SUP-R-ROM

SURVEYING SOFTWARE

for the

HP-41 C/V

HEWLETT PACKARD

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DISCLAIMER

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GENERAL INSTRUCTIONS

1. BE SURE YOUR BODY IS FREE OF STATIC ELECTRICITY BEFORE HANDLING YOUR SUP-R-ROM.

2. FOLLOW INSTRUCTIONS CAREFULLY. Most mistakes result from carelessness and not bothering to check the instruction sheet for initialization, order of input, etc. Be sure of your data input particularly as you near the end of a long traverse. In most cases you can recover from an input error, so become familiar with the RECOVERING FROM INPUT ERRORS section on page 63.

3. All angles and bearings are input in the form DD.MMSSss, and output is in the same form.

4. Registers 00 through 19 are "working" registers while Registers 20 through 299 are used to store angles, distances, azimuths, or coordinates. The final result is always coordinates in the traverse programs.

5. ACCESSING A PROGRAM: Note that accessing a program never initializes it; so should you call for a wrong program, no damage is done. Simply call for the correct program. And of course, there are times when you will wish to access a program and not initialize.

6. INITIALIZATION: All registers are cleared in just two programs; FIELD DATA COLLECTOR and VERTICAL CURVE ELEVATIONS. This prevents the inadvertent clearing of stored data. In those programs that require three or four seconds to initialize, Registers 00 through 19 are cleared, Flags 01 through 10 are cleared, 4 is stored in Register 19, 1 is stored in Registers 10, 11, and 12 and a beep signals the completion of initialization.

7. FLAGS: When Flag 00 is set, coordinates are printed. When Flag 01 is set, the calculator works in the azimuth mode; it is set automatically in FIELD TRAVERSE and COGO when an azimuth is input using [■] [a]. When Flag 02 is set, the calculator always stops and prompts for a point number with ??.0000 OK?. If the suggested number is OK, pressing [R/S] uses that number. Or you may input any other number before pressing [R/S].

8. When inputting a series of items, keep an eye on the PRGM annunciator to be sure it is off before beginning to key in the next data. Several programs sound Tone 9 when computation is complete and the calculator is ready to accept new data. If this tone is annoying, you may silence it by clearing Flag 26. However, turning the calculator off and then back on, re-sets Flag 26 and Tone 9 will again be heard.

9. ALARM: To hear this feature, access FIELD TRAVERSE and press [XEQ] [A]. This warns that Point 140 (or 280, etc.) has been input and you must record the coordinates on magnetic cards or casette tape before inputting further courses. It sounds in TRAVERSE ADJUSTMENT also to inform you that Point 140 has been reached. Pressing [R/S] will silence it.

10. WARNING: If the printer is plugged into the calculator, be sure that it is turned on when any program is being executed. AVIEW is used frequently to print the ALPHA register. And if the printer is connected but turned off, the running program stops to display the ALPHA register before having completed the routine.

11. SIZE: Two programs require that 300 registers be allocated to storage. These are AREA / INVERSE (if batch loading is to be executed), and FIELD DATA COLLECTOR (if sideshots are to be input). Otherwise the necessary size depends on the length of your traverse. Unless you have a compelling reason not to, it is best that you go ahead and execute SIZE 300. However, should you be in the process of entering a long traverse and get a NONEXISTENT display because you have run out of storage registers, don't panic! Simply execute SIZE, <u>being careful not to change the stack</u>, and press [R/S]. Program execution will continue without harm to your traverse.

12. KEY REASSIGNMENTS: In addition to the key assignments that access the various programs, [■] [O] executes HR, and [■] [P] executes HMS. These key assignments use Registers 307 through 319. So after executing SIZE 300, you have just 7 registers to use in programs or other key assignments. Or you may execute SIZE 307 and use Registers 300 through 306 for storage. (This will not increase your point storage capability.) If you wish to change any of the key assignments to other keys, or to make assignments of your own, the ROM assignments will be written over and will remain until a MEMORY LOST is executed.

13. REGISTER CONTENTS: When a register is used for more than one purpose, a slash mark (/) separates them. Also in a program such as TRAVERSE ADJUSTMENT, items before the slash mark are used in CRANDALL RULE and those after the mark are used in COMPASS RULE. Note the CRAN/COM that heads the register listing.

14. AREA: Generally, you must ask for the closure data and then press [R/S] to get the area. You may skip the closure data by pressing [XEQ] [M]. However, this leaves the calculator in FIELD TRAVERSE; so if you were in another program, you would have to access it again.

15. When using mainframe functions, be sure to take the calculator out of USER mode when necessary. You will note that no key assignments were made to [■] [SF], [■] [CF], and [■] [FIX] functions so that they will operate whether the calculator is in USER mode or not.

<u>CLEARING PROCEDURES</u>

To clear individual registers, store zero in the register. [0] [STO] [XX]
To clear ALL registers, press: [XEQ] ALPHA] [CLRG] ALPHA]. OR you may clear all registers and all programs by turning the calculator off, holding down the clear key [←] and turn the calculator back on. MEMORY LOST is displayed.
To clear a program, press: [XEQ] [ALPHA] [CLP] [ALPHA] [ALPHA] [NAME OF PROGRAM] [APLHA].

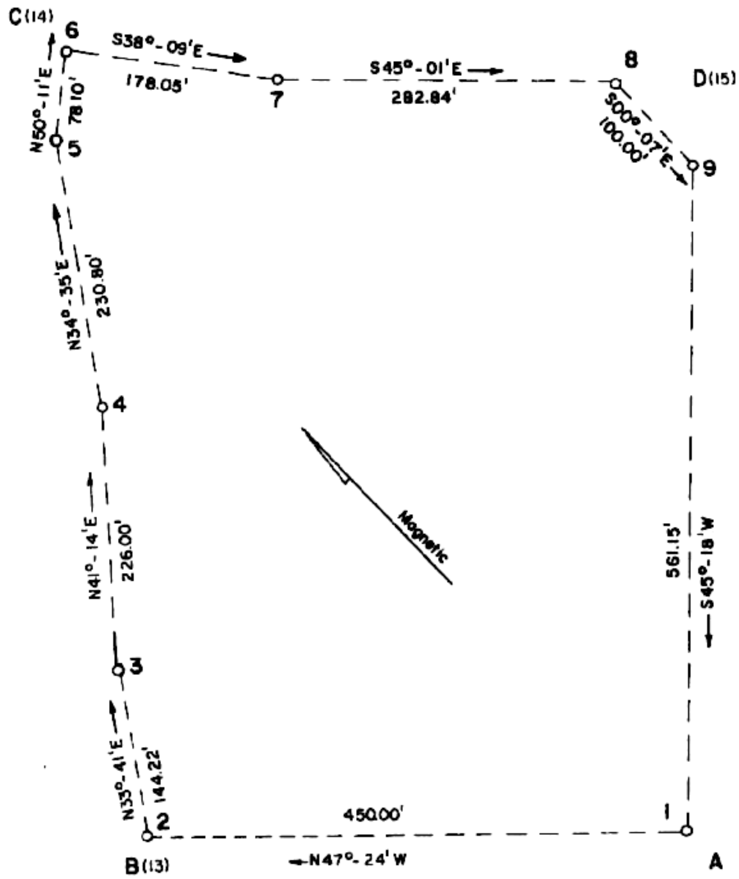
It is very important that you become familiar with the operation of your HP-41C/V before using your new SUP-R-ROM Module. Please look through your calculator manual and become "friendly" with your calculator before proceeding. It may seem like a waste of time, but it will be the best time you can spend.

ABBREVIATIONS

ADJ	Adjust(ment)	°F	Degrees Fahrenheit
Azim	Azimuth	FS	Foresight
BDI	Bearing-distance intersection	HD	Horizontal distance
BEG	Beginning	HI	Height of instrument
BRNG	Bearing	HZA	Horizontal angle
BBI	Bearing-bearing intersection	Inc	Increment
BP	Base point	INST	Instrument point
BS	Backsight	L	Length of curve
CCWBS	Counterclockwise from backsight	Lats	Latitudes
CL	Centerline	Lt	Left
Clos	Closure	LVC	Length of vertical curve
COGO	Coordinate Geometry	N	North coordinate
Com	Compass	N_b	Beginning north coordinate
Coord	Coordinates	N_e	Ending north coordinates
CP	Common point	No.	Number
Corr	Correction	OFST	Offset point
Cum	Cumulative	PC	Point of curvature
CWBS	Clockwise from backsight	PI	Point of intersection
D	Degree of curve, arc definition	POC	Point on curve
D	Distance	PREC	Precision of survey
DBI	Distance-bearing intersection	Pt	Point
D.dddd	Decimal of degree	PT	Point of tangency, or point
DDI	Distance-distance intersection	R	Radius
DD.MMSS	Degrees, minutes, seconds	Rt	Right
Def	Deflection	SD	Slope distance
Deps	Departures	SOL	Solution, or solar
Dist	Distance	STA	Station
E	East coordinate	SOPT	Stakeout point
E_b	Beginning east coordinate	T	Tangent distance
EC	Error correction	TCF	Temperature correction factor
E_e	Ending east coordinate	Temp	Temperature
El, Ele	Elevation	VD	Vertical distance
EOC	Error of closure	VPI	Vertical curve PI
Err	Error	V/ZA	Vertical or zenith angle
Ext	External distance		

IMPORTANT NOTICE: There are times in this wonderful world of high technology when we get some crazy results and there is no apparent reason for it. A possibility is someone may have been playing around with your calculator and assigned some labels which override those on the SUP-R-ROM. If this occurs it is a good practice to do a "MEMORY LOST" by: 1. Turning off calculator. 2. Hold the [←] key down and turn calculator back on. "MEMORY LOST" will then be displayed. Don't forget all stored coordinates will be lost and flags and memory size must be reentered.

FIELD TRAVERSE EXAMPLE



GIVEN: The traverse in the above figure. It is desired to establish a line from B to C that will best fit Points 2, 3, 4, 5 and 6 and another line from C to D that will best fit Points 6 7 and 8.

PROCEDURE:

1. Use FIELD TRAVERSE to input the traverse and check the closure.
2. Use TRAVERSE ADJUSTMENT to balance the traverse by the Compass Rule.
3. Use LINEAR REGRESSION to find the best fit from B to C and from C to D.
4. Use INTERSECTIONS to establish coordinates on corners B, C, and D.
5. Use ROTATION / TRANSLATION to translate coordinates for the State Grid System.
6. Use AREA / INVERSE to compute the final traverse.
7. Use PERPENDICULAR OFFSET to find the offset distances from the lines.

INPUT	PRESS	REMARKS
	[■] [F]	Access program.
	[R/S]	Initialize.
	[■] [SF] [00]	Let's print coordinates.
1000	[ENTER] [■] [b]	Input beginning coordinates.
47.24	[D]	Input traverse.
450	[E]	
33.41	[A]	
144.22	[E]	
41.14	[A]	
226	[E]	
34.36	[A]	
280.3	[E]	
50.11	[A]	
78.1	[E]	Oops! Looking back two courses, we note an input error: distance 280.3 should have been 230.8. So, we back out two courses. Notice that it is not necessary to re-enter the bearing on the first course to be backed out.
78.1	[■] [e]	
34.36	[A]	
280.3	[■] [e]	
230.8	[E]	Now, we input the correct data.
50.11	[A]	
78.1	[E]	
38.09	[B]	
178.05	[E]	
45 01	[B]	
282.84	[E]	
.07	[B]	
100	[E]	
46.18	[C]	
561.16	[E]	
	[■] [c]	Check the closure. Closure OK. Go to page 12.

```
TRAVERSE

        1.    ***
1,000.0000    ***
1,000.0000    ***

N 47.2400 W
HD= 450.0000

        2.    ***
1,304.5942    ***
  668.7563    ***

N 33.4100 E
HD= 144.2200

        3.    ***
1,424.6019    ***
  748.7411    ***

N 41.1400 E
HD= 226.0000

        4.    ***
1,594.5610    ***
  897.7038    ***

N 34.3500 E
HD= 280.3000

        5.    ***
1,825.3324    ***
1,056.8033    ***

N 50.1100 E
HD= 78.1000

        6.    ***
1,875.3425    ***
1,116.7917    ***

HD= -78.1000

        5.    ***
1,825.3324    ***
1,056.8033    ***

N 34.3500 E
HD= -280.3000

        4.    ***
1,594.5610    ***
  897.7038    ***

HD= 230.8000

        5.    ***
1,784.5790    ***
1,028.7069    ***

N 50.1100 E
HD= 78.1000

        6.    ***
1,834.5890    ***
1,088.6953    ***

S 38.0900 E
HD= 178.0500

        7.    ***
1,694.5712    ***
1,198.6807    ***

S 45.0100 E
HD= 282.8400

        8.    ***
1,494.6313    ***
1,398.7370    ***

S 0.0700 E
HD= 100.0000

        9.    ***
1,394.6315    ***
1,398.9406    ***

S 45.1800 W
HD= 561.1500

       10.    ***
  999.9215    ***
1,000.0755    ***

ΣHD= 2,251.1600
ΣLATS= -0.0785
ΣDEPS= 0.0755
EOC DIST= 0.1089
N 43.5324 W
PREC= 1: 20,678.8404
```

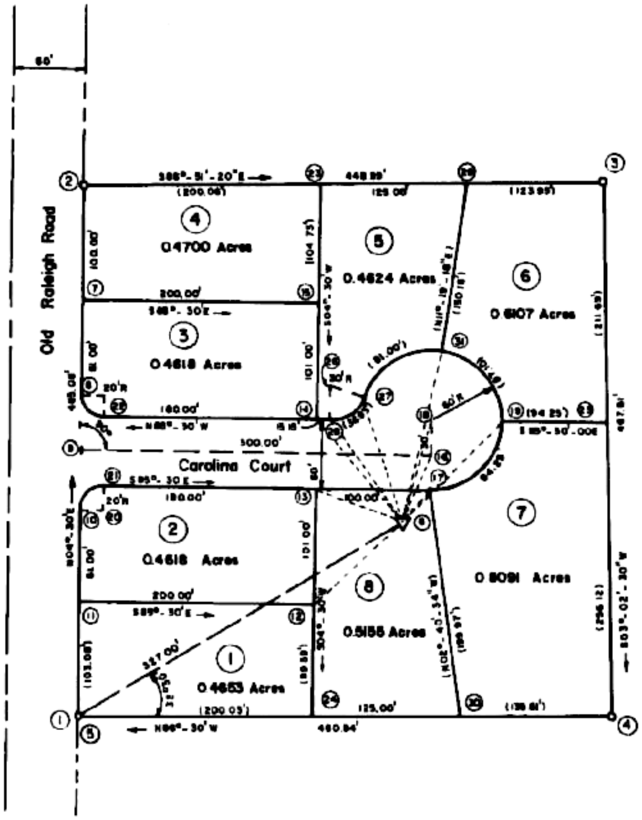
SUP-R-ROM ©		FIELD TRAVERSE		
■ a Azim	■ b NbEb NeEe	■ c Closure Data	■ d Force Closure	■ e Back out Last Course
A NE	B SE	C SW	D NW	E Distance
F CWBS	G Def	H Temp	I	J V/ZA

STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [F]
2	Initialize.		[R/S]
3	a. (Optional) Fix decimal IF FIX 4 is not satisfactory.	Number	[STO] [19] [■] [FIX] [NO]
	b. (Optional) Input grid factor (OR any other factor: sea level, scale, combined).	Factor	[STO] [11]
	c. (Optional) Input temperature in ^{O}F.	Temperature	[H]
4	Input beginning coordinates: a. If OK for the first point to be No. 1.	N_b E_b	[ENTER] [■] [b]
	b. If you wish to assign the first point No. Display prompts with 1.0000 OK? Input desired point number and press [R/S].	N_b E_b	[ENTER] [XEQ] [B]
5	Input reference bearing. OR reference azimuth. (If reference bearing or reference azimuth is also the bearing or azimuth of the first leg, proceed to Step 7.)	Bearing Azimuth	[A] [B] [C] or [D] [■] [a]
6	Input angle: a. If CWBS b. If CCWBS c. If deflection angle right d. If deflection angle left OR, input next bearing. OR, input next azimuth	CWBS CCWBS Def angle Def angle Bearing Azimuth	[F] [CHS] [F] [G] [CHS] [G] [A] [B] [C] or [D] [■] [a]
7	Input distance: a. If horizontal, b. If slope,	Distance V/ZA Slope Distance	[E] [J] [E]
	REPEAT STEPS 6 & 7 FOR ALL COURSES.		
8	Input end coordinates (if different from beginning coordinates.)	N_e E_e	[ENTER] [■] [b]
9	a. For closure data. b. For area.		[■] [c] [R/S]
10	For a forced closure at any time.		[■] [d]
11	a. To Back out the last course, b. To back out a course other than the last course, input the bearing or azimuth exactly as before. Then, execute Step 11a. Any number of courses may be removed in this manner; but they must be in the reverse order in which they were input.	Distance	[■] [e]
12	FOR TRAVERSES WITH MORE THAN 140 POINTS: a. When 139 courses have been input, the alarm sounds; silence it by pressing [R/S]. Go to MASS STORAGE program and execute Step 1, then either Step 2a or 3a. Return to this program, execute Step 1 and continue with your traverse. b. When all courses have been input, go to MASS STORAGE program and execute Step 1, then either Step 2b or 3a. (This records the final data in your working registers as well as the last points.)		

REGISTER CONTENTS

FIELD TRAV	05 AREA	11 GRID FACTOR	17 Σ LATS
00 IND STO/RCL	06 POINT NO.	12 V/ZA	18 Σ DEPS
01 Σ (DL/S)	07 THIS HD	13 Ne	19 DEC FIX NO.
02 Σ (L↑2/S)	08 THIS LAT	14 Ee	20 Nb
03 Σ (D↑2/S)	09 THIS DEP	15 AZIMUTH	21 Eb
04 USED	10 TEMP FACTOR	16 Σ HD	22 N2

COGO EXAMPLE



GIVEN: The above subdivision.

FIND: All unknown bearings and distances, the area of lot, and stakeout information from Point 6.

(The tapes produced by this problem are found on page 10.)

INPUT	PRESS	REMARKS
	[■] [G]	Access program.
	[R/S]	Initialize.
1000	[ENTER]	Input beginning coordinates.
	[■] [b]	
4.3	[A]	Input traverse.
	[STO] [01]	Store azimuth for recall by bearing code.
465.08	[E]	
86.512	[B]	
448.99	[E]	
3.023	[C]	
467.81	[E]	
86.3	[D]	
460.84	[E]	
32.3	[CHS] [F]	Set control point for later use.
327	[E]	
2	[■] [c]	Use branching technique to store lot corners.
1.2	[■] [e]	Bearing code calls for reverse of azimuth stored in Register 01.
100	[E]	
7	[■] [CF] [02]	Assign 7 to point; clear Flag 02 to stop point number prompting.
	[R/S]	
81	[E]	
50	[E]	Note that when traversing along the same bearing, it is not necessary to re-enter the bearing.
50	[E]	
81	[E]	
1.1	[■] [e]	
200	[E]	
1	[■] [e]	
101	[E]	
60	[E]	
101	[E]	
9	[■] [c]	Begin new branch.
1.1	[■] [e]	
300	[E]	
16	[■] [CF] [02]	
	[R/S]	
1.2	[■] [e]	
30	[E]	
60	[CHS] [E]	A negative distance is simpler than using a bearing code.

INPUT	PRESS	REMARKS
17	[■] [c]	Use curve traverse to set Point 19.
1.1	[■] [e]	
60	[CHS] [STO] [16]	
94.25	[I]	
19	[R/S]	
10	[■] [c]	Begin new branch.
1.1	[■] [e]	
20	[E]	
20	[■] [CF] [02]	
	[R/S]	
1	[■] [e]	
20	[E]	
60	[E]	
14	[■] [c]	Let's set a temporary point 30' from 14 in order to compute Point 27 later.
1	[■] [e]	
30	[E]	
5	[R/S]	Since Point 5 is redundant, let's use it again.
	[■] [N]	Now, we access INTERSECTIONS to compute coordinates on Points 23, 24, 25, and 26.
	[R/S]	
2	[R/S]	
15	[R/S]	
86.512	[B]	Note that for a BBI you do not need to step through the prompts for D1 and D2.
4,3	[C]	
23	[R/S]	
	[J]	Initialize for another problem.
12	[R/S]	
1	[R/S]	
4,3	[C]	
86.3	[D]	
24	[R/S]	
	[J]	
19	[R/S]	
4	[R/S]	
85.3	[B]	
3.023	[C]	
25	[R/S]	
	[J]	
18	[R/S]	
5	[R/S]	
90	[R/S]	
85.3	[D]	
26	[R/S]	
	[■] [G]	Back to COGO.
	[R/S]	Initialize.
26	[■] [c]	
66.0144	[B]	
30	[E]	
27	[R/S]	
26	[■] [c]	
4.3	[C]	
30	[E]	
28	[R/S]	
23	[■] [c]	
86.512	[B]	
125	[E]	
29	[R/S]	
24	[■] [c]	
86.3	[B]	
125	[E]	
30	[R/S]	
18	[■] [c]	Here, we are going to establish Point 31 between Points 18 and 29 without finding the bearing. Had we needed the bearing printed, we could have input a zero CWBS after the INST and BS.
29	[R/S]	
60	[CHS] [E]	
31	[R/S]	
	[■] [I]	Now we use AREA / INVERSE to compute the area and inverses of Lot No. 5. We will not use the batch loading procedure because of the curves. (We could batch-load 28, 14, 23, 29, and 31 and then finish using [A] and [E].)
	[R/S]	
14	[D]	
23	[E]	
29	[E]	
31	[E]	
60	[CHS] [A]	Curve is to the left.
27	[E]	
30	[A]	Curve is to the right.
28	[E]	
14	[E]	
	[C]	Compute the area.
		GO TO PAGE 22.

