

**Practice Problems for Section 15.8 and 15.9**

**Problem 1** Express  $\iiint_E \sqrt{x^2 + y^2}$  in cylindrical coordinates, where  $E$  is the solid bounded by the paraboloid  $z = 9 - x^2 - y^2$  and the  $xy$ -plane.

**Problem 2** Convert  $\int_0^1 \int_0^{\sqrt{1-y^2}} \int_{x^2+y^2}^{\sqrt{x^2+y^2}} (xyz) dz dx dy$  to cylindrical coordinates.

**Problem 3** Express  $\iiint_E xyz dV$  in spherical coordinates, where  $E$  is  $0 \leq z \leq \sqrt{1 - x^2 - y^2}$ .

**Problem 4** Express the volume of the solid that lies above the cone  $\phi = \frac{\pi}{3}$  and below the sphere  $\rho = 4 \cos \phi$ .

**Problem 5** Let  $Q$  be the elliptical region  $\frac{x^2}{4} + \frac{y^2}{9} \leq 1$ . Evaluate  $\iint_Q x^2 dA$  by making an appropriate change of variables.

**Problem 6** Evaluate  $\iint_R \cos\left(\frac{y-x}{y+x}\right) dA$ , where  $R$  is the trapezoidal region with vertices  $(1, 0), (2, 0), (0, 2), (0, 1)$ .