

Sharp EL-546V (and R) Calculator

Regression Calculations

Introduction

This material is designed to review the regression calculation functions of the **Sharp EL-546V (and R) Scientific Calculator**.

- The calculator performs regression calculations for the six regressions models:

- Linear

$$y = a + bx$$

- Exponential

$$y = ae^{bx}$$

- Power

$$y = ax^b$$

- Quadratic

$$y = a + bx + cx^2$$

- Logarithmic

$$y = a + b \ln x$$

- Inverse

$$y = a + b \frac{1}{x}$$

- The Sharp regression functions produce:

- the coefficients a and b (and c for the quadratic model) for the regression equation.
- the summations: $\sum x$; $\sum x^2$; $\sum y$; $\sum y^2$; and $\sum xy$.
- the correlation coefficient r .
- the mean values \bar{x} and \bar{y} .
- estimated values, y' and x' .
- the standard deviation of the x data, s_x .
- the standard deviation of the y data, s_y .

Secondary functions are activated by pressing the **2nd F** key before pressing the function key.

Statistics Mode Setting

2nd

MODE

3

The calculator statistics mode is **3** and is used in conjunction with the calculator statistics functions.

- To enter the **Statistics** mode:

Press..... 2nd MODE 3

Display: Stat ? is the prompt to select the desired option.

0 - 6

- Once a regression model is selected:

STAT appears near the upper-right corner.

- To return to the calculator **Normal** mode:

Press..... 2nd MODE 0

STAT disappears from the upper-right corner.

The default mode setting is 0 - NORMAL

A Linear Regression Example

To perform linear regression calculations for the data:

x :	days absent	2	1	3	5	2	4	15	4
y :	mark	90	85	80	70	75	82	40	80

Using the *Sharp EL-546 V* calculator,

- Enter the statistics mode:..... Display

2nd mode 3 Stat ?
0 - 6

- Select **1**, the linear model ($a + bx$) from the **6** different options for regression on 2 variables (1-6).

Enter **1**..... Display: Stat 1
0.

- Enter the Data using the (x,y) and $DATA$ keys

- To enter the first data point $(2,90)$

Enter 2 (x,y) 90 $DATA$ Display: $n =$
1.

(the display indicates that 1 data point has been entered)

- To enter the second data point $(1,85)$

Enter 1 (x,y) 85 $DATA$ Display: $n =$
2.

(the display indicates that 2 data points have been entered)

- Repeat the data entry for the remaining 6 data points.

The Calculation Values

Once the data has been entered,

- Identify the coefficients a and b for the linear model $y = a + bx$

- for a (intercept) value

Enter RCL a Display: $a =$
90.119565

- for b (slope) value

Enter RCL b Display: $b =$
-3.303478

The regression equation for a linear model is:

$$y = \overset{y-INT}{a} + \underset{SLP}{b} \cdot x$$

the regression equation is $y = 90.12 - 3.30x$

● For the summation values:

- Enter **RCL** Σx Display: $\Sigma x =$
36.
- Enter **RCL** Σx^2 Display: $\Sigma x^2 =$
300.
- Enter **RCL** Σy Display: $\Sigma y =$
602.
- Enter **RCL** Σy^2 Display: $\Sigma y^2 =$
46974.
- Enter **RCL** Σxy Display: $\Sigma xy =$
2253.

● For the mean values:

- Enter **RCL** \bar{x} Display: $\bar{x} =$
4.5
- Enter **RCL** \bar{y} Display: $\bar{y} =$
75.25

● For the Correlation Coefficient r :

- Enter **RCL** r Display: $r =$
-0.9488825

● Estimating y and x values from the regression equation:

- For an estimate of y (y'), when $x = 6$:

Enter **6** **2nd F** y' Display: $6y'$
70.293478

- For an estimate of x (x'), when $y = 65$:

Enter **65** **2nd F** x' Display: $65x'$
7.601974

Reset to Normal Calculator Mode

To reset your calculator to the normal (non-statistics) mode:

● Enter

2nd

MODE

0

A Non-linear Regression Example

Your calculator is capable of regression calculations for several types of non-linear equation models.

These include:

sharp convention

◆ 2nd order polynomial	STAT 2	$y = a + bx + cx^2$
◆ exponential	STAT 3	$y = ae^{bx}$
◆ logarithmic ($x > 0$)	STAT 4	$y = a + b \ln x$
◆ power ($x \neq 0$)	STAT 5	$y = ax^b$
◆ reciprocal ($x \neq 0$)	STAT 6	$y = a + \frac{b}{x}$

Example

To perform **exponential** function regression calculations for the data:

$x :$	5	10	15	20	25	30	35	40	45
$y :$	305	196	140	99	69	51	30	20	16

Using the **Sharp EL-546 V** calculator,

- Enter the statistics mode:..... Display

mode

- Select **3**, the exponential model e^x for ($y = ae^{bx}$) from the **6** different options for **regression on 2 variables** (1-6).

Enter **3**..... Display:

- Enter the Data using the and keys

- To enter the first data point (**5,305**)

Enter **5** **305** Display:

(the display indicates that **1** data point has been entered)

- To enter the second data point (**10,196**)

Enter **10** **196** Display:

(the display indicates that **2** data points have been entered)

- Repeat the data entry for the remaining **7** data points.

The Calculation Values

Once the data has been entered,

- Identify the coefficients a and b for the exponential model $y = a \cdot e^{b \cdot x}$
 - for a (intercept) value

Enter Display: $a =$
433.99548

- for b (slope) value

Enter Display: $b =$
-0.074607

The regression equation is:

$$y = 433.99548e^{-0.074607x}$$

- For the summation values:

- Enter Display: $\Sigma x =$
225.

- Enter Display: $\Sigma x^2 =$
7125.

- Enter Display: $\Sigma y =$
37.87064

Note that the calculator value Σy is actually $\Sigma \ln y$

- Enter Display: $\Sigma y^2 =$
167.732

Note that the calculator value Σy^2 is actually $\Sigma (\ln y)^2$

- Enter Display: $\Sigma xy =$
834.855

Note that the calculator value Σxy is actually $\Sigma x \ln y$

● For the mean values:

• Enter **RCL** \bar{x} Display: $\bar{x} =$
25.

• Enter **RCL** \bar{y} Display: $\bar{y} =$
4.20785

Note that the calculator value \bar{y} is actually $\overline{\ln y}$

● For the Correlation Coefficient r :

• Enter **RCL** r Display: $r =$
-0.998279

● Estimating y and x values from the regression equation:

• For an estimate of y (y'), when $x = 28$:

Enter **28** **2nd F** y' Display: $28y'$
53.733

• For an estimate of x (x'), when $y = 125$:

Enter **125** **2nd F** x' Display: $125x'$
16.6836

Reset to Normal Calculator Mode

To reset your calculator to the normal (non-statistics) mode:

● Enter **2nd** **MODE** **0**

Other Non-linear Models

The procedure is similar for the other non-linear equation models.
These include:

		sharp convention
♦ <i>2nd</i> order polynomial	STAT 2	$y = a + bx + cx^2$
♦ logarithmic ($x > 0$)	STAT 4	$y = a + b \ln x$
♦ power ($x \neq 0$)	STAT 5	$y = ax^b$
♦ reciprocal ($x \neq 0$)	STAT 6	$y = a + \frac{b}{x}$
