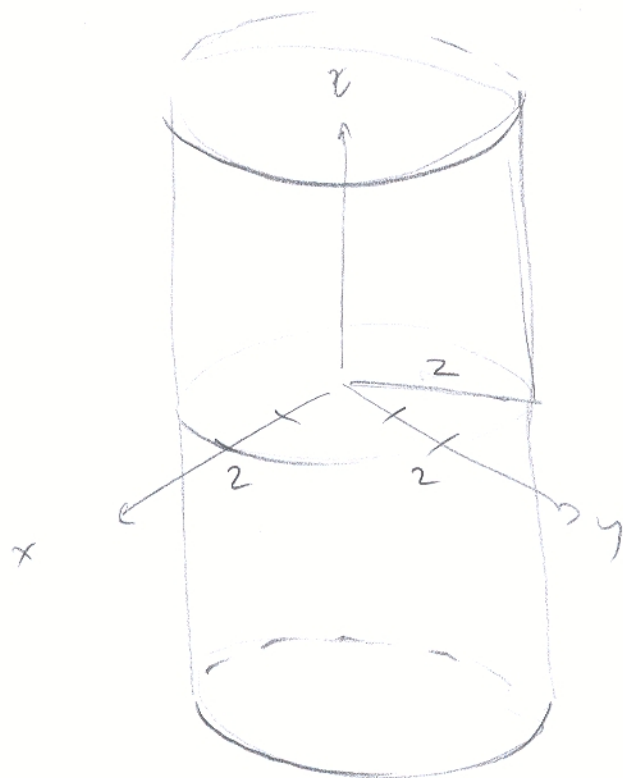


Math 212, Midterm 2 - February 18, 2009 SOLUTIONS

1. Sketch the region in \mathbb{R}^3 described by $x^2 + y^2 = 4$. Describe the region using your choice of cylindrical or spherical coordinates.



It's a cylinder of radius 2 centered around the z -axis. In cylindrical coordinates, it is described by the equation $r = 2$.

Computation: $x^2 + y^2 = 4$ $x = r \cos \theta$ $y = r \sin \theta$

$$\therefore r^2 \cos^2 \theta + r^2 \sin^2 \theta = 4$$
$$r^2 = 4.$$

2. If $f: \mathbb{R}^2 \rightarrow \mathbb{R}^3$ is the function

$$f(\theta, \phi) = (\sin \phi \cos \theta, \sin \phi \sin \theta, \cos \phi)$$

compute the derivative Df .

$$Df = \begin{bmatrix} -\sin \phi \sin \theta & \cos \phi \cos \theta \\ \sin \phi \cos \theta & \cos \phi \sin \theta \\ 0 & -\sin \phi \end{bmatrix}$$