Calculus Lesson #4 Unit 11

Class Worksheet #4

Volume of Solids With Known Cross Section

Calculus Class Worksheet #4 Unit 11 Solutions

Known Cross Section

In each problem a solid is described. You must

a) sketch the base of the solid, showing a typical cross sectional slice,
b) write an expression for the volume of this cross sectional slice,
c) express the exact volume of the solid as a definite integral, and
d) evaluate the integral.

Sample 1. The base of a solid is the circle $x^2 + y^2 = 9$. Each cross section by a plane perpendicular to the x-axis is a square with one side in the base of the solid.

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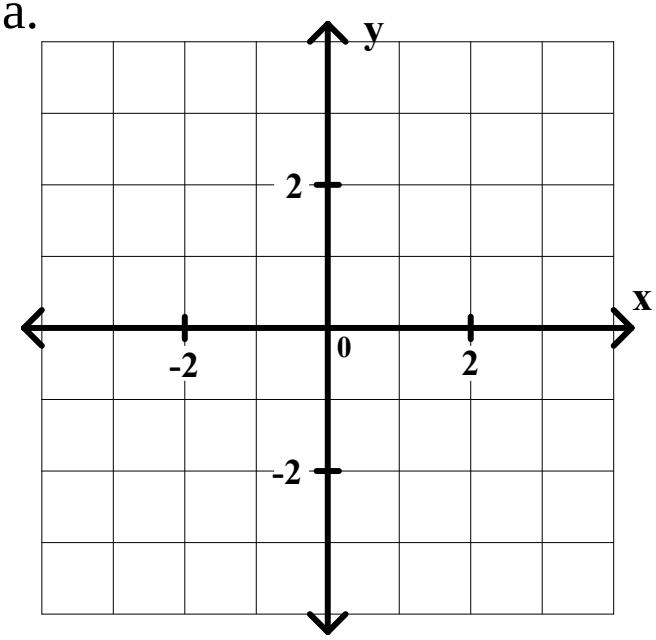

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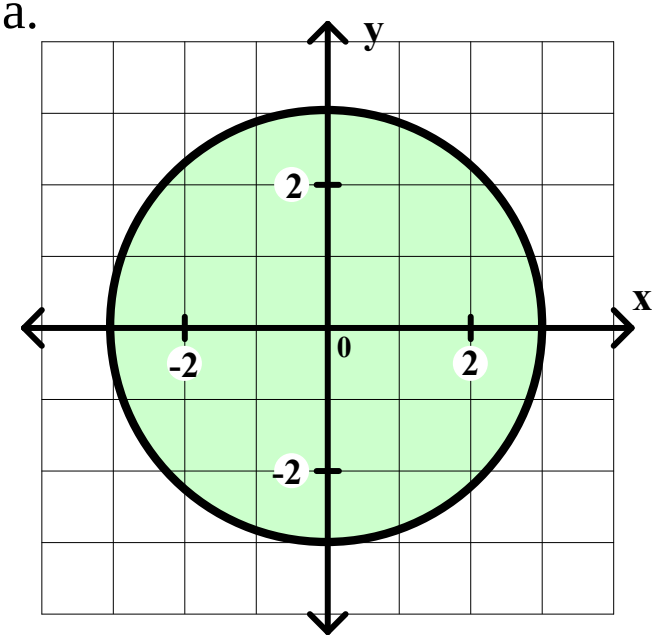

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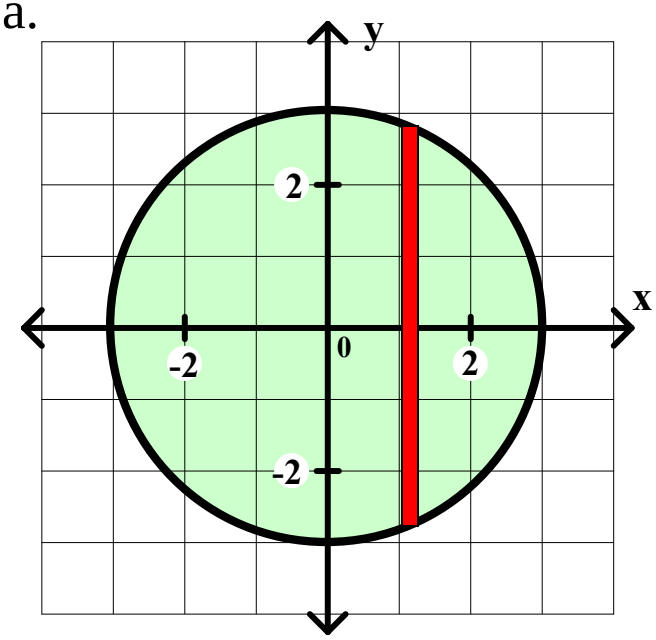

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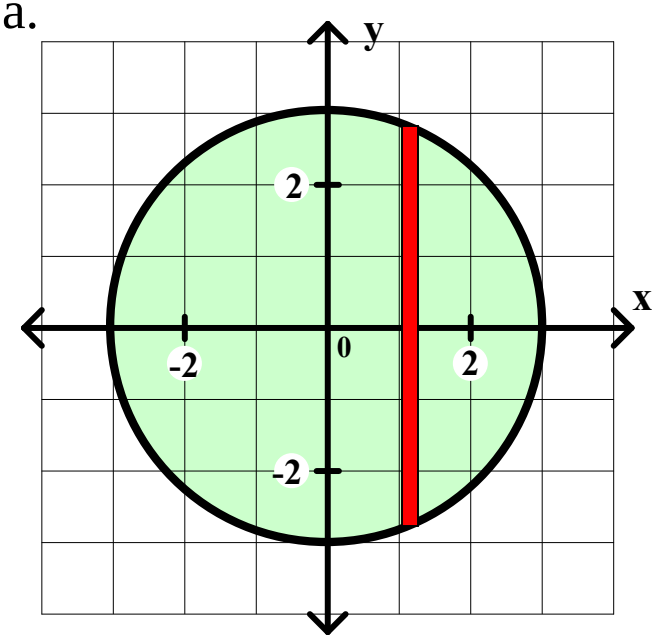

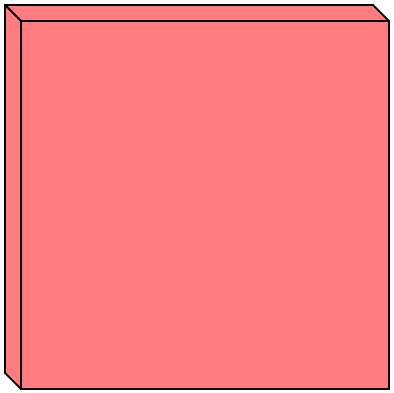

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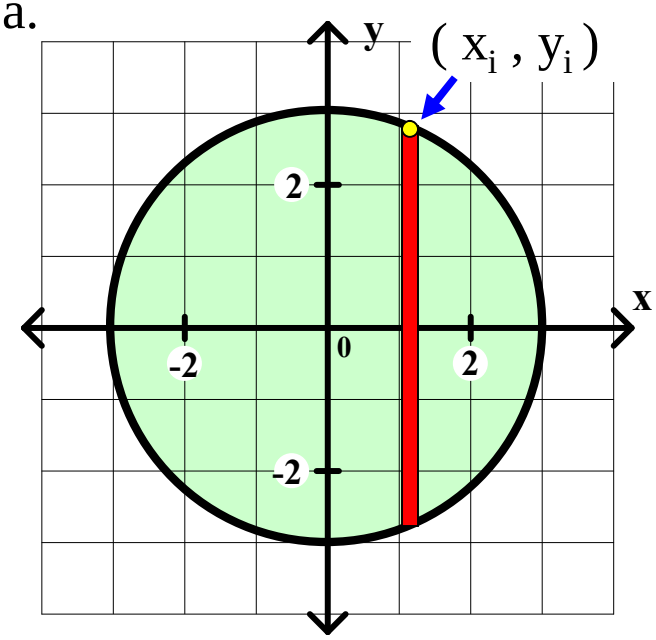

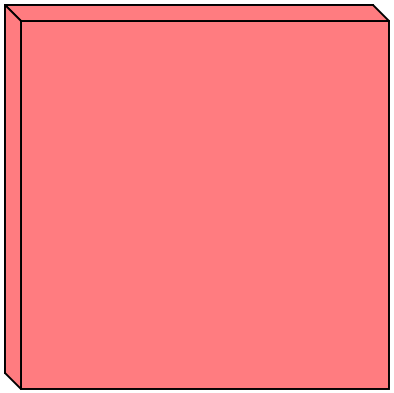

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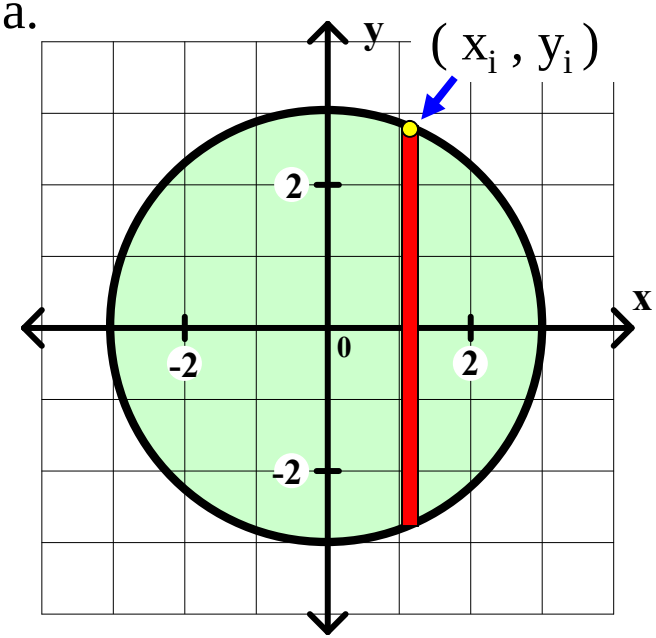

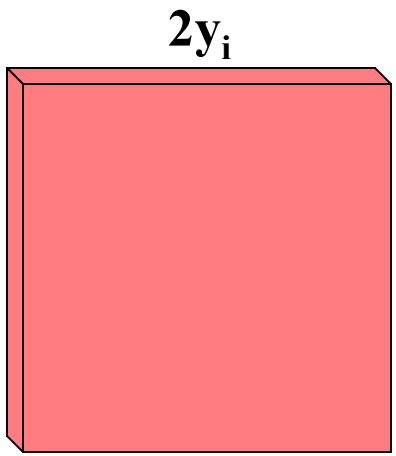

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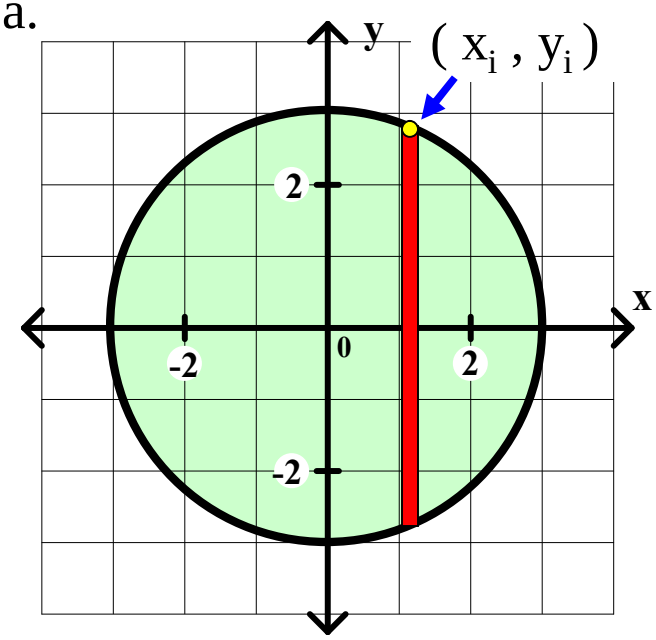

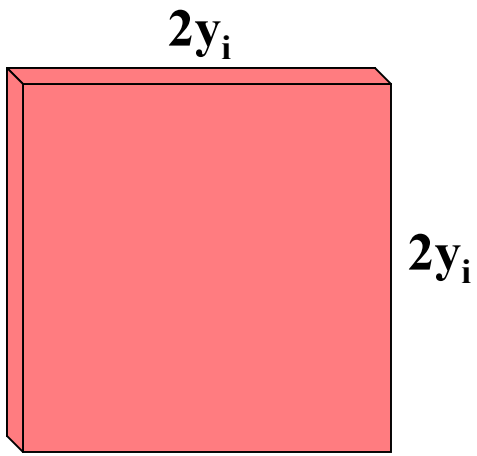

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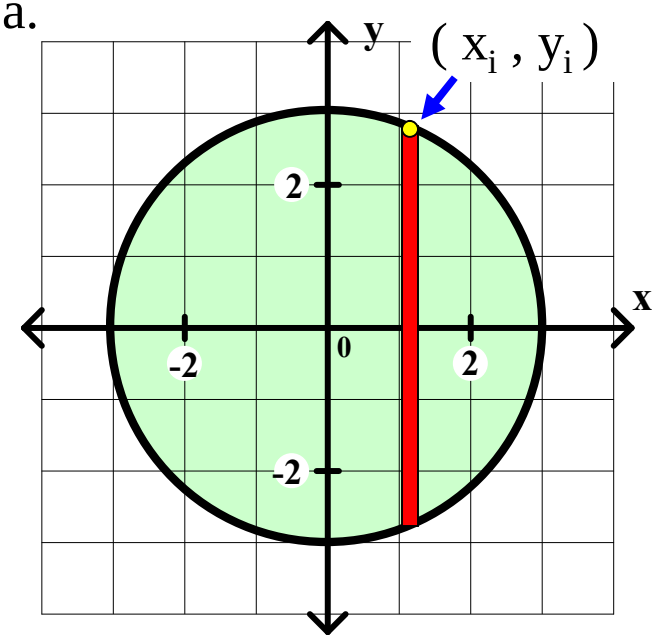
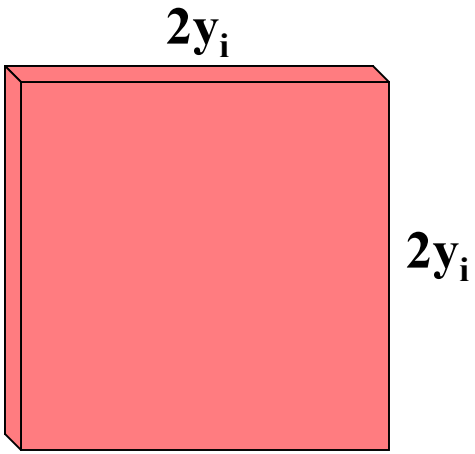


V =



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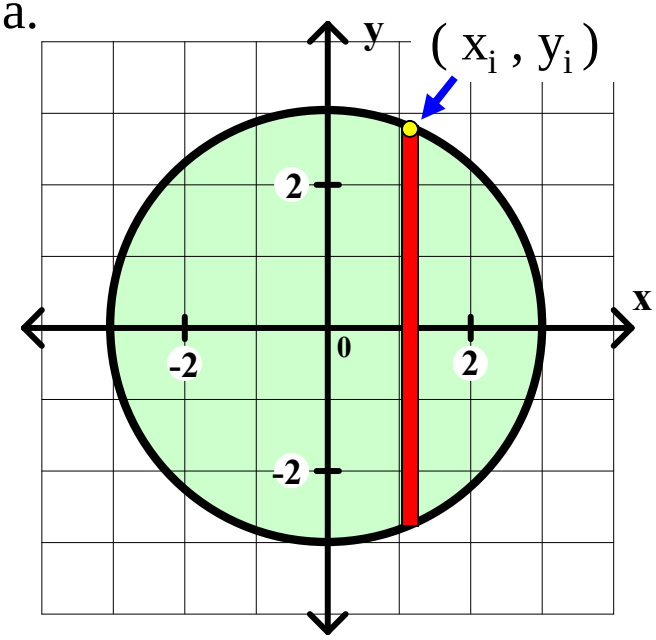
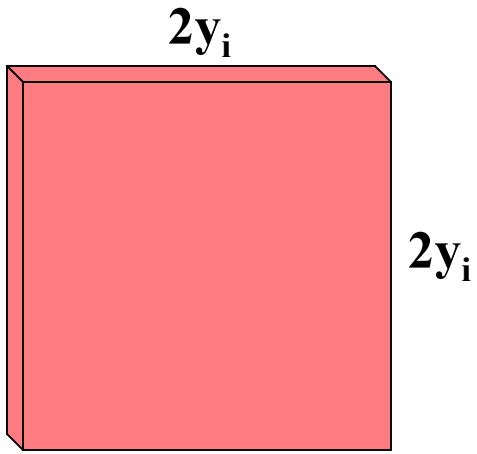


$V = A_c$



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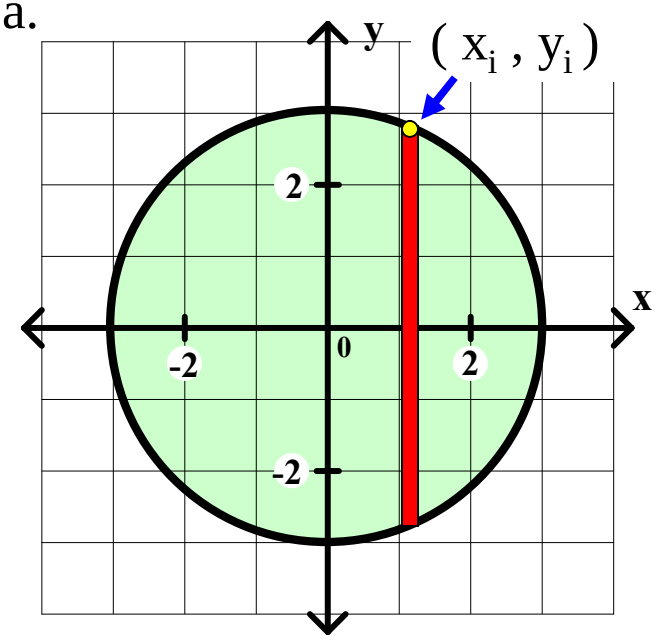
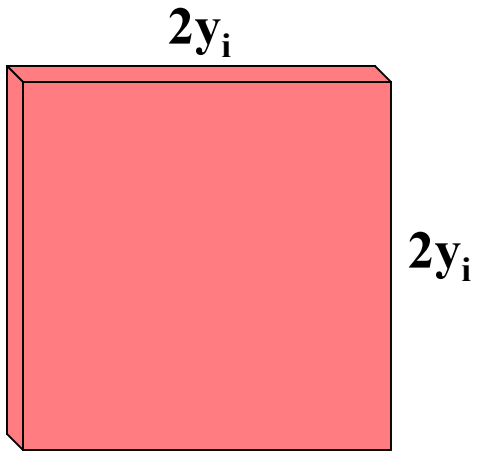


V = A_c (thickness)



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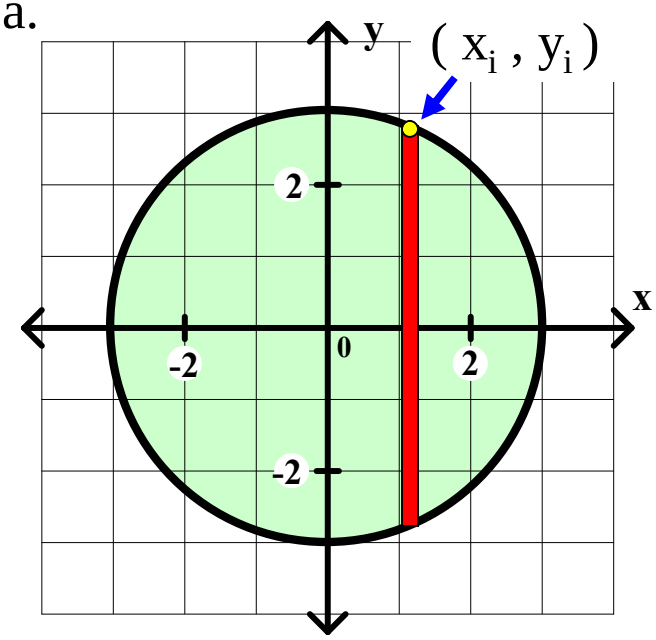
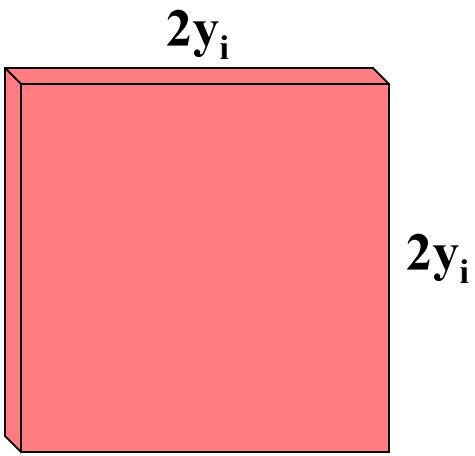


A_c =

thickness =



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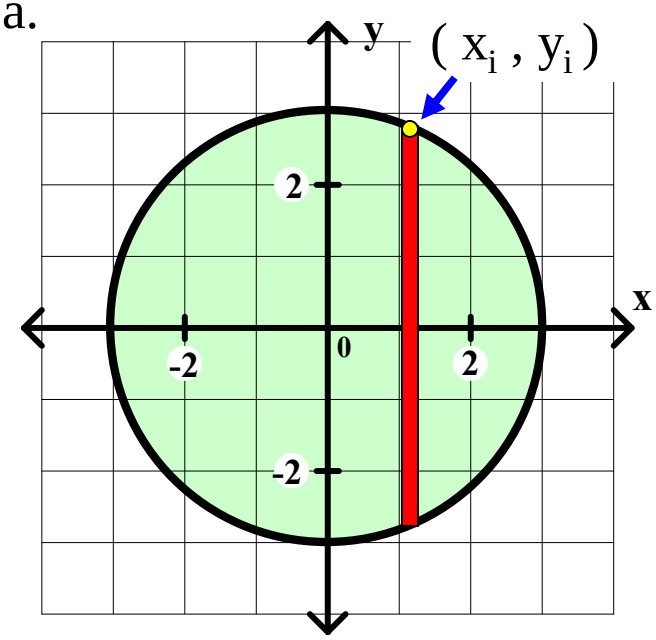
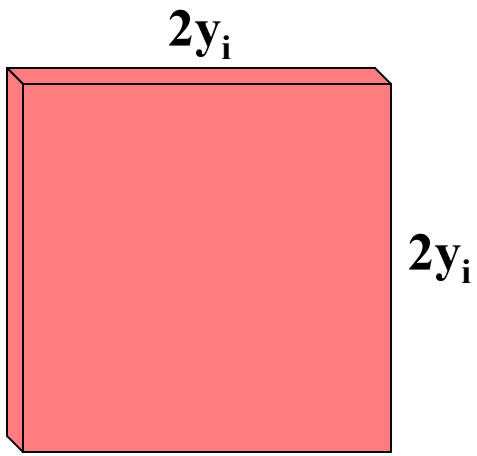


