Linear Regression Analysis Equations and How to Interpret Them

Equations	**Form**	***Looks like a straight line if plotted on:***	**Equations for calculating slope, intercept, and the coefficient of determination**
Linear	$y = mx + b$	Rectilinear, or engineering, paper (both x and y axes are linear scale)	$m = \frac{n\left(\sum x_i y_i\right) - \left(\sum x_i\right)\left(\sum y_i\right)}{n\left(\sum x_i^2\right) - \left(\sum x_i\right)^2}$ $b = \frac{\sum y_i - m\left(\sum x_i\right)}{n}$ $r^2 = \left[\frac{n\left(\sum x_i y_i\right) - \left(\sum x_i\right)\left(\sum y_i\right)}{\sqrt{n\left(\sum x_i^2\right) - \left(\sum x_i\right)^2}\sqrt{n\left(\sum y_i^2\right) - \left(\sum y_i\right)^2}}\right]^2$
Exponential	$y = be^{mx}$	Semi-log paper (x-axis is linear scale; y-axis is log scale)	$m = \frac{n\left(\sum x_i \ln(y_i)\right) - \left(\sum x_i\right)\left(\sum \ln(y_i)\right)}{n\left(\sum x_i^2\right) - \left(\sum x_i\right)^2}$ $\ln(b) = \frac{\sum \ln(y_i) - m\left(\sum x_i\right)}{n}$ $b = e^{\ln(b)}$ $r^2 = \left[\frac{n\left(\sum x_i \ln(y_i)\right) - \left(\sum x_i\right)\left(\sum \ln(y_i)\right)}{\sqrt{n\left(\sum x_i^2\right) - \left(\sum x_i\right)^2}\sqrt{n\left(\sum \ln(y_i)^2\right) - \left(\sum \ln(y_i)\right)^2}}\right]^2$
Power	$y = bx^m$	Log-log paper (both x and y axes are log scale)	$m = \frac{n\left(\sum \log(x_i)\log(y_i)\right) - \left(\sum \log(x_i)\right)\left(\sum \log(y_i)\right)}{n\left(\sum \log(x_i)^2\right) - \left(\sum \log(x_i)\right)^2}$ $\log(b) = \frac{\sum \log(y_i) - m\left(\sum \log(x_i)\right)}{n}$ $b = 10^{\log(b)}$ $r^2 = \left[\frac{n\left(\sum \log(x_i)\log(y_i)\right) - \left(\sum \log(x_i)\right)\left(\sum \log(y_i)\right)}{\sqrt{n\left(\sum \log(x_i)^2\right) - \left(\sum \log(x_i)\right)^2}\sqrt{n\left(\sum \log(y_i)^2\right) - \left(\sum \log(y_i)\right)^2}}\right]^2$

Expression	What it means
Linear	
n	The number of data points
$\sum x_i y_i$	Multiply each value of the independent variable (x) by the corresponding value of the dependent variable (y); then calculate the sum of those values
$\sum x_i$	Calculate the sum of all the values for the independent variable (x)
$\sum y_i$	Calculate the sum of all the values for the dependent variable (y)
$\sum {x_i}^2$	Square each value for the independent variable (x); then calculate the sum of those values
$\left(\sum x_i\right)^2$	Find $\sum x_i$, then square that value
$\sum {y_i}^2$	Square each value for the dependent variable (y); then calculate the sum of those values
$\left(\sum y_i\right)^2$	Find $\sum y_i$, then square that value
Exponential	
n	The number of data points
$\sum x_i \ln(y_i)$	Multiply each value of the independent variable (x) by the natural log (ln) of the corresponding value of the dependent variable (y); then calculate the sum of those values
$\sum x_i$	Calculate the sum of all the values for the independent variable (x)
$\sum \ln(y_i)$	Calculate the natural log (ln) of each value of the dependent variable (y); then calculate the sum of those values
$\sum {x_i}^2$	Square each value for the independent variable (x); then calculate the sum of those values
$\left(\sum x_i\right)^2$	Find $\sum x_i$, then square that value
$\sum \ln(y_i)^2$	Square each value for the natural log (ln) of the dependent variable (y); then calculate the sum of those values
$\left(\sum \ln(y_i)\right)^2$	Find $\sum \ln(y_i)$, then square that value
Power	
n	The number of data points
$\sum \log(x_i)\log(y_i)$	Multiply the log of each value of the independent variable (x) by the log of the corresponding value of the dependent variable (y); then calculate the sum of those values
$\sum \log(x_i)$	Calculate the log of each value of the independent variable (x); then calculate the sum of those values
$\sum \log(y_i)$	Calculate the log of each value of the dependent variable (y); then calculate the sum of those values
$\sum \log(x_i)^2$	Calculate the log of each value of the independent variable, then square that value; then calculate the sum of those values
$\left(\sum \log(x_i)\right)^2$	Find $\sum \log(x_i)$; then square that value
$\sum \log(y_i)^2$	Square each value for the log of the dependent variable (y); then calculate the sum of those values
$\left(\sum \log(y_i)\right)^2$	Find $\sum \log(y_i)$, then square that value