

1. Parametrize and give bounds for the portion of the paraboloid  $z = x^2 + y^2$  lying above the rectangle with vertices  $(0,0)$ ,  $(2,0)$ ,  $(2,3)$ , and  $(0,3)$ .

$$\begin{aligned}x(u, v) &= u \\y(u, v) &= v \\z(u, v) &= u^2 + v^2\end{aligned}$$

$$\text{for } 0 \leq u \leq 2, 0 \leq v \leq 3$$

2. Parametrize and give bounds for the portion of the cylinder with radius 4 centered around the  $z$ -axis between  $z = 2$  and  $z = 10$ .

$$\begin{aligned}x(u, v) &= 4 \cos u \\y(u, v) &= 4 \sin u \\z(u, v) &= v\end{aligned}$$

$$\text{for } 0 \leq u \leq 2\pi, 2 \leq v \leq 10$$

3. Parametrize and give bounds for a sphere with radius 5, centered at the origin.

$$\begin{aligned}x(u, v) &= 5 \sin u \cos v \\y(u, v) &= 5 \sin u \sin v \\z(u, v) &= 5 \cos u\end{aligned}$$

$$\text{for } 0 \leq u \leq \pi, 0 \leq v \leq 2\pi$$

1. Parametrize and give bounds for the rectangle with vertices  $(3,0,0)$ ,  $(3,2,0)$ ,  $(3,2,5)$ , and  $(3,0,5)$ .

$$x(u, v) = 3$$

$$y(u, v) = u$$

$$z(u, v) = v$$

$$\text{for } 0 \leq u \leq 2, 0 \leq v \leq 5$$

2. Parametrize and give bounds for the right half (i.e. the portion with positive  $y$  coordinates) of the cylinder with radius  $a$  and centered on the  $x$ -axis between  $x = 0$  and  $x = 5$ .

$$x(u, v) = u$$

$$y(u, v) = a \cos v$$

$$z(u, v) = a \sin v$$

$$\text{for } 0 \leq u \leq 5, -\pi/2 \leq v \leq \pi/2$$

3. Parametrize and give bounds for the portion to the right of  $y = 0$  of a sphere with radius 5, centered at the origin.

$$x(u, v) = 5 \sin u \cos v$$

$$y(u, v) = 5 \sin u \sin v$$

$$z(u, v) = 5 \cos u$$

$$\text{for } 0 \leq u \leq \pi, 0 \leq v \leq \pi$$