

THE TI-92 WORKSHOP

(PART 4: THE VARIOUS EDITORS)

by B KUTZLER

Reset the screen with

☐ -2nd-ON

and use []-[-] and []-[+] to adjust the contrast.

So far, function definitions were entered using the **STO>** key, e.g. $x^2 - 2 \rightarrow y1(x)$. An alternative is the **DEFINE** command that can be found in the **F4** menu. Use this command to define the above sample function and then solve the equation $y1(x) = 0$ with respect to x .

☐ **F4** **1**:DEFINE $y1(x)=x^2-2$ **ENTER** **solve**($y1(x)=0,x$) **ENTER**

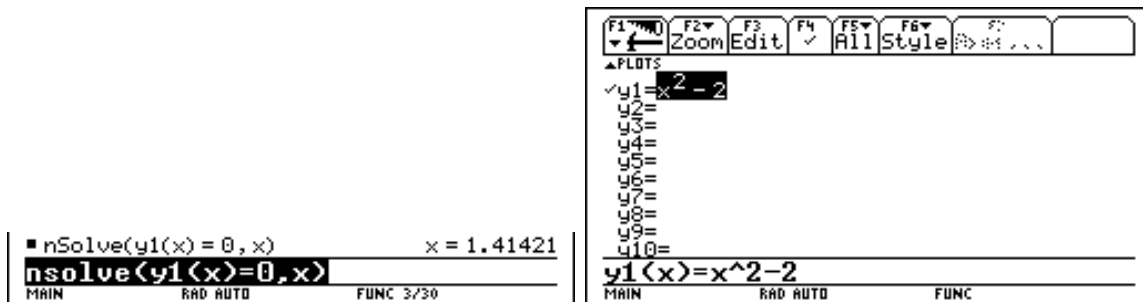


This was the method for obtaining the algebraic solution. Another function for solving equations is **NSOLVE** (which you can find in the **ALGEBRA** menu). Since the last entry is still available, simply insert the letter 'N' in front of the function name 'SOLVE'. The result of this function applied to an equation is a single approximate solution. Try it on the above example and then switch to the **Y=** editor.

☐ ... to remove the highlighting

n **ENTER** ... to insert 'n' in front of 'solve'

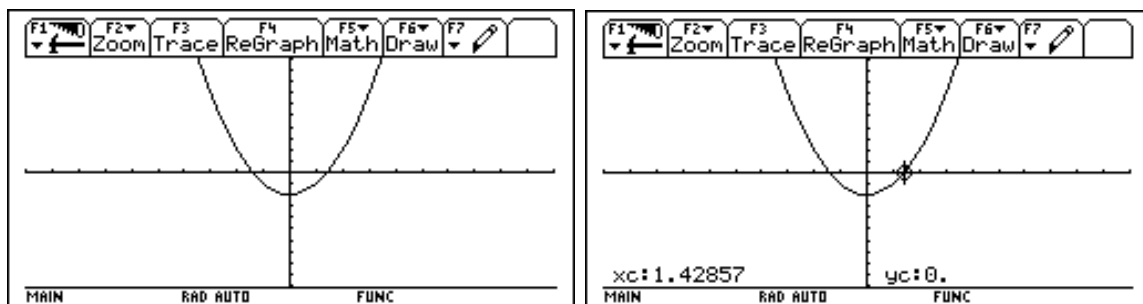
[**Y=**] ... to switch to the **Y=** editor



Since the function was named $y1$, it automatically appears in the **Y=** editor ($y1$ is one of the TI-92's global variable names). Plot its graph and move the graphics cursor to the positive zero.

☐ [**GRAPH**]

...



This is the geometric method of solving the equation. The solution obtained is $x = 1.428571$, which is not very good. However, you could use the various zoom functions to improve its accuracy significantly.

Now the change of sign occurs between 1.4 and 1.5. Update the TABLE SETUP accordingly: use 1.4 as the next start value and 0.01 as the next increment.

□ [TBLSET]

1.4 ↓ .01 [ENTER]

[ENTER]

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
tblStart:	1.4				
Δtbl:	.01				
Graph <-> Table:	OFF→				
Independent:	AUTO→				
Enter=SAVE			ESC=CANCEL		
1.7	.89				
x=1.4					
TYPE + [ENTER]=OK AND [ESC]=CANCEL					

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
x	y1				
1.4	-.04				
1.41	-.0119				
1.42	.0164				
1.43	.0449				
1.44	.0736				
1.45	.1025				
1.46	.1316				
1.47	.1609				
x=1.4					
MAIN RAD AUTO FUNC					

For the next iteration use a start value of 1.41 and an increment of 0.001.

□ [TBLSET]

1.41 ↓ .001 [ENTER]

[ENTER]

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
tblStart:	1.41				
Δtbl:	.001				
Graph <-> Table:	OFF→				
Independent:	AUTO→				
Enter=SAVE			ESC=CANCEL		
1.47	.1609				
x=1.41					
TYPE + [ENTER]=OK AND [ESC]=CANCEL					

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
x	y1				
1.41	-.0119				
1.411	-.0091				
1.412	-.0063				
1.413	-.0034				
1.414	-.0006				
1.415	.0023				
1.416	.00506				
1.417	.00789				
x=1.41					
MAIN RAD AUTO FUNC					

1.414 would be the next start value. You might have observed that the default start value in the TABLE SETUP is the x -value from the first line. Consequently, if you shift the column such that 1.414 is the first value, then you don't need to enter the value via the keyboard any more.

□ ↓ ↓ ...

[TBLSET]

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
x	y1				
1.414	-.0006				
1.415	.00223				
1.416	.00506				
1.417	.00789				
1.418	.01072				
1.419	.01356				
1.42	.0164				
1.421	.01924				
x=1.421					
MAIN RAD AUTO FUNC					

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
tblStart:	1.414				
Δtbl:	.001				
Graph <-> Table:	OFF→				
Independent:	AUTO→				
Enter=SAVE			ESC=CANCEL		
1.421	.01924				
x=1.421					
TYPE + [ENTER]=OK AND [ESC]=CANCEL					

So all you need to change is the value of the increment.

□ ↓ .0001 [ENTER]

[ENTER]

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
tblStart:	1.414				
Δtbl:	1.e-4				
Graph <-> Table:	OFF→				
Independent:	AUTO→				
Enter=SAVE			ESC=CANCEL		
1.421	.01924				
x=1.421					
TYPE + [ENTER]=OK AND [ESC]=CANCEL					

F1	F2	F3	F4	F5	F6
Setup	Cell	Header	Del	Pow	Int
TABLE SETUP					
x	y1				
1.414	-.0006				
1.4141	-.0003				
1.4142	-4.e-5				
1.4143	.00024				
1.4144	.00053				
1.4145	.00081				
1.4146	.00109				
1.4147	.00138				
x=1.414					
MAIN RAD AUTO FUNC					

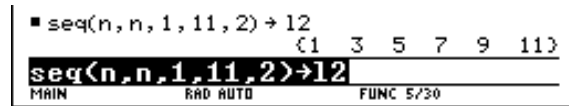
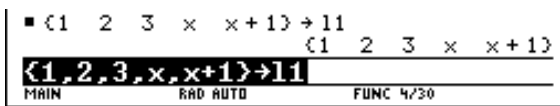
Enough of tables. Let's do lists.

Lists are written within braces (curly brackets). Return to the Home screen and enter a list L1 comprising of the five elements 1, 2, 3, x , and $x+1$ (left picture). Then enter a list L2 comprising of all the odd numbers between 1 and 11 (right picture).

□ [HOME]

{1,2,3,x,x+1} [STO] 11 [ENTER]

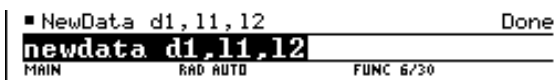
seq(n,n,1,11,2) [STO] 12 [ENTER]



List L1 was entered by entering all its elements. List L2 was entered by giving a descriptive definition. The defining expression uses the SEQ function, which produces a list of elements n , such that n goes from 1 to 11 in steps of 2.

Use the NEWDATA command to combine the two lists into a data file which can be further processed with the data/matrix editor.

□ newdata d1,11,12 [ENTER]



The data/matrix editor is activated through the APPLICATIONS menu. Press the [APPS] key and select option number 6.

