

You should work on the following problems in groups of 3. Try to get through as many as you can, but you aren't expected to finish everything. Instead, you should make sure everyone in your group knows **how** to solve all the problems, and not just the answers.

Volumes

1. Find the volume of a sphere of radius r
2. Find the volume of a right circular cone with height h and base radius r
3. For each of the following, (i) Sketch the described solid, (ii) write down an integral that gives its volume, (iii) find the volume.
 - (a) The area between $y = \ln x, y = 1, y = 2, x = 0$ about the y-axis
 - (b) The area between $y = x^2/4$ and $y = 5 - x^2$ is rotated about the x-axis.
 - (c) The area between $y = \frac{1}{x}, y = 0, x = 1$, and $x = 3$ is rotated about $y = -1$
 - (d) The area between $y = x^2$ and $x = y^2$ about $x = -1$
4. Set up, but do not bother to evaluate, an integral for the volume obtained by rotating the region bounded by $y = \tan^3 x, y = 1, x = 0$ about the line $y = 1$
5. We know that the volume of right circular cone is $\frac{1}{3}\pi r^2 h$ and the volume of a square pyramid is $\frac{1}{3}s^2 h$. Using geometry, show that in general the area of any cone with base area A and height A is $\frac{Ah}{3}$
 - (a) What is the volume of material removed by drilling a hole of radius r through the center of a sphere of radius R ? You may assume $R > r$.
 - (b) Repeat the above problem for a right circular cylinder and a hole drilled perpendicular to the axis of the cylinder.
 - (c) By using your answer to (b) and taking $r = R$, find the volume of the intersection of two right circular cylinders of radius R whose axes intersect and do so at a right angle.