TITLE:	Zero of a Solution of a Differential Equation
	(Using Library Routine F1) (SADOI or DOI)
TYPE:	Closed, with one program parameter (see below)
NUMBER OF WORDS:	16
TEMPORARY STORAGE:	0, 1, 2, 3
PRESET PARAMETERS:	S3-S5
3 00F 00mF	Program parameter for routine F1 (SEE F1)
4 00F 00gF	Steps proportional to $N(g)$.
5 00F 00hF	Routine F1 begins at h.
PROGRAM PARAMETER:	Entry

p	50 eF	$N(e)$ is to become zero.
	50 pF	
p+1	26 xF	This routine begins at x.

DESCRIPTION: This routine enters Code F1 repeatedly, adjusting the size
of the steps, until one of the variables y_1 vanishes.
The variable which is to become zero is selected by the
program parameter.

The auxiliary routine used by Library Routine F1 must be
so designed that the scaled derivatives $2^m hy_1'$ are all
proportional to a scale factor stored in g. This scale
factor is altered during the convergence to the zero, and
must be restored if further steps are to be carried out.
$|N(g)|$ is never increased by this routine, so that if the
steps are initially sufficiently small for accurate
integration they will remain so. This means that several
steps may be necessary to reach the neighborhood of the
zero; when this has occurred, about six steps are usually
sufficient for convergence. $N(e)$ is normally reduced to
0 or to $\pm 2^{-39}$; if hy' > $N(g)$ the error may be as large

as 2^{-39} hy'/N(g) but this would be abnormal.
Integration proceeds in the direction in which $|N(e)|$
decreases. If a non-zero minimum of $|N(e)|$ is encountered
control may be incorrectly returned to the main program,
or the machine may get into a loop. This routine should
therefore only be entered when the integration is near
the required zero. The scaled derivative of the variable
which is to vanish must be non-zero when this routine is
entered.

DATE October 5, 1953 RT: 2/25/60	
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APPROVED BY J. P. Nash	

ns

LOCATION	ORDER		NOTES
	OOK(HF1)		
0	K5 F		
	46 6L		
1	42 5L		Set link etc.
	L4 39S5		
2	46 3L		
	26 3L		Waste
3	L5 F	By 2	
	40 F	From 14'	$2^m hy'$ to 0
4	L3 F		
	10 S3		Form $2^{-39} - |hy'|$
5	L4 15L		
	32 F	By 1	Link: Test for convergence
6	50 F	By 0'	
	L0 15L		Test if $|y| \geq |hy'|$
7	S6 F		
	32 10L		
8	S5 F		
	00 S3		Near zero: Use Newton-Raphyson
9	66 F		
	79 S4		
10	26 12L		
	71 F	From 7'	Test whether to reverse
11	36 13L		
	L1 S4		Reverse step
12	40 S4	From 10	
	26 13L		Waste
13	00 S3	From 11	
	50 13L		Enter Program F1
14	26 S5		
	26 3L		
15	00 F		
	00 1F		