□ [APPS]

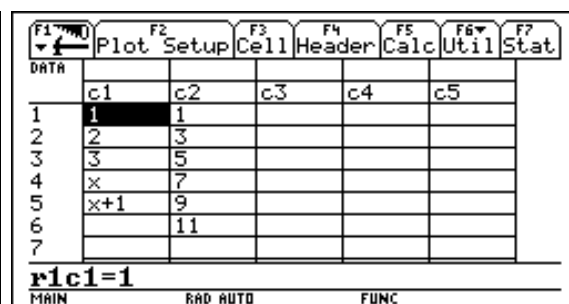
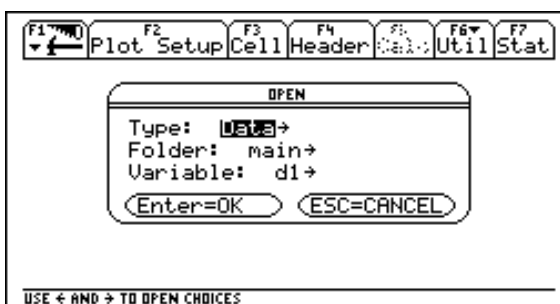
[6]:DATA/MATRIX EDITOR



Since you have to open the existing data file D1, use option [2]:OPEN (left picture). Since D1 is the only data file in the memory now, it appears as default choice in the VARIABLE field and you only need to press [ENTER] to accept the suggestions (right picture).

□ [2]:OPEN

[ENTER]



L1 is the data file's first column, L2 is its second column. All other columns are empty. Each column has a header name, namely C1, C2,

You can use all four arrow keys to move the highlighting within the single cells of the data file. Move it to the first cell in the third column.

☐ → →

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1					
2	2	3					
3	3	5					
4	x	7					
5	x+1	9					
6		11					
7							
r1c3=							
MAIN RAD AUTO FUNC							

Observe how the respective row and column counts appear in the editor line. R1C3 means: row 1, column 3. Press [F4]:HEADER to enter a definition for this column's header. Enter *shift(c2,1)* and see what happens.

☐ [F4]:HEADER shift(c2,1)

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1					
2	2	3					
3	3	5					
4	x	7					
5	x+1	9					
6		11					
7							
c3=							
MAIN RAD AUTO FUNC							

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1					
2	2	3					
3	3	5					
4	x	7					
5	x+1	9					
6		11					
7							
c3=shift(c2,1)							
MAIN RAD AUTO FUNC							

☐ [ENTER]

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1	3				
2	2	3	5				
3	3	5	7				
4	x	7	9				
5	x+1	9	11				
6		11	undef				
7							
r1c3=3							
MAIN RAD AUTO FUNC							

All elements of the third column were computed according to the definition of the column header, i.e. they were shifted one row up. (This operation introduced the undefined value UNDEF as the last element of the third column, since, by definition, the new column has the same length as the one it was computed from.) The first element - which is element R1C3 - is highlighted. The lock symbol in the editor line indicates that this element cannot be updated via the editor, since it is determined by a definition (i.e. it is dependent).

The fourth column shall be the sum of the first and the second column. Proceed as follows:

☐ → ... to highlight a cell of the fourth column

[F4]:HEADER ... to edit this column's header

c1+c2

[ENTER]

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1	3				
2	2	3	5				
3	3	5	7				
4	x	7	9				
5	x+1	9	11				
6		11	undef				
7							
c4=c1+c2							
MAIN RAD AUTO FUNC							

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1	3				
2	2	3	5				
3	3	5	7				
4	x	7	9				
5	x+1	9	11				
6		11	undef				
7							
c4=c1+c2							
MAIN RAD AUTO FUNC							

ERROR

Dimension mismatch

(ESC=CANCEL)

The DIMENSION MISMATCH error message reminds us that it is impossible to add two columns of different length. Cancel the message (left picture) and clear the line editor (right picture).

[ESC]

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c4	c5	c6	c7	c8		
2							
3							
4							
5							
6							
7							
c4=c1+c2							
MAIN RAD AUTO FUNC							

[CLEAR]

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c4	c5	c6	c7	c8		
2							
3							
4							
5							
6							
7							
c4=							
MAIN RAD AUTO FUNC							

It looks as if the first three columns disappeared. But not really. They were shifted off the screen only. You will get them back into the display area by moving the highlighting to the left.

↓ ... to move the highlighting into the first line Highlight the last element of the second column.

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c4	c5	c6	c7	c8		
2							
3							
4							
5							
6							
7							
r1c4=							
MAIN RAD AUTO FUNC							

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c1	c2	c3	c4	c5		
2	1	1	3				
3	2	3	5				
4	3	5	7				
5	x	7	9				
6	x+1	9	11				
7		11	undef				
r6c2=11							
MAIN RAD AUTO FUNC							

Delete this cell. This can be done via the **[F6]:UTIL** menu. Activate it and open the DELETE submenu. This submenu offers commands for deleting a single CELL or the whole ROW or the whole COLUMN. Select the CELL command.

[F6]:UTIL [2]:DELETE

[1]:CELL

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c1	c2	c3	c4	c5		
2	1	1	3				
3	2	3	5				
4	3	5	7				
5	x	7	9				
6	x+1	9	11				
7		11	undef				
r6c2=11							
TYPE OR USE ←+ → + [ENTER]=OK AND [ESC]=CANCEL							

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c1	c2	c3	c4	c5		
2	1	1	3				
3	2	3	5				
4	3	5	7				
5	x	7	9				
6	x+1	9	undef				
7							
r6c2=							
MAIN RAD AUTO FUNC							

This made the second column the same length as the first column. Also observe how the third column was updated accordingly. Repeat the previous attempt of making the fourth column the sum of the first two columns.

→ → ... to highlight a cell from the fourth column

[F4]:HEADER

c1+c2 [ENTER]

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c1	c2	c3	c4	c5		
2	1	1	3				
3	2	3	5				
4	3	5	7				
5	x	7	9				
6	x+1	9	undef				
7							
c4=							
MAIN RAD AUTO FUNC							

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1	c1	c2	c3	c4	c5		
2	1	1	3	2			
3	2	3	5	5			
4	3	5	7	8			
5	x	7	9	x+7			
6	x+1	9	undef	x+10			
7							
r6c4=							
MAIN RAD AUTO FUNC							

Now it worked!

Highlight the second element of the first column. Pressing **[ENTER]** activates the line editor for this cell.

- Highlight the second element of the first column. **[ENTER]**

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1	3	2			
2	2	3	5	5			
3	3	5	7	8			
4	x	7	9	x+7			
5	x+1	9	undef	x+10			
6							
7							
r2c1=2							
MAIN RAD AUTO FUNC							

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1	3	2			
2	2	3	5	5			
3	3	5	7	8			
4	x	7	9	x+7			
5	x+1	9	undef	x+10			
6							
7							
r2c1=2							
MAIN RAD AUTO FUNC							

Overwrite the old element 2 with the new element 15. Press **[ENTER]** and observe how also the second element of the fourth column is updated automatically.

- 15 **[ENTER]**

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	1	1	3	2			
2	15	3	5	18			
3	3	5	7	8			
4	x	7	9	x+7			
5	x+1	9	undef	x+10			
6							
7							
r3c1=3							
MAIN RAD AUTO FUNC							

Delete all entries before continuing with another example. Open the **[F1]** menu and apply the DELETE command.

- **[F1]**

[8]:CLEAR EDITOR

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
				c4	c5		
1	1	1	3	2			
2	15	3	5	18			
3	3	5	7	8			
4	x	7	9	x+7			
5	x+1	9	undef	x+10			
6							
7							
r3c1=3							
TYPE OR USE ←+1 + [ENTER]=OK AND [ESC]=CANCEL							

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
1							
2							
3							
4							
5							
6							
7							
r3c1=3							
MAIN RAD AUTO FUNC							

- **[ENTER]**

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1							
2							
3							
4							
5							
6							
7							
r1c1=							
MAIN RAD AUTO FUNC							

As a next example, you will maintain a data base with some data from a group of men. The first column shall contain the men's names, the second column their heights. Later you will add another column for their weights.

Simply type the name of the first man. As you type the first character, the TI-92 switches into line editing mode automatically. Conclude the input with **ENTER** and repeat this procedure with the second man's name.

jim **ENTER**

tom **ENTER**

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	jim						
2							
3							
4							
5							
6							
7							
r2c1=							
MAIN		RAD AUTO			FUNC		

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3							
4							
5							
6							
7							
r3c1=							
MAIN		RAD AUTO			FUNC		

Add the following three more names:

peter **ENTER**

bob **ENTER**

dave **ENTER**

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3	peter						
4	bob						
5	dave						
6							
7							
r6c1=							
MAIN		RAD AUTO			FUNC		

The cell above the header C1 is empty. This cell can be used for a column title. Highlight this cell and enter the title 'NAME'.

Highlight the cell above C1.

name

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3	peter						
4	bob						
5	dave						
6							
7							
c1.Title=							
MAIN		RAD AUTO			FUNC		

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA							
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3	peter						
4	bob						
5	dave						
6							
7							
c1.Title=name							
MAIN		RAD AUTO			FUNC		

ENTER

	F1 Plot	F2 Setup	F3 Cell	F4 Header	F5 Calc	F6 Util	F7 Stat
DATA	name						
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3	peter						
4	bob						
5	dave						
6							
7							
c1=							
MAIN		RAD AUTO			FUNC		

Highlight the second column's title cell and enter the title 'HEIGHT'.

