

## 4.2 DIFERENTIATION

Press <D> to brings the next menu:

Function Data Help

<F>unction

Using this option the user can differentiate analytic functions. The function should be written using Lotus rules (built-in Lotus functions begin with the "@"character like @SIN(X) or the "+" or "-" sign).

Press <f> to brings the next screen:

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	A	B	C	D	E
1	=====				
2	Units		Output/Input		Memory
3	=====				
4	None		0.00		0.00
5	=====				
	EV				
1	@cos(var)-var				
2					
3					
4					
5					
6					
7					
8	Input or edit the function as a FORMULA and press ENTER ....				
9					
10					
11					
12					
13					
14					

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The program is now in the Lotus EDIT mode, edit or type a function and than press the ENTER key or just press the ENTER key for no changes. When you are finished editing press ENTER to return to the previous menu.

\*\*\*\* WARNING \*\*\*\*

Since the program is in the EDIT mode the Lotus keys are operative, however the user is strongly advised to use ONLY the UP, PGUP, DOWN and PGDN keys to scroll between the lines, the program doesn't allow scrolling to the sides by hiding all the columns except the current column. Trying to unhide the columns MAY destroy the program code. For example: if by mistake you have pressed the "/" key press ESC to get back to the READY mode and then press F2 to enter EDIT mode or just continue to type or press ENTER to exit.

Type the formula [ @cos(var)-var ] and press ENTER to get the next menu:

1st order 2nd order 3rd order Graph Help

The user can have:

- 1st order differentiation which uses the formula  $dy/dx=(Y1-Y0)/h$ , and works with unevenly spaced data too
- 2nd order differentiation which uses the formula  $dy^2/dx^2=(Y2-2*Y1+Y0)/h^2$  and works only with evenly spaced data
- 3rd order differentiation which uses the formula  $dy^3/dx^3=(Y3-3*Y2+3*Y1-Y0)/h^3$  and works only with evenly spaced data

Choosing one of the differentiation order bring the next three prompts

Input the lower limit - 0

Input the upper limit - 14

Input the number of steps - 200

For each prompt type the appropriate number and press ENTER. The results for the 1st order differentiation and these inputs are:

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1st order 2nd order 3rd order Graph Help

Uses the formula  $dy/dx=(Y1-Y0)/h$ , works with unevenly spaced data

	A	B	C	D	E
1	=====				
2	Units		Output/Input		Memory
3	=====				
4	None		0.00		0.00
5	=====				
	EV	EW	EX	EY	EZ
1	1	0	-1.0349857107	-1.0349857107	
2	0.9275510003	0.07	-1.104785772	-1.104785772	
3	0.8502159962	0.14	-1.1740725927	-1.1740725927	
4	0.7680309147	0.21	-1.2425068059	-1.2425068059	
5	0.6810554383	0.28	-1.3097532209	-1.3097532209	
6	0.5893727128	0.35	-1.3754824648	-1.3754824648	
7	0.4930889403	0.42	-1.4393725957	-1.4393725957	
8	0.3923328586	0.49	-1.50111068	-1.50111068	
9	0.287255111	0.56	-1.5603943243	-1.5603943243	
10	0.1780275083	0.63	-1.6169331575	-1.6169331575	
11	0.0648421873	0.7	-1.6704502525	-1.6704502525	
12	-0.0520893304	0.77	-1.7206834824	-1.7206834824	
13	-0.1725371742	0.84	-1.767386805	-1.767386805	
14	-0.2962542505	0.91	-1.8103314675	-1.8103314675	

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Press <G>raph to get the next screen:

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Before After Data\_save Graph\_save Help  
The function before integration