$A_c = 4y_i^2$

thickness =



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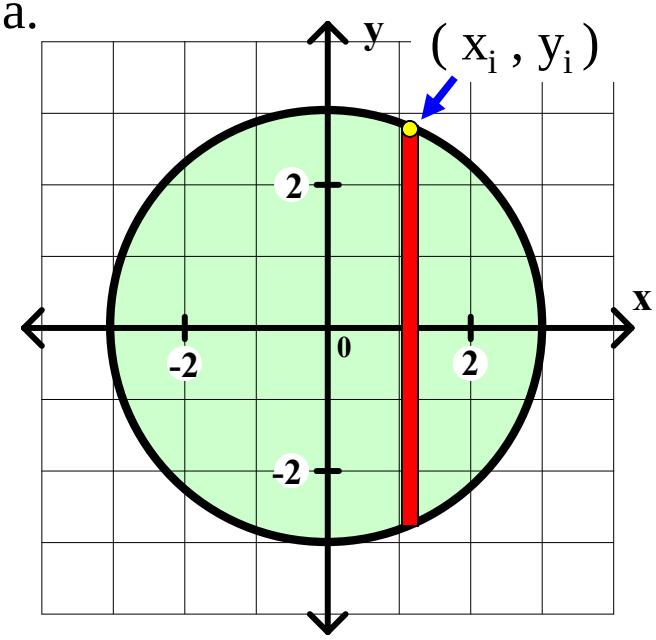
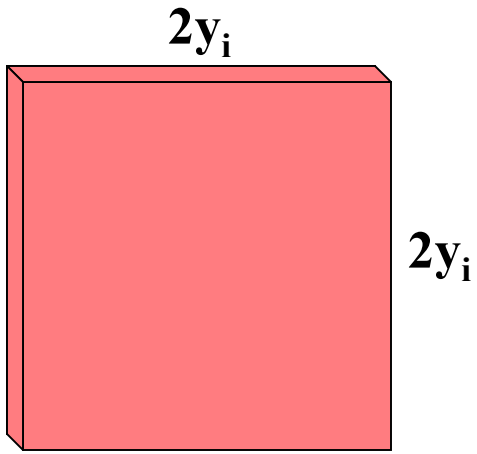


$A_c = 4y_i^2 =$

thickness = Δx



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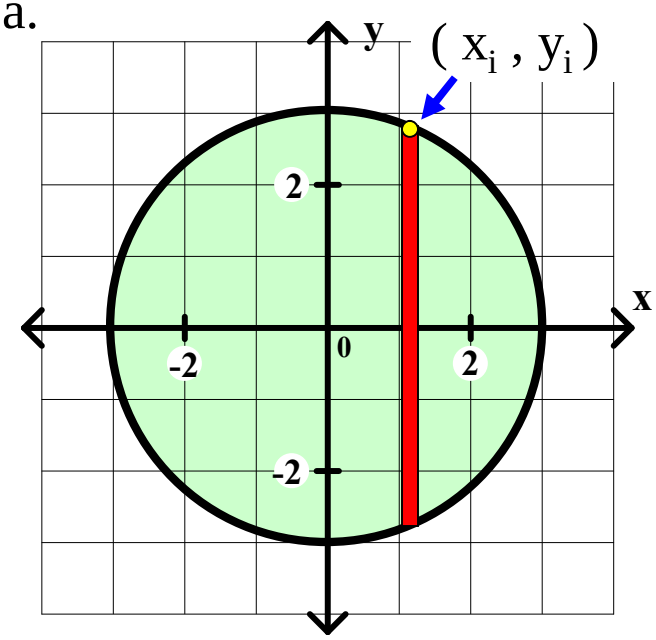
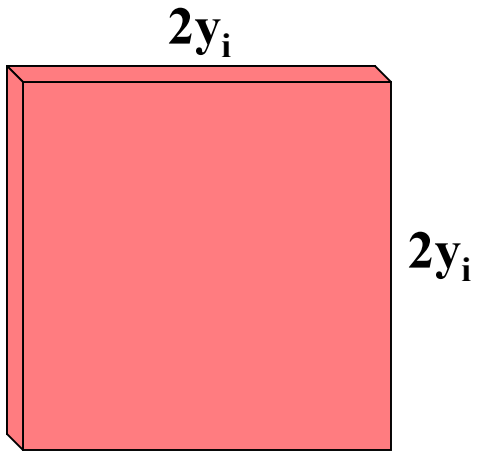


$A_c = 4y_i^2 = 4($

thickness = Δx



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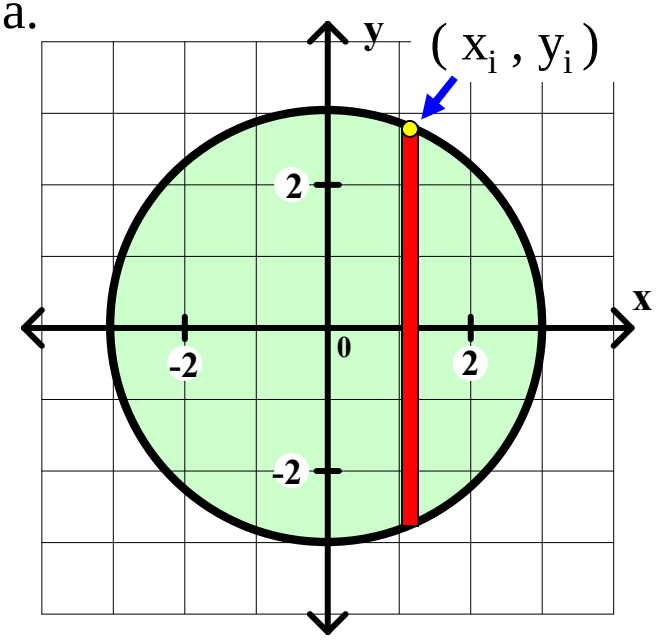
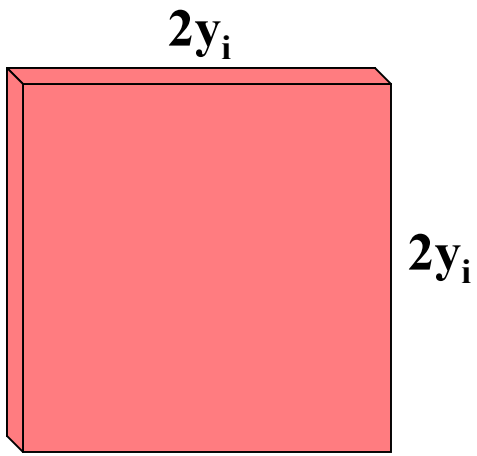


$A_c = 4y_i^2 = 4(9 - x_i^2)$

thickness = Δx



$V = A_c$ (thickness)

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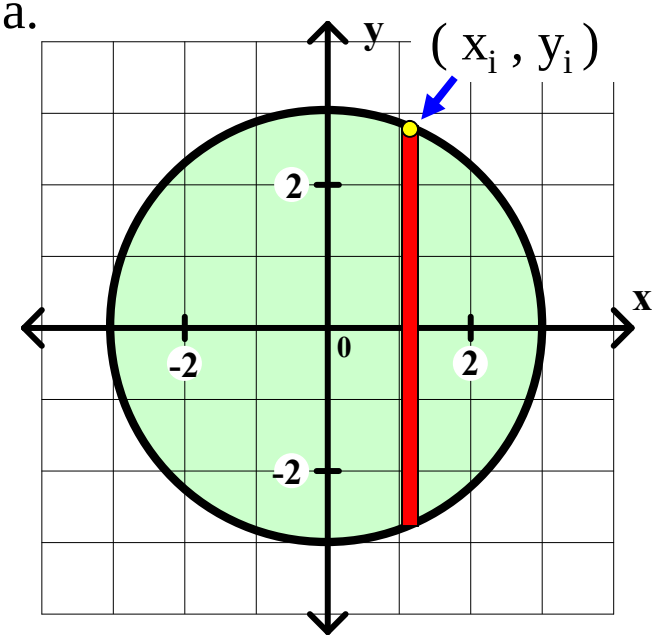

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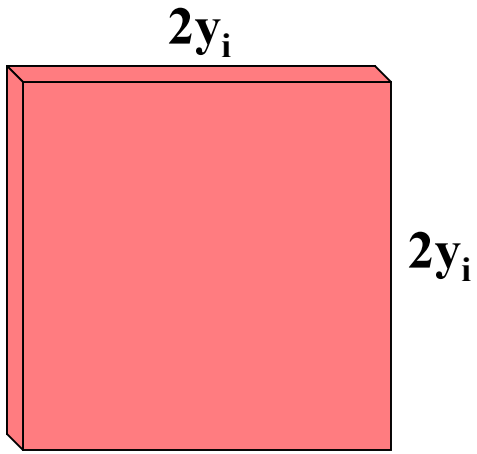
$V = A_c$ (thickness)

b. $V_i =$



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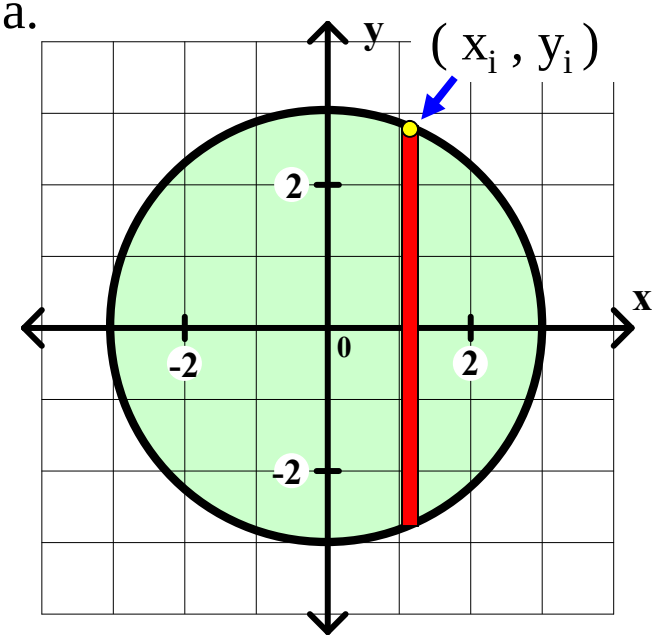

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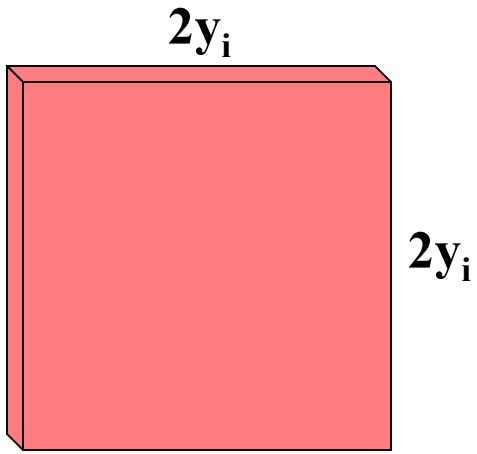
thickness = Δx



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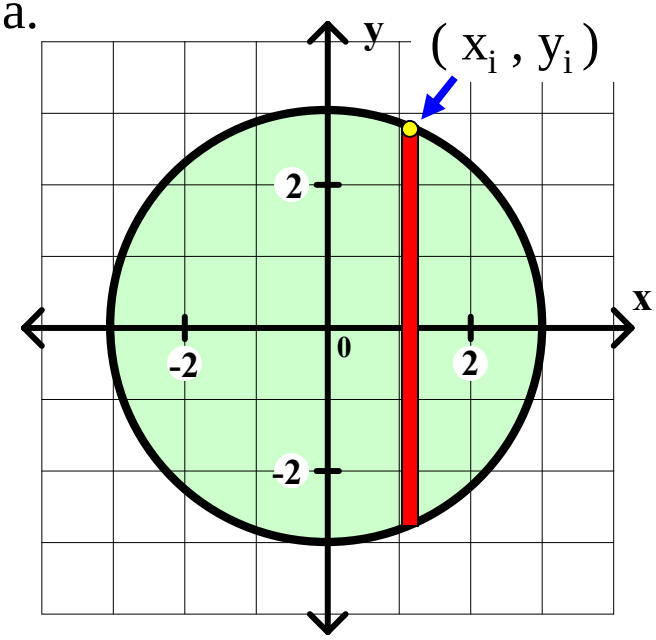

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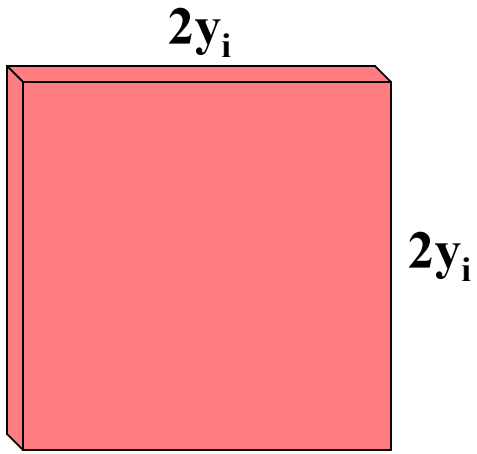
thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 4(9 - x_i^2)\Delta x$

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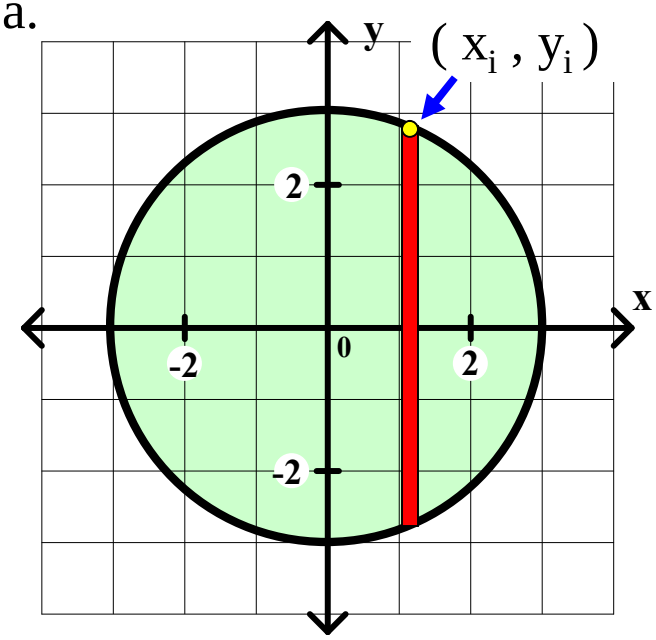
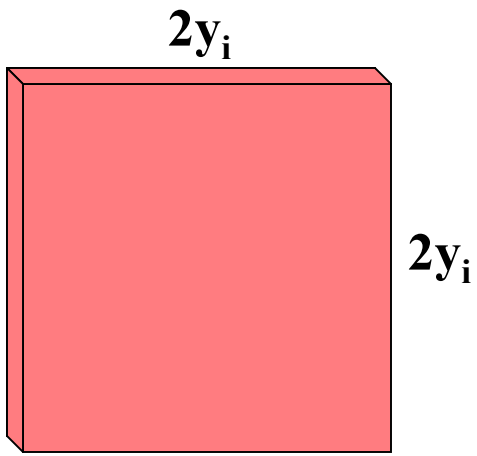


$A_c = 4y_i^2 = 4(9 - x_i^2)$

thickness $= \Delta x$



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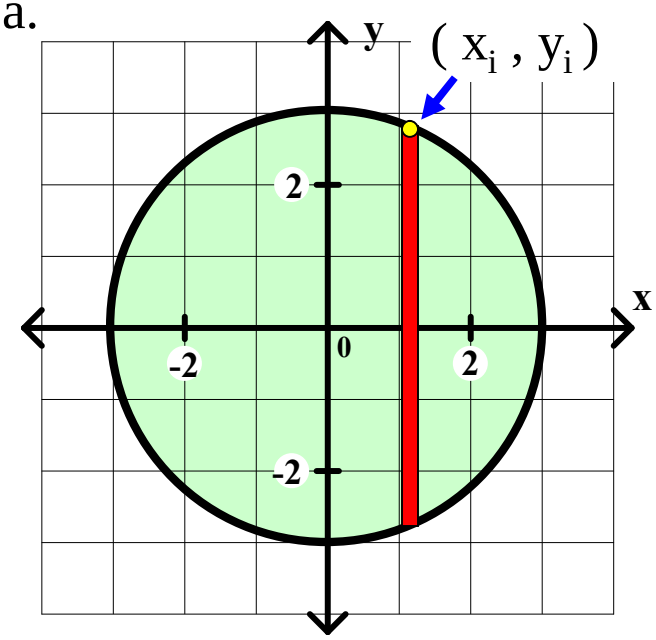
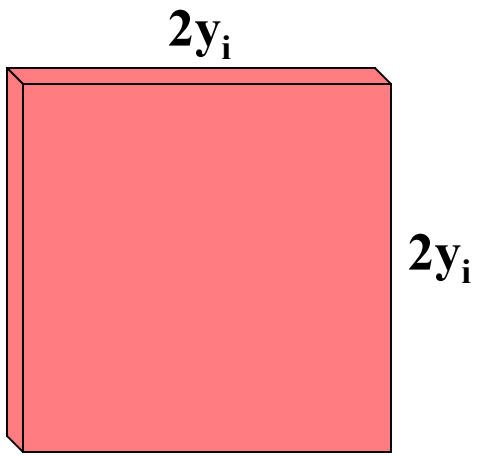


$A_c = 4y_i^2 = 4(9 - x_i^2)$

thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 4(9 - x_i^2)\Delta x$

c. $V =$

Calculus Class Worksheet #4 Unit 11 Solutions

Known Cross Section

In each problem a solid is described. You must

a) sketch the base of the solid, showing a typical cross sectional slice,
b) write an expression for the volume of this cross sectional slice,
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Sample 1. The base of a solid is the circle $x^2 + y^2 = 9$. Each cross section by a plane perpendicular to the x-axis is a square with one side in the base of the solid.

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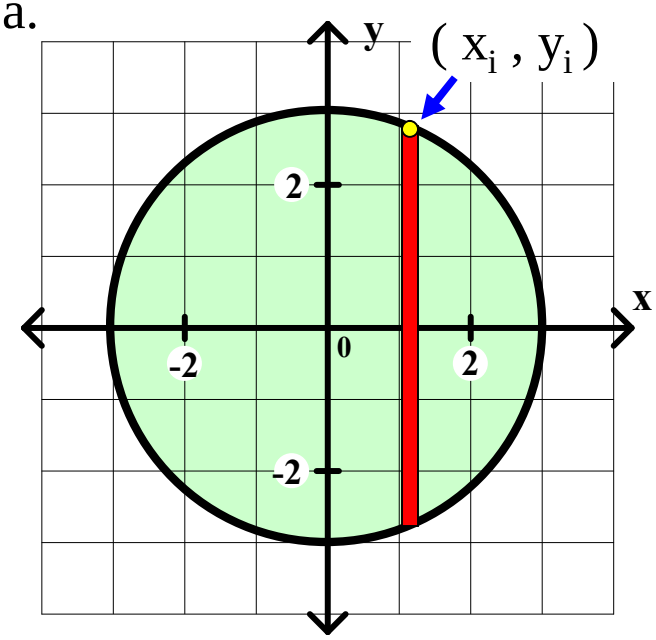
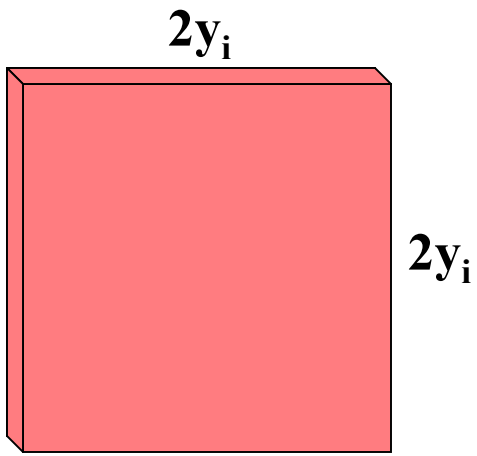


$A_c = 4y_i^2 = 4(9 - x_i^2)$

thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 4(9 - x_i^2)\Delta x$

c. $V = 4$

Calculus Class Worksheet #4 Unit 11 Solutions

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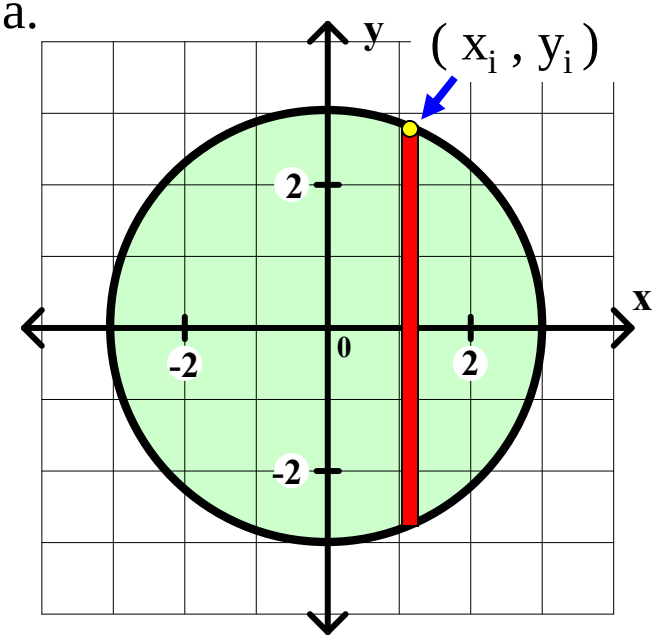

$A_c = 4y_i^2 = 4(9 - x_i^2)$

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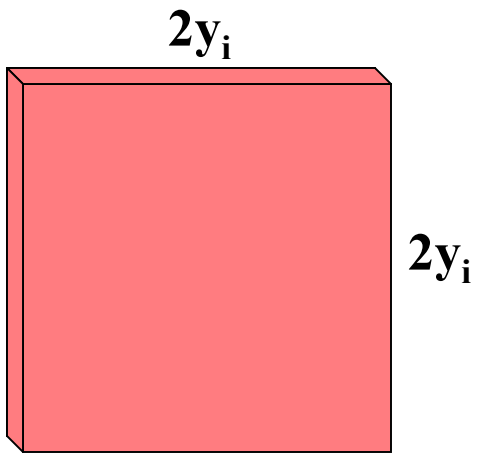

