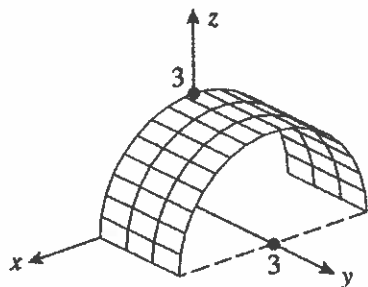
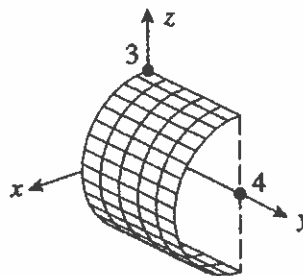
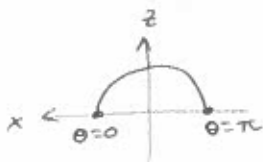


1. Parameterize each of the surfaces below. Make sure to include the domain of your parameterization.



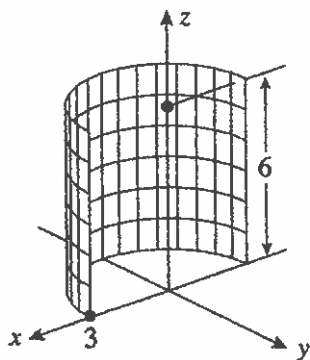
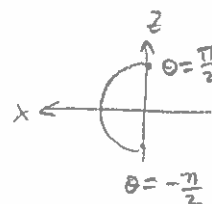
$$\begin{cases} x = 3 \cos \theta \\ y = y \\ z = 3 \sin \theta \end{cases}$$

$$\begin{aligned} 0 &\leq \theta \leq \pi \\ 0 &\leq y \leq 3 \end{aligned}$$



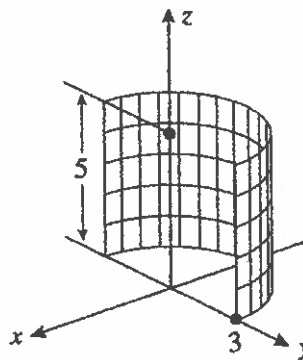
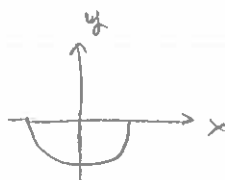
$$\begin{cases} x = 3 \cos \theta \\ y = y \\ z = 3 \sin \theta \end{cases}$$

$$\begin{aligned} -\frac{\pi}{2} &\leq \theta \leq \frac{\pi}{2} \\ 0 &\leq y \leq 4 \end{aligned}$$



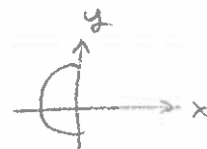
$$\begin{cases} x = 3 \cos \theta \\ y = 3 \sin \theta \\ z = z \end{cases}$$

$$\begin{aligned} \pi &\leq \theta \leq 2\pi \\ 0 &\leq z \leq 6 \end{aligned}$$



$$\begin{cases} x = 3 \cos \theta \\ y = 3 \sin \theta \\ z = z \end{cases}$$

$$\begin{aligned} \frac{\pi}{2} &\leq \theta \leq \frac{3\pi}{2} \\ 0 &\leq z \leq 5 \end{aligned}$$



2. Parameterize the part of the plane $z = x - 2y + 3$ that lies inside the cylinder $x^2 + y^2 = 4$.

$$\begin{cases} x = x \\ y = y \\ z = x - 2y + 3 \end{cases}, \quad x^2 + y^2 \leq 4$$

3. Parameterize the part of the cone $z = \sqrt{x^2 + y^2}$ that lies on or below $z = 3$.

$$\begin{cases} x = x \\ y = y \\ z = \sqrt{x^2 + y^2} \end{cases}, \quad x^2 + y^2 \leq 9$$

$z \leq 3 \quad \text{so} \quad \sqrt{x^2 + y^2} \leq 3$

4. Parameterize the part of the sphere $x^2 + y^2 + z^2 = 4$ that lies above the cone $z = \sqrt{x^2 + y^2}$.

$$\begin{cases} x = 2 \cos \theta \sin \phi \\ y = 2 \sin \theta \sin \phi \\ z = 2 \cos \phi \end{cases}$$

$$0 \leq \theta \leq 2\pi$$

$$0 \leq \phi \leq \pi/4$$

$\rho = 2$ in spherical

$\phi = \pi/4$ in spherical

above means
 $0 \leq \phi \leq \pi/4$



OR the intersection of the two

surfaces: $x^2 + y^2 + (\sqrt{x^2 + y^2})^2 = 4$

$$2x^2 + 2y^2 = 4$$

$$x^2 + y^2 = 2$$



$$\phi = \pi/4$$

5. Parameterize the part of the cone $z = \sqrt{x^2 + y^2}$ that lies inside the sphere $x^2 + y^2 + z^2 = 4$.

$z = r$
in cylindrical

$r^2 + z^2 \leq 4$ in cylindrical

$r^2 + r^2 \leq 4 \leftarrow \text{since } z = r$

$$2r^2 \leq 4$$

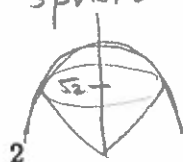
$$r \leq \sqrt{2}$$

$$\begin{cases} x = r \cos \theta \\ y = r \sin \theta \\ z = r \end{cases}$$

$$0 \leq \theta \leq 2\pi$$

$$0 \leq r \leq \sqrt{2}$$

OR since the cone and the sphere intersect when $z = \sqrt{2}$



$$0 \leq z \leq \sqrt{2}$$

and since $z = r$, $0 \leq r \leq \sqrt{2}$