- Highlight the cell above c2.

height

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name						
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3	peter						
4	bob						
5	dave						
6							
7							

c2,Title=

MAIN RAD AUTO FUNC

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3	peter						
4	bob						
5	dave						
6							
7							

c2=

MAIN RAD AUTO FUNC

Now highlight the first data cell of the second column and enter Jim's height (in centimeters).

- ↓

178

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	jim						
2	tom						
3	bob						
4	peter						
5	dave						
6							
7							

r1c2=

MAIN RAD AUTO FUNC

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	jim	178					
2	tom						
3	peter						
4	bob						
5	dave						
6							
7							

r2c2=

MAIN RAD AUTO FUNC

Enter the heights of the other four men.

- 185 187 177 192

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	jim	178					
2	tom	185					
3	peter	187					
4	bob	177					
5	dave	192					
6							
7							

r6c2=

MAIN RAD AUTO FUNC

How would you like to sort the records according to the heights? You will find a respective command in the UTIL menu. However, be careful to select the SORT COL, ADJUST ALL command, since only this command preserves the row-wise links, i.e. the men's names are adjusted accordingly.

- :UTIL

:SORT COL, ADJUST ALL

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	jim	178					
2	tom	185					
3	peter	187					
4	bob	177					
5	dave	192					
6							
7							

r6c2=

TYPE OR USE ←→+ + [ENTER]=OK AND [ESC]=CANCEL

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	bob	177					
2	jim	178					
3	tom	185					
4	peter	187					
5	dave	192					
6							
7							

r6c2=

MAIN RAD AUTO FUNC

Now sort the records according to names.

- ☐ ← ... to highlight an element of the first column

[F6]:UTIL [4]:SORT COL, ADJUST ALL

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	bob	177					
2	dave	192					
3	jim	178					
4	peter	187					
5	tom	185					
6							
7							

r6c1=
MAIN RAD AUTO FUNC

To insert a column between columns one and two, highlight any element of the second column and open the INSERT submenu from the UTIL menu.

- ☐ → ... to highlight an element of column 2

[F6]:UTIL [1]:INSERT

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	height					
	c1	c2	c3	c4	c5		
1	bob	177					
2	dave	192					
3	jim	178					
4	peter	187					
5	tom	185					
6							
7							

r6c2=
MAIN RAD AUTO FUNC

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	r 1:cell	1:Insert					
	d 2:row	2>Delete					
	c 3:column	3:Sort Column					
		4:Sort Col, adjust all					
		5:Clear Column					
1	dave	192					
2	jim	178					
3	peter	187					
4	tom	185					
5							
6							
7							

r6c2=
TYPE OR USE ←+↑+ [ENTER]=OK AND [ESC]=CANCEL

Again, you can insert a single cell or a whole row or a whole column. Insert a column.

- ☐ [3]:COLUMN

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name		height				
	c1	c2	c3	c4	c5		
1	bob		177				
2	dave		192				
3	jim		178				
4	peter		187				
5	tom		185				
6							
7							

r6c2=
MAIN RAD AUTO FUNC

The new column shall contain the weights of the five men. So first of all, give this column an appropriate title.

- ☐ Highlight the cell above c2.

weight [ENTER]

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name		height				
	c1	c2	c3	c4	c5		
1	bob		177				
2	dave		192				
3	jim		178				
4	peter		187				
5	tom		185				
6							
7							

c2.Title=
MAIN RAD AUTO FUNC

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	weight	height				
	c1	c2	c3	c4	c5		
1	bob		177				
2	dave		192				
3	jim		178				
4	peter		187				
5	tom		185				
6							
7							

c2=
MAIN RAD AUTO FUNC

Enter the following weights: 89 kg for Bob, 91 kg for Dave, 75 kg for Jim, 90 kg for Peter, and 88 kg for Tom.

- ↓ ... to highlight the first data cell

89 [ENTER] 91 [ENTER] 75 [ENTER] 90 [ENTER] 88 [ENTER]

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	weight	height				
	c1	c2	c3	c4	c5		
1	bob	89	177				
2	dave	91	192				
3	jim	75	178				
4	peter	90	187				
5	tom	88	185				
6							
7							

r6c2=
MAIN RAD AUTO FUNC

Sort the records according to weights.

- [F6]:UTIL [4]:SORT COL, ADJUST ALL

	F1	F2	F3	F4	F5	F6	F7
	Plot	Setup	Cell	Header	Calc	Util	Stat
DATA	name	weight	height				
	c1	c2	c3	c4	c5		
1	jim	75	178				
2	tom	88	185				
3	bob	89	177				
4	peter	90	187				
5	dave	91	192				
6							
7							

r6c2=
MAIN RAD AUTO FUNC

In the next exercises you will learn how to do a statistical analysis of the second versus the third column. Start the CALC dialog box and open the selection menu for the CALCULATION TYPE field.

- [F5]:CALC → ... to open the selection field

main\d1 Calculate

Calculation Type. **1:OneVar**→

x.....

1 y.....

2 Store RegEQ to... none→

3 Use Freq and Categories? NO→

4 Freq.....

5 Category.....

6 (include Categories) C

7

8

9

Enter=SAVE ESC=CANCEL

USE ← AND → TO OPEN CHOICES

main\d1 Calculate

Calculation Type. **2:TwoVar**→

x.....

1 y.....

2 Store RegEQ to... none→

3 Use Freq and Categories? NO→

4 Freq.....

5 Category.....

6 (include Categories) C

7

8

9

Enter=SAVE ESC=CANCEL

TYPE OR USE ←→+ [ENTER]=OK AND [ESC]=CANCEL

This selection field lists all available statistical analysis types. Try a linear regression: Select [5]:LINREG and then use the down arrow key to select the next entry field.

- [5]:LINREG ↓ ... select the X input field

main\d1 Calculate

Calculation Type. **LinReg**→

x.....

1 y.....

2 Store RegEQ to... none→

3 Use Freq and Categories? NO→

4 Freq.....

5 Category.....

6 (include Categories) C

7

8

9

Enter=SAVE ESC=CANCEL

USE ← AND → TO OPEN CHOICES

main\d1 Calculate

Calculation Type. **LinReg**→

x.....

1 y.....

2 Store RegEQ to... none→

3 Use Freq and Categories? NO→

4 Freq.....

5 Category.....

6 (include Categories) C

7

8

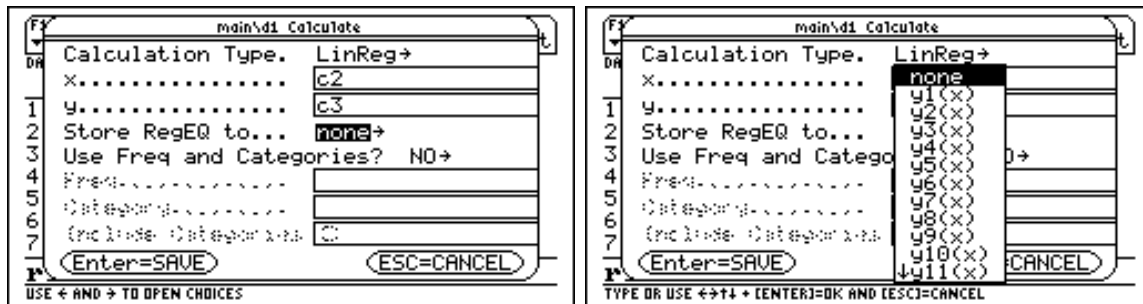
9

Enter=SAVE ESC=CANCEL

MAIN RAD AUTO FUNC

Take the weights as the x values and the heights as the y values. Accordingly, enter the column labels C2 and C3 into the entry fields for X and Y. Then open the selection menu for the STORE REGEQ TO field.

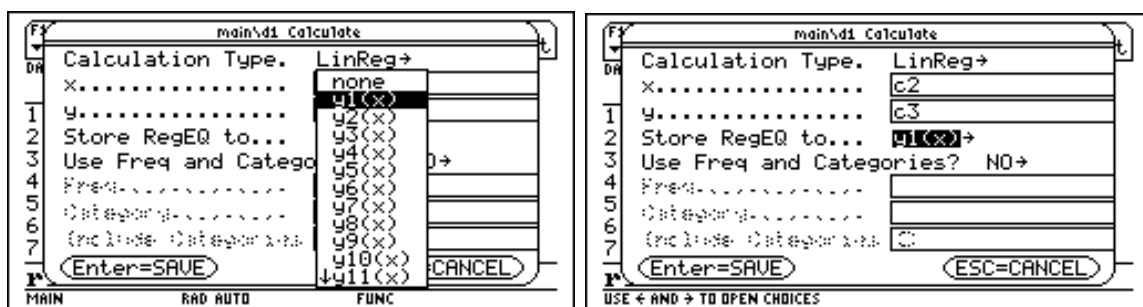
□ c2 ↓ c3 ↓



As you can see from the suggested function names, this entry can generate a link with the Y= editor. Select $y1(x)$.

