Volumes

Volumes by Base and Cross Section

1. Draw the base (on a set of axes)
2. Draw the intersection of the cross section with the base
3. Determine the variable of integration
4. Determine the bounds on the variable
5. Draw the cross section separate from the figure
   - Make sure to identify on the picture of the cross section where the intersection with the base occurs
6. Find a formula for the area of the cross section
7. Use the figure of the base to write the area formula in the proper variable

Volume of a Solid of Revolution

1. Draw the region
2. Draw the axis of rotation
3. Draw an approximating rectangle by connecting the two functions
4. Determine which method of volumes to use
   - Washers: the slice is *perpendicular* to the axis of rotation
   - Shells: the slice is *parallel* to the axis of rotation
5. Determine the variable of integration (from the thickness of the slice)
6. Determine the bounds (on the variable of integration)

Washers

7. Determine R: the distance from the axis of rotation to the far function
8. Determine r: the distacne from the axis of rotation to the close function
9. Set up the integral: $\pi \int_a^b (R^2 - r^2) d*$

Shells

7. Determine r: the distance from the slice to the axis of rotation
8. Determine h: the distance between the two functions
9. Set up the integral: $2\pi \int_a^b rh\, d*$