

Scatterplots

One way to test the relationship between two quantitative variables is a scatterplot. Can you make a scatter plot 1) by hand? 2) using a graphing calculator 3) using Desmos/Geogebra 4) Using other software (StatCrunch/StatKey/spreadsheets)?.

Make sure you label and title your graphs and choose appropriate scales

Practice

Here are the heights and weights of 10 individuals. Create a scatterplot.

Height (inches)	57	60	62	64	65	67	68	69	71	74
Weight (lbs)	110	112	132	134	150	151	160	175	200	240

[Data on Sheets](#) and Desmos: <https://www.desmos.com/calculator/aqo1bz1tsd>

Regression

Least Squares regression is a statistical process which finds the line (or curve) of best fit to model the relationship

While it is good to learn the process of how regression is performed by hand, it is not needed for the AP Exam. Instead

it is more important to know how to use technology to generate a regression equation and how to interpret the results of a regression. You may see linear regressions in the form of $y=a+bx$, or $ax+b$, just make sure you know what a and b represent

$$Y' = A + B * X$$

SIMPLE REGRESSION EQUATION

X : predictor (present in data)
 B : coefficient (estimated by regression)
 A : intercept (estimated by regression)
 Y' : predicted value (calculated from A, B and X)

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Can you find and graph a linear (or nonlinear) regression 1) by hand [yikes!]? 2) using a graphing calculator 3) using Desmos/Geogebra 4) Using other software (StatCrunch/spreadsheets)?.

Practice

What is the linear regression equation for our height/weight data? _____

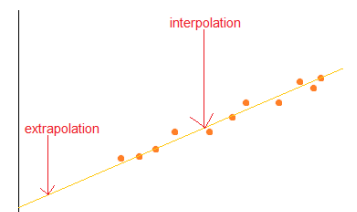
What is the slope and what does it mean? _____

What is the y-intercept and what does it mean? _____

Extrapolation and Interpolation

Interpolation means looking **inside** the data bounds of a regression to make a prediction

Extrapolation means looking **outside** of the data bounds of a regression to make a prediction. This is sometimes risky or unrealistic



Practice

What weight does the model predict for someone with a height of 70 inches?

If someone weighed 400 pounds, how tall would you predict them to be?

Residuals and Residual Plots

A residual is the difference between an actual data value at an input and the value that the model predicts for the input. *Residual=Observed-Predicted Value*

A residual plot is a graph of the residuals and can be used to help determine how well the model fits the data. If the points in a residual plot are randomly dispersed around the horizontal axis, a linear regression model is appropriate for the data; otherwise, a non-linear model is more appropriate. Can you make a residual plot 1) by hand [yikes!]? 2) using a graphing calculator 3) using Desmos/Geogebra 4) Using other software (StatCrunch/spreadsheets)?

Practice

What are the residuals for $x=67$? For $x=71$?

What does the residual plot for our example look like and tell us about the model?

Correlation and the correlation coefficient “r” and Goodness of fit “r²”

The correlation coefficient “r” measure the strength and direction of a linear relationship. r^2 , the coefficient of determination is the proportion of the variance in the dependent variable that is predictable from the independent variable.

Can you find r and r^2 1) by hand [yikes!]? 2) using a graphing calculator 3) using Desmos/Geogebra 4) Using other software?.

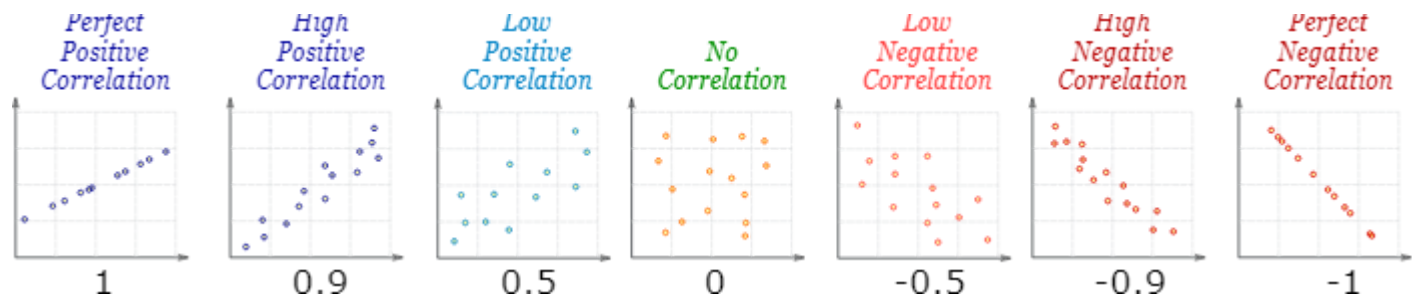
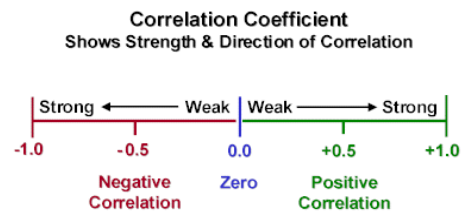


Image from <https://www.mathsisfun.com/data/correlation.html> Play: <http://guessthecorrelation.com/>

Practice

What are r and r^2 for our example and what do they tell us about the model?

r= Meaning r^2 = Meaning