- Today: Volumes
- Homework before Wednesday's class: watch video 10.2.
- Term test 3: Friday, February 10, 4-6pm.

Volume of a cylinder

Find the volume of a cylinder with base radius 1 and height 2.

First step: put this cylinder in a convenient place in our usual coordinate system.

Second step: find the cross-sectional area.

Third step: express the volume as an integral.

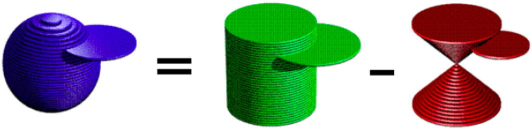
An equation for volumes by "slicing"

Let $a < b$.
Let f be a continuous, positive function defined on $[a, b]$.
Let R be the region in the first quadrant bounded between the graph of f and the x-axis.
Find a formula for the volume of the solid of revolution obtained by rotation the region R around the x-axis.

You know a formula for the volume of a sphere with radius R. Now you are able to prove it!

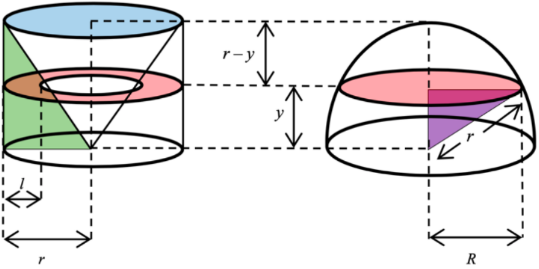
1. Write an equation for the circle with radius R centered at $(0, 0)$.
2. If you rotate this circle around the x-axis, it will produce a sphere. Compute its volume as an integral by slicing it like a carrot.

Ball = cylinder – cone (Archimedes, 3rd century BC)



Cavalieri's Principle: **"equal sections ⇒ equal volumes"**

Compare areas of sections at height y and compute volumes as integrals:



Many axes of rotation

Let R be the region between the graphs of $y = x$ and $y = x^2$ is rotated about the x-axis.

What does the cross-section look like?

Find the volume.

What about if we rotate about the line $y = -1$?

What happens when we rotate it about the y-axis?