

15.3 Videos Guide

15.3a

- Rectangular-polar conversions
 - $x = r \cos \theta$
 - $y = r \sin \theta$
 - $x^2 + y^2 = r^2$
 - $\tan \theta = \frac{y}{x}$
- The double integral in polar coordinates
 - $\iint_R f(x, y) dA = \int_{\alpha}^{\beta} \int_a^b f(r \cos \theta, r \sin \theta) r dr d\theta$
 - AND $\iint_D f(x, y) dA = \int_{\alpha}^{\beta} \int_{h_1(\theta)}^{h_2(\theta)} f(r \cos \theta, r \sin \theta) r dr d\theta$
 - Note that $dV = r dr d\theta$

Exercises:

15.3b

- Sketch the region whose area is given by the integral and evaluate the integral.
$$\int_{\pi/2}^{\pi} \int_0^{2 \sin \theta} r dr d\theta$$
- Evaluate the integral by changing to polar coordinates.
 $\iint_R (2x - y) dA$, where R is the region in the first quadrant enclosed by the circle $x^2 + y^2 = 4$ and the lines $x = 0$ and $y = x$.

15.3c

- $\iint_D x dA$, where D is the region in the first quadrant that lies between the circles $x^2 + y^2 = 4$ and $x^2 + y^2 = 2x$

15.3d

- Use polar coordinates to find the volume of the solid below the cone $z = \sqrt{x^2 + y^2}$ and above the ring $1 \leq x^2 + y^2 \leq 4$.
- Evaluate the iterated integral by converting to polar coordinates.

$$\int_0^a \int_{-\sqrt{a^2-y^2}}^{\sqrt{a^2-y^2}} (2x + y) dx dy$$