Example: Ice Cream Sales

The local ice cream shop keeps track of how much ice cream they sell versus the temperature of that day for t
Formulate a null hypothesis and verify it by Pearsons and Spearman coefficients

Ho: there is no correlation
H1: There is correlation

Temperature (°C)	Ice Cream Sales ($)
14.2	215
16.4	325
11.9	185
15.2	332
18.5	406
22.1	522
19.4	412
25.1	614
23.4	544
18.1	421
22.6	445
17.2	408
average 18.7	402.4

rank t	rank sales	d	d2
11	11	0	0
9	10	-1	1
12	12	0	0
10	9	1	1
6	8	-2	4
4	3	1	1
5	6	-1	1
1	1	0	0
2	2	0	0
7	5	2	4
3	4	-1	1
8	7	1	1
			14

-4.5	-187.4	838.7
-2.3	-77.4	176.1
-6.8	217.4166667	-1473.0
-3.5	-70.4	244.6
-0.2	3.6	-0.6
3.4	119.6	409.6
0.7	9.6	6.9
6.4	211.6	1354.1
4.7	141.6	669.0
-0.6	18.6	-10.7
3.9	42.6	167.1
2.3	5.6	13.0
179.9	174756.7425	2394.994

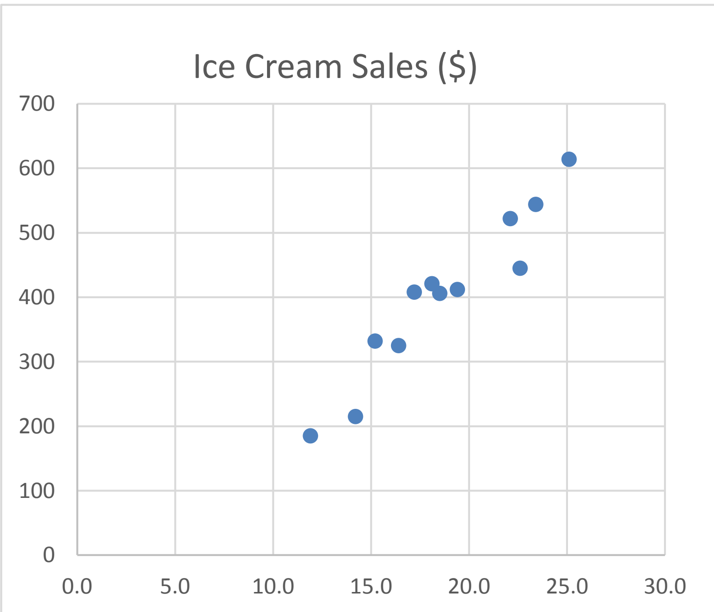
Pearson's law

$$r = \frac{\sum (X_i - \overline{X})(Y_i - }{\sqrt{\sum (X_i - \overline{X})^2 \sum (Y_i}}$$

0.427151

0.576 crit

H0= is rejected.



:he last 12 days:

Spearman's law

$$rs = 1 - \frac{6\sum_{i=1}^{n} d_i^{2}}{n^{3} - n}$$

0.587 crit

0.951049

n\α	0.2	0.1	0.05
4	1.000	1.000	—
5	0.800	0.900	1.000
6	0.657	0.829	0.886
7	0.571	0.714	0.786
8	0.524	0.643	0.738
9	0.483	0.600	0.700
10	0.455	0.564	0.648
11	0.427	0.536	0.618
12	0.406	0.503	0.587
13	0.385	0.484	0.560
14	0.367	0.464	0.538
15	0.354	0.446	0.521
16	0.341	0.429	0.503
17	0.328	0.414	0.488

$$\frac{\bar{Y})}{-\bar{Y})^2}$$

Pearson r crit.

