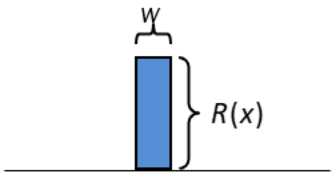
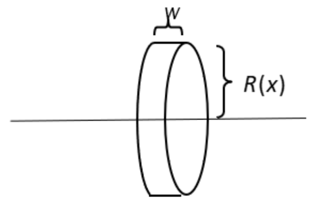
CHA		
4	Topic: 8.9	Volume with Disc Method: Revolving Around the *x*- or *y*-Axis
Learning Objective CHA-5.C: Calculate volumes of solids of revolution using definite integrals.		

The Disc Method

Using areas of the known cross sections from the previous two topics is not the only way calculus and the definite integral can be used to find the volumes of three-dimensional solids. The solids in this topic and the next will focus on those with cross sections that are all circular.





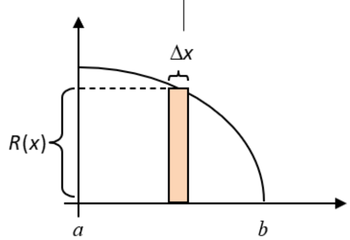
A **2-dimensional figure** ………..which, when rotated about the x-axis becomes a…….**3-dimensional figure**

Recall: The formula for the volume of a cylinder is $V = \pi r^2 h$. A disk is basically a very short cylinder where the height, h is actually the w value. The radius retains its actual meaning. The π pops out in front and you get the following formula below.

To find the volume of a solid of revolution with the **disk method**, use one of the following:

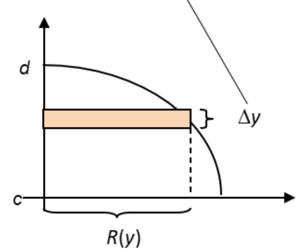
Horizontal Axis of Revolution

Volume $= V = \pi \int_a^b [R(x)]^2 \, dx$



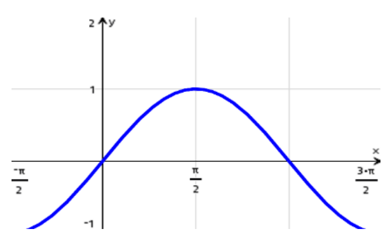
Vertical Axis of Revolution

Volume $= V = \pi \int_c^d [R(y)]^2 \, dy$



<u>Example 1</u>: Using the Disc Method (No video)

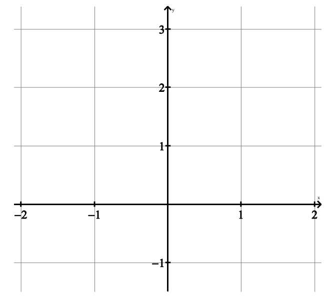
Find the volume of the solid formed by revolving the region bounded by the graphs of $f(x) = \sqrt{\sin x}$ and the x-axis about the x-axis $(0 \le x \le \pi)$.



CHA		
2	Topic: 8.10	Volume with Disc Method: Revolving Around Other Axes
Learning Objective CHA-5.C: Calculate volumes of solids of revolution using definite integrals.		

Example 2: Revolving About a Line That Is Not A Coordinate Axis

Find the volume of the solid formed by revolving the region bounded by the graphs of $f(x) = 2 - x^2$ and $g(x) = 1$ about the line $y = 1$.



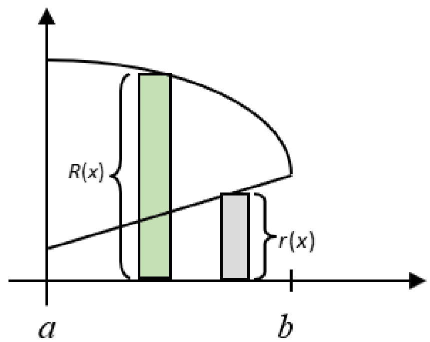
CHA		
4	Topic: 8.11	Volume with Washer Method:Revolving Around the *x*- or *y*-Axis
Learning Objective CHA-5.C: Calculate volumes of solids of revolution using definite integrals.		

