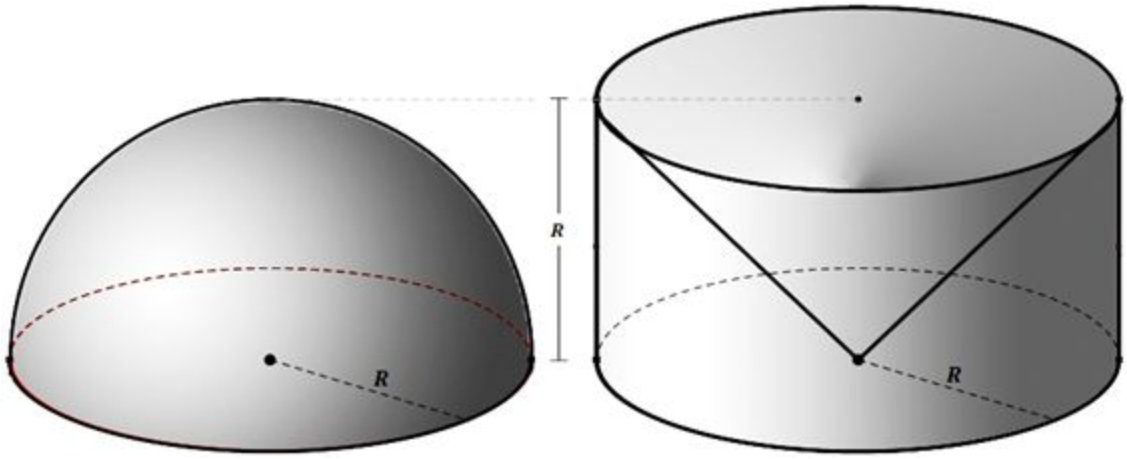
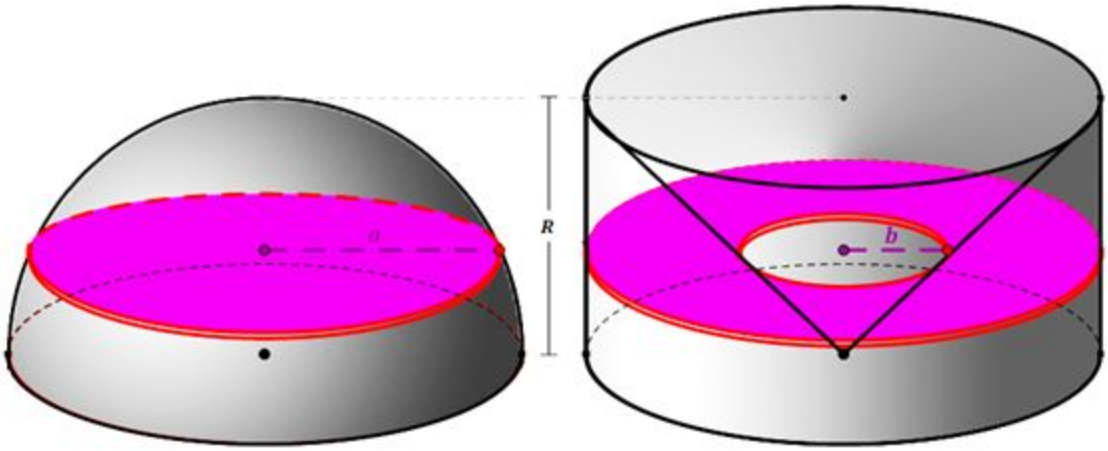
How can Cavalieri's Principle help to find the formula for the volume of a Sphere?

What is Cavalieri's Principle?

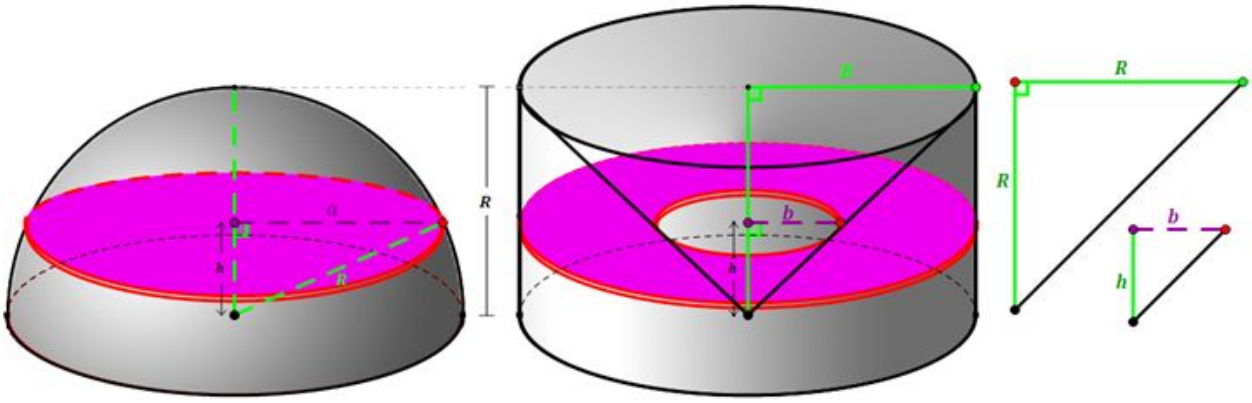
- **First, consider a hemisphere with a radius of R.**
- **Create a cylinder that has a base with the same radius R and a height equal to the radius R.**
- **Then, remove a cone from the cylinder that has the same base and height.**



- **Next, consider a cross section that is parallel to the base and cuts through both solids using the same plane.**



Cavalieri's Principle suggests if the 2 cross sections have the same area then the 2 solids must have the same volume.



Hemisphere	Cylinder with Cone Removed
Represent the AREA of the cross section of the sphere using "a"	Represent the AREA of the cross section of the donut using "R" and "b"
Use the Pythagorean theorem to solve for a^2 in the triangle relationship	What do you know about the two triangles shown above?
Use substitution to represent the area of the cross section in terms of R^2 and h^2	Based on this relationship, what can you conclude about h and b? Use substitution to represent the cross section area in terms of R^2 and h^2.

Based on Cavalieri's Principle, what can we conclude about the volume of the hemisphere and the volume of the cylinder with the cone removed?

Represent that relationship using the known formulas for the volume of the cylinder and the volume of the cone.

How can we represent the volume of the entire sphere using this relationship?