$V = A_c$ (thickness)

b. $V_i = 4(9 - x_i^2)\Delta x$

c. $V = 4\int$

Calculus Class Worksheet #4 Unit 11 Solutions

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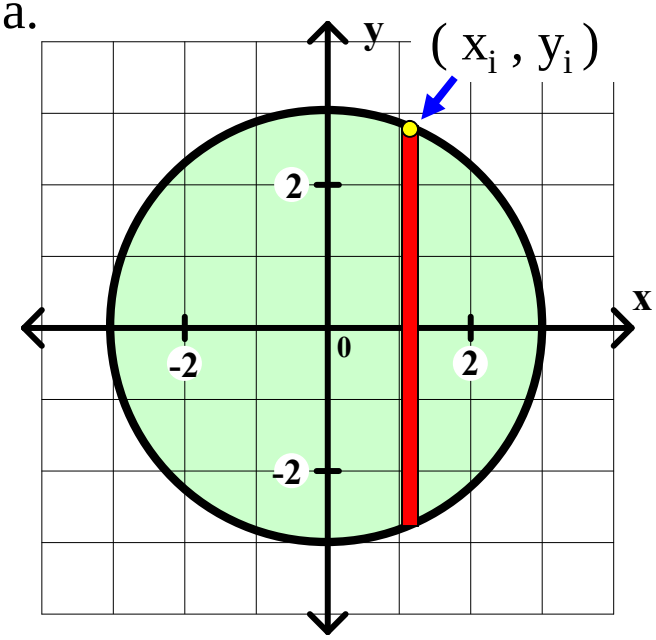
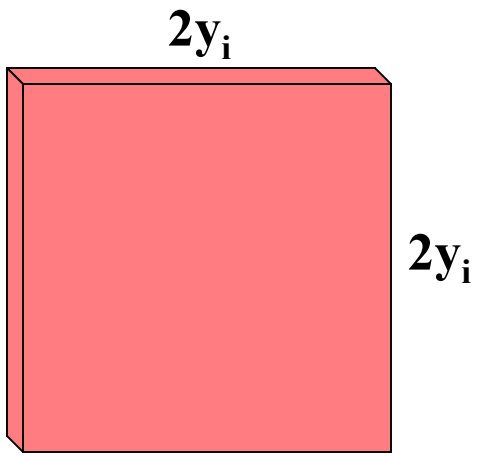


$A_c = 4y_i^2 = 4(9 - x_i^2)$

thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 4(9 - x_i^2)\Delta x$

c. $V = 4\int (9 - x^2)$

Calculus Class Worksheet #4 Unit 11 Solutions

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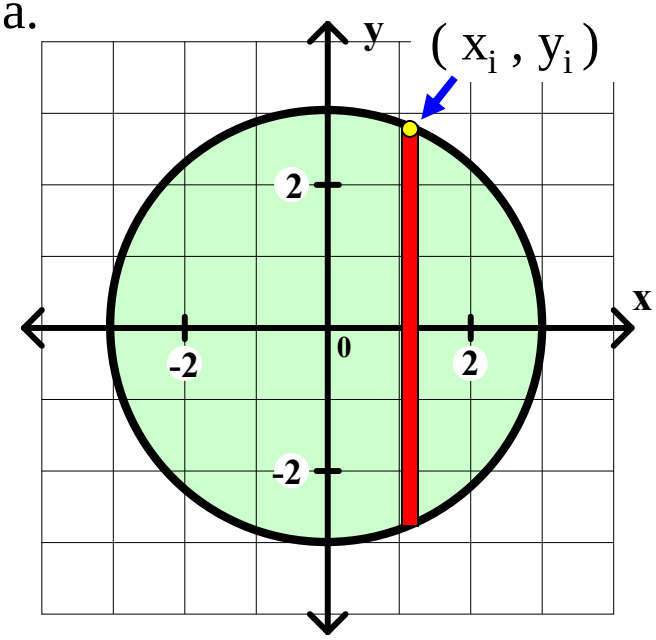

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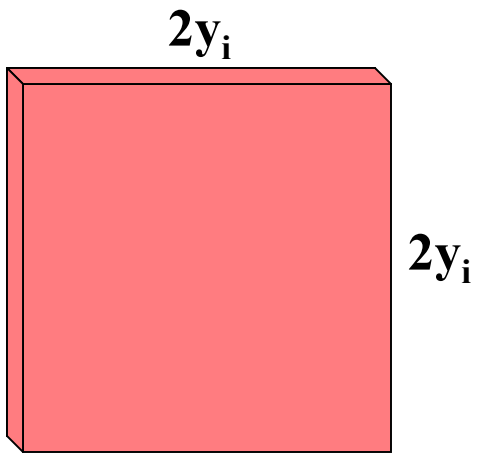

$V = A_c$ (thickness)

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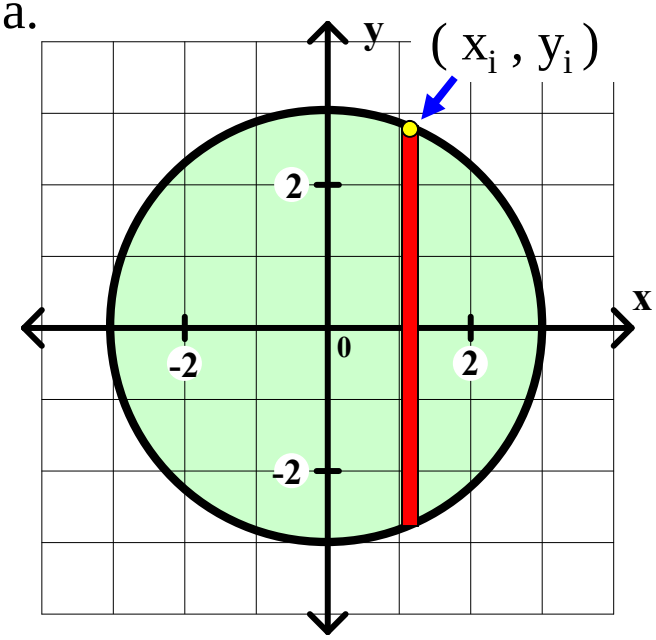

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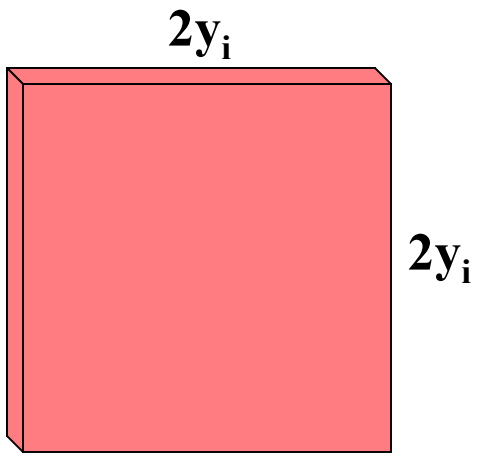

$V = A_c$ (thickness)

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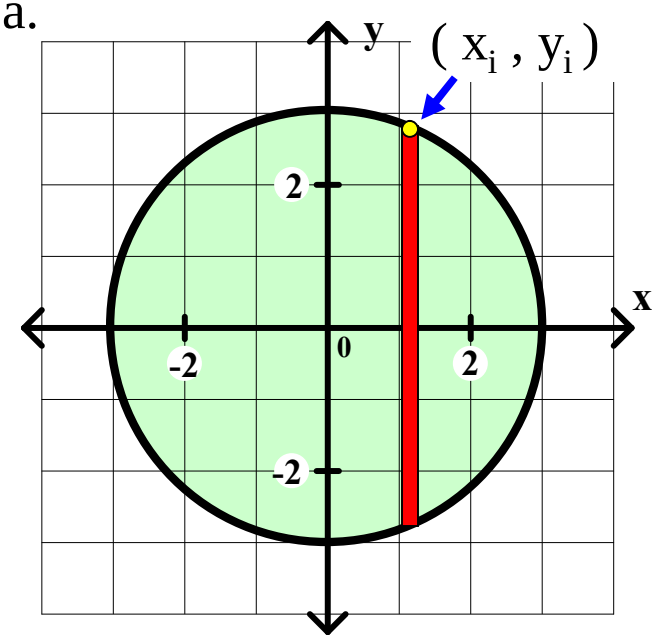

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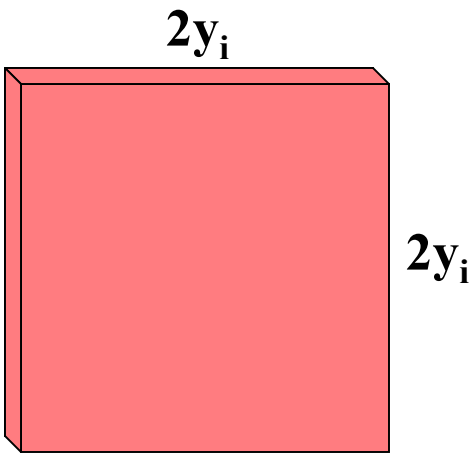

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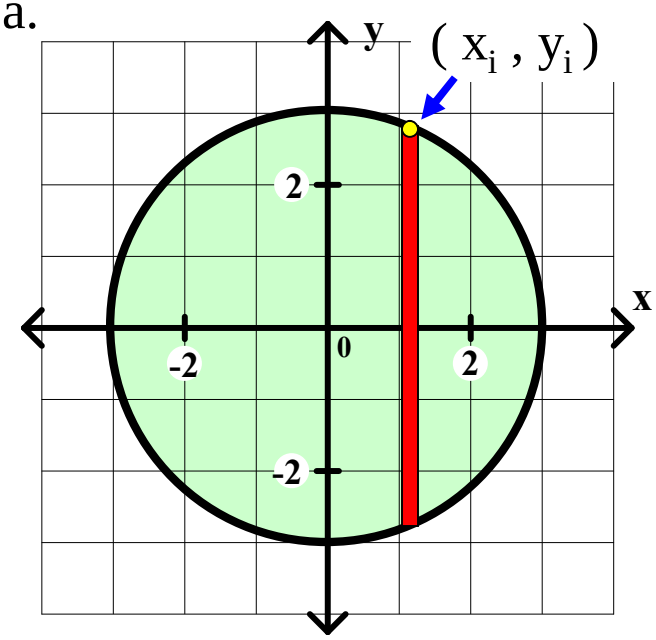

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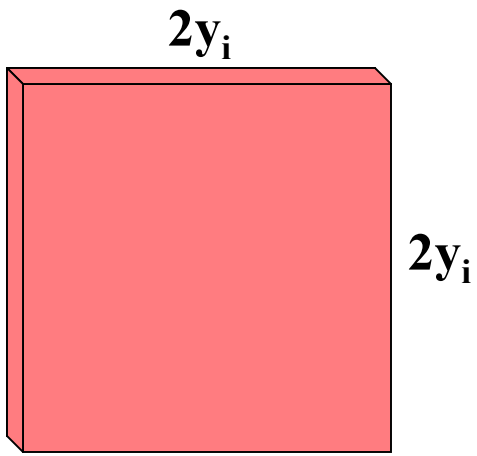

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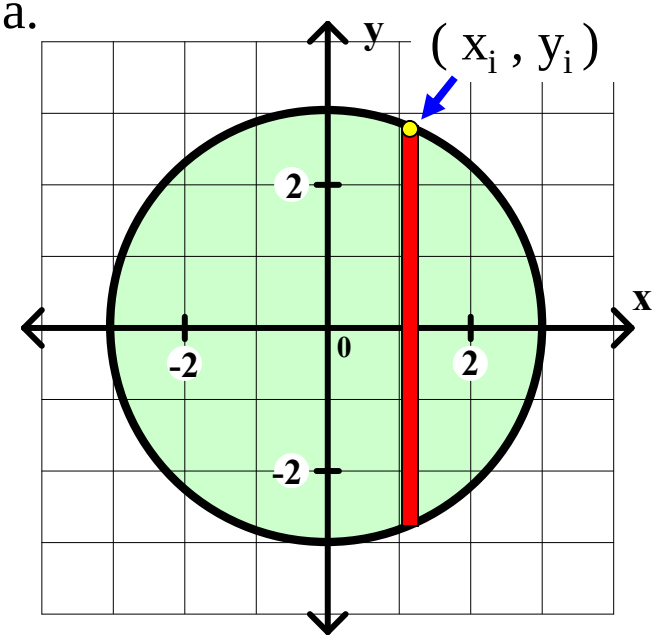

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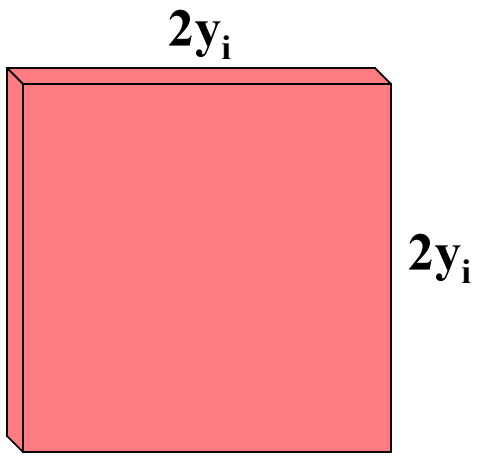

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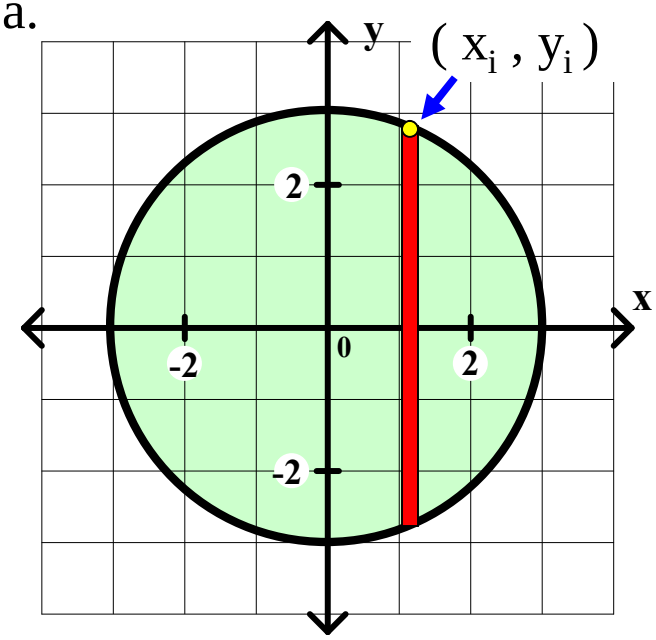

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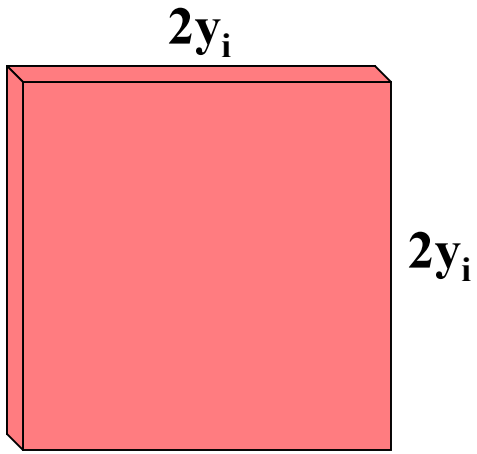
thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 4(9 - x_i^2)\Delta x$

c. $V = 4\int_{-3}^{3} (9 - x^2)\, dx$

d. V = 144 cu. units

Calculus Class Worksheet #4 Unit 11 Solutions

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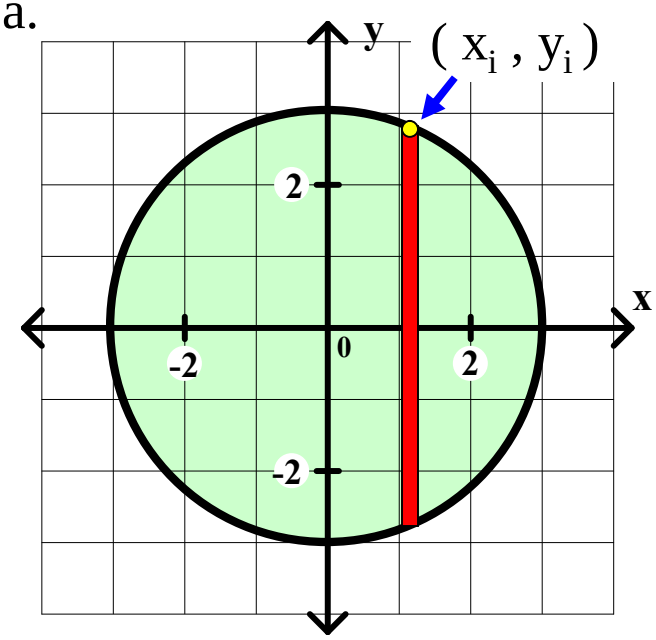

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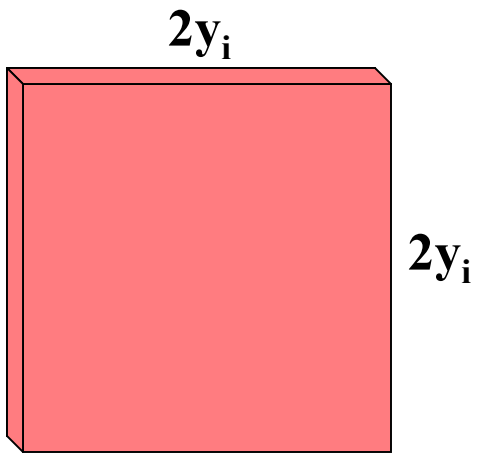

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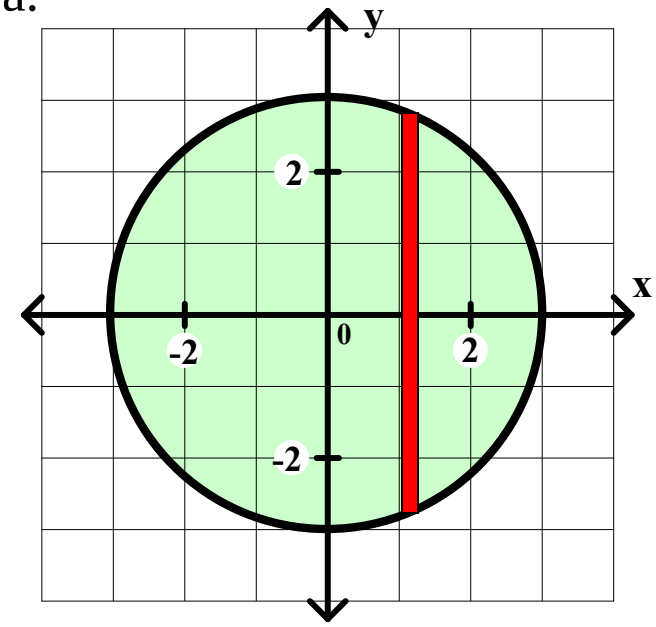

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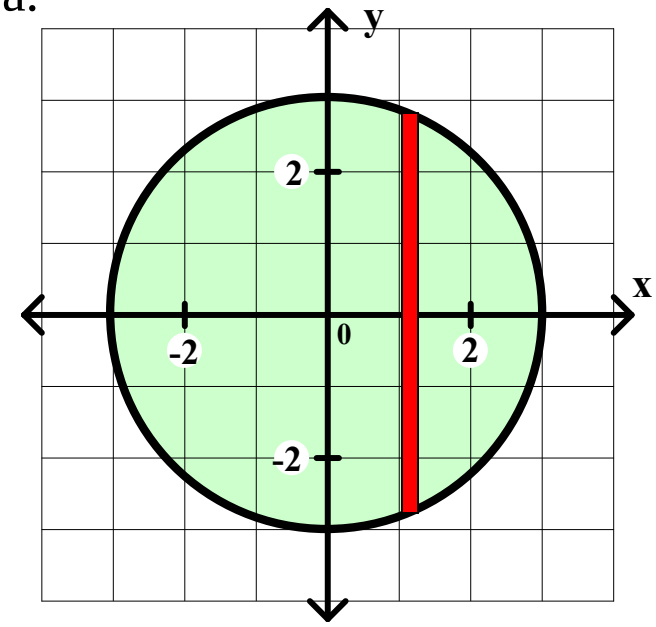

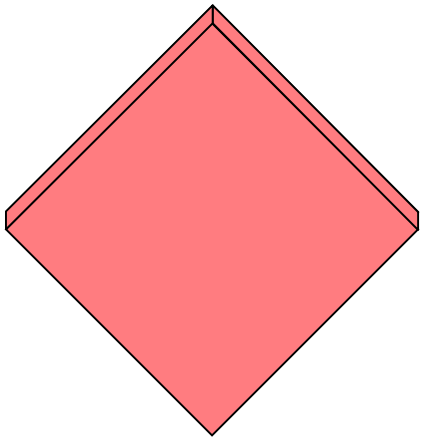

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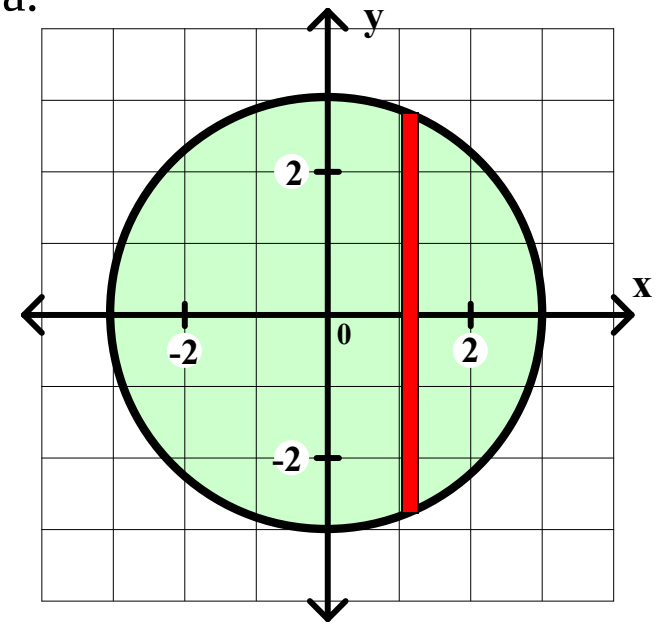

