**Product-Moment Correlation Coefficient**

\[ r = \frac{\sum(xy)}{\sqrt{(\sum x^2)(\sum y^2)}} \]

\( r = \) product–moment correlation coefficient  
\( x = \) first set of data  
\( y = \) second set of data

**Population Correlation Coefficient**

\[ \rho = \frac{1}{N} \sum \left\{ \left[ \frac{(X_i - \mu_X)}{\sigma_X} \right] \cdot \left[ \frac{(Y_i - \mu_Y)}{\sigma_Y} \right] \right\} \]

\( \rho = \) population correlation coefficient  
\( N = \) population size  
\( X_i = \) the \( i \)th element of the first population  
\( Y_i = \) the \( i \)th element of the second population  
\( \mu_X = \) mean of the first population  
\( \mu_Y = \) mean of the second population  
\( \sigma_X = \) the standard deviation of the first population  
\( \sigma_Y = \) the standard deviation of the second population

**Sample Correlation Coefficient**

\[ r = \left[ \frac{1}{(n - 1)} \right] \sum \left\{ \left( \frac{x_i - \bar{x}}{s_x} \right) \cdot \left( \frac{y_i - \bar{y}}{s_y} \right) \right\} \]

\( r = \) sample correlation coefficient  
\( n = \) sample size  
\( x_i = \) the \( i \)th element of the first sample  
\( y_i = \) the \( i \)th element of the second sample  
\( \bar{x} = \) mean of the first sample  
\( \bar{y} = \) mean of the second sample  
\( s_x = \) first sample's standard deviation  
\( s_y = \) second sample's standard deviation

**Population Regression Line**

\[ Y = B_0 + B_1 X \]

\( Y = \) value of the dependent variable  
\( B_0 = \) a constant
Estimate of Population Regression Line

\[ \hat{y} = b_0 + b_1 x \]

\( \hat{y} \) = predicted value of the dependent variable

\( b_0 \) = a constant

\( b_1 \) = regression coefficient

\( x \) = value of the independent variable

Regression Coefficient

\[ b_1 = \frac{\sum[(x_i - \bar{x})(y_i - \bar{y})]}{\sum[(x_i - \bar{x})^2]} \]

\( b_1 \) = regression coefficient

\( \Sigma \) = summation

\( x_i \) = the ith element of the first sample

\( y_i \) = the ith element of the second sample

\( \bar{x} \) = mean of the first sample

\( \bar{y} \) = mean of the second sample

Constant in the Regression Equation

\[ b_0 = \bar{y} - b_1 \times \bar{x} \]

\( b_0 \) = constant

\( \bar{y} \) = mean of sample y

\( b_1 \) = regression coefficient

\( \bar{x} \) = mean of sample x

Coefficient of Determination

\[ R^2 = \left\{ \left( \frac{1}{N} \times \frac{\sum[(x_i - \bar{x}) \times (y_i - \bar{y})]}{\sigma_x \times \sigma_y} \right) \right\}^2 \]

\( R^2 \) = the coefficient of determination

\( N \) = population size

\( \bar{x} \) = mean of the first sample

\( \bar{y} \) = mean of the second sample

\( x_i \) = the ith element of the first sample
\[ y_i = \text{the } i\text{th element of the second sample} \]

Standard Deviation of Population X

\[ \sigma_x = \sqrt{\frac{\sum(x_i - \bar{x})^2}{N}} \]

\( \sigma_x = \text{the standard deviation of the first sample} \)
\( \bar{x} = \text{mean of sample } x \)
\( N = \text{population size} \)
\( x_i = \text{the } i\text{th element of the first sample} \)

Residual

\[ e = y - \hat{y} \]
\( e = \text{residual} \)
\( y = \text{observed value} \)
\( \hat{y} = \text{predicted value} \)

Exponential Model

\[ \log(y) = b_0 + b_1 x \]
\( \log = \text{log base } 10 \)
\( y = \text{dependent variable} \)
\( b_0 = \text{constant} \)
\( b_1 = \text{regression coefficient} \)
\( x = \text{independent variable} \)

Quadratic Model

\[ \sqrt{y} = b_0 + b_1 x \]
\( y = \text{dependent variable} \)
\( b_0 = \text{constant} \)
\( b_1 = \text{regression coefficient} \)
\( x = \text{independent variable} \)

Reciprocal Model

\[ \frac{1}{y} = b_0 + b_1 x \]
\( y = \text{dependent variable} \)
Logarithmic Model

\[ y = b_0 + b_1 \log(x) \]

\( b_0, b_1 \) = regression coefficients
\( x \) = independent variable
\( \log \) = log base 10
\( y \) = dependent variable

Power Model

\[ \log(y) = b_0 + b_1 \log(x) \]

\( b_0, b_1 \) = regression coefficients
\( x \) = independent variable
\( \log \) = log base 10
\( y \) = dependent variable

\[ SE = s_{b1} = \sqrt{\frac{\sum(y_i - \hat{y}_i)^2}{n-2}} \]

\( SE \) = standard error
\( s_{b1} \) = standard deviation of \( b1 \)
\( \bar{x} \) = mean of sample \( x \)
\( \hat{y} \) = predicted value
\( x_i \) = the \( i \)th element of the first sample
\( y_i \) = the \( i \)th element of the second sample

Standard Error

\[ t = \frac{b_1}{SE} \]

\( b_1 \) = regression coefficient
\( SE \) = standard error
\[ t = \text{test statistic for } t \text{ norms} \]

**Degrees of Freedom (Linear Regression)**

\[ DF = n - 2 \]

\( DF = \text{degrees of freedom,} \quad n = \text{sample size} \)