



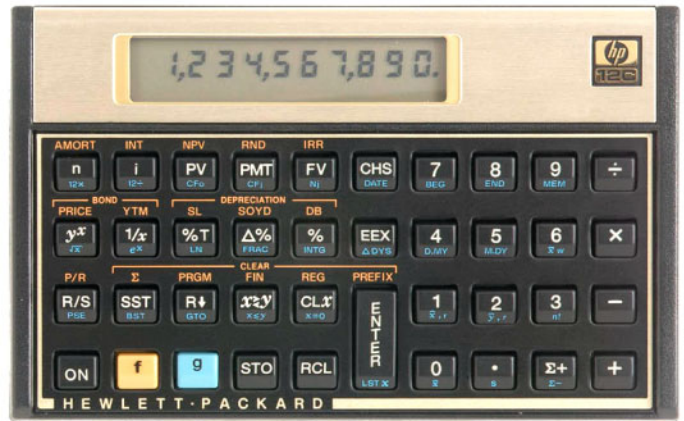
## hp calculators

HP 12C Statistics - Linear regression

Linear regression

HP12C Statistics

Practice solving linear regression problems



### Linear regression

Linear regression is a statistical method for finding a smooth straight line that best fits two or more data pairs in a sample being analyzed. Any straight line like the one shown in Figure 1 owns two specific coefficients that precisely locate it in a planar coordinate system: a  $y$ -intercept  $A$  and a slope  $B$ . These coefficients compose the straight line equation  $y = A + Bx$ . It is also important to mention that the correlation  $|r|$  is always 1 when only two points are entered.

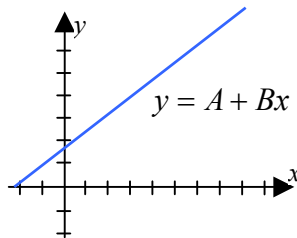


Figure 1

### HP12C Statistics

In the HP12C, summations resulting from statistics data are suitable for linear regression computations. Given the  $y$  and  $x$  coordinates of any two or more points belonging to a curve, the linear regression coefficients can be easily found.

### Practice solving linear regression problems

Example 1: Based on the information presented in the graphic in Figure 2, compute the  $y$ -intercept and slope to characterize the straight line. Note that the line crosses the  $x$ -axis at the origin  $(0,0)$ .

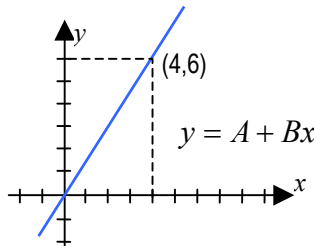


Figure 2

Solution: One of the points that belongs to the curve is  $(0,0)$  and the other one is  $(4,6)$ . Both must be entered to compute the equation of the line. Be sure to clear the statistics / summation memories before starting the problem.

f  $\Sigma$  0 ENTER 0  $\Sigma+$  6 ENTER 4  $\Sigma+$

2.00

Figure 3

The display shows the number of entries.

Now compute the slope (B) by entering: (Since  $A$  is already zero)

$\boxed{1} \boxed{g} \boxed{\hat{y},r}$

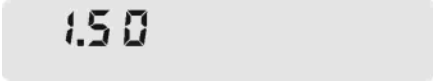


Figure 4

**Answer:** The expression for this straight line has  $A=0$  and  $B=1.5$ . The equation is  $y = 1.5x + 0$

**Example 2:** Based on the information presented in the graphic in Figure 5, compute the  $y$ -intercept and slope to characterize the straight line. Then use  $x$ -forecasting to compute the  $x$ -related coordinate for  $y=5$ .

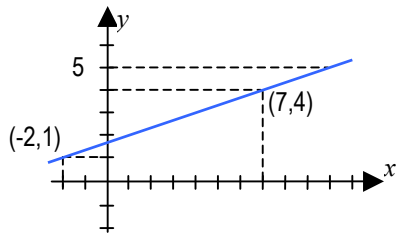


Figure 5

**Solution:** Be sure to clear the statistics / summation memories before starting the problem.

$\boxed{f} \boxed{\Sigma}$

The data pairs must be entered before computing the coefficients.

