10. $r^2=x^2+y^2=3^2+3^2=18$ 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 $\left(3\sqrt{2},\frac{\pi}{4},-2\right)$.

20. $\rho=\sqrt{x^2+y^2+z^2}=\sqrt{0+3+1}=2$, $\cos\phi=\frac{z}{\rho}=\frac{1}{2}\Rightarrow\phi=\frac{\pi}{3}$, and $\cos\theta=\frac{x}{\rho\sin\phi}=\frac{0}{2\sin(\pi/3)}=0\Rightarrow$ $\theta=\frac{\pi}{2}$ (since $y>0$). Thus spherical coordinates are $\left(2,\frac{\pi}{2},\frac{\pi}{3}\right)$.

25. $\rho=\sqrt{r^2+z^2}=\sqrt{3+1}=2$; $\theta=\frac{\pi}{2}$; $\cos\phi=\frac{z}{\rho}=\frac{-1}{2}\Rightarrow\phi=\frac{2\pi}{3}$, so in spherical coordinates the point is $\left(2,\frac{\pi}{2},\frac{2\pi}{3}\right)$.

26. $\rho=\sqrt{16+9}=5$; $\theta=\frac{\pi}{8}$; $\cos\phi=\frac{3}{5}\Rightarrow\phi=\cos^{-1}\left(\frac{3}{5}\right)$, so in spherical coordinates the point is $\left(5,\frac{\pi}{8},\cos^{-1}\left(\frac{3}{5}\right)\right)\approx\left(5,\frac{\pi}{8},0.927\right)$.

30. $z=4\cos\frac{\pi}{3}=2$, $r=4\sin\frac{\pi}{3}=2\sqrt{3}$, $\theta=\frac{\pi}{4}$ and the point is $\left(2\sqrt{3},\frac{\pi}{4},2\right)$.

56. **(a)** $z=r^2(\cos^2\theta-\sin^2\theta)$ or $z=r^2\cos 2\theta$.
(b) $\rho\cos\phi=\rho^2\sin^2\phi(\cos^2\theta-\sin^2\theta)$ or $\cos\phi=\rho\sin^2\phi\cos 2\theta$.