1. Suppose $x$ and $y$ are functions of $t$:

$$x = x(t), \quad y = y(t).$$

Also suppose that

$$x(0) = 1, \quad y(0) = 0 \quad x'(0) = 1, \quad \text{and} \quad y'(0) = 2.$$

Let $f(x, y) = \sqrt{x \cos y}$. What is $(df/dt)(0)$?
2. Suppose $u = u(x, y)$. Show that $\nabla(e^u) = e^u \nabla u$. 
3. Find the absolute maximum and minimum of the function

\[ f(x, y) = x(1 - x) y \]

on (and inside) the square with corners (0, 0), (0, 1), (1, 0), (1, 1).
4. Find the extreme values of the function

\[ f(x, y) = xy \]

on the unit circle

\[ x^2 + y^2 = 1. \]
5. Find the directional derivative of 
\[ f(x, y) = 2\sqrt{x} - y^2 \]
at the point \((1, 5)\) in the direction toward the point \((4, 1)\).
6. Show that there is no point where the tangent plane to the surface
\[ xyz = 8 \]
is parallel to the \( xy \)-plane.