sqrt{\frac{x_i}{2}}\right)^2 - \left(\frac{1}{2}x_i\right)^2\right] \Delta x$

c. $V = \pi\int_0 \left(\frac{1}{2}x - \frac{1}{4}x^2\right) dx$

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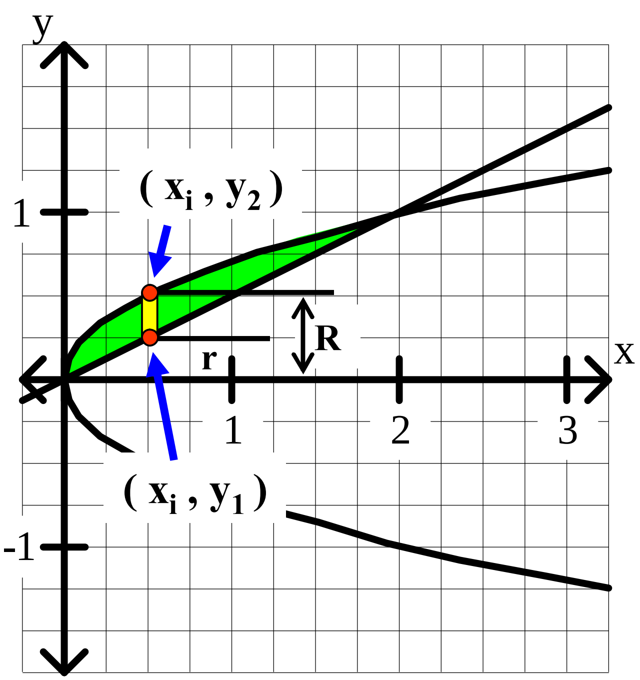

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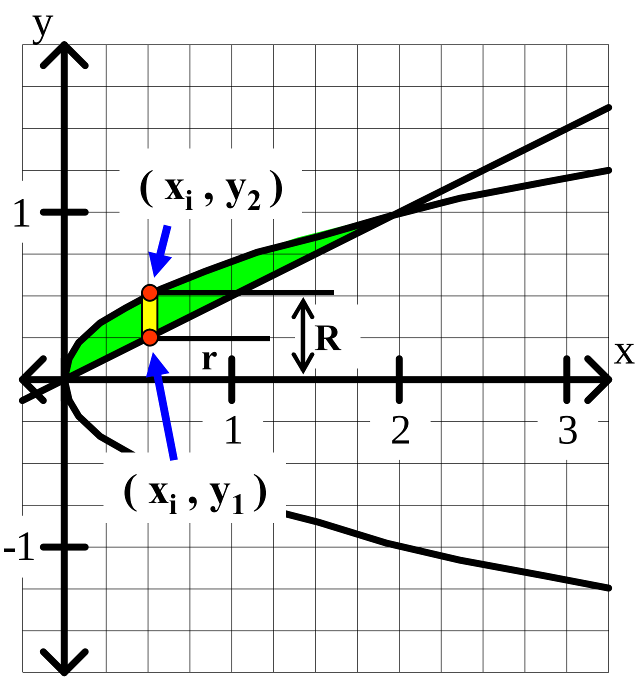

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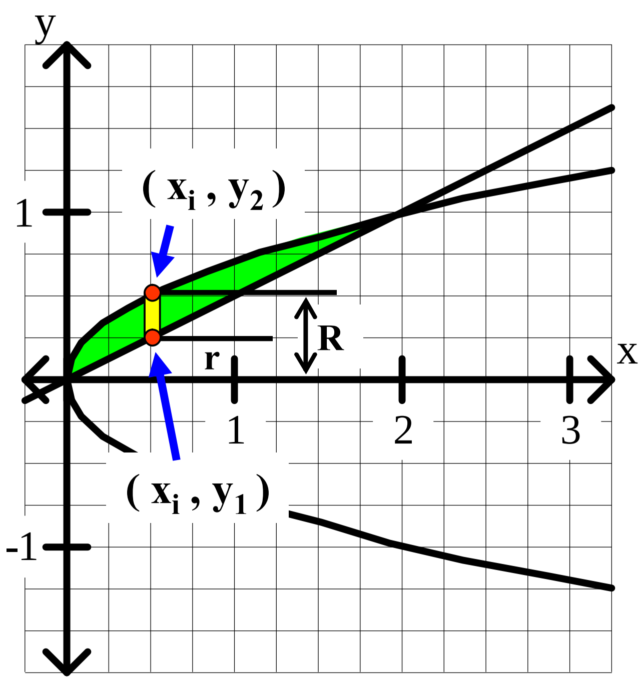

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$h = \Delta x$

b. $V_i = \pi\left[\left(\sqrt{\frac{x_i}{2}}\right)^2 - \left(\frac{1}{2}x_i\right)^2\right]\Delta x$

c. $V = \pi\int_0^2 \left(\frac{1}{2}x - \frac{1}{4}x^2\right) dx$

d. $V \approx$

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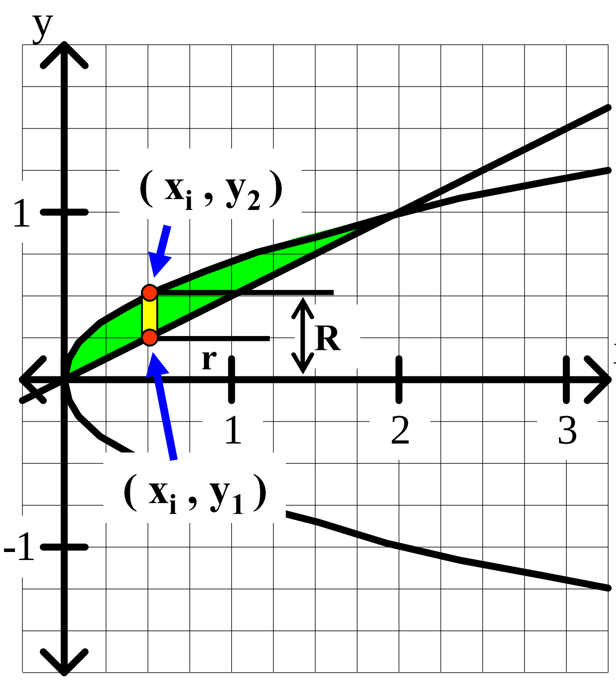
b) write an expression for the volume generated by this rectangle,
c) express the exact volume of the solid as a definite integral, and
d) evaluate the integral.

Sample 2a. The region enclosed by $x = 2y^2$ and $x = 2y$ is rotated about the x-axis.

a.



Washers: $V = \pi(R^2$ ï $r^2)h$

$R = y_2 = \sqrt{\frac{x_i}{2}}$

$r = y_1 = \frac{1}{2}x_i$

$h = \Delta x$

b. $V_i = \pi[(\sqrt{\frac{x_i}{2}}\ )^2$ ï $(\frac{1}{2}x_i)^2]\ \Delta x$

c. $V = \pi\int_0^2 (\frac{1}{2}x$ ï $\frac{1}{4}x^2)\ dx$

d. $V \approx 1.05$ cu. units

Calculus   Class Worksheet #2   Unit 11   Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

a) sketch the generating region, showing a typical generating rectangle,
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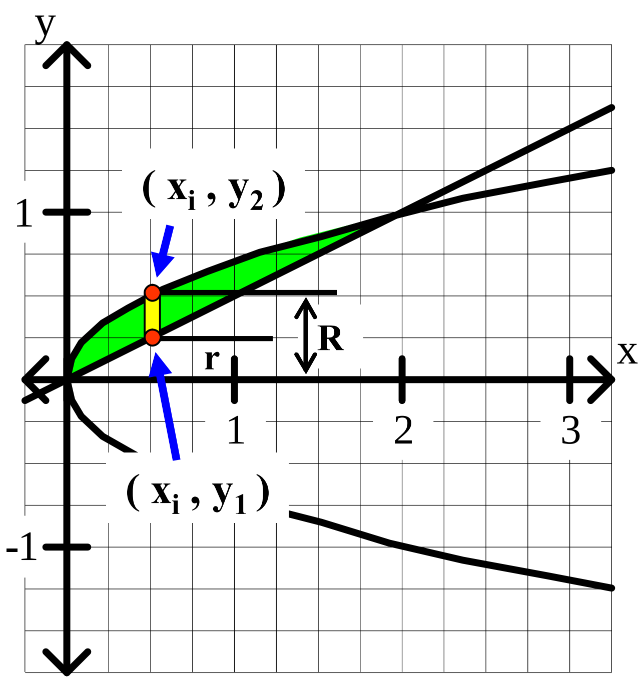
Sample 2a. The region enclosed by $x = 2y^2$ and $x = 2y$ is rotated about the x-axis.

a.



Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = y_2 = \sqrt{\frac{x_i}{2}}$

$r = y_1 = \frac{1}{2}x_i$

$h = \Delta x$

b. $V_i = \pi[(\sqrt{\frac{x_i}{2}})^2 \text{ ï } (\frac{1}{2}x_i)^2]\,\Delta x$

c. $V = \pi\int_0^2 (\frac{1}{2}x \text{ ï } \frac{1}{4}x^2)\,dx$

d. $V \approx 1.05$ cu. units

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

a) sketch the generating region, showing a typical generating rectangle,
b) write an expression for the volume generated by this rectangle,
c) express the exact volume of the solid as a definite integral, and
d) evaluate the integral.

Sample 2b. The region enclosed by $x = 2y^2$ and $x = 2y$ is rotated about the y-axis.

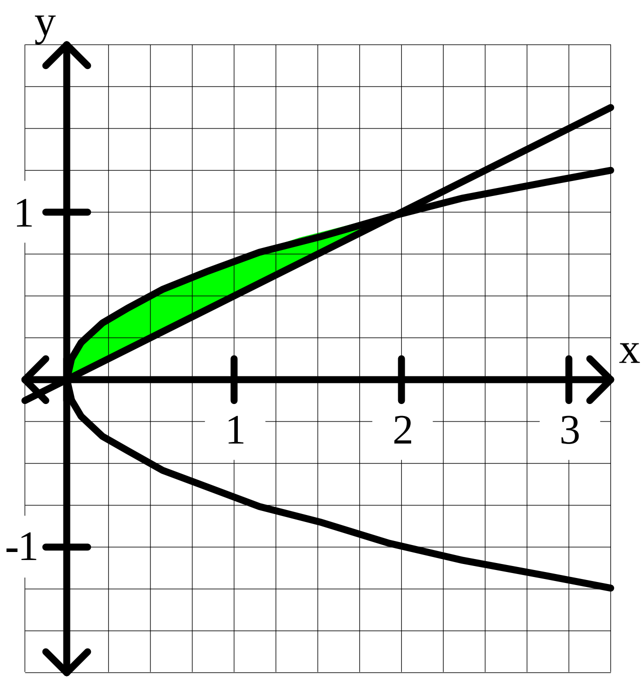
Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

a) sketch the generating region, showing a typical generating rectangle,
b) write an expression for the volume generated by this rectangle,
c) express the exact volume of the solid as a definite integral, and
d) evaluate the integral.

Sample 2b. The region enclosed by $x = 2y^2$ and $x = 2y$ is rotated about the y-axis.

a.



Calculus Class Worksheet #2 Unit 11 Solutions

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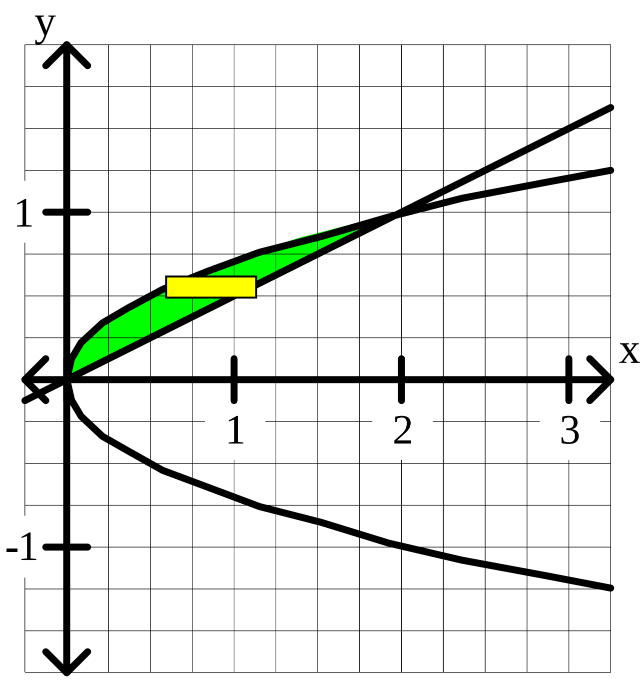
a.



Calculus   Class Worksheet #2   Unit 11   Solutions

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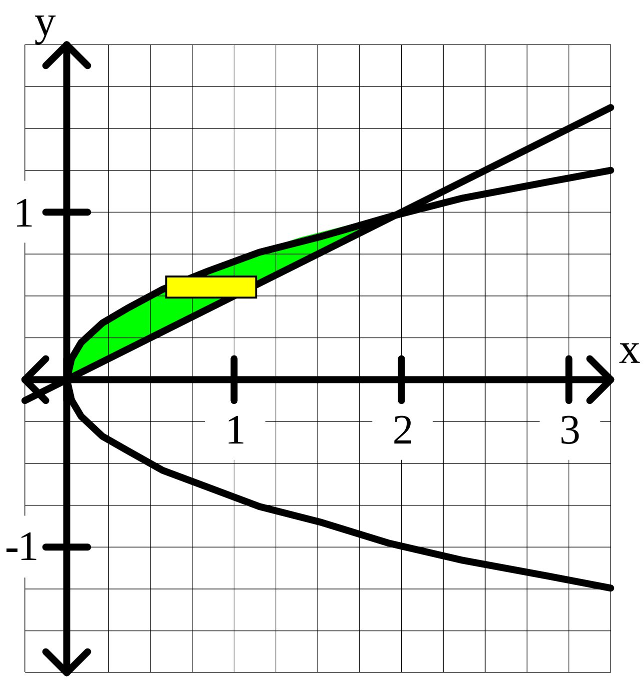
a.



Washers: $V = \pi(R^2$ ï $r^2)h$

R =

r =

h =

Calculus   Class Worksheet #2   Unit 11   Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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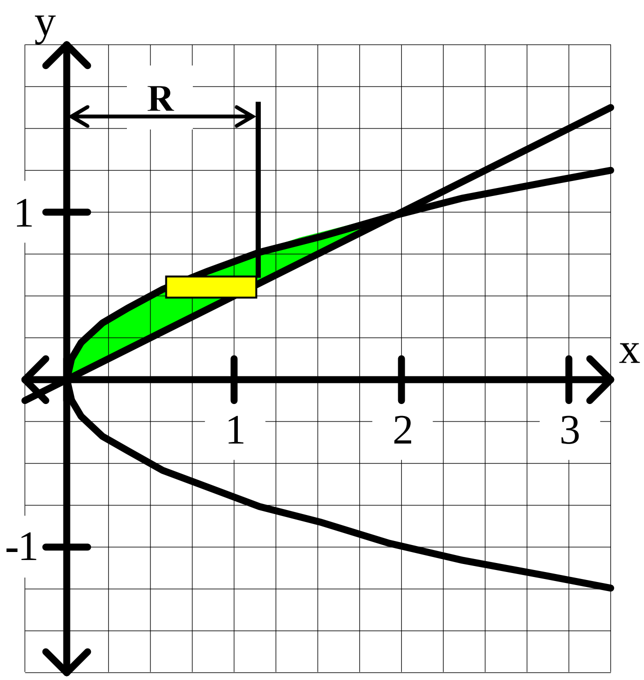
Sample 2b. The region enclosed by $x = 2y^2$ and $x = 2y$ is rotated about the y-axis.

a.



