00366 PROGRAM SUBMITTAL

☒ New Program ☐ Revision to Program

Model No. ☐ 67 ☐ 97 ☒ 41C

Program Title: DIOPHANTINE EQUATIONS
AX + BY = C

No. of Steps/Lines: 81 Category No.: 201

Category Name: NUMBER THEORY

Abstract — 50 Word Maximum: This program finds the integer solutions to the equation Ax + By = C. The parametric forms of the solutions, X = M + Ut and Y = N + Vt are displayed directly, and the coefficients, M,U,N, and V can be used in further studies.

Necessary Accessories: None required.

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If my program is accepted, my bonus choice is:

☐ FOUR PROGRAMS OR ☒ CREDIT FOR FOUR PROGRAMS*

* No partial credit will be given. Select all four programs at the same time.

3/24B

Submittal Checklist: Please use the checklist below to insure submittal of all proper program documentation.

☒ Program Submittal ☒ Program Description II ☒ Program Listing(s) ☒ Registers, Status ...

☒ Program Description I ☒ User Instructions ☒ Magnetic Card(s) ☒ Keyboard, Card Labeling (optional)

ACKNOWLEDGMENT AND AGREEMENT

T st of my knowledge, I have the right to contribute this program material without breaching any obligation concerning nondisclosure of proprietary or confidential information of other persons or c. ions. I am contributing this program material on a nonconfidential nonobligatory basis to Hewlett-Packard Company ("HP") for inclusion in its program library, and I agree that HP may use, duplicate, modify, publish, and sell the program material, and authorize others to do so without obligation or liability of any kind. HP may publish my name and address, as the contributor, to facilitate user inquiries pertaining to this program material.

Signature: Gary Goodman Date: 3/18/80

PROGRAM DESCRIPTION I

Program Title DIOPHANTINE EQUATIONS Ax + By = C

Contributor's Name Gary Goodman

Address OSU IRCC, 406 Baker Systems Engr. Bldg., 1971 Neil Avenue

City Columbus **State/Country** Ohio/U.S.A **Zip Code** 43210

Program Description, Equations, Variables This program finds the integer solutions to the equation $Ax + By = C$. The parametric forms of the solutions, $x = X_o + Ut$ and $y = Y_o + Vt$ where t is any integer, are displayed directly. X_o is the lowest positive value of x which will solve the given equation, and Y_o is the corresponding value of y.

Inputs: A, B, and C can be entered in any order or changed as desired.

Outputs: The parametric forms of the solutions: $x = X_o + Ut$ and $y = Y_o + Vt$. The solution coefficients, X_o, U, Y_o, and V are available for further studies.

Necessary Accessories None

Operating Limits and Warnings Solutions exist only when C is divisible by the greatest common divisor of A and B. Otherwise the program displays NO SOLUTION. If A or B equals zero, the program displays DATA ERROR.

Reference(s)

PROGRAM DESCRIPTION II

Sample Problem (Sketch if Desired)

1. Solve the equation $34x + 76y = 10$ for integer values of x and y.

   Thus A = 34
   B = 76
   C = 10

2. Retrieve the coefficients in the solutions; $x = X_o + Ut$, $y = Y_o + Vt$ for the equation in problem 1.

SOLUTION:

	Input	Function	Display	Comments
1.		[XEQ] SIZE 005		Minimum SIZE
		[USER]		Set USER mode
	34	[A]	34.00	Enter A
	76	[B]	76.00	Enter B
	10	[C]	10.00	Enter C
		[E]	x = 7. + 38.T	Solution for x; T = 0, ±1, ±2,...
		[R/S]	y = -3. - 17.T	Solution for y; T = 0, ±1, ±2,...
		[R/S] , etc.	x = ...	Display alternates x and y solutions.
2.	Solve the equation as described for sample problem 1.			
			x = 7. + 38.T	Display the solution for x.
		[←] or [XEQ] CLD	7.00	X_o
		R↓	38.00	U
		R↓	-3.00	Y_o
		R↓	-17.00	V

USER INSTRUCTIONS

				SIZE: (HP-41C) 005
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1.	Enter the program, and set USER mode.			
2.	Store inputs in any order or change			
	any existing values			
	. coefficient of x	A	[A]	A
	. coefficient of y	B	[B]	B
	. constant term	C	[C]	C
3.	Solve equation:			
	. display solution for x.		[E]	x = (M) + (U)T
	(optional) display solution for y.		[R/S]	y = (N) + (V)T
	Note: To alternately display x and y			
	solutions:		[R/S] , etc.	

PROGRAM LISTING

☐ 67 ☐ 97 ☒ 41C

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
01	LBL "DIOPHN"		
	LBL A		
	STO 01		store A
	RTN		
	LBL B		
	STO 02		store B
	RTN		
	LBL C		
	STO 03		store C
10	RTN		
	LBL E		solve Ax+By=C
	"NO SOLUTION"		
	1		
	STO 04		initialization
	CLX		
	STO 00		
	RCL 02		
	STO ÷ Y		force error if B=0
	RCL 01		
20	LBL 00		begin loop for solution
	RCL Y		and find greatest common
	X≷Y		divisor (g.c.d.)
	MOD		
	STO Z		
	LAST X		
	R↓		
	−		
	RCL Z		
	÷		
30	CHS		
	RCL 00		
	X<> 04		
	STO 00		
	X		
	STO+04		
	R↓		
	X≠0?		
	GTO 00		continue in loop
	RCL 03		
40	RCL Z		g.c.d.
	÷		
	STO X 00		
	ERC		If C is not divisible
	X≠0?		by g.c.d., there is
	PROMPT		NO SOLUTION
	RCL 00		
	RCL 04		
	ABS		U
	STO 04		
50	STO T		store U

