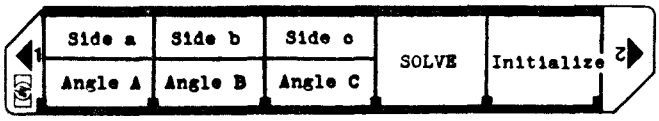
67/97/41C TRIANGLES

The response to the Triangle Solution program in V6N8P11 has been well received. Lynn R. Moto (3013) brought to my attention a case discovered by a friend in which the program gave two solutions to a triangle which really had a unique answer. One solution the program returned was correct but the second was a spurious one. This bug resulted from skipping over steps in the angle search subroutine and has been corrected by simply re-arranging the order of steps in the formula selection for the angle.



HP-97 TRIANGLE SOLUTION PROGRAM By John Kennedy (918)

001	*LBL A		21 11	069	x	-35	137	-	-45
002	6		06	070	STO I	35 01	138	RCL 5	36 05
003	GTO B		22 00	071	x	-35	139	RCL 3	36 03
004	*LBL B		21 12	072	x	-35	140	x	-35
005	4		04	073	RCL 7	36 07	141	ENT↑	-21
006	GTO B		22 00	074	x	-35	142	+	-55
007	*LBL C		21 13	075	RTN	24	143	÷	-24
008	2		02	076	*LBL 4	21 04	144	COS⁻¹	16 42
009	GTO B		22 00	077	RCL 7	36 07	145	GTO 4	22 04
010	*LBL a	21 16 11		078	X≠0?	16-42	146	*LBL 0	21 00
011	7		07	079	GTO 6	22 06	147	+	-55
012	GTO B		22 00	080	RCL 6	36 06	148	RCL 3	36 03
013	*LBL b	21 16 12		081	X=0?	16-43	149	X=0?	16-43
014	5		05	082	GTO 6	22 06	150	GTO 6	22 06
015	GTO B		22 00	083	RCL 5	36 05	151	RCL 2	36 02
016	*LBL c	21 16 13		084	X=0?	16-43	152	GTO 0	22 00
017	3		03	085	GTO 0	22 00	153	*LBL 1	21 01
018	*LBL 0		21 00	086	RCL 4	36 04	154	+	-55
019	STO I		35 46	087	X≠0?	16-42	155	RCL 4	36 04
020	R↓		-31	088	GTO 1	22 01	156	*LBL 0	21 00
021	STO I		35 45	089	RCL 6	36 06	157	X=0?	16-43
022	F?S		16-51	090	RCL 3	36 03	158	GTO 6	22 06
023	STO I		35 45	091	X=0?	16-43	159	SIN	41
024	RTN		24	092	GTO 6	22 06	160	R↓	-31
025	*LBL D		21 14	093	+R	44	161	X≷Y	-41
026	GSB 3		23 03	094	RCL 5	36 05	162	X()Y?	16-34
027	GSB 3		23 03	095	-	-45	163	CF 0	16 22 00
