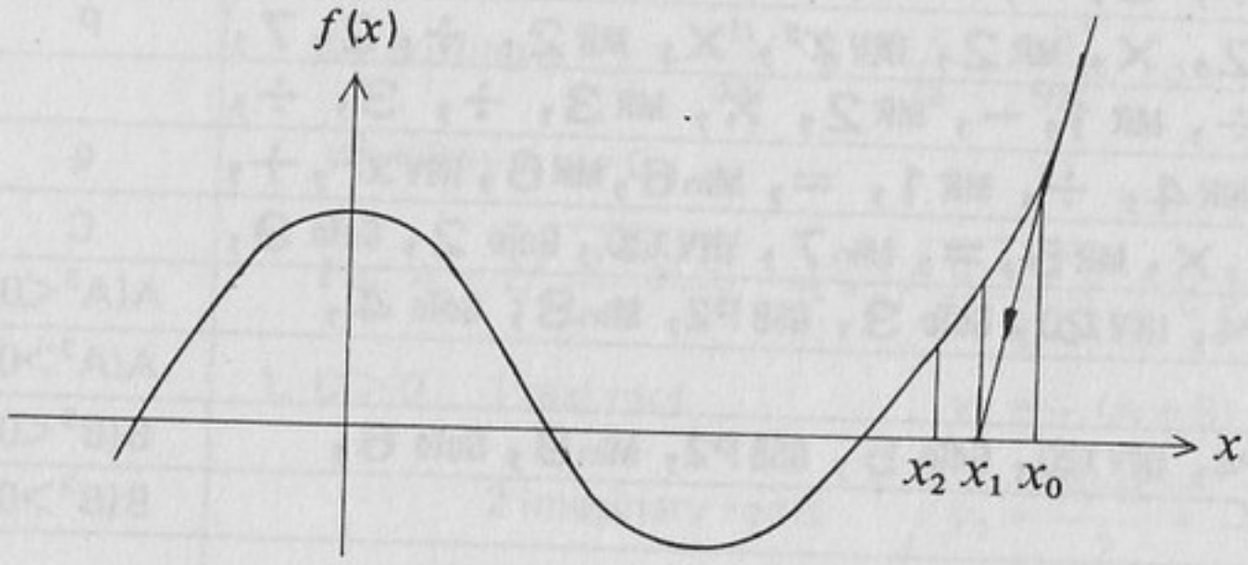
CASIO PROGRAM SHEET

Program for	No.	
Solving a cubic equation by the Newton method	Mathematics–8	

Description

• Input the program written in the next page.



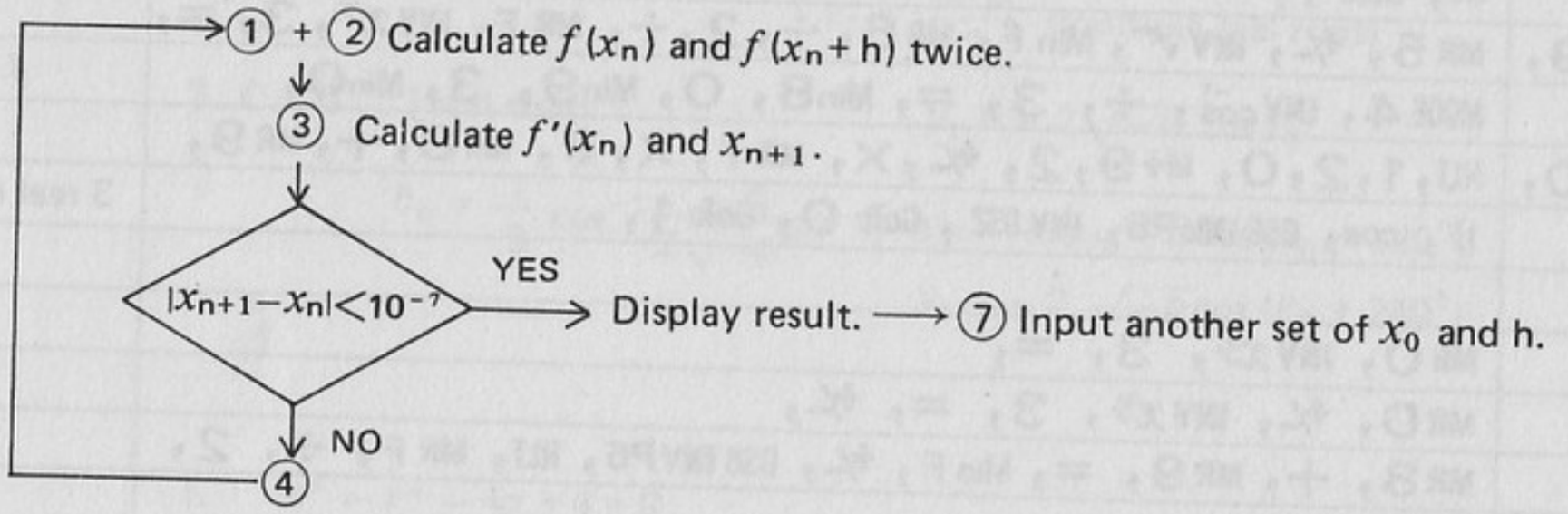
$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$f'(x) = \frac{f(x+h) - f(n)}{h}$$