SUP-R-ROM ©		COORDINATE GEOMETRY		
■ a Azim	■ b NbEb	■ c INST BS	■ d Spin	■ e BRNG Code
A NE	B SE	C SW	D NW	E Distance
F CWBS	G Def	H Temp	I Arc	J V/ZA

STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [G]
2	Initialize.		[R/S]
3	a. (Optional) Fix decimal if FIX 4 is not satisfactory.	Number	[STO] [19] [■] [FIX] [NO]
	b. (Optional) Input grid factor (OR any other factor: sea level, scale, combined).	Factor	[STO] [11]
	c. (Optional) Input temperature in$^{o o}$F.	Temperature	[H]
4	Input beginning coordinates: a. If OK for the first point to be No. 1.	N_b E_b	[ENTER] [■] [b]
	b. If you wish to assign the first point No.	N_b E_b	[ENTER] [XEQ] [B]
	The display prompts with 1.0000 OK? Input desired point number and press [R/S]. And if you wish subsequent point numbers to be sequential, clear Flag 02.		[■] [CF] [02]
5	Input reference bearing. OR reference azimuth. (If reference bearing or reference azimuth is also the bearing or azimuth of the first leg, proceed to Step 7.)	Bearing Azimuth	[A] [B] [C] or [D] [■] [a]
6	Input angle: a. If CWBS b. If CCWBS c. If deflection angle right d. If deflection angle left OR, input next bearing OR, input next azimuth OR, input bearing code	CWBS CCWBS Def angle Def angle Bearing Azimuth Bearing Code	[F] [CHS] [F] [G] [CHS] [G] [A] [B] [[C] or [D] [■] [a] [■] [e]
	To store Azimuths: Enter bearing and press [A],[B],[C] or [D]. Then store Azimuth by pressing [STO] [01,[02],[03],[04] or [05].		
	1 Recalls the azimuth stored in Register 01, and prints its bearing. 1.1 Recalls the azimuth stored in Register 01, applies 90° right and prints its bearing. 1.2 Recalls the azimuth stored in Register 01, applies 180° and prints its bearing. 1.3 Recalls the azimuth stored in Register 01, applies 270° right and prints its bearing. The digit before the decimal point refers to the register in which the azimuth is stored. And the digit in the tenths place indicates direction. So Code 3.2 would recall the azimuth stored in Register 03 with 180° applied.		
7	Input distance: a. If horizontal b. If slope	Distance V/ZA Slope Distance	[E] [J] [E]
	Continued on page 11.		

REGISTER CONTENTS

	COGO	05	BEARING CODE	11	GRID FACTOR	17	N
00	IND STO/RCL	06	POINT NO.	12	V/ZA	18	E
01	BEARING CODE	07	THIS HD	13	USED	19	DEC FIX NO.
02	BEARING CODE	08	THIS LAT	14	USED	20	Nb
03	BEARING CODE	09	THIS DEP	15	AZIMUTH	21	Eb
04	BEARING CODE	10	TEMP FACTOR	16	RADIUS	22	N2
						23	E2 ETC.

TAPE PRODUCED BY COORDINATE GEOMETRY EXAMPLE ON PAGE 8.

```
COGO

          1.    ***
  1,000.0000    ***
  1,000.0000    ***

N 4.3000 E
HD= 465.0000

          2.    ***
  1,463.6463    ***
  1,036.4898    ***

S 86.5120 E
HD= 448.9900

          3.    ***
  1,439.0177    ***
  1,484.8038    ***

S 3.0230 W
HD= 467.8100

          4.    ***
    971.8667    ***
  1,459.9008    ***

N 86.3000 W
HD= 460.8400

          5.    ***
  1,000.0004    ***
  1,000.0003    ***

CWBS= -32.3000
N 61.0000 E
HD= 327.0000

          6.    ***
  1,158.5331    ***
  1,286.0010    ***

            2. INST
  1,463.6463    ***
  1,036.4898    ***

S 4.3000 W
HD= 100.0000

          7.    ***
  1,363.9546    ***
  1,028.6430    ***

HD= 81.0000

          8.    ***
  1,283.2043    ***
  1,022.2087    ***

HD= 50.0000

          9.    ***
  1,233.3584    ***
  1,018.3657    ***

HD= 50.0000

         10.    ***
  1,183.5125    ***
  1,014.4427    ***

HD= 81.0000

         11.    ***
  1,102.7622    ***
  1,008.0876    ***

S 85.3000 E
HD= 200.0000

         12.    ***
  1,087.0704    ***
  1,207.4710    ***

N 4.3000 E
HD= 101.0000

         13.    ***
  1,107.7591    ***
  1,215.3954    ***

HD= 60.0000

         14.    ***
  1,247.5741    ***
  1,220.1029    ***

HD= 101.0000

         15.    ***
  1,348.2628    ***
  1,228.0273    ***

            9. INST
  1,233.3584    ***
  1,018.3657    ***

S 85.3000 E
HD= 300.0000

         16.    ***
  1,209.8207    ***
  1,317.4409    ***

S 4.3000 W
HD= 30.0000

         17.    ***
  1,179.9132    ***
  1,315.0871    ***

HD= -60.0000

         18.    ***
  1,239.7282    ***
  1,319.7947    ***

           17. INST
  1,179.9132    ***
  1,315.0871    ***

S 85.3000 E
N 49.2956 E
ARC 94.2500
HD= 84.8544

         19.    ***
  1,235.0229    ***
  1,379.6099    ***

           10. INST
  1,183.5125    ***
  1,014.4427    ***

S 85.3000 E
HD= 20.0000

         20.    ***
  1,181.9434    ***
  1,034.3811    ***

N 4.3000 E
HD= 20.0000

         21.    ***
  1,201.8817    ***
  1,035.9503    ***

HD= 60.0000

         22.    ***
  1,261.6967    ***
  1,040.6578    ***

           14. INST
  1,247.5741    ***
  1,220.1029    ***

N 4.3000 E
HD= 30.0000

          5.    ***
  1,277.4816    ***
  1,222.4567    ***

INTERSECT

              2.0000
             15.0000
S 86.5120 E
S 4.3000 W

BBI
          2.    ***
  1,463.6463    ***
  1,036.4898    ***

S 86.5120 E
200.0560
         23.    ***
  1,452.6726    ***
  1,236.2445    ***

S 4.3000 W
104.7327
         15.    ***
  1,348.2628    ***
  1,228.0273    ***

             12.0000
              1.0000
S 4.3000 W
N 86.3000 W

BBI
         12.    ***
  1,087.0704    ***
  1,207.4710    ***

S 4.3000 W
99.5890
         24.    ***
    987.7884    ***
  1,199.6574    ***

N 86.3000 W
200.0385
          1.    ***
  1,000.0000    ***
  1,000.0000    ***

             19.0000
              4.0000
S 85.3000 E
S 3.0230 W

BBI
         19.    ***
  1,235.0229    ***
  1,379.6099    ***

S 85.3000 E
94.2518

         25.    ***
  1,227.6280    ***
  1,473.5711    ***

S 3.0230 W
256.1220
          4.    ***
    971.8667    ***
  1,459.9008    ***

             10.0000
              5.0000
             90.0000
N 85.3000 W

BBI NEAR SOL
         18.    ***
  1,239.7282    ***
  1,319.7947    ***

N 66.0144 W
90.0000
         26.    ***
  1,276.2932    ***
  1,237.5572    ***

N 85.3000 W
15.1472
          5.    ***
  1,277.4816    ***
  1,222.4567    ***

COGO

           26. INST
  1,276.2932    ***
  1,237.5572    ***

S 66.0144 E
HD= 30.0000

         27.    ***
  1,264.1049    ***
  1,264.9697    ***

           26. INST
  1,276.2932    ***
  1,237.5572    ***

S 4.3000 W
HD= 30.0000

         28.    ***
  1,246.3857    ***
  1,235.2034    ***

           23. INST
  1,452.6726    ***
  1,236.2445    ***

S 86.5120 E
HD= 125.0000

         29.    ***
  1,445.0159    ***
  1,361.0563    ***

           24. INST
    987.7884    ***
  1,199.6574    ***

S 86.3000 E
HD= 125.0000

         30.    ***
    900.1574    ***
  1,324.4242    ***

           18. INST
  1,239.7282    ***
  1,319.7947    ***

             29. BS
  1,445.0159    ***
  1,361.0563    ***

HD= -60.0000

         31.    ***
  1,298.5606    ***
  1,331.5730    ***

AR/INV

         14.    ***
  1,247.5741    ***
  1,220.1029    ***

N 4.3000 E
HD= 205.7327

         23.    ***
  1,452.6726    ***
  1,236.2445    ***

S 86.5120 E
HD= 125.0000

         29.    ***
  1,445.0159    ***
  1,361.0563    ***

S 11.1910 W
HD= 150.1777

         31.    ***
  1,298.5606    ***
  1,331.5730    ***

S 62.3847 W
HD= 74.9886

ARC= 81.0012
R= -60.0000
         27.    ***
  1,264.1049    ***
  1,264.9697    ***

S 59.1400 W
HD= 34.6411

ARC= 36.9280
R= 30.0000
         28.    ***
  1,246.3857    ***
  1,235.2034    ***

N 85.3000 W
HD= 15.1472

         14.    ***
  1,247.5741    ***
  1,220.1029    ***

SQFT= 20,140.2022
ACRS= 0.4624
```

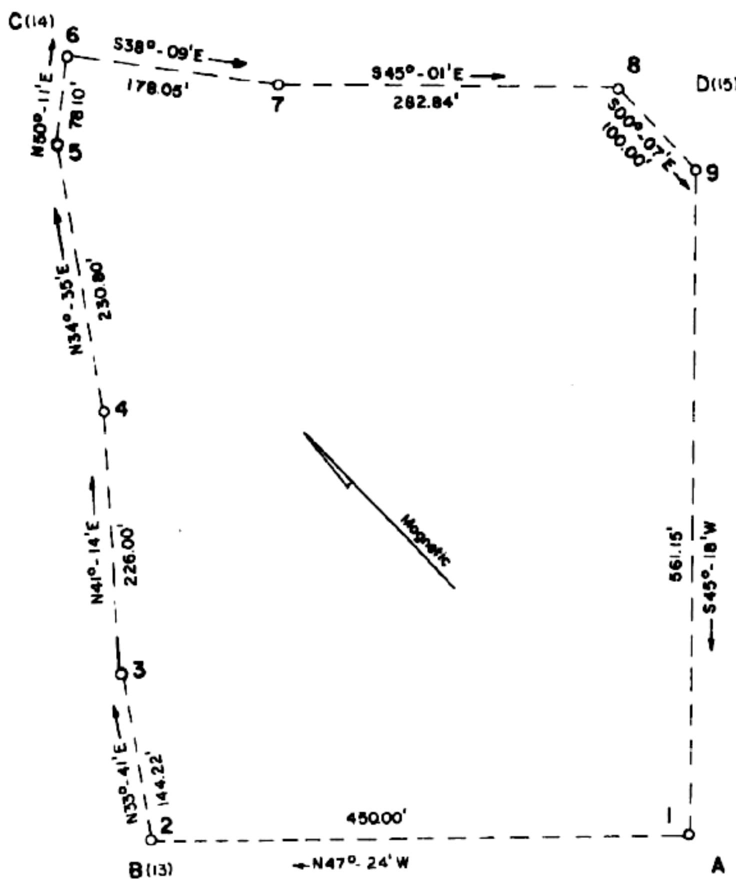
SUP-R-ROM ©		COORDINATE GEOMETRY		
■ a Azim	■ b NbEb	■ c INST BS	■ d Spin	■ e BRNG Code
A NE	B SE	C SW	D NW	E Distance
F CWBS	G Def	H Temp	I Arc	J V/ZA

STEP	PROCEDURE	INPUT	PRESS
8	TRAVERSING AROUND A CURVE		
	(The previous bearing must be the incoming bearing at the PC and the last point is the PC.)		
	a. Input radius: If curve is to the right	Radius	[STO] [16]
	If curve is to the left	Radius	[CHS] [STO] [16]
	b. Input arc length (in feet)	Arc	[I]
	(Execute Step b from the PC to POC to POC and so on around the curve to the PT. The calculator is left with the azimuth tangent to the curve at each POC or PT. So when you reach the PT, you may proceed ahead on tangent by inputting a distance and pressing [E].		
9	BRANCHING OR SIDESHOTS		
	NOTE: If this routine is approached from any program other than FIELD TRAVERSE, you must execute Step 2 and, as necessary, Step 3.		
	a. Input INST point number.	INST	[■] [c]
	b. Input BS point number. Step 9b may be omitted if your first course will be input with a bearing or azimuth.	BS	[R/S]*
	c. If you wish to spin off more than one sideshot from the same INST and BS, input any positive number.	Positive No.	[■] [d]
	d. Execute Steps 6 and 7 as necessary to input the branch or sideshot(s).		
	e. ASSIGNING POINT NUMBERS		
	After the distance has been input and [E] has been pressed, the calculator prompts with ?.0000 OK? If the displayed number is satisfactory, press [R/S]. If it is not satisfactory, input the desired number and press [R/S]. If a branch is being executed, after the first number has been assigned, you may clear Flag 02 and the remainder of the point numbers will be sequential...... [■] [CF] [02].		
	g. If Step 9c was executed, when finished with the sideshots from a particular INST point, input any negative number	Negative No.	[■] [d]
	h. For a single course sideshot at any time, press [XEQ] [00] just prior to Step 6.		

REGISTER CONTENTS

*If printer is NOT attached, after execution of steps 9a and 9b Flags 06 & 07 must be cleared before proceeding [■] [CF] [06] [■] [CF] [07]

TRAVERSE ADJUSTMENT EXAMPLE



GIVEN: The above figure and the registers intact from the FIELD TRAVERSE example.

PROMPT	INPUT	PRESS	REMARKS
		[■] [H]	Access program.
		[R/S]	Initialize.
1ST PT NO?	1	[R/S]	
SELECT RULE		[F]	COMPASS RULE, coordinates printed.
		[R/S]	Check area.

GO TO PAGE 50.

```
TRAV ADJ

COM RULE

           1   ***
   1000.0000   ***
   1000.0000   ***

N 47.2359 W
450.0217

           2   ***
   1304.6099   ***
    668.7412   ***

N 33.4050 E
144.2215

           3   ***
   1424.6226   ***
    748.7211   ***

N 41.1350 E
226.0009

           4   ***
   1594.5896   ***
    897.6763   ***

N 34.3450 E
230.8022

           5   ***
   1784.6156   ***
   1028.6716   ***

N 50.1050 E
78.0997

           6   ***
   1834.6284   ***
   1088.6574   ***

S 38.0859 E
178.0414

           7   ***
   1694.6167   ***
   1198.6369   ***

S 45.0100 E
282.8263

           8   ***
   1494.6867   ***
   1398.6837   ***

S 0.0653 E
99.9965

           9   ***
   1394.6904   ***
   1398.8839   ***

S 45.1810 W
561.1496

          10   ***
   1000.0000   ***
   1000.0000   ***

SQFT= 317940.8002
ACRS= 7.2989
```

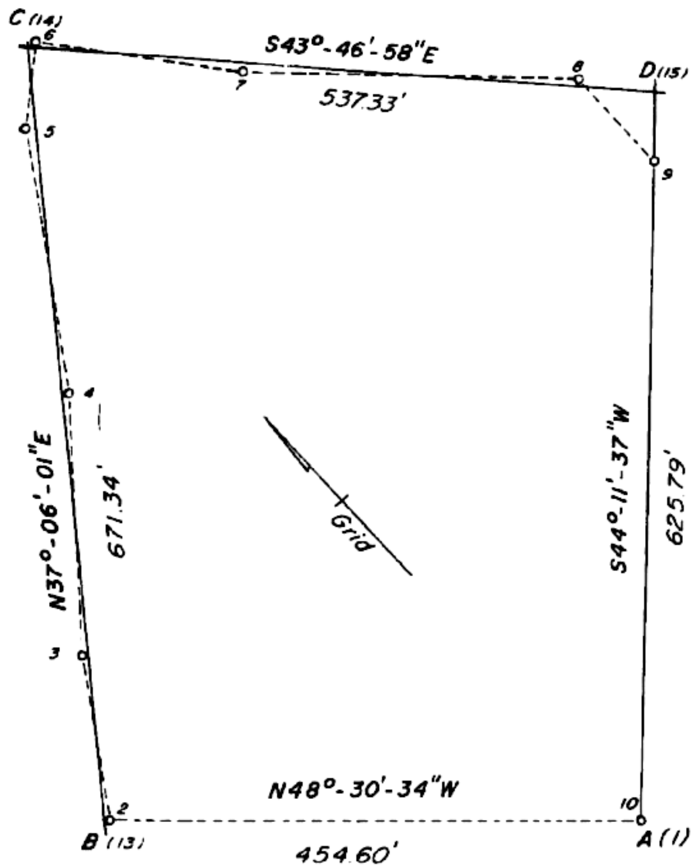
SUP-R-ROM ©		TRAVERSE ADJUSTMENT		
■ a	■ b	■ c	■ d	■ e
A Cran Rule Print	B Cran Rule No Print	C Cran Rule Resume	D	E
F Com Rule Print	G Com Rule No Print	H Com Rule Resume	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Access program		[■] [H]
2	Initialize.		[R/S]
	(The display prompts: 1ST PT NO?)		
3	Input number of the first point in traverse.	Point No.	[R/S]
	(The display prompts: SELECT RULE.)		
4	FOR TRAVERSES WITH 139 OR FEWER COURSES:		
	a. For Crandall Rule, coordinates printed.		[A]
	b. For Crandall Rule, coordinates not printed.		[B]
	c. For Compass Rule, coordinates printed.		[F]
	d. For Compass Rule, coordinates not printed.		[G]
5	For balanced area.		[R/S]
6	FOR TRAVERSES WITH MORE THAN 139 COURSES		
	a. Go to MASS STORAGE program and execute Step 1, then either Step 2c or 3c.		
	b. Return to this program and execute Steps 1, 2, 3, and 4 above.		
	c. When the first 139 courses have been adjusted, the alarm will sound; silence it by pressing [R/S].		
	d. Again, go to MASS STORAGE program and execute Step 1. (Optional) If you wish to record the adjusted coordinates, execute either Step 2a or 3a. Then, execute Step 2c or 3c.		
	e. Access this program again.		[■] [H]
	f. To resume adjusting: If Crandall Rule		[C]
	If Compass Rule		[H]
	g. Execute Steps 6c, 6d, 6e, and 6f as necessary to complete the adjusting.		
	h. For balanced area.		[R/S]

REGISTER CONTENTS

00	CRAN/COM IND STO/RCL	05	AREA	11	CORR E	17	FAC A/LAT FAC
01	USED/	06	POINT NO.	12	FAC B/DEP FAC	18	Σ DEPS
02		07	THIS HD	13	USED	19	DEC FIX NO.
03		08	THIS LAT	14	USED	20	Nb
04	USED	09	THIS DEP/	15	AZIMUTH	21	Eb
		10	CORR N	16			

AREA / INVERSE EXAMPLE



GIVEN: The above figure and the registers intact from ROTATION / TRANSLATION example.

INPUT	PRESS	REMARKS
	[■] [I]	Access program.
1	[F]	Batch load point numbers.
13	[R/S]	
14	[R/S]	
15	[R/S]	
1	[R/S]	
	[G]	Compute final traverse.
	[C]	Compute area.
		GO TO PAGE 28.