Washers: $V = \pi(R^2 \text{ ï } r^2)h$

R =

r =

h =

Calculus Class Worksheet #2 Unit 11 Solutions

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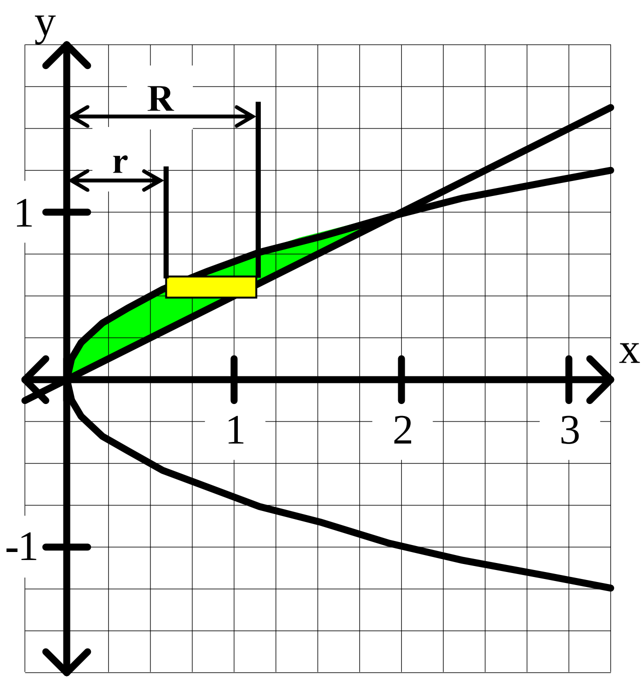
a.



Washers: $V = \pi(R^2$ ï $r^2)h$

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r =

h =

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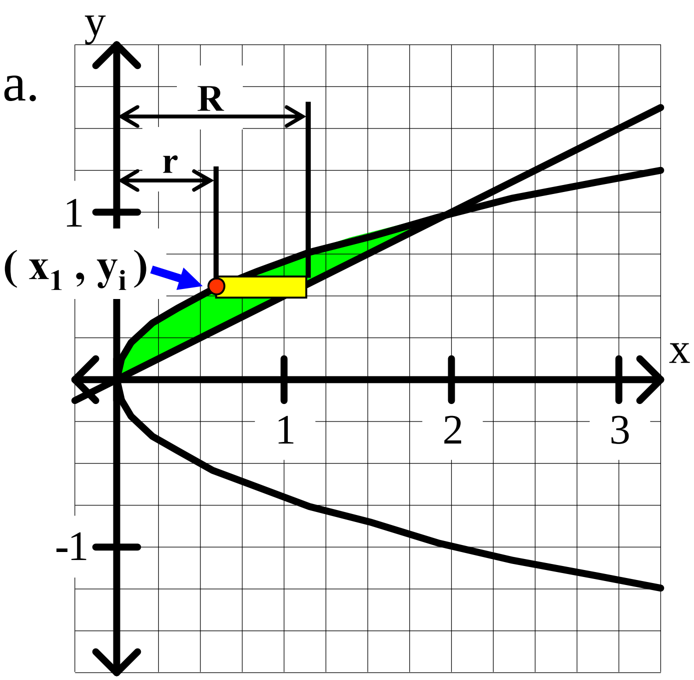

Washers: $V = \pi(R^2$ ï $r^2)h$

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Calculus Class Worksheet #2 Unit 11 Solutions

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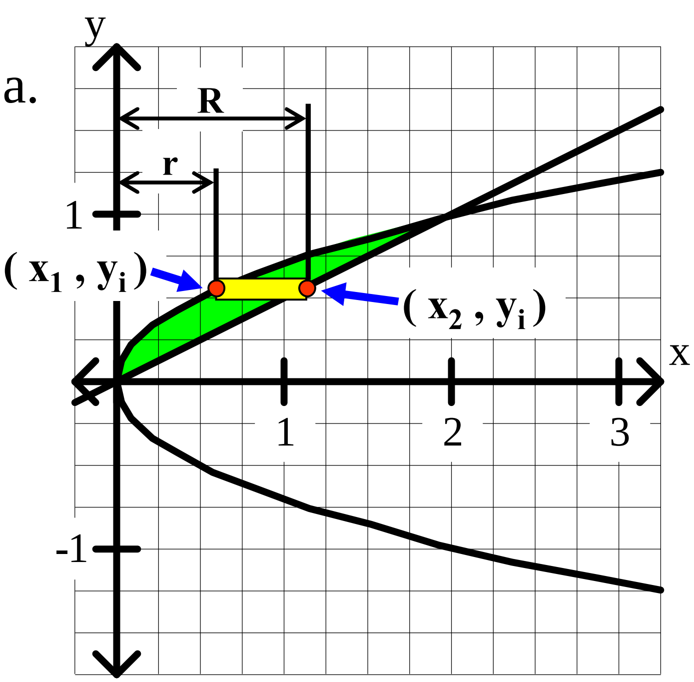

Washers: V = $\pi(R^2$ ï $r^2)h$

R =

r =

h =

Calculus   Class Worksheet #2   Unit 11   Solutions

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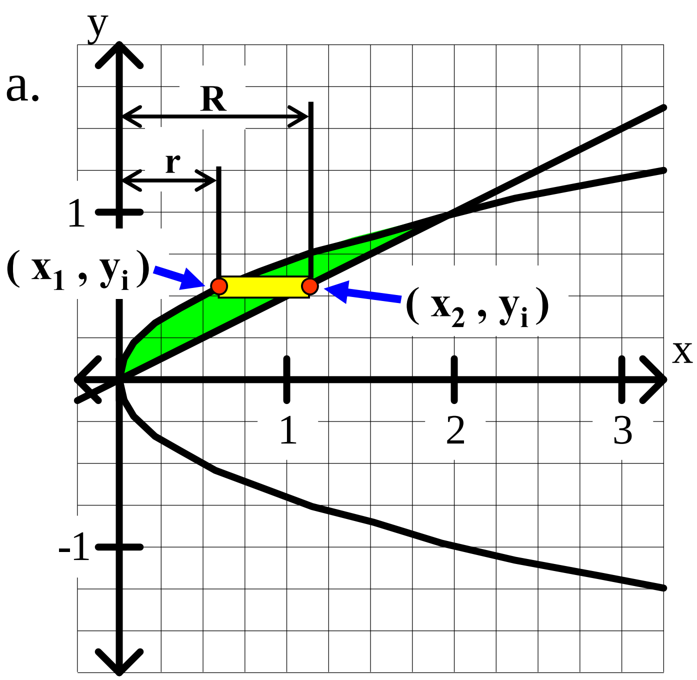

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2$

$r =$

$h =$

Calculus Class Worksheet #2 Unit 11 Solutions

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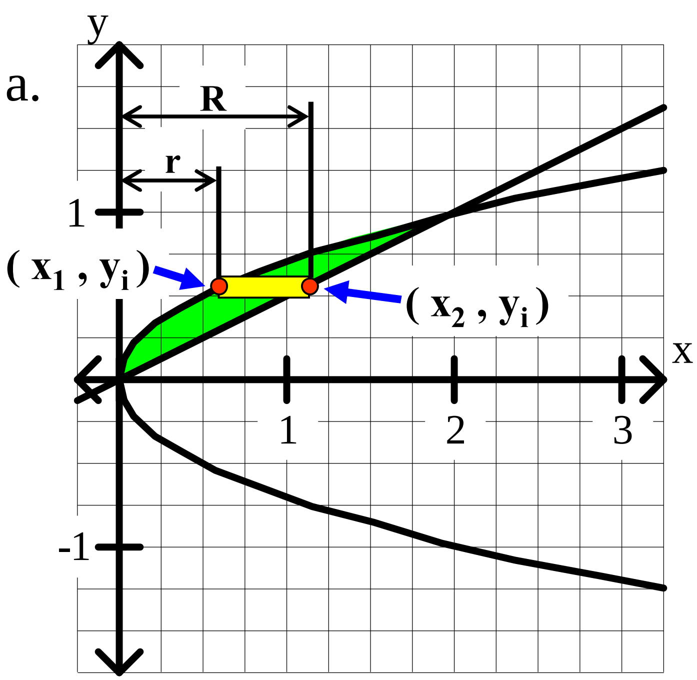

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = x_2$

$r = x_1$

$h =$

Calculus Class Worksheet #2 Unit 11 Solutions

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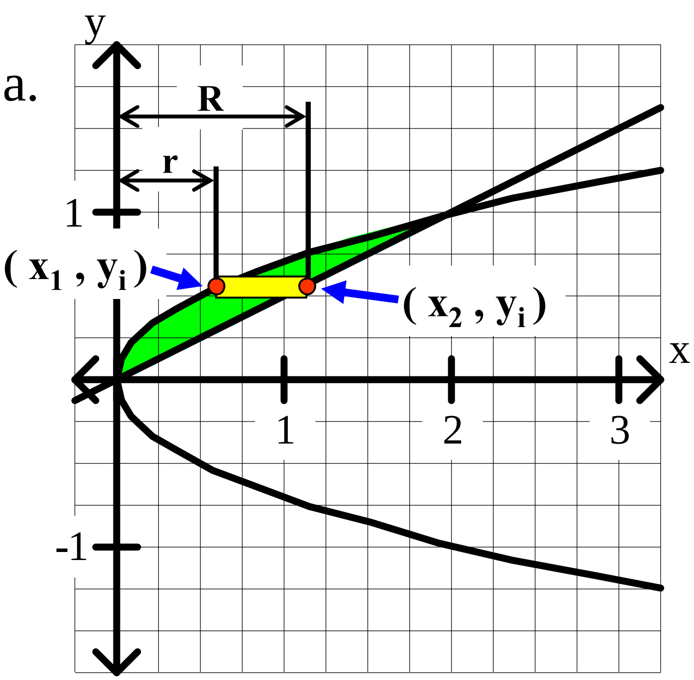

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2$

$r = x_1$

$h = \Delta y$

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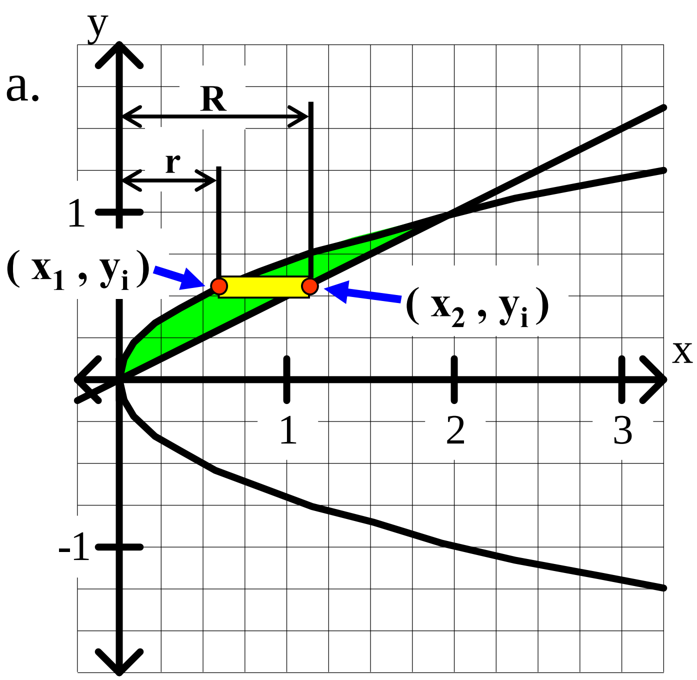

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 =$

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Calculus   Class Worksheet #2   Unit 11   Solutions

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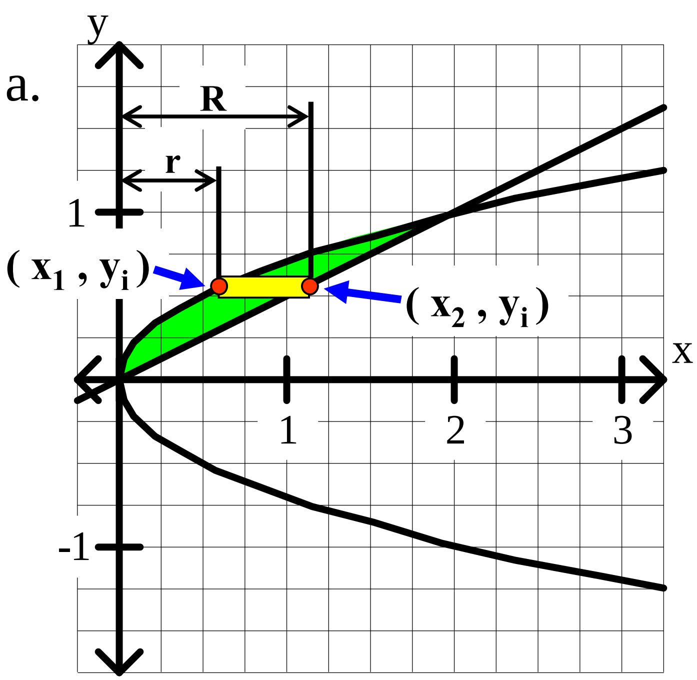

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1$

$h = \Delta y$

Calculus Class Worksheet #2 Unit 11 Solutions

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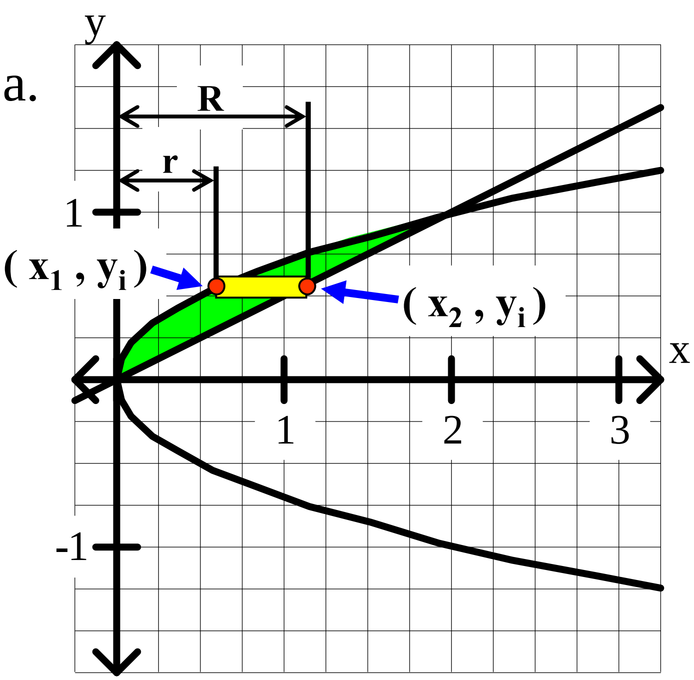

Washers: $V = \pi(R^2 - r^2)h$

$R = x_2 = 2y_i$

$r = x_1 =$

$h = \Delta y$

Calculus Class Worksheet #2 Unit 11 Solutions

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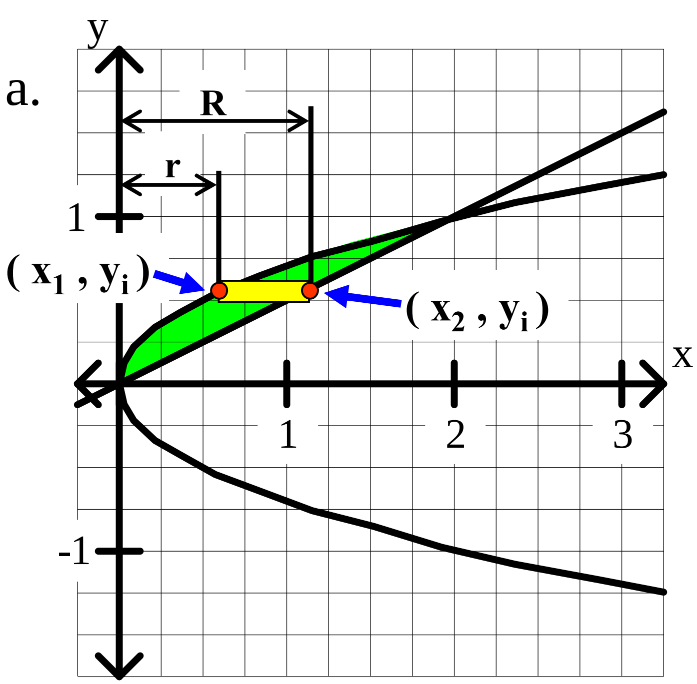

