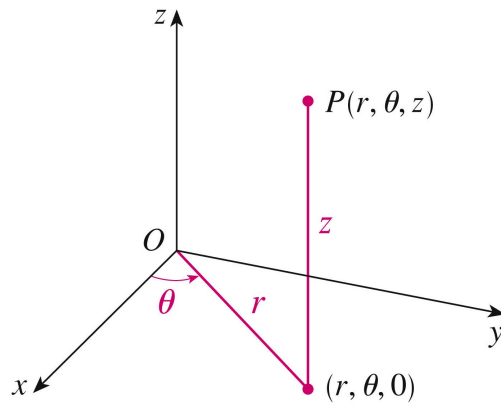# Lesson 52. Triple Integrals in Cylindrical Coordinates

1   Cylindrical coordinates

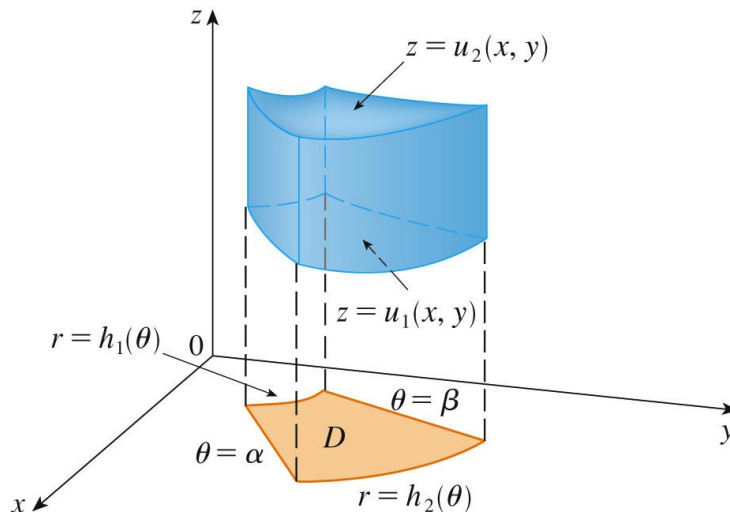- Idea: polar coordinates with a z-axis

- Converting between cylindrical and rectangular coordinates:

Example 1.   (a) Describe the surface whose equation in cylindrical coordinates is $r = 2$.
  (b) Describe the surface whose equation in cylindrical coordinates is $z = r$.

2 Evaluating triple integrals in cylindrical coordinates

$$\iiint_E f(x, y, z)\, dV = \iint_D \left[\int_{u_1(x,y)}^{u_2(x,y)} f(x, y, z)\, dz \right] dA$$

=

Example 2. Set up an iterated integral for $\iiint_E \sqrt{x^2 + y^2}\, dV$, where E is the region that lies inside the cylinder $x^2 + y^2 = 16$ and between the planes $z = 2$ and $z = 5$.

Example 3. Convert $\int_0^2 \int_0^{\sqrt{4-x^2}} \int_0^{4-x^2-y^2} (x + z)\, dz\, dy\, dx$ to a triple integral in cylindrical coordinates.