Warning: I think the ‘answers’ given below are correct, but don’t stake your life on it.

1. Section 6.2: #19, 26a
2. Section 6.3: #5, 9, 10, 12
   (Hints: For #5, to find the intersection of the two surfaces eliminate $x^2 + y^2$ from the two equations. For #7, I think the book’s answer is wrong: I got $\frac{\pi}{3}(36 - 16\sqrt{2})$. For #15, use the change of variables $x = v - u, y = u + v$.)
4. Let $S$ be the solid region lying inside the sphere $x^2 + y^2 + z^2 = 10$ but above the plane $z = 3$.
   (a) Set up a triple integral in cylindrical coordinates to find the volume of this solid. Do not evaluate.
   (b) Set up an integral in spherical coordinates that would give you the same volume—do not evaluate.
   It’s probably best to use $d\phi d\theta d\rho$ here.
   (c) Evaluate ONE of the integrals you wrote down in (a) and (b). (Ans: $2\pi[\frac{11\sqrt{11}}{3} - 12]$.)
5. Consider the integral
   \[
   \int_0^{\pi/2} \int_0^1 \int_0^{1-r}(r^2 \cos \theta) dzdrd\theta.
   \]
   (a) Using $xyz$-coordinates, sketch a picture of the region of integration.
   (b) Convert the above integral into rectangular coordinates (but do not evaluate).
   (c) Convert the same integral into spherical coordinates (do not evaluate).
   (d) Use cylindrical coordinates, but change the order of integration to $d\theta dr dz$ (do not evaluate the integral).
6. Consider the solid bounded above by the cone $z = \sqrt{x^2 + y^2}$, below by the $xy$-plane, and on the sides by the $y = 0$ plane, the $x = 0$ plane, and the cylinder $x^2 + y^2 = 4$. Assume the solid has constant density, and compute the $x$-coordinate of its center of mass. (Ans: $\frac{4}{3}$).
7. Consider a wedge-shaped solid bounded above by the $z = y$ plane, below by the $z = 0$ plane, and on the side by the cylinder $x^2 + y^2 = 4$. Assuming the density is given by $\rho(x, y, z) = yz$, compute the total mass.
8. Find the average distance to the origin for points inside the sphere $x^2 + y^2 + z^2 = 1$.
9. Let $S$ be the solid defined by $1 \leq x^2 + y^2 + z^2 \leq 2$, $z \geq 0$. The total mass of this solid turns out to be $\frac{14\pi}{3}$. Find the center of mass of the solid, using spherical coordinates. (Partial answer: The $z$-coordinate is $\frac{45}{56}$).

Some review problems (do not hand in):

10. p. 394, #17, 22.
11. Evaluate the integral
    \[
    \int \int_R \sqrt{(x + y)(x - 2y)} \, dx \, dy
    \]
    where $R$ is the region enclosed between $x = 2y, y = 0$, and $x + y = 1$. Use the change of coordinates $x = \frac{2u + v}{3}$, and $y = \frac{2v - u}{3}$. (Ans: $\frac{2}{27}$).
12. Let $P$ be the parallelogram with vertices (0, 0), (1, 3), (5, 1), and (6, 4). By using an appropriate change-of-coordinates (which you have to come up with), convert the integral $\int \int_P xy \, dA$ into an integral over the unit square $0 \leq u \leq 1, 0 \leq v \leq 1$. Evaluate the integral. (Ans: $\frac{280}{3}$).