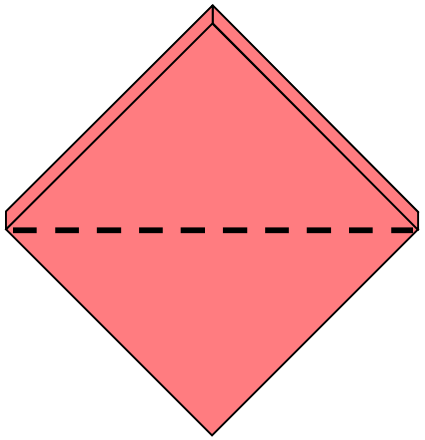

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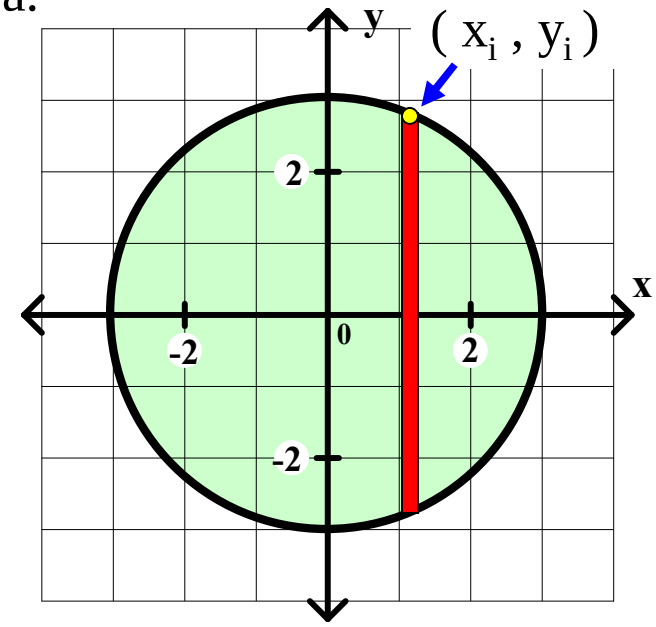

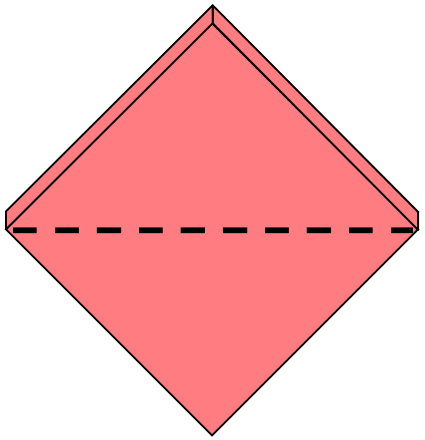

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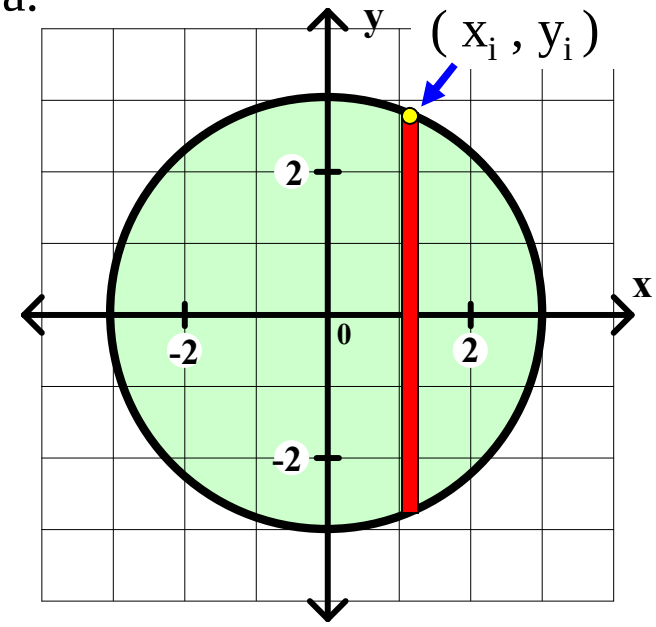

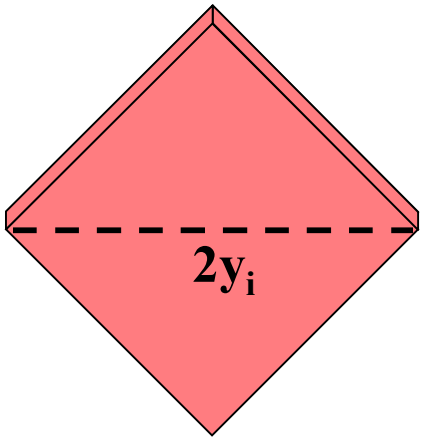

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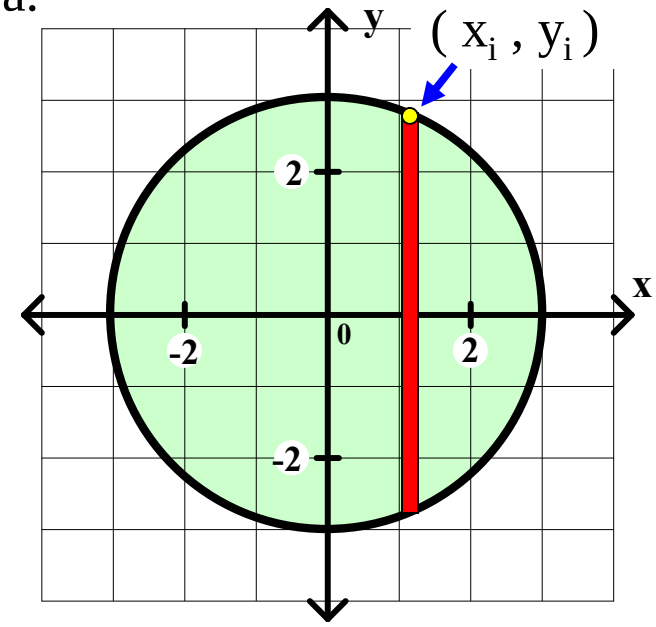

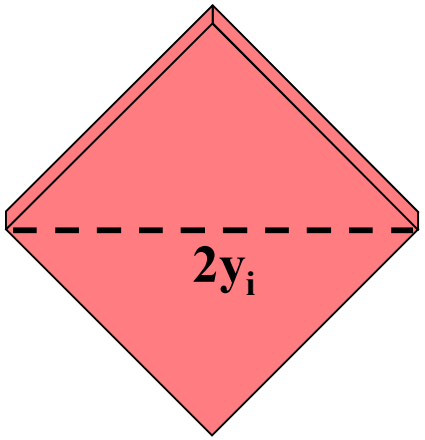

$V = A_c$ (thickness)

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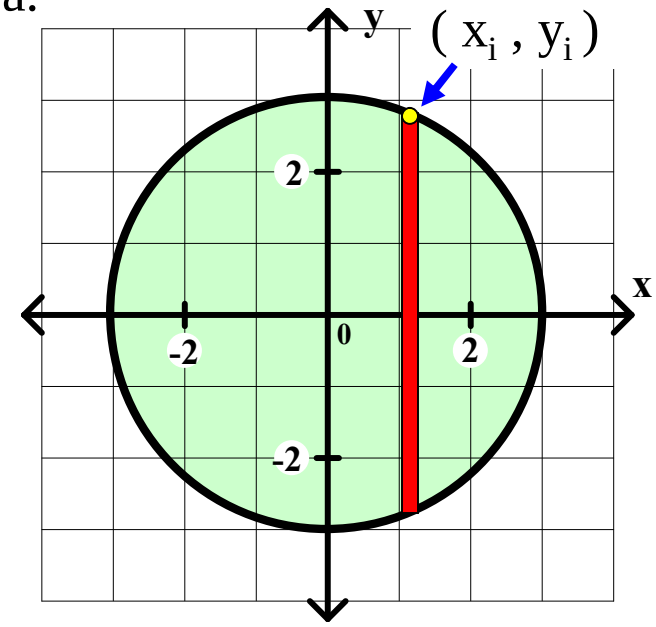
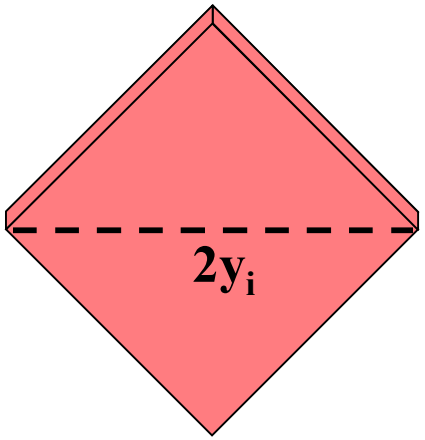


A_c =

thickness =



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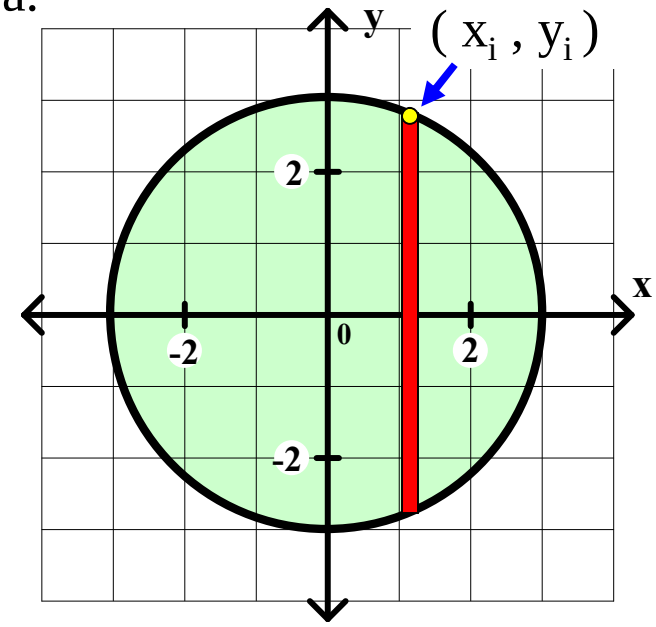
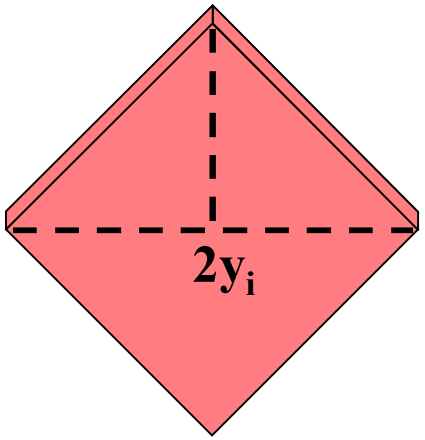


A_c =

thickness =



$V = A_c$ (thickness)

Calculus Class Worksheet #4 Unit 11 Solutions

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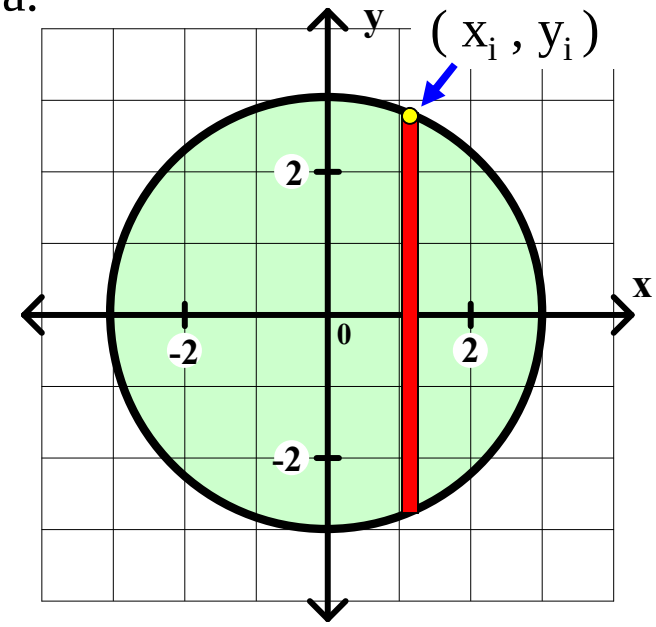

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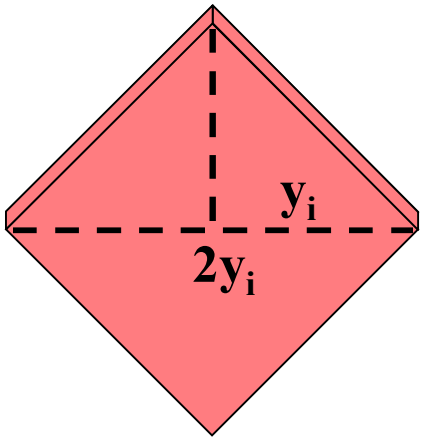

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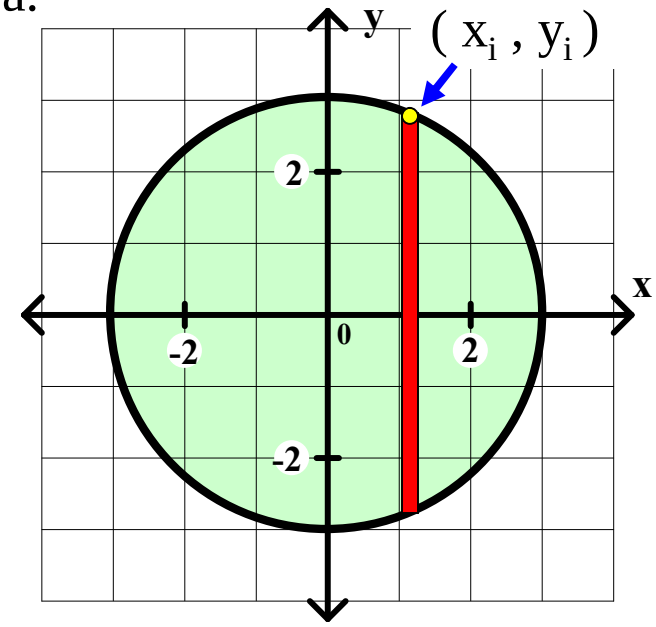

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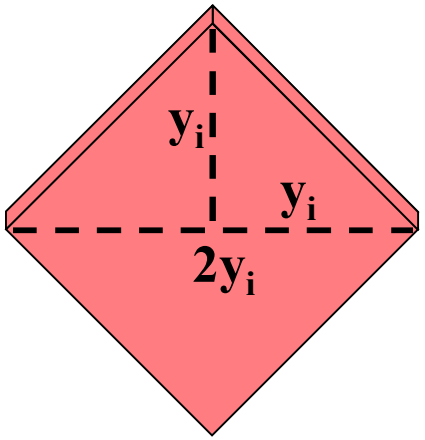

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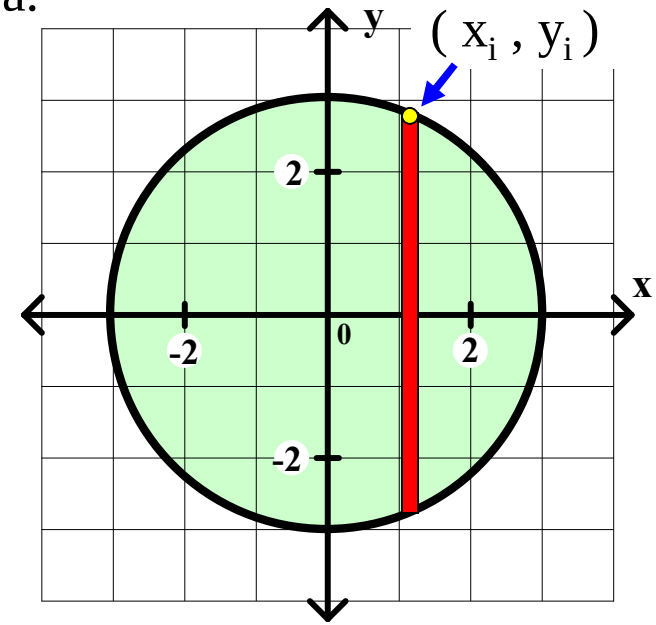
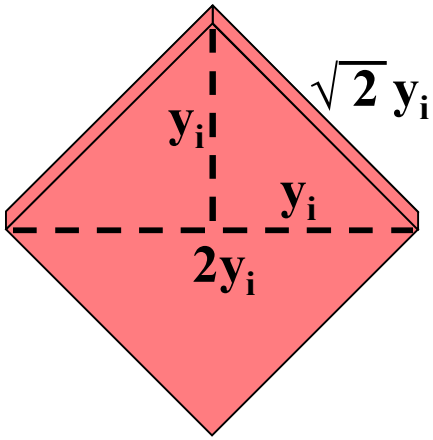


A_c =

thickness =



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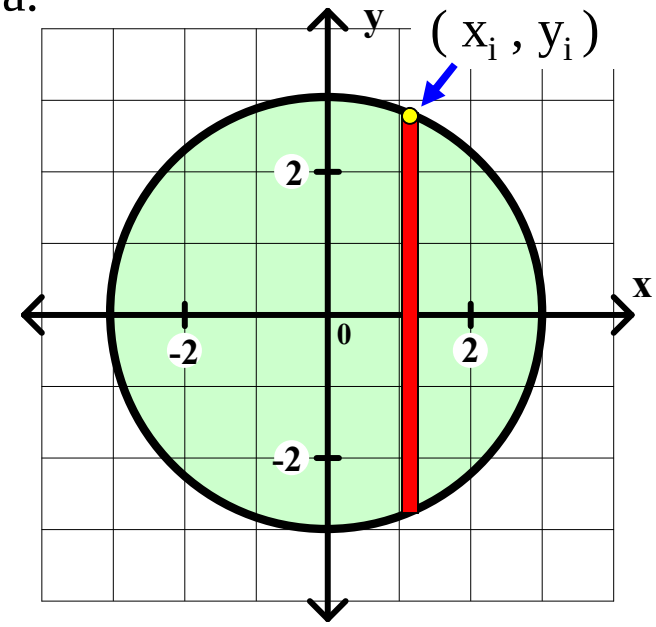

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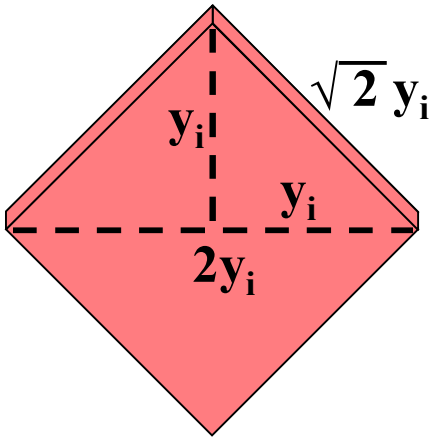

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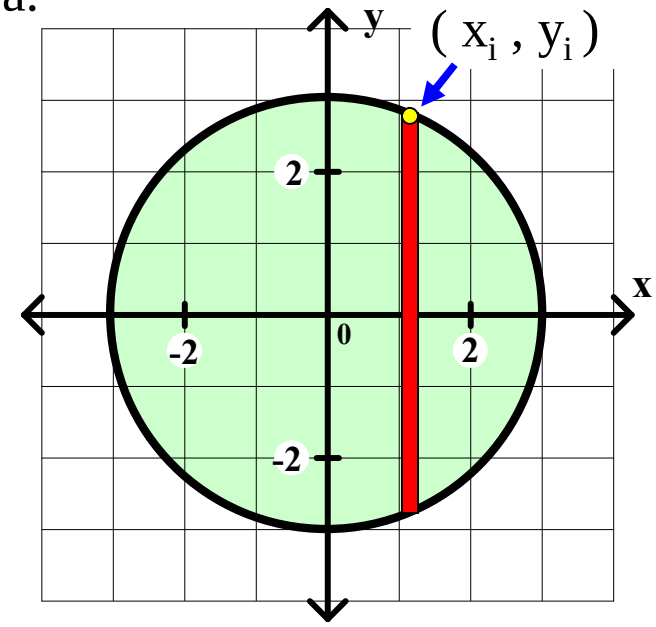
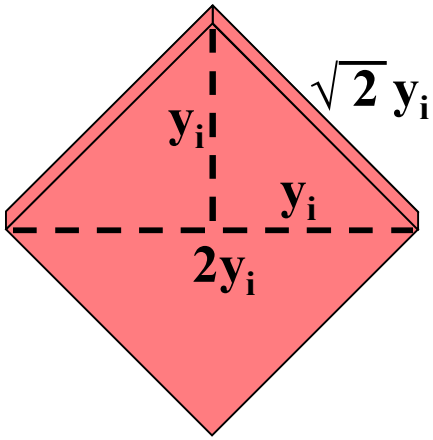


$A_c = 2y_i^2$

thickness = Δx

$V = A_c$ **(thickness)**



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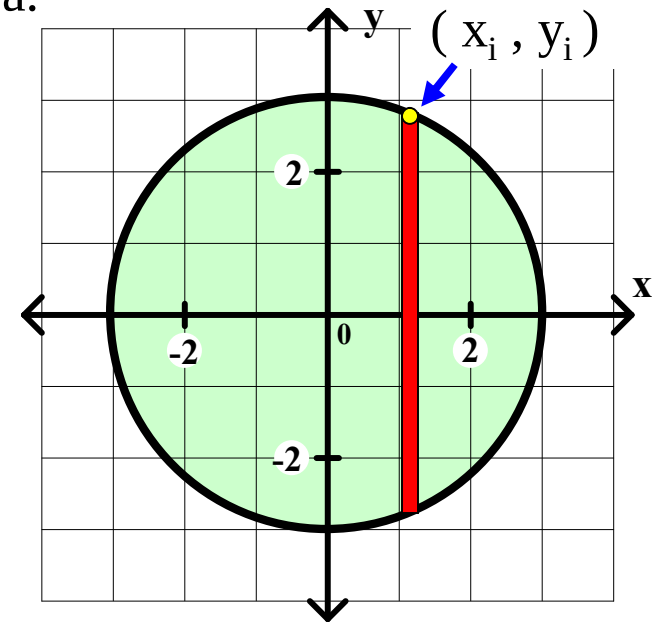

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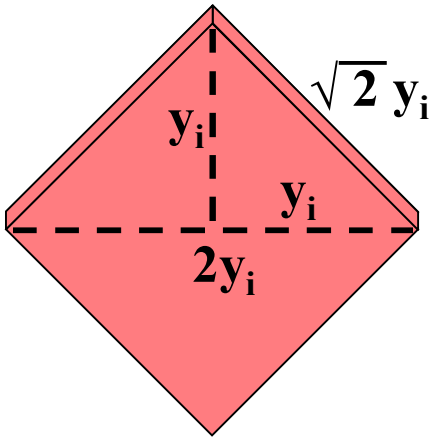