Washers: $V = \pi(R^2$ ï $r^2)h$

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$r = x_1 = 2y_i^2$

$h = \Delta y$

Calculus   Class Worksheet #2   Unit 11   Solutions

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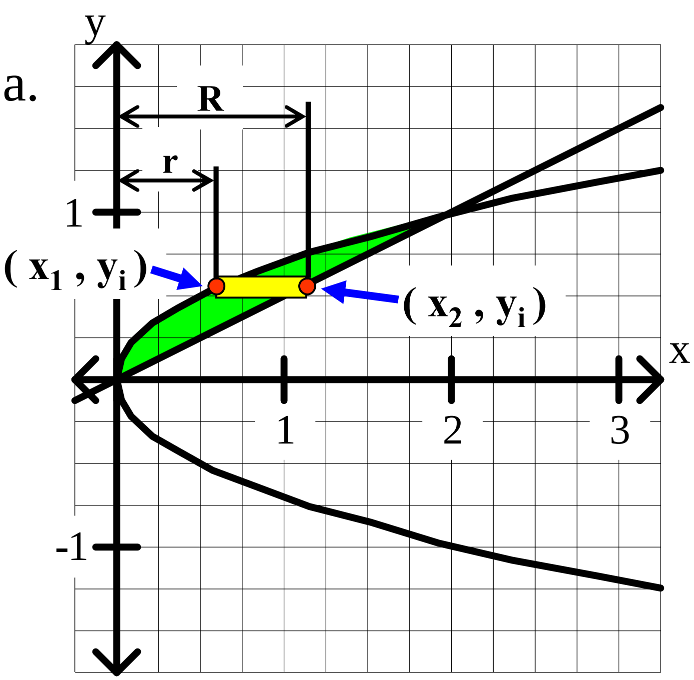

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

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$h = \Delta y$

b. $V_i =$

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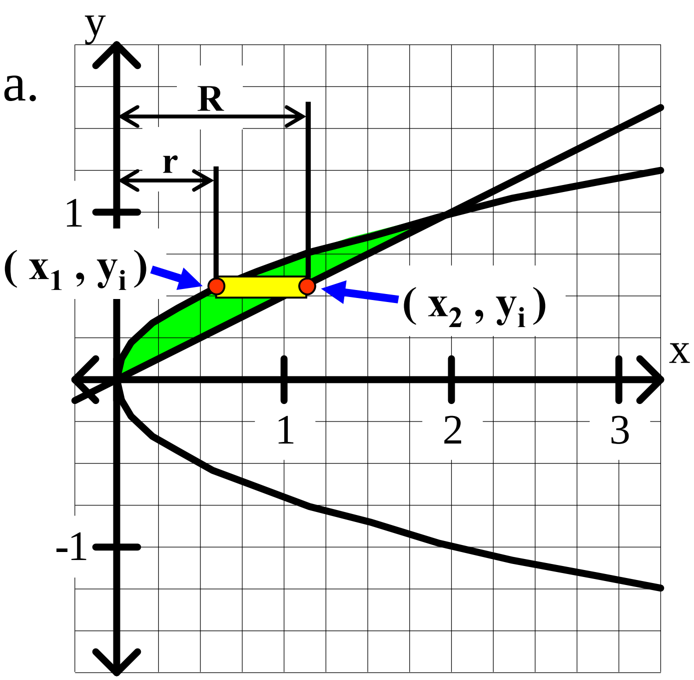
a.



Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi$

Calculus   Class Worksheet #2   Unit 11   Solutions

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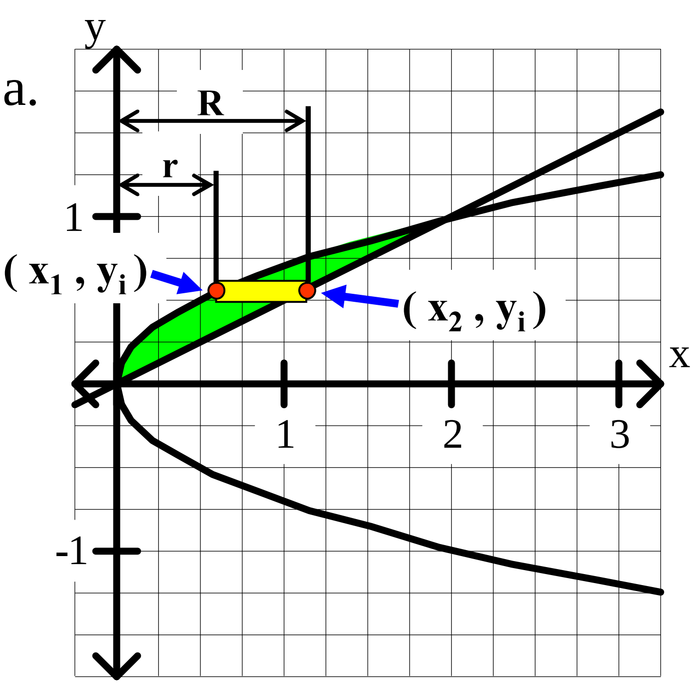
a.



Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)$

Calculus Class Worksheet #2 Unit 11 Solutions

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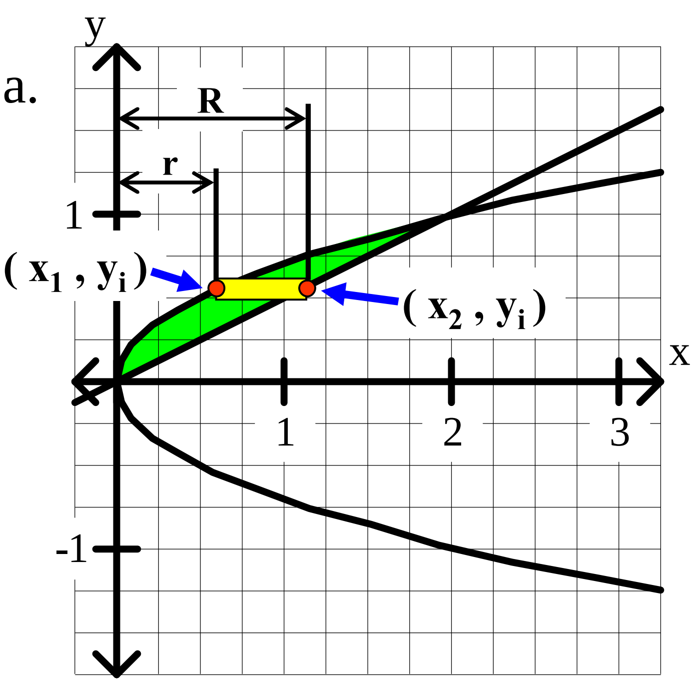
a.



Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2$

Calculus Class Worksheet #2 Unit 11 Solutions

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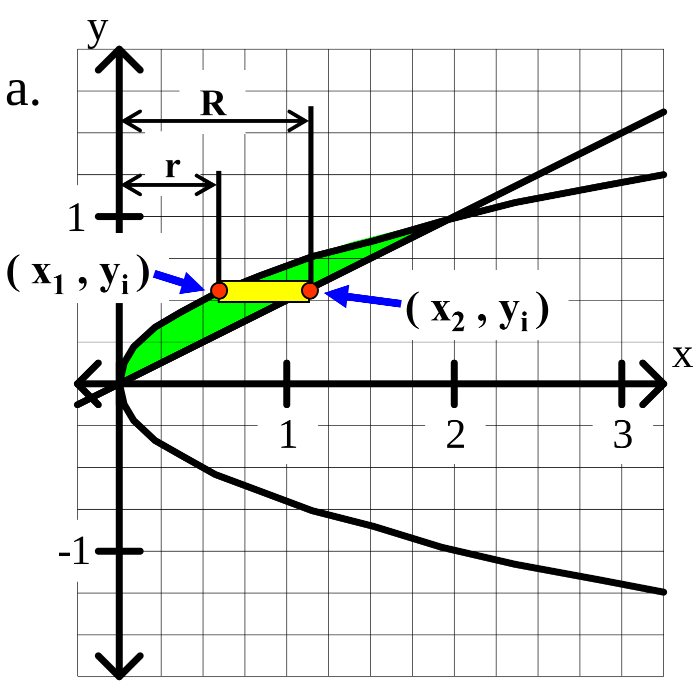
a.



Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

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Calculus   Class Worksheet #2   Unit 11   Solutions

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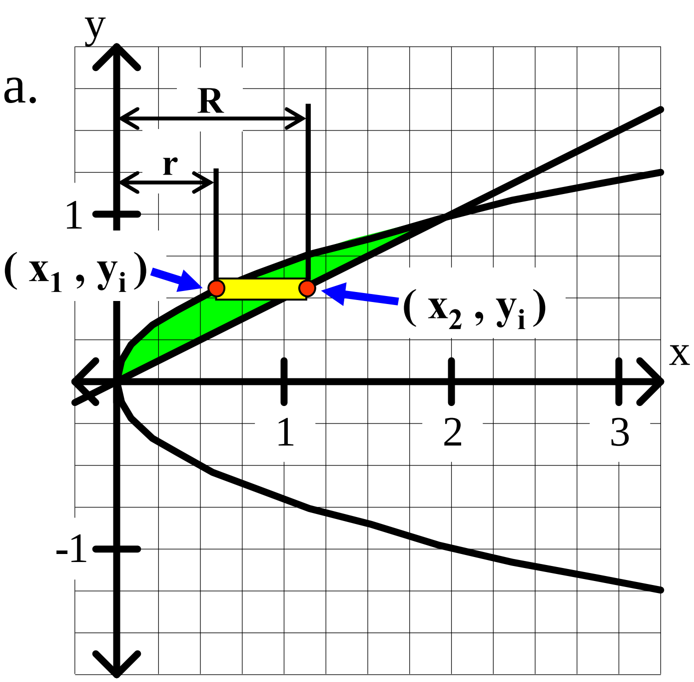

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2 \text{ ï } (2y_i^2))$

Calculus Class Worksheet #2 Unit 11 Solutions

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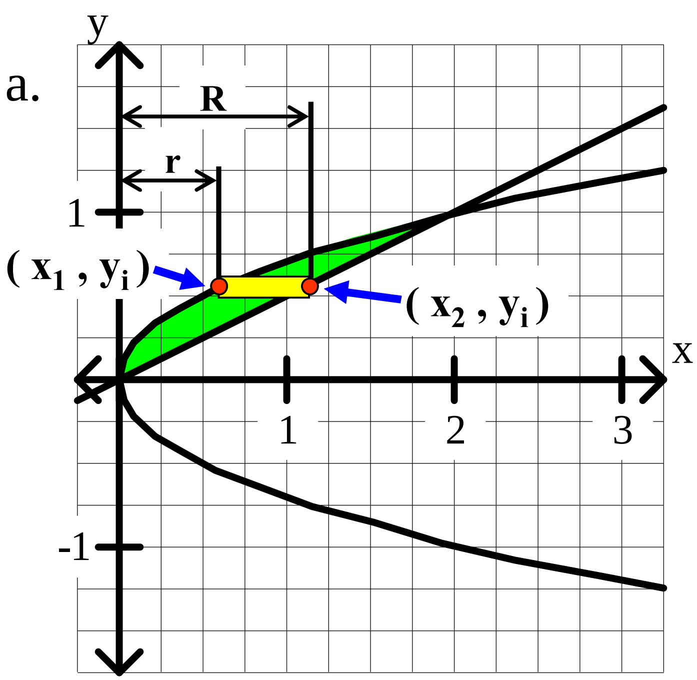

Washers: $V = \pi(R^2$ ï $r^2)h$

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$h = \Delta y$

b. $V_i = \pi((2y_i)^2$ ï $(2y_i^2)^2$

Calculus   Class Worksheet #2   Unit 11   Solutions

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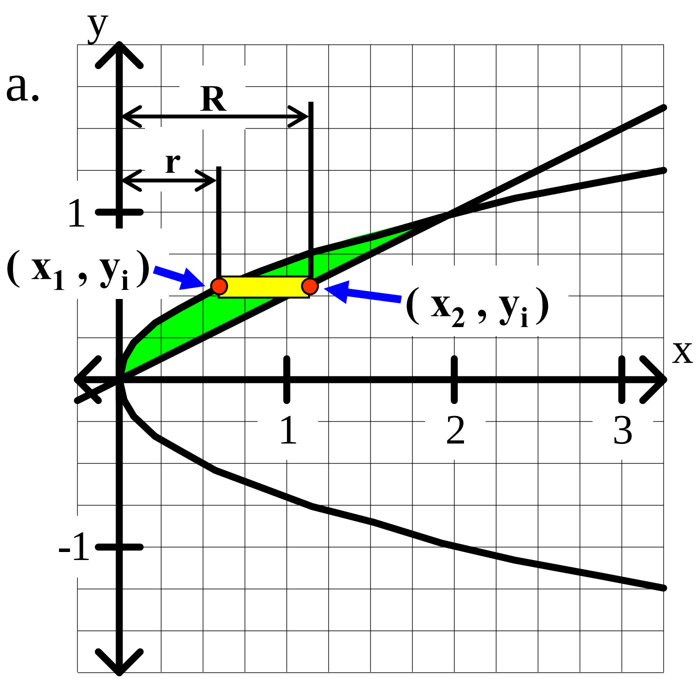

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2 \text{ ï } (2y_i^2)^2)\,\Delta y$

Calculus   Class Worksheet #2   Unit 11   Solutions

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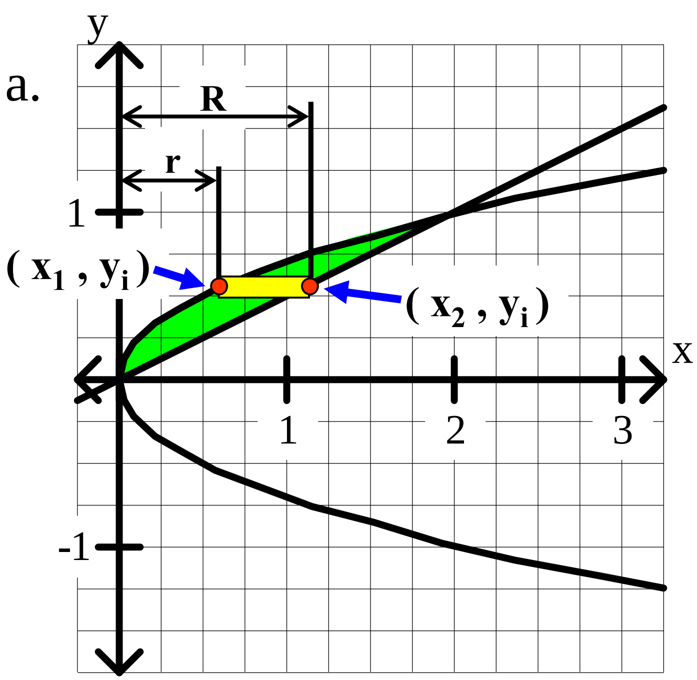