x_n will be taken as an approximate solution if $|x_{n+1} - x_n| < \epsilon_0$.

$$f(x) = ax^3 + bx^2 + cx + d$$

< Flowchart >



Example

$f(x) = x^3 + x^2 - x - 1$

$x_0 = 0$, $\epsilon_0 = 1 \times 10^{-7}$, h = 0.01

Step	Data input operation	Read-out	Remark
	MODE 1		
1	PO	0.	
2	(a) 1 EXE	1.	
3	(b) 1 EXE	1.	
4	(c) 1 +/− EXE	−1.	
5	(d) 1 +/− EXE	−1.	
6	(ϵ_0) 1 EXE 7 +/− EXE	1×10⁻⁷	
7	(x_0) 2 EXE	2.	
8	(h) 0.01 EXE	1.000000019	(x)
9			
10			

Step	Data input operation	Read-out	Remark
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Program for Solving a cubic equation by the Newton method

Transfer		Program		Remark	No. of steps
	/	MODE, 2, (Not included in No. of steps)			
	1	P0	HLT, Min 1, HLT, Min 2, HLT, Min 3, HLT, Min 4, HLT, Min F,		
	2	LBL 1,	HLT, Min 5, HLT, Min 6,		
	3				
	4	LBL 2,	MR 5, Min 7, 2, Min 0,		
	5	LBL 3,	MR 1, ×, MR 5, INV x^2, ×, MR 5, +, MR 2, ×, MR 5, INV x^2,		
	6		+, MR 3, ×, MR 5, +, MR 4, =, Min 9,		
	7		MR 6, M+ 5,		
②	8		INV DSZ, GoTo 4,		
①	9		GoTo 5,		
⑦	10	LBL 4,	MR 9, Min 8, GoTo 3,		
③	11	LBL 5,	(, MR 9, −, MR 8,), ÷, MR 6, =, Min 9,	$f'(x_n)$	
⑤	12		MR 7, −, MR 8, ÷, MR 9, =, Min 8, −, MR 7, =, INV ABS,	$\lvert x_{n+1}-x_n\rvert<\epsilon_0$	
	13		INV $x\geqq$F, GoTo 6,		
④	14		GoTo 7,		
⑥	15	LBL 6,	MR 8, Min 5, GoTo 2,		
	16	LBL 7,	MR 7, GoTo 1,		
	17				
	18			Total	81
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				

Note

If "−" remains displayed perpetually the approximation does not converge because start point x_0 is wrong. Depress AC, change the value of x_0 and repeat operation from step 1.

Contents in memories

0	DSZ	·0	
1	a	·1	
2	b	·2	
3	c	·3	
4	d	·4	
5	$x_0 \longrightarrow x_n+h$	·5	
6	h	·6	
7	$x_0 \longrightarrow x_n$	·7	
8	$f(x_n) \longrightarrow x_{n+1}$	·8	
9	$f(x_n+h) \longrightarrow f'(x_n)$	·9	
F	ϵ_0	·F	