No of Pts.	You May Batch Load
119	119
120	119
121	113
122	107
123	101
124	95
125	89
126	83
127	77
128	71
129	65
130	59
131	53
132	47
133	41
134	35
135	29
136	23
137	17
138	11
139	5
140	0

```
AR/INV

              1   ***
    620925.9956   ***
    222028.5199   ***

N 48.3032 W
HD= 454.6004

             13   ***
    621227.1701   ***
    221687.9976   ***

N 37.0601 E
HD= 671.3427

             14   ***
    621762.6203   ***
    222092.9594   ***

S 43.4658 E
HD= 537.3313

             15   ***
    621374.6841   ***
    222464.7530   ***

S 44.1137 W
HD= 625.7960

              1   ***
    620925.9956   ***
    222028.5199   ***

SQFT= 320173.5124
ACRS= 7.3502
```

SUP-R-ROM ©		AREA / INVERSE		
■ a	■ b	■ c	■ d First Point	■ e Next Point
A Radius	B	C Area	D First Point	E Next Point
F First Point	G Run	H	I First Point	J Next Point

REQUIRED SIZE: 300

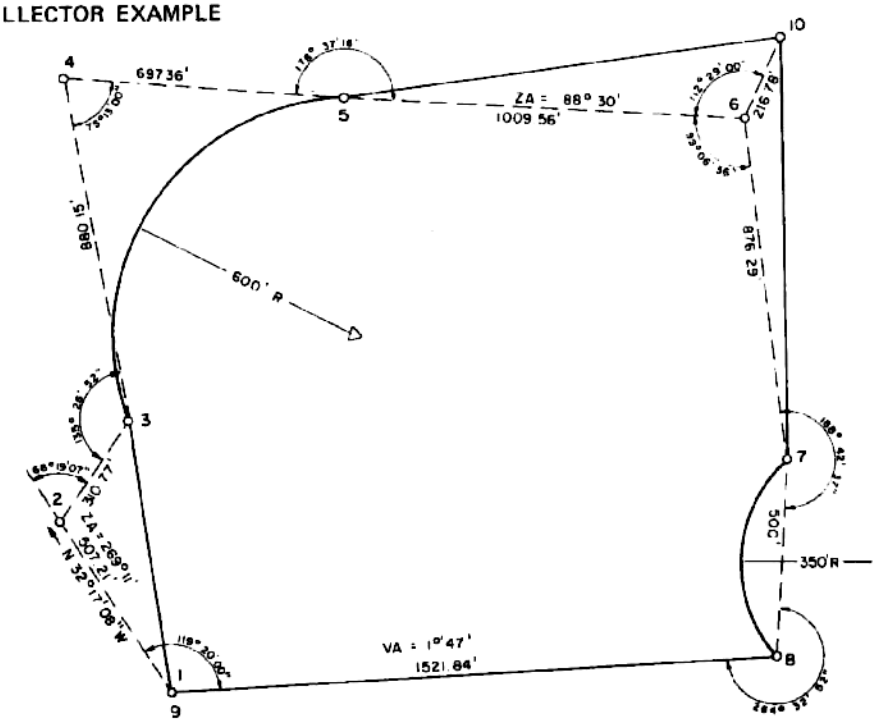
STEP	PROCEDURE	INPUT	PRESS
1	Access program. No Initialization required, but pressing [R/S] prints program identification on tape.		[■] [I]
2	COMPUTING TRAVERSE FROM POINT NUMBERS		
	a. Input first point number	Number	[D]
	b. For courses with curved boundaries: If curve is to the right.	Radius	[A]
	If curve is to the left.	Radius	[CHS] [A]
	c. Input next point number.	Number	[E]
	Repeat Step 2c (and 2b as applicable) until the first point has been re-entered.		
	ALTERNATE METHOD You may batch load point numbers as follows:		
	d. Input first point number.	Number	[F]
	e. Input next point number.	Number	[R/S]
	Continue executing Step 2e until the first point number has been re-entered.		
	f. Compute the traverse.		[G]
	LIMITATION: This method will not work on curved boundaries. However, you may batch load the numbers beginning at the PT of a curve and ending at the PC of the next curve.. But if you have more than one curve, you may NOT batch load a second time.... For the limit on the number of points that may be batch loaded, see opposite page.		
3	For area.		[C]
4	For a simple inverse, execute Steps 2a and 2c above.		
5 *	COMPUTING TRAVERSE FROM INPUT COORDINATES		
	a. Input coordinates of the first point.	N_b E_b	[ENTER] [I]
	b. For courses with curved boundaries, execute Step 2b.		
	c. Input coordinates of the next point.	N E	[ENTER] [J]
	Repeat Step 5c (and 5b as applicable) until the first point has been re-entered.		
6	COMPUTING TRAVERSE USING CASETTE DRIVE		
	To call coordinates from casette tape:		
	a. Press [■] [a]. (The calculator prompts: FILE?)		
	b. Input file name.	File Name	[R/S]
	c. Input first point number.	Number	[■] [d]
	d. For courses with curved boundaries, execute Step 2b.		
	e. Input next point number.	Number	[■] [e]
	NOTE: This routine retrieves the coordinate values from the tape, stores them in Registers 20 and 21, and then calls the point No. 1. This of course destroys your original Point 1 (or 141, or 181, etc.).		
	You may alternate calling numbers from tape registers and from the mainframe registers.		
	You may NOT batch load from the tape.		

AR/INV REGISTER CONTENTS

00	IND STO/RCL	05	AREA	10	DEFLECTION	15	AZIMUTH
01	USED	06	POINT NO.	11	ARC	16	RADIUS
02	USED	07	THIS HD	12		17	Σ LATS
03	USED	08	THIS LAT	13	Ne	18	Σ DEPS
04	USED	09	THIS DEP	14	Ee	19	DEC FIX NO.

* Step 5 will not work without a printer!

FIELD DATA COLLECTOR EXAMPLE



GIVEN: The above field traverse data.

INPUT	PRESS	REMARKS
	[■] [J]	Access program.
	[R/S]	Initialize.
32.1708	[D]	Bearing of first leg.
269.11	[J]	V/ZA
507.21	[E]	Slope distance.
66.1907	[ENTER]	Convert def. angle to
180	[+] [F]	CWBS.
301.77	[E]	HD
135.2652	[F]	CWBS
880.15	[E]	HD
75.13	[CHS] [F]	CCWBS
697.36	[E]	HD
178.3716	[F]	CWBS
88.3	[J]	V/ZA
1009.56	[E]	Slope distance.
6	[ENTER]	INST (Sideshot)
5	[ENTER]	BS (Sideshot)
10	[■] [d]	Assign point number.
112.29	[F]	CWBS (Sideshot)
216.78	[E]	HD (Sideshot)
99.0636	[CHS] [F]	CCWBS
876.29	[E]	HD
188.4237	[F]	CWBS
500	[E]	HD
264.3252	[F]	CWBS
1.47	[J]	V/ZA
1521.84	[E]	Slope distance.
119.2	[CHS] [F]	CCWBS
	[■] [c]	Check angular EOC.
	[R/S]	Distance EOC is bad. Since angles are OK, let's check the distances.

INPUT	PRESS	REMARKS
1	[I]	OK
2	[I]	And, we see a digit reversal, and correct it.
310.77	[R/S]	
	[XEQ] [F]•	Check EOC again. Looks good.
		(All the above could have been done in the field or office.)
		Connect the printer.
	[XEQ] [J]	Special initialization.
1000	[ENTER]	Input beginning coordinates.
	[R/S]	Angles are adjusted and the traverse computed.
		Now, let's adjust the traverse.
	[■] [H]	Access program.
	[R/S]	Initialize;
1	[R/S]	Input first point No.
	[A]	Adjust traverse using Crandall Rule.
	[■] [J]	Access FIELD DATA again.
	[XEQ] [I]	Compute sideshot
		Compute final traverse with AREA / INVERSE program.
	[■] [I]	Access program.
	[R/S]	Identify program on tape.
1	[D]	Input point numbers.
3	[E]	
600	[A]	Radius, right.
5	[E]	
10	[E]	
7	[E]	
350	[CHS] [A]	Radius, left.
8	[E]	
1	[E]	
	[C]	Compute area.

SUP-R-ROM© FIELD DATA COLLECTOR

■ a CWBS Reading	■ b	■ c EOC	■ d Sideshot	■ e V/ZA
A NE	B SE	C SW	D NW	E Distance
F CWBS	G	H Angle Corr.	I Distance Corr.	J V/ZA

REQUIRED SIZE: 300

STEP	PROCEDURE	INPUT	PRESS
1	Access program		[■] [J]
2	Initialize.		[R/S]
3	a. (Optional) Fix decimal if FIX 4 is not satisfactory.	Number	[STO] [19]
	b. (Optional) Input grid factor (OR any other factor: sea level, scale, combined.)	Factor	[STO] [11]
	c. (Optional) Input temperature in ^{o}F.	Temperature	[■] [F] [H] [■] [J]
	d. (Optional) Input angle criterion in decimal of degree (IF 12 seconds is not acceptable.)	Angle	[STO] [03]
	e. If angles are not to be doubled, set Flag 04.		[■] [SF] [04]
4	a. Input bearing of first leg of traverse.	Bearing	[A] [B] [C] or [D]
	b. Input V/ZA (if applicable). SEE BELOW.		
	c. Input distance of first leg.	Distance	[E]
5	Input HZA. SEE BELOW.		
6	Input V/ZA (if applicable). SEE BELOW.		
7	Input horizontal or slope distance.	Distance	[E]
8	STORING SIDESHOT DATA		
	a. Input INST point number.	INST	[ENTER]
	b. Input BS point number..	BS	[ENTER]
	c. Assign point number to the sideshot.	Number	[■] [d]
	d. Input HZA. (Step 5)		
	e. Input distance. (Step 7, or if slope, Steps 6 and 7.) (Distance must not be greater than 999.99.)		
	EXECUTE STEPS 5, 6, 7, AND 8 AS NECESSARY TO INPUT ALL ANGLES AND DISTANCES. (Your last entry will be an angle.)		
9	If traverse is between two sets of known coordinates, input the final bearing.	Bearing	[A] [B] [C] or [D]
*** ***	* *	* * * * * * * * * *	* * * * * * * * * * *
V/ZA	a. To input V/ZA directly,	V/ZA	[J]
	b. To input V/ZA by scale readings: Input first reading (near 90^{o})	1st Reading	[■] [e]
	Input second reading (near 270^{o})	2nd Reading	[J]
HZA	a. To input horizontal angles directly: If CWBS	CWBS	[F]
	If CCWBS	CCWBS	[CHS] [F]
	b. To input HZA by scale or vernier readings: Input first BS reading.	BS Reading	[ENTER]
	Input first FS reading.	FS Reading	[■] [a]
	Input second BS reading.	BS Reading	[ENTER]
	Input second FS reading.	FS Reading	[R/S]
	*NOTE: YOU MAY USE [XEQ] [F] TO CHECK EOC ANY NUMBER OF TIMES AFTER MAKING AN ENTRY CORRECTION WITHOUT AFFECTING THE TRAVERSE.		

NOTE: Angles are not meaned unless readings are input (HZA, b above). When angles are being meaned, if the difference between the first and second angles exceeds the acceptable criterion, "BAD ANGLE" is displayed. You may return to HZA (b) and turn the entire set over. OR, you may determine which angle is "good" by recalling Registers 07 and 08. The good angle needs to be stored in Register 07; so transfer the contents of 08 to 07 if necessary and proceed as follows:

Input second (actually third) BS reading and press [ENTER]
Input second (actually third) FS reading and press [XEQ] [A]

TAPE PRODUCED BY FIELD DATA EXAMPLE ON PAGE 16.

```
           1.   ***
  1,000.0000   ***
  1,000.0000   ***

N 32.1700 W
HD= 507.1585

           2.   ***
  1,428.7500   ***
    729.1060   ***

N 34.0205 E
HD= 310.7700

           3.   ***
  1,686.2842   ***
    903.0439   ***

N 10.3056 W
HD= 880.1500

           4.   ***
  2,551.6525   ***
    742.4143   ***

S 85.4350 E
HD= 697.3600

           5.   ***
  2,499.7345   ***
  1,437.8390   ***

S 87.0627 E
HD= 1,009.2140

           6.   ***
  2,448.8073   ***
  2,445.7673   ***

S 6.1257 E
HD= 876.2900

           7.   ***
  1,577.6687   ***
  2,540.6447   ***

S 2.2947 W
HD= 500.0000

           8.   ***
  1,078.1432   ***
  2,518.8665   ***
```

```
S 87.0245 W
HD= 1,521.1029

           9.   ***
    999.7537   ***
    999.7848   ***


ΣHD= 6,302.0454
ΣLATS= -0.2463
ΣDEPS= -0.2152
EOC DIST= 0.3271
N 41.0843 E
PREC= 1: 19,2[illegible].9262

SQFT= 2,435 951.245
ACRS= 55 9217

TRAV ADJ

CRAN RULE
           1.   ***
  1,000.0000   ***
  1,000.0000   ***

N 32.1700 W
507.1807

           2.   ***
  1,428.7600   ***
    729.0949   ***

N 34.0205 E
310.8072

           3.   ***
  1,686.3338   ***
    903.0528   ***

N 10.3056 W
880.2221

           4.   ***
  2,551.7729   ***
    742.4101   ***

S 85.4350 E
697.4043

           5.   ***
  2,499.8516   ***
  1,437.8789   ***

S 87.0627 E
1,009.2806
```

```
           6.   ***
  2,448.9211   ***
  2,445.8736   ***

S 6.1257 E
876.2127

           7.   ***
  1,577.8594   ***
  2,540.7427   ***

S 2.2947 W
499.9503

           8.   ***
  1,078.3836   ***
  2,518.9666   ***

S 87.0245 W
1,520.9877

           9.   ***
  1,000.0000   ***
  1,000.0000   ***


           6. INST
  2,448.9211   ***
  2,445.8736   ***

           5.  BS
  2,499.8516   ***
  1,437.8789   ***

DEF= 292.2860
N 25.2233 E
HD= 216.7800

          10.   ***
  2,644.7853   ***
  2,538.7756   ***
```

```
AR/INV

           1.   ***
  1,000.0000   ***
  1,000.0000   ***

N 8.0224 W
HD= 693.1470

           3.   ***
  1,686.3338   ***
    903.0528   ***

N 33.1919 E
HD= 973.5760

ARC= 1,135.6742
R= 600.0000
           5.   ***
  2,499.9516   ***
  1,437.8789   ***

N 82.3000 E
HD= 1,110.3960

          10.   ***
  2,644.7853   ***
  2,538.7756   ***

S 0.0620 E
HD= 1,066.9277

           7.   ***
  1,577.8594   ***
  2,540.7427   ***

S 2.2947 W
HD= 499.9503

ARC= 556.8510
R= -350.0000
           8.   ***
  1,078.3836   ***
  2,518.9666   ***

S 87.0245 W
HD= 1,520.9877

           1.   ***
  1,000.0000   ***
  1,000.0000   ***

SQFT= 2,351,557.118
ACRS= 53.9843
```

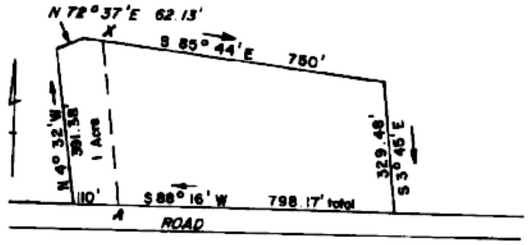
SUP-R-ROM©	FIELD DATA COLLECTOR			
■ a CWBS Reading	■ b	■ c EOC	■ d Sideshot	■ e V/ZA Reading
A NE	B SE	C SW	D NW	E Distance
F CWBS	G	H Err Corr Angle	I Err Corr Distance	J V/ZA

STEP	PROCEDURE	INPUT	PRESS
10	Closure data: a. For angular EOC,		[■] [c]
	b. For distance EOC:		
	If traverse is a closed loop,		[R/S]
	If traverse is not a closed loop,	N_b	[ENTER]
		E_b	[ENTER]
	Note: If you make any corrections to the Traverse you may check closure again by pressing [XEQ] [F].	N_e	[ENTER]
		E_e	[R/S]
	(Executing Step 10 changes no registers.)		
	See "RECOVERING FROM INPUT ERRORS" on page 54.		
* * *	* *	* * * * * * * * * * * * * * * * * *	* *
	COMPUTING AND PRINTING FIELD DATA		
	BE SURE PRINTER IS CONNECTED		
1	Access program.		[■] [J]
2	Special initialization.		[XEQ] [J]
3	Input beginning coordinates:	N_b	[ENTER]
		E_b	[R/S]
	The angular error will be distributed to all courses, and courses and coordinates will be printed, unless coordinate printing is supressed by clearing Flag 00. Closure data and area will be printed.		
4	If traverse is not a closed loop, input end coordinates.	N_e	[ENTER]
		E_e	[R/S]
	The closure data and a meaningless area will be printed again.		
5	Go to TRAVERSE ADJUSTMENT program, if desired.		
6	If sideshots were stored, return to this program:		
	a. Access program.		[■] [J]
	b. Compute sideshot coordinates.		[XEQ] [I]
7	Go to AREA / INVERSE program for final computation of traverse.		
	NOTE: This program may also be used as an office routine where you wish to input raw field data, balance the angles, etc.		

FIELD DATA COLLECTOR — REGISTER CONTENTS

00 IND STO/RCL	05 AREA	10 TEMP FACTOR	15 AZIMUTH
01 Σ HZA	06 POINT NO.	11 GRID FACTOR	16 Σ HD
02 USED	07 1ST ∡	12 V/ZA	17 Σ LATS
03 HZA CRITERION	08 2ND ∡	13 BEG AZIMUTH	18 Σ DEPS
04 USED	09 USED	14 END AZIMUTH	19 DEC FIX NO.

PREDETERMINED AREA I EXAMPLE



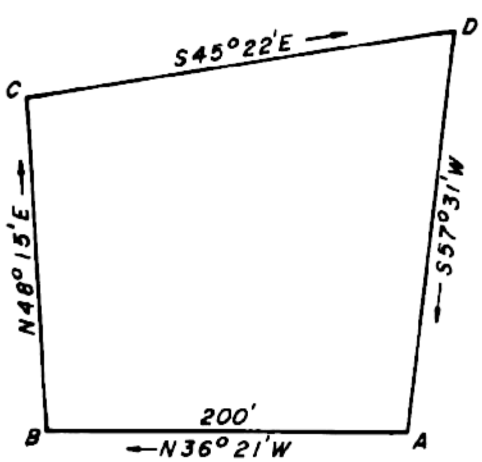
GIVEN: The above figure.

FIND: It is required to stake out a lot on the west side with 110 frontage and contain exactly one acre.

INPUT	PRESS	REMARKS
	[■] [K]	Access program.
	[R/S]	Initialize.
43560	[■] [a]	Input required area.
88.16	[C]	Input traverse.
110	[E]	
4.32	[D]	
391.38	[E]	
72.37	[A]	
62.13	[E]	
85.44	[B]	
750	[E]	Figure is completed.

```
PRED AREA

43,560.0000

S 88.1600 W
HD= 110.0000

N 4.3200 W
HD= 391.3800

N 72.3700 E
HD= 62.1300

S 85.4400 E
HD= 46.6315

S 4.5922 E
HD= 403.4500

SQFT= 43,560.0000
ACRS= 1.0000
```

PREDETERMINED AREA II EXAMPLE



GIVEN: The above figure.

FIND: The unknown distances to enclose exactly one acre.

INPUT	PRESS	REMARKS
	[■] [K]	Access program.
	[R/S]	Initialize.
43560	[F]	Input required area.
36.21	[D]	Input bearings around the figure.
48.15	[A]	
45.22	[B]	
57.31	[C]	
200	[J]	Input distance AB.
		Figure is completed.

```
PRED AREA

43,560.0000

N 36.2100 W
N 48.1500 E
S 45.2200 E
S 57.3100 W
HD= 200.0000

N 36.2060 W
HD= 200.0000

N 48.1500 E
HD= 183.8799

S 45.2200 E
HD= 235.0726

S 57.3100 W
HD= 220.4065

SQFT= 43,560.0000
ACRS= 1.0000
```

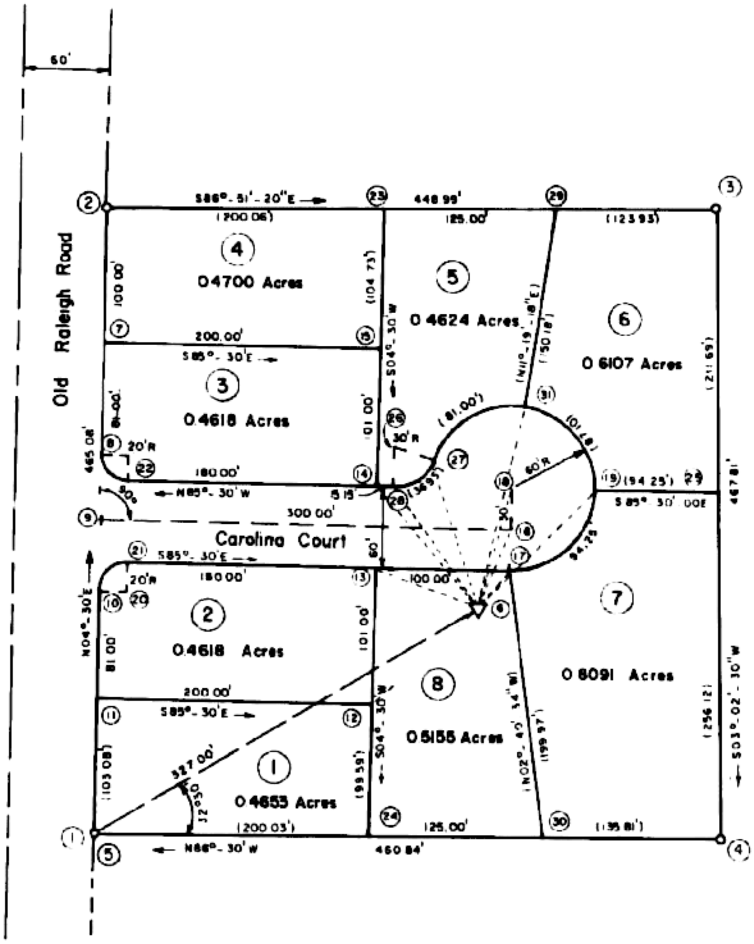
SUP-R-ROM©	PREDETERMINED AREA			
■ a PA (I)	■ b RCL (I)	■ c	■ d	■ e
A NE	B SE	C SW	D NW	E Distance
F PA (II)	G RCL (II)	H	I	J Distance

STEP	PROCEDURE	INPUT	PRESS
	PREDETERMINED AREA I		
1	Access program.		[■] [K]
2	Initialize.		[R/S]
3	Input desired area in square feet.	Area	[■] [a]
4	Input first course.	Bearing Distance	[A] [B] [C] or [D] [E]
	(Note that the distance is not printed until it is certain that the desired area will not be achieved on that course.)		
	Continue inputting successive courses in a clockwise or counterclockwise direction until the calculator completes the figure to enclose the desired area.		
5	If used in the field without the printer: For distance ?X For bearing XA For distance XA		 [■] [b] [R/S] [R/S]
• • •	• •	• • • • • • • • •	• • • • • • • • • • •
	PREDETERMINED AREA II		
1	Access program.		[■] [K]
2	Initialize.		[R/S]
3	Input desired area in square feet.	Area	[F]
4	Input bearings AB, BC, CD, and DA in clockwise order.	Bearing	[A] [B] [C] or [D]
5	Input distance AB.	AB	[J]
6	If used in the field without the printer: For distance AB For distance BC For distance CD For distance DA		 [G] [R/S] [R/S] [R/S]
	NOTE: If courses BC and AD converge and the desired area is larger than that which would be enclosed in the triangle, NO SOLUTION is printed.		