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2$ ï $(2y_i^2)^2)\,\Delta y$

Calculus   Class Worksheet #2   Unit 11   Solutions

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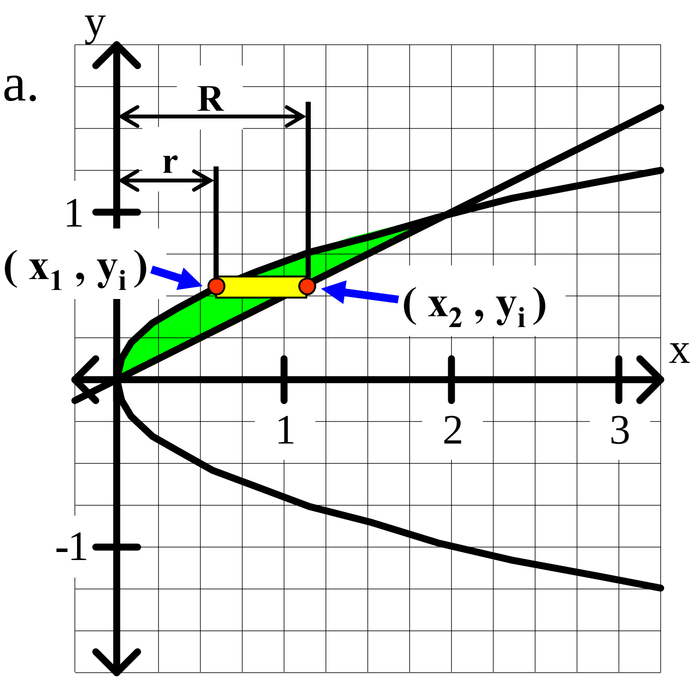

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2 \text{ ï } (2y_i^2)^2)\,\Delta y$

c.   V =

Calculus Class Worksheet #2 Unit 11 Solutions

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a) sketch the generating region, showing a typical generating rectangle,
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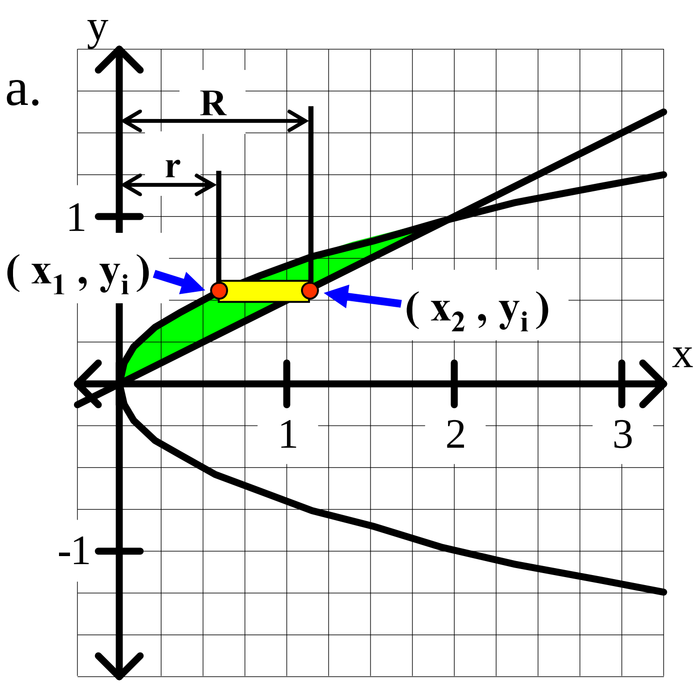
c) express the exact volume of the solid as a definite integral, and
d) evaluate the integral.

Sample 2b. The region enclosed by $x = 2y^2$ and $x = 2y$ is rotated about the y-axis.

a.



Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2$ ï $(2y_i^2)^2)\ \Delta y$

c. $V = \pi$

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

a) sketch the generating region, showing a typical generating rectangle,
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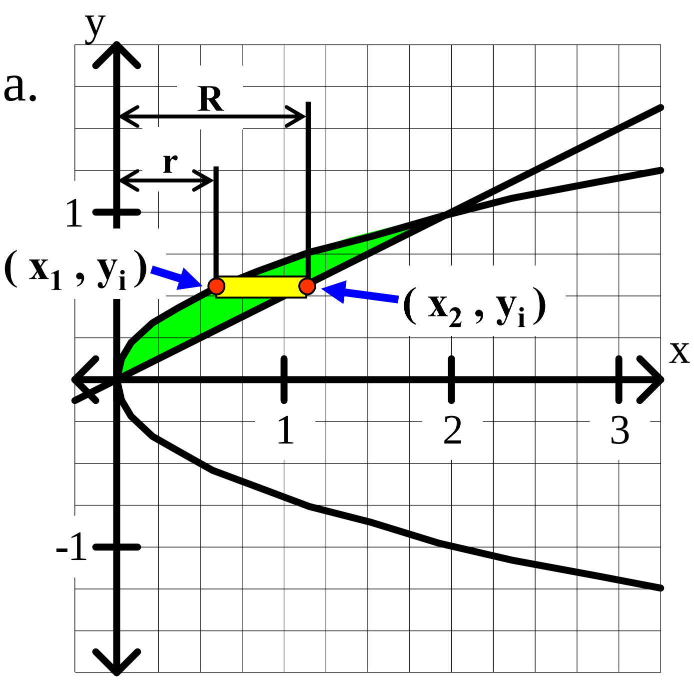

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2$ ï $(2y_i^2)^2)\ \Delta y$

c. $V = \pi\int$

Calculus Class Worksheet #2 Unit 11 Solutions

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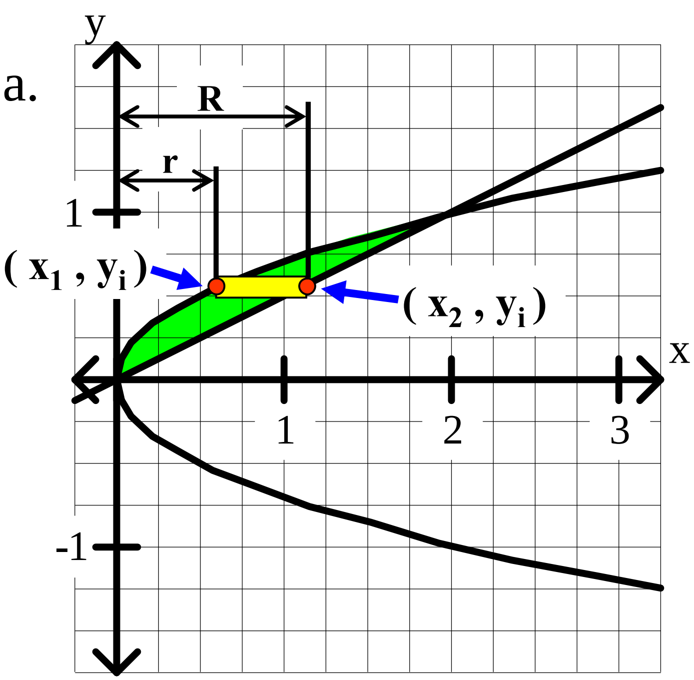

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2$ ï $(2y_i^2)^2)\,\Delta y$

c. $V = \pi\int((2y)^2$ ï $(2y^2)^2)\,dy$

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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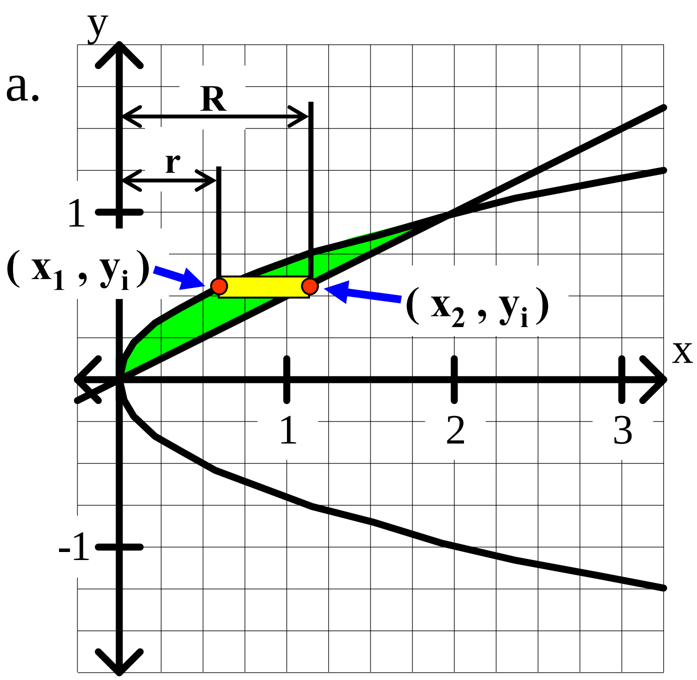

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2$ ï $(2y_i^2)^2) \Delta y$

c. $V = \pi\int_0 ((2y)^2$ ï $(2y^2)^2)\, dy$

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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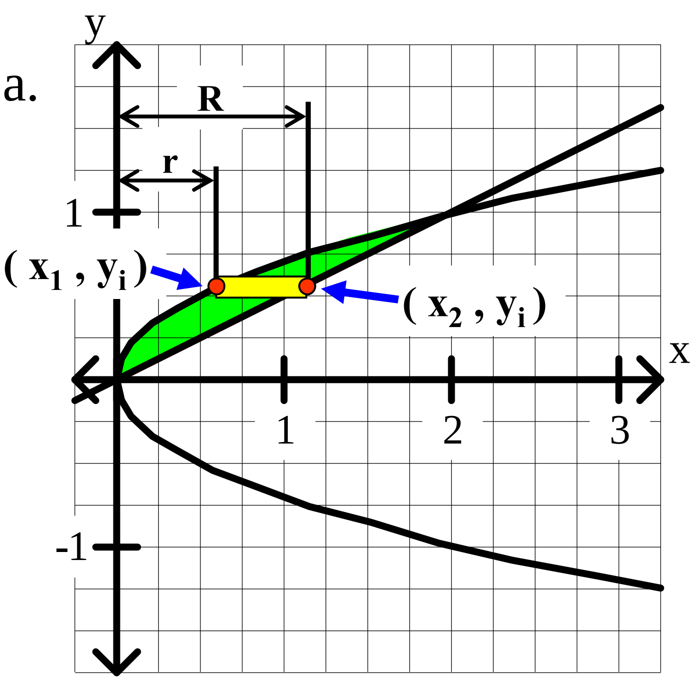

Washers: $V = \pi(R^2 - r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2 - (2y_i^2)^2)\,\Delta y$

c. $V = \pi\int_0^1 ((2y)^2 - (2y^2)^2)\,dy$

Calculus Class Worksheet #2 Unit 11 Solutions

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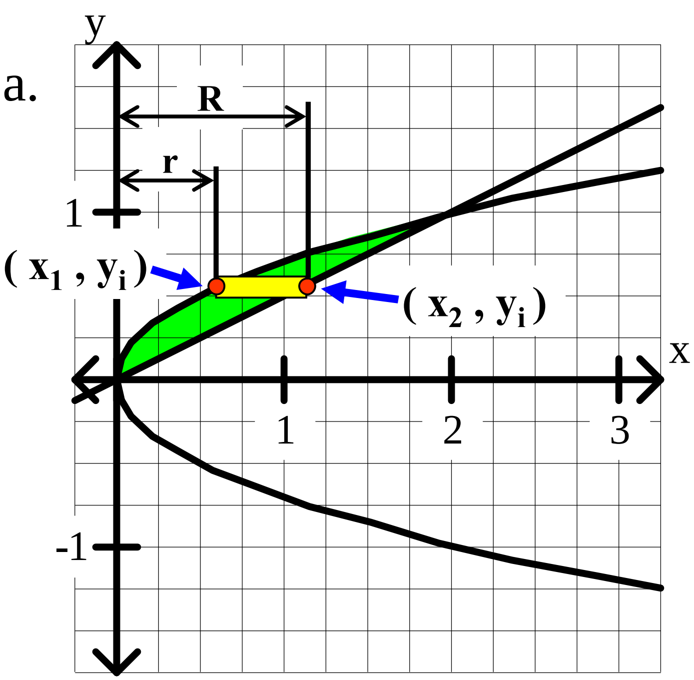

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Calculus Class Worksheet #2 Unit 11 Solutions

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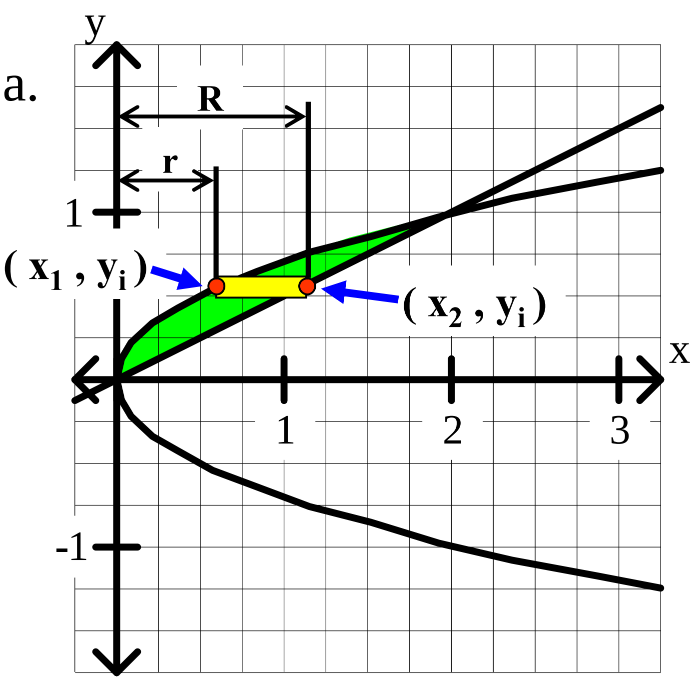

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$h = \Delta y$

b. $V_i = \pi((2y_i)^2$ ï $(2y_i^2)^2)\,\Delta y$

c. $V = \pi\int_0^1((2y)^2$ ï $(2y^2)^2)\,dy$

$V = \pi\int_0^1(4y^2$ ï $4y^4)\,dy$

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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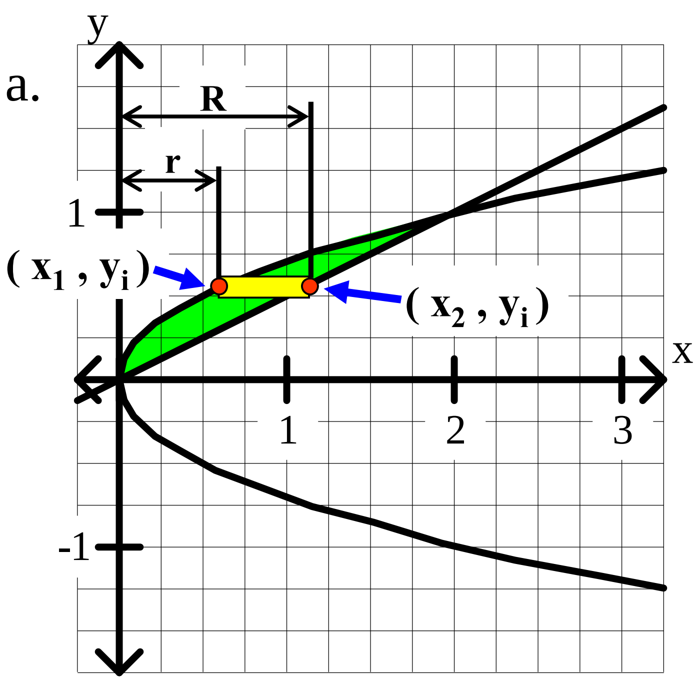