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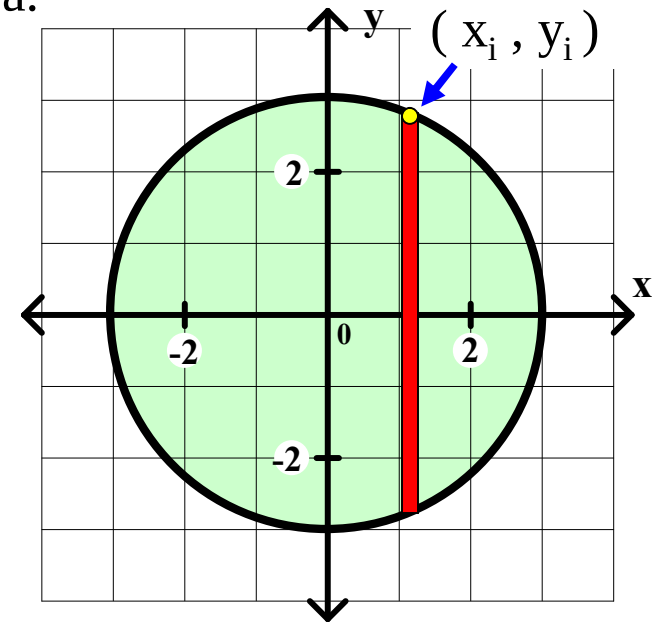
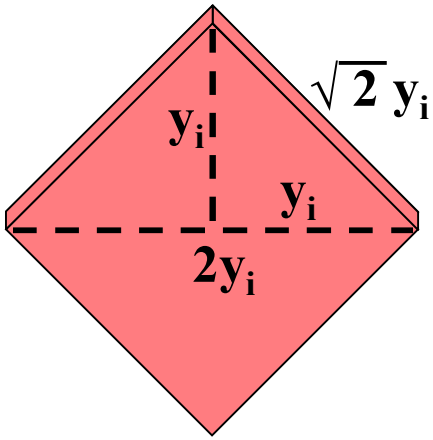


$A_c = 2y_i^2 = 2($

thickness = Δx



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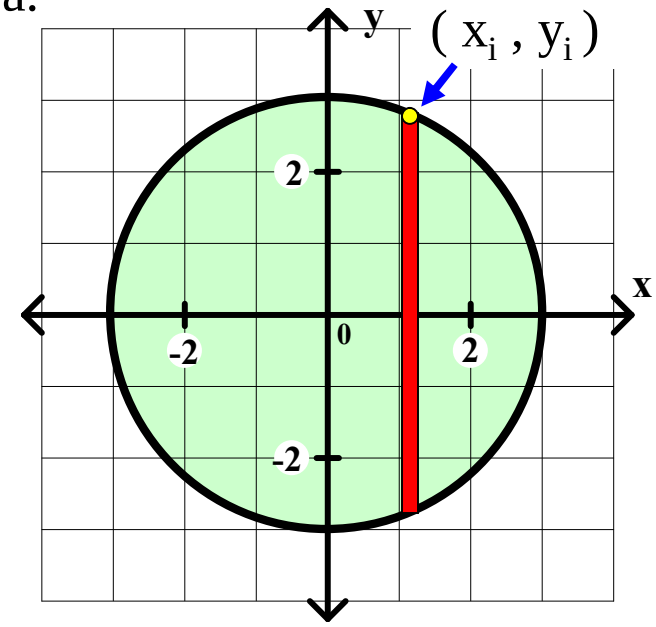
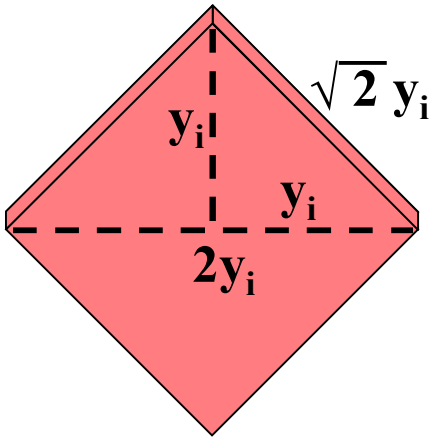


$A_c = 2y_i^2 = 2(9 - x_i^2)$

thickness = Δx

$V = A_c$ (thickness)



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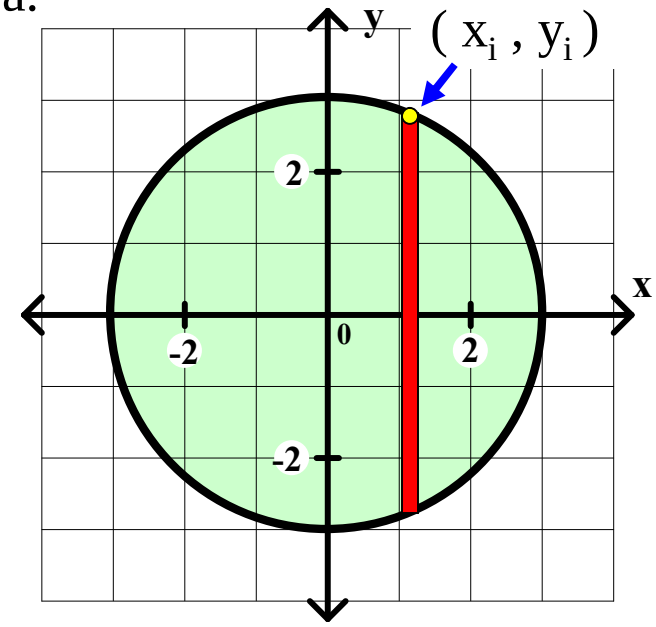

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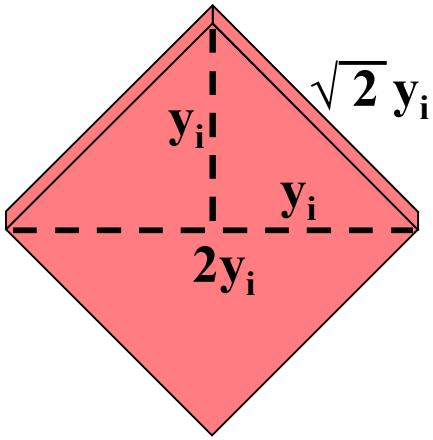
thickness $= \Delta x$

$V = A_c$ **(thickness)**

b. $V_i =$



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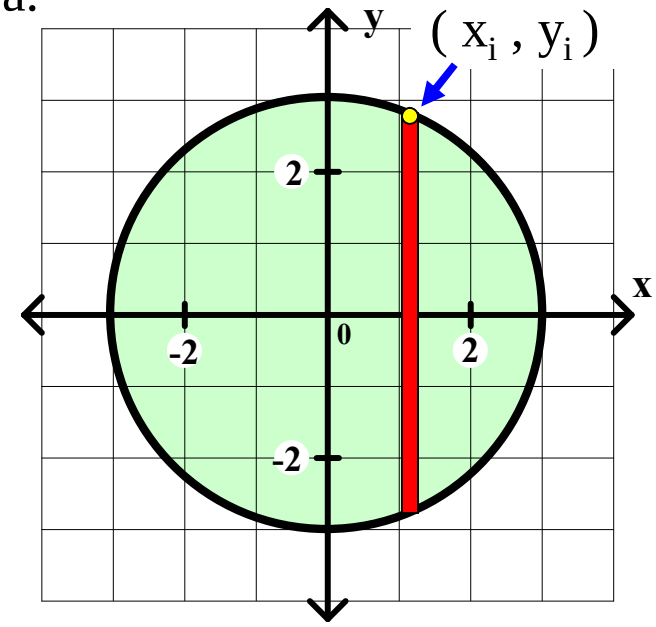

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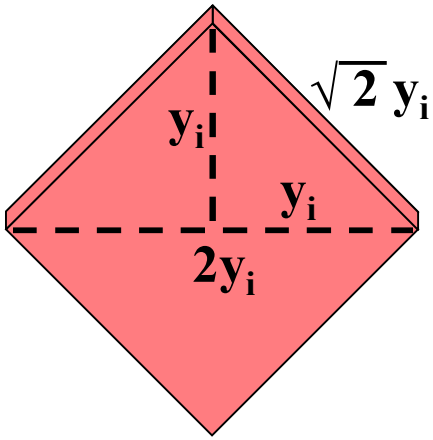

b. $V_i = 2(9 - x_i^2)$

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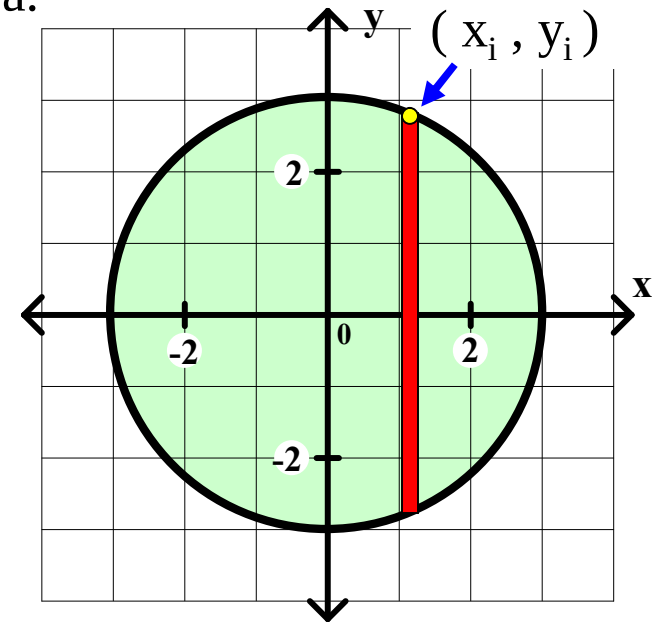

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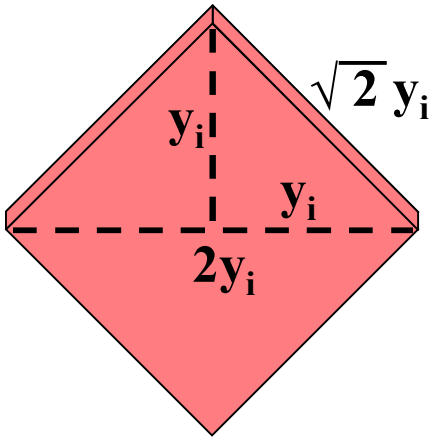

b. $V_i = 2(9 - x_i^2)\Delta x$

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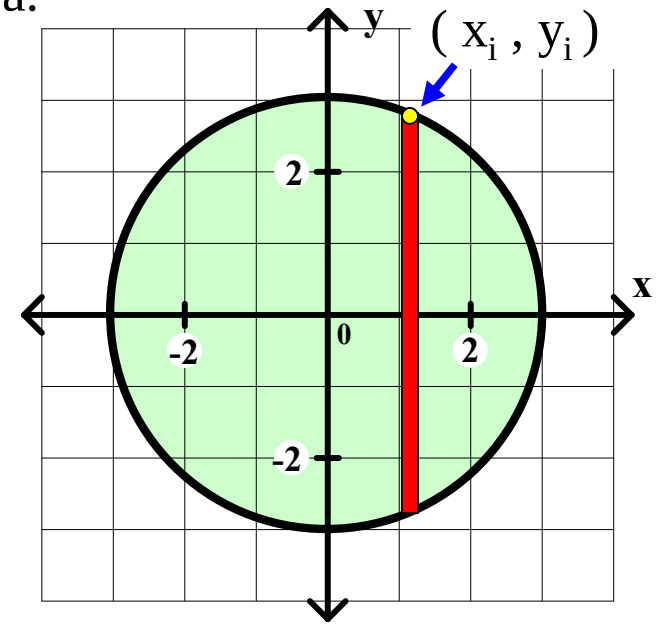

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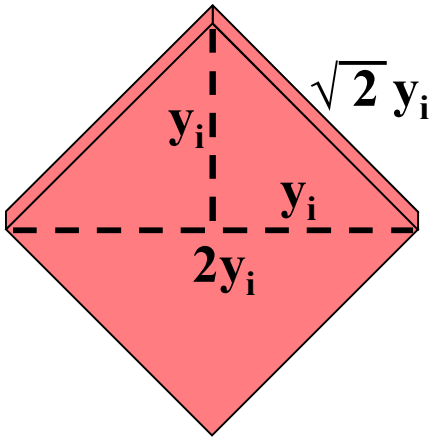
thickness = Δx

$V = A_c$ (thickness)

b. $V_i = 2(9 - x_i^2)\Delta x$



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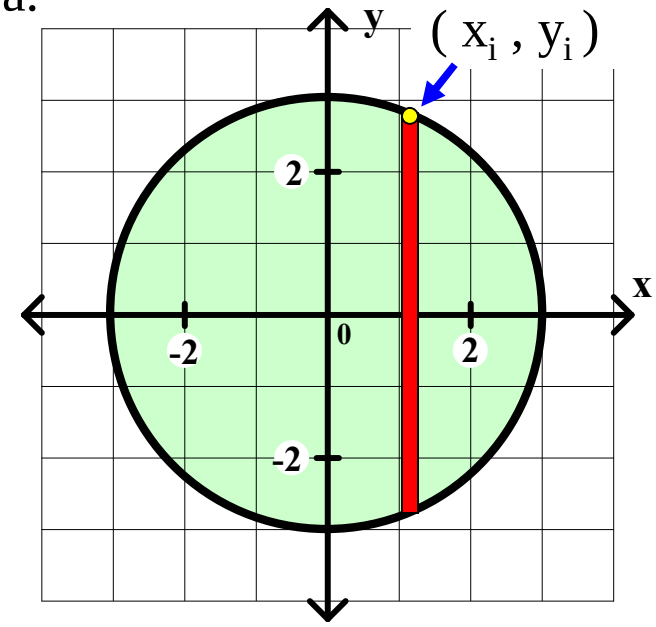
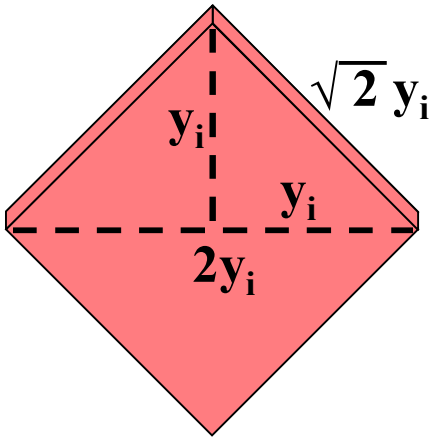


$A_c = 2y_i^2 = 2(9 - x_i^2)$

thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 2(9 - x_i^2)\Delta x$

c. $V =$

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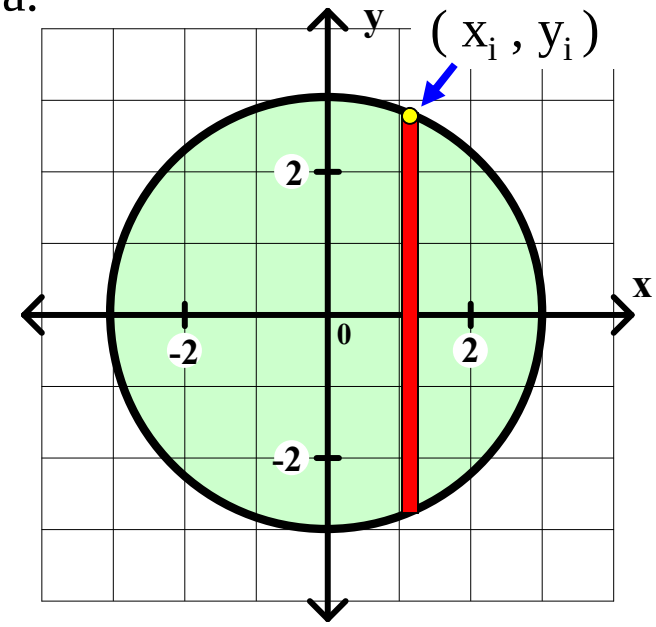

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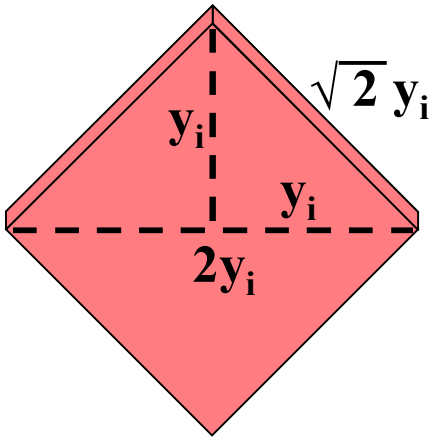

$V = A_c$ (thickness)

b. $V_i = 2(9 - x_i^2)\Delta x$

c. $V = 2$

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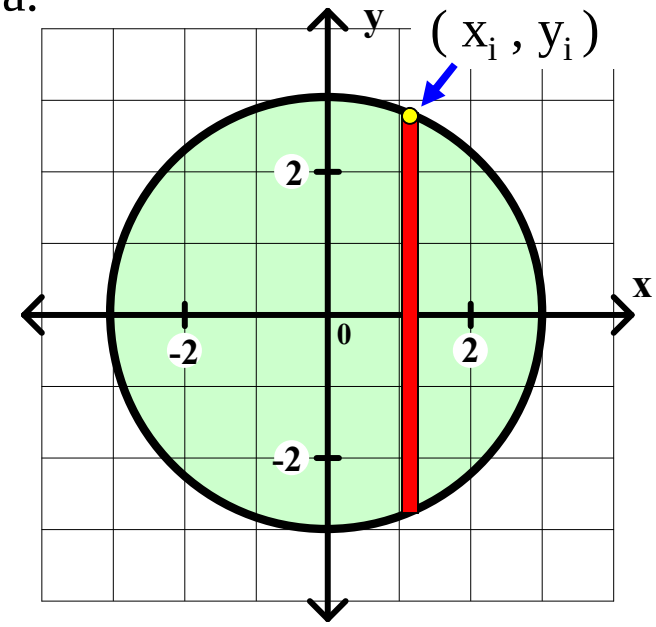

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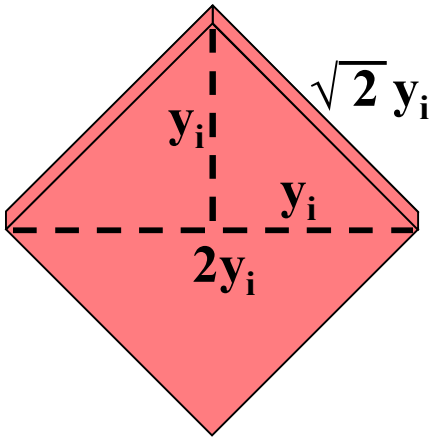

$V = A_c$ (thickness)

b. $V_i = 2(9 - x_i^2)\Delta x$

c. $V = 2\int$

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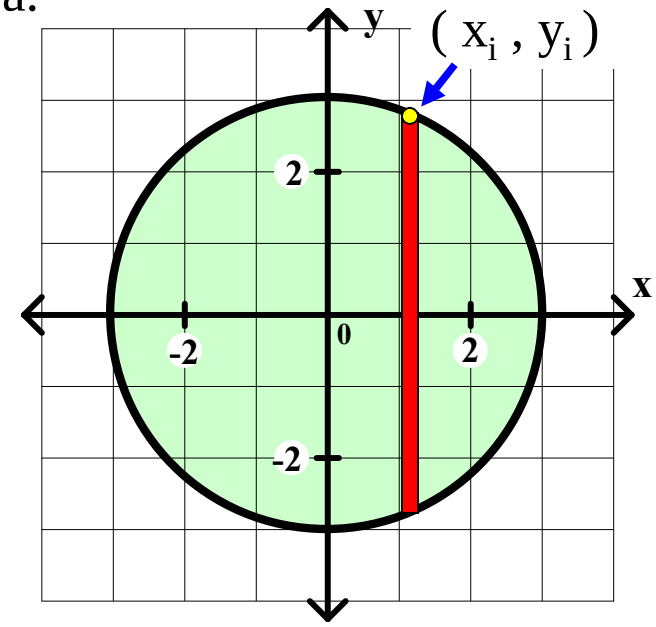

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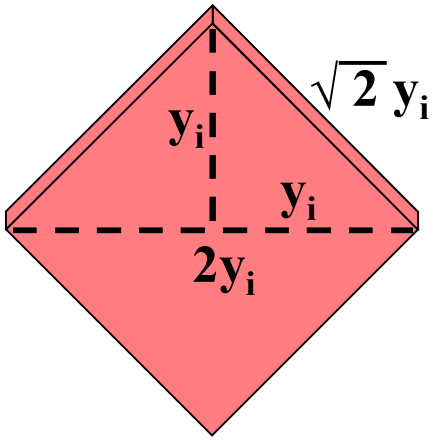

$V = A_c$ (thickness)

b. $V_i = 2(9 - x_i^2)\Delta x$

c. $V = 2\int (9 - x^2)\, dx$

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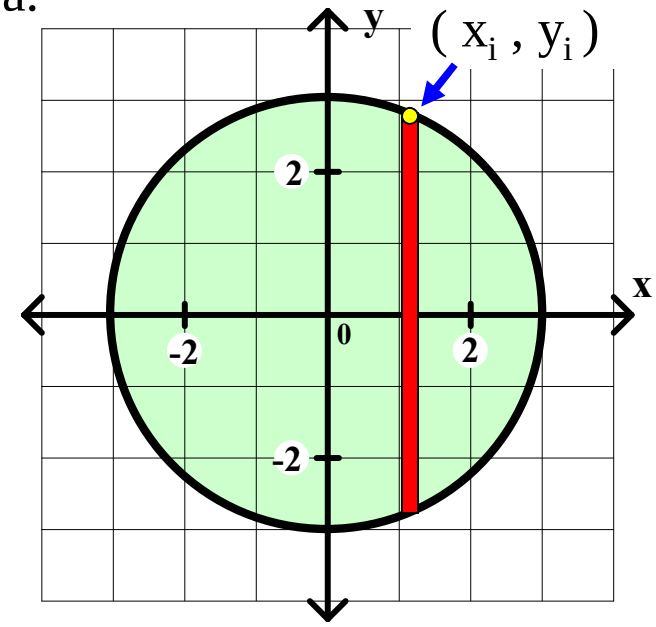

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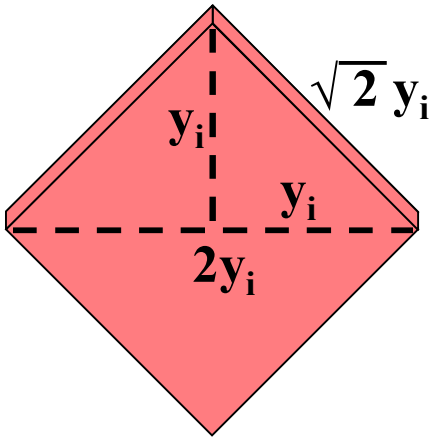
thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 2(9 - x_i^2)\Delta x$