REGISTER CONTENTS

00 PA I / PA II / USED	05 AREA / SIN D	10 / DA	15 AZIM / USED
01 PRED AREA	06 / SIN X	11 XA / AZIM AB	16 CX / A + B
02 Σ LATS / SIN A	07 / AB	12 CLOS AREA /AZIM BC	17 / B
03 Σ DEPS / SIN B	08 DIST / BC	13 Σ LATS / AZIM CD	18 / C
04 USED / SIN C	09 / CD	14 Σ DEPS / AZIM DA	19 DEC FIX NO.

STAKEOUT EXAMPLE



GIVEN: The above figure and the registers intact from COGO example.

INPUT	PRESS	REMARKS
	[■] [L]	Access program.
	[R/S]	Initialize.
	[■] [CF] [00]	Let's not print coordinates.
6	[■] [C]	Input INST.
1	[R/S]	Input BS.
13	[E]	Input SOPT numbers.
14	[E]	
28	[E]	
27	[E]	
31	[E]	
18	[E]	
16	[E]	
17	[E]	
12	[E]	

```
STAKEOUT

                 6. INST
                 1.   BS
                13. SOPT
N 67.3049 W
HD= 76.4153
CWBS= 51.2911

                14. SOPT
N 36.3017 W
HD= 110.7779
CWBS= 82.2943

                28. SOPT
N 30.0213 W
HD= 101.4813
CWBS= 88.5747

                27. SOPT
N 11.1560 W
HD= 107.6463
CWBS= 107.4401

                31. SOPT
N 18.0140 E
HD= 147.2569
CWBS= 137.0140

                18. SOPT
N 22.3550 E
HD= 87.9469
CWBS= 141.3550

                16. SOPT
N 31.3032 E
HD= 60.1572
CWBS= 150.3032

                17. SOPT
N 53.4055 E
HD= 36.0986
CWBS= 172.4055

                12. SOPT
S 47.4151 W
HD= 106.1785
CWBS= 346.4152
```

SUP-R-ROM ©		STAKEOUT		
■ a	■ b	■ c INST BS	■ d	■ e
A	B	C	D	E SOPT
F	G	H	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [L]
2	Initialize.		[R/S]
3	Input INST point number.	INST	[■] [c]
4	Input BS point number.	BS	[R/S]
5	Input stakeout point number.	SOPT	[E]
	Repeat Step 5 for all points to be set from this INST point.		
6	If used without the printer, after Step 5 has been executed, the CWBS is in the display.		
	To display the HD,		[RCL] [07]

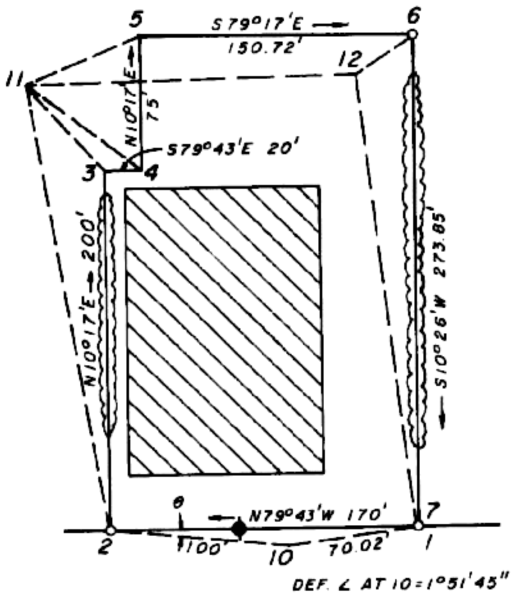
REGISTER CONTENTS

STAKEOUT

00 IND STO/RCL	05	10	15 AZIMUTH
01	06 POINT NO.	11	16
02	07 HD	12	17 N
03	08	13 USED	18 E
04	09	14 USED	19 DEC FIX NO.

(24)

SEARCH / SET EXAMPLE



In the above figure, Points 1 through 7 were stored in the calculator using FIELD TRAVERSE. On arriving at the site, Points 1 and 2 were found but they were not intervisible. So a temporary point was set 100' from Point 2, and angle was turned to Point 1, and the distance measured. Then to store the coordinates of Point 10:

INPUT	PRESS	REMARKS
	[■] [F]	Access FIELD TRAVERSE.
	[R/S]	Initialize
0	[ENTER]	Assume beginning coordinates of zero.
	[XEQ] [B]	
10	[R/S]	When prompted: 1.0000 OK?, assign 10.
0	[A]	Assume bearing of North for first leg.
100	[E]	
1.5145	[D]	
70.02	[E]	
	[■] [d]	Compute closure of triangle. If the printer is not attached, as soon as the next display appears, touch [R/S] quickly. You should see the bearing from Point 1 to Point 2 (S 0.4601 E), which is equal to the angle Θ. If you were not quick enough pressing [R/S], try pressing [ALPHA]; If it isn't in the alpha register, recall the azimuth from Register 15 and convert it to its bearing in DD.MMSS. Also you may check the distance from Point 1 to Point 2 by recalling Register 07.
	[■] [SST]	Access SEARCH / SET.
	[R/S]	Initialize.
2	[■] [c]	Input INST. <u>If printer is not attached, clear Flag 07 before proceeding.</u> Press: [■] [CF] [07].
1	[R/S]	Input BS.
.4601	[F]	Θ is your CWBS.
100	[E]	Input distance. Assign 10 to the temporary point. NOTE: You may prefer solving the triangle by some other method; but the idea is to get the temporary point stored in the calculator on the same datum as the other points.
2	[■] [c]	Input INST. <u>If the printer is not attached, clear Flag 07 before proceeding.</u> Press: [■] [CF] [07].
10	[R/S]	Input BS
258.47	[F]	Set satellite point. Turn CWBS and get distance.
251.22	[E]	11 is OK.
	[R/S]	
3	[■] [e]	Where is Point 3 from here? Display shows: CWBS= 326.2215.
	[⇔]	Display shows: 65.4991. So we BS on Point 2, turn 326° 22' 15", and measure 65.50'; And we find Point 3 or we set it.
4	[■] [e]	Where is Point 4 from here? Display shows: CWBS= 316.0656.
	[⇔]	Display shows: 80.7014. So we BS on Point 2, turn 316° 06' 56" and measure 80.70'. And we either find Point 4 or we set it.
5	[■] [e]	Where is Point 5 from here? Display shows: CWBS= 257.2150.
	[⇔]	Display shows: 71.2721. So we BS on Point 2, turn 257° 21' 50", and measure 71.27'. And we either find Point 5 or we set it.
277.01	[F]	Set satellite point. Turn CWBS and measure distance.
183.57	[E]	Assign 12 to point.
12	[R/S]	
6	[■] [e]	Where is Point 6 from this new satellite point? Display shows: .157.5119.
	[⇔]	Display shows: 36.6292. So we BS on Point 11, turn 157° 51' 19", and measure 36.63'. And we either find Point 6 or we set it.
		Now, you may make a tie back to Point 1, and complete the closure for a check.

SUP-R-ROM ©		SEARCH / SET		
■ a Occupy	■ b	■ c INST BS	■ d	■ e Where is Point nn?
A NE	B SE	C SW	D NW	E Distance
F CWBS	G Def	H	I	J V/ZA

STEP	PROCEDURE	INPUT	PRESS
1	Load the deed or map calls into the calculator using FIELD TRAVERSE. Adjust the traverse, if necessary. (These items may be done before leaving the office.)		
2	Find any two intervisible corners. If no two are intervisible, follow a procedure similar to the one shown in the example on the facing page.		
3	Access program.		[■] [SST]
4	Initialize.		[R/S]
5	a. Input INST point number.	INST	[■] [c]
	b. Input BS point number.	BS	[R/S] *
6	Set satellite point:		
	a. Input field angle: If CWBS.	Angle	[F]
	If deflection.	Angle	[G]
	b. Input distance. If horizontal.	HD	[E]
	If slope.	V/ZA Angle	[J]
		Slope distance	[E]
	OR you may skip this step for now.		
7	Request the location of desired corner.	Point No.	[■] [e]
	The display will show the CWBS angle to the point. To display the distance, press [x≷y]. (The distance is stored in the X register; the angle is in the alpha register.)		
8	a. If the corner is NOT found, you may set it using the data generated in Steo 7. Then, you have three options: 1. You may request the location of another corner (Step 7). 2. You may set another satellite point (Step 6).		
	3. You may occupy the point just set.		[■] [a]
	(You will be prompted for the point No. with the same number used in Step 7; you may change it or use it as is.)		[R/S]
	b. If the corner is found and the field measurements are so close that you do not wish to refine them, you have the same options listed in Step 8a.		
	c. If the corner is found and you do wish to refine the field measurements: (1) Execute Step 6. (Point is occupied.) (2) You may proceed from the corner just occupied, or you may re-occupy the satellite point by executing Step 5.	* If printer is NOT attached, after each excecution of Steps 5a and 5b Flags 06 & 07 must be cleared before proceeding [■] [CF] [06] [■] [CF] [07]	

REGISTER CONTENTS

SEARCH/SET

00 IND STO/RCL	05	10	15 AZIMUTH
01	06 POINT NO.	11	16
02	07 HD	12	17 N
03	08 THIS LAT	13 USED	18 E
04	09 THIS DEP	14 USED	19 DEC FIX NO.

QUIK-CHEK EXAMPLE

Once upon a time, a kindly judge assigned four surveyors to make a survey of a piece of property. When they met on the site, each had brought his own favorite measuring device, and true to their breed, each insisted that only his system of measurement made sense.

John Johnson believed only in feet and tenths; Wojokowitz insisted on poles, naturally; Sam Gunter said, "If it was good enough for great, great, great, great grandpa Edmund, it's good enough for me." And Pierre LeBlanc commented, "Voila," which being translated says, "Think Metric."

Since no one was willing to yield, they agreed to disagree. And decided that since there were four sides to the property, that each would measure one side and so record it.

And, believe it or not, the following deed resulted:

Beginning at a point in the center of a Giant Redwood tree with dogwood and blackgum pointers; thence N 69° 09' E 801.36 feet to an iron stake; thence S 21° 18' E 9 chains and 85 links to another iron stake; thence S 72° 08' W 51 poles to a lightwood knot; thence N 17° 39' W 185.08 meters to the point of beginning, containing exactly **11.8449** acres, more or less.

"But how are we going to know if we have a good closure?" someone asked. "Aha," said the kindly judge, "Fear not, for I brought my trusty 41CV and my SUP-R-ROM module." "And you're going to use the QUIK-CHEK program!" they all cried in unison.

AND SO,

INPUT	PRESS
	[■] [Q]
	[R/S]
69.09	[A]
801.36	[E]
21.18	[B]
9.85	[J]
72.08	[C]
51	[F]
17.39	[D]
185.08	[H]
	[R/S]

```
QUIK-CHEK

N 69.0900 E
FT= 801.3600

S 21.1800 E
CH= 9.8500
FT= 650.1000

S 72.0800 W
POL= 51.0000
FT= 841.5000

N 17.3900 W
M= 185.0800
FT= 607.2105


ΣHD= 2,900.1705
ΣLATS= -0.0181
ΣDEPS= 0.0087
EOC DIST= 0.0201
N 25.4119 W
PREC= 1: 144,406.6460
```

"One in 144,000?" said the judge. "Why that's fantastic!"

"Voilá" said Pierre.

"And they think they're so hot," thought the little back rodman. "Why if I hadn't been moving those tacks over in the center of the stakes, they wouldn't have been in the same county!"

SUP-R-ROM ©	QUIK-CHEK			
■ a	■ b	■ c	■ d	■ e
A NE	B SE	C SW	D NW	E Feet
F Poles/Rods	G	H Meters	I	J Chains

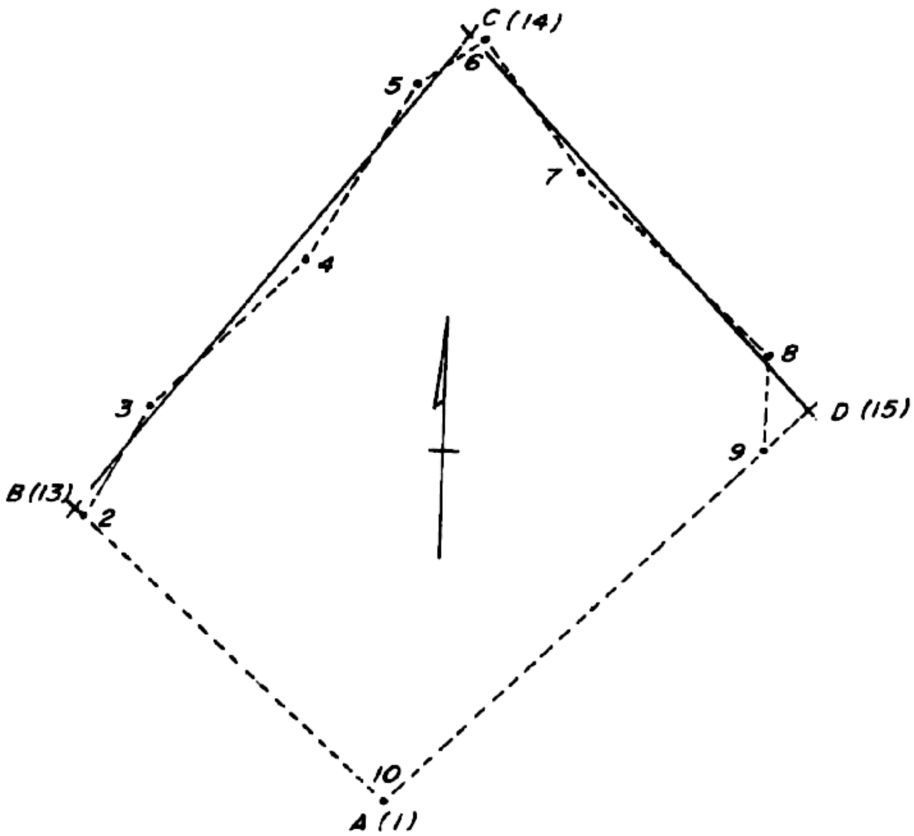
STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [Q]
2	Initialize.		[R/S]
3	Input bearing.	Bearing	[A] [B] [C] or [D]
4	Input distance:		
	If feet,	Distance	[E]
	If chains,	Distance	[J]
	If poles or rods,	Distance	[F]
	If meters,	Distance	[H]
5	For closure data.		[R/S]
	For area.		[R/S]
	NOTE: If input is other than feet, conversion is made to feet, and all output is in feet or square feet.		

REGISTER CONTENTS

QUIK-CHEK

00	05 AREA	10	15 AZIMUTH
01	06	11	16 Σ HD
02	07 EOC	12	17 Σ LATS
03	08 THIS DEP	13	18 Σ DEPS
04 USED	09	14	19 DEC FIX NO.

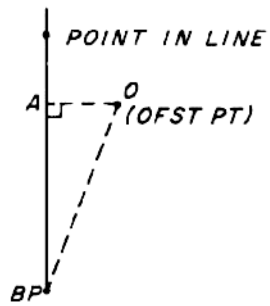
PERPENDICULAR OFFSET EXAMPLE



INPUT	PRESS	REMARKS
	[■] [M]	Access program.
	[R/S]	Initialize.
13	[R/S]	Input base point number.
14	[R/S]	Input another point in the base line
		Compute perpendicular offsets for Points 2, 3, 4, 5, and 6.
2	[R/S]	
3	[R/S]	
4	[R/S]	
5	[R/S]	
6	[R/S]	
	[E]	New problem.
14	[R/S]	Input base point number.
43.4658	[B]	Let's input the bearing for this problem.
	[■] [SF] [03]	Let's print coordinates of the points on the base line and store them.
6	[R/S]	Input point number.
16	[R/S]	Assign 16 to the point.
7	[R/S]	Input point number.
17	[R/S]	Assign 17 to the point.
8	[R/S]	Input point number.
18	[R/S]	Assign 18 to the point.

```
PER OFST

BASE NO= 13.0000
LINE NO= 14.0000

OFST NO= 2.0000
BASE= -0.3514
OFST= 4.5651 RT

OFST NO= 3.0000
BASE= 143.4198
OFST= 6.8226 LT

OFST NO= 4.0000
BASE= 369.1066
OFST= 5.0886 RT

OFST NO= 5.0000
BASE= 599.4461
OFST= 9.5195 LT

OFST NO= 6.0000
BASE= 675.8473
OFST= 6.6799 RT


BASE NO= 14.0000
S 43.4658 E

OFST NO= 6.0000
BASE= 5.8818
OFST= 5.5061 LT

             16   ***
    621758.3739   ***
    222097.0291   ***

OFST NO= 7.0000
BASE= 183.3685
OFST= 8.5368 RT

             17   ***
    621630.2340   ***
    222219.8369   ***

OFST NO= 8.0000
BASE= 465.9583
OFST= 3.0262 LT

             18   ***
    621426.2132   ***
    222415.3682   ***
```

SUP-R-ROM ©		PERPENDICULAR OFFSET		
■ a	■ b	■ c	■ d	■ e
A NE	B SE	C SW	D NW	E New Prob.
F	G	H	I	J

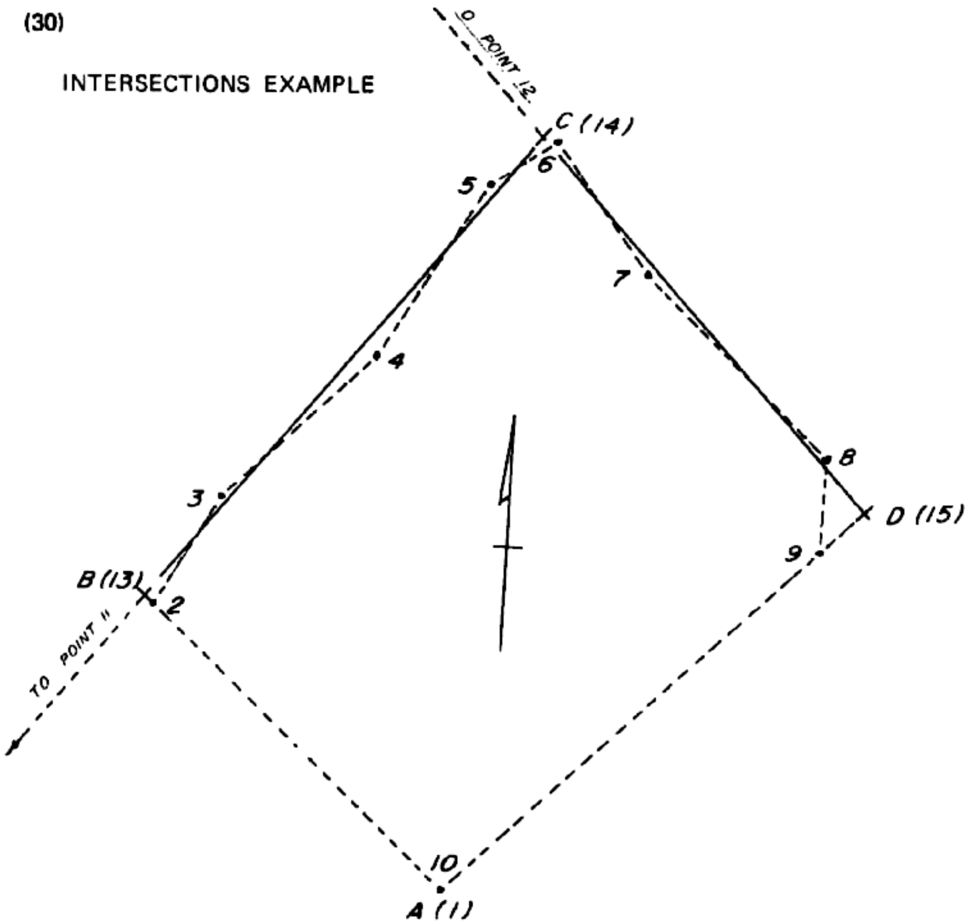
STEP	PROCEDURE	INPUT	PRESS
			
1 1	Access program.		[■] [M]
2	Initialize.		[R/S]
3	If you wish to store the coordinates of Point A,		[■] [SF] [03]
4	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	BASE NO= — Input base point number.	Number	[R/S]
	LINE NO= — Input number of any other point in the line.	Number	[R/S]
	OR, input bearing of the base line.	Bearing	[A] [B] [C] or [D]
	OFST NO= — Input number of the offset point.	Number	[R/S]
	?.0000 OK? — If Flag 03 was set in Step 3, the display prompts with the offset point number. If OK for Point A to replace the offset point, press, [R/S]. If not, assign point number and press [R/S].		
	After each computation, the calculator will prompt for another offset point number.		
	NOTE: A negative base distance indicates the offset point is back of the base point.		
5	For new problem.		[E]
6	FIELD USE: (If used without a printer, be sure Flag 03 is clear.)		
	For offset distance,		[R ↓]
	For base distance,		[R ↓]
	If Flag 03 is set, the offset distance is lost, but the base distance is stored in Register 04. If you wish to store the coordinates of Point A, you may input the OFST NO once with Flag 03 clear, retrieve your distances, and then repeat with Flag 03 set.		

REGISTER CONTENTS

PER OFST

00	IND STO/RCL	05	DIST BP TO O	10		15	BASE LINE AZIM
01		06	POINT NO.	11		16	
02	Nbp	07	AZIM BP TO O	12		17	
03	Ebp	08	Na	13		18	
04	DIST BP TO A	09	Ea	14		19	DEC FIX NO.

