1. Let \( q = f(u, v, w) \), \( u = 2x - y^2 \), \( v = x \sin 3y \), and \( w = x^4 \). Find \( \frac{\partial q}{\partial x} \) and \( \frac{\partial q}{\partial y} \). Your answer will involve \( f_u \), \( f_v \), and \( f_w \).

2. Find the equation of the tangent plane to the surface \( z = \sqrt{x} + \tan^{-1} y \) at the point \((9, 0, 3)\).

3. We say that a real-valued function of one variable \( f(x) \) is differentiable at a point \( a \) if there is a number \( A \) and a function \( g(x) \) such that

\[
    f(x) = f(a) + A(x - a) + (x - a)g(x)
\]

and \( g(x) \to 0 \) as \( x \to a \). In this case we call the number \( A \) the derivative of \( f \) at \( a \) and set \( f'(a) = A \).

(a) Relate this to the definition of \( f'(a) \) that you know and love. Consider solving for \( g(x) \).
(b) Relate this to Prof. Caldararu’s definition of a differentiable function of two variables.
(c) Relate this to the Taylor series.
(d) Relate this to the tangent line approximation.