$R = x_2 = 2y_i$

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$h = \Delta y$

b. $V_i = \pi((2y_i)^2 \text{ ï } (2y_i^2)^2)\,\Delta y$

c. $V = \pi\int_0^1((2y)^2 \text{ ï } (2y^2)^2)\,dy$

$V = \pi\int_0^1(4y^2 \text{ ï } 4y^4)\,dy$

d. $V \approx$

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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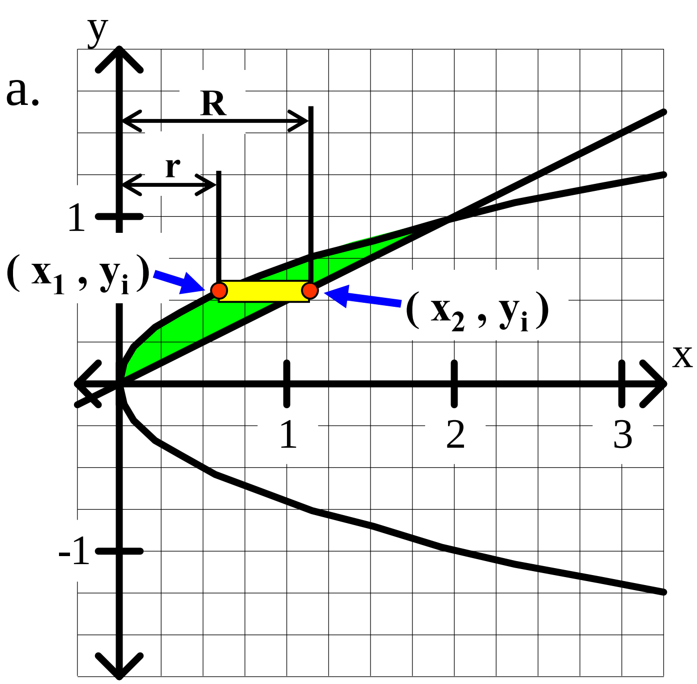

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = x_2 = 2y_i$

$r = x_1 = 2y_i^2$

$h = \Delta y$

b. $V_i = \pi((2y_i)^2 \text{ ï } (2y_i^2)^2)\, \Delta y$

c. $V = \pi\int_0^1 ((2y)^2 \text{ ï } (2y^2)^2)\, dy$

$V = \pi\int_0^1 (4y^2 \text{ ï } 4y^4)\, dy$

d. $V \approx 1.68$ cu. units

Calculus Class Worksheet #2 Unit 11 Solutions

Use ñwashersò to find the volume generated by rotating the given region about the given line. For each problem, you must

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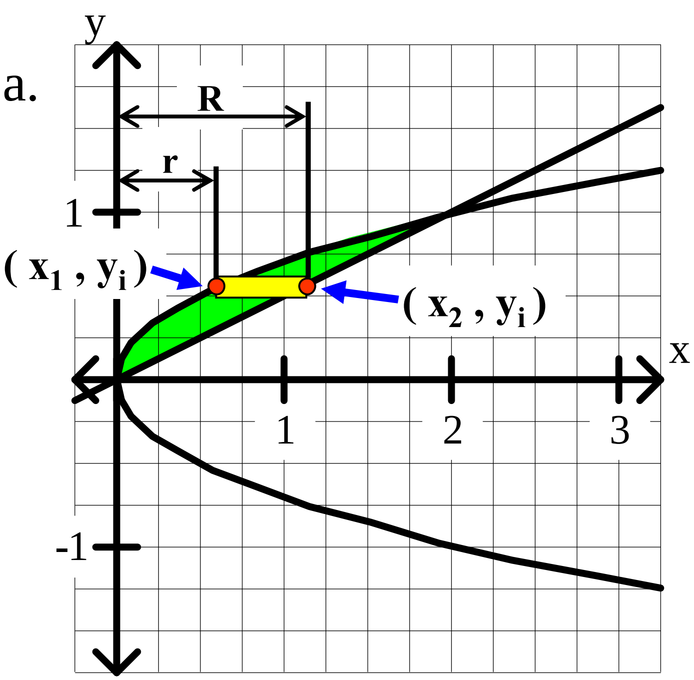

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$V = \pi\int_0^1 (4y^2 - 4y^4)\,dy$

d. $V \approx 1.68$ cu. units

Calculus Class Worksheet #2 Unit 11 Solutions

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Sample 2c. The region enclosed by $x = 2y^2$ and $x = 2y$ is rotated about the line $x = 3$.

Calculus   Class Worksheet #2   Unit 11   Solutions

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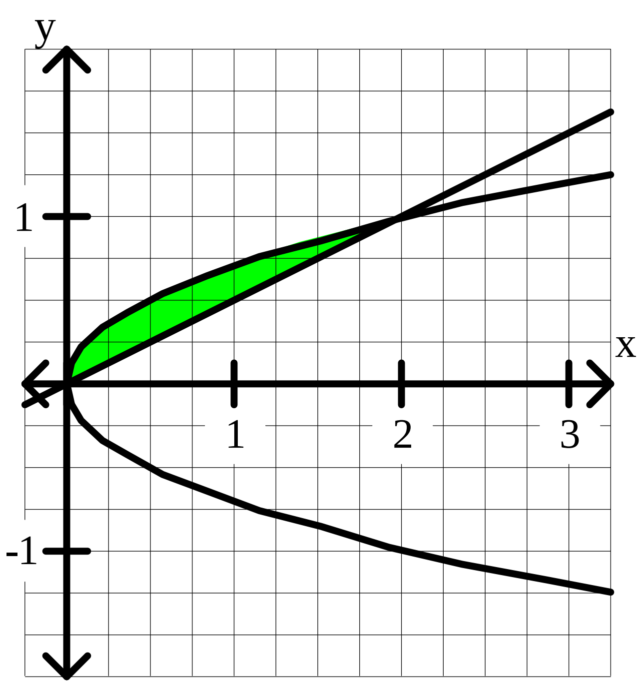

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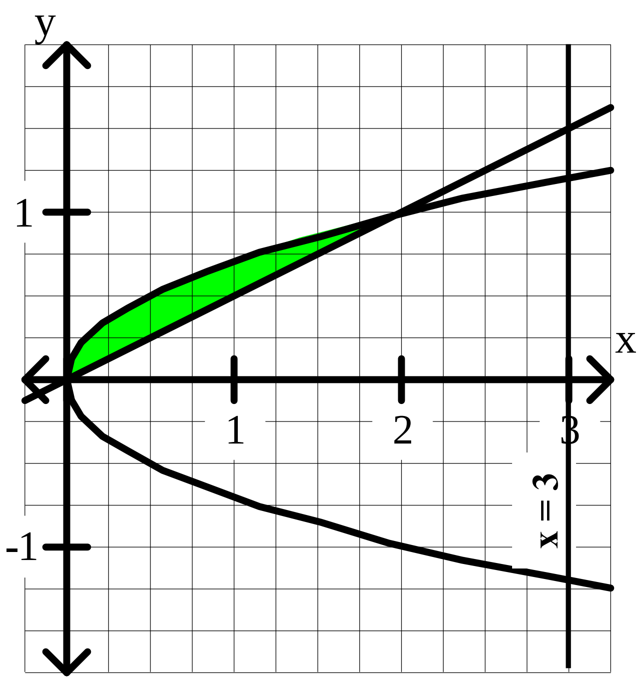

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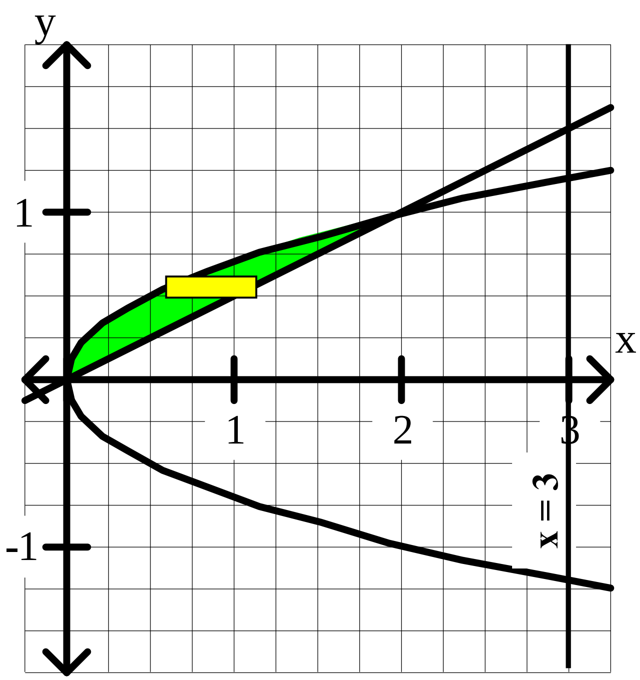

Calculus   Class Worksheet #2   Unit 11   Solutions

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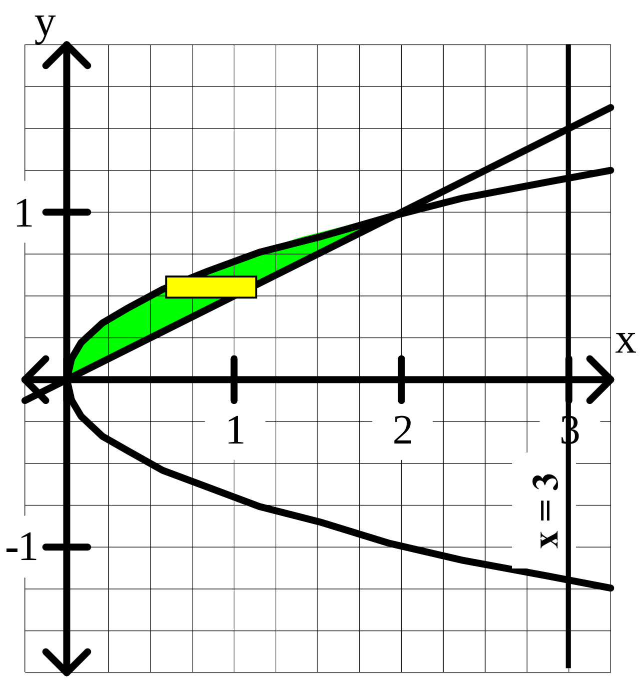

Washers: V = $\pi(R^2$ ï $r^2)h$

R =

r =

h =

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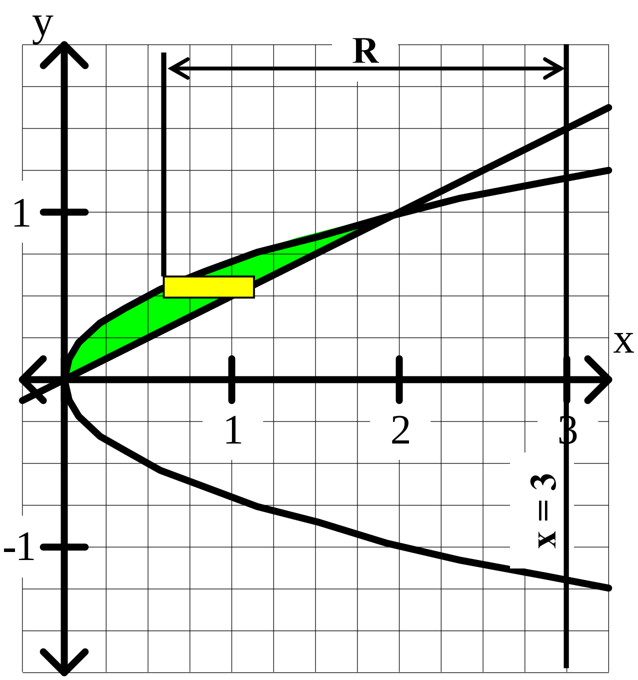

R =

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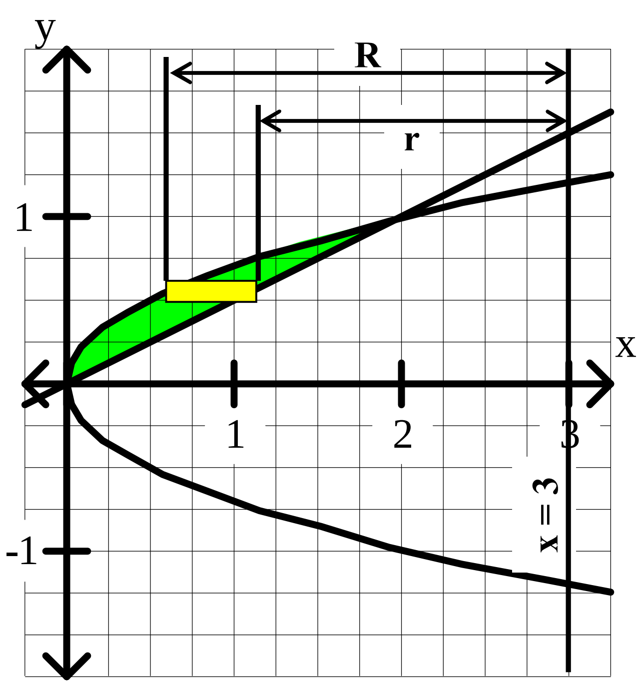

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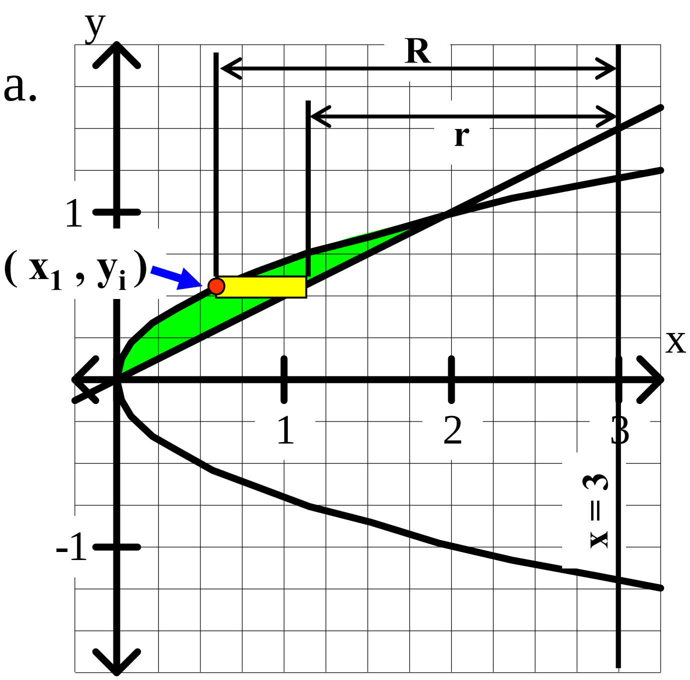

Washers: V = π(R^2 ï r^2)h

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h =

Calculus   Class Worksheet #2   Unit 11   Solutions

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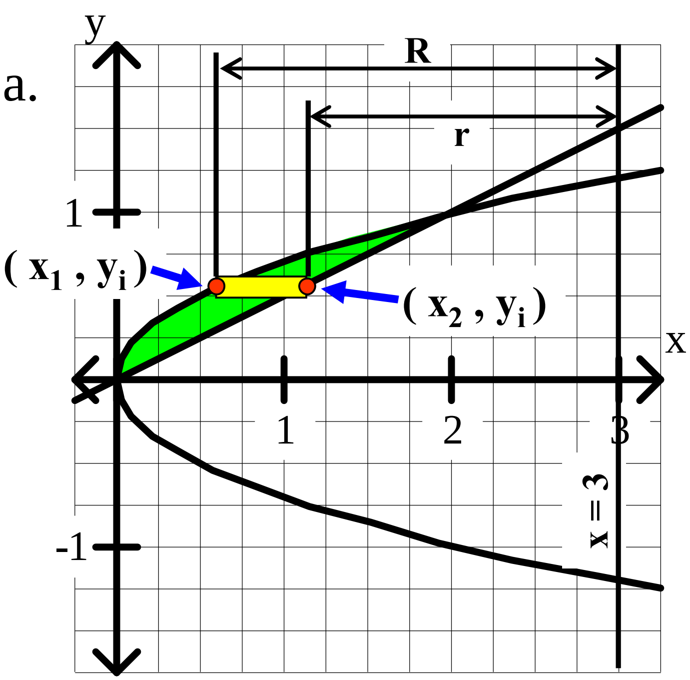