INTERSECTIONS EXAMPLE



GIVEN: The above figure and the registers intact from the LINEAR REGRESSION example.

PROMPT	INPUT	PRESS	REMARKS
		[■] [N]	Access program.
		[R/S]	Initialize.
BEG PT NO?	11	[R/S]	
END PT NO?	1	[R/S]	
D1?		[R/S]	
D2?		[R/S]	
BRNG?	38.1234	[A]	
BRNG?	47.2359	[B]	Use adjusted bearing from 2 to 1.
140.0000 OK?	13	[R/S]	Assign 13 to Point B.
		[J]	New problem.
BEG PT NO?	13	[R/S]	
END PT NO?	12	[R/S]	
D1?	38.1234	[A]	Note that for a BBI, it is not necessary to step through prompts for D1 and D2.
BRNG?	42.4025	[D]	
140.0000 OK?	14	[R/S]	Assign 14 to Point C.
		[J]	New problem.
BEG PT NO?	14	[R/S]	
END PT NO	1	[R/S]	
D1?	42.4025	[B]	
BRNG?	45.181	[C]	
140.0000 OK?	15	[R/S]	Assign 15 to Point D.
			GO TO PAGE 48.

```
INTERSECT

                    11.0000
                     1.0000
N 38.1234 E
S 47.2359 E


BBI
                  11.      ***
            462.4601      ***
              0.0000      ***

N 38.1234 E
1,075.7165
                  13.      ***
          1,307.7097      ***
            665.3715      ***

S 47.2359 E
454.6004
                   1.      ***
          1,000.0000      ***
          1,000.0000      ***


                    13.0000
                    12.0000
N 38.1234 E
N 42.4025 W


BBI
                  13.      ***
          1,307.7097      ***
            665.3715      ***

N 38.1234 E
671.3427
                  14.      ***
          1,835.2205      ***
          1,080.6224      ***

N 42.4025 W
1,594.2589
                  12.      ***
          3,007.3625      ***
              0.0000      ***


                    14.0000
                     1.0000
S 42.4025 E
S 45.1810 W


BBI
                  14.      ***
          1,835.2205      ***
          1,080.6224      ***

S 42.4025 E
537.3313
                  15.      ***
          1,440.1691      ***
          1,444.8369      ***

S 45.1810 W
625.7961
                   1.      ***
          1,000.0000      ***
          1,000.0000      ***
```

SUP-R-ROM ©	INTERSECTIONS			
■ a	■ b	■ c	■ d	■ e
A NE	B SE	C SW	D NW	E New Sol (Same Coord)
F	G	H	I	J New Prob

STEP	PROCEDURE	INPUT	PRESS
1.	Access Program		[■] [N]
2.	Initialize.		[R/S]
	(TO FIX DECIMAL)	Number	[sto] [19]
3.	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	a. BEG PT NO? — If points are stored in the calculator, input beginning point number. If points are not stored, press [R/S] without keyboard entry and go to step 3c.	Number	[R/S]
	b. END PT NO? — Input ending point number.	Number	[R/S]
	c. NbEbNeEe? — Input beginning and ending coordinates.	N_b E_b N_e E_e	[ENTER] [ENTER] [ENTER] [R/S]
	d. D1? — Input the first distance, if known. If unknown, press [R/S] without keyboard entry.	D1	[R/S]
	e D2? — Input the second distance, if known. If unknown, press [R/S] without keyboard entry.	D2	[R/S]
	f. BRNG? — Input bearing of first course and/or bearing of second course.	Bearing	[A] [B] [C] or [D]
	g. 140.0000 OK? — When the calculator has enough data, computation begins. When the first course has been computed, this prompt occurs. If OK for the intersection point to be numbered 140, press [R/S]. If not, input desired number. (Do not assign a number greater than 140).	Point Number	[R/S]
4	For second solutions.		[R/S]
5	If you wish to try another solution using the same coordinates,		[E]
6	For a new problem altogether,		[J]

NOTES:

1. BBI
   a. If the second bearing is reversed, all data will be correct except the end coordinates will be printed wrong. The stored coordinates of the end point will not be affected.
   b. If the first bearing or both bearings are reversed, the coordinates of the point of Intersection will be printed wrong but the stored coordinates will be incorrect. Again, the end coordinates will be printed wrong but the stored coordinates will not be affected.
   c. The computed distances will always be correct regardless of any bearing reversal.
2. If there is no valid solution to a DDI or a BDI/DBI the calculator displays "NO SOL" and calculation ceases. And if a second solution is requested in a BBI or a third in a BDI/DBI. "NO OTHER SOL" is displayed.
3. In a DDI the clockwise solution is computed first. Generally, in a BDI/DBI, the NEAR solution is computed first. However, if the input distance is greater than the distance between the beginning point and the ending point, the configuration becomes clockwise or counterclockwise. The NEAR solution will have one negative distance, which is algebraically correct because of the bearing direction.
4. In a DDI if one of the distances is longer than the sum of the other distance plus the distance from the beginning point to the ending point, there is no valid solution and "DATA ERROR" is displayed.
5. If bearing is entered as N00000E "NO SOL" will be displayed — N00000W is O.K.

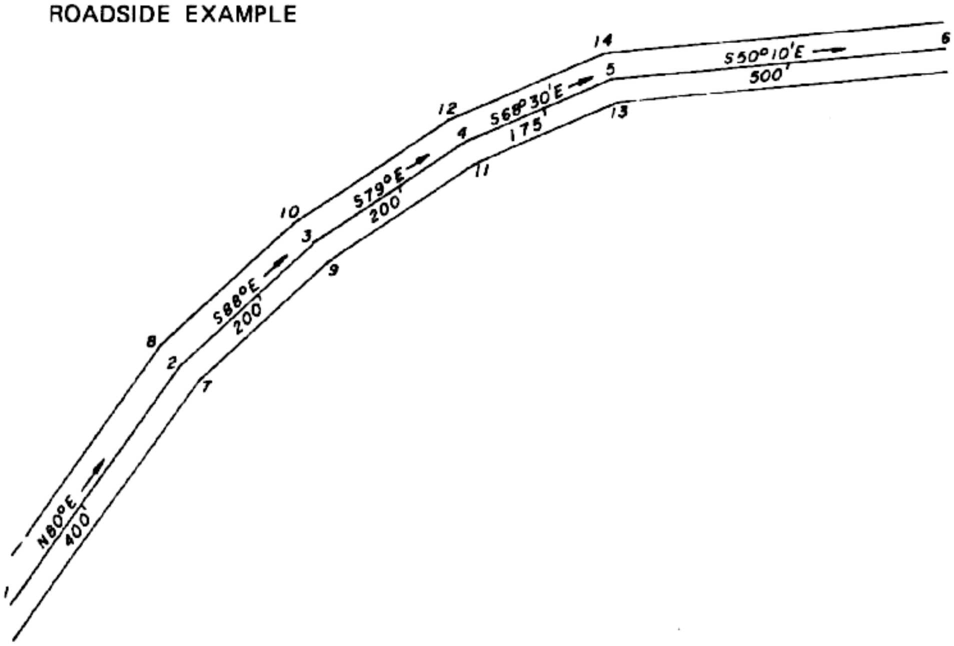
REGISTER CONTENTS

INTERSECTIONS

00 IND STO/RCL	05 USED	10 D2	15 E
01 Nb	06 USED	11 Ne - Nb	16 USED
02 Eb	07 1ST AZIMUTH	12 Ee - Eb	17 USED
03	08 D1	13 BEG PT NO.	18 N
04	09 2ND AZIMUTH	14 END PT NO.	19 DEC FIX NO.

REV. 3/26/84.

ROADSIDE EXAMPLE



GIVEN: The above figure with right-of-way offset 25' right and 30' left.

FIND: Coordinates of points in the right-of-way and diagonal distances from the centerline points.

PROMPT	INPUT	PRESS	REMARKS
			We will use FIELD TRAVERSE to store centerline coordinates.
		[■] [F]	Access program.
		[R/S]	Initialize.
	1000	[ENTER]	
		[■] [b]	
	80	[A]	
	400	[E]	
	88	[B]	
	200	[E]	
	79	[B]	
	200	[E]	
	68.3	[B]	
	175	[E]	
	50.1	[B]	
	500	[E]	
		[■] [T]	Access ROADSIDE program.
		[R/S]	Initialize.
OFST: RT ↗ LT?	25	[ENTER]	
	30	[R/S]	
BS ↗ INST ↗ FS?	1	[ENTER]	
	2	[ENTER]	
	3	[R/S]	
1.0000 OK?	7	[■] [CF] [02] [R/S]	Succeeding point numbers will be sequential.
NEXT FS?	4	[R/S]	
NEXT FS?	5	[R/S]	
NEXT FS?	6	[R/S]	

```
RDSIDE

INST= 2.0000
HD RT= 25.1377
               7.    ***
      1,044.3828    ***
      1,395.6766    ***

HD LT= 30.1652
               8.    ***
      1,099.5510    ***
      1,391.8109    ***

◆◆◆◆◆◆◆◆◆◆◆◆◆

INST= 3.0000
HD RT= 25.0773
               9.    ***
      1,037.5633    ***
      1,590.9624    ***

HD LT= 30.0928
              10.    ***
      1,092.3787    ***
      1,597.2079    ***

◆◆◆◆◆◆◆◆◆◆◆◆◆

INST= 4.0000
HD RT= 25.1053
              11.    ***
      1,000.2152    ***
      1,783.1015    ***

HD LT= 30.1264
              12.    ***
      1,053.2404    ***
      1,798.5569    ***

◆◆◆◆◆◆◆◆◆◆◆◆◆

INST= 5.0000
HD RT= 25.3234
              13.    ***
        938.3980    ***
      1,940.0338    ***

HD LT= 30.3881
              14.    ***
        986.3181    ***
      1,968.4490    ***

◆◆◆◆◆◆◆◆◆◆◆◆◆
```

SUP-R-ROM ©		ROADSIDE		
■ a	■ b	■ c	■ d	■ e
A	B	C	D	E
F	G	H	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [T]
2	Initialize.		[R/S]
3	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	a. OFST: RT ≠ LT? — Input right and left offset distances.	Distance Right Distance Left	[ENTER] [R/S]
	b. BS ≠ INST ≠ AH? — Input point numbers of backsight, instrument point, and point ahead.	BS Point INST Point Point Ahead	[ENTER] [ENTER] [R/S]
	c. 1.0000 OK? — Assign number to the point right of the INST point. (If you wish the remainder of the points to be sequential, clear Flag 02. If Flag 02 is set, you will be prompted for each point number.)	Number	[R/S]
	d. NEXT PT? — When computations are complete, you will be prompted for the next point ahead.	Point Number	[R/S]
	Continue executing Step 3d until all points have been input.		
	NOTE: If you do not wish computations for either side of the INST point, input zero for that offset in Step 3a.		

REGISTER CONTENTS

ROADSIDE

00	IND STO/RCL	05	AZIMUTH AH	10	POINT NO.	15	AZIMUTH
01	BS NO.	06	POINT NO.	11	OFFSET LT	16	HD RT
02	INST NO.	07	DIST LT	12	OFFSET RT	17	
03	FS NO.	08	N (INST)	13	N	18	
04	USED	09	E (INST)	14	E	19	DEC FIX NO.

UTILITY PROGRAM EXAMPLES

A. STORING COORDINATES BY POINT NUMBER

PROMPT	INPUT	PRESS	REMARKS
		[■] [U]	Access UTILITY program.
		[F]	Select program.
		[R/S]	Initialize.
PT NO?	1	[R/S]	Input point number.
N ↑ E?	11111	[ENTER]	Input coordinates.
	22222	[R/S]	
PT NO?	2	[R/S]	Input next point number.
N ↑ E?	33333	[ENTER]	Input coordinates.
	44444	[R/S]	
PT NO?	Etc.	Etc.	

```
STO COORD

           1.0000
      11,111.0000
      22,222.0000

           2.0000
      33,333.0000
      44,444.0000
```

B. LISTING COORDINATES BY POINT NUMBER

PROMPT	INPUT	PRESS	REMARKS
		[■] [U]	Access UTILITY program.
		[H]	Select program.
		[R/S]	Initialize.
1ST ↑ LAST?	1	[ENTER]	Input number of first point.
	2	[R/S]	Input number of last point.

```
LIST COORD

       1.        ***
     11,111.00000
     22,222.00000

       2.        ***
     33,333.00000
     44,444.00000
```

C. ANGLES FROM BEARINGS

INPUT	PRESS	REMARKS
	[■] [U]	Access UTILITY program.
12.25	[D]	Input first bearing.
10.26	[A]	Input next bearing.
	[E]	Compute CWBS.
15.25	[A]	Input next bearing.
	[E]	Compute CWBS.
10.25	[A]	Input next bearing.
	[E]	Compute CWBS.

```
N 12.2500 W
N 10.2500 E
CWBS= 22.5000

N 15.2500 E
CWBS= 5.0000

N 10.2500 E
CWBS= 355.0000
```

D. PRINTING JOB-DATE

PRESS	REMARKS
[■] [U]	Access UTILITY program.
[J]	Print JOB-DATE.

```
JOB NO..

DATE....
```

SUP-R-ROM©		UTILITY PROGRAM		
■ a	■ b	■ c	■ d	■ e
A NE	B SE	C SW	D NW	E
F Sto Coord	G	H List Coord	I	J JOB-DATE

STEP	PROCEDURE	INPUT	PRESS
1	Access program. (UTIL PGM is displayed.)		[■] [U]
2	STORING COORDINATES BY POINT NUMBER		
	a. Initialize.		[F] [R/S]
	b. Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	PT NO? — Input assigned point number.	Point Number	[R/S]
	N ↑ E? — Input coordinates.	N E	[ENTER] [R/S]
	Repeat as necessary for all coordinates.		
3*	LISTING COORDINATES BY POINT NUMBER		
	a. Initialize.		[H] [R/S]
	b. Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	1ST ↑ LAST? — Input No. of first point to be listed. Input No. of last point to be listed.	First Point No. Last Point No.	[ENTER] [R/S]
4	ANGLES FROM BEARINGS (No initialization is required.)		
	a. Input first bearing.	Bearing	[A] [B] [C] or [D]
	b. Input next bearing.	Bearing	[A] [B] [C] or [D]
	c. Compute CWBS.		[E]
	Repeat as necessary.		
	NOTE: You may omit Step 4a when inputting contiguous bearings.		
	NOTE: This program may be used in the field without the printer. The CWBS will be in the display in DD.MMSS, and stored in Register 01 in DD.dddd.		
5	To print JOB..... and DATE..... for a tape heading,		[J]

* When listing point numbers over 500, point numbers will be off by 1 digit. For example, coordinates for 501 will be shown as 502, etc.

REGISTER CONTENTS

UTIL PGM

00 IND STO/RCL	05 USED	10	15 AZIMUTH
01 CWBS	06 POINT NO.	11	16
02	07 USED	12	17
03	08	13	18
04	09	14	19 DEC FIX NO.

REV. 3/26/84.

VERTICAL CURVE ELEVATIONS EXAMPLE

GIVEN:

Beginning station	= 115 + 50
Beginning elevation	= 92.95
First VPI station	= 120 + 50
Elevation	= 105.45′
Length of VC	= 400′
Second VPI station	= 127 + 00
Elevation	= 74.58′
Length of VC	= 500′
Last station	= 133 + 17.62
Last elevation	= 81.92
Increment	= 100′

FIND: VC data, elevations for each station, station and elevation of max/min elevation for each curve, and the elevation at station 121 + 17.62.

PROMPT	INPUT	PRESS	REMARKS
		[■] [V]	Access program.
		[R/S]	Initialize.
ODD? SF 04		[■] [SF] [04]	We wish to compute one odd station.
		[R/S]	
BEG STA?	115.5	[R/S]	Note station value.
ELEV?	92.95	[R/S]	
VPI STA?	120.5	[R/S]	Note station value.
PI ELEV?	105.45	[R/S]	
LVC?	4	[R/S]	Note station value
VPI STA?	127	[R/S]	Note station value.
PI ELEV?	74.58	[R/S]	
LVC?	5	[R/S]	Note station value.
VPI STA?		[R/S]	No keyboard entry.
LAST STA?	133.1762	[R/S]	Note station value.
ELEV?	81.92	[R/S]	
INC?	1	[R/S]	Note station value. (First VC is computed.)
ODD STA?	121.1762	[R/S]]	Note station value.
		[■] [CF] [04]	Odd stations are not requested at the PT of the next curve.
		[R/S]	No keyboard entry.

```
VERT CURVE

STA= 115.5000
ELEV= 92.9500

STA= 116.0000
ELEV= 94.2000

STA= 117.0000
ELEV= 96.7000

STA= 118.0000
ELEV= 99.2000

VPI= 120.5000
ELEV= 105.4500
LVC= 4.0000
G1= 2.5000
G2= -4.7492
INC= 1.0000

VPC= 118.5000
ELEV= 100.4500

STA= 119.0000
ELEV= 101.4735

STA= 119.8795
MXMN= 102.1743

STA= 120.0000
ELEV= 102.1612

STA= 121.0000
ELEV= 101.0365

STA= 122.0000
ELEV= 98.0996

VPT= 122.5000
ELEV= 95.9515

ODD= 121.1762
ELEV= 100.6506

STA= 123.0000
ELEV= 93.5769

STA= 124.0000
ELEV= 88.8277

VPI= 127.0000
ELEV= 74.5800
LVC= 5.0000
G1= -4.7492
G2= 1.1884
INC= 1.0000

VPC= 124.5000
ELEV= 86.4531

STA= 125.0000
ELEV= 84.2269

STA= 126.0000
ELEV= 80.6652

STA= 127.0000
ELEV= 78.2910

STA= 128.0000
ELEV= 77.1044

STA= 128.4992
MXMN= 76.9564

STA= 129.0000
ELEV= 77.1053

VPT= 129.5000
ELEV= 77.5511

STA= 130.0000
ELEV= 78.1453

STA= 131.0000
ELEV= 79.3337

STA= 132.0000
ELEV= 80.5222

STA= 133.0000
ELEV= 81.7106

STA= 133.1762
ELEV= 81.9200
```

SUP-R-ROM ©	VERTICAL CURVE ELEVATIONS			
■ a	■ b	■ c	■ d	■ e
A	B	C	D	E
F	G	H	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [V]
2	Initialize. (All registers are cleared.)		[R/S]
3	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION (Input and output distances are in stations.)		
	a. ODD? SF 04 — Set Flag 04 if you wish to compute elevations for stations and pluses not covered by the increment.		[■] [SF] [04]
	b. BEG STA? — Input beginning station.	Station	[R/S]
	c. ELEV? — Input elevation of beginning station.	Elevation	[R/S]
	d. VPI STA? — Input first PI station.	PI station	[R/S]
	e. PI ELEV? — Input elevation of first PI.	Elevation	[R/S]
	f. LVC? — Input length of first vertical curve.	LVC	[R/S]
	g. VPI STA — The calculator now repeats Steps d, e, and f until all curves have been input. When the last LVC has been input and the calculator prompts for the next VPI STA?, press [R/S] without keyboard entry.		
	h. LAST STA? — Input last station.	Station	[R/S]
	i. ELEV? — Input elevation of last station.	Elevation	[R/S]
	j. INC? — Input desired increment.	Increment	[R/S]
	CALCULATION IS INITIATED.		
4	If Flag 04 was set in Step 3a, calculation ceases at the VPT of the first curve and the prompt "ODD STA?" appears. Input the station and plus and press [R/S]. When calculation is complete, the same prompt appears again, and you may compute any number of odd stations. When you are finished with the odd stations, press [R/S] without keyboard entry and calculation will be resumed. If you have no odd stations on succeeding curves, you may clear Flag 04 before pressing [R/S], and the remainder of the computations will be executed without pausing for odd station entries.		

NOTE: <u>A CAUTION ON STATION ENTRIES</u>

Station 239 + 17.22 is input 239.1722

A 400' is input as 4

Notice: We've discovered a BUG in this Vertical Curve Program. When multiple curves are entered and the increment is less than 1 (100') you may get an increment station printout before and after the P.C. If this happens use the value shown before the P.C. and disregard the one printed afterwards.

REGISTER CONTENTS

VERT CURVE

00	USED	10	PT ELEV	20	USED	30	
01	PI STA	11	DIST	21	USED	31	2ND PI STA
02	PI ELEV	12	THIS STA	22	USED	32	2ND PI ELEV
03	L/2	13	(G2 - G1) / 2L	23	FIRST STA	33	2ND LVC
04	G1	14	MXMN	24	FIRST ELEV	34	3RD PI STA
05	G2	15	LAST STA	25	LAST STA	35	3RD PI ELEV
06	INCREMENT	16	USED	26	LAST ELEV	36	3RD LVC
07	PC STA	17		27		37	4TH PI STA
08	PC ELEV	18		28		38	4TH PI ELEV
09	PT STA	19		29		39	4TH LVC
							ETC

SOLAR & POLARIS OBSERVATIONS
INTRODUCTION

EQUIPMENT you will need:

For solar observations -

1. Radio to receive WWV (time station) or a Time Kube (from Radio Shack) and an electronic watch preferably with lap time stopwatch feature.
2. Solar ephemeris.
3. Map to scale the longitude and latitude of the point of observation. A US Geological Survey quad sheet is ideal.
4. Sun filter for theodolite. If you have a "total station", be sure to buy a filter for the front (objective) lens of the instrument so you will not damage the electronic portion of the instrument.