028	+		-24	096	+P	34	164	X≷Y	-41
029	*LBL d	21 16 14		097	STO 7	35 07	165	R↑	16-31
030	SPC		16-11	098	GTO 6	22 06	166	X≷Y	-41
031	7		07	099	*LBL 0	21 00	167	÷	-24
032	STO I		35 46	100	RCL 3	36 03	168	x	-35
033	*LBL e	21 16 15		101	X=0?	16-43	169	SIN⁻¹	16 41
034	RCL I		36 45	102	GTO 6	22 06	170	F1?	16 23 01
035	PRTX		-14	103	RCL 2	36 02	171	GTO 3	22 03
036	DSZI	16 25 46		104	X=0?	16-43	172	GTO 4	22 04
037	GTO e	22 16 15		105	GTO 6	22 06	173	*LBL 2	21 02
038	F0?	16 23 00		106	*LBL 1	21 01	174	RCL 4	36 04
039	RTN		24	107	RCL 6	36 06	175	RCL 2	36 02
040	SPC		16-11	108	SIN	41	176	+	-55
041	2		02	109	X≷Y	-41	177	*LBL 3	21 03
042	PRTX		-14	110	SIN	41	178	COS	42
043	F?S		16-51	111	+	-24	179	CHS	-22
044	SF 1	16 21 01		112	x	-35	180	COS⁻¹	16 42
045	GSB 3		23 03	113	STO 7	35 07	181	*LBL 4	21 04
046	GSB 3		23 03	114	GTO 6	22 06	182	STO 6	35 06
047	SF 0	16 21 00		115	*LBL 5	21 05	183	*LBL 6	21 06
048	GTO d	22 16 14		116	RCL 6	36 06	184	RCL 5	36 05
049	*LBL E		21 15	117	X≠0?	16-42	185	RCL 6	36 06
050	CLRG		16-53	118	GTO 6	22 06	186	RCL 3	36 03
051	F?S		16-51	119	RCL 4	36 04	187	RCL 7	36 07
052	CLRG		16-53	120	RCL 2	36 02	188	STO 5	35 05
053	SF 0	16 21 00		121	x	-35	189	R↓	-31
054	CF 1	16 22 01		122	X≠0?	16-42	190	STO 7	35 07
055	0		00	123	GTO 2	22 02	191	R↓	-31
056	RTN		24	124	RCL 7	36 07	192	RCL 2	36 02
057	*LBL 3		21 03	125	X=0?	16-43	193	STO 6	35 06
058	GSB 5		23 05	126	GTO 6	22 06	194	R↓	-31
059	GSB 5		23 05	127	RCL 5	36 05	195	RCL 4	36 04
060	GSB 5		23 05	128	X=0?	16-43	196	STO 2	35 02
061	GSB 4		23 04	129	GTO 0	22 00	197	R↓	-31
062	GSB 4		23 04	130	RCL 3	36 03	198	STO 4	35 04
063	GSB 4		23 04	131	X=0?	16-43	199	R↓	-31
064	x		-35	132	GTO I	22 01	200	STO 3	35 03
065	2		02	133	+P	34	201	RTN	24
066	+		-24	134	X²	53	202	R/S	51
067	RCL 6		36 06	135	RCL 7	36 07			
068	SIN		41	136	X²	53			

