Day 20
Triple Integration using Cylindrical Coordinates and Intro to Spherical Coordinates

- Cylindrical Coordinates
  - Polar in 3D – just add the z coordinate on.
  - r is measured as in Polar except $0 \le r <$ □
  - θ is measured as in Polar except: $0 \le \theta \le 2\pi$
  - z is measured as in rectangular: $-$□ $< z <$ □
    - Plot a point $\left(2, \frac{\pi}{4}, 3\right)$
    - Describe the equations in Cylindrical Coordinates
      - $r = 2$
      - $\theta = \frac{\pi}{4}$
      - $z = 3$
- Integrating in Cylindrical Coordinates
  - What does ΔV look like?
  - $\iiint_R f(r,\theta,z)\, r\, d\theta\, dr\, dz$
  - Note: If $f(r,\theta,z)$ = 1, then

    $\iiint_R f(r,\theta,z)\, r\, d\theta\, dr\, dz = \iiint_R 1 \cdot r\, d\theta\, dr\, dz = Volume\ of\ R$
  - Example 1: Find the volume of a cylinder with Radius R and height H. (This is included in the video above.)

    You Try It
    Do Section 16.5 #13 Answer in Text

  - Example 2: Find the volume between the cone $z = \sqrt{x^2 + y^2}$ and the plane $z = 4$

    You Try It
    Do Section 16.5 # 33 Answer in Text

- Spherical Coordinates
  - ρ is the distance measured out from the origin to the point, $0 \le \rho <$ □
  - ϕ is the angel measured down from the positive z – axis, $0 \le \phi \le \pi$
  - θ is the same θ from Polar coordinates, $0 \le \theta \le 2\pi$
  - Here's a link to a site that will help you get comfy with Spherical Coordinates
    - Plot a point $\left(3, \frac{\pi}{4}, \frac{\pi}{2}\right)$, given as $(\rho, \theta, \phi,)$
    - Describe the equations in Spherical Coordinates

- $\rho = 2$
- $\theta = \frac{\pi}{4}$
- $\phi = \frac{\pi}{4}$
- $\phi = \frac{3\pi}{4}$
- $\phi = \frac{\pi}{2}$ *and* $\rho = 2$
- $\phi = \frac{\pi}{2}$ *and* $0 \le \rho \le 2$

    - Practice Problems on Spherical Coordinates Website
- Conversion Equations