1 Directional Derivative

You are on a hike. The altitude nearby is described by the function $f(x, y) = kx^2y$, where $k = 20\frac{\text{m}}{\text{km}^3}$ is a constant, x and y are east and north coordinates, respectively, with units of kilometers. You're standing at the spot $(3\text{ km}, 2\text{ km})$ and there is a cottage located at $(1\text{ km}, 2\text{ km})$. You drop your water bottle and the water spills out.

(a) Plot the function $f(x, y)$ and also its level curves in your favorite plotting software. Include images of these graphs. Special note: If you use a computer program written by someone else, you must reference that appropriately.

(b) In which direction in space does the water flow?

(c) At the spot you're standing, what is the slope of the ground in the direction of the cottage?

(d) Does your result to part (c) make sense from the graph?