Quiz 10 **Name:** _____

Multivariable Calculus

Math 408D:

Instructor: Athil George

Problem 1. Consider the following function, where the parameters m and g are constants.

$$H(t, p_x, p_y, p_z, x, y, z) = \frac{1}{2m}(p_x^2 + p_y^2 + p_z^2) + mgz$$

Find the following partial derivatives:

1. $\frac{\partial H}{\partial t}$
2. $\frac{\partial H}{\partial x}$
3. $\frac{\partial H}{\partial y}$
4. $\frac{\partial H}{\partial z}$
5. $\frac{\partial H}{\partial p_x}$
6. $\frac{\partial H}{\partial p_y}$
7. $\frac{\partial H}{\partial p_z}$

This function is the Hamiltonian of a particle with mass m in a uniform gravitational field! The Hamiltonian is a function of the states (x,y,z) and costates (p_x,p_y,p_z) that describes the sum of the Kinetic and Potential Energy of a particle or system. The partials that you found in this problem have great significance in Hamiltonian mechanics.