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
   \[ x = y, \quad z = y - 5, \quad z = 0 \text{ and } x = 0. \]
   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 a 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 $6.674 \times 10^{-11} \text{Nm}^2/\text{kg}^2$).
   Set up a spherical integral which computes the force of gravity of a spherical planet with constant density $c$ in $\text{kg/m}^3$ and radius $R$ in m on a point mass of mass $m$ located $D$ meters from the center of the planet.

4. Evaluate $\int \int_{R} x^2 - xy + y^2 \, dA$ where $R$ is the region bounded by the ellipse $x^2 - xy + y^2 = 2$. Use the change of variables $x = \sqrt{2}u - \sqrt{\frac{2}{3}}v$, $y = \sqrt{2}u + \sqrt{\frac{2}{3}}v$. 