I. For each function, find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$.

1. $f(x, y) = 5xy - 7x^2 - y^2 + 3x - 6y + 2$
2. $f(x, y) = xe^{(x+2y)}$

II. For $f(x, y, z) = \ln(x + 2y^2 + 3z^3)$ find
   1. $f_x$
   2. $f_y$
   3. $f_z$

III. The amount of work done by the left ventricle of the heart is given by

$$W(P, V, \delta, \gamma, g) = PV + \frac{V\delta\gamma^2}{2g}.$$ Find
   1. $\frac{\partial W}{\partial V}$
   2. $\frac{\partial W}{\partial \gamma}$

III. For the function $f(x, y) = xe^y + y^2 + x^3$
   1. Find all the second order partial derivatives.
   2. Compute the Hessian at the point $(3,1)$.

V. Given $w = x^2 + y^2$, $x = \cos(t) + \sin(t)$, $y = \cos(t) - \sin(t)$
   1. Draw a lattice diagram used to find $\frac{\partial w}{\partial t}$.
   2. Find $\frac{\partial w}{\partial t}$.

VI. For the function $f(x, y, z) = (x^2 + y + z^2)^{1/2} + \ln(xyz)$
   1. Find $\nabla f$.
   2. Evaluate $\nabla f$ at the point $(-1,2,-2)$.

VII. For the surface $x^2 + y^2 - 2xy - x + 3y - z = -4$ and the point $P_0(2,-3,18)$ find
   1. The equation of the tangent plane at $P_0$.
   2. The equation of the normal line at $P_0$.

VIII. Find the linearization of the function $f(x, y) = x^3 + y^2 + 1$ at the point $(1,1)$.

IX. For the function find all local maxima, local minima, and saddle points.
   1. $f(x, y) = 2xy - 2x^2 - 2y^2 + 4x + 4y - 4$

X. Find the absolute extremum of $f(x, y) = x^2 - xy + y^2$ on the closed triangle in the first quadrant bounded by $x = 0$, $y = 4$, and $y = 2x$

XI. Use Lagrange Multipliers to find the extreme values of $f(x, y) = x^2 + y$ subject to $x^2 + y^2 - 1 = 0$. 