□ ↓ ... to highlight $y1(x)$

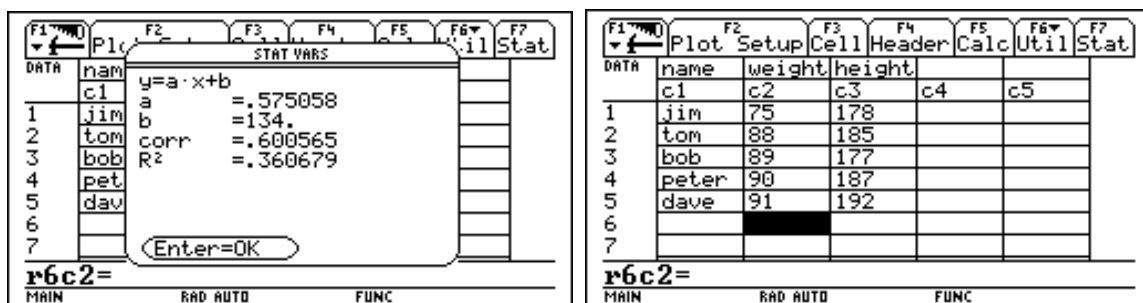
[ENTER] ... to select it



When you save these parameters with [ENTER], the corresponding statistical analysis will be computed and the results will be displayed (left picture). As a side effect, the linear regression function is saved as $y1(x)$. Use [ENTER] to exit from the display.

□ [ENTER]

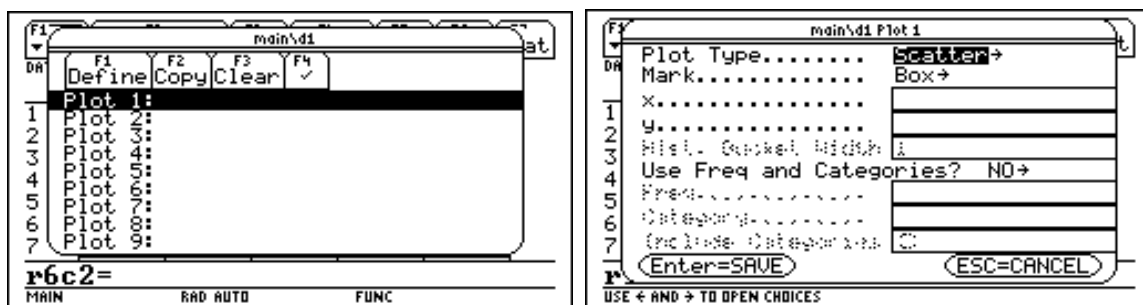
[ENTER]



These are interesting numbers, but: A picture says more than a thousand words. The resulting linear function already has been "transferred" to the Y= editor. It remains to define a plot of the data points. Execute the PLOT SETUP command and then use [F1]:DEFINE to define the data point plot.

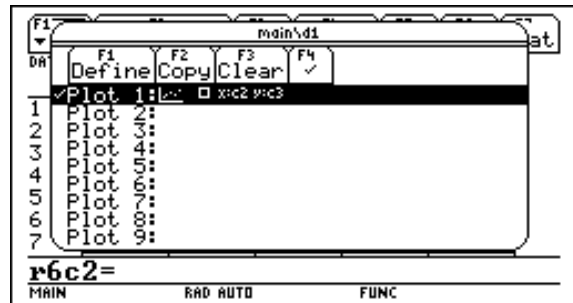
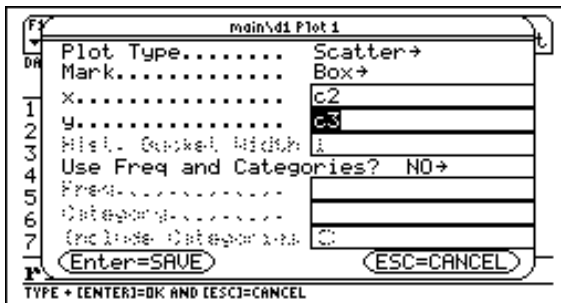
□ [F2]:PLOT SETUP

[F1]:DEFINE



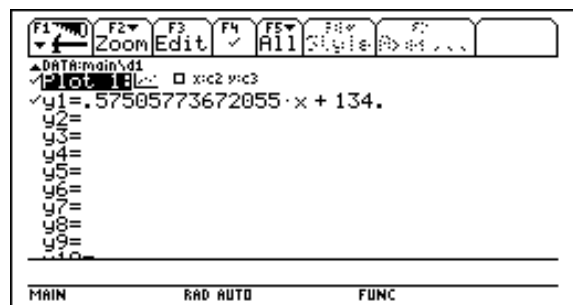
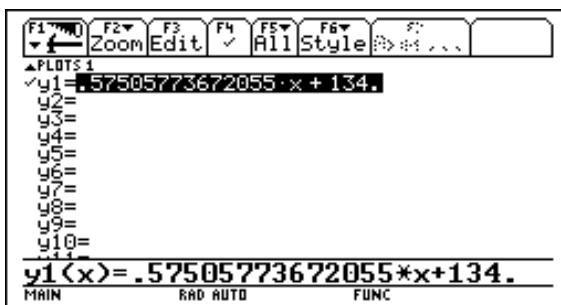
Accept the default entries for the fields PLOT TYPE and MARK. Move on to the entry field for X, enter column C2, move to the entry field for Y, enter column C3, and finally save the input.

- **↓ ↓** c2 ... to enter into the X input field
- **↓** c3 **[ENTER]** ... to enter into the Y input field **[ENTER]** ... to save the values



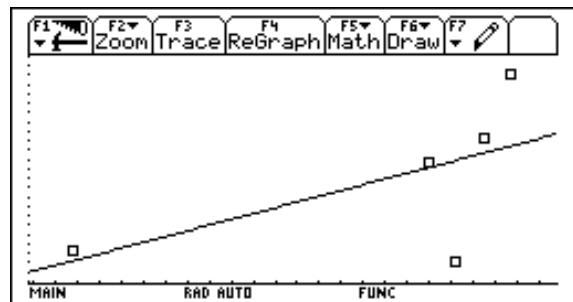
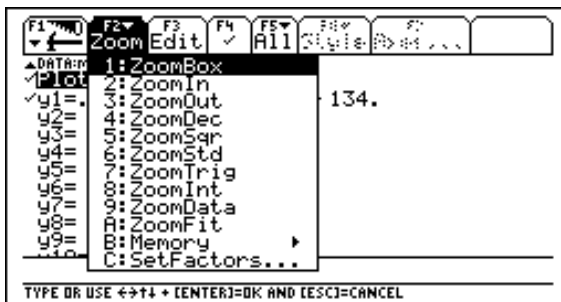
Switch to the Y= screen and use the up arrow key to see what comes above the function y1.

- **[Y=]** **↑**



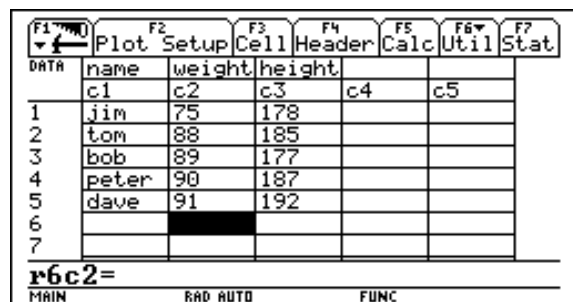
$y1(x)$ is the equation of the linear regression line. PLOT1 is the definition of the data point plot. Open the ZOOM menu (which is the same as the ZOOM menu from the graphics screen). The ZOOMDATA command selects suitable WINDOW parameters such that all data points "just fit on the screen".

- **[F2]:ZOOM**
- **[9]:ZOOMDATA**



The data/matrix editor with the weights and heights of the five men is still open - but somewhere overlaid by various other applications/screens. Use the APPLICATIONS menu to return to the current data file.

- **[APPS]** **[6]:DATA/MATRIX EDITOR**
- **[1]:CURRENT**



□ ↑-↑



□ ↑-← ↑-← ...



The diamond key [◆] is the equivalent of a PC's control key (CTRL). Use [◆][C] to copy the highlighted text into the "clip board", enter a space, and then use [◆][V] to paste the text in.

