18.02 Recitation
Problems
05 October 2011

1. Find the best fit line through the three points $(-1, 0)$, $(0, 1)$, and $(2, 2)$.

2. How would you fit a quadratic function $y = ax^2 + bx + c$ to through a collection of points (x_i, y_i)?

3. Compute the gradient of the function $f(x, y) = \sqrt{xy}$. What is its derivative in the direction $\langle 1, 1\rangle$ at the point $(x, y) = (1, 2)$?

4. Think back to the topographic map from last week. What's the meaning of the gradient ∇h?

5. Suppose that you go for a hike so that your position at time t is $(x(t), y(t))$. What does the chain rule tell you about $\frac{\partial h}{\partial t}$? Does this answer seem to make sense?

6. (2E-2d) Suppose $f(x, y, z)$ is a function with $\nabla f = \langle 3x^2y, x3 + z, y\rangle$. Let $x = t$, $y = t^2$, and $z = t^3$. Find $\frac{df}{dt}$.

7. (13.7.38) Three resistors of resistance $R_1 = 100\,\Omega$, $R_2 = 100\,\Omega$, $R_3 = 200\,\Omega$ are wired in parallel, with total resistance

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}.$$

   Suppose R_1 and R_2 increase at the rate of $1\,\Omega/s$, while R_3 decreases at $2\,\Omega/s$. At what rate (and in what direction) does R change?

8. A cylinder of radius $r = 5$ and height $h = 5$ expands, with the radius growing at a rate of 1 ft/sec, and the height at 2 ft/sec. Compute dV/dt.