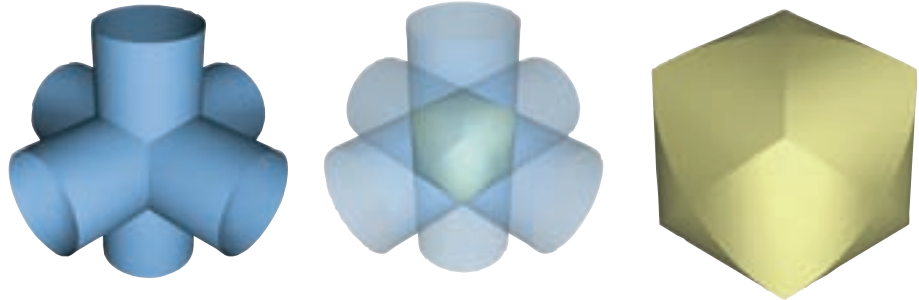


## 12.6

## DISCOVERY PROJECT: THE INTERSECTION OF THREE CYLINDERS

This project can be completed anytime after you have studied Section 12.6 in the textbook.

The figure shows the solid enclosed by three circular cylinders with the same diameter that intersect at right angles. In this project we compute its volume and determine how its shape changes if the cylinders have different diameters.



1. Sketch carefully the solid enclosed by the three cylinders  $x^2 + y^2 = 1$ ,  $x^2 + z^2 = 1$ , and  $y^2 + z^2 = 1$ . Indicate the positions of the coordinate axes and label the faces with the equations of the corresponding cylinders.
2. Find the volume of the solid in Problem 1.
- CAS 3. Use a computer algebra system to draw the edges of the solid.
4. What happens to the solid in Problem 1 if the radius of the first cylinder is different from 1? Illustrate with a hand-drawn sketch or a computer graph.
5. If the first cylinder is  $x^2 + y^2 = a^2$ , where  $a < 1$ , set up, but do not evaluate, a double integral for the volume of the solid. What if  $a > 1$ ?