□ [◆][C] ... to copy the text

→ ... to remove the highlighting

() ... to enter a space

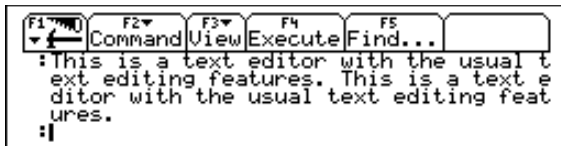
[◆][V] ... to past the previously copied text



Pressing the [ENTER] key starts a new paragraph.

□ [ENTER]

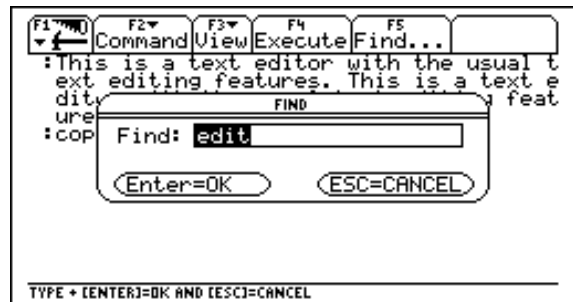
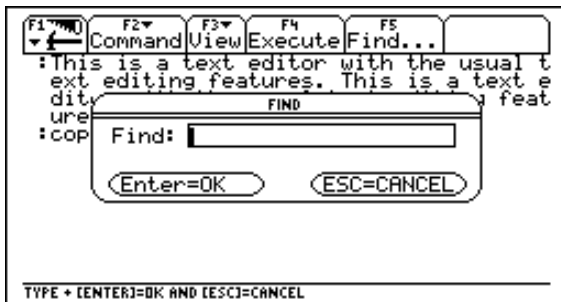
copy - paste - search



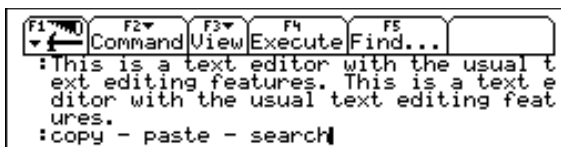
Now use the FIND command to search for a string.

□ [F5]:FIND

edit [ENTER]



□ [ENTER] ... to start the search



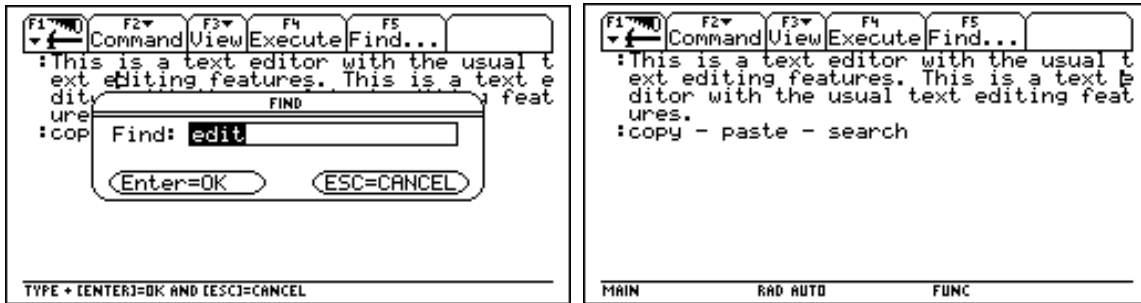
The string was not found, as is indicated by the the fact that the cursor (still) blinks at the end of the text. This is because the search is from the current cursor position to the end of the text - and the cursor WAS at the end of the text. Press the up arrow key three times to move the cursor in the middle of the text.

□ ↑↑↑



Start the FIND command once more. Since the string 'edit' still is displayed in the dialog box's entry field, you only need to press [ENTER] for starting the search again.

- ☐ [F5]:FIND [ENTER]

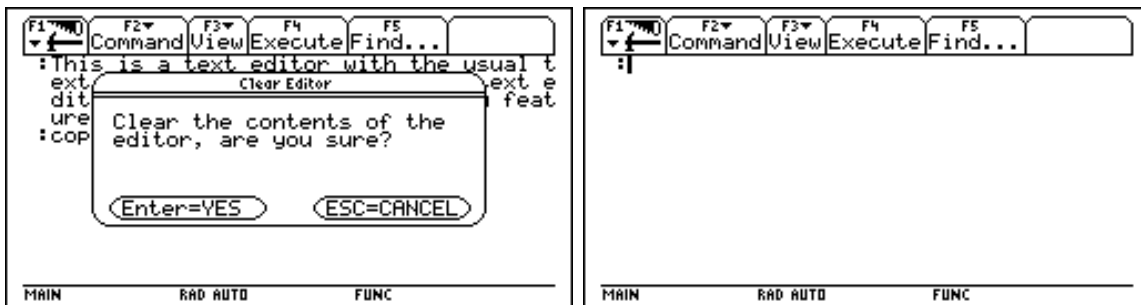


The search was successful now and the cursor was positioned in front of the found occurrence. Repeat this process to search for the next occurrence. Then activate the [F1] menu and clear the editor.

- ☐ [F5]:FIND [ENTER] [F1]

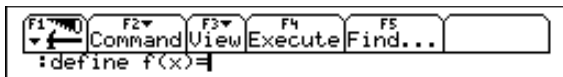


- ☐ [8]:CLEAR ALL [ENTER]



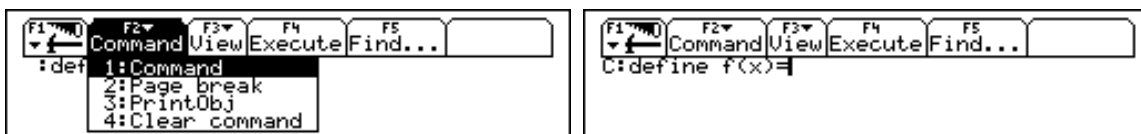
Texts can be executed. This particular feature is very useful, especially for educational purposes. Enter a command for defining a function $f(x)$ - but without defining a concrete function yet.

- ☐ define $f(x)=$



So far, this is a simple line of text. However, you can make this an executable line by applying to it the COMMAND command from the COMMAND menu.

- ☐ [F2]:COMMAND [1]:COMMAND



This introduced the letter C in front of the double point (the double point indicates the start of a paragraph). This C denotes a *command line*.

Enter text and commands as described in the sequel:

- ENTER ... to start a new paragraph

zeros: ENTER

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:|
    
```

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
:|
    
```

- zeros(f(x),x)

Make this a command line and press ENTER.

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
:zeros(f(x),x)|
    
```

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:|
    
```

- candidates for extremal points: ENTER

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:candidates for extremal points:
:|
    
```

- zeros(d(f(x),x),x)

Make this a command line.

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:candidates for extremal points:
:zeros(d(f(x),x),x)|
    
```

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:candidates for extremal points:
C:zeros(d(f(x),x),x)|
    
```

- ENTER ... to start a new line

graph f(x)

Make this a command line.

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:candidates for extremal points:
C:zeros(d(f(x),x),x)
C:graph f(x)|
    
```

Open the [F3] menu and use the SCRIPT VIEW command to split the screen into a text and a home window.

- [F3]:VIEW

[1]:SCRIPT VIEW

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:candidates for extremal points:
C:zeros(d(f(x),x),x)
C:graph f(x)
1:Script View
2:Clear split
TYPE OR USE ←+ + ENTER)=OK AND (ESC)=CANCEL
    
```

```

F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:candidates for ex
tremal points:
C:zeros(d(f(x),x),x)
C:graph f(x)|
nSolve(y1(x)=0,x)
x=1.41421
(1 2 3 x x+
(1 2 3 x x+
seq(n,n,1,11,2)
(1 3 5 7 9
NewData d1,11,12
Done
MAIN RAD AUTO FUNC
    
```

Move the cursor to the first line and complete the function definition by entering the expression $x^2 - x$.

- Move the cursor to the end of the first line.

$x^2 - x$

```

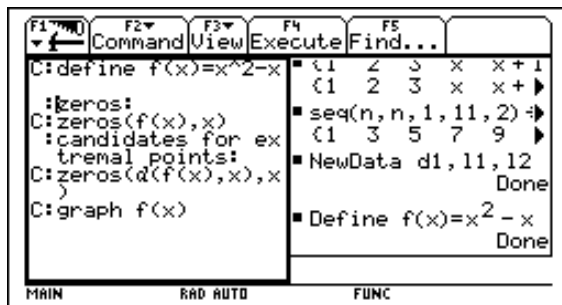
F1 Command View F3 Execute F5 Find...
C:define f(x)=
:zeros:
C:zeros(f(x),x)
:candidates for ex
tremal points:
C:zeros(d(f(x),x),x)
C:graph f(x)
nSolve(y1(x)=0,x)
x=1.41421
(1 2 3 x x+
(1 2 3 x x+
seq(n,n,1,11,2)
(1 3 5 7 9
NewData d1,11,12
Done
MAIN RAD AUTO FUNC
    
