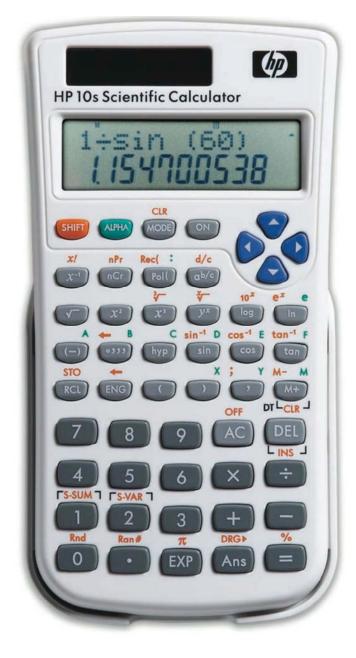**hp calculators**

HP 10s Statistics – Linear regression

Linear regression

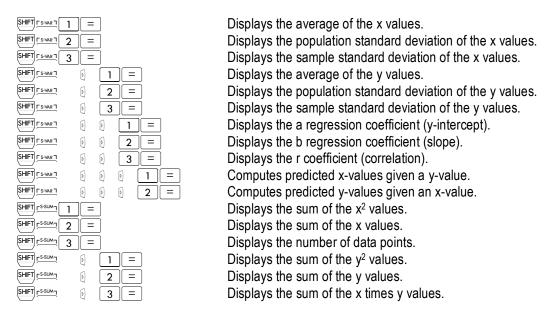Practice fitting a line to data

Linear regression

The HP10s provides several functions to fit data to different regression models.

Linear regression is the processing of finding the equation of a line y = b x + a (where b is the slope and a is the intercept) that "best fits" a set of given x and y coordinates. This is done by minimizing the sum of the squared residuals, or differences between the actual data points and the points on the line fit to the data points. On the HP 10s linear regression can be calculated in regression mode [MODE] [3] and then choice [1].

On the HP 10s, the following key sequences can be used to display calculated regression coefficients.

Key sequence	Description
[SHIFT] [S-VAR] [1] [=]	Displays the average of the x values.
[SHIFT] [S-VAR] [2] [=]	Displays the population standard deviation of the x values.
[SHIFT] [S-VAR] [3] [=]	Displays the sample standard deviation of the x values.
[SHIFT] [S-VAR] [▷] [1] [=]	Displays the average of the y values.
[SHIFT] [S-VAR] [▷] [2] [=]	Displays the population standard deviation of the y values.
[SHIFT] [S-VAR] [▷] [3] [=]	Displays the sample standard deviation of the y values.
[SHIFT] [S-VAR] [▷] [▷] [1] [=]	Displays the a regression coefficient (y-intercept).
[SHIFT] [S-VAR] [▷] [▷] [2] [=]	Displays the b regression coefficient (slope).
[SHIFT] [S-VAR] [▷] [▷] [3] [=]	Displays the r coefficient (correlation).
[SHIFT] [S-VAR] [▷] [▷] [▷] [1] [=]	Computes predicted x-values given a y-value.
[SHIFT] [S-VAR] [▷] [▷] [▷] [2] [=]	Computes predicted y-values given an x-value.
[SHIFT] [S-SUM] [1] [=]	Displays the sum of the x^2 values.
[SHIFT] [S-SUM] [2] [=]	Displays the sum of the x values.
[SHIFT] [S-SUM] [3] [=]	Displays the number of data points.
[SHIFT] [S-SUM] [▷] [1] [=]	Displays the sum of the y^2 values.
[SHIFT] [S-SUM] [▷] [2] [=]	Displays the sum of the y values.
[SHIFT] [S-SUM] [▷] [3] [=]	Displays the sum of the x times y values.

Practice fitting a line to data

Example 1: Johnson's Chair Company has experienced the following costs for the first 6 months of the year:

# Chairs Made	Total Costs
5,000	$120,000
5,500	$122,100
4,800	$118,540
5,300	$122,400
4,950	$119,100
5,150	$124,200

What estimate would a linear regression equation produce for Johnson's fixed and variable cost? How good is the fit of the linear regression line generated (What is the correlation)? What are the total costs predicted if 5,400 chairs were to be made? If the total costs were $125,000, how many chairs would you estimate had been produced?

HP 10s Statistics – Linear regression

Solution: First of all, let's enter regression mode by pressing [MODE] [3] [1]. Every time we select another mode, the statistics data is cleared so that we can be confident that no data remains from previous calculations. Now enter the data. Note that the [M+] key is the same thing as the [DT] key.

5	0	0	0	,	1	2	0	0	0	0	[M+]
5	5	0	0	,	1	2	2	1	0	0	[M+]
4	8	0	0	,	1	1	8	5	4	0	[M+]
5	3	0	0	,	1	2	2	4	0	0	[M+]
4	9	5	0	,	1	1	9	1	0	0	[M+]
5	1	5	0	,	1	2	4	2	0	0	[M+]

In this situation, the fixed cost will be the y-intercept and the variable cost will be the slope.

[SHIFT] [S-VAR] [▷] [▷] [1] [=]   Displays the a regression coefficient (y-intercept).
[SHIFT] [S-VAR] [▷] [▷] [2] [=]   Displays the b regression coefficient (slope).
[SHIFT] [S-VAR] [▷] [▷] [3] [=]   Displays the r coefficient (correlation).

[1][2][5][0][0][0] [SHIFT] [S-VAR] [▷] [▷] [▷] [1] [=]   Computes predicted x-values given a y-value.
[5][4][0][0] [SHIFT] [S-VAR] [▷] [▷] [▷] [2] [=]   Computes predicted y-values given an x-value.

Answer: The linear regression equation generated is of the form: $Y = 6.18X + 89449.38$. The slope of 6.18 is the Estimate for the variable cost and the Y-intercept of 89,449.38 is the estimate for the fixed cost. The correlation value of 0.72 is not as close to +1 as might be hoped, but still indicates a moderate fit. The total cost estimate if 5,400 chairs were made is $122,806. The estimated number of chairs made if the total costs were $125,000 is 5,755 chairs.

Example 2: John's store has had sales for the last 5 months of $150, $165, $160, $175, and $170. Use a trend line to predict sales for months 6 and 7 and also predict when estimated sales would reach $200. What is the correlation for the regression line?

Solution: The X values will be the months of 1 through 5. The Y values will be the existing sales numbers. First of all, let's enter regression mode by pressing [MODE] [3] [1].

1	,	1	5	0	[M+]
2	,	1	6	5	[M+]
3	,	1	6	0	[M+]
4	,	1	7	5	[M+]
5	,	1	7	0	[M+]

[SHIFT] [S-VAR] [▷] [▷] [1] [=]   Displays the a regression coefficient (y-intercept).
[SHIFT] [S-VAR] [▷] [▷] [2] [=]   Displays the b regression coefficient (slope).
[SHIFT] [S-VAR] [▷] [▷] [3] [=]   Displays the r coefficient (correlation).

[2][0][0] [SHIFT] [S-VAR] [▷] [▷] [▷] [1] [=]   Computes predicted x-values given a y-value.
[6] [SHIFT] [S-VAR] [▷] [▷] [▷] [2] [=]   Computes predicted y-values given an x-value.
[7] [SHIFT] [S-VAR] [▷] [▷] [▷] [2] [=]   Computes predicted y-values given an x-value.

Answer: Sales in month 6 are predicted to be $179 and in month 7 $184. Sales are predicted to reach $200 between months 10 and 11. The correlation is 0.82, which indicates a fairly strong relationship and predictive ability.