A two-dimensional region in the $y z$ plane is bounded by the circle of radius 1 centered at the origin, the circle of radius 2 centered at the origin, the $45^{\circ}$ line through the origin, and the $30^{\circ}$ line through the origin (see figure). This region is revolved about the $z$ axis to form a three-dimensional region in the $x y z$ coordinate system. Using spherical coordinates, find the volume of this region.