[ESC] - Previous menu

	A	B	C	D	E
1	=====				
2	Units		Output/Input		Memory
3	=====				
4	None		0.00		0.00
5	=====				
	EV	EW	EX	EY	EZ
1	1	0	-1.0349857107	-1.0349857107	
2	0.9275510003	0.07	-1.104785772	-1.104785772	
3	0.8502159962	0.14	-1.1740725927	-1.1740725927	
4	0.7680309147	0.21	-1.2425068059	-1.2425068059	
5	0.6810554383	0.28	-1.3097532209	-1.3097532209	
6	0.5893727128	0.35	-1.3754824648	-1.3754824648	
7	0.4930889403	0.42	-1.4393725957	-1.4393725957	
8	0.3923328586	0.49	-1.50111068	-1.50111068	
9	0.287255111	0.56	-1.5603943243	-1.5603943243	
10	0.1780275083	0.63	-1.6169331575	-1.6169331575	
11	0.0648421873	0.7	-1.6704502525	-1.6704502525	
12	-0.0520893304	0.77	-1.7206834824	-1.7206834824	
13	-0.1725371742	0.84	-1.767386805	-1.767386805	
14	-0.2962542505	0.91	-1.8103314675	-1.8103314675	

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<B>efore - View the original graph

<A>fter - View the graph after integration

<D>ata\_save - Save the data table to a disk as a text (ASCII) file for later use

<G>raph\_save - Creates a .PIC file of the last displayed graph

The column EV includes the function values  $Y = @cos(var)-var$

The column EW includes the independent variable (var)

The column EY includes the differentiated function values.

To see the function before differentiation print the file DIFFBEFO.PIC using Lotus PRINTGRAPH. To see the function after differentiation print the file DIFFAFT.PIC.

<D>ata

Using this option the user can integrate a function given as a data table. The table should be arranged as two columns of numbers as a text (ASCII) file. The 1st column is F(X) and the 2nd column is X.

Press <D> to see the next prompt:

input file name - ISRA7.PRN

The next screen appears:

1st order 2nd order 3rd order Graph Help

---

	A	B	C	D	E
1	=====				
2	Units		Output/Input		Memory
3	=====				
4	None		0.00		0.00
5	=====				
	EV	EW	EX	EY	EZ
1	1200	1195			
2	1201	1195.14			
3	1201	1195.28			
4	1201.5	1195.42			
5	1200	1195.56			
6	1201	1195.7			
7	1201	1195.84			
8	1201.5	1195.98			
9	1199	1196.12			
10	1198	1196.26			
11	1197	1196.4			
12	1197.5	1196.54			
13	1200	1196.68			
14	1201	1196.82			

Press <1> to create the next screen:

1st order 2nd order 3rd order Graph Help  
 Uses the formula  $dy/dx=(Y1-Y0)/h$ , works with unevenly spaced data

	A	B	C	D	E
1	=====				
2	Units		Output/Input		Memory
3	=====				
4	None		0.00		0.00
5	=====				
	EV	EW	EX	EY	EZ
1	1200	1195	7.1428571429	7.1428571429	
2	1201	1195.14	0	0	
3	1201	1195.28	3.5714285714	3.5714285714	
4	1201.5	1195.42	-10.714285714	-10.714285714	
5	1200	1195.56	7.1428571429	7.1428571429	
6	1201	1195.7	0	0	
7	1201	1195.84	3.5714285714	3.5714285714	
8	1201.5	1195.98	-17.857142857	-17.857142857	
9	1199	1196.12	-7.1428571429	-7.1428571429	
10	1198	1196.26	-7.1428571429	-7.1428571429	
11	1197	1196.4	3.5714285714	3.5714285714	
12	1197.5	1196.54	17.857142857	17.857142857	
13	1200	1196.68	7.1428571429	7.1428571429	
14	1201	1196.82	0	0	

Press <G>raph to get the next menu:

Before After Data\_save Graph\_save Help

Where:

- <B>efore - View the original graph
- <A>fter - View the graph after integration
- <D>ata\_save - Save the data table to a disk as a text (ASCII) file for later use
- <G>raph\_save - Creates a .PIC file of the last displayed graph

The column EV includes the function values  $Y = @cos(var) - var$

The column EW includes the independent variable (var)

The column EY includes the integral values.

To see the function before integration print the file DINTBEF.PIC using Lotus PRINTGRAPH. To see the function after integration print the file DINTAFT.PIC.