For Polaris observations -

1. Items 1 through 3 above.
2. Night lighting attachment for theolodite with cross hair illumination.

SOLAR OBSERVATION

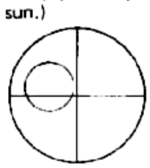
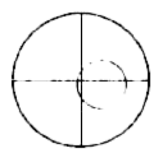
First, a word of caution. Under NO circumstances should you attempt to observe the sun without a filter. Even a fraction of a second of exposure to the magnified rays of the sun WILL (not may) destroy the retina. Also be sure to buy a filter furnished by your instrument manufacturer that fits properly, and be equally sure that you have attached it properly so that it does not fall off during the observation.

Occupy the point from which you wish to make the observation with your theodolite. Backsight on the mark with the telescope in the direct position. The mark may be a target set on a traverse point, an arbitrary point set to be turned from later, or a well-defined long distance point (church spire, sign, etc.). Record your backsight reading in the "BS on mark" blank (Line 1). This may be 0° 00′ 00″ or any other reading. Attach the solar filter and point the telescope toward the sun. Because of the low angle of the sun in winter, you can observe it at all times without steep angle prisms or attachments. In the summertime between the hours of 9:30 ± and 4:30 ± Daylight Time, these attachments will probably be required. Because the sun's fastest movement is at noon (one second of time equals about 15″ of arc), it is far better and more accurate to make your observations in early morning or late afternoon when the sun's motion is more nearly vertical. Also, for the sake of accuracy, the observation time per angle set should be ten minutes or less.

AM  PM 

In the morning the sun's movement is up and to the right; in the afternoon, it is down and to the right.

Now, back to our field work. Point your telescope to the sun and lead the sun with the vertical cross hair a little as shown at left below. (Since we are not getting our latitude and longitude via the vertical angle, don't worry about the horizontal cross hair. However, you may avoid errors caused by instrument maladjustment by keeping the horizontal hair near the center of the sun.)

First and third foresights on sun  Second and fourth foresights on sun 

You will notice the sun is moving to the right and closing the gap between it and the vertical cross hair. At the exact moment the edge of the sun touches the hair, say "mark" to your notekeeper, or press the lap time button on your watch and read the time and record in the "Record watch time" blank (Line 2). Read and record the horizontal angle on Line 3. Now, perform the remainder of the angle sets in like manner. (But note that on the second and fourth foresights on the sun, you must sight on the left side of the sun, and you will need to allow the sun to be bisected by the vertical cross hair. Then, when the left side of the sun becomes tangent to the vertical cross hair, call "mark" to your notekeeper.) See diagram on right above.)

As you complete Lines 4 through 12, you may prefer to leave the filter on since removing and attaching it is somewhat cumbersome, 'and duplicate the "BS on mark" value in all but Line 12.

This completes the field portion of the observation. You may elect to retire to more comfortable quarters to enter the remainder of the values for Lines 13 through 21.

POLARIS OBSERVATION

Occupy the point from which you wish to make the observation with your theodolite. Backsight on the mark with the telescope in the direct position. The mark may be a target set on a traverse point, an arbitrary point set to be turned from later, or a well-defined long distance object (church spire, sign, etc.). Record your BS reading in the BS "BS on mark" blank (Line 1). This can be 0° 00′ 00″ or any other reading.

Turn to Polaris and record the exact time of the observation on Line 2. Read the horizontal angle and record it on Line 3. . . . Continue to enter the proper values for Lines 4 through 12.

This completes the field portion of the observation. You may elect to retire to more comfortable quarters to continue to enter the remainder of the values for Lines 13 through 19.

FOR SOLAR / POLARIS EXAMPLE, See page 56.

SUP-R-ROM© SOLAR / POLARIS OBSERVATION				
■ a	■ b	■ c	■ d	■ e
A Solar	B Polaris	C	D	E RUN
F	G	H	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Access program "SOL/POL? A/B" is displayed.		[■] [W]
2	Initialize: For solar observation, For Polaris observation,		[A] [B]
3	Input Items 1 through 21 (if solar), or Items 1 through 19 (if Polaris). Press [R/S] after each entry. All items except Nos. 15 and 16 are input in the form DD.MMSSs. NOTE: This program uses a loop to input data and will prompt for Item 20 (Polaris) and Item 22 (solar). Ignore these prompts and proceed to Step 4.		
4	Run program. Printout will show: Average bearing to mark, first set. Average bearing to mark, second set. Space. Average bearing to mark, both sets.		[E]

NOTE: Executing Step 4 alters only Register 15. So if you have a bust, you may correct the bad entry, re-store the time zone in Register 15 and run the program again. Item 1 is stored in Register 01, Item 5 in Register 05, etc. So to correct an entry, convert it to decimal of degree and store it in its register. If solar observation, set Flag 09 before pressing [E] to re-run the program.

NOTE: When you receive the prompt for Item 18, press [⊟] to display the X register. If the displayed number is less than 24, use the tabular value for the date of observation. If the displayed number is 24 or greater, use the tabular value for the date following the date of observation.

NOTE: All angular entries are in the form DD.MMSSs; so be sure to change those values from the ephemeris that are given in tenths of minutes.

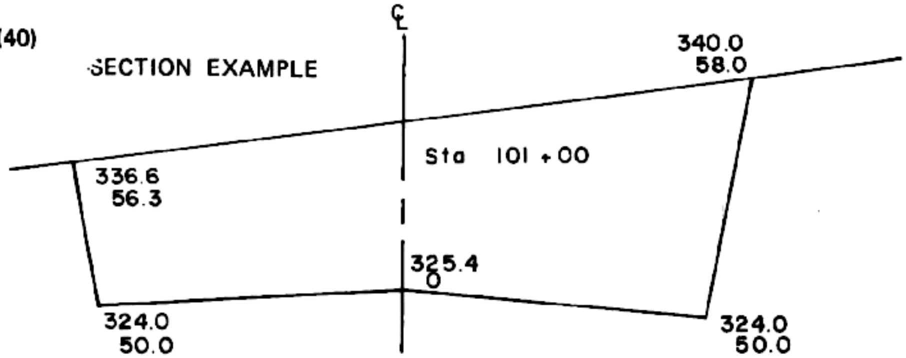
REGISTER CONTENTS

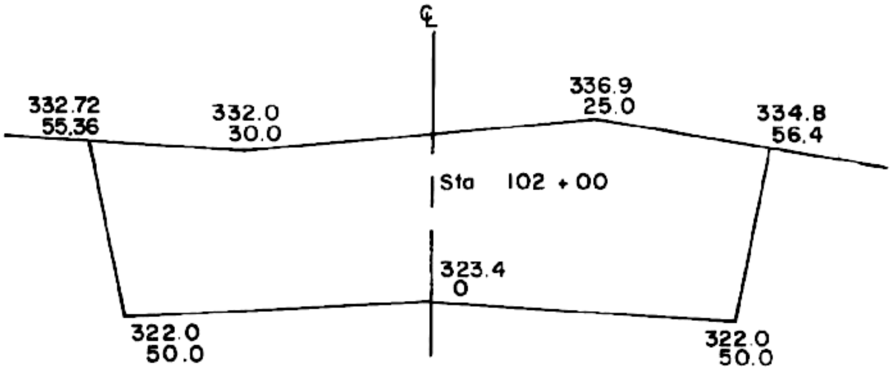
POL · SOL

00	USED	10	4TH WATCH TIME	20	/ EQT TODAY	30	t
01	1ST BS	11	4TH FS	21	/ EQT TOMORROW	31	Z1
02	1ST WATCH TIME	12	4TH BS	22	HZA 1	32	Z2
03	1ST FS	13	LATITUDE	23	HZA 2	33	AZI TO MARK 1
04	2ND WATCH TIME	14	LONGITUDE	24	GCT 1	34	AZI TO MARK 2
05	2ND FS	15	TIME ZONE	25	GCT 2	35	MEAN AZI TO MARK
06	2ND BS	16	0 OR 12	26	HZA		
07	3RD BS	17	WATCH CORR	27	GCT		
08	3RD WATCH TIME	18	GHA / DECL TODAY	28	USED		
09	3RD FS	19	p / DECL TOMORROW	29	DECL		

(40)

SECTION EXAMPLE





GIVEN: Station 100 + 00 has zero area.
Station 101 + 00 cross-section above.
Station 102 + 00 cross-section above.
Station 103 + 00 has zero area.

PROMPT	INPUT	PRESS	REMARKS
		[■] [X]	Access program.
		[R/S]	Initialize.
PRT INPUT?	6	[R/S]	Yes.
1ST STA=	10000	[R/S]	
NEXT STA?	10100	[R/S]	
EL ↗ D?	325.4	[ENTER]	
	0	[R/S]	
EL ↗ D?	324	[ENTER]	
	50	[CHS] [R/S]	
EL ↗ D?	336.6	[ENTER]	
	56.3	[CHS] [R/S]	
EL ↗ D?	340	[ENTER]	
	58	[R/S]	
EL ↗ D?	324	[ENTER]	
	50	[R/S]	
EL ↗ D?		[E]	Compute the section.
NEXT STA?	10200	[R/S]	
EL ↗ D?	323.4	[ENTER]	
	0	[R/S]	
EL ↗ D?	322	[ENTER]	
	50	[CHS] [R/S]	
EL ↗ D?	332.72	[ENTER]	
	55.36	[CHS] [R/S]	
EL ↗ D?	332	[ENTER]	
	30	[CHS] [R/S]	
EL ↗ D?	336.9	[ENTER]	
	25	[R/S]	
EL ↗ D?	334.8	[ENTER]	
	56.4	[R/S]	
EL ↗ D?	322	[ENTER]	
	50	[R/S]	
EL ↗ D?		[E]	Compute the section.
NEXT STA?	10300	[R/S]	
EL ↗ D?		[E]	Compute the section.

```
X-SECT

1ST STA= 10,000.00

                    10,100.00
                       325.40
                         0.00
                       324.00
                       -50.00
                       336.60
                       -56.30
                       340.00
                        58.00
                       324.00
                        50.00
STA= 10,100.00
SQFT= 1,460.80
VOL= 2,705.19
ΣVOL= 2,705.19

                    10,200.00
                       323.40
                         0.00
                       322.00
                       -50.00
                       332.72
                       -55.36
                       332.00
                       -30.00
                       336.90
                        25.00
                       334.80
                        56.40
                       322.00
                        50.00
STA= 10,200.00
SQFT= 1,242.68
VOL= 5,006.44
ΣVOL= 7,711.63

                    10,300.00
STA= 10,300.00
SQFT= 0.00
VOL= 2,301.26
ΣVOL= 10,012.89
```

SUP-R-ROM ©	CROSS-SECTION AREAS AND VOLUMES			
■ a	■ b	■ c	■ d	■ e
A	B	C	D	E Compute
F	G	H	I	J Err Corr

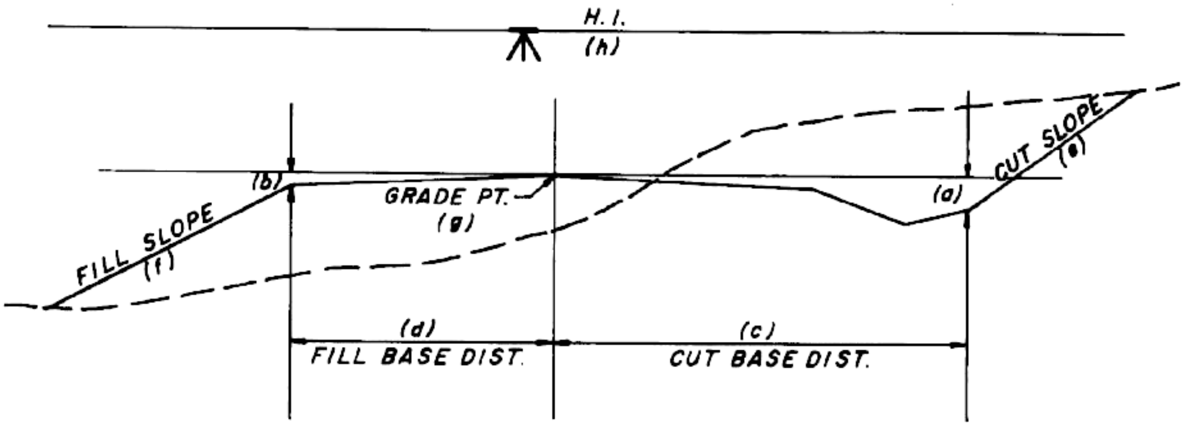
STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [X]
2	Initialize.		[R/S]
3	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	Input and output data are in feet.		
	a. PRT INPUT? — If you wish to print all input data, input any digit except 0.	6	[R/S]
	If you do not wish to print input data, press [R/S] without keyboard entry.		
	b. 1ST STA= — Input first station.	Station	[R/S]
	c. NEXT STA? — If the first station is a face station, (has area), press [R/S] without keyboard entry. If the first station has zero area, input the next station.	Station	[R/S]
	d. EL ↗D? — Begin on any point and proceed clockwise or counterclockwise around the section. You may input either the elevations or rod readings (provided all readings were taken from a single HI).	Elev or Rod	[R/S]
	If the point is right of centerline.	Distance	[R/S]
	If the point is left of centerline.	Distance	[CHS] [R/S]
	Repeat Step 3d until all points have been input. <u>BUT DO NOT RE-INPUT THE FIRST POINT.</u>		
4	Compute the section.		[E]
	The following is printed: Station (feet) Area of section (square feet) Volume between this station and last station (cu yds) Cumulative volume (cu yds)		
5	Following Step 4, the calculator again prompts NEXT STA? Continue executing Steps 3c, 3d, and 4 for all stations.		
6	If the last station has zero area, input the staion value.	Station	[R/S]
	Then execute Step 4.		[E]

NOTE: After execution of any or all of Steps 3d and 4, an input error is noted, you may correct it by pressing [J] and beginning the section all over again at Step 3d. But, DO NOT RE-ENTER THE STATION. If the error is in the station value itself and is noted before execution of Step 4, store the correct value in Register 11 and continue with Step 3d and/or Step 4. If the error is noted after execution of Step 4, press [J], store the correct station value in Register 11, and re-input the section (Step 3d).

REGISTER CONTENTS

00 CROSS-SECTIONS	05 USED	10 AREA LAST STA	15 USED
01	06 USED	11 THIS STA	16
02 USED	07 USED	12 LAST STA	17
03 USED	08 USED	13 THIS VOL	18
04 USED	09 AREA THIS STA	14 CUMULATIVE VOL	19

SLOPE-STAKE EXAMPLE



GIVEN:
- a = - 1.9
- b = - 1.3
- c = 40
- d = 24
- e = 3
- f = 5
- g = 112.17
- h = 117.00

PROMPT	INPUT	PRESS	REMARKS
		[■] [Y]	Access program.
		[R/S]	Initialize.
CUT DIFF?	1.9	[CHS] [R/S]	
FILL DIFF?	1.3	[CHS] [R/S]	
C BASE DIST?	40	[R/S]	
F BASE DIST?	24	[R/S]	
CUT SLOPE?	3	[R/S]	
FILL SLOPE?	5	[R/S]	
C OR F?		[C]	Let's do the cut side first.
CL GRADE ELEV?	112.17	[R/S]	
HI?	117	[R/S]	Estimate distance from CL for first test rod reading, say 50'. Levelman calls 1.8, which yields a distance of 54.8... Try 56'... Levelman calls 1.5 which yields a distance of 55.7... Try 55.7... Levelman calls 1.5, and we have a slope stake point at 55.7'.
TEST ROD?	1.8	[R/S]	
	1.5	[R/S]	
			Now, lets try the fill side. Since we have the same CL grade elevation and the same HI, we can avoid re-entering them. Press [F] to set up the calculator for the fill section, and enter the first test rod reading with [XEQ] [00].
		[F]	
CL GRADE ELEV?	15	[XEQ] [00]	Try 80'... Levelman calls 15.0 which yields a distance of 68.4... Try 70'... Levelman calls 13.5, which yields a distance of 60.9... Too far, try 57'... Levelman calls 12.7, which yields a distance of 56.9... Close enough!
	13.5	[R/S]	
	12.7	[R/S]	
			(Of course, the above figures are necessarily contrived.)

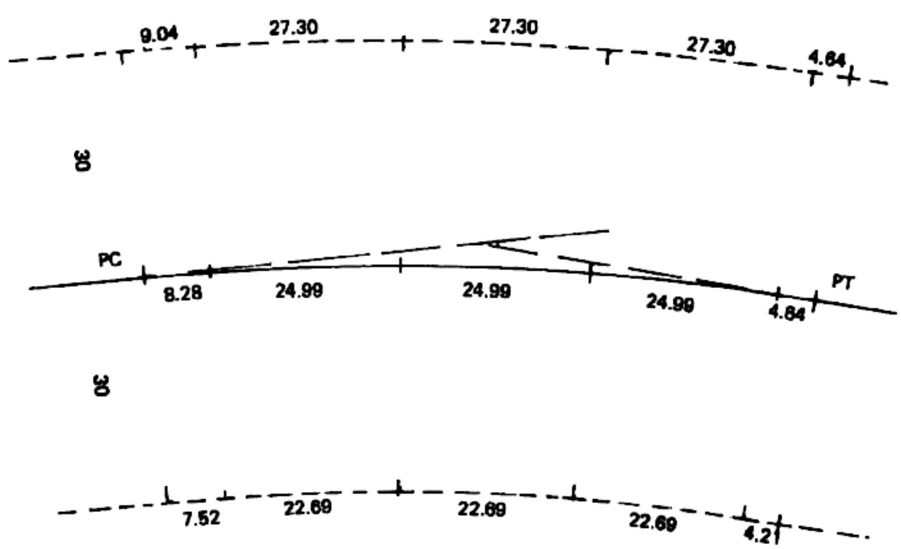
SUP-R-ROM ©		SLOPE-STAKE		
■ a	■ b	■ c	■ d	■ e
A New Section	B	C CUT	D	E Sl St Info
F FILL	G	H	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Access program. Clear Calculator		[■] [Y]
2	Initialize.		[R/S]
3	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION (Refer to figure on opposite page.)		
	a. CUT DIFF? — * Input difference between the CL elevation and the base point elevation (cut section).	a	[R/S]
	b. FILL DIFF? — * Input same for fill section.	b	[R/S]
	c. C BASE DIST? — Input the distance from the CL to the cut base point.	c	[R/S]
	d. F BASE DIST? — Input the distance from the CL to the fill base point.	d	[R/S]
	e. CUT SLOPE? — Input cut slope ratio.	e	[R/S]
	f. FILL SLOPE? — Input fill slope ratio.	f	[R/S]
	g. C OR F? — If cut section,		[C]
	If fill section,		[F]
	h. CL GRADE EL? — Input CL grade elevation.	Elevation	[R/S]
	i. HI? — Input HI.	HI Elevation	[R/S]
	j. TEST ROD? — Give rodman a test distance; input the consequent rod reading.	Rod Reading	[R/S]
	RESULTS: The display will show the distance from the CL to the point where the slope line would meet the elevation produced by the test rod reading. Continue with new test rod reading(s) until the test rod reading produces the given test distance.		
4	For the difference in the natural ground and the base point elevation,		[E]
5	For a new section with the same base data (items 3a through 3f), press [C] for cut section or [F] for fill section. Then, press R/S without entry in response to prompts 3h & 3i.		
6	For a new section with different base data,		[A]
	* If the base point is lower than the CL, press [CHS] before pressing [R/S].		

REGISTER CONTENTS

00	SLOPE STAKE	05	FILL BASE DISTANCE	10		15	
01	HI	06	CUT DIFERENCE	11		16	
02	CUT SLOPE	07	FILL DIFFERENCE	12		17	
03	FILL SLOPE	08	CL GRADE ELEV	13		18	
04	CUT BASE DISTANCE	09	STEP 4 INFO	14		19	

CURVE DATA EXAMPLE



The above figure shows computed chord distances.

CURVE DATA

```
       25.0000   ***
       30.0000   ***
       30.0000   ***
    12560.9500   ***
       15.3000   ***
       44.2300   ***
      324.9959   ***

PI= 12560.9500
Δ= 15.3000
D= 17.3747
T= 44.2300
L= 87.9199
CHD= 87.6520
EXT= 2.9959
R= 324.9959
```

GIVEN:
- PI Station = 125 + 60.95
- Delta = 15° 30′
- T = 44.23′
- Offset line outside = 30′
- Offset line inside = 30′

FIND: Remainder of the curve data, deflections on 25′ increments, tangent offsets on 20′ increments, and the chord information.

