

TI-83 Plus

1. System of Linear Equations

To solve the system $AX = B$ where $A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & 1 & 0 \\ 2 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 6 \\ 5 \\ 7 \end{bmatrix}$ with the TI-83 graphing calculator,

- MATRX, → to EDIT, 1 to edit matrix A.
- 3 enter (row), 3 enter (column), 1 enter, 1 enter, 1 enter, 3 enter, 1 enter, 0 enter, 2 enter, 1 enter, 1 enter, then 2nd QUIT.
- MATRX, → to EDIT, 2 to edit matrix B.
- 3 enter (row), 1 enter (column) 6 enter, 5 enter, 7 enter, then 2nd QUIT.
- To compute $X = A^{-1}B$, MATRX 1 (i.e. matrix A), x^{-1} (inverse of A), * (multiplication symbol is optional) MATRX 2 (i.e. matrix B), enter.

f) Output for the column vector X is $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$.

- MATRX, 1, x^{-1} enter, yields A^{-1} . These commands can be used to view the inverse of matrix A.

ex: To show that $A^{-1}A = I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$: MATRX, NAMES, 1 (i.e. matrix A), x^{-1} (inverse of A), then *

(optional), MATRX, NAMES, 1 (i.e. matrix A), enter.

Remark: To view decimal output in a "pretty print" form, after the decimal output appears, press MATH, option 1, to get Ans▷Frac, then press enter and the output, if in decimal form, will appear in fraction form. This is often quite helpful when viewing A^{-1} .

2. Linear Regression

To perform a least squares linear regression and generate a best fit line $y = ax + b$ for the observations (1,2), (2,4), (3,3), (4,5) with the TI-83,

- STAT, EDIT, enter (x,y) observations in L1 and L2.
- Put the cursor on L1, CLEAR, enter, in order to clear the list. Do likewise for L2. Note: These steps may not be necessary if the lists are empty, but it is a good practice to make sure the lists are empty.
- Put the cursor immediately below L1, enter all of the x entries i.e. 1↓ (down arrow), 2↓, 3↓, 4↓, then → (right arrow) to move the cursor immediately below L2.
- Enter the values for L2 i.e. 2↓, 4↓, 3↓, 5↓.
- STAT, CALC, option 4 (for LinReg); at the LinReg (ax+b) prompt, enter the following: L1,L2, Y_1 then enter. Note: L1 appears over the "1" key and the comma is the key above the number 7 key. To enter Y_1 , depress the key VARS, use the Y-VARS option, then option 1 (Function), then 1 for Y_1 .
- The following will appear on the screen:

```
LinReg
y=ax+b
a=.8
b=1.5
r^2=.64
r=.8
```

The equation $y = .8x + 1.5$ automatically is entered into Y_1 . The correlation coefficient $r = .8$ is a measure of agreement between the x and y values (± 1 are the best possible values), and r^2 is the percentage of variance accounted for in the model. To get the correlation output, you must set the function DiagnosticOn to the on position. This should be done only once since it is a toggle switch and remains on unless turned off. To turn the function on, 2nd

CATALOG, D (automatically in alpha mode and allows quick access to the functions starting with the letter D), use the down arrow to access DiagnosticOn, then depress the enter key twice.

g) To graph the model $y=.8x+1.5$ and the actual data, get to the Y= screen, highlight Plot1 (options can be changed by pressing 2nd STAT PLOT, then 2nd quit when changes are made), ZOOM, option 9 (ZoomStat) to automatically set the appropriate window and generate the graph. Note: The window can be redefined as you wish, then press GRAPH. **Figure 1** was generated in this manner with Xmin=0, Xmax=5, Ymin=0, Ymax=6. Be sure to turn off Plot1 when done, otherwise the actual data will continue to appear on all graphs.

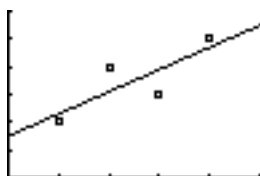


Figure 1

TI-86

1. System of Linear Equations

To solve the system $AX = B$ where $A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & 1 & 0 \\ 2 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 6 \\ 5 \\ 7 \end{bmatrix}$ with the TI-86 graphing calculator,

- 2nd MATRX (over the 7 key), F2 to EDIT the matrix A.
- Name=A (already in alpha mode, just type A), enter.
- 3 enter, 3 enter for rows and columns, 1 enter, 1 enter, 1 enter, 3, enter, 1 enter, 0 enter, 2 enter, 1 enter, 1 enter, then 2nd QUIT.
- 2nd MATRX, F2 to EDIT matrix B.
- Name=B, enter.
- 3 enter, 1 enter for rows and columns, 6 enter, 5 enter, 7 enter, 2nd QUIT.
- To compute $X = A^{-1}B$, 2nd MATRX, F1 (names), F1 to get matrix A, 2nd x^{-1} (G button) to compute A^{-1} , * (multiplication symbol is optional) F2 to get matrix B, enter.

g) Output for the column vector X is $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$.

h) 2nd MATRX, F1 (NAMES), F1 to access matrix A, 2nd x^{-1} , enter (yields A^{-1}). These commands can be used to view the inverse of matrix A.

ex: To show that $A^{-1}A = I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$: 2nd MATRX, F1 (NAMES), F1 (i.e. matrix A), 2nd x^{-1} (inverse of

A), then * (optional), F1 (matrix A), enter.

Remark: To view decimal output in a "pretty print" form, after the decimal output appears, press 2nd MATH (over the multiplication key), MISC (F5), MORE, \triangleright Frac (F1), to get Ans \triangleright Frac, then press enter and the previous output, if in decimal form, will appear in fraction form. This is often quite helpful when viewing A^{-1} .

