



51892 Program Description I

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Program Title LITERAL DERIVATION

FUNCTION UP TO 100 STEPS

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Program Description, Equations, Variables Function is stored in registers R₅ to R₉

See the codes below. Coding form is: .XXXXXX'XX'X' in every register

Every code has up to 2 digits. R₀: Step 00 to 09 etc... R₉: Step 90 to 99

Code	function	Code	function
0	End, Space	97	Ln x
1	+	98	e ^x
2	-		
3	x		
4	(		
5	)		
6	CHS (reserved for result)		
7 m (0 ≤ m ≤ 9)	a _m (external)		
8 m (0 ≤ m ≤ 9)	x ^m		
91	sin x		
92	cos x		
93	sh x		
94	ch x		
95	√x		
96	1/x		

The code is the same for the function and her derivative

You can use one level of parenthesis only

The syntax is the same in a (...) than out of (...)

Multiplication up to 6 factors

Composing as long as you want

10 external constants a₀ to a₉

There are 3 dots for the beginning (You can use a data card)

Write the composing like you calculate them

(example: sin(cos x) will be written cos x sin x and coded .9291)

Never put x after a constant a_m (a_mx^p is coded .7m8p)

Never put a constant a_m after a function.

Don't confuse sin(a_m) with (a_m)sin and coded .47m591

with a_mx sin x written a_m sin and coded .7m91

Operating Limits and Warnings x is never implied between 2 functions or 2 groups of parenthesis

Program displays derivative's code digit after digit ^{apart} for few functions derivative (cos, √x, 1/x)

After Step 49 do only begin multiplication with up to 5 factors.

Every display is in DSP2 except ^{value of} numerical constants in DSP9 (example 7.00000000 in the derivative of x⁷)

Put a 0 after any function so you'll know when derivative is finished (when this 0 is displayed and no 8 or 7 before)

This program has been verified only with respect to the numerical example given in Program Description II. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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51892 Program Description II

Sketch(es)

Sample Problem(s) ① Derivative of $\sqrt{x}$

Enter the 2 sides of the card. Enter the data card or press following sequence:

Using the all registers and store: 16 in A; 5962.5 in B and 6726 in C.

Store the function $\sqrt{x}$: .95 STO 0 P=5

Start the Program Press A

Machine displays 9. Press R/S after every display to continue.

Following displays are: 5963. ~~and~~ 0.50000000 and 0. ← derivative is finished

If you continue you'll obtain only 0. ~~and~~ 0.

Then the derivative's value is 95963(.5) that's to say $(\sqrt{x}) \frac{1}{x} \times .5 = \frac{1}{2} \frac{1}{\sqrt{x}}$

② Derivative of $e^{\sin(a_0 x + a_1)}$ and written $(a_0 x^1 + a_1) \sin x e^x = f(x)$

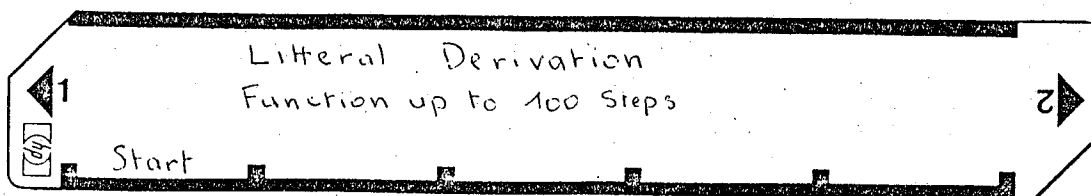
Load data card or clear all and store A, B and C

Store the ending form: .4708117159 STO 0 and .198 STO 1 P=5
Press A to start

Solution(s) Program will display:

4.	5.	1.	4.	1.
7.	3.	7.	7.	5.
0.	4.	1.	0.	9.
5.	7.	5.	8.	1.
0.	0.	9.	1.	9.
1.	8.	2.	1.	8.
0.00000000	1.	3.	7.	0. ← finished

