Linear Regression in Excel

Below, one way to calculate the coefficients of a linear equation by linear regression in Excel will be shown.

Numer pomiaru	T [s]	T^2 [s^2]	l [m]
1	1,38	1,9044	0,5
2	1,68	2,8224	0,7
3	1,9	3,61	0,9
4	2,11	4,4521	1,1
5	2,26	5,1076	1,3
6	2,46	6,0516	1,5
7	2,61	6,8121	1,7
8	2,76	7,6176	1,9
9	2,88	8,2944	2,1

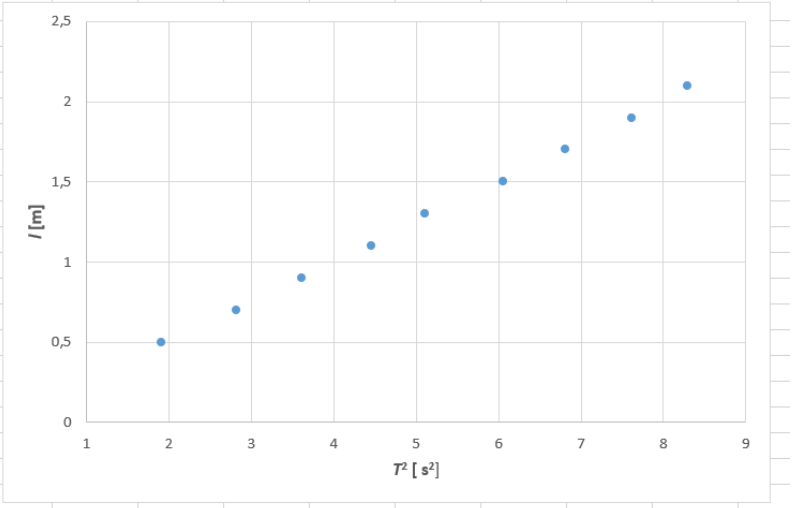
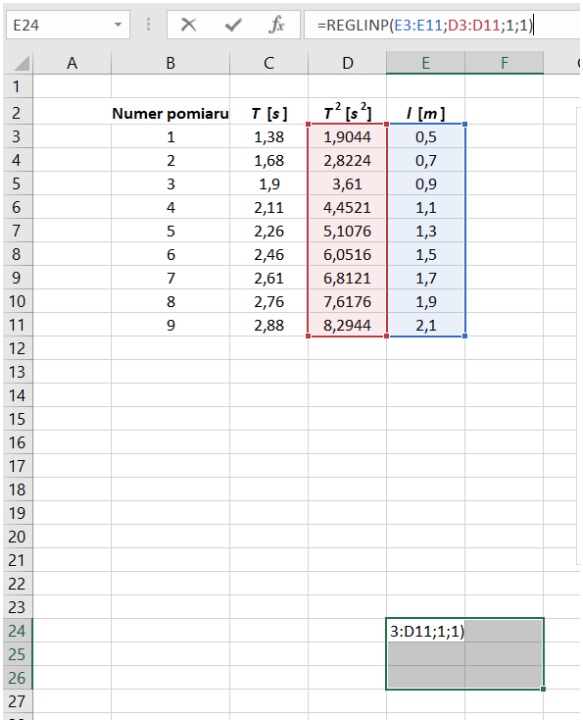


Figure 1.

Figure 1 presents exemplary data - the dependence of the oscillation period T on the length of the pendulum l. In this case, we assume that the linear equation will be of the form:

$$l = aT^2 + b$$



	Numer pomiaru	T [s]	T^2 [s^2]	l [m]
1	1	1,38	1,9044	0,5
2	2	1,68	2,8224	0,7
3	3	1,9	3,61	0,9
4	4	2,11	4,4521	1,1
5	5	2,26	5,1076	1,3
6	6	2,46	6,0516	1,5
7	7	2,61	6,8121	1,7
8	8	2,76	7,6176	1,9
9	9	2,88	8,2944	2,1

Figure 2.

therefore, the data in the table have been properly prepared, i.e. we have column T^2 and column l. In the graph $l(T^2)$ we can confirm that the points are arranged on a straight line.

First, let's mark the 2 x 3 matrix in the worksheet - see Figure 2. In the formula bar, after the equal sign "=", we start entering the name of the function and complete the data in brackets (e.g. using the mouse) separating the data with semicolons ***REGLINP***(known_x;known_y;constant;statistics). The parameters "constant" and "statistic" should be set to 1. We close the brackets and press the key combination **Ctrl** + **Shift** + **Enter**. The matrix should fill with numbers.

The meaning of the numbers in the matrix is explained in Figure 3:

	$l = a * T^2 + b$			
slope factor a =		0,250046	0,00331	intercept b =
uncertainty u(a) =		0,00279	0,015575	uncertainty u(b) =
correlation coefficient r^2 =		0,999129	0,017281	uncertainty of correlation coefficient

Figure 3.

Please remember that as important as the coefficients *a* and *b* of a linear equation are their uncertainties u(*a*) and u(*b*). Both coefficients *a* and *b*, as well as their uncertainties, are usually nominal quantities, i.e. they have a dimension. In our case, dimension *a* and u(*a*) are m/s^2, and dimension *b* and u(*b*) are m. Also remember to round the obtained values appropriately when entering them into the report:

$$a = 0{,}2500(28)\ \text{m/s}^2 \quad \text{i} \quad b = 0{,}003(16)\ \text{m}$$

Finally, we can add a line to the chart, e.g. as a trend line - see Figure 4.

Numer pomiaru	T [s]	T^2 [s^2]	l [m]
1	1,38	1,9044	0,5
2	1,68	2,8224	0,7
3	1,9	3,61	0,9
4	2,11	4,4521	1,1
5	2,26	5,1076	1,3
6	2,46	6,0516	1,5
7	2,61	6,8121	1,7
8	2,76	7,6176	1,9
9	2,88	8,2944	2,1

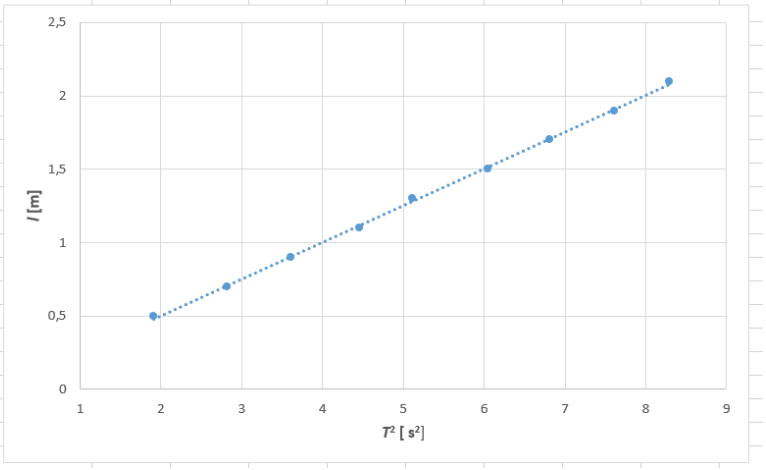


Figure 4.