```

```

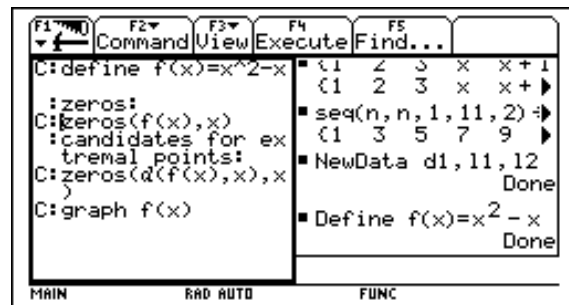
F1 Command View F3 Execute F5 Find...
C:define f(x)=x^2-x
:zeros:
C:zeros(f(x),x)
:candidates for ex
tremal points:
C:zeros(d(f(x),x),x)
C:graph f(x)|
nSolve(y1(x)=0,x)
x=1.41421
(1 2 3 x x+
(1 2 3 x x+
seq(n,n,1,11,2)
(1 3 5 7 9
NewData d1,11,12
Done
MAIN RAD AUTO FUNC
    
```

Activate the EXECUTE command and observe the computations which are performed in the Home window and the movements of the text cursor. Observe that the text window remains the active window all the time. However, the user *can* flip windows.

□ [F4]:EXECUTE

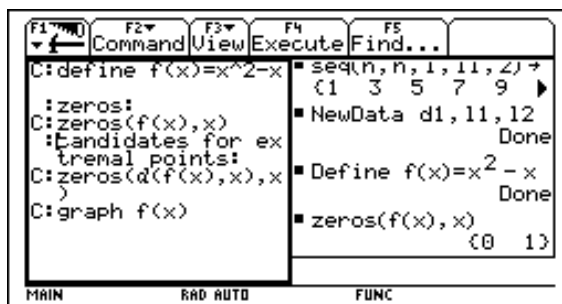


[F4]:EXECUTE

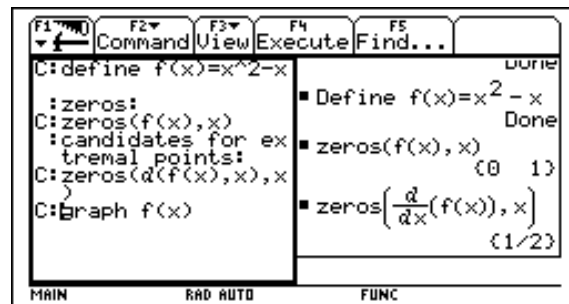


Nothing happens in the Home window when a simple text line is executed.

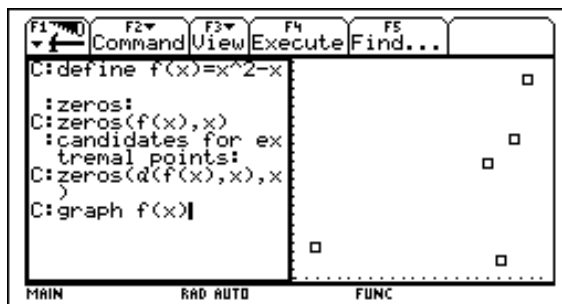
□ [F4]:EXECUTE



[F4]:EXECUTE [F4]:EXECUTE

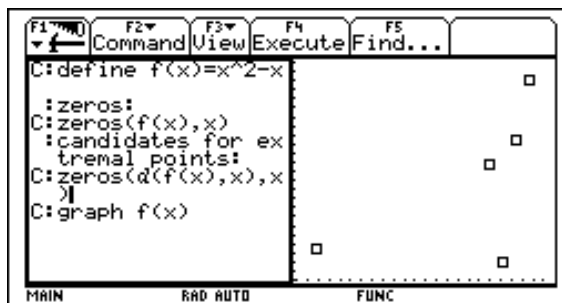


□ [F4]:EXECUTE



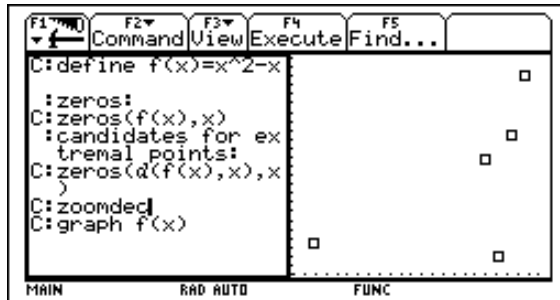
Oops. The graphics window parameters are still set from our previous statistical analysis example. To make such an executable text independent from any earlier activities, it might be wise to insert a ZOOMDEC and a CLRGRAPH command.

□ ↑ ... to move the cursor to the end of the penultimate paragraph

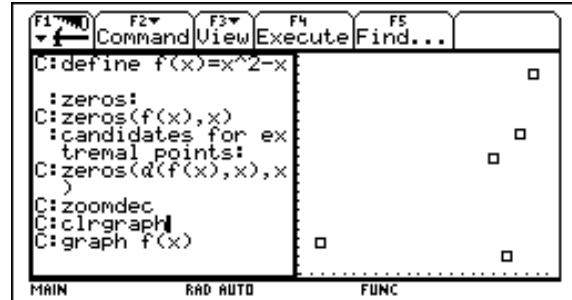


- ENTER
zoomdec

Make this a command line.



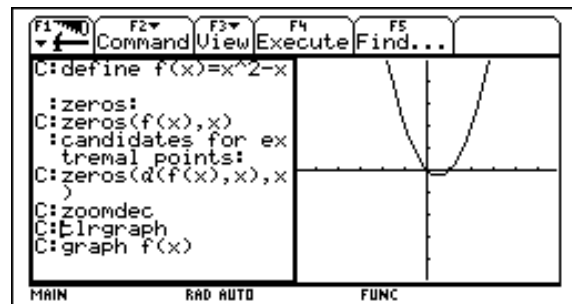
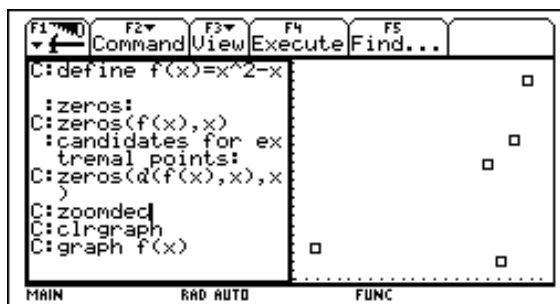
- ENTER
clrgraph
- Make this a command line.



Move the cursor to the ZOOMDEC command and execute it using the EXECUTE command.

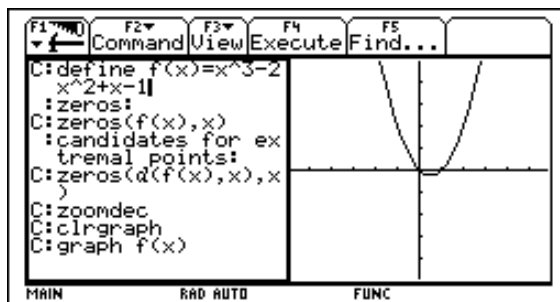
- ↑

- [F4]:EXECUTE



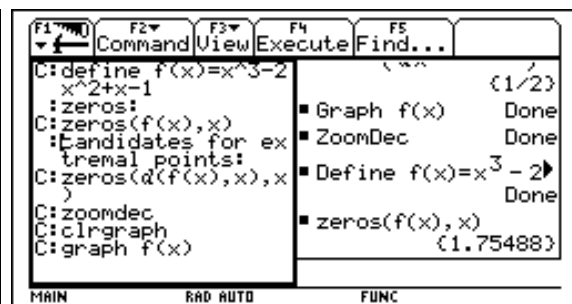
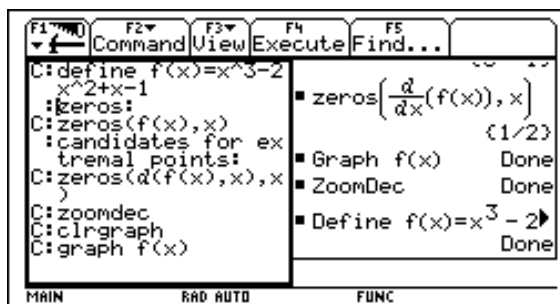
Execute the text file once again, but now with a different function.

- Update the first line to $f(x) = x^3 - 2x^2 + x - 1$.

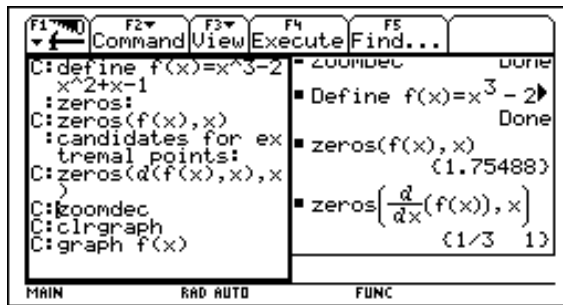


- [F4]:EXECUTE

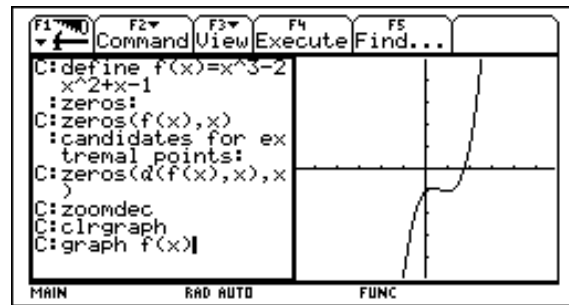
- [F4]:EXECUTE [F4]:EXECUTE



☐ [F4]:EXECUTE [F4]:EXECUTE

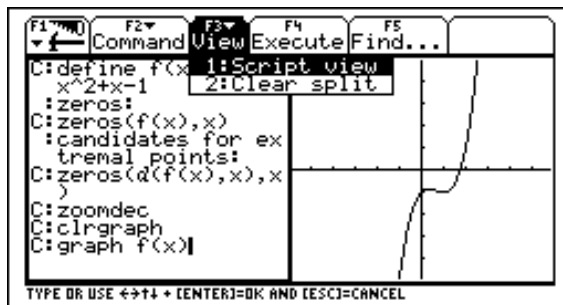


[F4]:EXECUTE [F4]:EXECUTE [F4]:EXECUTE

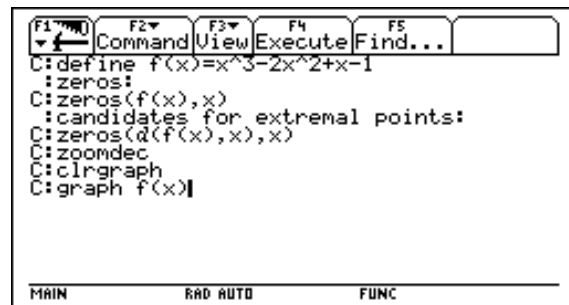


Turn off the SCRIPT VIEW mode:

☐ [F3]:VIEW

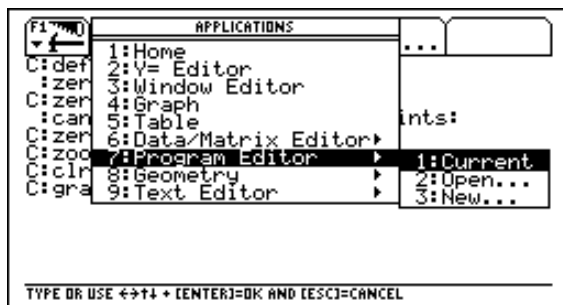


[2]:CLEAR SPLIT

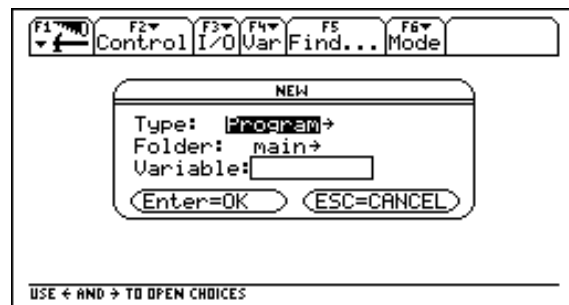


The final application which you are going to learn now is the program editor. Start the editor via the APPLICATIONS menu.

☐ [APPS] [7]:PROGRAM EDITOR



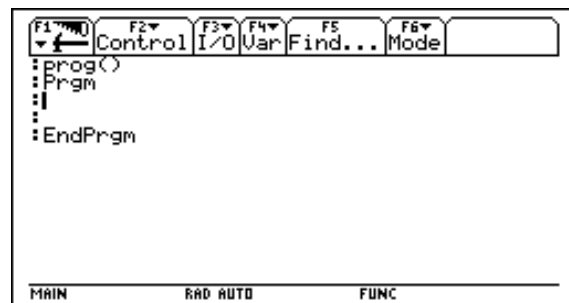
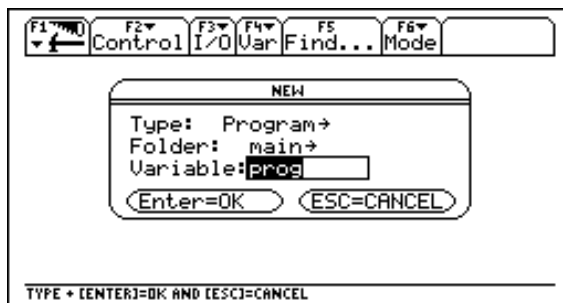
[3]:NEW



Give the program the name PROG.

☐ ↓ ↓ ... to select the VARIABLE input field
prog [ENTER]

[ENTER]



The TI-92 displays the program editor with an "empty program" included. In the sequel you will enter a program that reads an expression and displays the expression and its first five derivatives with respect to x.

The first statement is for reading an input via a dialog box:

- request "enter an expression",ex **ENTER**

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
: request "enter an expression",ex
:
:
:EndPrgm
    
```

