4/11/2023

Linear Functions
Interpreting Slope/y-intercepts
Scatterplots
Review for Exam #2

Linear Functions

Linear growth occurs in a sequence of values when there is a common difference between consecutive values. (arithmetic sequences)

3, 5, 7, 9, 11, 13, … to move from 3 to 5, you step up by 2, and then to move from 5 to 7, you also step up by 2, and to move from 7 to 9, you also step up by 2, … and so on.

Linear function looks like:

$$y = mx + b$$
$$y = ax + b$$
$$f(x) = mx + b$$

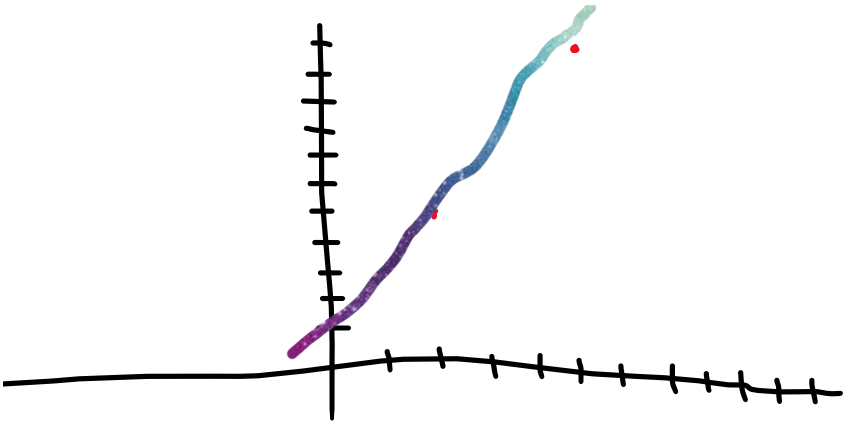
X is the input, and y or f(x) is the output.
b is the intercept (y-intercept: the value of the equation when x=0)
And m (or a) the coefficient of x is the slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope as the average rate of change.

Two points: $(x_1, y_1) = (2,5), (x_2, y_2) = (5, 11)$. What is the slope of the line that connects the points?

$$m = \frac{11 - 5}{5 - 2} = \frac{6}{3} = 2$$



Positive is up to the right (negative is down to the right).
>1 is a steeper slope, and shallower slope is between 0<m<1

Slope-intercept form: $y = mx + b$
Point-slope form: $(y - y_1) = m(x - x_1)$

Using the point-slope form: replace x_1 and y_1 with the values from a single point. And the slope to replace m.

$$y - 5 = 2(x - 2)$$
$$y - 5 = 2x - 4$$
$$y = 2x + 1$$

$$y - 11 = 2(x - 5)$$
$$y - 11 = 2x - 10$$
$$y = 2x + 1$$

If you use $y = mx + b$ slope-intercept form, first plug in one point and the slope to find the intercept, and then rewrite the equation with the intercept that you found.

$$5 = 2(2) + b$$
$$5 = 4 + b$$
$$1 = b$$

$$y = 2x + 1$$

The equation of the line has values for both m and b, and still includes x and y.

Interpretation:

We started with (2,5) and (5,11).
What could these mean?
So suppose that when you park at a particular lot for 2 hours, the fee is $5. And when you park at the same lot for 5 hours, the fee is $11.

The x-coordinate is in hours, and the y-coordinate is in dollars.

So suppose that I need to park in this lot for 4 hours. How much money do I need to bring with me?

Replace x=4 in the equation y=2x+1, and the value of y we get will be the cost to park for that time.

$$y = 2(4) + 1 = \$9$$

How much does it cost to park for 2 hours? $5
How much does it cost to park for 3 hours? $7
How much does it cost to park for 4 hours? $9
How much does it cost to park for 5 hours? $11

2 is the slope, and it's the common difference if we increase the time we need to park by 1 hour

We can interpret the slope (generally) as the amount that y increases for each unit that x increases.

In this case, as time goes up by 1 hr (x), then cost (y) goes up by $2.

The units of the slope are always the y-units over the x-units: $2/hr.

The y-intercept: is the cost when there are 0 hours (0 units of x). In this case, the base cost is $1.

Caveat: the slope can always be interpreted. But, the y-intercept will sometimes take on unrealistic values, possibly because x cannot be 0, or the y-value can't be negative (or other issues).

See Excel for scatterplots.

Scatterplots are basically plots of pairs of values (points) in 2 dimensions. Comparing (the relationship between) two numerical values.

Assumes that the variables we are comparing are in pairs of points (the data is the same length).

Exam #2 is next week.

Starts with Descriptive Statistics: finding mean, the median, the mode, standard deviation, 5-number summary (quartiles, min/max, median), etc.
Weighted Averages: this can be a sticking point

Histograms and boxplots (when you submit these on the test, you have to copy them into a Word file because Canvas breaks these plots online).
Unit conversions and scaling.
Lots of probability: basic rules, probabilities from a two-way table (including conditional probability and independence).
Counting rules
Calculating formulas in Excel: setting up Excel to calculate the value of a math formula (so that it can be repeated with different values)