Writing assignment:

Suppose you are a hiker standing on the graph of the function $f(x,y) = 2e^{-(x^2+y^2)}$, directly above the point $(\frac{1}{2}, -\frac{1}{2})$ in the xy-plane. Explain what partial derivatives, the gradient, directional derivatives, and the differential tell you about the terrain in your immediate vicinity.

Guide for your work:

A fully complete writing assignment will include the steps outlined below as well as additional discussion of the key ideas and how they are connected.

(a) Suppose due north is in the $\hat{j}$ direction in the xy-plane. What is the slope of your path if you hike due north? Due south? Due east? Due west?

(b) What is the slope of your path if you hike $30°$ east of north? What is the slope of your path if you hike in the direction of steepest ascent? What compass direction is the direction of steepest ascent?

(c) Find the differential df at $(\frac{1}{2}, -\frac{1}{2})$, and explain how it can be used to estimate your change in elevation if you hike only a short distance from your initial point.

(d) Sketch a contour diagram for the graph of $f(x,y)$, and use it to check that your answers above make sense.