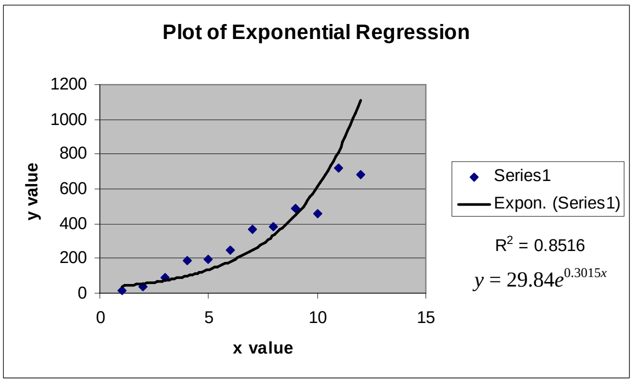
R^2 and *Excel* & Graphics Calculators

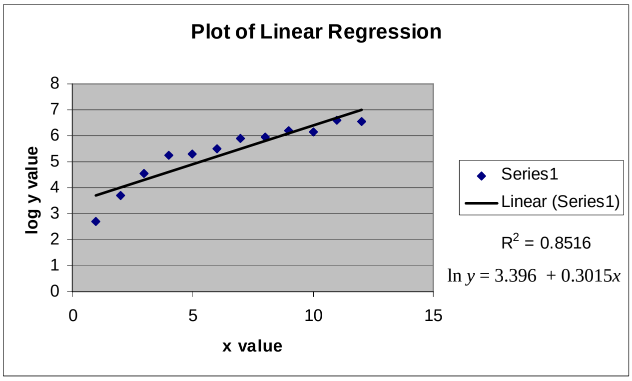
Excel and two graphics calculators were used on the following data. Their printouts are given below.

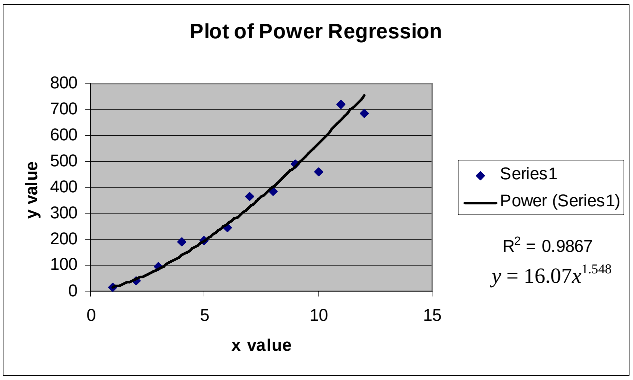
Data Set

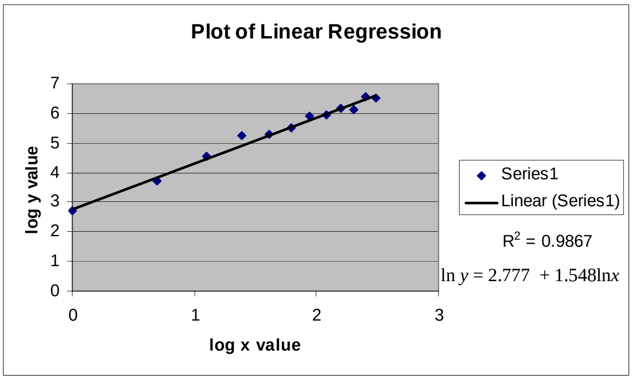
x value	y value	log x value	log y value
1	15	0	2.70805
2	41	0.693147	3.713572
3	93	1.098612	4.532599
4	188	1.386294	5.236442
5	196	1.609438	5.278115
6	247	1.791759	5.509388
7	366	1.94591	5.902633
8	386	2.079442	5.955837
9	488	2.197225	6.190315
10	460	2.302585	6.131226
11	722	2.397895	6.582025
12	685	2.484907	6.529419

Excel









Note:

1. The R^2 values printed with the **exponential** and **power** plot curves for *Excel* are **wrong**. Do **not** use them.
2. *Excel* has based its R^2 values for the exponential and power plots on the linearly transformed data. For example, for the exponential curve, $y = ae^{bx}$, *Excel* computes R^2 using $\ln y = \ln a + bx$. It is wrong to do this. (*Excel*'s R^2 values for the linear (semi-log and log-log) plots are correct.)

Graphics Calculators

Casio fx-9750G PLUS

Exponential Regression
y = a.e^bx

a = 29.8404023
b = 0.30152902
r = 0.92283291
r^2 = 0.85162058

Linear Regression
lny = bx + lna

b = 0.30152902
lna = 3.39586326
r = 0.92283291
r^2 = 0.85162058

Power Regression
y = a.x^b

a = 16.070768
b = 1.54826975
r = 0.9933374238
r^2 = 0.98671923

Linear Regression
lny = blnx + lna

b = 1.54826975
lna = 2.77700197
r = 0.99333742
r^2 = 0.98671923

Texas Instruments TI-83

Exponential Regression
y = a.b^x

a = 29.84040238
b = 1.351924358
r^2 = 0.8516205865
r = 0.9228329136

Linear Regression
lny = lna + (lnb)x

lna = 3.39586326
lnb = 0.3015290279
r^2 = 0.8516205865
r = 0.9228329136

Power Regression
y = a.x^b

a = 16.07076801
b = 1.548269753
r^2 = 0.9867192375
r = 0.9933374238

Linear Regression
lny = lna + blnx

lna = 2.77700197
b = 1.548269753
r^2 = 0.9867192375
r = 0.9933374238

Note:

1. The r and r^2 values printed with the **exponential** and **power** regressions for these two graphics calculators are **wrong**. Do **not** use them. The sample correlation coefficient, r, should only be used with **linear** relationships.
2. The given r^2 values printed with the exponential and power relationships are **not** equal to their R^2 values. (These r^2 values have been based on and computed from the linearly transformed data, i.e., linear relationships.)
3. The r and r^2 values printed with the **linear** models are correct. In these **linear** cases, the given r^2 values are equal to R^2 values.

Use r, r^2, and R^2 values from *Excel* and graphics calculators with caution!

References:
Scott, A.J. and Wild, C.J. (1991) "Transformations and R^2", *The American Statistician*, 45, 127—129.
Kvalseth, T.O. (1985) "Cautionary Note About R^2", *The American Statistician*, 39, 279—285.

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