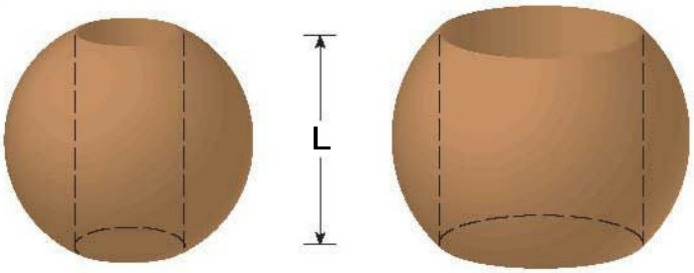
# ACTIVITY#4 — Math 151 — Calculus II — Spring 2021

**Professor/TA:** _____ **Sec:** _____ **RedID:** _____

**NAME (printed):** _____ _____ **Partners:** _____
**(Family Name)** **(First Name)**

## Volume of napkin rings

Suppose that you had two wooden spheres but of *different* radii. You make napkin rings out of them by drilling holes of *different* diameters through their middles. When you are done, you notice that the rings have exactly the *same* height $L$, as seen in the following sketch of the rings showing a vertical cross-sections through the centers of the rings.




(a) *Guess* which ring has the most volume (i.e., the most amount of wood). Why?

(b) Write an integral for the volume of a napkin ring made of a sphere of radius $R$ by using *slices*. Draw sketches of the slices and the quantities you are using. You do NOT need to compute this integral now but please do **simplify** the integrand as much as possible and you will notice something surprising! → In particular, how does the volume depend on the radius $R$ of the sphere?

(c) Now write an integral for the volume using *cylindrical shells*. Draw a typical shell for this object. You do NOT need to compute this integral now.

(d) On the back of the page compute explicitly the integrals you obtained in (b) and (c).