The Washer Method

To find the volume of a solid of revolution with the **washer method**, use one of the following:

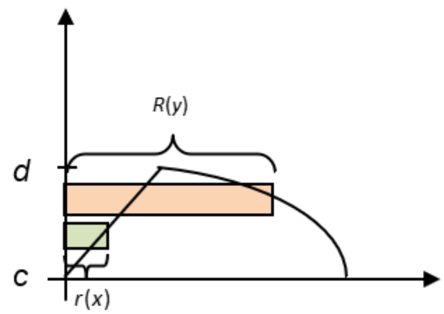
Horizontal Axis of Revolution

$$\text{Volume} = V = \pi \int_a^b ([R(x)]^2 - [r(x)]^2)dx$$



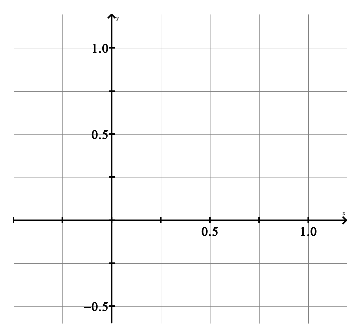
Vertical Axis of Revolution

$$\text{Volume} = V = \pi \int_c^d ([R(y)]^2 - [r(y)]^2)dy$$



Example 3: Using the Washer Method

Find the volume of the solid formed by revolving the region bounded by the graphs of $f(x) = \sqrt{x}$ and $y = x^2$ about the x-axis.

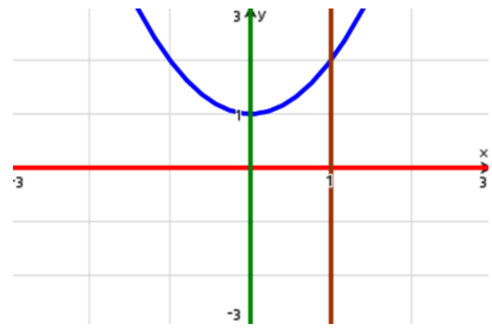


CHA			
2	Topic: 8.12	Volume with Washer Method: Revolving Around Other Axes	
Learning Objective CHA-5.C: Calculate volumes of solids of revolution using definite integrals.			

Let's revisit our Example 2 from Topic 8.10 but this time, we will revolve our region around a few other axes.

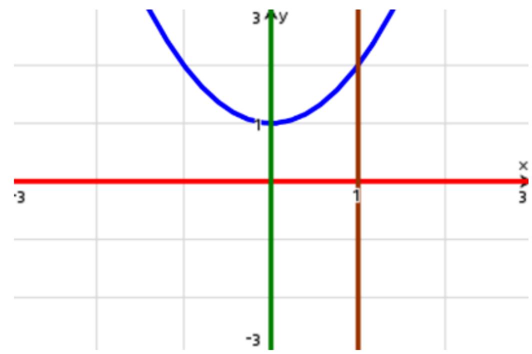
Example 4: Washer Method Using Other Axes of Revolution - I

Set up, but do not solve, an expression involving one or more integrals that would compute the volume of the solid formed by revolving the region bounded by the graphs of $y = x^2 + 1, y = 0, x = 0,$ and $x = 1$ about the line $y = -2$.



Example 5: Washer Method Using Other Axes of Revolution - II

Set up, but do not solve, an expression involving one or more integrals that would compute the volume of the solid formed by revolving the region bounded by the graphs of $y = x^2 + 1, y = 0, x = 0,$ and $x = 1$ about the line $x = -1$.



Example 6: Washer Method Using Other Axes of Revolution - III

Set up, but do not solve, an expression involving one or more integrals that would compute the volume of the solid formed by revolving the region bounded by the graphs of $y = x^2 + 1, y = 0, x = 0,$ and $x = 1$ about the line $x = 2$.