1. Find the centroid for the following objects:
   (a) Let D be a solid cone with height h base radius r and constant density.
   (b) Let R be a plate in the shape of the bounded region enclosed by the functions $y = x^2 - 1$ and $y = \frac{3x^2}{4} - \frac{7}{16}$ with constant density function.
2. Let D be a bounded object enclosed by the planes
$$x = y, \quad z = y - 5, \quad z = 0 \quad \text{and} \quad x = 0.$$
with density function $f(x, y, z) = |x + y + z| + 1$.
   (a) Find the total mass of D.
   (b) Find the y-coordinate of the centroid of D.
3. The force of gravity that an point mass with mass m_1 exerts on a point mass with mass m_2 at a distance r has magnitude
$$|\mathbf{F}| = \frac{Gm_1m_2}{r^2}$$
where G is the universal gravitational constant (and has value approximately $6.674 \times 10^{-11}\mathtt{Nm}^2/\mathtt{kg}^2$) Set up a spherical integral which computes the force of gravity of a spherical planet with constant density c in $\mathtt{kg}/\mathtt{m}^3$ and radius R in $\mathtt{m}$ on a point mass of mass m located D meters from the center of the planet.
4. Evaluate $\iint_R x^2 - xy + y^2 \, dA$ where R is the region bounded by the ellipse $x^2 - xy + y^2 = 2$. Use the change of variables $x = \sqrt{2}u - \sqrt{\frac{2}{3}}v$, $y = \sqrt{2}u + \sqrt{\frac{2}{3}}v$.