Since the REQUEST command reads a *string*, the next statement needs to convert the *string* into an *expression*. This is necessary so that we can perform mathematical operations on *ex*. The EXPR function performs this coercion.

- expr(ex) **STO** ex **ENTER**

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
: request "enter an expression",ex
: expr(ex)→ex
:
:
:EndPrgm
    
```

The next programming construct shall be a FOR loop. You could type it or simply select it from the CONTROL menu:

- F2**:CONTROL
- 4**:FOR...ENDFOR

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
: request "enter an expression",ex
: expr(ex)→ex
:
:
:EndPrgm
    
```

TYPE OR USE ←+ + [ENTER]=OK AND [ESC]=CANCEL

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
: request "enter an expression",ex
: expr(ex)→ex
: For
: EndFor
:
:EndPrgm
    
```

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The advantage of this method is that the "closing" ENDFOR statement is introduced automatically. The cursor was positioned immediately after the FOR command, reminding us that we need to enter the loop variable, the start and end values, and the increment.

- i=0,5,1 **ENTER**

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
: request "enter an expression",ex
: expr(ex)→ex
: For i=0,5,1
:
: EndFor
:
:EndPrgm
    
```

Using indentations is regarded part of a good programming style. Press the space bar to indent the body of the FOR loop.

- ()

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
: request "enter an expression",ex
: expr(ex)→ex
: For i=0,5,1
:   |
: EndFor
:
:EndPrgm
    
```


The cursor indicates the erroneous statement. If you check with the manual, you will find that the FOR loop uses the syntax $i,0,5,1$ rather than $i = 0,5,1$. Update the line accordingly and try again.

- Update the line to: "for i,0,5,1" [HOME]

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
:Request "enter an expression",ex
:expr(ex)→ex
:For i,0,5,1
:Disp i,". derivative:",d(ex,x,i)
:EndFor
:
:EndPrgm
    
```

```

F1 Algebra F2 Calc F3 Other F4 PrgmIO F5 Clear a-z... F6
:zeros(f(x),x) (1.75488)
:zeros(d/dx(f(x)),x) (1/3 1)
:ZoomDec Done
:ClrGraph Done
:Graph f(x) Done
:prog()
:Error: Argument must be a variable name
    
```

- [ENTER] ... to start the program again

$x^8 - 2x^2 + 3$ [ENTER] [ENTER]

```

F1 Algebra F2 Calc F3 Other F4 PrgmIO F5 Clear a-z... F6
: derivative:
:336·x5
:4
: derivative:
:1680·x4
:5
: derivative:
:6720·x3
    
```

The DISP command writes each of its three arguments into a new line. Try to change this. Converting the expressions i and $d(ex,x,i)$ into strings and concatenate all three strings into one single string, thus making a single argument for DISP. Flip to the program screen via the APPLICATIONS menu.

