

Let  $f(x, y) = e^{-x^2-y^2} - 3e^{-(x-1)^2-(y-1)^2}$

Suppose you are standing at the point  $(1, 0.5)$  on the surface  $z = f(x, y)$

1. If you walk in the given direction, will you be going uphill or downhill?  
At what rate?
  - (a)  $\vec{u} = \langle 1, 0 \rangle$
  - (b)  $\vec{u} = \langle 0, 1 \rangle$
  - (c)  $\vec{w} = \langle -1, 2 \rangle$
2. In which direction should you walk to move uphill at the fastest rate?
3. If you drop an armadillo, in which direction will it roll?
4. What direction should you walk to stay at the same altitude?  
Is there more than one answer?
5. Make a contour plot to verify that your answers are plausible