

## Math 203 — Cylindrical coordinates

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**Problem 1.** Set up a triple integral in cylindrical coordinates for the volume of each solid region described below. Begin by sketching the region.

- Bounded by the cylinders  $x^2 + y^2 = 1$  and  $x^2 + y^2 = 25$  and the planes  $z = 0$  and  $z = 6$ .
- Bounded by the half-cylinder  $x^2 + y^2 = 9$  where  $x \leq 0$  with height 4 and base on the  $xy$ -plane.
- Bounded below by the cone  $z = \sqrt{x^2 + y^2}$  and above by unit sphere.
- Bounded below by the cone  $z = \sqrt{x^2 + y^2}$  and above by the plane  $z = 2$ .
- The solid cylinder bounded by  $x^2 + y^2 = 1$  and  $z = 0, z = 1$  but with the solid cone bounded by  $z = \sqrt{x^2 + y^2}$  and  $z = 1$  removed.

**Problem 2.** A triple integral in cylindrical coordinates is given. Describe the region of integration in words and with a sketch.

- $\int_0^{\pi/2} \int_0^2 \int_0^2 r \, dz \, dr \, d\theta$
- $\int_0^\pi \int_0^1 \int_0^{1-r} r \, dz \, dr \, d\theta$
- $\int_0^{2\pi} \int_0^1 \int_0^{2-r} r \, dz \, dr \, d\theta$