1) Find the linearization (i.e the generalized tangent line) of

$$h(x, y, z) = zx^2 + y^2\sqrt{z}$$

at $(2, -1, 4)$. See pg 1023 for more information.

2) Use the increment theorem to exlain why the following function is differentiable for every (x, y):

$$f(x, y) = \begin{cases} 0 & y > x \\ (x-y)^2 & y \leq x \end{cases}$$

3) Compute

$$\frac{\partial f}{\partial x} \quad \frac{\partial f}{\partial y} \quad \frac{\partial^2 f}{\partial x^2} \quad \frac{\partial^2 f}{\partial x \partial y} \quad \frac{\partial^2 f}{\partial y^2}$$

at $(0, 0)$ for each of the following functions:

a) $f(x, y) = x^2 + y^2$.

b) $f(x, y) = x^2 - y^2$.

c) $f(x, y) = xy$.

Relate these results to the “concavity” of the three functions (think about the graphs).