# 14.3-6: Recap

Monday, March 7

## Hill climbing

A hiker is climbing a hill. The height of the hill is given by $H(x, y) = \max(-x^2 - 2x - 9y^2 + 36y - 1, 0)$ (so that the height never goes below zero).

1. Sketch a contour map of the hill. In particular, find the curve describing where the hill hits ground level.

2. Is the height of the hill continuous as a function of $x$ and $y$? Is it differentiable? If not, find a point and show that it is not continuous/differentiable at that point.

3. The hiker is currently at the location $(2, 1)$. Find $H_x$ and $H_y$ at this point.

4. If the hiker moves in the direction $\langle 1, 1\rangle$, will they be moving uphill or downhill? $\langle -4, -1\rangle$? $\langle -1, 3\rangle$?

5. Find the curve consisting of all points on the hill with height equal to the hiker's current height. Find the slope tangent to the curve at the hiker's current location.

6. Let $L(x, y)$ be the linear approximation to $H$ at $(2, 1)$. Plot the level curve of $L$ that passes through $(2, 1)$. What is its relation to the level curve of $H$?

7. What direction should the hiker walk in order to (at that instant) be moving neither uphill nor downhill?

8. Suppose the hiker's location as a function of time is $\langle -t^2 + t + 2, t \rangle$, so that the hiker hits the point $(2, 1)$ at time $t = 1$. Will the hiker be moving uphill or downhill at $t = 1$?

9. At what point in time (approximately) is the hiker's elevation at a maximum?