

CHEBYSHEV, LEGENDRE, HERMITE AND LAGUERRE POLYNOMIALS

Label T computes the value of the Chebyshev polynomial $T_n(x)$ by using the recurrence equation

$$T_{n+1}(x) = 2xT_n(x) - T_{n-1}(x)$$

where starting values are $T_0(x) = 1$, $T_1(x) = x$ and n is a positive integer.

Label P computes the value of the Legendre polynomial $P_n(x)$ by using the recurrence equation

$$P_{n+1}(x) = \frac{(2n+1)xP_n(x) - nP_{n-1}(x)}{n+1}$$

where starting values are $P_0(x)=1$, $P_1(x)=x$ and n is a positive integer.

Label H computes the value of the Hermite polynomial $H_n(x)$ by using the recurrence equation

$$H_{n+1}(x) = 2xH_n(x) - 2nH_{n-1}(x)$$

where the starting values are $H_0(x) = 1$, $H_1(x) = 2x$ and n is a positive integer.

Label L computes the value of the Laguerre polynomial $L_n(x)$ by using the recurrence equation

$$L_{n+1}(x) = \frac{(2n+1-x)L_n(x) - nL_{n-1}(x)}{n+1}$$

Note that all four functions leave $f(x)$ in the x register if you wish to see more accuracy (see ex. 4).

Examples:

1. Find $T_3(0.4)$
2. Find $P_{10}(0.98)$
3. Find $H_5(3)$
4. Find $L_6(3)$

Keystrokes:

Display:

[XEQ] [ALPHA] SIZE [ALPHA] 007

[XEQ] [ALPHA] T [ALPHA]

N?

3 [R/S]

X?

.4 [R/S]

T3(0.40)=-0.94

[XEQ] [ALPHA] P [ALPHA]

N?

10 [R/S]

X?

0.98 [R/S]

P10(0.98)=0.16

[XEQ] [ALPHA] H [ALPHA]

N?

5 [R/S]

X?

3 [R/S]

H5(3.00)=3,816.00

[XEQ] [ALPHA] L [ALPHA]

N?

6 [R/S]

X?

3 [R/S]

L6(3.00)=-0.01

■ [FIX] 4

-0.0125

Program Listings

01*LBL "T"	Chebyshev polynomial	52 STO 03	Loop for recur- rence equation
02 XEQ A		53 X<>Y	
03 STO 00		54 X<=Y?	
04 2		55 GTO 04	
05 STO 01		56 2	
06 *		57 STO 02	
07 STO 02		58*LBL 03	
08 CLX		59 RCL 04	
09 X<>Y		60 RCL 01	
10 X<=Y?		61 *	
11 GTO 00		62 ENTER↑	
12 1		63 ENTER↑	
13 STO 03		64 RCL 03	
14 X=Y?		65 -	
15 GTO 01		66 +	
16*LBL 02	Loop for recur- rence equation	67 LASTX	Test
17 CLX		68 RCL 04	
18 RCL 02		69 STO 03	
19 RCL 00		70 CLX	
20 *		71 RCL 02	
21 RCL 03		72 /	
22 LASTX		73 -	
23 STO 03		74 STO 04	
24 RDN		75 RCL 00	
25 -		76 RCL 02	
26 STO 00		77 1	
27 CLX		78 +	
28 RCL 01		79 STO 02	
29 1		80 X<=Y?	
30 +		81 GTO 03	
31 STO 01		82 RCL 04	
32 X<=Y?	Test, $r_1 \leq n_1$ so back to loop	83 "P"	Hermite polynomial
33 GTO 02		84 GTO d	
34*LBL 01		85*LBL 04	
35 RCL 00		86 RCL 01	
36 "T"		87 RTN	
37 GTO d		88*LBL H	
38*LBL 00		89 XEQ A	
39 1		90 STO 01	
40 "T"		91 2	
41 GTO d		92 *	
42*LBL "P"		93 STO 03	
43 XEQ A		94 CLX	
44 STO 01		95 X<>Y	
45 STO 04		96 X<=Y?	
46 CLX		97 GTO 00	
47 X<>Y	Legendre polynomial	98 1	
48 STO 00		99 STO 00	
49 X<=Y?		100 STO 02	
50 GTO 00		101 X<>Y	
51 1		102 X<=Y?	

Program Listings

103 GTO 05	-----	154 RCL 03	
104*LBL 06		155 -	
105 RCL 00	Test for recurrence equation	156 RCL 04	
106 RCL 03		157 +	
107 STO 00		158 RCL 01	
108 RCL 01		159 RCL 04	
109 *		160 *	
110 X<>Y		161 RCL 03	
111 RCL 02		162 -	
112 *		163 RCL 02	
113 -		164 /	
114 2		165 RCL 04	
115 *		166 STO 03	
116 STO 03		167 RDN	
117 CLX		168 -	
118 RCL 02		169 STO 04	
119 1		170 RCL 00	
120 +		171 RCL 02	
121 STO 02		172 1	
122 X<>Y		173 +	
123 X=Y?	Test	174 STO 02	
124 GTO 06		175 X<=Y?	Test
125 RCL 03		176 GTO 08	
126 "H"		177*LBL 07	
127 GTO d		178 RCL 04	
128*LBL 05		179 "L"	
129 RCL 03		180 GTO d	
130 RTN		181 STOP	
131*LBL "L"	Laguerre polynomial	182*LBL A	Input n and x
132 XEQ A		183 "H?"	
133 ENTER↑		184 PROMPT	
134 1		185 STO 05	
135 STO 03		186 "X?"	
136 +		187 PROMPT	
137 STO 01		188 STO 06	
138 2		189 RTN	
139 STO 02		190*LBL d	Display
140 X<>Y		191 CF 29	
141 -		192 FIX 0	
142 STO 04		193 ARCL 05	
143 CLX		194 "F<"	
144 X<>Y		195 SF 29	
145 X<=Y?		196 FIX 2	
146 GTO 00		197 ARCL 06	
147 STO 00		198 "F>="	
148 1		199 ARCL X	
149 X<>Y		200 RVIEW	
150 X<=Y?		201 STOP	
151 GTO 07		202 .END.	
152*LBL 08	Loop for recurrence equation		
153 RCL 04			

CHEBYSHEV LEGENDRE HERMITE
AND LAGUERRE POLYNOMIALS
PROGRAM REGISTERS NEEDED: 39

PAGE 1
OF 2

ROW 1 (1 - 7)



ROW 2 (8 - 18)



ROW 3 (19 - 31)



ROW 4 (32 - 40)



ROW 5 (40 - 44)



ROW 6 (45 - 55)



ROW 7 (56 - 68)



ROW 8 (69 - 81)



ROW 9 (81 - 89)



ROW 10 (89 - 99)



ROW 11 (100 - 111)



ROW 12 (112 - 124)



ROW 13 (124 - 131)



ROW 14 (131 - 140)



ROW 15 (141 - 151)



ROW 16 (152 - 164)



ROW 17 (165 - 176)



ROW 18 (177 - 183)



ROW 19 (184 - 192)



ROW 20 (192 - 198)



ROW 21 (198 - 202)

