Video: Straight Lines are Handy Tools (4:40 min)

Lines and linear equations (0:05):

This video talks about lines and linear equations aka polynomial functions of degree 1. We'll mostly talk about point slope equations, although other forms are possible. We'll talk about the use of lines in graphing and approximating rates of change. We'll also talk about linear models.

Point-Slope equation for a line (0:25)

Lets review the point-slope equation for a line. You've all heard the adage two point determine a straight line. We can understand that geometrically by looking at an example. If we have 2 points in the plane there is exactly 1 way to draw a straight line between them. The point-slope equation for a line is y = mx + b, m is the slope and b is the y-intercept. The slope, m, is the rate of change of y with respect to x, delta y over delta x. To calculate delta y, we subtract the 2 y-coordinates of the points, thats 1 - 2 or -1. To calculate delta x, we subtract the 2 x-coordinates of the points, thats 3 - 1 which 2. The ratio is -½ or -0.5. Well we are still not done yet because we still need to find b, the y-intercept. So far, we have the equation: y = -0.5x + b. To find b, we look at are line. Both points have to satisfy the equation, so let's pick one of them let's say (1,2) and substitute the values for x and y in to determine b. After solving for b we find out the it is equal to 2.5 and we have are equation.

X and Y intercepts (1:53):

There is a little more terminology to talk about. You need to be familiar with x and y intercepts. The x-intercept is where the line hits the x-axis, in other words when y is 0. To find it you simply put y = 0 into the equation and solve. Are x-intercept is x = 5. Similarly, the y-intercept is where the line goes through the y-axis or when x is zero. Substitute x = 0 into the equation and solve. We find out that are y-intercept is y = 2.5. Ok, now we found the equation of a straight line, what good is it?

Line Graphs use them (2:31):

Well first off we have been using them in graphing. Line graphs are really a series of straight lines. The successive points in are data are connected by straight lines. When the points get close together the curve appears smooth and we don't see the lines.

Slope of Secant is average rate of change (2:50):

Lines are also very useful for calculating the average rate of change of one variable with respect to another. Let's look at this in terms of secants. A secant for a curve is a straight line connecting any two points on the curve. The slope of the secant line is actually the average rate of change of the curve for those two points. So, if you can calculate a slope, you can calculate average rate of change. The idea of secant lines and rates of change forms a foundation for relational calculus, how cool is that! The idea is that as the secant points get close together, the secant line hugs the curve more closely and the limit as the secant points approach each other the slope of the secant line becomes the slope of the curve.

Linear Models (3:44):

Another great line idea is that of linear models. The idea is to try to predict the value of one variable based on the values of another. If you plot the two variables against each other, you often see a linear relationship. St this point you may be saying woah, I only need 2 points to determine a line, which line am I going to draw? Here the idea of optimizations comes in, we want to find the line that’s the best line by some criteria. If we can actually find a good line, then we can make predictions of y without measuring any additional values of x. We just pick the x, plug it into the equation, and then evaluate it to estimate y. Calculating best fit lines and finding linear models is a widely used technique used in many areas of science, statistics, and computing.