Practice Quiz 2.

**Problem 1.** Let $f(x, y) = e^{-x^2-y^2}$. Sketch (and label) some level curves of this function. Use the level curves to sketch the graph of the function in $\mathbb{R}^3$.

**Problem 2.** Let $f(x, y) = \sin(x^2+3y) + xy^2$. Compute $f_x$, $f_y$, $f_{xx}$, $f_{xy}$ and $f_{yy}$. 
Problem 3. Suppose that the width of a box is increasing at a rate of 2 cm/s while its height is decreasing at a rate of 3 cm/s. What is the instantaneous rate of change of the volume of the box if its proportions are

\[ \text{length} \times \text{width} \times \text{height} = 1 \times 2 \times 3? \]

Problem 4. Suppose that \( z = f(a, b, c) \) and that \( a = g(x, y) \) and \( b = h(x, y) \) and \( c = i(x, y) \). Give a general expression for the partial derivative \( \partial z / \partial x \).
Problem 5. What is the equation of the tangent plane to the surface
\[ x^2 + 2y^2 + 3z^2 = 6 \]
at the point \((1, 1, 1)\)? (Hint: It is easiest to use implicit differentiation.)

Problem 6. Verify that
\[
    u(x,t) = \frac{1}{\sqrt{4\pi t}} e^{-x^2/4ct}
\]
is a solution to the heat equation \(u_t = cu_{xx}\).