§5.1, 6: \((\ln 9)/4; 14: The region is bounded by \(z = |x| \sin(\pi y)\), the \(xy\)-plane \((z = 0)\), and the planes \(x = -2, x = 3, y = 0,\) and \(y = 1\). The volume of this region is \(13/\pi\).

§5.2, 20: (a) The volume of a solid prism with constant height is the area of the base times the height; in this case the height is 1. A more formal proof can be constructed using Riemann sums. (b) If \(D\) is the region bounded by the circle \(x^2 + y^2 = a^2\), then

\[
\iint_D 1 \, dA = \int_{-a}^{a} \int_{\sqrt{a^2-x^2}}^{-\sqrt{a^2-x^2}} dy \, dx = \int_{-a}^{a} 2\sqrt{a^2-x^2} \, dx = \pi a^2.
\]

Extra problems:

1. (a) The volume of the hemisphere is

\[
\iint_D \sqrt{r^2-x^2-y^2} \, dA = \int_{-r}^{r} \int_{-\sqrt{r^2-x^2}}^{\sqrt{r^2-x^2}} \sqrt{r^2-x^2-y^2} \, dy \, dx
\]

\[
= \int_{-r}^{r} \left( \frac{y\sqrt{r^2-x^2-y^2}}{2} + \frac{r^2-x^2}{2} \sin^{-1} \frac{y}{\sqrt{r^2-x^2}} \right) \bigg|_{-\sqrt{r^2-x^2}}^{\sqrt{r^2-x^2}} \, dx
\]

\[
= \int_{-r}^{r} \frac{\pi}{2} (r^2-x^2) \, dx
\]

\[
= \frac{2\pi r^3}{3}.
\]

(b) \(4\pi r^3/3\).

2. (a) The disk is centered at \((x_0, 0, 0)\), and \((x_0, \sqrt{r^2-x_0^2}, 0)\) is a point on the boundary of the disk. It follows that the radius of the disk is the distance between these two points, or \(\sqrt{r^2-x_0^2}\). The area is \(\pi (r^2-x_0^2)\).

(b) The slices go from \(x = -r\) to \(x = r\); thus the volume is

\[
\int_{-r}^{r} \pi (r^2-x^2) \, dx = \frac{4\pi r^3}{3}.
\]