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

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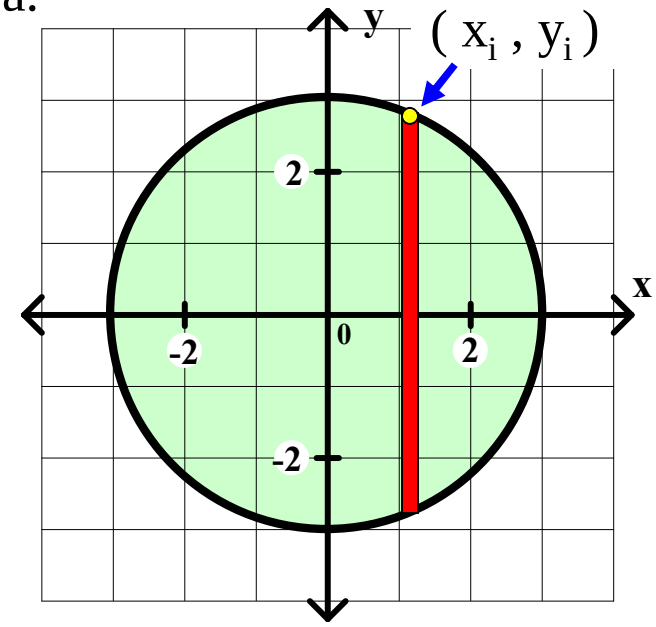
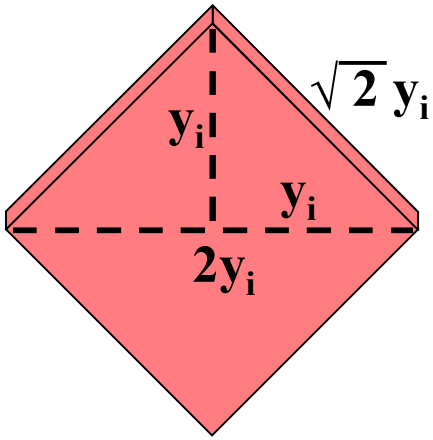


$A_c = 2y_i^2 = 2(9 - x_i^2)$

thickness = Δx



$V = A_c$ (thickness)

b. $V_i = 2(9 - x_i^2)\Delta x$

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

Calculus Class Worksheet #4 Unit 11 Solutions

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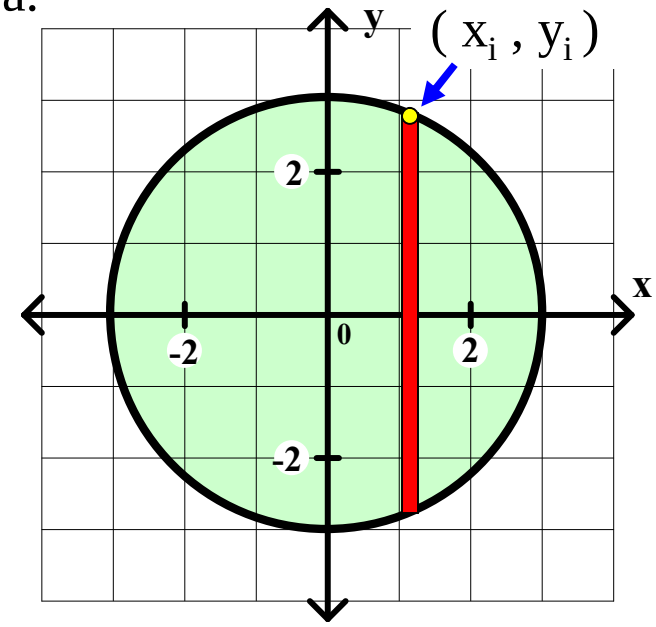

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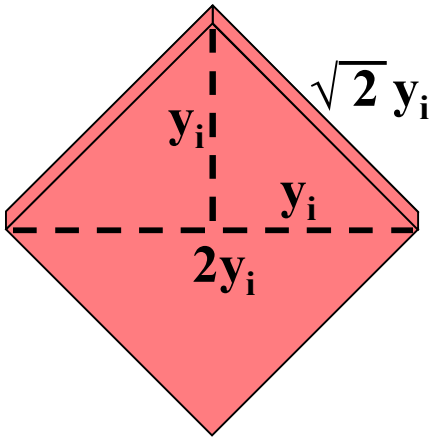

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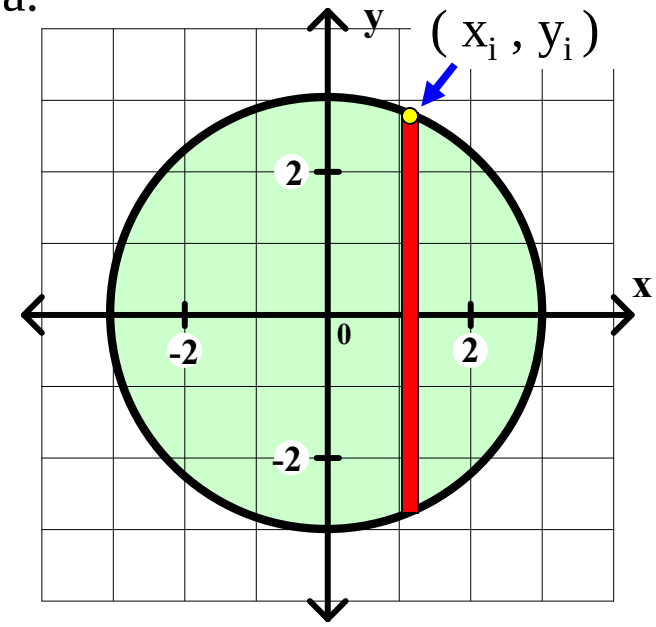

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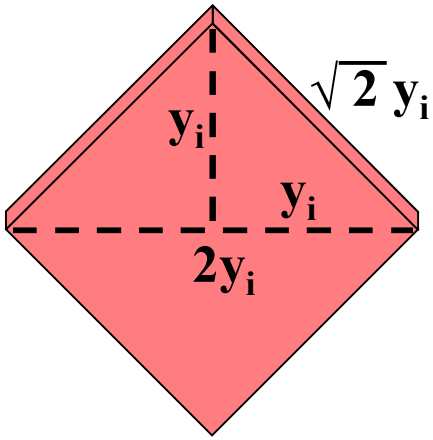

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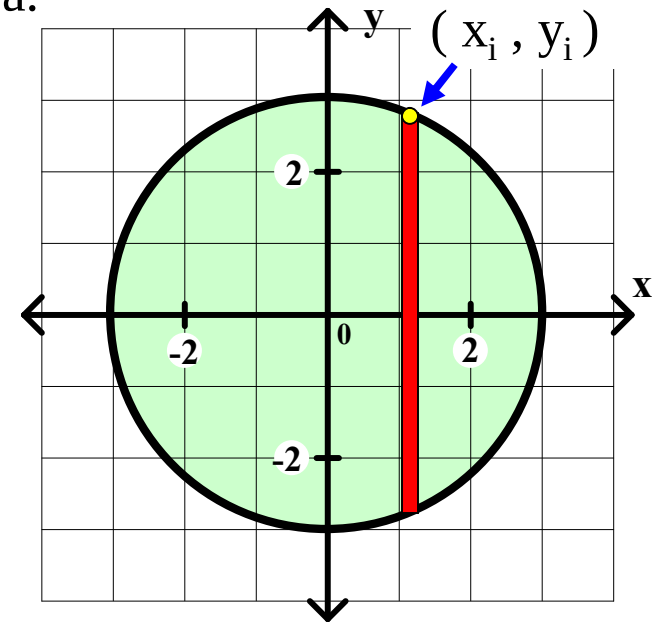

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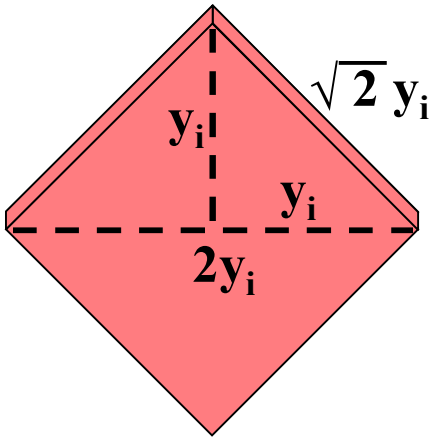

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d. V = 72 cu. units

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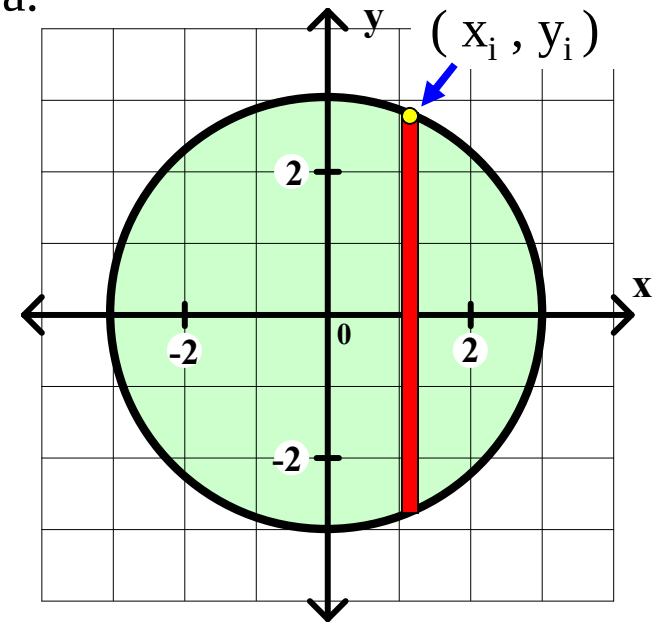

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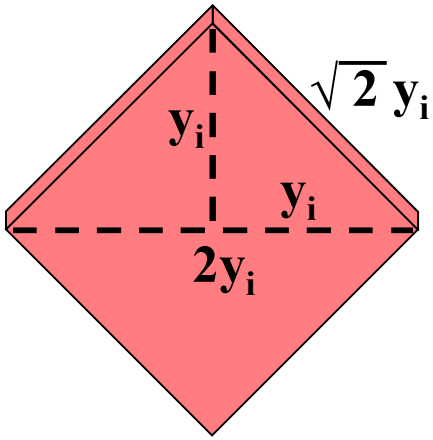

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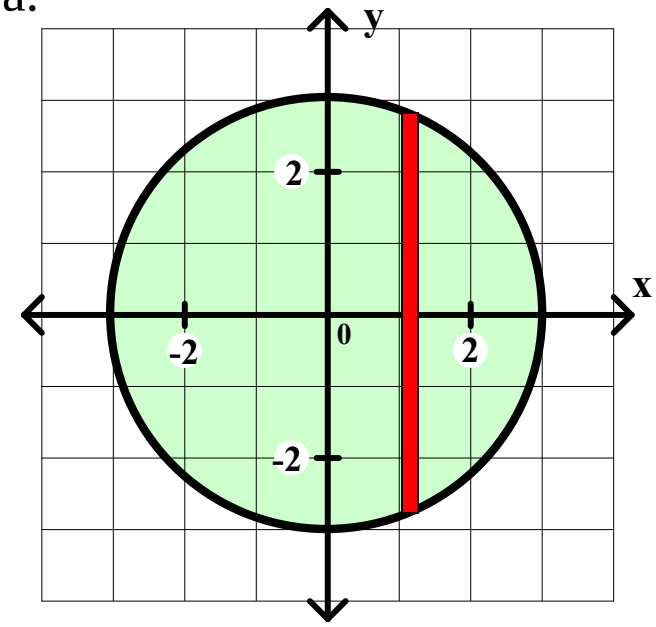

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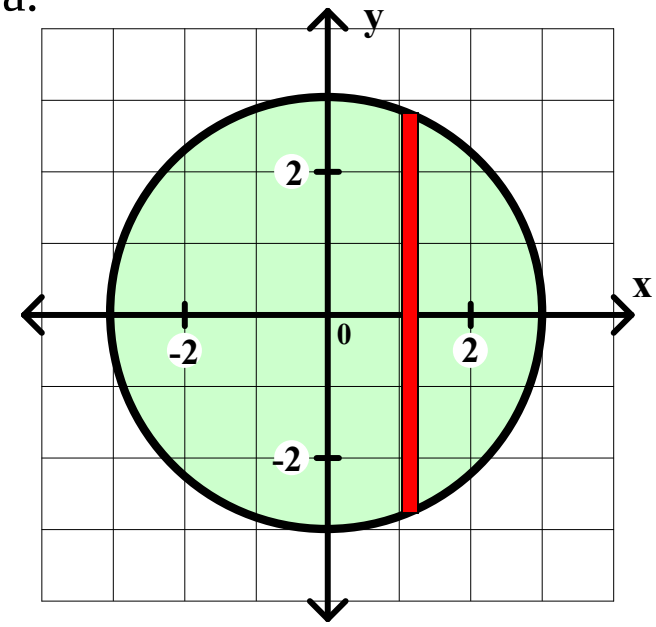

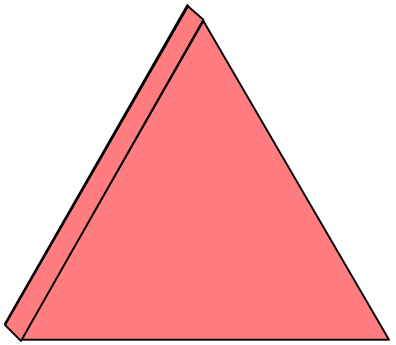

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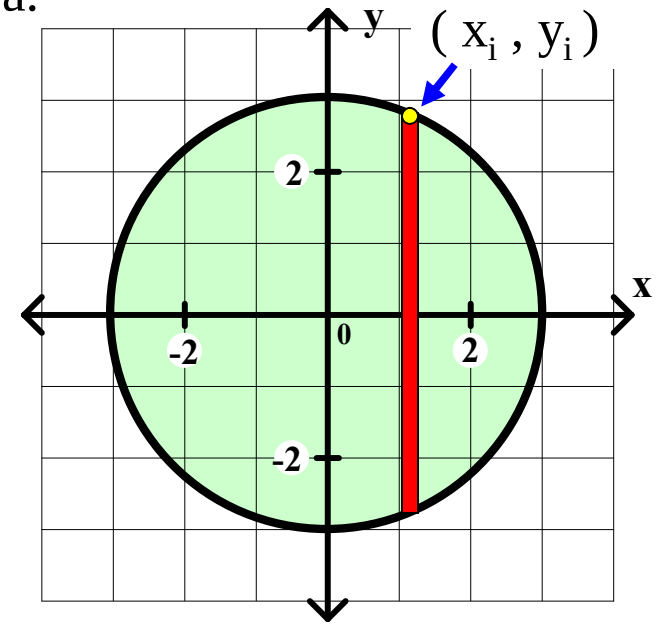

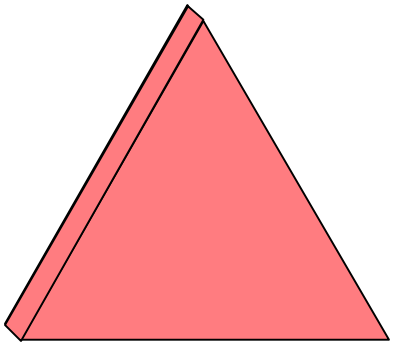

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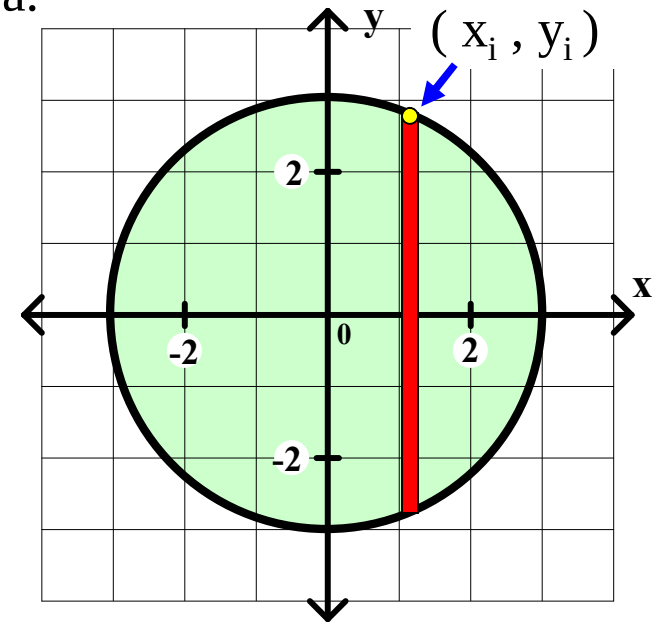

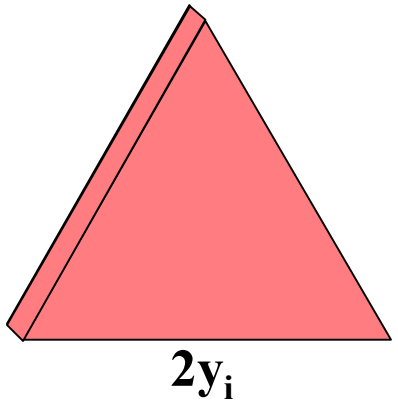

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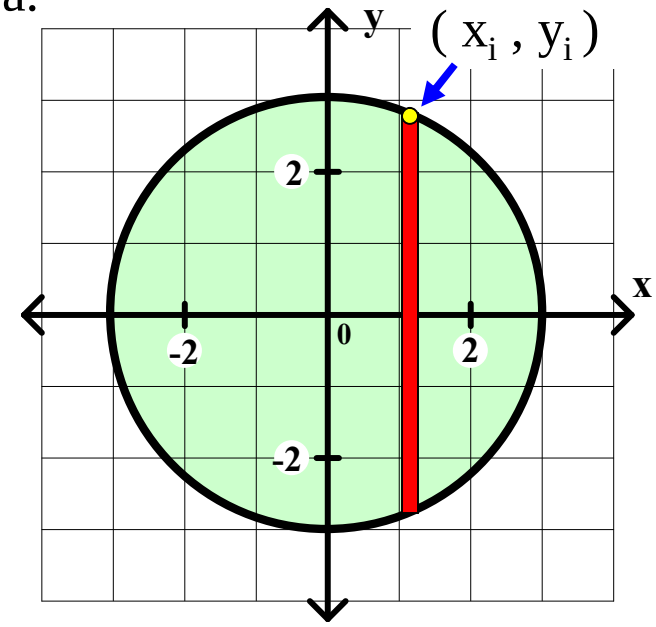
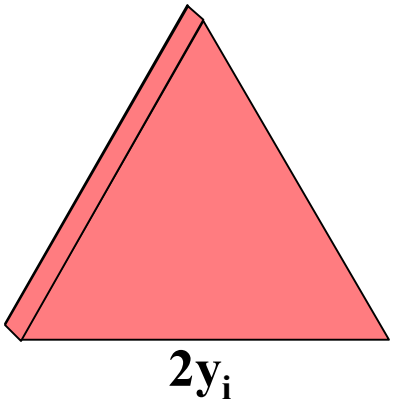


$V = A_c$ (thickness)



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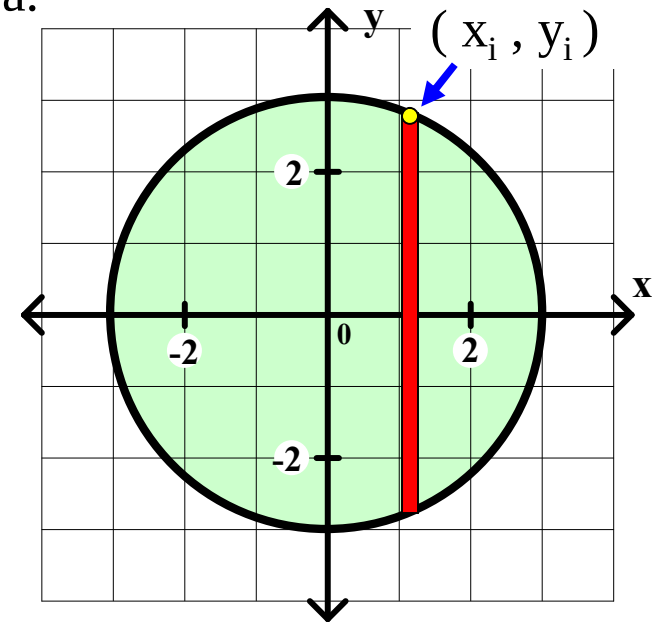
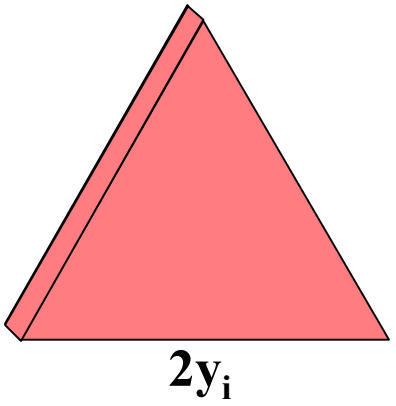


$\mathbf{A_c =}$

thickness =



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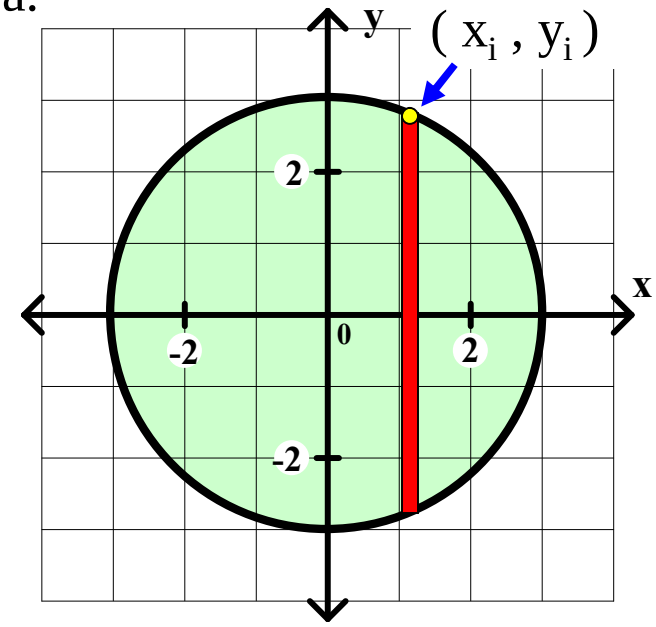

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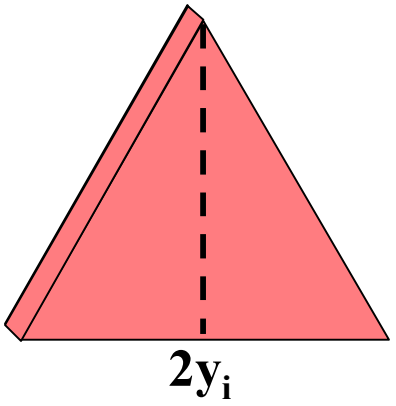

