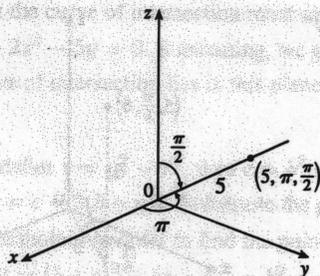


6. (a) $r^2 = x^2 + y^2 = 3^2 + 3^2 = 18$ so $r = \sqrt{18} = 3\sqrt{2}$; $\tan \theta = \frac{y}{x} = \frac{3}{3} = 1$ and the point $(3, 3)$ is in the first quadrant of the xy -plane, so $\theta = \frac{\pi}{4} + 2n\pi$; $z = -2$. Thus, one set of cylindrical coordinates is $(3\sqrt{2}, \frac{\pi}{4}, -2)$.

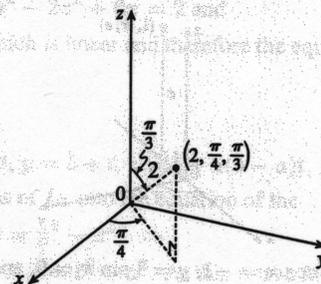
(b) $r^2 = 3^2 + 4^2 = 25$ so $r = 5$; $\tan \theta = \frac{4}{3}$ and the point $(3, 4)$ is in the first quadrant of the xy -plane, so $\theta = \tan^{-1} \frac{4}{3} + 2n\pi \approx 0.93 + 2n\pi$; $z = 5$. Thus, one set of cylindrical coordinates is $(5, \tan^{-1} \frac{4}{3}, 5) \approx (5, 0.93, 5)$.

8. (a)



$x = 5 \sin \frac{\pi}{2} \cos \pi = -5$, $y = 5 \sin \frac{\pi}{2} \sin \pi = 0$,
 $z = 5 \cos \frac{\pi}{2} = 0$ so the point is $(-5, 0, 0)$ in rectangular coordinates.

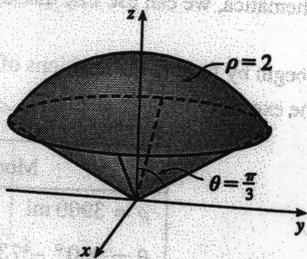
(b)



$x = 2 \sin \frac{\pi}{3} \cos \frac{\pi}{4} = \frac{\sqrt{6}}{2}$,
 $y = 2 \sin \frac{\pi}{3} \sin \frac{\pi}{4} = \frac{\sqrt{6}}{2}$, $z = 2 \cos \frac{\pi}{3} = 1$ so
the point is $(\frac{\sqrt{6}}{2}, \frac{\sqrt{6}}{2}, 1)$ in rectangular coordinates.

16. Since $\rho \sin \phi = 2$ and $x = \rho \sin \phi \cos \theta$, $x = 2 \cos \theta$. Also $y = \rho \sin \phi \sin \theta$ so $y = 2 \sin \theta$. Then $x^2 + y^2 = 4 \cos^2 \theta + 4 \sin^2 \theta = 4$, a circular cylinder of radius 2 about the z -axis.

28.



$\rho = 2 \Leftrightarrow x^2 + y^2 + z^2 = 4$, which is a sphere of radius 2, centered at the origin. Hence $\rho \leq 2$ is this sphere and its interior. $0 \leq \phi \leq \frac{\pi}{3}$ restricts the solid to that section of this ball that lies above the cone $\phi = \frac{\pi}{3}$.

30. (a) The hollow ball is a spherical shell with outer radius 15 cm and inner radius 14.5 cm. If we center the ball at the origin of the coordinate system and use centimeters as the unit of measurement, then spherical coordinates conveniently describe the hollow ball as $14.5 \leq \rho \leq 15$, $0 \leq \theta \leq 2\pi$, $0 \leq \phi \leq \pi$.

(b) If we position the ball as in part (a), one possibility is to take the half of the ball that is above the xy -plane which is described by $14.5 \leq \rho \leq 15$, $0 \leq \theta \leq 2\pi$, $0 \leq \phi \leq \pi/2$.