PROMPT	INPUT	PRESS	REMARKS
		[■] [=]	Access program;
		[R/S]	Initialize.
		[■] [CF] [29]	(Optional)
DEF INC?	25	[R/S]	Input increment
CHD OFST: O / I?	30	[ENTER]	Input outside and
		[R/S]	inside increments.
TO INC?	20	[R/S]	Input tangent offset increment.
PC STA?		[R/S]	PC station unknown.
PI STA?	12560.95	[R/S]	Input PI station.
Delta?	15.3	[R/S]	Input delta.
D?		[R/S]	Degree unknown.
R?		[R/S]	Radius unknown.
T?	44.23	[R/S]	Input tangent distance.
			Curve is computed.

```
PC= 12516.7200
DEF= 0.0000

STA= 12525.0000
DEF= 0.4348

STA= 12550.0000
DEF= 2.5601

STA= 12575.0000
DEF= 5.0814

STA= 12600.0000
DEF= 7.2028

PT= 12604.6400
DEF= 7.4500
```

CHORD DATA

```
PC TO STA
CL ARC= 8.2800
CL CHD= 8.2798
OUT CHD= 9.0441
IN CHD= 7.5155

FULL INCR
CL ARC= 25.0000
CL CHD= 24.9938
OUT CHD= 27.3010
IN CHD= 22.6867

STA TO PT
CL ARC= 4.6400
CL CHD= 4.6400
OUT CHD= 5.0683
IN CHD= 4.2117
```

TAN OFSTS

```
FROM PC/PT
TD= 20.0000
TO= 0.6160

TD= 40.0000
TO= 2.4710

FROM PI
TD= 20.0000
TO= 0.9045

TD= 40.0000
TO= 0.0275
```

SUP-R-ROM ©		SIMPLE CURVE DATA		
■ a	■ b	■ c	■ d	■ e
A	B	C	D	E Odd Sta
F	G	H	I	J

STEP	PROCEDURE		INPUT	PRESS
1	Access program.			[■] [=]
2	Initialize.			[R/S]
3	Input data as prompted by the calculator:			
	PROMPT	EXPLANATION (Input and output data are in feet)		
	a. DEF INC?	If deflections are desired, input desired increment.	Increment	[R/S]
		If NOT desired, press [R/S] without keyboard entry.		
	b. CHD OFST: O ↗ I?	If chord data are desired, input: Offset distance (outside)	Offset	[ENTER]
		Offset distance (inside)	Offset	[R/S]
		If NOT desired, press [R/S] without keyboard entry.		
	c. TO INC?	If tangent offsets are desired, input desired increment.	Increment	[R/S]
		If NOT desired, press [R/S] without keyboard entry.		
	d. PC STA?	If PC station is known, input and go to Step 3f.	PC Station	[R/S]
		If unknown, press [R/S] without keyboard entry.		
	e. PI STA?	Input PI station.	PI Station	[R/S]
	f. DELTA?	Input Delta, if known.	Delta	[R/S]
		If unknown, press [R/S] without keyboard entry and go to Step 3m.		
	g. D?	If delta was input, the prompts at left occur in order as [R/S] is pressed without keyboard entry. When a known element is input, computation begins.	Degree	[R/S]
	h. R?		Radius	[R/S]
	i. T?		Tangent Dist.	[R/S]
	j. L?		Length	[R/S]
	k. CHD?		Chord Length	[R/S]
	l. EXT?		External	[R/S]
	m. R ↗ L?	Input radius and length.	Radius	[ENTER]
			Length	[R/S]
	Calculation begins when sufficient data has been input.			
4	For odd stations not computed in the above,		Odd Station	[E]

CHORD DATA: The centerline arc and chord and the outside and inside chords are computed from the PC to the first station or the first incremented station and plus. The same data is then computed for a full increment, and finally for the last station (or station and plus) to the PT.

TANGENT OFFSETS: Using the increment input in Step 3c, tangent offsets are computed from the PC or PT toward the PI, and then from the PI toward the PC and PT.

NOTE: You may wish to clear Flag 29 for this program. The separator (comma) does not coincide with the "plus" when expressing a station and plus value. For example, station 125 + 60.96 appears as 12,560.96 in the display and on the tape. But with Flag 29 clear, the station appears as 12560.96.

REGISTER CONTENTS

CURVE DATA

00	USED	05	D	10	R	15	USED
01	PI STATION	06	T	11	5729.578	16	USED
02	PC STATION	07	L	12	OFFSET OUTSIDE	17	PT STATION
03	DELTA	08	CHD	13	OFFSET INSIDE	18	TO INCREMENT
04	DELTA / 2	09	EXT	14	DEF INCREMENT	19	DEC FIX NO.

CURVE PROBLEMS EXAMPLE

Store coordinates as follows:

PROMPT	INPUT	PRESS	REMARKS
		[■] [U]	Access UTILITY program.
		[F]	
		[R/S]	Initialize.
PT NO?	1	[R/S]	
N ↗ E?	0	[ENTER]	
		[R/S]	
PT NO?	2	[R/S]	
N ↗ E?	514.0512	[ENTER]	
	368.7734	[R/S]	

PROMPT	INPUT	PRESS
PT NO?	3	[R/S]
N ↗ E?	654.2099	[ENTER]
1163.	1163.6525	[R/S]
PT NO?	4	[R/S]
N ↗ E?	680.2383	[ENTER]
	199.0481	[R/S]
PT NO?	5	[R/S]
N ↗ E?	686.7085	[ENTER]
	907.7811	[R/S]

* *

(See first figure on opposite page.)

GIVEN: Coordinates of Points A, B, and C.

PROMPT	INPUT	PRESS	REMARKS
		[■] [?]	Access program.
		[R/S]	Print ID.
		[A]	Initialize.
PT NOS?	1	[ENTER]	
	2	[ENTER]	
	3	[R/S]	RESULTS:
			CURVE PROBS
			R= 954.9299

GIVEN: Delta = 44° 20′ 41″
AB = 632.65
BC = 807.14

PROMPT	INPUT	PRESS	REMARKS
		[■] [?]	Access pgm.
		[R/S]	Print ID.
		[A]	Initialize.
PT NOS?		[R/S]	
AB?	632.65	[R/S]	
BC?	807.14	[R/S]	
DELTA?	44.2041	[R/S]	RESULTS:
			CURVE PROBS
			R= 954.9334

* *

See second figure on opposite page.

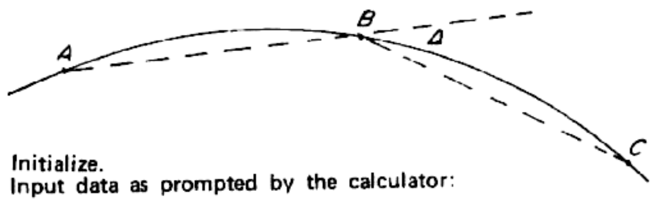
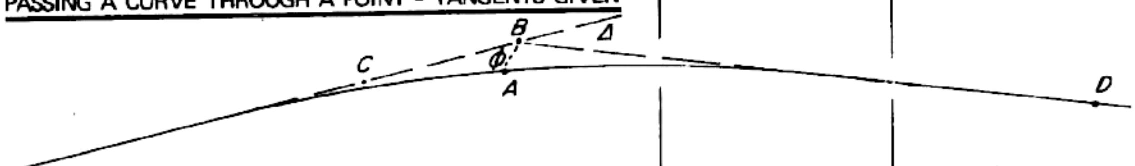
GIVEN: Coordinates of Points A, B, C, and D

PROMPT	INPUT	PRESS	REMARKS
		[■] [?]	Access program.
		[R/S]	Print ID.
		[B]	Initialize.
PT NOS?	2	[ENTER]	
	4	[ENTER]	
	1	[ENTER]	
	5	[R/S]	RESULTS:
			CURVE PROBS
			R= 954.9299

GIVEN: Delta = 73°10′
PHI = 61° 54′ 30″
AB = 237.54′

PROMPT	INPUT	PRESS	REMARKS
		[■] [?]	Access program.
		[R/S]	Print ID.
		[B]	Initialize.
PT NOS?		[R/S]	
AB?	237.54	[R/S]	
PHI?	61.543	[R/S]	
DELTA?	73.1	[R/S]	RESULTS:
			CURVE PROBS
			R= 954.9504

SUP-R-ROM ©		CURVE PROBLEMS		
■ a	■ b	■ c	■ d	■ e
A 3-Point Problem	B 1-Point Problem	C	D	E
F	G	H	I	J

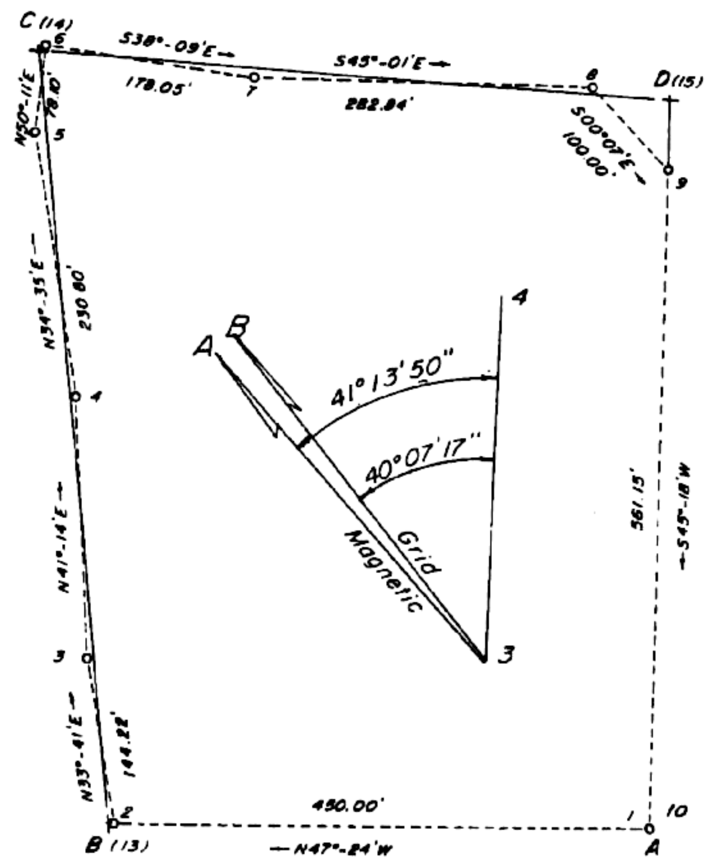
STEP	PROCEDURE	INPUT	PRESS
1	Access program. (Pressing [R/S] will print "CURVE PROBS")		[■] [?]
	PASSING A CURVE THROUGH THREE POINTS 		
2	Initialize.		[A]
3	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	a. PT NOS? — If Points A, B, and C are stored in the calculator, input their numbers:	A B C	[ENTER] [ENTER] [R/S]
	If points are not stored in the calculator, press [R/S] without keyboard entry.		
	b. AB? — Input distance AB.	AB	[R/S]
	c. BC? — Input distance BC.	BC	[R/S]
	d. DELTA? — Input delta.	Delta	[R/S]
	PASSING A CURVE THROUGH A POINT - TANGENTS GIVEN 		
4	Initialize.		[B]
5	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	a. PT NOS? — If Points A, B, C, and D are stored in the calculator, input their numbers in the following order:	A B C D	[ENTER [ENTER] [ENTER] [R/S]
	If points are not stored in the calculator, press [R/S] without keyboard entry.		
	b. AB? — Input distance AB.	AB	[R/S]
	c. PHI? — Input angle	ϕ	[R/S]
	d. DELTA? — Input delta.	Delta	[R/S]
6	RESULTS: Output in all cases is the curve radius.		

REGISTER CONTENTS

CURVE PROBS A / B

00 USED	05	10 / USED	15
01 AB / BC	06 POINT NO.	11 / USED	16 / AB
02 BC / BD	07 USED	12 / USED	17 / PHI
03 DELTA	08 USED	13 N	18 / DELTA / 2
04 / USED	09 USED	14 E	19

ROTATION AND TRANSLATION EXAMPLE




```
ROT/TR

        358.5327   ***
GR A= 1,424.6226
GR A= 748.7211
GR B= 621,345.6745
GR B= 221,769.0685

          1.0000   ***
GR A= 1,000.0000
GR A= 1,000.0000
GR B= 620,925.9956
GR B= 222,028.5199

          2.0000   ***
GR A= 1,304.6099
GR A= 668.7412
GR B= 621,224.1361
GR B= 221,691.4267

          3.0000   ***
GR A= 1,424.6226
GR A= 748.7211
GR B= 621,345.6745
GR B= 221,769.0685

          4.0000   ***
GR A= 1,594.5896
GR A= 897.6763
GR B= 621,518.4930
GR B= 221,914.7056

          5.0000   ***
GR A= 1,784.6156
GR A= 1,028.6716
GR B= 621,711.0192
GR B= 222,041.9980

          6.0000   ***
GR A= 1,834.6284
GR A= 1,088.6574
GR B= 621,762.1837
GR B= 222,101.0044

          7.0000   ***
GR A= 1,694.6167
GR A= 1,198.6369
GR B= 621,624.3272
GR B= 222,213.6736

          8.0000   ***
GR A= 1,494.6867
GR A= 1,398.6837
GR B= 621,428.3071
GR B= 222,417.5530

          9.0000   ***
GR A= 1,394.6904
GR A= 1,398.8839
GR B= 621,328.3334
GR B= 222,419.6899

         10.0000   ***
GR A= 1,000.0000
GR A= 1,000.0000
GR B= 620,925.9956
GR B= 222,028.5199

         11.0000   ***
GR A= 462.4601
GR A= 0.0000
GR B= 620,369.1990
GR B= 221,039.1126

         12.0000   ***
GR A= 3,007.3625
GR A= 0.0000
GR B= 622,913.6246
GR B= 220,989.8499

         13.0000   ***
GR A= 1,307.7097
GR A= 665.3715
GR B= 621,227.1701
GR B= 221,687.9976

         14.0000   ***
GR A= 1,835.2205
GR A= 1,000.6224
GR B= 621,762.6203
GR B= 222,092.9594

         15.0000   ***
GR A= 1,440.1601
GR A= 1,444.8369
GR B= 621,374.6841
GR B= 222,464.7530
```

GIVEN: The above figure and the registers intact from INTERSECTIONS example.

Assume that a tie is made to the State Coordinate Grid System at Point 3, and the new coordinates are: N621345.6745 and E221769.0685. Also the computed bearing from Point 3 to Point 4 is N 40° 07' 17" E.

SOLUTION: Draw a sketch to determine the relative position of the north arrows in the two systems. It is determined that the north of system A is 358° 53' 27" clockwise from system B.

PROMPT	INPUT	PRESS	REMARKS
		[■] [SPACE]	Access program
		[R/S]	Initialize.
ROT ∡ ?	358.5327	[R/S]	Input angle of rotation.
NA ↗ EA?			Input present coordinates of Point 3 from tape, OR you may find the register number (point No. times 2 + 18) and recall the coordinates from storage. 3 x 2 + 18 = 24.
		[RCL] [24]	
		[RCL] [25]	
		[R/S]	
NB ↗ EB?	621345.6745	[ENTER]	Input state grid coordinates of the same point.
	221769.0685	[R/S]	
SC FAC?		[R/S]	Scale factor is 1.
	1	[ENTER]	Rotate and translate the coordinates of Points 1 through 15, and replace the original coordinates.
	15	[J]	
			GO TO PAGE 14.

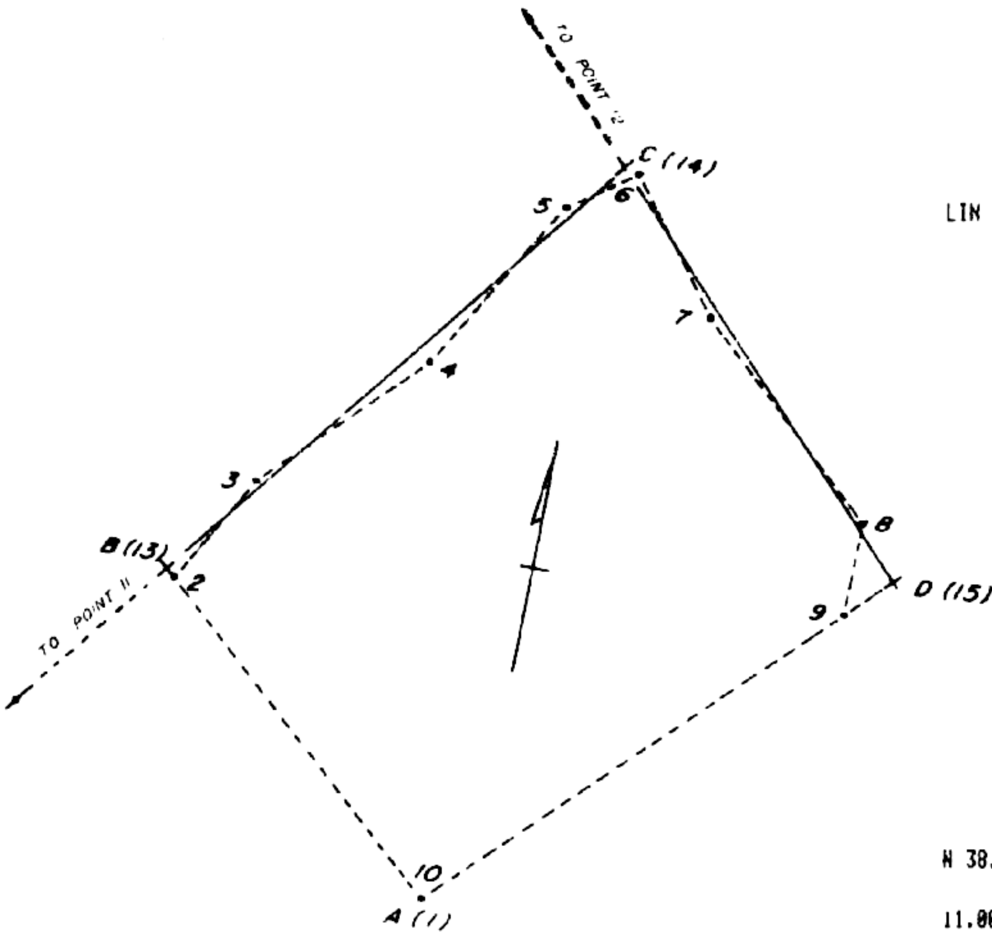
SUP-R-ROM ©	ROTATION AND TRANSLATION			
■ a	■ b	■ c	■ d	■ e
A Keyboard A → B	B Keyboard B → A	C	D Storage B → A	E Storage A → B
F	G	H	I Storage B → A	J Storage A → B

STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [SPACE]
2	Initialize.		[R/S]
3	Fix decimal.		
4	Input data as prompted by the calculator:		
	PROMPT EXPLANATION		
	a. ROT ∡ ? Input the clockwise angle from Grid System B to Grid System A. Note that if System B is east (or clockwise) from A, the angle will be near 360 degrees. NOTE: If translation without rotation is to occur, input zero for the angle.	Angle	[R/S]
	b. NA ↗ EA? Input coordinates of a common point in System A.	N E	[ENTER] [R/S]
	c. NB ↗ EB? Input coordinates of the same point in System B.	N E	[ENTER] [R/S]
	d. SC FAC? Input scale factor, if desired. (Pressing [R/S] without keyboard entry defaults to scale factor of 1.)	Factor	[R/S]
5	To translate coordinates input from the keyboard:		
	a. From Grid System A to Grid System B,	N_a E_a	[ENTER] [A]
	b. From Grid System B to Grid System A,	N_b E_b	[ENTER] [B]
6	To translate stored coordinates from Grid System A to Grid System B:		
	a. Input number of the first point to be translated.	Number	[ENTER]
	b. Input number of the last point to be translated.	Number	
	Then, if points are to be translated on tape only,		[E]
	If points are to be translated on tape and replace the original stored coordinates,		[J]
7	To translate stored coordinates from Grid System B to Grid System A:		
	a. Input number of the first point to be translated.	Number	[ENTER]
	b. Input number of the last point to be translated.	Number	
	Then, if points are to be translated on tape only,		[D]
	If points are to be translated on tape and replace the original stored coordinates,		[I]
	NOTE: IT IS OF UTMOST IMPORTANCE THAT A SKETCH BE MADE IN ORDER TO DEFINE GRID SYSTEM "A" AND GRID SYSTEM "B". (See example.) REMEMBER, Grid System A is the old system whose coordinates are now stored in the calculator. And Grid System B is the new system TO which the coordinates will be translated.		

REGISTER CONTENTS

00 ROT/TR IND STO/RCL	05 ROT ∡	10 GR B=	15
01 NA	06 POINT NO.	11	16
02 EA	07 SCALE FAC	12	17
03 NB	08 LAST PT NO.	13	18
04 EB	09 GR A=	14	19

LINEAR REGRESSION EXAMPLE



GIVEN: The above figure and the registers intact from TRAVERSE ADJUSTMENT example.