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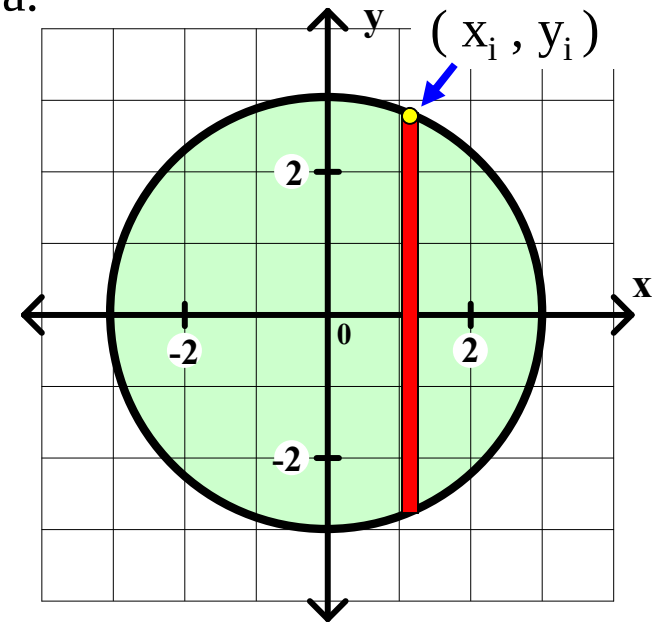

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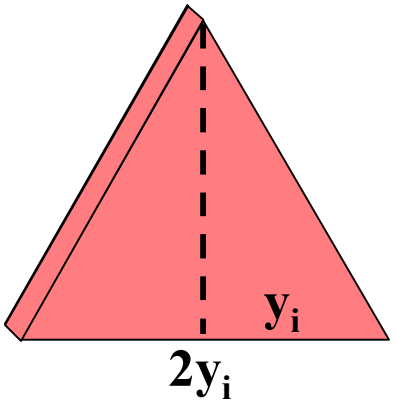

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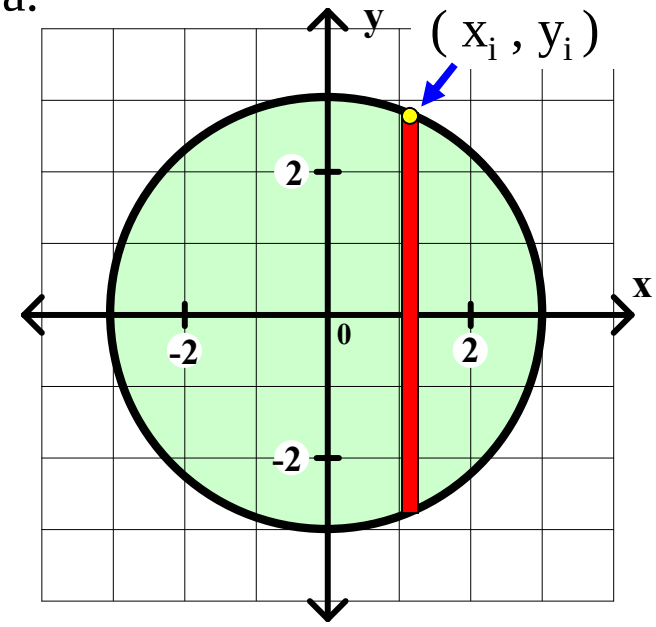

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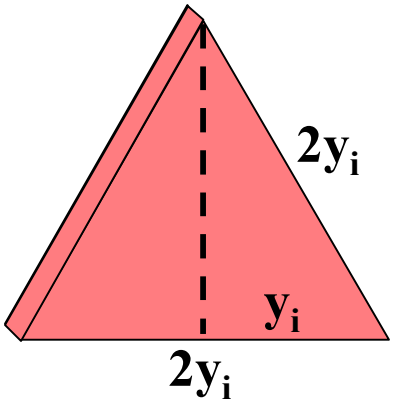

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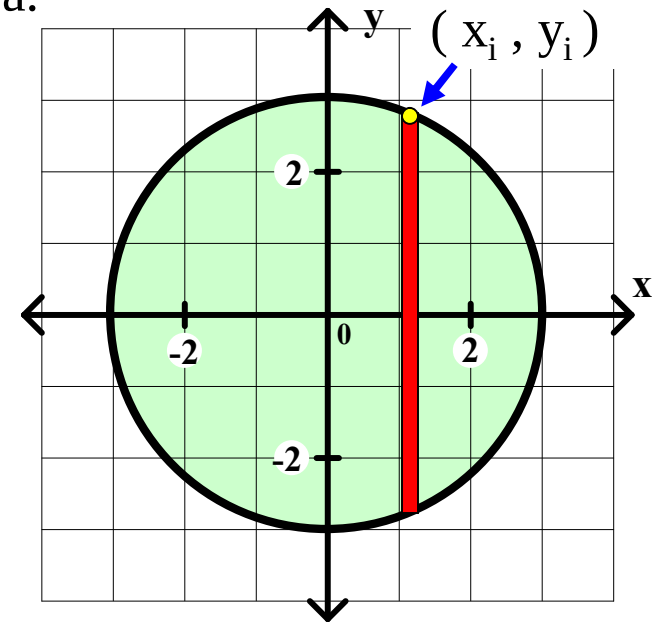

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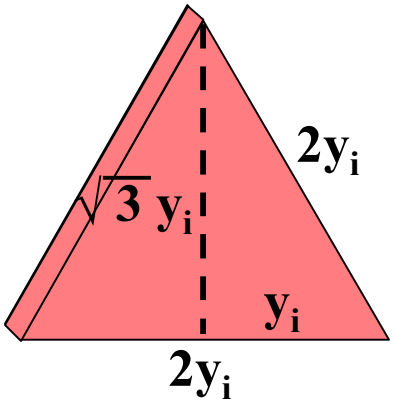

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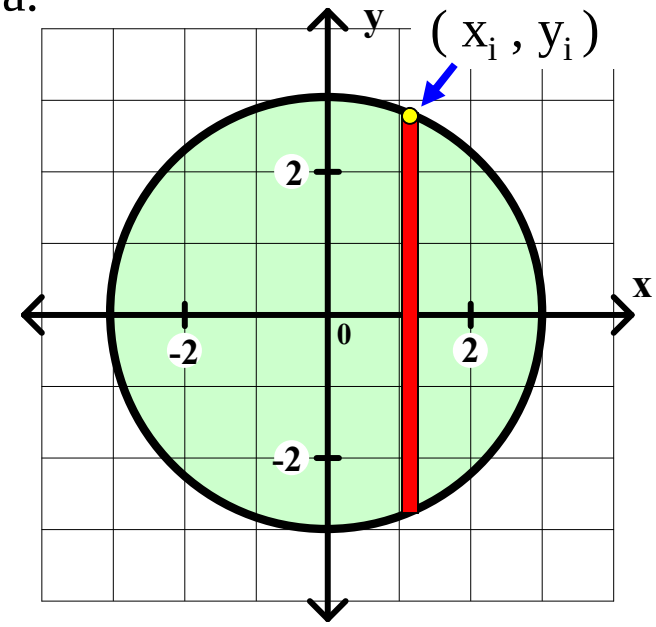

$A_c = \sqrt{3}\, y_i^2$

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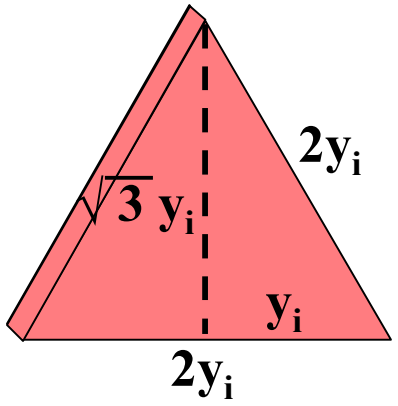

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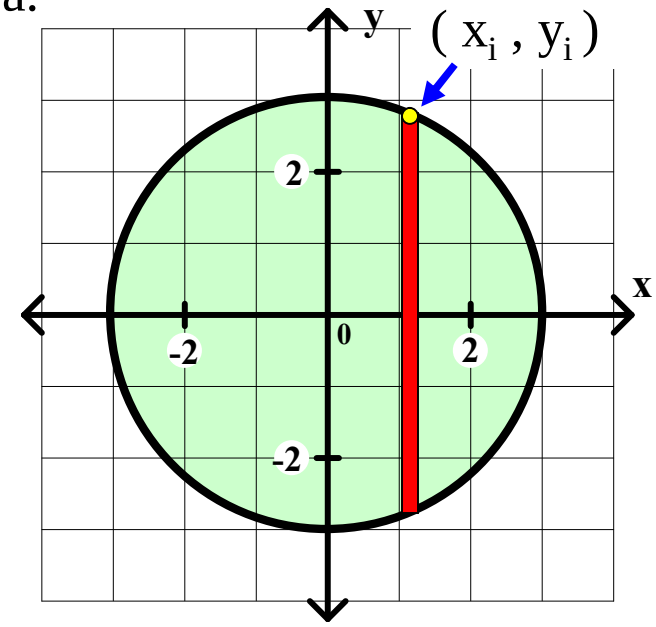

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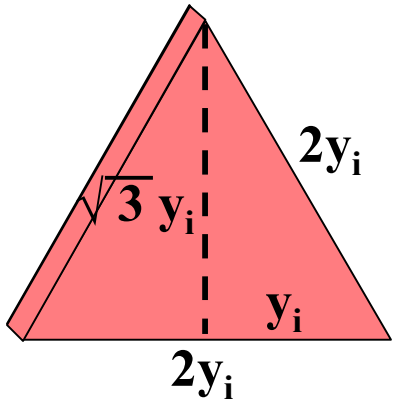

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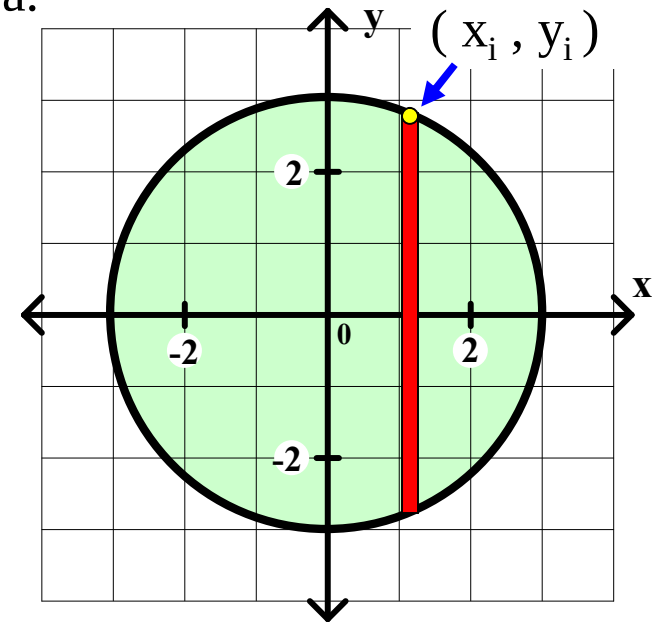

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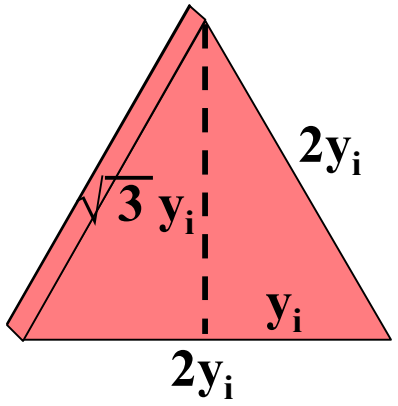

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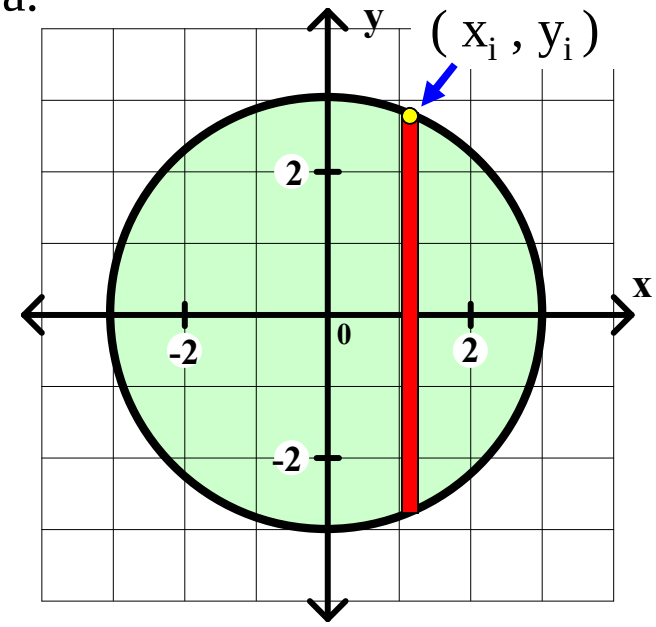
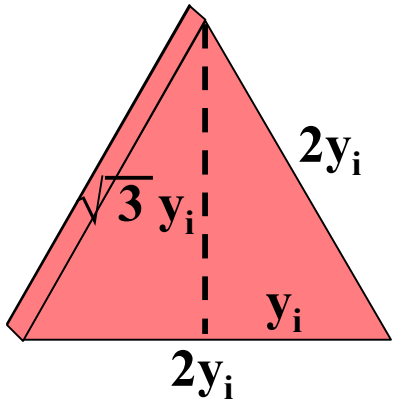


$A_c = \sqrt{3}\, y_i^2 = \sqrt{3}\,($

thickness = Δx



$V = A_c$ (thickness)

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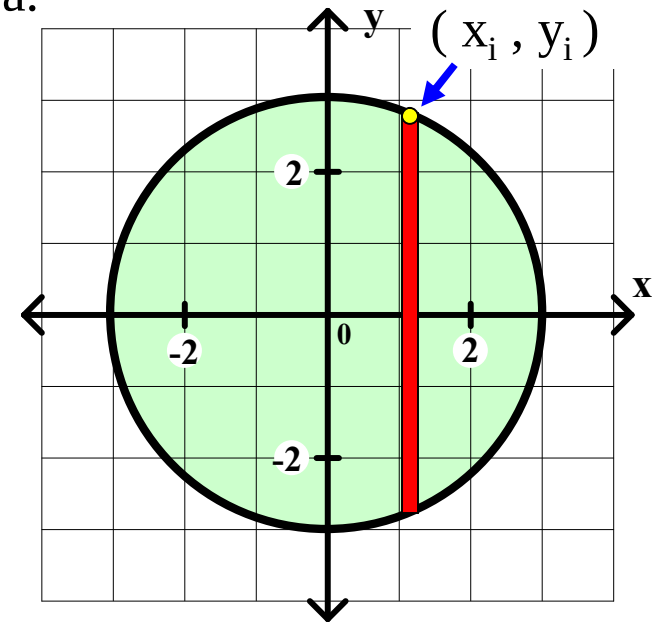

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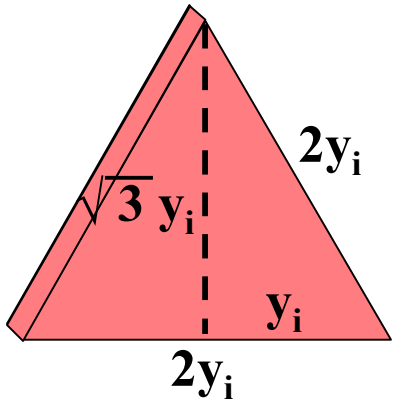

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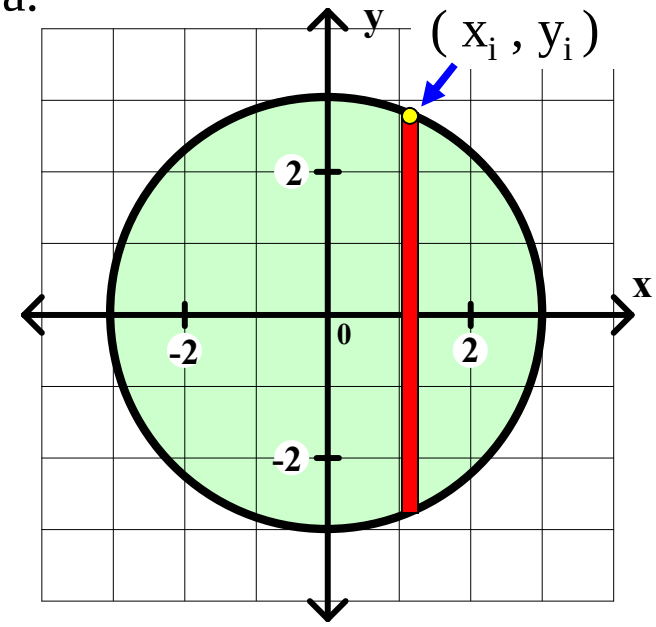

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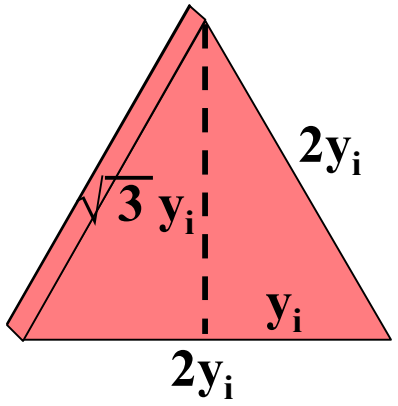
b. $V_i =$



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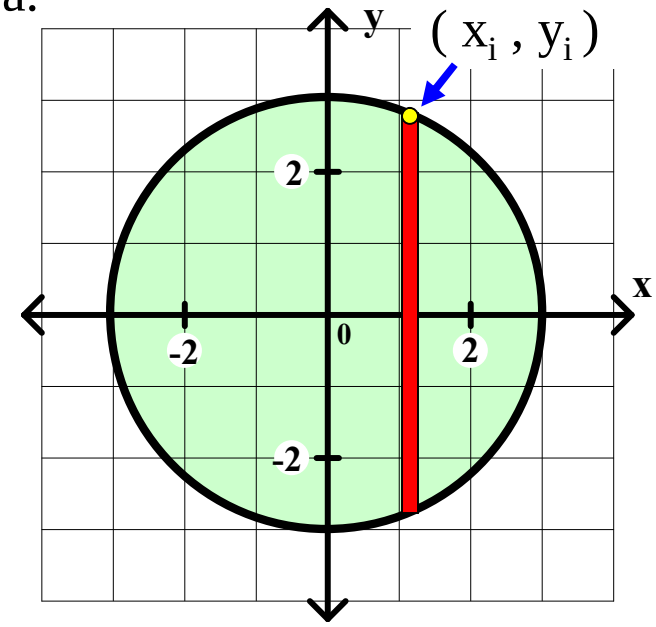

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thickness $= \Delta x$

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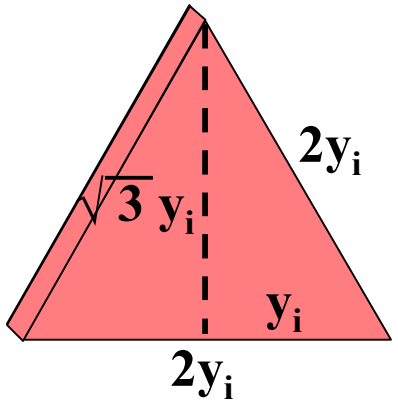

b. $V_i = \sqrt{3}$

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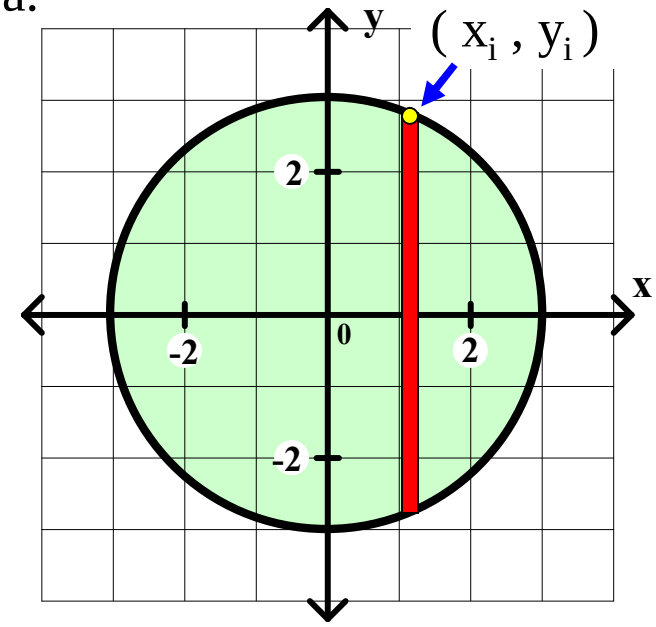

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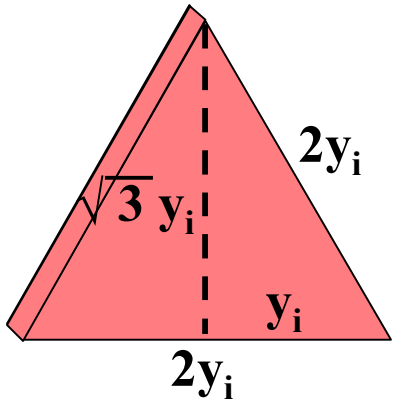

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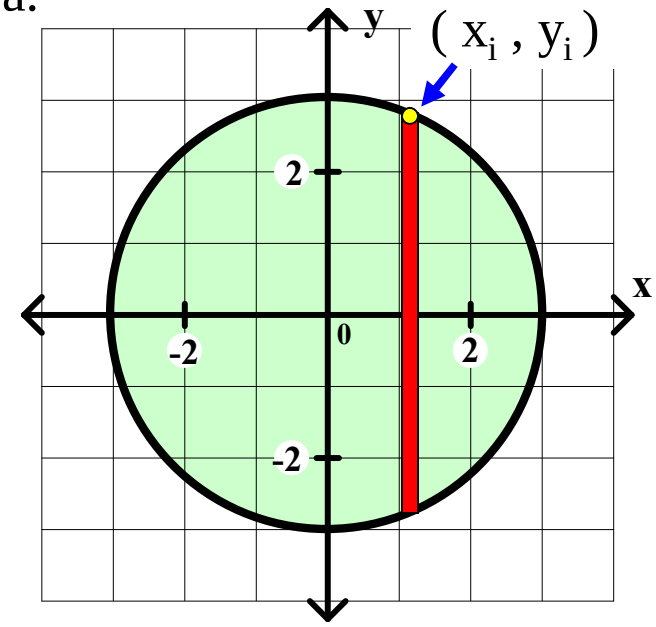

