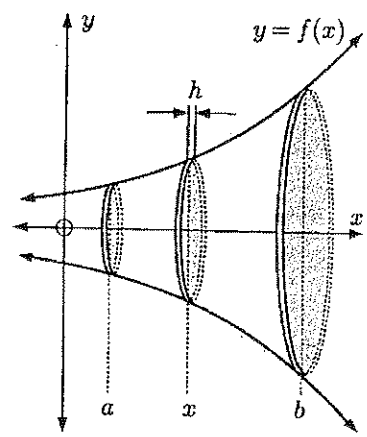
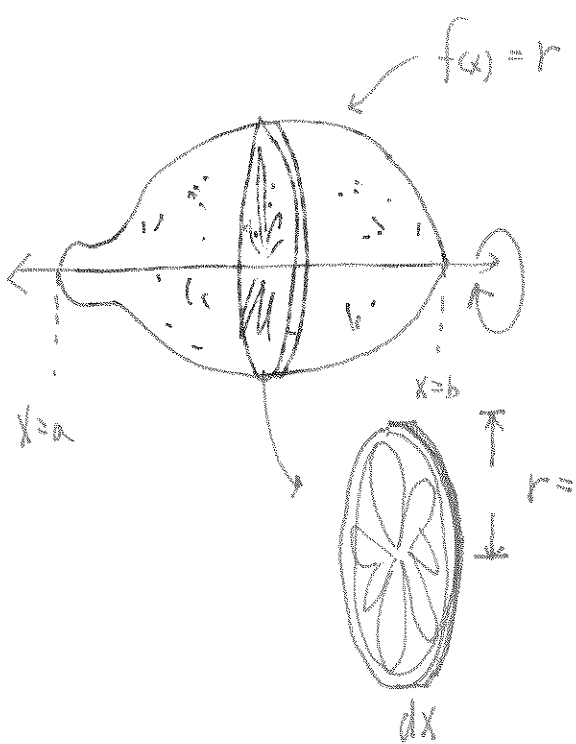
Calculating the volume by slicing the cross sectional disks is called "**the Disk Method**". The idea is that a solid can be thought to be made up of an infinite number of thin cylindrical discs.

- Area of a disk $= A(x) = \pi r^2$
- $dV = A(x)dx = \pi r^2 dx$
- $r = f(x)$
- $dV = A(x)dx = \pi f(x)^2 dx$
- Volume of the solid$= \int_a^b A(x)dx = \pi \int_a^b |f(x)|^2 dx$



4. Compare "the Disk Method" concept above and "Finding the volume of the lemon" by adding up the slices. With the symmetry of the lemon, the shape could be generated by using a rotating "flag".
Sketch the flag which would generate the shape of the lemon. And then discuss with your group member how "the disk method" will work to find the volume of the lemon if you know the function for the shape of the lemon. Be ready to explain the concept and the diagram to Mrs. Shim. Call Mrs. Shim by raising your hand to present your understanding.



$A = \pi r^2$

$dV = \pi r^2 dx$

$\int dV = \int \pi r^2 dx \Rightarrow \text{Volume} = \int_a^b \pi r^2 dx$

$r = f(x)$

$\therefore r = f(x)$

$\Rightarrow \boxed{\text{Volume} = \pi \int_a^b (f(x))^2 dx}$

Get a stamp from Mrs. Shim when you complete # 4 tasks.

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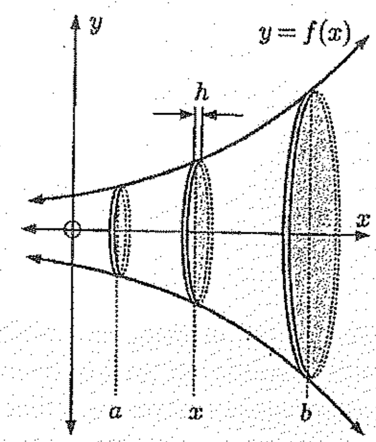
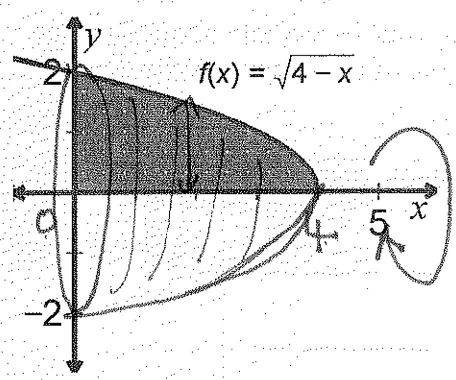
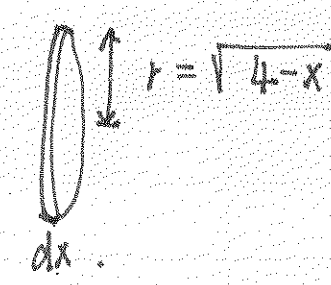


Bethany considers the 3-D solid that would be generated by rotating the region shown 360° around the x-axis.

5. Sketch the 3-D solid that Bethany is considering.



6. Consider a cross section of the solid that occurs at some arbitrary value of x. Sketch the cross section and label its radius in terms of x.



7. What is the area of the cross section in terms of x?

$dA = \pi(\sqrt{4-x})^2$

8. Write an integral and evaluate it to calculate the volume of the entire solid.

$$V = \pi\int_0^4 (4-x)dx = \pi\left[4x - \frac{x^2}{2}\right]_0^4 = \pi\left[16-8\right] = \boxed{8\pi} \text{ units}^3$$

Disk Method Practice

A solid is generated by revolving the region bounded by the given equations about the x-axis. For each problem:

a. Sketch the solid.
b. Draw a representative slice and label the radius.
c. Set up and evaluate the integral which gives the volume of the solid.

1. $y = x^2,\ y = 0,\ x = 2$
2. $y = x^3,\ y = 0,\ x = 2$
3. $y = \sqrt{9-x^2},\ y = 0$
4. $y = e^{-x},\ y = 0,\ x = 0,\ x = 1$
5. $y = \sqrt{\cos x},\ y = 0,\ x = 0,\ x = \frac{\pi}{2}$

HW p 692 #.1 (1aceg)