MONT 106N – Identifying Patterns
Group Discussion – Lines
October 5, 2009

Background and Goals

After the Columbus Day break, we will be starting into a new section of the Freedman, Pisani, Purves text dealing with *correlation and linear regression*, two important statistical techniques aimed at identifying relationships between quantities. To deal with both of these ideas, we need to review a very basic topic from high school algebra and geometry: the various forms of equations of straight lines in the coordinate plane. This should be something you know well (or *knew well at some point*!). The purpose of today's discussion is to "jog the memory."

Discussion Questions

A. We all know that given two different points $P = (x_1, y_1)$ and $Q = (x_2, y_2)$ in the plane there is one and only one straight line containing both P and Q. What are two other geometric ways to specify a straight line *uniquely*? (One of these might be a special case of the other!)

B. Your answers to part A lead to two different ways to write down the xy-equation of the line. What are they, and what are the corresponding formulas? What constants are involved here, and what do they mean geometrically? (Notes: You can assume that the x-coordinates of P and Q are different here: $x_1 \neq x_2$. How does that make things simpler? What happens if $x_1 = x_2$? How is that case different?)

C. Find an xy-equation for the line that is described in each part.

1. The line passing through the points $P = (1, 2)$ and $Q = (4, -1)$.
2. The line passing through the point $P = (5, 3)$ and *parallel* to the line with equation $y = 2x + 4$.
3. The line passing through the point $P = (5, 3)$ and *perpendicular* to the line from part 2.
4. The line passing through the y-axis at $(0, 2)$ and crossing the x axis at an angle of $45°$ (measured from the x-axis to your line).

D. Suppose x and y are two quantities we can measure that are related in some way – changing the value of x changes the value of y. Think x = temperature measured in degrees Celsius and y = temperature measured in degrees Fahrenheit, for instance. We say that the two quantities x, y are *(exactly) linearly related* if the scatter plot of all measurements of x and corresponding measurements of y would show points along a single straight line.

1. Are F = temperature measured in degrees Celsius and C = temperature measured in degrees Fahrenheit linearly related? If so, what is the equation of the line that the (F, C) points lie along. (Recall that 32°F is the same as 0°C and 212°F is the same as 100°C.)

2. Today's forecast high temperature in Worcester is 61°F. What is the equivalent temperature in degrees Celsius?
3. If you write your line from part 1 in the form $C = mF + b$, what do the constants m, b represent in "temperature terms" (what is their physical significance)?
4. Is there a value of F where $C = F$? If so, what is it?

Assignment

Group writeups due at the end of class.