Washers: $V = \pi(R^2$ ï $r^2)h$

R =

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h =

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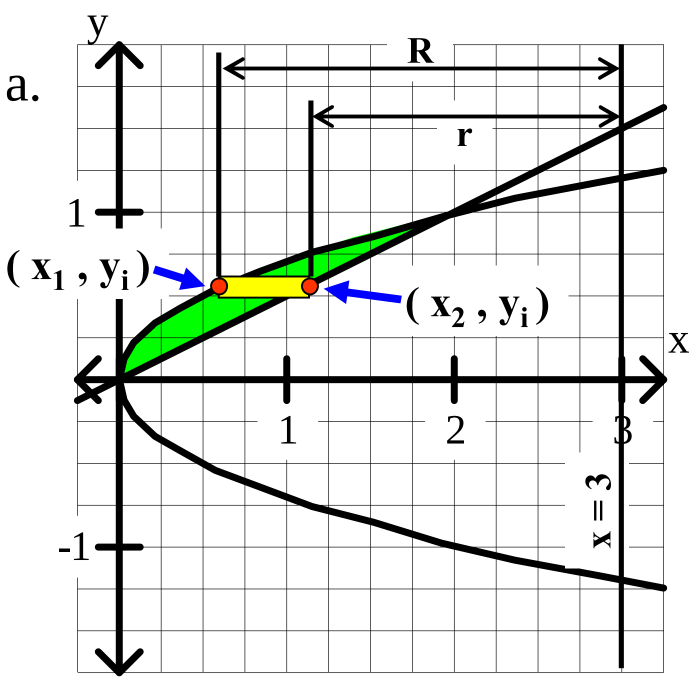

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = 3 \text{ ï } x_1$

$r =$

$h =$

Calculus   Class Worksheet #2   Unit 11   Solutions

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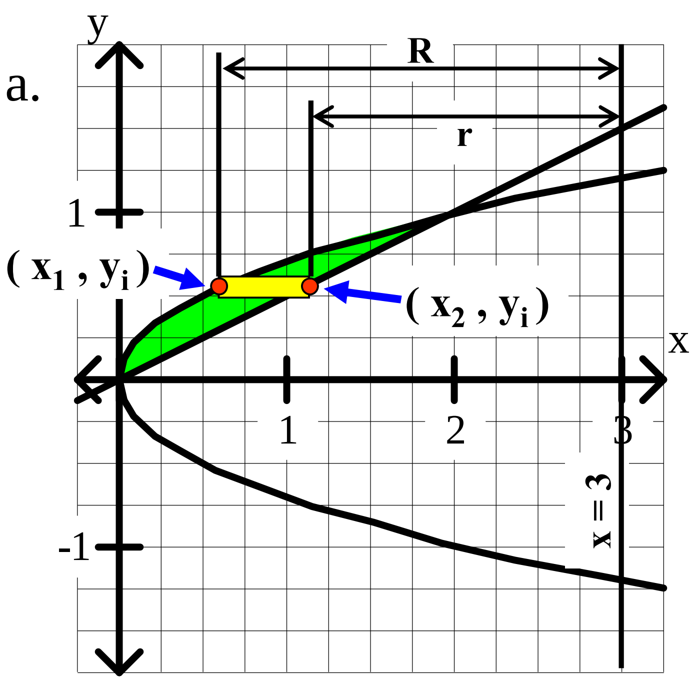

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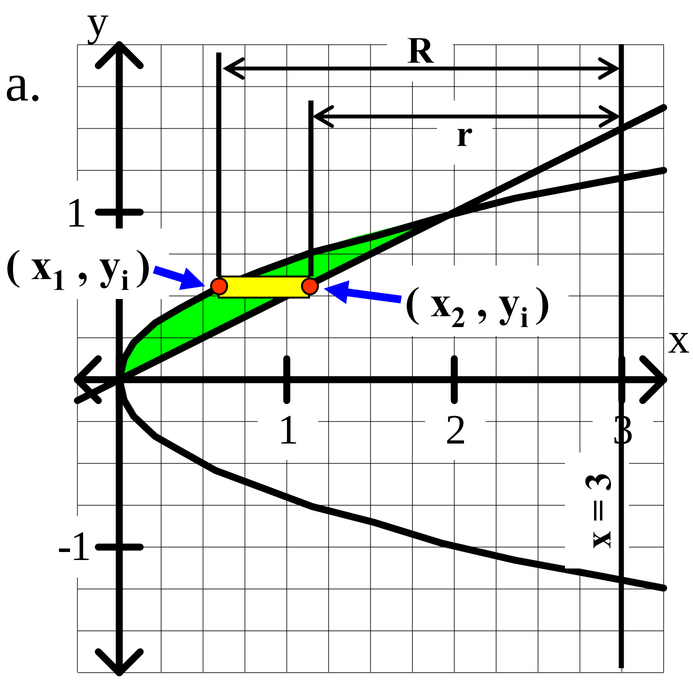

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R = 3 ï x_1

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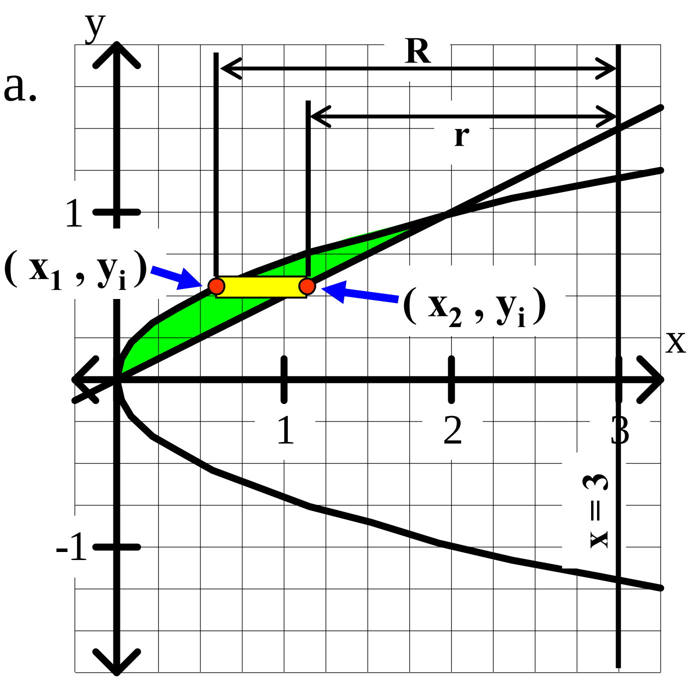

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

$R = 3 \text{ ï } x_1 =$

$r = 3 \text{ ï } x_2$

$h = \Delta y$

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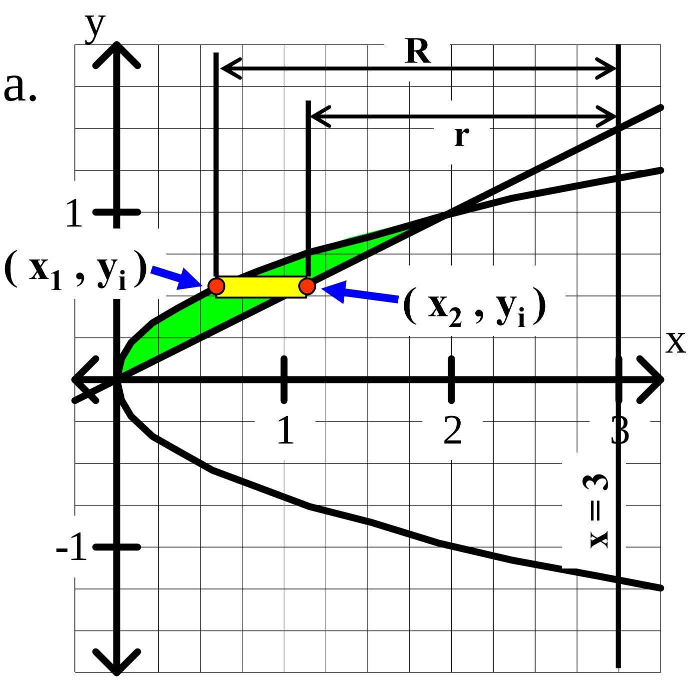

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = 3$ ï $x_1 = 3$ ï $2y_i^2$

$r = 3$ ï x_2

$h = \Delta y$

Calculus   Class Worksheet #2   Unit 11   Solutions

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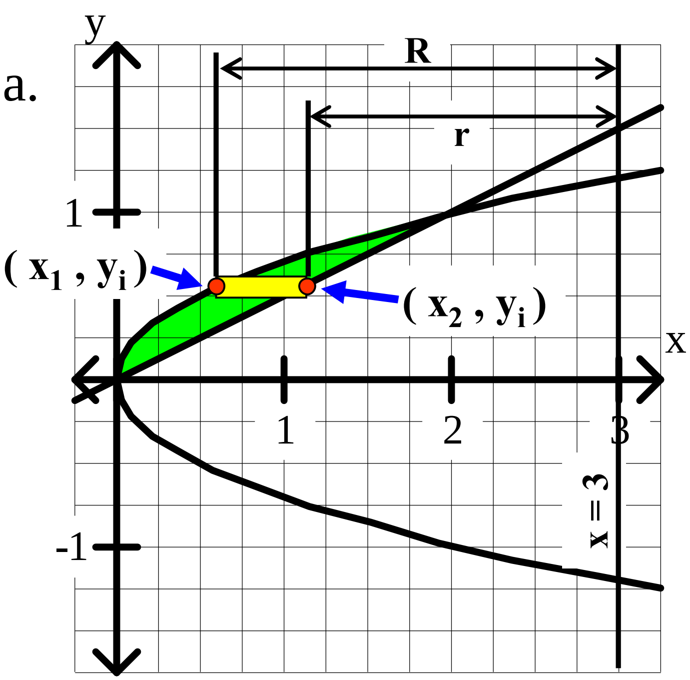

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = 3$ ï $x_1 = 3$ ï $2y_i^2$

$r = 3$ ï $x_2 =$

$h = \Delta y$

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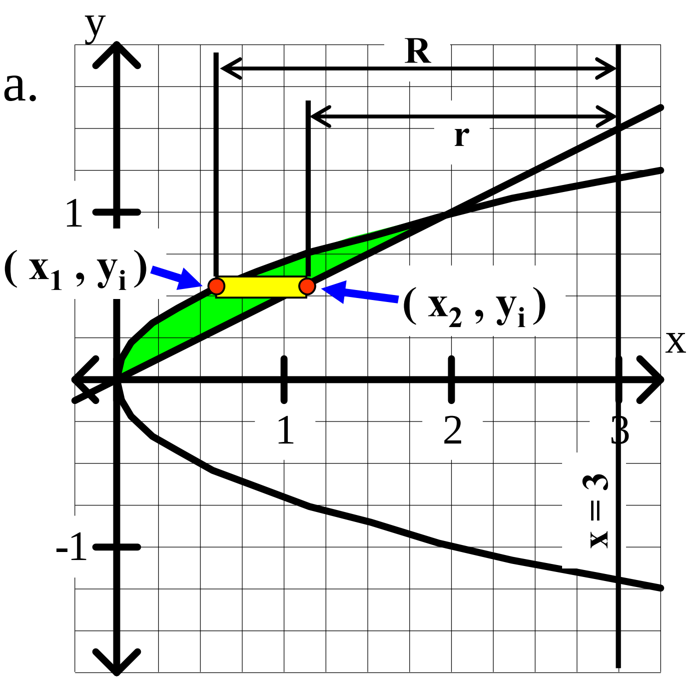

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = 3$ ï $x_1 = 3$ ï $2y_i^2$

$r = 3$ ï $x_2 = 3$ ï $2y_i$

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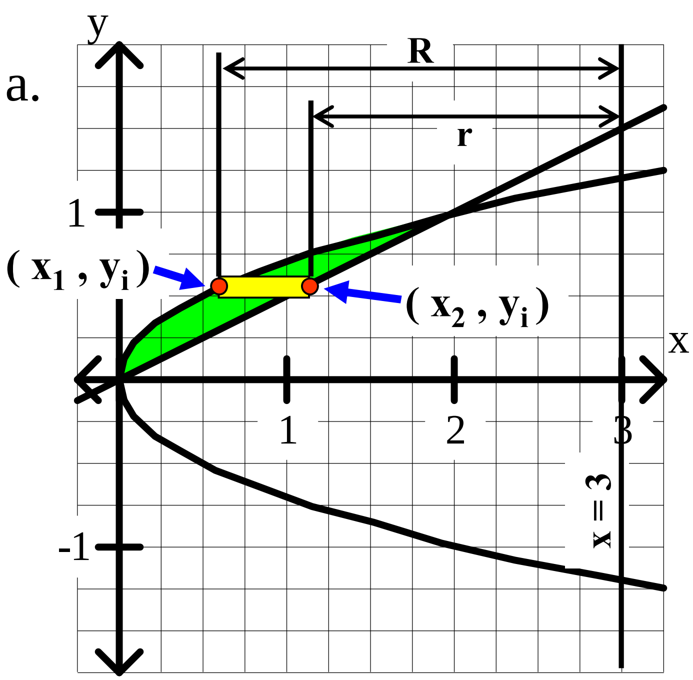

Washers: $V = \pi(R^2$ ï $r^2)h$

$R = 3$ ï $x_1 = 3$ ï $2y_i^2$

$r = 3$ ï $x_2 = 3$ ï $2y_i$

$h = \Delta y$

b. $V_i =$

Calculus   Class Worksheet #2   Unit 11   Solutions

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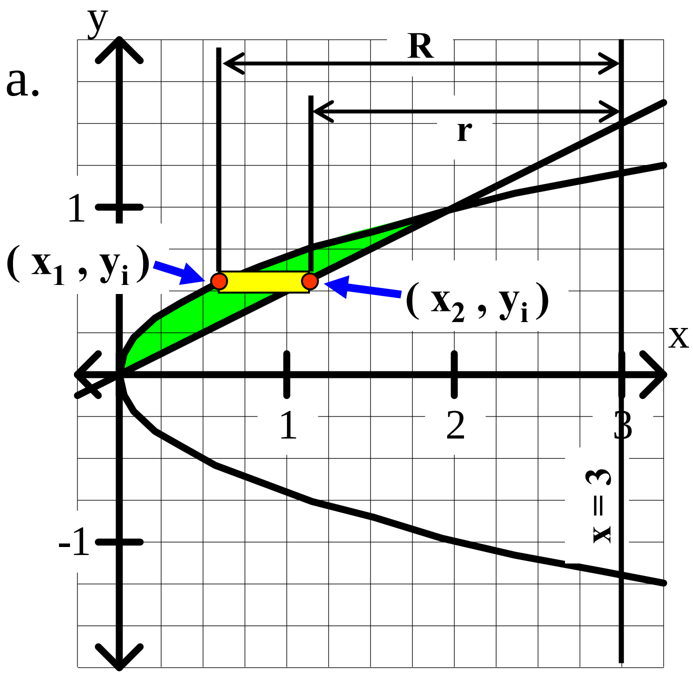