	One-Tailed Test		
	.05	.025	.01
	Two-Tailed Test		
df	.10	.05	.02
1	.988	.997	.9995
2	.900	.950	.980
3	.805	.878	.934
4	.729	.811	.882
5	.669	.754	.833
6	.622	.707	.789
7	.582	.666	.750
8	.549	.632	.716
9	.521	.602	.685
10	.497	.576	.658

0.02	0.01
—	—
1.000	—
0.943	1.000
0.893	0.929
0.833	0.881
0.783	0.833
0.745	0.794
0.709	0.755
0.678	0.727
0.648	0.703
0.626	0.679
0.604	0.654
0.582	0.635
0.566	0.618

n\α	0.2	0.1	0.05	0.02	0.01
18	0.317	0.401	0.472	0.550	0.600
19	0.309	0.391	0.460	0.535	0.584
20	0.299	0.380	0.447	0.522	0.570
21	0.292	0.370	0.436	0.509	0.556
22	0.284	0.361	0.425	0.497	0.544
23	0.278	0.353	0.416	0.486	0.532
24	0.271	0.344	0.407	0.476	0.521
25	0.265	0.337	0.398	0.466	0.511
26	0.259	0.331	0.390	0.457	0.501
27	0.255	0.324	0.383	0.449	0.492
28	0.250	0.318	0.375	0.441	0.483
29	0.245	0.312	0.368	0.433	0.475
30	0.240	0.306	0.362	0.425	0.467

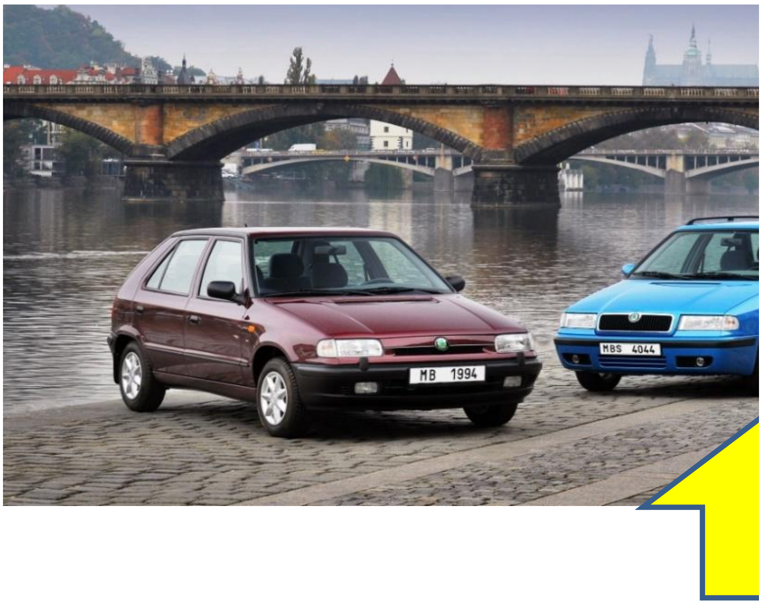
rho critical values for 2-tailed test

age (yrs)	price/1000 Kč
3	167
4	165
5	139
6	149
7	119
7	129
8	89
8	115
9	76
9	89

Here is a pricelist of used 10 cars Skoda Felicia Combi

1. pressume normal distribution of the data
2. construct a simple regression model how the price depends on th
3. evaluate quality of the model
4. estimate a price of a ten-year-old Felicia Combi

e age



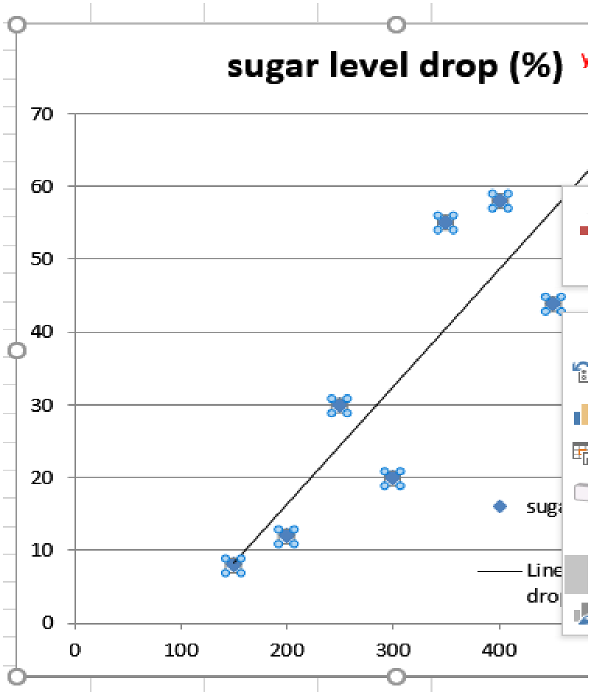
A new kind of insulin was developed. Its effect was tested as a drop of sugar level in blood 2 hours after the injection application.
8 Randomly selected patients were dozed with different insulin amounts.
Results are in the table:

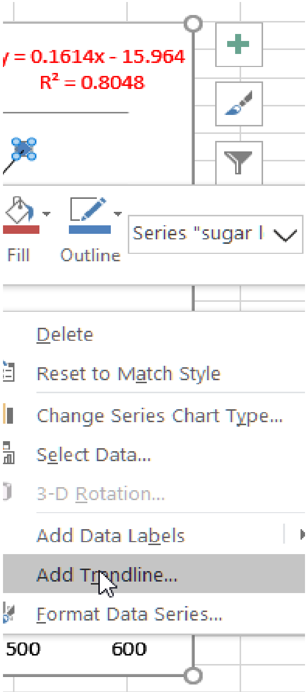
Prove a strong correlation and plot a graph of regression residua

insuline amount (ug)	150	200	250	300	350	400
sugar level drop (%)	8	12	30	20	55	58

als!

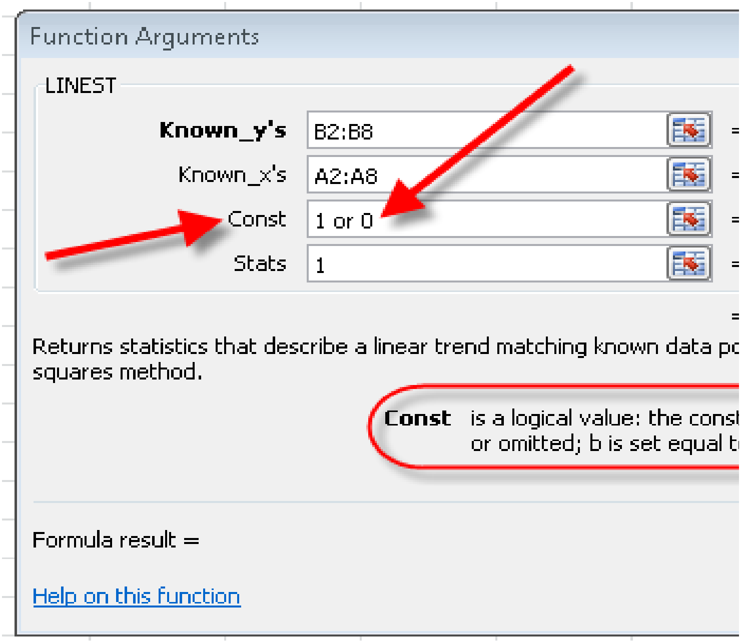
450	500
44	65

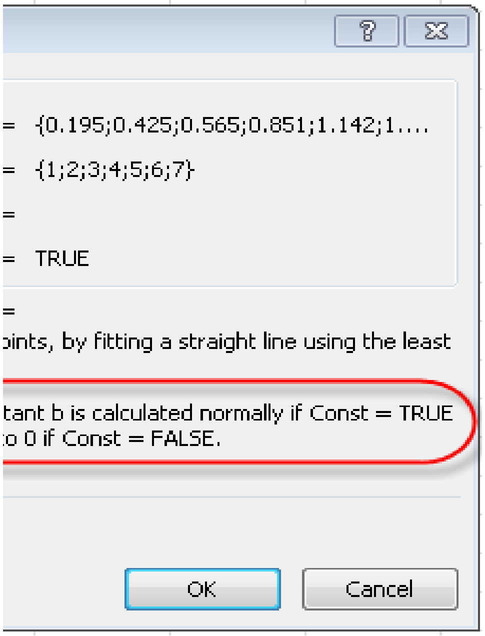


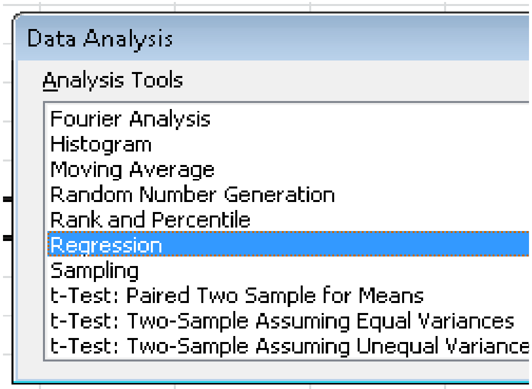

y = 0.1614x - 15.964
R² = 0.8048
Fill
Outline
Series "sugar l
Delete
Reset to Match Style
Change Series Chart Type...
Select Data...
3-D Rotation...
Add Data Labels
Add Trendline...
Format Data Series...
500
600

