

## Section 14.6 Triple Integrals in Cylindrical and Spherical Coordinates

### Cylindrical Coordinates

$$\iiint_E f(x, y, z) dV = \int_{\alpha}^{\beta} \int_{h_1(\theta)}^{h_2(\theta)} \int_{u_1(r \cos(\theta), r \sin(\theta))}^{u_2(r \cos(\theta), r \sin(\theta))} f(r \cos(\theta), r \sin(\theta), z) r dz dr d\theta.$$

### Spherical Coordinates

$$\iiint_E f(x, y, z) dV = \int_c^d \int_{\alpha}^{\beta} \int_a^b f(\rho \sin(\phi) \cos(\theta), \rho \sin(\phi) \sin(\theta), \rho \cos(\phi)) \rho^2 \sin(\phi) d\rho d\theta d\phi$$

where  $E$  is a spherical wedge given by

$$E = \{(\rho, \theta, \phi) | a \leq \rho \leq b, \alpha \leq \theta \leq \beta, c \leq \phi \leq d\}.$$