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$h = \Delta y$

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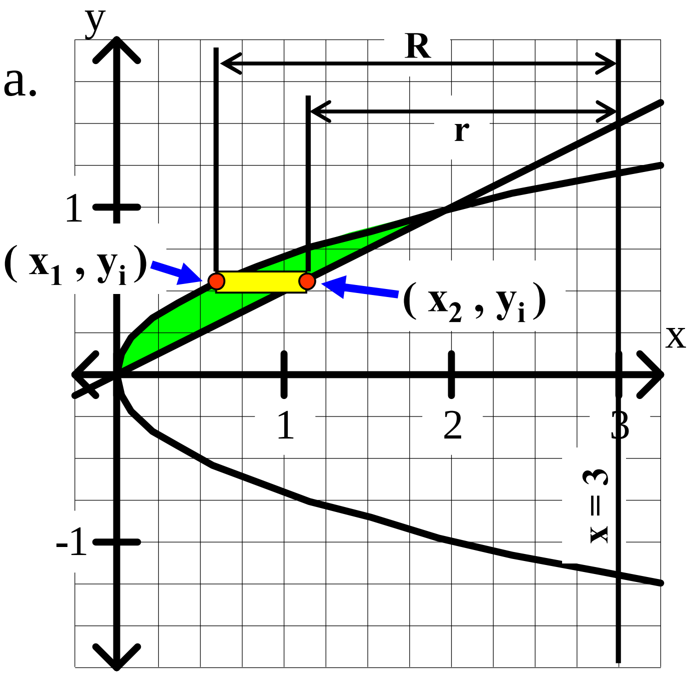

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$h = \Delta y$

b. $V_i = \pi((3$ ï $2y_i^2)$

Calculus Class Worksheet #2 Unit 11 Solutions

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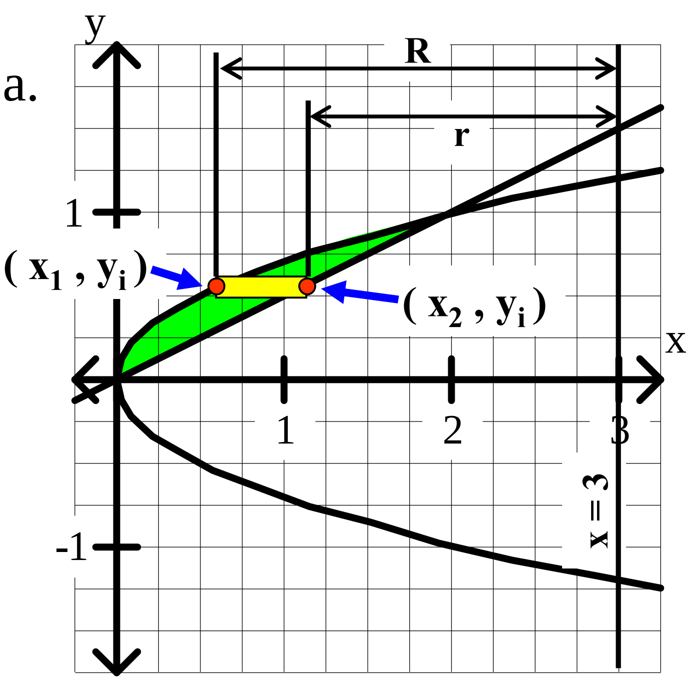

Washers: $V = \pi(R^2 - r^2)h$

$R = 3 - x_1 = 3 - 2y_i^2$

$r = 3 - x_2 = 3 - 2y_i$

$h = \Delta y$

b. $V_i = \pi((3 - 2y_i^2)^2$

Calculus   Class Worksheet #2   Unit 11   Solutions

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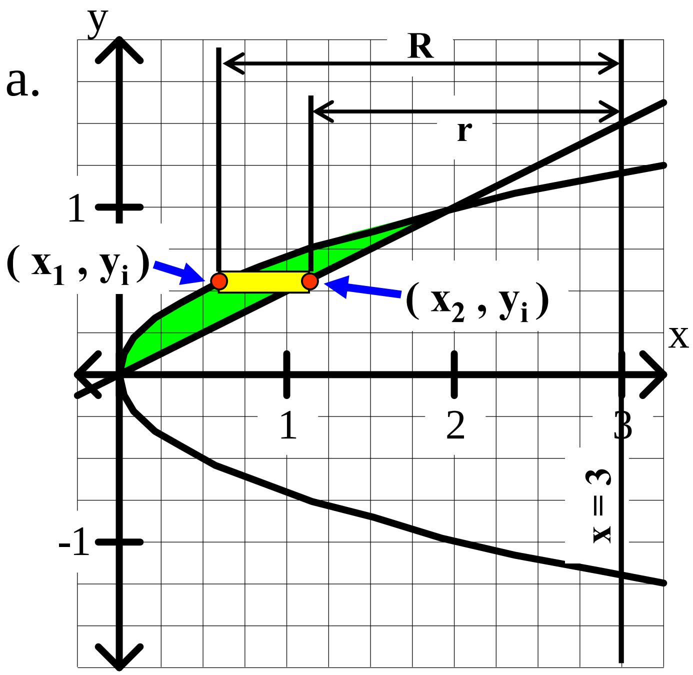

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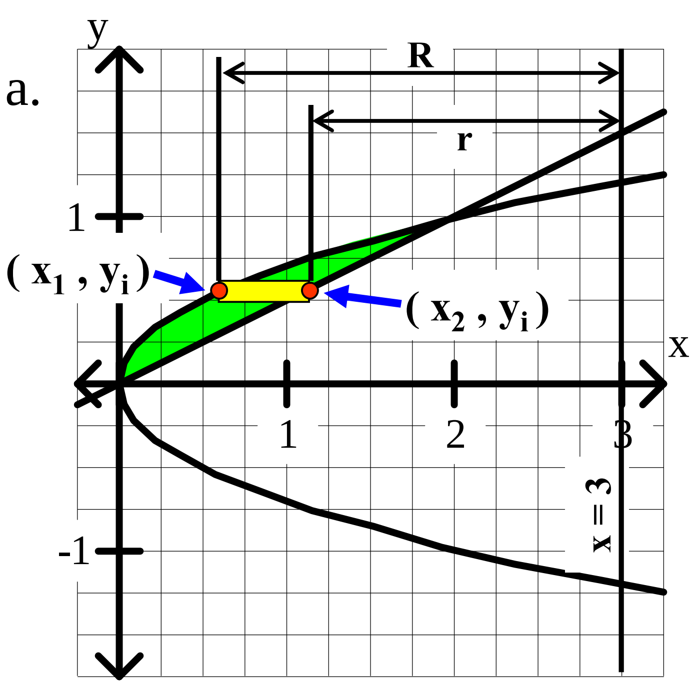

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$R = 3 ï x_1 = 3 ï 2y_i^2$

$r = 3 ï x_2 = 3 ï 2y_i$

$h = \Delta y$

b. $V_i = \pi((3 ï 2y_i^2)^2 ï (3 ï 2y_i)$

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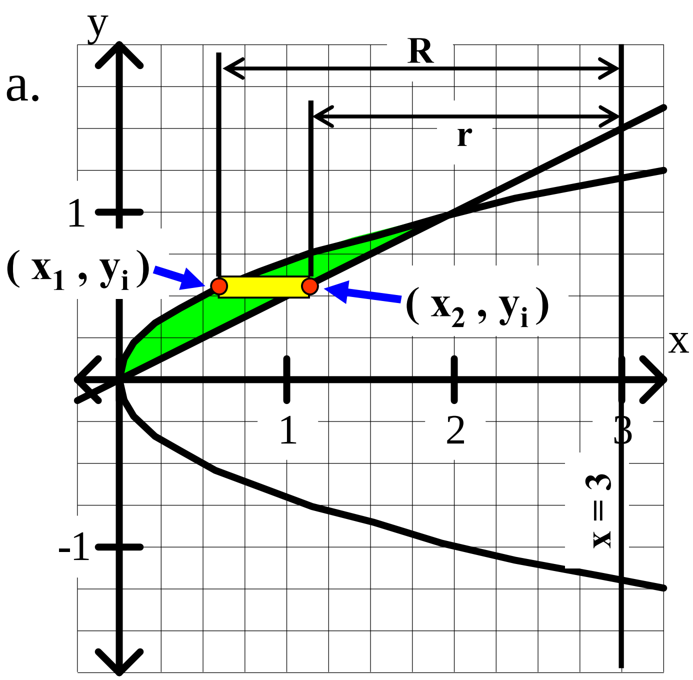

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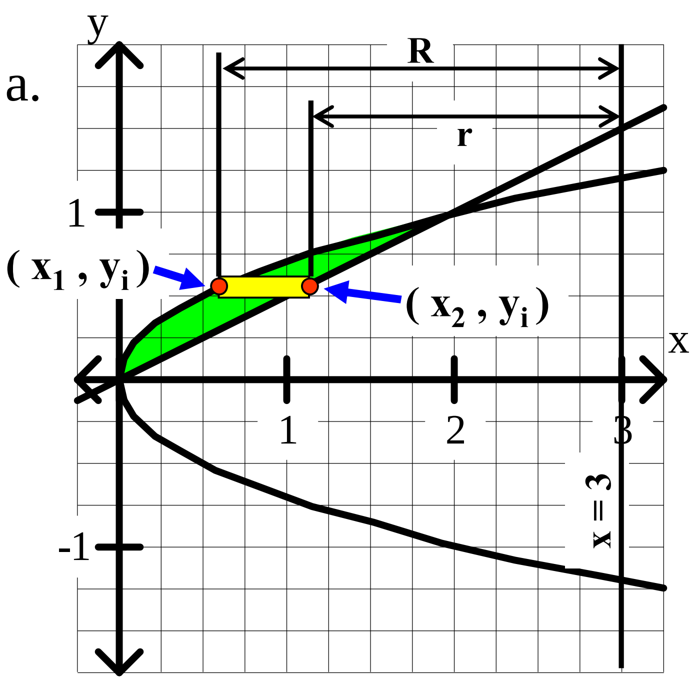

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$h = \Delta y$

b. $V_i = \pi((3 \text{ ï } 2y_i^2)^2 \text{ ï } (3 \text{ ï } 2y_i)^2)\, \Delta y$

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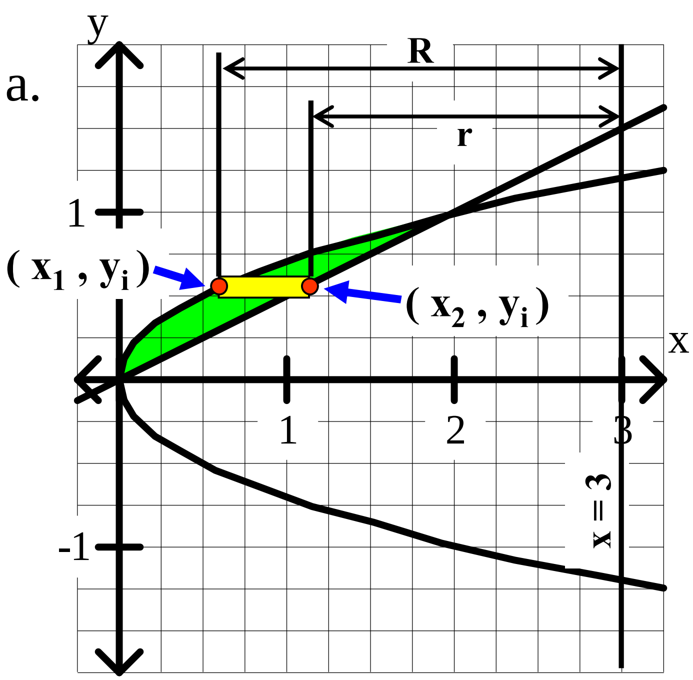

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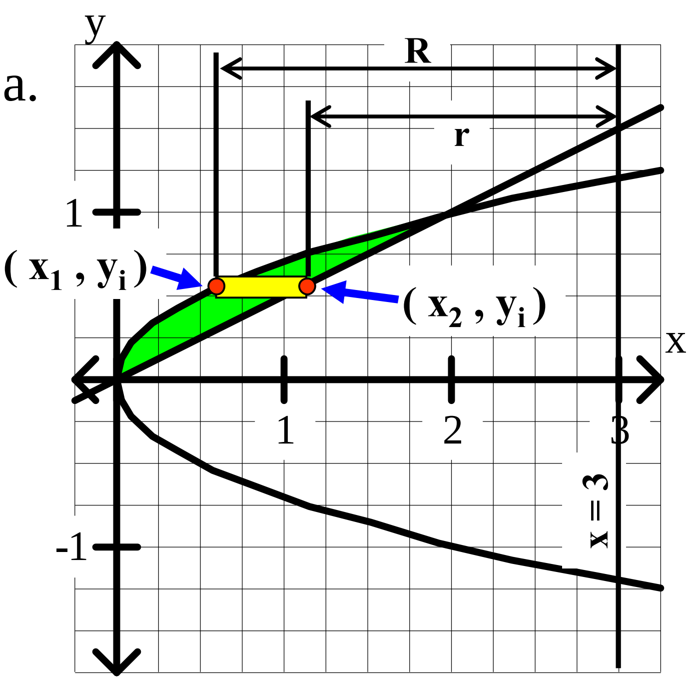

Washers: $V = \pi(R^2 \text{ ï } r^2)h$

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$r = 3 \text{ ï } x_2 = 3 \text{ ï } 2y_i$

$h = \Delta y$

b. $V_i = \pi((3 \text{ ï } 2y_i^2)^2 \text{ ï } (3 \text{ ï } 2y_i)^2)\, \Delta y$

c. $V =$

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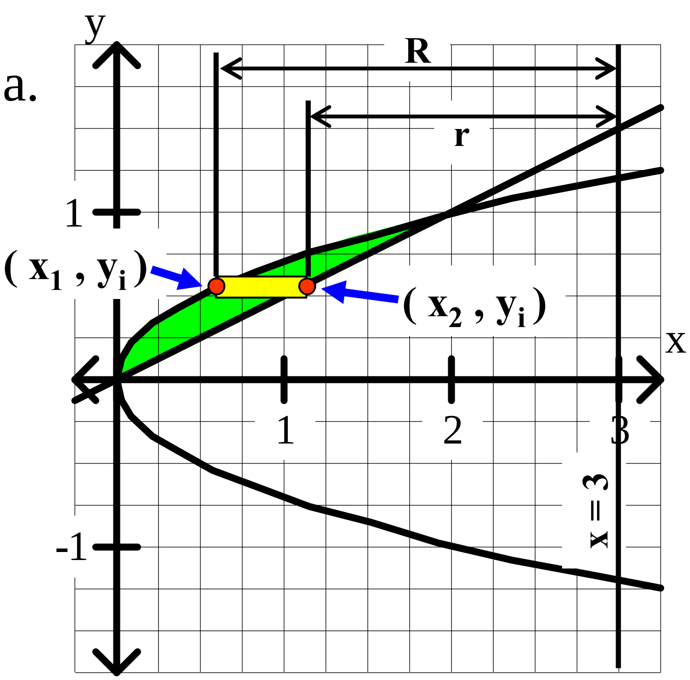