So that $f'(x) = (a_0 x^0 + a_1) \times (a_0 x^1 + a_1) \sin x \times (a_0 x^1 + a_1) \sin x e^x$
 $f'(x) = a_0 \omega(a_0 x + a_1) e^{\sin(a_0 x + a_1)}$



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS										
1	Load the 2 sides of the program card													
2	Load the data card													
	or clear all registers and store	16	STO A											
		5962,5	STO B											
		6726	STO C											
3	Code the function and respect the writing rules													
4	Store the coded function in registers R ₀ to R ₉													
	every part of code has to be like .XXXXXXXXXX	.XXXX...	STO 0											
		.	.											
		.	.											
		.XXXX...	STO 9											
			f R/S											
5	Start the calculus		A											
	Machine will display the digits of the coded derivative, in DSP0 generally													
	When DSP 9, if the display is the value of a constant...													
6	After every display, press R/S to continue.		R/S											
	When machine displays 0, not preceded by 7. or 8., if the derivative's code is finished. If you continue you'll obtain 0.			0.										
	For another function to derivate go to Step 2													
	Warning - Don't press any key after a display and before continuing													
	Before calculate another derivative, verify that the Flag Status is:													
	<table border="1" style="display: inline-table;"> <tr> <td>F</td><td>0</td><td>1</td><td>2</td><td>3</td></tr> <tr> <td>Status</td><td>1</td><td>0</td><td>0</td><td>0 or 1</td></tr> </table>	F	0	1	2	3	Status	1	0	0	0 or 1			
F	0	1	2	3										
Status	1	0	0	0 or 1										
	this condition is verified if you go to Step 2 just after end of Step 6													



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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	LBL A	31 25 11	Start XLoops		R/S	84	
	CF 1	35 61 01			LBL 2	31 25 02	
	RLO	34 00			CF 1	35 71 01	
	STO 1	33 01		060	GTO C	22 13	
	1	01			RLO	34 00	
	STO 8	33 08			RLO 8	34 08	
	LBL B	31 25 12			10 ⁷⁰	32 53	
	RLO	34 00			X	71	
	CF 0	35 71 00			STO + 2	33 61 02	
	1	01			2	02	
010	STO 7	33 07			STO + 8	33 61 08	
	STO 5	33 05			GTO C	22 13	
	7	07			LBL 1	31 25 01	
	GSA JE	32 22 15		070	SF 1	35 51 01	
	X > Y	32 81			RLO 1	34 01	
	GTO JA	22 31 11			STO 0	33 00	
	LBL JD	32 25 14			1	01	
	X = Y	32 51			STO 8	33 08	
	GTO 0	22 00			R/S	84	
	R/S	84			LBL E	31 25 15	
020	3	03			GSA JE	32 22 15	
	X > Y	32 81			R/S	84	
	GTO A	22 11			RLO	34 00	
	X = Y	32 51		080	RCL 2	34 02	
	GTO 2	22 02			INT	31 83	
	F1 0	35 71 00			EEX	43	
	GTO JC	22 31 13			2	02	
	SFO	35 51 00			%	81	
	RCL 3	34 03			FRAC	32 83	
	STO 1	33 01			1	01	
030	RCL 4	34 04			0	00	
	STO 2	33 02			X	71	
	CF 1	35 61 01			X ≠ Y	32 61	
	CF 2	35 71 02		090	GTO E	22 15	
	SF 1	35 51 01			EEX	43	
	RCL 7	34 07			2	02	
	STO 5	33 05			STO ÷ 2	33 81 02	
	GTO 4	22 04			GTO B	22 12	
	LBL D	31 25 14			LBL JE	32 25 15	
	R/S	84			RLO	34 00	
040	5	05			STI	35 33	
	GSA JE	32 22 15			P = S	31 42	
	X ≠ Y	32 61			RCL (i)	34 24	
	GTO D	22 14		100	P = S	31 42	
	R/S	84			X = Y	35 52	
	LBL C	31 25 13			FRAC	32 83	
	6	06			.	83	
	GSA JE	32 22 15			1	01	
	X > Y	32 81			STO + 0	33 61 00	
050	GTO D	22 31 14			%	81	
	4	04			10 ⁷⁰	32 53	
	X = Y	32 51			X	71	
	GTO D	22 14			FRAC	32 83	
	CRC	44		110	1	01	
	3	03			0	00	
	X ≠ Y	32 61			X	71	
	GTO 1	22 01					

