15. The lower limit on $z$, $z = r$, gives a cone, while the upper limit is a horizontal plane. $\theta$ goes from 0 to $2\pi$, so we take the cone all the way around the $z$-axis. Since $r$ goes from 0 to 4, we get the entire (solid) cone up to $z = 4$. See the back of the book for a graph.

16. $z$ ranges from the $xy$-plane to the upside-down paraboloid $9 - x^2 - y^2$, which meets the $xy$-plane in a circle of radius 3 centered at the origin. $r$ only goes out to 2, so we have a cylinder of radius 2 cut off by the parabolic cap. Finally, since $\theta$ only ranges from 0 to $\pi/2$, we only get the portion of this in the first octant.

17. $\int_0^{2\pi} \int_0^4 \int_{-5}^4 (r) rdzdrd\theta = (2\pi)(4^3/3)(9) = 384\pi$.

18. The paraboloid meets the $xy$-plane in the circle $x^2 + y^2 = 1$, so we get $\int_0^{\pi/2} \int_0^1 \int_0^{1-r^2} (r^3 \cos^3 \theta + r^3 \cos \theta \sin^2 \theta) rdzdrd\theta = \int_0^{\pi/2} \int_0^1 \int_0^{1-r^2} r^4 \cos \theta dzdrd\theta = \frac{2}{35}$.

20. $z$ ranges from 0 to $x + y + 5$, $r$ ranges from 2 to 3, and $\theta$ ranges from 0 to $2\pi$. (The plane that serves as a "lid" is entirely above the $xy$-plane over this circle, so we don’t need to cut $\theta$ down any.) We get $\int_0^{2\pi} \int_2^3 \int_0^{r \cos \theta + r \sin \theta + 5} (r \cos \theta) rdzdrd\theta = \frac{65\pi}{4}$.

26. The density is given by $kr$ for some constant $k$. We have $\int_0^{2\pi} \int_0^a \int_{\sqrt{a^2 - r^2}}^{\sqrt{a^2 - a^2}} (kr) rdzdrd\theta = \frac{k\pi^2 a^4}{4}$.

29. (a) $W = \iiint_E h(P)g(P)dV$.

(b) The cone rises from 0 feet to 12,400 feet over a 62,000-foot span, for a slope of $\frac{1}{5}$ down the side of the cone. Since the cone has circular symmetry, polar coordinates are natural for this problem. We get $\int_0^{2\pi} \int_0^{62000} \int_0^{12400 - r/5} 200zrdzdrd\theta \approx 3.1 \times 10^{19}$ foot-pounds.