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c. $V = \pi$

Calculus   Class Worksheet #2   Unit 11   Solutions

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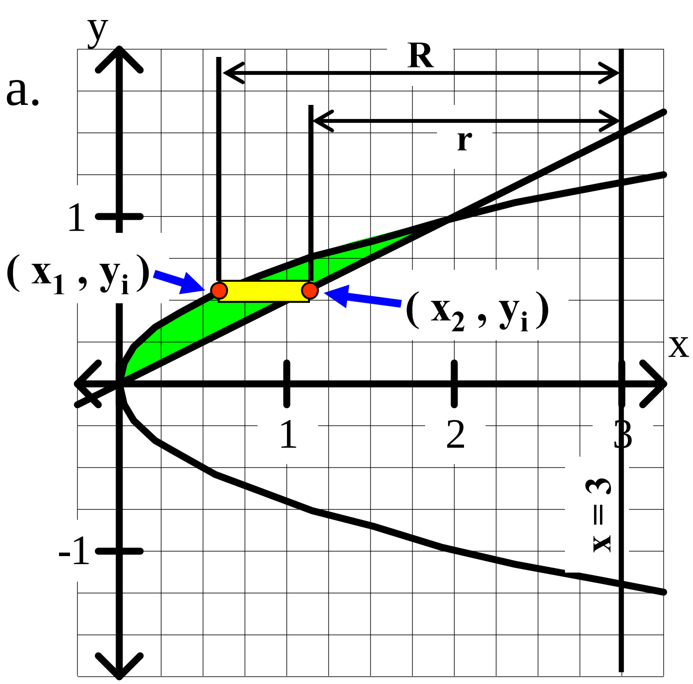

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$h = \Delta y$

b. $V_i = \pi((3 \text{ ï } 2y_i^2)^2 \text{ ï } (3 \text{ ï } 2y_i)^2)\, \Delta y$

c. $V = \pi\int$

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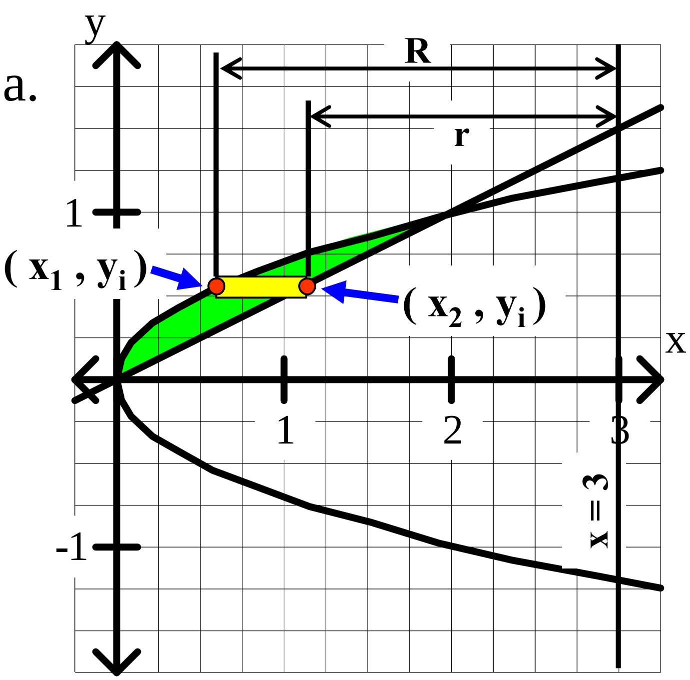

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$h = \Delta y$

b. $V_i = \pi((3$ ï $2y_i^2)^2$ ï $(3$ ï $2y_i)^2)\,\Delta y$

c. $V = \pi\int((3$ ï $2y^2)^2$ ï $(3$ ï $2y)^2)\,dy$

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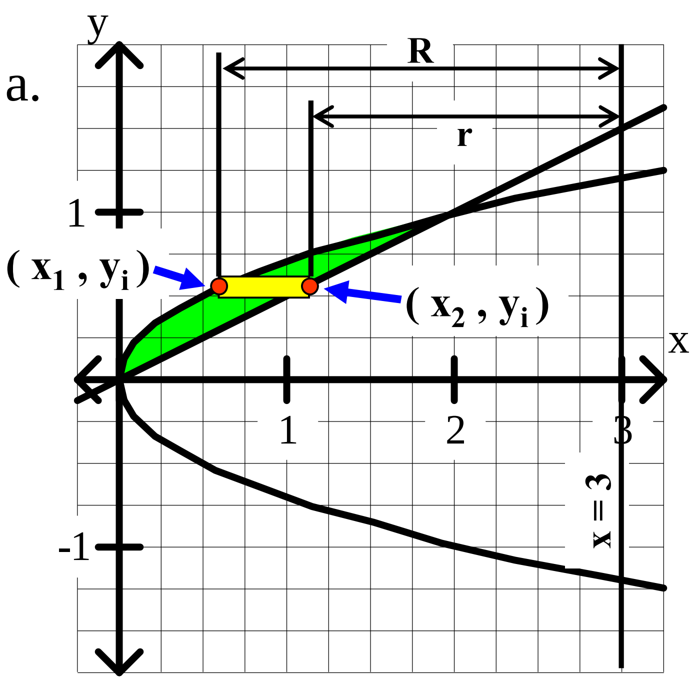

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$h = \Delta y$

b. $V_i = \pi((3 \text{ ï } 2y_i^2)^2 \text{ ï } (3 \text{ ï } 2y_i)^2)\, \Delta y$

c. $V = \pi\int_0 ((3 \text{ ï } 2y^2)^2 \text{ ï } (3 \text{ ï } 2y)^2)\, dy$

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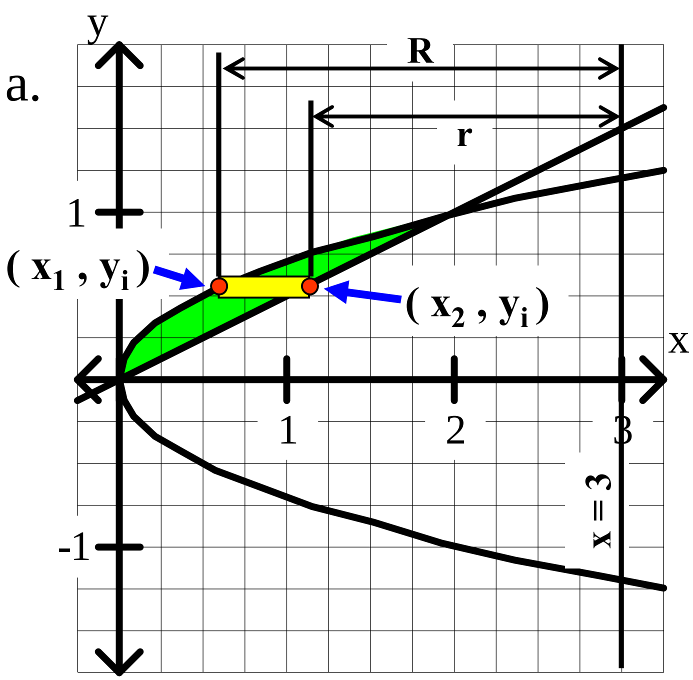

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b. $V_i = \pi((3$ ï $2y_i^2)^2$ ï $(3$ ï $2y_i)^2)\, \Delta y$

c. $V = \pi\int_0^1 ((3$ ï $2y^2)^2$ ï $(3$ ï $2y)^2)\, dy$

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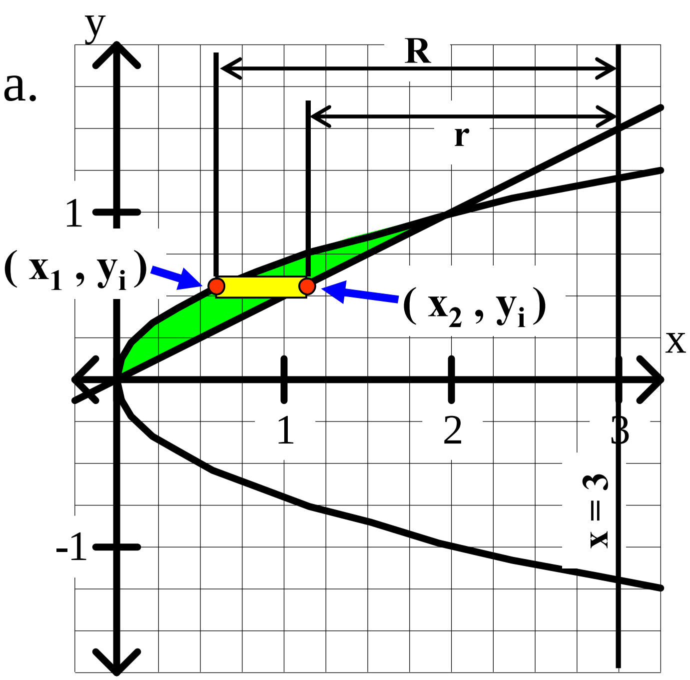

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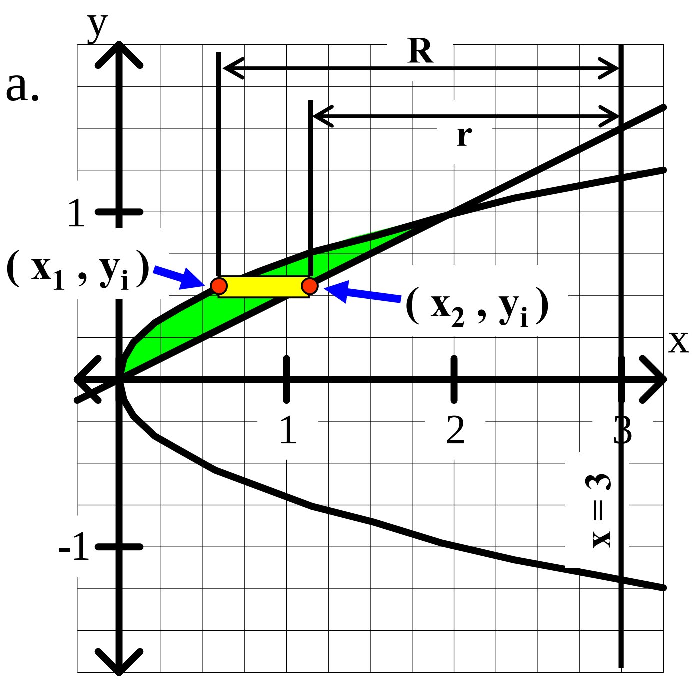

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$h = \Delta y$

b. $V_i = \pi((3 ï 2y_i^2)^2 ï (3 ï 2y_i)^2)\,\Delta y$

c. $V = \pi\int_0^1 ((3 ï 2y^2)^2 ï (3 ï 2y)^2)\,dy$

$V = \pi\int_0^1 (4y^4 ï 16y^2 + 12y)\,dy$

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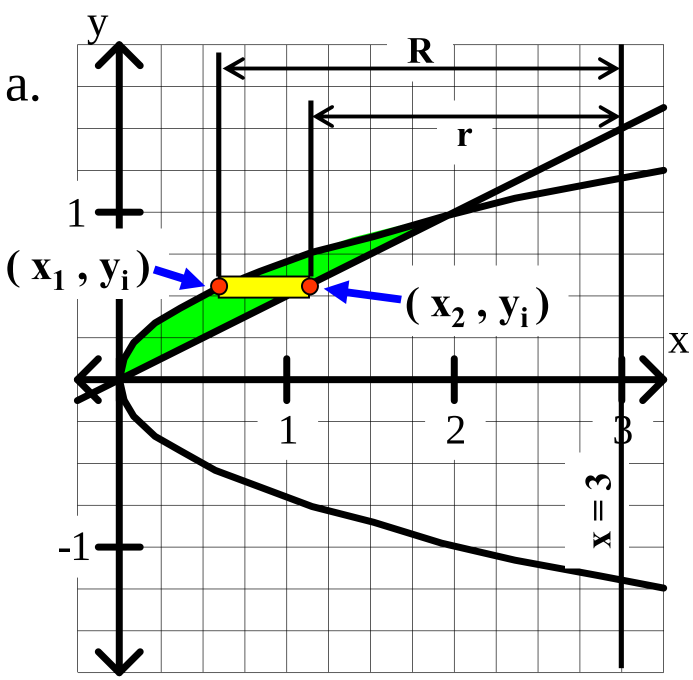

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c. $V = \pi\int_0^1 ((3 \text{ ï } 2y^2)^2 \text{ ï } (3 \text{ ï } 2y)^2)\,dy$

$V = \pi\int_0^1 (4y^4 \text{ ï } 16y^2 + 12y)\,dy$

d. $V \approx$

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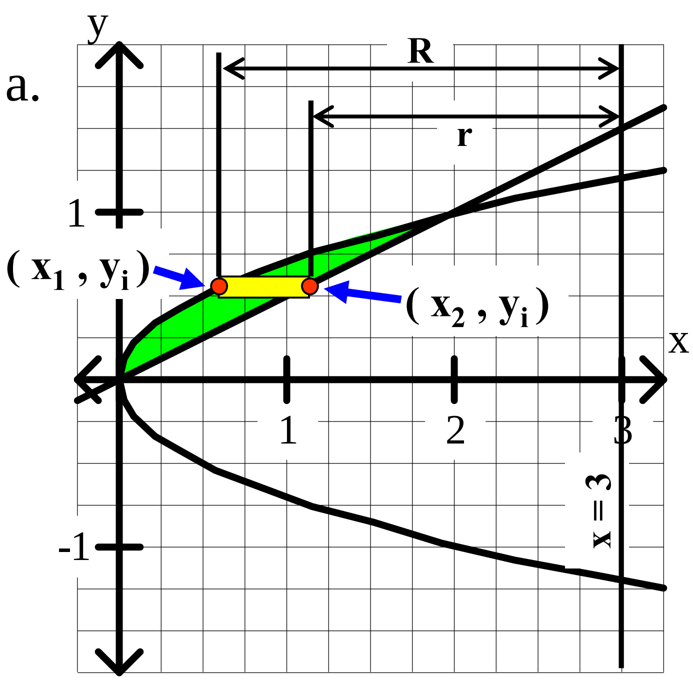

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$V = \pi \int_0^1 (4y^4 \text{ ï } 16y^2 + 12y)\, dy$

d. $V \approx 4.61$ cu. units

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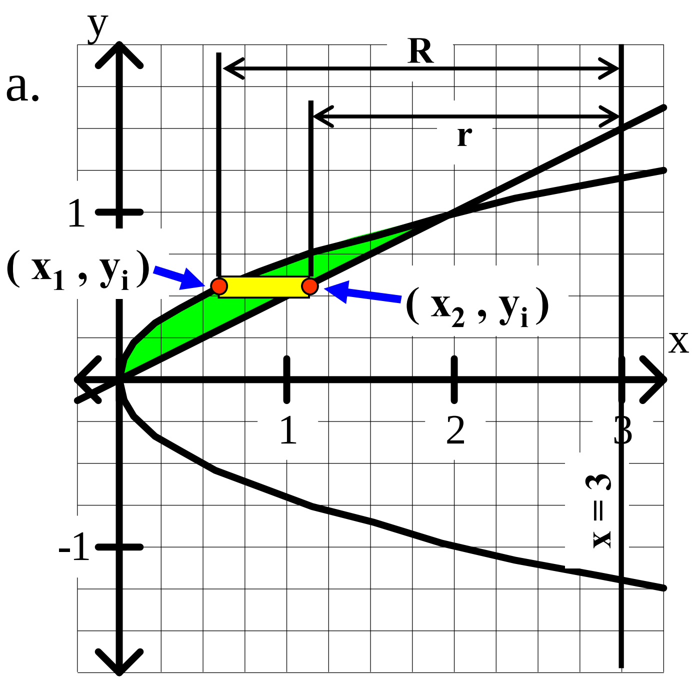

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$r = 3 - x_2 = 3 - 2y_i$

$h = \Delta y$

b. $V_i = \pi((3 - 2y_i^2)^2 - (3 - 2y_i)^2)\,\Delta y$

c. $V = \pi\int_0^1 ((3 - 2y^2)^2 - (3 - 2y)^2)\,dy$

$V = \pi\int_0^1 (4y^4 - 16y^2 + 12y)\,dy$

d. $V \approx 4.61$ cu. units