4/13/2021

Linear Functions/Linear Regression

Linear functions graph as a straight line

$$y = mx + b$$

Slope-intercept form
$m$ is the slope
$b$ is the intercept (the value of y when x is zero)

$$y = ax + b$$
$$y = b_0 + b_1 x$$

Formula for the slope:
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{change\ in\ y}{change\ in\ x} = \frac{rise}{run} = \frac{units\ of\ y}{units\ of\ x}$$

Slope is a rate: miles per gallon: $\frac{miles}{gallons}$

$$y = 35.1x$$

X is in gallons and y is in miles

35.1 is in miles/gallon

X=0, y=0
X=1, y=35.1
X=2, y=70.2

For each unit of increase in x, the value of y goes up by the slope value
For each gallon of gas I buy, the number of miles I can drive increases by 35.1
This equation has no y-intercept (b=0), which means I can't go anywhere until I gas

Slopes can always be interpreted, but y-intercepts can't always be interpreted

$$y = 5600x + 45,000$$

X is square feet and y is selling price
For each additional square foot of house, I can get an additional $5600 in selling price
When x is zero, the selling price is $45,000…. This is the price of the land.

$$y = 23.01x - 11,345$$

X is the current year
Y is the profit in millions for a oil and gas company

This intercept is not interpretable because there was no company when x was zero (before the company was founded).

From Sheet 3 of Excel file:
$$y = 0.0241x - 413.28$$

X is cost
Y is units produced

Interpret this equation in the context of the problem:
What does the slope mean in context?

For each additional unit of cost, on average increase the number of units produced by 0.0241
For each $1000 of cost, on average, the number of units produced will increase by 2.41

The intercept is hard to interpret. When I spend no money (no cost), the number of units produced is -413.28…. which is not something you can do in the real world.

Excel Sheet 4

$$y = 863.66x + 29517$$

X was years of experience
Y was salary

Interpret the slope in the context of the problem?
For every year of experience the salary increases by (on average) $863.66

Interpret the intercept?
Someone with no experience has a base pay of $29,517

Linear regression equations:
-line of best-fit
-least-squares regression line
-trendlines

Making predictions (using equations with known x values to predict "average" y-values)

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Make a scatter plot of the data:
-is the data approximately linear or non-linear? (default is linear if there is no relationship)

Make a trendline/linear regression line and obtain the equation

Interpret the slope and the intercept (if possible)

Make Predictions from the trendline/linear regression equation