2. Linear Regression

To perform a least squares linear regression and generate a best fit line $y = ax + b$ for the observations (1,2), (2,4), (3,3), (4,5) with the TI-86,

- a) 2nd STAT (over the + key), F2 (to EDIT the data and enter (x,y) observations in xStat and yStat columns).
- b) Put the cursor on xStat, CLEAR, enter, in order to clear the list. Do likewise for yStat.
Note: These steps may not be necessary if the lists are empty, but it is a good practice to make sure the lists are empty.
- c) Put the cursor immediately below xStat, enter all of the x entries i.e. 1 ↓ (down arrow), 2 ↓, 3 ↓, 4 ↓, then → (right arrow) to move the cursor immediately below yStat.
- d) Enter the values for yStat i.e. 2 ↓, 4 ↓, 3 ↓, 5 ↓.
- e) Then move the cursor to the fStat column (frequencies) and put a 1 in each of the entries, i.e. 1 ↓, 1 ↓, 1 ↓, 1 ↓, 2nd QUIT (to get to the home screen).
- f) 2nd STAT, F1 (CALC), F3 (for LinR); at the LinR prompt depress the enter key and the least squares output will appear on the screen. Hit the down arrow to see more of the output. To see all the output at once, type 2nd QUIT and the following will appear on the screen:
- ```
LinReg
y=a+bx
a=1.5
b=.8
corr=.8
n=4
```
- g) To graph the least squares line and data, enter the straight line function at the  $Y(x)$  = screen, i.e.  $Y_1 = 1.5 + .8x$ , and highlight Plot1 at the same screen. Then, set the ZOOM to ZDATA (automatically adjusts window settings), i.e. M3, MORE, F5.

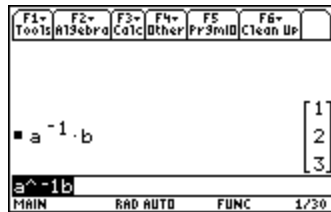
Note: The window can be redefined as you wish, then press GRAPH (F5). **Figure 1** was generated in this manner with Xmin=0, Xmax=5, Ymin=0, Ymax=6. Be sure to turn off Plot1 when done, otherwise the actual data will continue to appear on all graphs.

## TI-89

### 1. System of Linear Equations

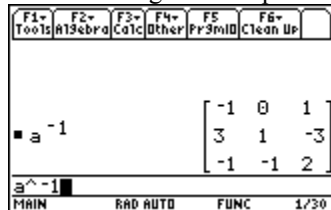
To solve the system  $AX = B$  where  $A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & 1 & 0 \\ 2 & 1 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 6 \\ 5 \\ 7 \end{bmatrix}$  with the TI-89 graphing calculator,

- APPS-> 6 (Data/Matrix Editor)-> 3 (New)
- Type-> 2 (Matrix), variable->alpha A, use the down arrow to move to next entry, Row dimension: 3, Col dimension: 3, enter twice.
- Then enter matrix A elements row by row, 2<sup>nd</sup> quit when done. Repeat steps a) and b) to enter matrix B with 3 rows and 1 column. If a message appears that the variable name is in use, then 2<sup>nd</sup> var-link, select the matrix name or names to delete with F4, F1 (manage), option 1 (delete)
- To compute  $X = A^{-1}B$ , 2<sup>nd</sup> quit and at the command line, 2<sup>nd</sup> var-link, highlight matrix A (it will appear as matrix 'a'), enter, and it will appear in the command line. Then to compute its inverse, ^ (exponentiation symbol under CLEAR) followed by -1 (use the (-1) symbol to the left of enter). Follow this by 2<sup>nd</sup> var-link, highlight matrix B (it will appear as matrix 'b'), enter, and it will appear in the command line. Press enter, then the command line and output screen will display as:



Output for the column vector  $X$  is  $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ . To view  $A^{-1}$ , at the command line,

enter  $a^{-1}$  to get the output screen



e) It is a good idea to delete the variables used for the matrices as in step c.

## 2. Linear Regression

To perform a least squares linear regression and generate a best fit line  $y = ax + b$  for the observations (1,2), (2,4), (3,3), (4,5) with the TI-89,

- Make sure the TI-89 is in the Mode=Function setting, i.e. MODE  $\rightarrow$  1 enter.
- To enter data, use the Data/Matrix editor, i.e. APPS option 6 option 3 (new)
- Type  $\rightarrow$  enter 3 (List), go to variable name (use t1), ok twice. Note: if a message appears that the variable name is in use, then 2nd var-link, select t1 with F4, F1 (manage), option 1 (delete)
- Enter the data under c1 (x values) and c2 (y values)
- F5 (Calc), calculation type  $\rightarrow$  to linreg, x: enter c1, y: enter c2, store regeq to y1(x), enter twice and the results should appear on the screen as:



- Enter to clear the screen, green diamond  $y=$ , up arrow to plot1 and enter, plot type scatter, mark box, x c1, y c2, enter. (Note: up arrow implies plot2, plot3, etc. and the down arrow to get back to y1(x), etc.)
- F2 (zoom), option 9 (zoomdata) for a plot of the line and actual data. When you are done, green diamond  $y=$ , highlight plot1, F4 to deselect it, then down arrow as necessary to eliminate plot1 from appearing on the screen. Note: **without** deselecting plot1, you won't be able to graph.
- It is a good idea to delete the variable t1 again as in step c.