While correcting this bug I decided to change the order of parts output and to make the program more compatible with the HP-97 printer. At the same time I re-arranged some labels and changed the contents of the data registers. The program technique as described in the article accompanying the program in V6N8 is still valid. Only the names of some labels, step numbers, and registers have been changed to protect the innocent! For completeness I'm including a 41C version as well as program instructions.

To solve all the parts of a triangle:

1) Press E to initialize the program before entering data. This clears all the registers.

2) Key in the known parts of the triangle followed by the user-defined keys for those parts. Three known parts are required, but if additional information is known more than three parts may be keyed in. All angles are assumed to be in degrees.

3) Press D to solve the triangle. The program shows the solution as a sequence of 7 numbers. All angles output are in degrees. The order of the output is as follows:

CONTINUED ON NEXT PAGE

HP-41C TRIANGLE SOLUTION PROGRAM By John Kennedy (918)
Card Reader + 1 RAM. See HP-67 Prgm, Size 026

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01*LBL E          59 ARCL 01        117 RCL 06        175 GTO 17
02 CF 02          60 AVIEW          118 RCL 03        176*LBL 12
03 CF 05          61 RTN            119 X=0?          177 +
04 CLRG           62*LBL D          120 GTO "R"       178 RCL 03
05 ADV            63 XEQ "S"        121 P-R           179 X=0?
06 " INPUT DATA"  64 XEQ "S"        122 RCL 05        180 GTO "R"
07 AVIEW          65 X=0?           123 -             181 RCL 02
08 RTN            66 GTO "NS"       124 R-P           182 GTO 14
09*LBL A          67*LBL 08         125 STO 07        183*LBL 13
10 STO 06         68 ADV            126 GTO "R"       184 +
11 STO 16         69 7              127*LBL 10        185 RCL 04
12*LBL 06         70*LBL 09         128 RCL 03        186*LBL 14
13 " ∠A= "        71 XEQ IND X      129 X=0?          187 X=0?
14 ARCL 06        72 DSE X          130 GTO "R"       188 GTO "R"
15 AVIEW          73 GTO 09         131 RCL 02        189 SIN
16 RTN            74 FC? 02         132 X=0?          190 RDN
17*LBL B          75 RTN            133 GTO "R"       191 X<>Y?
18 STO 04         76 ADV            134*LBL 11        192 SF 02
19 STO 14         77 "SECOND TRIANGLE"  135 RCL 06    193 R↑
20*LBL 04         78 AVIEW          136 SIN           194 X<>Y
21 " ∠B= "        79 7P<>S          137 X<>Y          195 /
22 ARCL 04        80 SF 05          138 SIN           196 *
23 AVIEW          81 XEQ "S"        139 /             197 SF 25
24 RTN            82 XEQ "S"        140 *             198 ASIN
25*LBL C          83 CF 02          141 STO 07        199 FC?C 25
26 STO 02         84 GTO 08         142 GTO "R"       200 GTO "NS"
27 STO 12         85*LBL "S"        143*LBL "AA"      201 FS? 05
28*LBL 02         86 XEQ "AA"       144 RCL 06        202 GTO 16
29 " ∠C= "        87 XEQ "AA"       145 X=0?          203 GTO 17
30 ARCL 02        88 XEQ "AA"       146 GTO "R"       204*LBL 15
31 AVIEW          89 XEQ "Sa"       147 RCL 04        205 RCL 04
32 RTN            90 XEQ "Sa"       148 RCL 02        206 RCL 02
33*LBL F          91 XEQ "Sa"       149 *             207 +
34 STO 07         92 *              150 X=0?          208*LBL 16
35 STO 17         93 2              151 GTO 15        209 COS
36*LBL 07         94 /              152 RCL 07        210 CHS
37 " SIDE a= "    95 RCL 04         153 X=0?          211 ACOS
38 ARCL 07        96 SIN            154 GTO "R"       212*LBL 17
39 AVIEW          97 *              155 RCL 05        213 STO 06
40 RTN            98 STO 01         156 X=0?          214*LBL "R"
41*LBL G          99 *              157 GTO 12        215 RCL 02
42 STO 05         100 *             158 RCL 03        216 X<> 04
43 STO 15         101 RCL 05        159 X=0?          217 ENTER↑
44*LBL 05         102 *             160 GTO 13        218 X<> 06
45 " SIDE b= "    103 RTN           161 R-P           219 STO 02
46 ARCL 05        104*LBL "Sa"      162 X↑2           220 RCL 03
47 AVIEW          105 RCL 07        163 RCL 07        221 X<> 05
48 RTN            106 X=0?          164 X↑2           222 ENTER↑
49*LBL H          107 GTO "R"       165 -             223 X<> 07
50 STO 03         108 RCL 06        166 RCL 05        224 STO 03
51 STO 13         109 X=0?          167 RCL 03        225 RTN
52*LBL 03         110 GTO "R"       168 *             226*LBL "NS"
53 " SIDE c= "    111 RCL 05        169 ST+ X         227 "NO SOLUTION"
54 ARCL 03        112 X=0?          170 /             228 AVIEW
55 AVIEW          113 GTO 10        171 SF 25         229 RTN
56 RTN            114 RCL 04        172 ACOS
57*LBL 01         115 X=0?          173 FC?C 25       USE F,G,H FOR SIDES
58 " AREA = "     116 GTO 11        174 GTO "NS"      SEE HP-67 PRGM
                                                      INSTRUCTIONS
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1st number- side a
2nd number- angle A
3rd number- side b
4th number- angle B
5th number- side c
6th number- angle C
7th number- area

In case of two solutions the display will show the 7 parts of the first solution and then show 2. with blinking decimal point and then give the 7 parts of the second solution and stop.

4) Simply press D to review again the results of a triangle solution. Press f P≷S to obtain the second triangle.

NOTE: The accuracy of certain computations may yield 2 solutions very close to eachother. The user may then decide if only one case applies.