REGISTERS

0 reading counter	1 used	2 used	3 used	4 used	5 used	6 used	7 used	8 used	9
S0 ←	S1	S2	S3	S4	S5	S6	S7	S8	S9 →
CODED FUNCTION									
A 110	B 5462.5	C 6726	D	E	I USED				



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Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
	INT	31 83			GTO 8	22 08	
	RTN	35 22		170	LBL 3	31 25 03	
	LBL 8 D	32 25 14			4	04	
	R/S	84			GTO 8	22 08	
	GSA 8 E	32 22 15			LBL 4	31 25 04	
	R/S	84			3	03	
	GTO C	22 12			GTO 8	22 08	
120	LBL 8 B	32 25 12			LBL 5	31 25 05	
	GSA 8 E	32 22 15			RCL 8	34 12	
	R/S	84			GTO 8	22 08	
	RCL 0	34 00			LBL 6	31 25 06	
	RCL 6	34 06		180	RCL	34 12	
	X=Y	32 61			GTO 8	22 08	
	GTO 8 B	22 21 12			LBL 7	31 25 07	
	GSA 8 E	32 22 15			6	06	
	LBL 8 A	32 25 11			LBL 8	31 25 08	
	R/S	84			R/S	84	
130	STI	35 33			FRAC	32 83	
	GSA (i)	31 22 24			DSP 9	23 09	
	LBL 4	31 25 04			X=0	31 61	
	RCL 0	34 00			R/S	84	
	STO 6	33 06		190	DSP 0	23 00	
	7	07			RTN	35 22	
	GSA 8 E	32 22 15			LBL 0	31 25 00	
	X=Y	32 71			GSA 8 E	32 22 15	
	GTO 8 D	22 31 14			GSA 8 E	32 22 15	
	RCL 5	34 05			3	03	
140	STO 0	33 00			X>Y	32 81	
	03	03			GTO 0	22 00	
	R/S	84			CLC	44	
	GTO 8 B	22 31 12			5	05	
	LBL 5	31 25 08		200	X=Y	32 51	
	GSA 8 E	32 22 15			GTO 0	22 00	
	1	01			7	07	
	-	51			R/S	84	
	R/S	84			R↑	35 54	
	X=0	31 51			GTO 5	22 05	
150	RTN	35 22			LBL 0	31 25 00	
	3	03			DSP 9	23 09	
	R/S	84			0	00	
	X≠Y	35 52			LBL 5	31 25 05	
	1	01		210	R/S	84	
	+	61			DSP 0	23 00	
	DSP 9	23 09			.	83	
	R/S	84			1	01	
	DSP 0	23 00			STO-0	33 51 00	
	RTN	35 22			GTO 8	22 12	
160	LBL 9	31 25 09			LBL 8 C	32 25 13	
	GSA 8 E	32 22 15			RCL 1	34 01	
	STI	35 33			STO 3	33 03	
	GTO (i)	22 24			RCL 2	34 02	
	LBL 1	31 25 01		220	STO 4	33 04	
	2	02			STO-2	33 51 02	
	GTO 8	22 08			EFC	35 61 00	
	LBL 2	31 25 02			F14	35 71 01	
	RCL A	34 11			SF 2	35 51 02	

LABELS					FLAGS	SET STATUS		
A Scan & Lamps	B used	C used	D used	E used	0 used	FLAGS	TRIG	DISP
a used	b used	c used	d used 2 times	e erasing of function	1 used	ON OFF	DEG ☒	FIX ☒
0 used 2 times	1 used 2 times	2 used	3 used	4 used 2 times	2 used	0 ☒ 1 ☒	GRAD ☐	SCI ☐
5 used	6 used	7 used	8 used	9 used	3	2 ☐ 3 ☒	RAD ☐	ENG ☐