1. (10 points each) Evaluate the following double integrals.

   (a) \( \iint_R (y - x) \, dA \), where \( R \) in the first quadrant is bounded by the curves \( x = 0 \), 
       \( y = 0 \), and \( x = 3 - 2y^2 \).

   (b) \( \iint_R e^{-x^2-y^2} \, dA \), where \( R \) is the region bounded by the curves \( x = -\sqrt{4-y^2} \) and 
       the \( y \)-axis.
2. (12 points) Find the local minimum and local maximum values and the saddle points (if any) of the following function:

\[ f(x, y) = x^3 y + 12x^2 - 8y. \]
3. (5 points each) If \( f(u, v) = ve^{uv} \) and \( u = x + 2y \) and \( v = x/y \), then find

(a) \( \frac{\partial f}{\partial x} \)

(b) \( \frac{\partial f}{\partial y} \)
4. (5 points each) Consider the function $f(x, y) = xe^{-y} + 3y$ and the point with coordinates $(x_0, y_0) = (1, 0)$.

(a) Find the gradient of $f(x, y)$.

(b) Find the direction of the minimum rate of change of $f(x, y)$ at $(x_0, y_0)$.

(c) Find the magnitude of the maximum rate of change of $f(x, y)$ at $(x_0, y_0)$.

(d) Find the directional derivative of $f(x, y)$ at $(x_0, y_0)$ in the direction of $u = (-1, 2)$. 
5. (11 points) Find the linear approximation of the function

\[ f(x, y) = \sqrt{20 - x^2 - 7y^2} \]

at \((x, y) = (2, 1)\) and use it to approximate \(f(1.95, 1.08)\).
6. (12 points) Use Lagrange Multipliers to find the maximum and minimum values of
\( f(x, y) = x^2 y \) subject to the constraint, \( x^2 + 2y^2 = 6. \)
7. (15 points) A lamina occupies the region $R = \{(x, y) \mid x^2 + y^2 \leq 1\}$ in the first quadrant. The density of the lamina is equal to its distance from the origin. Find the mass, moments about the $x$ and $y$-axes, and the center of mass of the lamina.