**Problems 16.3, Page 303**

3. A cylindrical surface, of radius 5 and height 7, resting on the $xy$-plane centered around the $z$-axis.

4. A spiral (helix) of constant radius 5, starting at (5,0,0) and making one turn around the $z$-axis during which it rises to $10\pi$.

5. A cone of height and base (or rather top) radius 5, with point at the origin and widening around the positive $z$-axis

8. A cylindrical surface rising vertically from the parabola $y = x^2$, with $-5 \leq x \leq 5$, in the $xy$-plane, and with height 7.

9. One answer (the one suggested by Figure 16.45) is $x = a\cos\theta$, $y = a\sin\theta$, $z = z$, with $0 \leq \theta \leq 2\pi$, $0 \leq z \leq h$.

12. (a) To get $2+s = 4$, we must have $s = 2$, and to have $4t = 12$, we must have $t = 3$, and then $3+s+t = 8$, so this point is on the plane.
(b) To get $2 + s = 1$, we must have $s = -1$, and to have $4t = 3$, we must have $t = 3/4$, and then $3 + s + t = 2.75$, not 2, so this point is not on the plane.

17. Taking a cue from spherical coordinates: $x = 5\sin\phi\cos\theta$, $y = 5\sin\phi\sin\theta$, $z = 5\cos\phi$, where $0 \leq \phi \leq \pi$, $0 \leq \theta \leq 2\pi$.

18. $x = 2 + 5\sin\phi\cos\theta$, $y = -1 + 5\sin\phi\sin\theta$, $z = 3 + 5\cos\phi$, where $0 \leq \phi \leq \pi$, $0 \leq \theta \leq 2\pi$.

30. $x^2 + y^2 = 9$, $x \geq 0$, $1 \leq z \leq 2$. This is half a cylinder, of radius 3, centered on the $z$-axis, in front of the $yz$-plane, from 1 to 2 units above the $xy$-plane.

31. $x^2 + y^2 + z^2 = 1$, $x, y, z \geq 0$, $x^2 + y^2 \leq 1$. This is the eighth of the sphere of radius 1 centered at the origin that lies in the first octant (where all the coordinates are positive).