Assignment 1, due Friday 22th Jan. 8am

1. Let $f(x, y) = \arctan \left( \frac{x^2 + y^2}{2} \right)$. Compute $f_x(1, 1)$ and $f_y(1, 1)$.

2. Find all unit vectors in $\mathbb{R}^3$ which are parallel to the vector $\langle 1, 0, -1 \rangle$.

3. Find all values of $a$ such that the point $(a, 1)$ lies on the level curve of the function $z = f(x, y) = x^2 + y^2 + xy$ for $z_0 = 7$. 
4. Consider the surface $S$ given by: $z^2 = 4x^2 + y^2$. Sketch the traces of $S$ in the $z = 1$ and $y = 0$ planes.

5. Find all critical points of the following function

\[ f(x, y) = e^{- \frac{1}{3} x^3 + x - y^2} \]

Classify each point as a local minimum, local maximum, or saddle point. (You do not have to solve for extrema on the boundary.)