- [APPS] [7]:PROGRAM EDITOR [1]:CURRENT

```

APPLICATIONS
1:Home
2:V= Editor
3:Window Editor
4:Graph
5:Table
6:Data/Matrix Editor
7:Program Editor
8:Geometry
9:Text Editor
1:Current
2:Open...
3:New...
: derivative:
:336·x5
:4
: derivative:
:1680·x4
:5
: derivative:
:6720·x3
    
```


```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
:Request "enter an expression",ex
:expr(ex)→ex
:For i,0,5,1
:Disp i,". derivative:",d(ex,x,i)
:EndFor
:
:EndPrgm
    
```

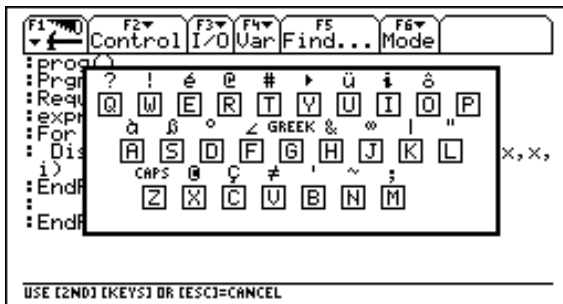
- Update the first argument in the DISP statement from 'I' to 'STRING(I)'

```

F1 Control F2 I/O F3 Var F4 Find... F5 Mode F6
:prog()
:Prgm
:Request "enter an expression",ex
:expr(ex)→ex
:For i,0,5,1
:Disp string(i)," . derivative:",d(ex,x,i)
:EndFor
:
:EndPrgm
    
```

The symbol '&' denotes the concatenation operator for strings. Since you will not find this symbol on the keyboard, use [][K] to display the QWERTY keyboard map with all the [2nd] functions displayed.

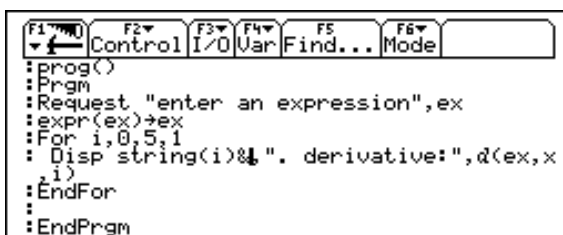
□ [][K]






And indeed: You find it there as the second function of the key [H].

□ [ESC] ... to exit from the keyboard map

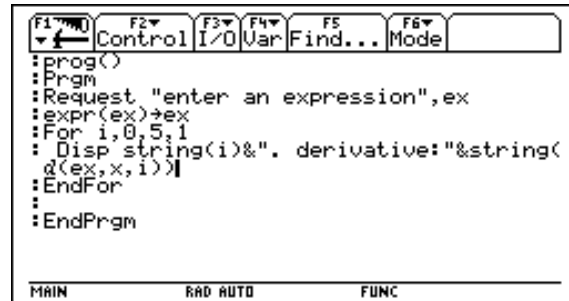
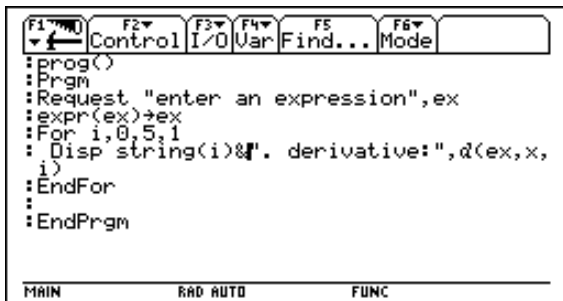
[2nd][H] ... to enter the '&' symbol



Now you need to delete the comma, which is right of the cursor. You could use the right arrow key to move the cursor right of the comma and then apply the backspace key , which is for deleting the character left of the cursor. But there is another method: Use the [DEL] (= [][]) key, which is for deleting the character right of the cursor (left picture). Then continue updating this statement.

□ [DEL]

Update the rest of this statement accordingly.

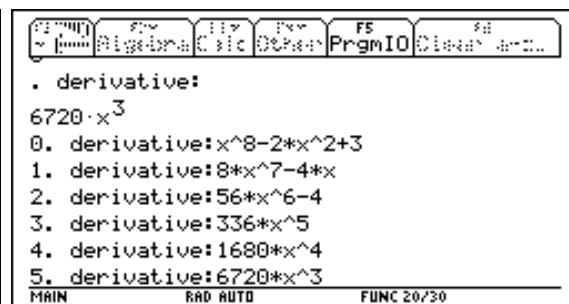
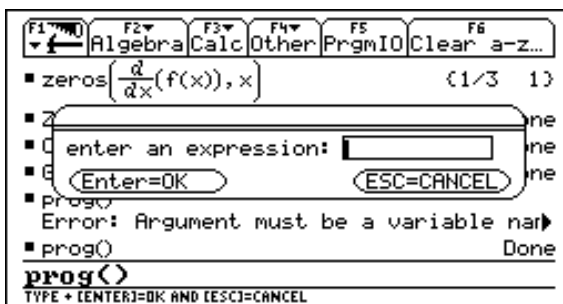


Run the program again.

□ [HOME]

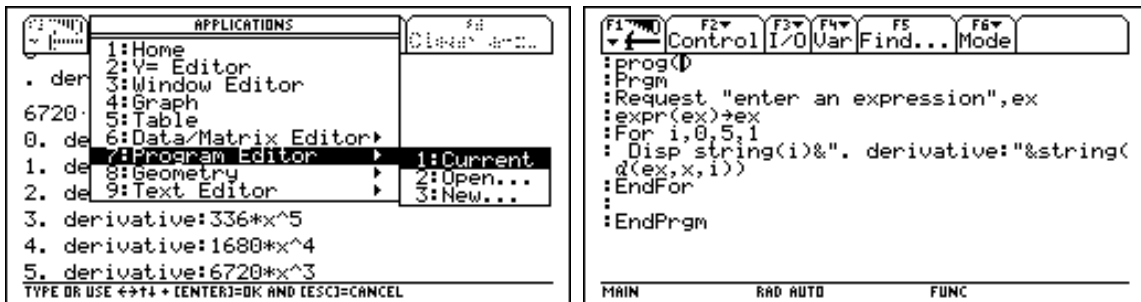
[ENTER] ... to start the program once more

$x^8 - 2x^2 + 3$ [ENTER] [ENTER]

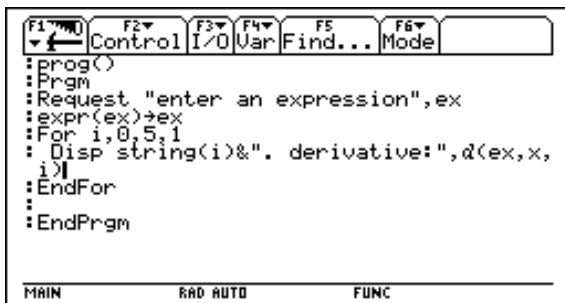


The conversion of an expression into a string destroyed the nice two dimensional output with raised up exponents. We would prefer real expressions here. So the ideal solution should be to undo half of the previous change, i.e. to leave the $d(ex,x,i)$ argument an expression.

- ☐ [APPS] [7]:PROGRAM EDITOR [1]:CURRENT

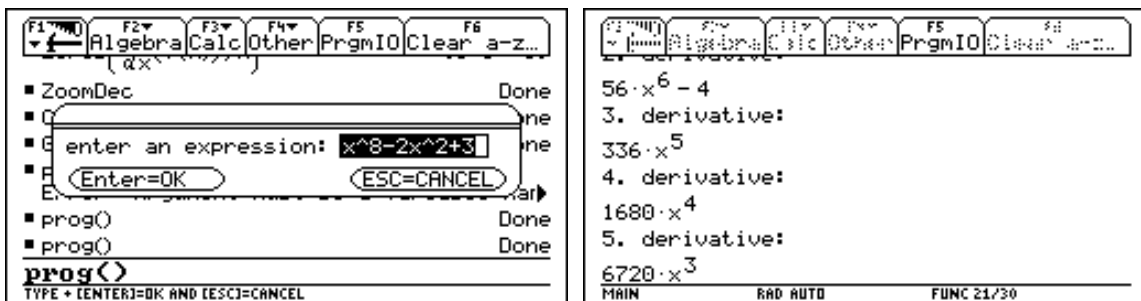


- ☐ Undo the previous change of the third argument of DISP.



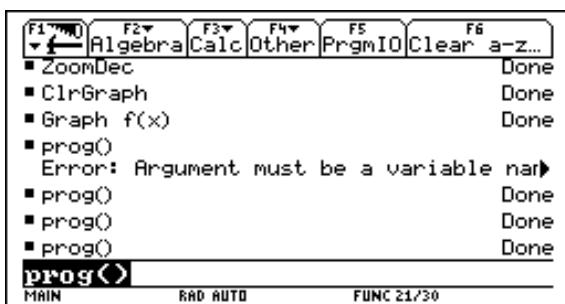
Run the program again.

- ☐ [HOME]
- [ENTER] ... to start the program once more
- $x^8 - 2x^2 + 3$ [ENTER]



The results of the program are written on an own screen, which is called the program i/o screen. Flip between the Home screen and the program i/o screen with the [F5] function key.

- ☐ [F5]:PRGMIO



This concludes the fourth - and last - part of the TI-92 workshop.