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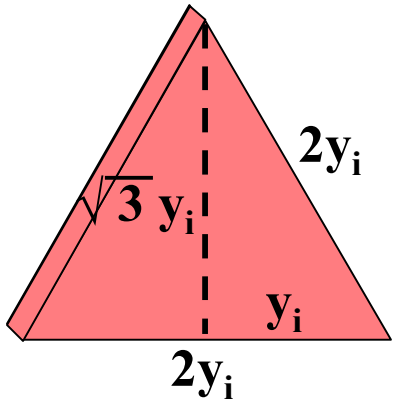

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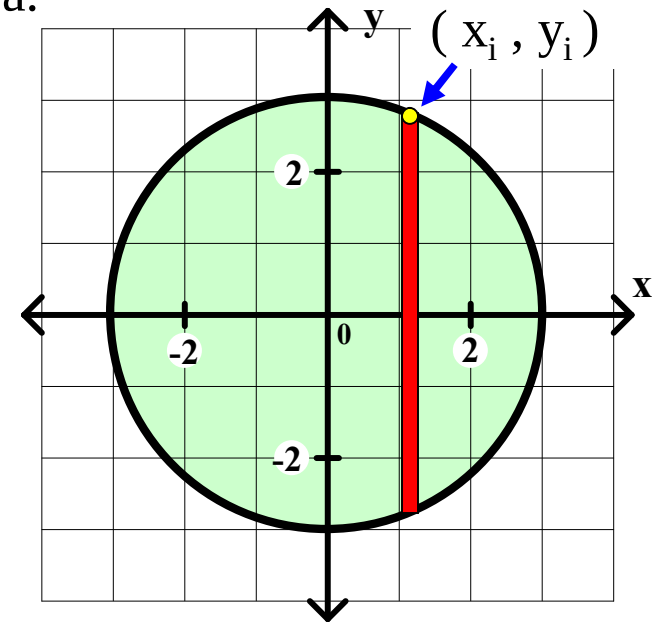

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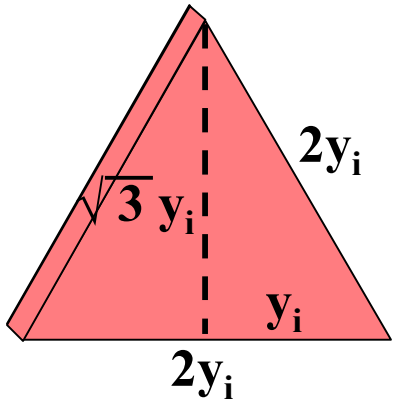

$V = A_c$ (thickness)

b. $V_i = \sqrt{3}\,(9 - x_i^2)\Delta x$

c. $V =$

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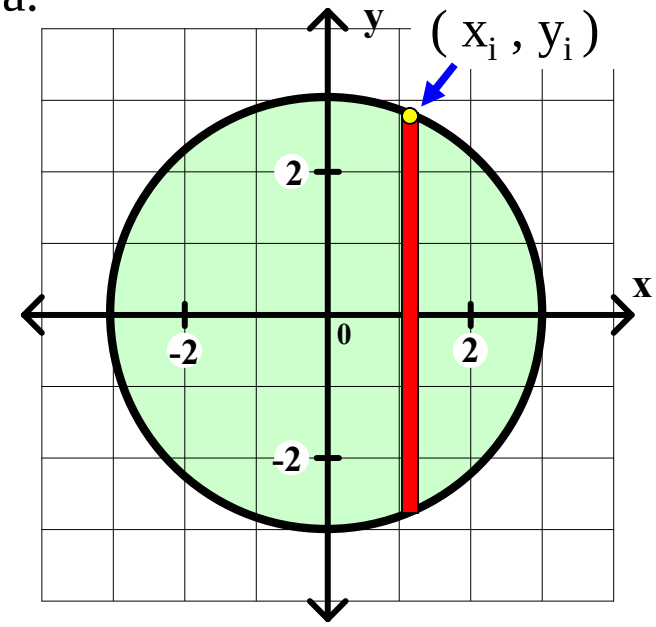

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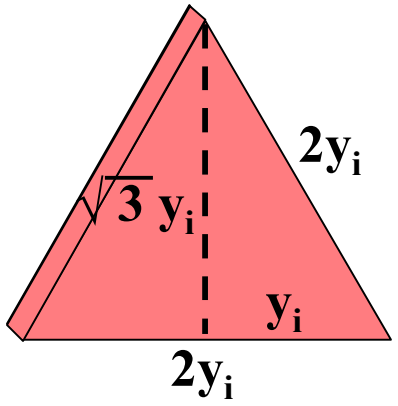

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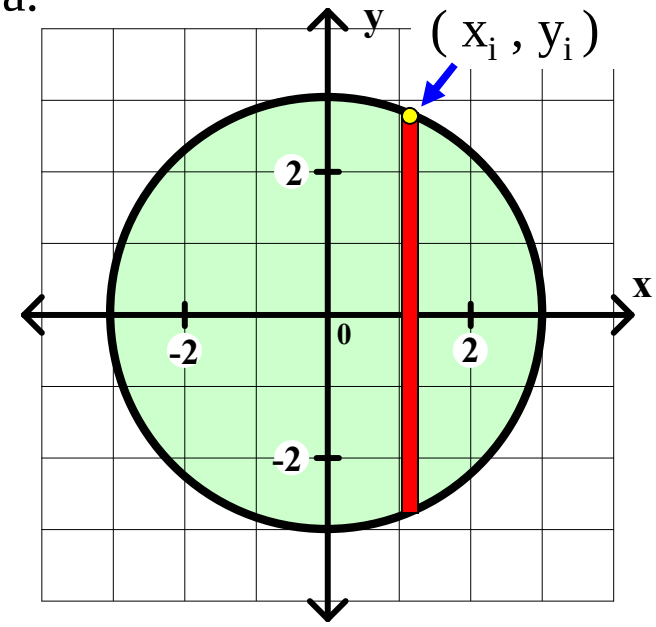

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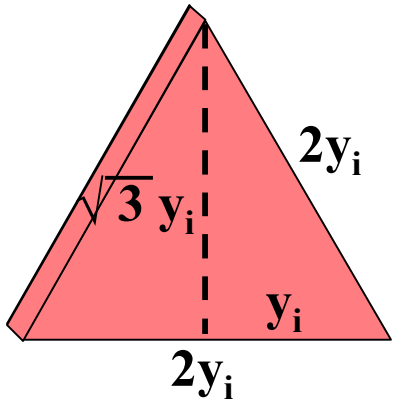

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c. $V = \sqrt{3} \int$

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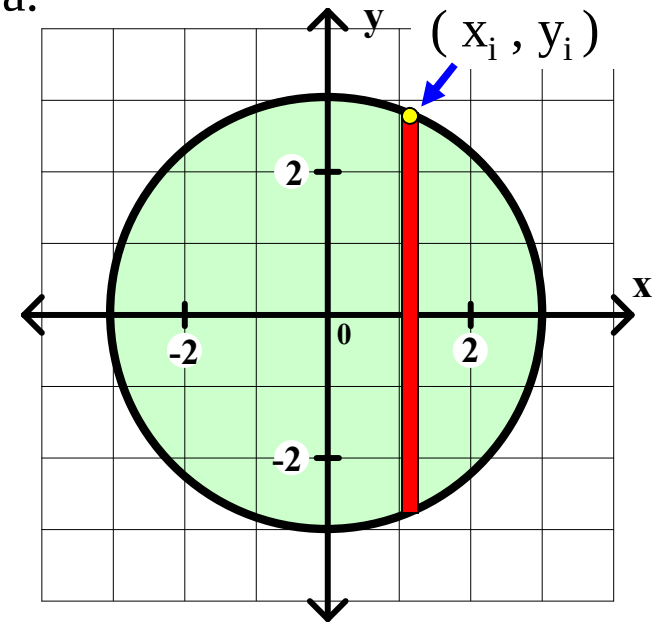

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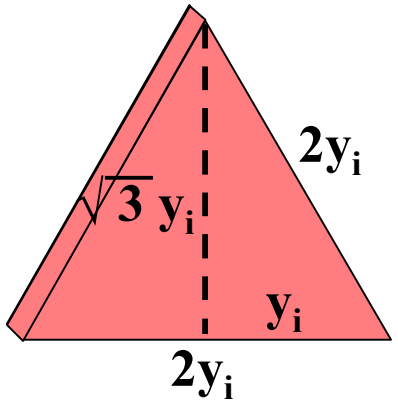

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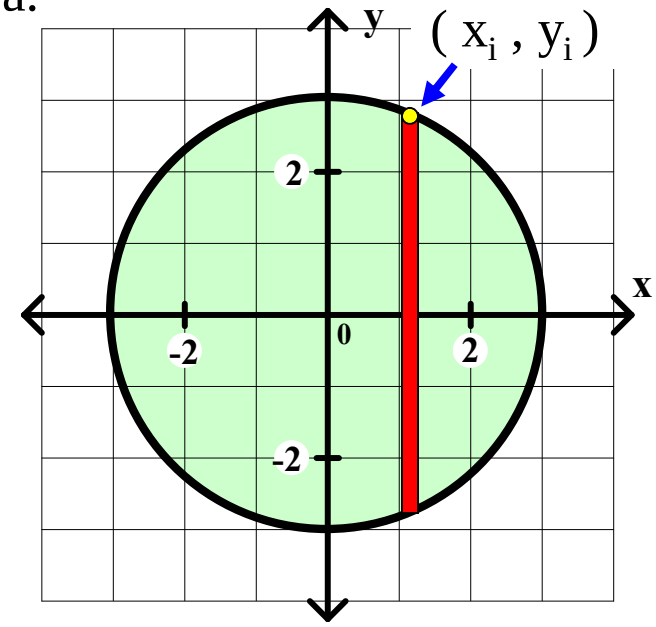

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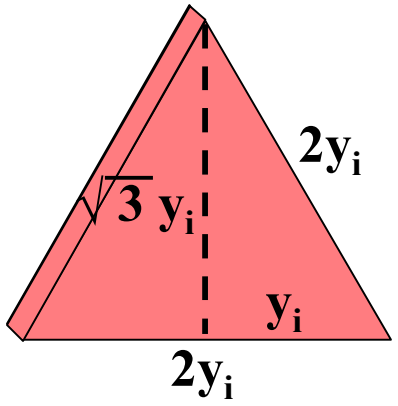

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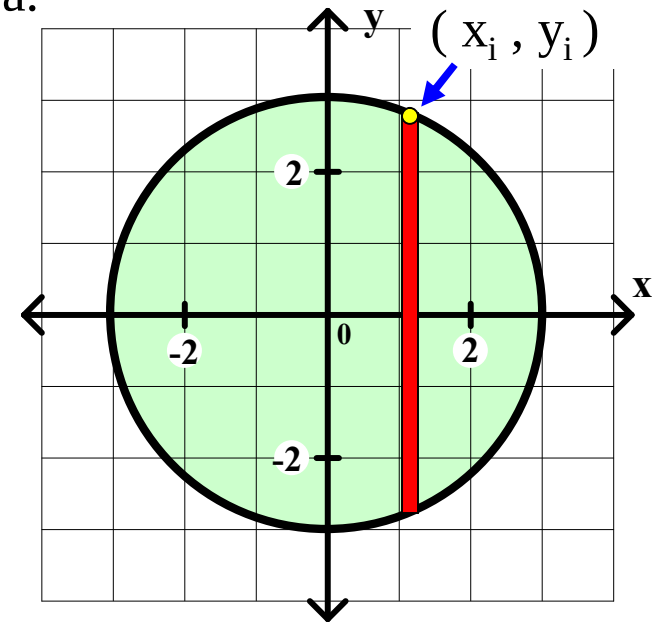

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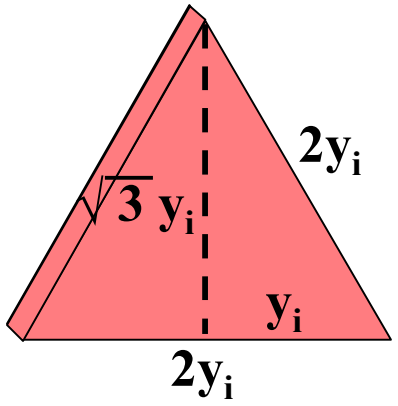

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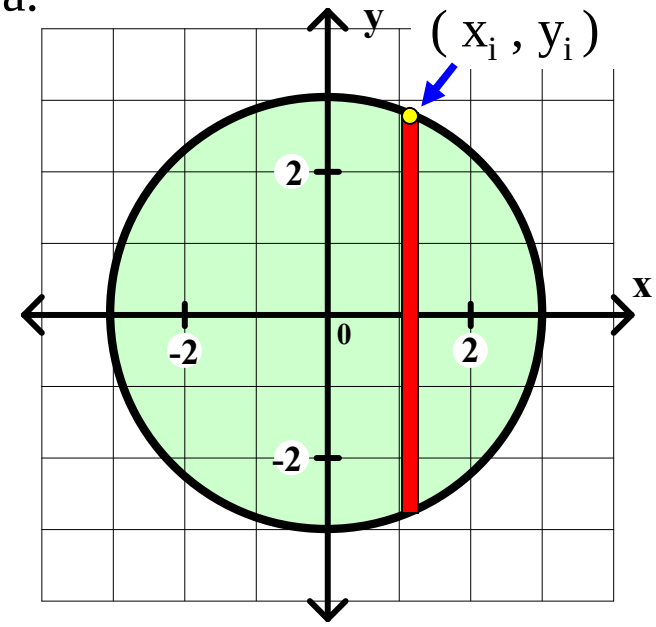

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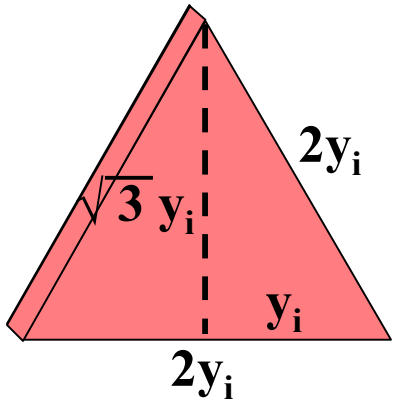

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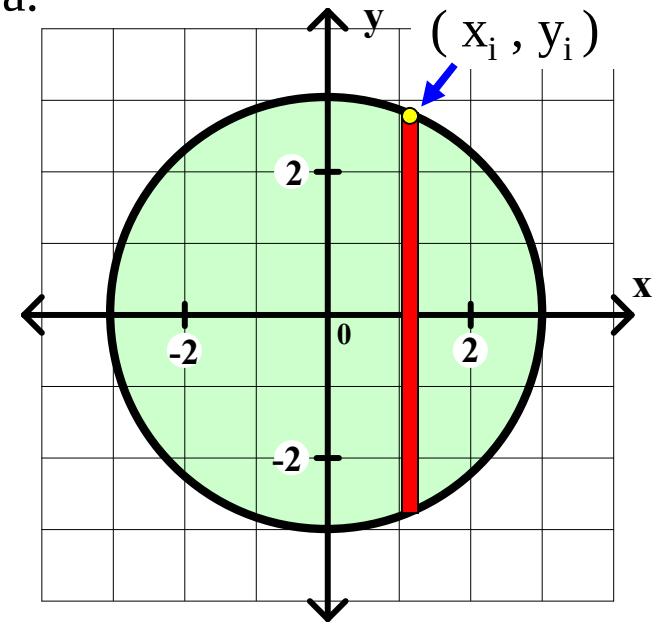

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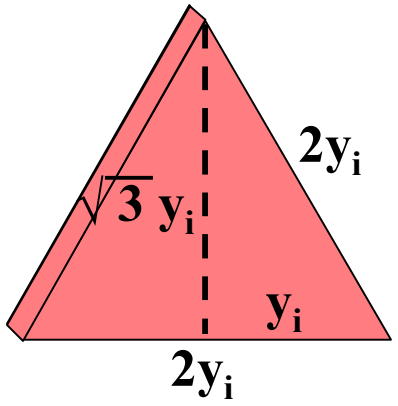

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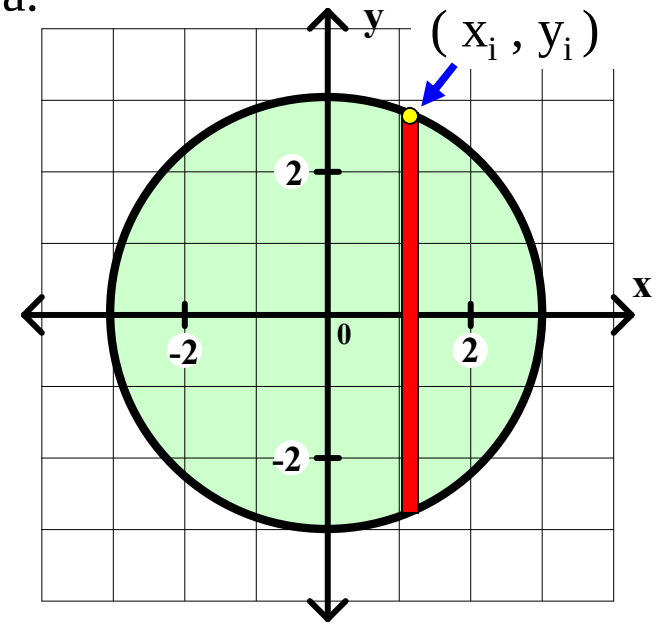

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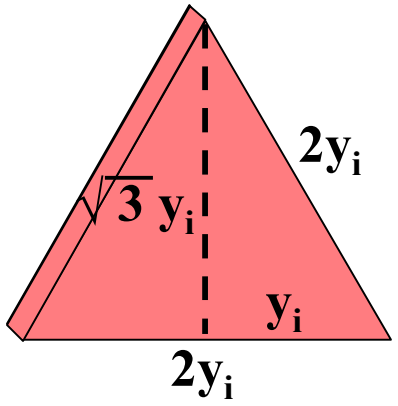

$V = A_c$ (thickness)

b. $V_i = \sqrt{3}\,(9 - x_i^2)\Delta x$

c. $V = \sqrt{3}\int_{-3}^{3}(9 - x^2)\,dx$

d. $V = 36\sqrt{3}$ cu. units

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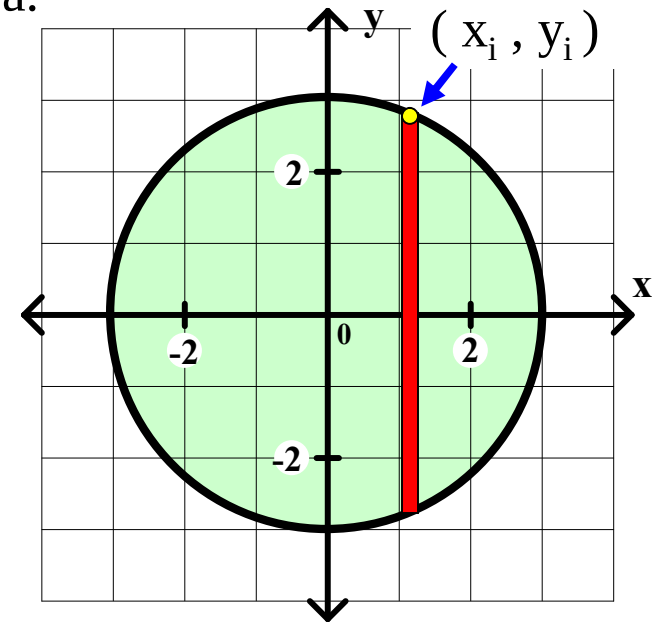

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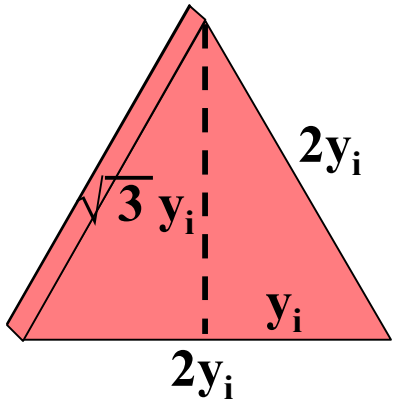

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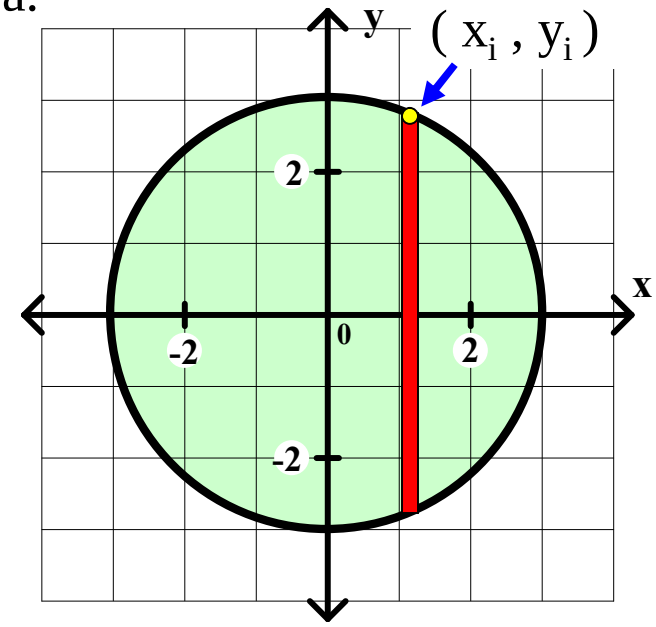
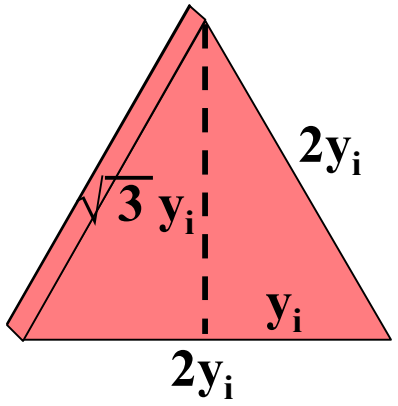


$A_c = \sqrt{3}\, y_i^2 = \sqrt{3}\,(9 - x_i^2)$

thickness = Δx



$V = A_c$ (thickness)

b. $V_i = \sqrt{3}\,(9 - x_i^2)\Delta x$

c. $V = \sqrt{3}\int_{-3}^{3}(9 - x^2)\,dx$

d. $V = 36\sqrt{3}$ cu. units

$V \approx 62.4$ cu. units