Problem 1. Find the center of mass of a lamina that occupies the region bounded by $y = x$ and $y = 2 - x^2$ and has a density $\rho(x, y) = x^2$.

Problem 2. Evaluate the integral $\int \int \int_E z^2 \, dV$, where $E$ is the unit ball $x^2 + y^2 + z^2 = 1$.

Problem 3. Find the volume of a solid bounded by the surfaces $y^2 + z^2 = 1$, $x = 0$ and $x + 2y + 3z = 10$.

Problem 4. Find all saddle points of the function $f(x, y) = x^2 e^{-x} + y^3 - 3y$.

Problem 5. Change the order of integration in the integral:

$$\int_{-1}^{0} \int_{\sqrt{1-x^2}}^{1-x^2} (x^2 + 5y) \, dy \, dx$$

Problem 6. Find the Jacobian of the transformation $x = uv + w$, $y = vw - u$, $z = uw + v$.

Problem 7. Evaluate the double integral of the function $f(x, y) = \frac{y}{x^2} + x^2$ over the region in the first quadrant bounded by the lines $y = x$, $y = \sqrt{3}x$ and the circle $x^2 + y^2 = 1$.

Problem 8. Evaluate the triple integral of the function $f(x, y, z) = 6y - 1$ over the region bounded by the planes $x = 0$, $y = 0$, $z = 0$ and $x + y + z = 1$. 
Problem 9. Use The Lagrange Multipliers Method to set up the system of the equations for finding the shortest distance from the point \((1, -2, 3)\) to the surface \(x^2 + 4y^2 - 4z^2 = 16\). Do not solve the system.

Problem 10. Find the absolute maximum value of
\[ f(x, y) = 6x^2 - 2x^3 + 3y^2 + 6xy \]
in the triangular region bounded by the coordinate axes and the line \(y = 1 - x\).