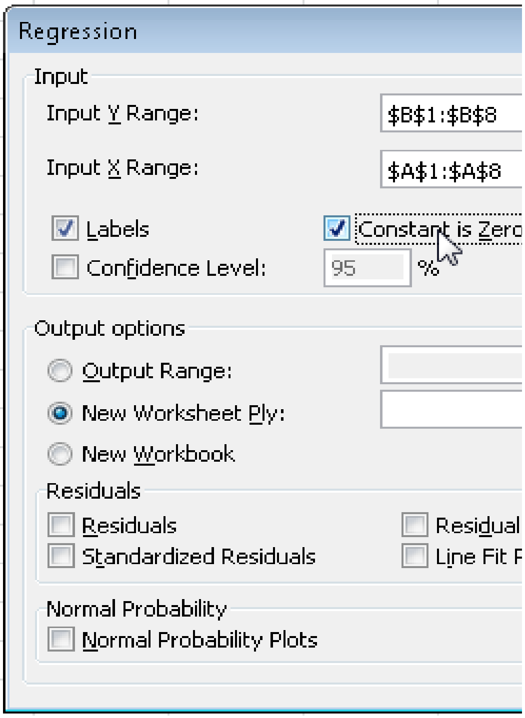
concentration	signal
1	0.195
2	0.425
3	0.565
4	0.851
5	1.142
6	1.198
7	1.530

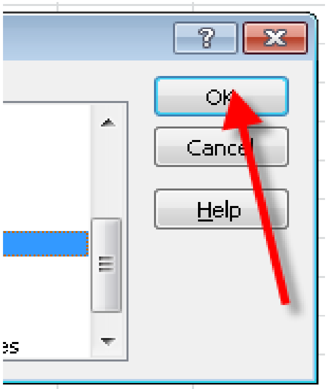
HOW TO FORCE Const a=0

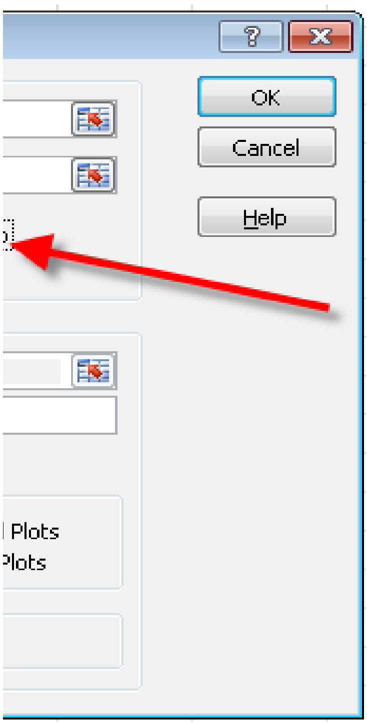



= {0.195;0.425;0.565;0.851;1.142;1....
= {1;2;3;4;5;6;7}
=
= TRUE
=
oints, by fitting a straight line using the least
tant b is calculated normally if Const = TRUE
o 0 if Const = FALSE.
OK
Cancel


Data Analysis
Analysis Tools
Fourier Analysis
Histogram
Moving Average
Random Number Generation
Rank and Percentile
Regression
Sampling
t-Test: Paired Two Sample for Means
t-Test: Two-Sample Assuming Equal Variances
t-Test: Two-Sample Assuming Unequal Variance


Regression
Input
Input Y Range:
$B$1:$B$8
Input X Range:
$A$1:$A$8
Labels
Constant is Zero
Confidence Level:
95
%
Output options
Output Range:
New Worksheet Ply:
New Workbook
Residuals
Residuals
Standardized Residuals
Residual
Line Fit P
Normal Probability
Normal Probability Plots


OK
Cancel
Help


OK
Cancel
Help
Plots
Plots