$\boxed{1} \boxed{\text{ENTER}} \boxed{2} \boxed{\text{CHS}} \boxed{\Sigma+}$   
 $\boxed{4} \boxed{\text{ENTER}} \boxed{7} \boxed{\Sigma+}$

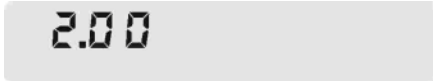


Figure 6

As the line does not cross the  $x$ -axis at the origin, we forecast  $y$  when  $x=0$  to find the  $y$ -intercept  $A$ :

$\boxed{0} \boxed{g} \boxed{\hat{y},r}$



Figure 7

To compute the slope, now press:

$\boxed{1} \boxed{g} \boxed{\hat{y},r} \boxed{\times \div y} \boxed{R\downarrow} \boxed{\times \div y} \boxed{-}$



Figure 8

Now it is necessary to forecast  $x$  for  $y=5$ .

$\boxed{5}$   $\boxed{\hat{x},r}$



Figure 9

**Answer:** This straight line has  $A=1.67$  and  $B=0.33$  and its expression is:  $y = 1.67 + 0.33x$

**Example 3:** Linear programming is a common technique used to solve operational research problems by graphics inspection. Based on the information presented in the graphics in Figure 10, compute the  $y$ -intercept and slope for both straight lines  $S_1$  and  $S_2$ .

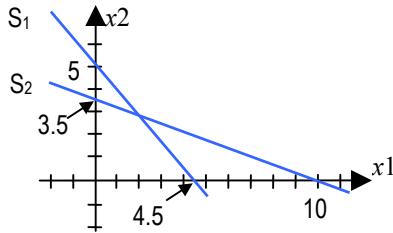


Figure 10

**Solution:** Be sure to clear the statistics / summation memories before starting the problem.

$\boxed{f}$   $\boxed{\Sigma}$

By inspection, the  $y$ -intercept for both lines is found to be 3.5 for  $S_1$  and 5 for  $S_2$ . Now we need to compute their slope. The data pairs for  $S_1$  are (10,0) and (0,3.5):

$\boxed{0}$   $\boxed{\text{ENTER}}$   $\boxed{1}$   $\boxed{0}$   $\boxed{\Sigma+}$   $\boxed{3}$   $\boxed{\cdot}$   $\boxed{5}$   $\boxed{\text{ENTER}}$   $\boxed{0}$   $\boxed{\Sigma+}$

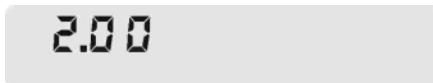


Figure 11

The slope for  $S_1$  can be found with the following sequence:

$\boxed{0}$   $\boxed{g}$   $\boxed{\hat{y},r}$   $\boxed{\text{CHS}}$   $\boxed{1}$   $\boxed{g}$   $\boxed{\hat{y},r}$   $\boxed{x\approx y}$   $\boxed{R\downarrow}$   $\boxed{+}$

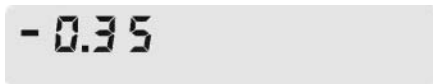


Figure 12

Now, to compute  $S_2$  slope it is necessary to clear the statistics / summation memories and enter (5,0) and (0,4.5) as the new data pairs.

f  $\Sigma$  0 ENTER 5  $\Sigma+$  4 • 5 ENTER 0  $\Sigma+$



2.00

Figure 13

The slope for  $S_2$  can be found with the same sequence as before:

0 9  $\hat{y},r$  CHS 1 9  $\hat{y},r$   $\times \approx y$  R $\downarrow$  +



-0.90

Figure 14

Answer: For  $S_1$ ,  $A = 3.5$  and  $B = -0.35$ . For  $S_2$ ,  $A = 5$  and  $B = -0.90$ .

$$S_1 \Rightarrow y = 3.5 - 0.35x \qquad S_2 \Rightarrow y = 5 - 0.90x$$