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
51	MOD		lowest positive x
	STO Y		store X
	RCL 01		
	STO X 04		
	X		$Y=\frac{C-Ax}{B}-\frac{Au}{B}t$
	RCL 03		
	−		
	RCL 02		$R_t \leftarrow U$
	CHS		$R_z \leftarrow x_o$
60	STO ÷ 04		$R_y \leftarrow V$
	÷		$R_x \leftarrow Y_o$
	RCL 04		
	X≷Y		All results calculated
	CF 12		
	LBL 01		Display Routine
	FIX 0		
	"X="		
	FS? 12		
	"Y="		
70	ARCL Z		
	R↑		
	X>0?		
	"+"		
	ARCL X		
	"T"		
	R↑		
	FIX 2		
	PROMPT		display solution
	FC?C 12		alternate X and Y
80	ST 12		solutions
	GTO 01		
90			
00			

Note: Refer to "HP-41C OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for specific information on keystrokes. The Function Index is found at the very back of the Handbook. Refer to Appendix E in 67 or 97 "OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for exact keystrokes.

REGISTERS, STATUS, FLAGS, ASSIGNMENTS

DATA REGISTERS

00	Used		
1	A		
2	B		
3	C		
4	Used		

STATUS

SIZE 005 TOT. REG. 24 USER MODE

ENG ____ FIX ____ SCI ____ ON X OFF ____

DEG ____ RAD ____ GRAD ____

FLAGS

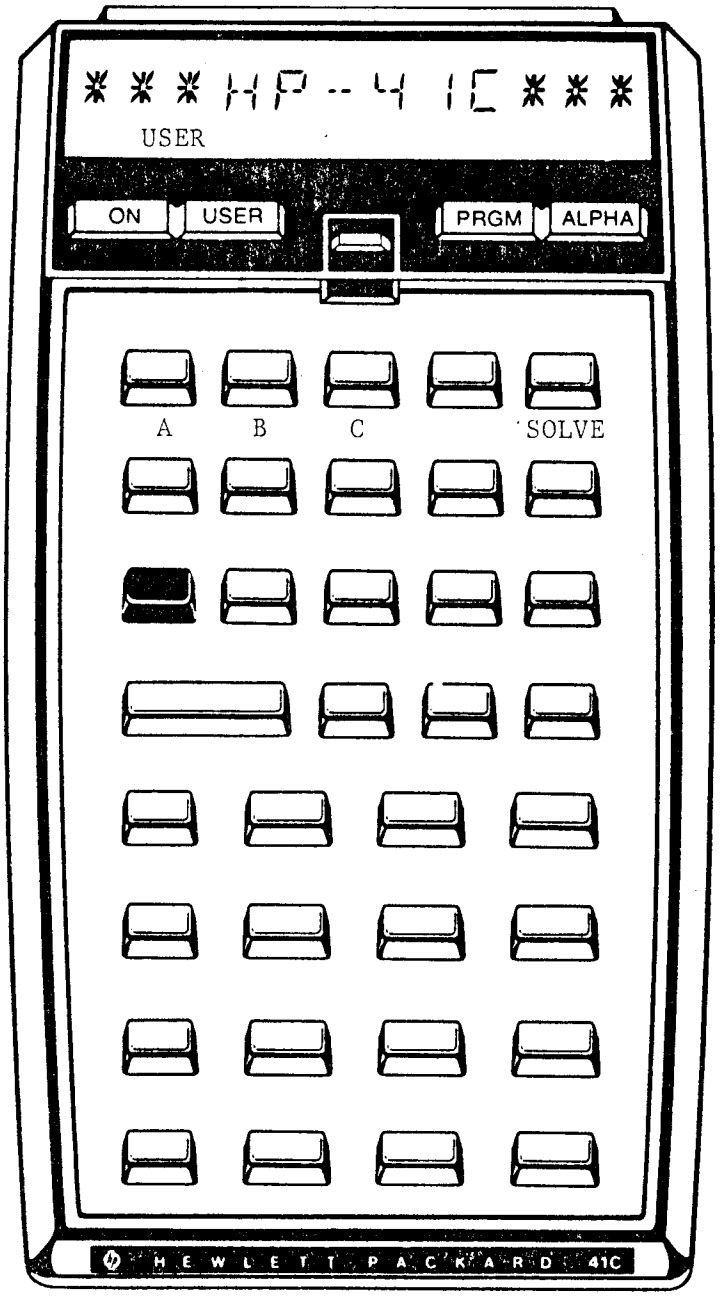
#	INIT S/C	SET INDICATES	CLEAR INDICATES
12		display y solution	display x solution

ASSIGNMENTS

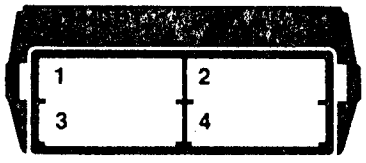
FUNCTION	KEY	FUNCTION	KEY

KEYBOARD CARD LABELING

KEYBOARD



SYSTEM CONFIGURATION



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