PROMPT	INPUT	PRESS	REMARKS
		[■] [,]	Access program.
		[R/S]	Initialize.
PTS?	6	[R/S]	Yes, we will use point numbers.
PT NO?	2	[R/S]	
PT NO?	3	[R/S]	
PT NO?	4	[R/S]	
PT NO?	5	[R/S]	
PT NO?	6	[R/S]	
PT NO?		[E]	Run program.
ASN PT NO?	11	[R/S]	Assign 11 to point.
		[A]	Initialize for new problem.
PTS?	3	[R/S]	Use point numbers.
PT NO?	6	[R/S]	
PT NO?	7	[R/S]	
PT NO?	8	[R/S]	
PT NO?		[E]	Run program.
ASN PT NO?	12	[R/S]	Assign 12 to point.
			GO TO PAGE 30.

```
LIN REGR

        2.0000   ***
     1304.6099   ***
      668.7412   ***

        3.0000   ***
     1424.6226   ***
      748.7211   ***

        4.0000   ***
     1594.5896   ***
      897.6763   ***

        5.0000   ***
     1784.6156   ***
     1028.6716   ***

        6.0000   ***
     1834.6284   ***
     1088.6574   ***

N 38.1234 E

11.0000
N= 462.4601
E= 0.0000

        6.0000   ***
     1834.6284   ***
     1088.6574   ***

        7.0000   ***
     1694.6167   ***
     1198.6369   ***

        8.0000   ***
     1494.6867   ***
     1398.6837   ***

N 42.4025 W

12.0000
N= 3007.3625
E= 0.0000
```

SUP-R-ROM ©		LINEAR REGRESSION		
■ a	■ b	■ c	■ d	■ e
A	B	C	D	E RUN
F	G	H	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Access program.		[■] [.]
2	Initialize.		[R/S]
	(Note: Input coordinates will be printed if Flag 00 is set.)		
3	Input data as prompted by the calculator:		
	PROMPT — EXPLANATION		
	a. PTS? — If coordinates are to be input from the keyboard, press [R/S] without keyboard entry and go to Step 3c. If coordinates are to be called from storage by point number, input any digit other than zero – say 6 –	6	[R/S]
	b. PT NO? — Input point number. (Continue executing Step 3b until all points have been input. Then, go to Step 3d.)	Number	[R/S]
	c. N ↗ E? — Input coordinate pairs as follows.	N E	[ENTER] [R/S]
	(Continue executing Step 3c until all coordinates have been input.)		
	d. — Execute the program.		[E]
	e. ASN PT NO? — Assign a point number to the computed line intercept with the N axis.	Number	[R/S]
4	RESULTS: Bearing of the regression line. Coordinate values where the regression line intercepts the N axis.		
	Now, you may use the INTERSECTION program to find the true corners.		
5	For a new problem,		[A]

REGISTER CONTENTS

LIN REGR

00 USED	05	10	15 USED Σ
01 ALPHA DATA	06 POINT NO.	11 USED Σ	16 USED Σ
02 N	07	12 USED Σ	17
03	08	13 USED Σ	18
04	09	14 USED Σ	19

SUP-R-ROM ©		MASS STORAGE		
■ a	■ b	■ c	■ d	■ e
A Write Cards	B Write Cards	C	D Read Cards	E Read Cards
F Write Tape	G	H	I Read Tape	J Read Tape

STEP	PROCEDURE	INPUT	PRESS
	CARD READER		
1	Access program.		[■] [:]
2	a. To record specific points on magnetic cards:		[A]
	PROMPT / EXPLANATION		
	1ST ⁄ LAST? — Input first point number.	First Number	[ENTER]
	Input last point number.	Last Number	[R/S]
	RDY 01 OF nn — Input cards as prompted.		
	b. To record working registers 00 through 19 plus all points from 1 through last on magnetic cards:		[B]
	PROMPT / EXPLANATION		
	LAST? — Input last point number.	Last number	[R/S]
	RDY 01 OF nn — Input cards as prompted.		
	c. To read specific points from cards into the calculator:		[E]
	PROMPT / EXPLANATION		
	1ST ⁄ LAST? — Input first point number.	First number	[ENTER]
	Input last point number.	Last Number	[R/S]
	CARD — Input cards as prompted.		
	d. To read working registers 00 through 19 plus all points from 1 through last from magnetic cards:		[D]
	PROMPT / EXPLANATION		
	LAST? — Input last point number.	Last Number	[R/S]
	CARD — Input cards as prompted.		
	CASETTE DRIVE		
3.	BE SURE to size calculator to 300.		
	a. To record all registers 00 through 299 on casette tape: (A 300-register file must have already been created.)		[F]
	PROMPT / EXPLANATION		
	FILE — Input file name. All registers 00 through 299 are recorded on the tape.	File name	[R/S]
	b. To read all registers 00 through 299 from casette tape into calculator:		[I]
	PROMPT / EXPLANATION		
	FILE — Input file name. All registers 00 through 299 are read into the calculator.	File name	[R/S]
	c. To read registers 20 through 299 from casette tape into calculator:		[J]
	PROMPT / EXPLANATION		
	FILE — Input file name. Registers 20 through 299 are read into the calculator.	File name	[R/S]

NOTE: When SUP-R-ROM points greater than 499 are stored. They will be off by 1 point number when they are recalled. (I.E. point 501 will be shown as 502, etc.

TO INITIALIZE THE TAPE – remember all existing data on the tape are erased!

1. Press [XEQ] [ALPHA] [NEWM] [ALPHA] calculator prompts 'NEWM___'
2. Press [050] [R/S]. (This permits 50 300-register files to be stored on the tape. TAKES ABOUT 4 1/2 minutes!)

TO CREATE A FILE

Press [300] [ENTER] [ALPHA] [FILE NAME] [ALPHA] [XEQ] [ALPHA] [CREATE] [ALPHA]

RECOVERING FROM INPUT ERRORS

FIELD TRAVERSE

1. If either beginning coordinate is input incorrectly, initialize again and input correctly.
2. If an angular error is discovered before [E] has been pressed, input the angle exactly as before but with the sign reversed. Then, re-input the angle correctly.
3. If a V/ZA input error is discovered before [E] has been pressed, input correctly and press [J].
4. If a bearing input error is discovered before [E] has been pressed, simply re-input and proceed.
5. On discovering any error after [E] has been pressed, follow instructions in Step 11 on page 7.

COORDINATE GEOMETRY

1. Items 1, 2, 3, and 4 above also apply to this program.
2. Any other input error may best be handled by using the branching technique as described in Step 9 on page 11.

TRAVERSE ADJUSTMENT

1. If the first point is input incorrectly, re-access the program, initialize again, and input the number correctly.
2. After having selected the Rule, there is no recovery. If you wish to insure against such a mistake, copy all registers on magnetic cards or on casette tape before using this program.

AREA / INVERSE

1. If point numbers are not being batch loaded, you may correct an input error by re-entering the previous point number(s) and backing out the course(s). Then, proceed ahead by inputting the correct number(s). But be careful if a curve is involved, when backing up the curve reverses direction and the sign of the radius must be reversed.
2. Stored coordinate values are not altered in this program, so you may stop at any time and start all over. If you should realize in the midst of inputting point numbers that you had failed to do a sideshot, you could go to COORDINATE GEOMETRY, input the sideshot, return to this program and start over again.
3. Batch loaded points may be corrected just like the ones input one at a time by backing out a course. But should you discover in the printout of a long traverse that you had input a point number incorrectly, you may correct that point by finding the register in which it is stored, correcting the input, and pressing [G] again. The program will begin at the first point again.
   ..... So you need to know just how the point numbers are stored. The first three point numbers are stored in reverse order in Register 299, the next three in 298, etc. If the first three numbers you input were 1, 3, and 7, Register 299 would look like this: 7,003,001.000. The table below shows just where the point numbers are stored. For example, the forty third, forty fourth, and forty fifth pointsnumbers are stored in Register 285.

R253= 140,139.0000	R265= 105,104,103.0	R277= 69,068,067.00	R289= 33,032,031.00
R254= 138,137,136.0	R266= 102,101,100.0	R278= 66,065,064.00	R290= 30,029,028.00
R255= 135,134,133.0	R267= 99,098,097.00	R279= 63,062,061.00	R291= 27,026,025.00
R256= 132,131,130.0	R268= 96,095,094.00	R280= 60,059,058.00	R292= 24,023,022.00
R257= 129,128,127.0	R269= 93,092,091.00	R281= 57,056,055.00	R293= 21,020,019.00
R258= 126,125,124.0	R270= 90,089,088.00	R282= 54,053,052.00	R294= 18,017,016.00
R259= 123,122,121.0	R271= 87,086,085.00	R283= 51,050,049.00	R295= 15,014,013.00
R260= 120,119,118.0	R272= 84,083,082.00	R284= 48,047,046.00	R296= 12,011,010.00
R261= 117,116,115.0	R273= 81,080,079.00	R285= 45,044,043.00	R297= 9,008,007.000
R262= 114,113,112.0	R274= 78,077,076.00	R286= 42,041,040.00	R298= 6,005,004.000
R263= 111,110,109.00	R275= 75,074,073.00	R287= 39,038,037.00	R299= 3,002,001.000
R264= 108,107,106.0	R276= 72,071,070.00	R288= 36,035,034.00	

As an example, suppose the sixteenth, seventeenth, and eighteenth point numbers should have been 32, 37, and 39. But you note Point 37 comes out as 27; so you press [R/S] to stop program execution. Note from the table that Point 17 is stored in Register 294. So store 294 in Register 00 and press [RCL] [■] [00] and see 39,027,032.00. To correct, key in 39037032 and press [STO] [■] [00]. Then press [G] and execution will begin at the first point again.

RECOVERING FROM INPUT ERRORS, CONTINUED.

FIELD DATA COLLECTOR

SIDESHOTS: a. If an input error is discovered before the distance is input by pressing [E], you may start over repeating Steps 8a, b, c, and d. All the erroneous data will be written over.

b. If an input error is discovered after the distance has been input and [E] has been pressed, press [2] [STO] [+] [20] and input the sideshot correctly.

TO USE THE TECHNIQUE DESCRIBED BELOW, YOU MUST WAIT UNTIL ALL ANGLES AND DISTANCES HAVE BEEN INPUT BEFORE MAKING ANY CORRECTIONS.

ANGLES: Input the number of the angle and press [H]. The angle as stored will be displayed as a deflection angle in DD.MMSS even though it may have been input as a CWBS. No correction has been made at this time; so if you should input the wrong number, simply re-enter the correct number and press [H] again.

. . . . To correct a bad entry, input the correct angle as a deflection angle in DD.MMSS and press [R/S]. If the angle is a CWBS, just add 180 and don't worry if it gives you a deflection angle above 360 degrees.

DISTANCES: Input the number of the distance and press [I]. The horizontal distance as stored will be displayed. Again, no correction has been made at this time; so if you input the wrong number, input the correct number and press [I] again.

. . . . To correct, input the correct horizontal distance and press [R/S].

NOTE: The order of entry is bearing, distance; angle, distance; angle, distance; angle, distance...etc. So should you inadvertently input two distances in a row, the second distance would be stored in the register for the next angle. To recover, omit the next angle, input the next distance, and when all input has been made, correct as above. The same holds true for inputting two angles in a row.

PREDETERMINED AREA I

1. If you note an error in either the bearing or distance of a course just input, you may input the same distance with a negative sign and press [E]. Correct the course and input again. If the error was in the distance, you do not need to input the bearing again.
2. You may change the required area at any time prior to reaching the course on which the area will be achieved.

PREDETERMINED AREA II

On noting any input error in this program, your best bet is to re-initialize and start over.

STAKEOUT

1. If either the INST point or BS point is input incorrectly, re-initialize and start over.
2. If a wrong SOPT is input, edit it off the tape.

SEARCH / SET

Since you are working primarily with coordinates in this program, about the only serious error you could make would be to assign a number to a satellite point that would destroy a needed point. You may recover from most input errors by inputting INST and BS points and proceeding from there.

QUIK-CHEK

You may back out a course by either reversing the bearing or making the distance negative and inputting the course again. In either case the bearing must be input each time. For example, given the course S 18° 29' W 200'.

INPUT	PRESS	REMARKS
18.29	[C]	
200	[J]	You pressed the wrong key!
18.29	[C]	Input the bearing again.
200	[CHS] [J]	Back out the distance.
18.29	[C]	Input the bearing again.
200	[E]	Mistake is corrected.

RECOVERING FROM INPUT ERRORS, CONTINUED.

PERPENDICULAR OFFSET

1. If an error is made in inputting the base point, line point, or bearing, re-initialize and start over.
2. If a wrong offset point number is input, edit it off the tape.

INTERSECTIONS

1. If a wrong beginning or ending point number is input, initialize again by pressing [J] and start over.
2. If any other input error is made , press [E]. It will not be necessary to input the beginning and ending point numbers again.

ROADSIDE

No recovery possible; initialize again and start over.

UTILITY PROGRAM

No recovery possible; initialize again and start over.

VERTICAL CURVE ELEVATIONS

No recovery possible. Be very careful with your input, expecially the use of station values rather than feet. When you have batch loaded several curves, should you detect an input error during program execution, stop execution by pressing [R/S]. Then, initialize again and re-load the input data from the place of error ahead.

SOLAR / POLARIS

See NOTE on page 39.

CROSS-SECTIONS

See NOTE on page 41.

SLOPE-STAKE

No recovery possible; initialize again and start over.

CURVE DATA

No recovery possible; initialize again and start over.

CURVE PROBLEMS

No recovery possible; initialize again and start over.

ROTATION AND TRANSLATION

No recovery possible. And the note on page 49 cannot be overemphasized.

LINEAR REGRESSION

No recovery possible; initialize again and start over.

MASS STORAGE

No recovery possible.

 SOLAR / POLARIS EXAMPLE

JOB NO. B-127
DATE 1-17-79
OBSERVER Barbour

INST. STA. Sign
BS (MARK) STA. Bateman
INSTRUMENT ID. T3 - 41333

						INPUT	PRESS
							[■] [W,
							[B]
(1)	(Telescope direct)	BS on mark.	Record horizontal reading.	00°00'233"	(1)	.00233	[R/S]
(2)	(Telescope direct)	FS on sun or Polaris.	Record watch time.	00h25'126"	(2)	.25126	[R/S]
(3)			Record horizontal reading.	243°06'58"	(3)	243.0658	[R/S]
(4)	(Telescope inverted)	FS on sun or Polaris.	Record watch time.	00h25'533"	(4)	.25533	[R/S]
(5)			Record horizontal reading.	63°06'411"	(5)	63.06411	[R/S]
(6)	(Telescope inverted)	BS on mark.	Record horizontal reading.	180°00'151"	(6)	180.00151	[R/S]
(7)	(Telescope direct)	BS on mark.	Record horizontal reading.	191°00'52"	(7)	191.0052	[R/S]
(8)	(Telescope direct)	FS on sun or Polaris.	Record watch time.	00h28'272"	(8)	.28272	[R/S]
(9)			Record horizontal reading.	74°07'228"	(9)	74.07228	[R/S]
(10)	(Telescope inverted)	FS on sun or Polaris.	Record watch time.	00h29'382"	(10)	.29382	[R/S]
(11)			Record horizontal reading.	254°07'344"	(11)	254.07344	[R/S]
(12)	(Telescope inverted)	BS on mark.	Record horizontal reading.	11°00'599"	(12)	11.00599	[R/S]
(13)	Input latitude of the place of observation. (May be scaled from map.)			35°56'02"	(13)	35.5602	[R/S]
(14)	Input longitude of the place of observation. (May be scaled from map.)			76°31'06"	(14)	76.3106	[R/S]
(15)	Input time zone of the place of observation. (See Note 1.)			5	(15)	5	[R/S]
(16)	If observation is taken in a.m., input zero; if p.m., input 12.			0	(16)	0	[R/S]
(17)	Input watch correction. (Fast is negative; slow is positive.)			0h00'00"	(17)	0	[R/S]
POLARIS							[⊟]
(18)	Input GHA from Table 1*. (See Note 2.)			82°53'06"	(18)	82.5306	[R/S]
(19)	Input polar distance from Table 3*. (Use same date as for GHA.)			°49'376"	(19)	.49376	[R/S]
SOLAR							[E]
	(South declinations are negative; press [CHS].)						
(18)	Input declination from Table 1*. (See Note 2.)			___°___'___"	(18)		
(19)	Input declination for the next day.			___°___'___"	(19)		
(20)	Input the EQT for the same date used in Item 18.			___°___'___"	(20)		
(21)	Input the EQT for the next day.			___°___'___"	(21)		

```
POLARIS

1= 0.0023
2= 0.2513
3= 243.0658
4= 0.2553
5= 63.0641
6= 180.0015
7= 191.0052
8= 0.2827
9= 74.0723
10= 0.2938
11= 254.0734
12= 11.0060
13= 35.5602
14= 76.3106
15= 5.0000
16= 0.0000
17= 0.0000
18= 82.5306
19= 0.4938


S 64.0747 E
S 64.0750 E

S 64.0748 E
```

NOTE 1: EST = 5, EDT = 4. CST = 6, CDT = 5. MST = 7, MDT = 6. PST = 8, PDT = 7.

NOTE 2: After Item 17 has been input, press [⊟]. The display will show the Greenwich Civil Time of the day of observation. This is your guide as to which tabular value to use. If the display is less than 24, use the date of observation, and if it is 24 or greater, use the date following the day of observation.

NOTE 3: All angular entries are in the form DD.MMSSs; so be sure to change those values from the ephemeris that are given in tenths of minutes.

* Tables referred to are from the K & E Solar Ephemeris.

SOLAR OR POLARIS OBSERVATIONS

JOB NO. ____________________

DATE ____________________

OBSERVER ____________________

INST. STA. ____________________

BS (MARK) STA. ____________________

INSTRUMENT ID. ____________________

(1)	(Telescope direct)	BS on mark.	Record horizontal reading.	___° ___' ___"	(1)
(2)	(Telescope direct)	FS on sun or Polaris.	Record watch time.	___h ___' ___"	(2)
(3)			Record horizontal reading.	___° ___' ___"	(3)
(4)	(Telescope inverted)	FS on sun or Polaris.	Record watch time.	___h ___' ___"	(4)
(5)			Record horizontal reading.	___° ___' ___"	(5)
(6)	(Telescope inverted)	BS on mark.	Record horizontal reading.	___° ___' ___"	(6)
(7)	(Telescope direct)	BS on mark.	Record horizontal reading.	___° ___' ___"	(7)
(8)	(Telescope direct)	FS on sun or Polaris.	Record watch time.	___h ___' ___"	(8)
(9)			Record horizontal reading.	___° ___' ___"	(9)
(10)	(Telescope inverted)	FS on sun or Polaris.	Record watch time.	___h ___' ___"	(10)
(11)			Record horizontal reading.	___° ___' ___"	(11)
(12)	(Telescope inverted)	BS on mark.	Record horizontal reading.	___° ___' ___"	(12)

(13) Input latitude of the place of observation. (May be scaled from map.) ___° ___' ___" (13)

(14) Input longitude of the place of observation. (May be scaled from map.) ___° ___' ___" (14)

(15) Input time zone of the place of observation. (See Note 1.) ___ (15)

(16) If observation is taken in a.m., input zero; if p.m., input 12. ___ (16)

(17) Input watch correction. (Fast is negative; slow is positive.) ___h ___' ___" (17)

POLARIS

(18) Input GHA from Table 1*. (See Note 2.) ___° ___' ___" (18)

(19) Input polar distance from Table 3*. (Use same date as for GHA.) ___° ___' ___" (19)

SOLAR

(South declinations are negative; press [CHS].)

(18) Input declination from Table 1*. (See Note 2.) ___° ___' ___" (18)

(19) Input declination for the next day. ___° ___' ___" (19)

(20) Input the EQT for the same date used in Item 18. ___° ___' ___" (20)

(21) Input the EQT for the next day. ___° ___' ___" (21)

NOTE 1: EST = 5, EDT = 4. CST = 6, CDT = 5. MST = 7, MDT = 6. PST = 8, PDT = 7.

NOTE 2: After Item 17 has been input, press [⊟]. The display will show the Greenwich Civil Time of the day of observation. This is your guide as to which tabular value to use. If the display is less than 24, use the date of observation, and if it is 24 or greater, use the date following the day of observation.

NOTE 3: All angular entries are in the form DD.MMSSs; so be sure to change those values from the ephemeris that are given in tenths of minutes.

* Tables referred to are from the K & E Solar Ephemeris.

USING THE SUP-R-ROM WITHOUT THE PRINTER

GENERAL

1. If you wish to recall an azimuth from storage and convert it to a bearing, you may do so in the ADDENDUM program, Step 3. Or you may choose to convert it from the keyboard. Or you may convert an azimuth to its bearing at any time (that is, from any program) by pressing [XEQ] [ALPHA] [AZ] [ALPHA]. However, the calculator is left in the FIELD TRAVERSE program. So if you use the ADDENDUM program or the [AZ] routine, be sure to re-access the program you were using WITHOUT initialization.

2. To recall coordinates from storage by point number, you may use the ADDENDUM program, Step 2. But again, be sure to return to the program you were using by accessing without initialization. Also, you may find the register where the north coordinate of a point is stored by multiplying the point number by 2 and adding 18; the east coordinate will be in the next higher register. For example, the north coordinate of point number 17 is found in Register 52. (2 x 17 + 18 = 52) The east coordinate is in Register 53.

3. For items not covered in the following, refer to the REGISTER CONTENTS at the bottom of each program page.

FIELD TRAVERSE (Page 7)

There are no problems with data input. To retrieve the bearing ahead (when angles are being input), press [RCL] [15] [XEQ] [12]. Sum HDs, Sum Lats, and Sum Deps may be viewed by recalling (or viewing) Registers 16, 17, and 18. For other closure data, press [■] [c] and when the data you want is in the display, touch [R/S] quickly. You may have to press [ALPHA] to bring out the data you want; but be sure to take it out of alpha mode before proceeding with other entries or executions.... Pressing [■] [c] changes no registers except the stack, so if you miss your data the first time, repeat the procedure.

COORDINATE GEOMETRY (Page 9)

There are no problems with data input except, after excecuting Step 9b on page 11, you must clear Flag 06 & 07 before proceeding. Press [■] [CF] [06] [■] [CF] [07]. This must be done after each excecution of Step 9a.

TRAVERSE ADJUSTMENT (Page 13)

Access the program but do not execute Step 2. Instead, store the first traverse point number in Register 05. Then, execute Step 4. After all courses have been adjusted, press [R/S] for the area. The area in square feet will be scrolled across the display and the acreage will be in the display when execution is complete. The area in square feet may be recalled from Register 05 and will be a negative quantity if the traverse was input in a clockwise direction.

AREA / INVERSE (Page 15)

Execution is identical to that in the instructions on page 15. But if you wish to record the bearings and distances, after inputting the second point number and pressing [E], watch the display and touch [R/S] quickly when you see the bearing (which will be the first item to be displayed). Then, press [ALPHA] to display the bearing. After recording the bearing, press [R/S] to resume calculations. The HD will be in the display when calculation is complete. Be sure to take calculator out of alpha mode before inputting the next point number...... If you batch load your point numbers, when you stop the calculation for the first bearing, leave the calculator in the alpha mode. Then you will only need to watch the display and press [R/S] at the proper times. Again, be sure to take the calculator out of alpha mode before proceeding with the input of other data or pressing [C] for the area. A WORD OF CAUTION: When stopping calculation for the retrieval of these data, do not do anything to change the stack. Should you press [R/S] too late to retrieve an item, simply leave it for now and come back later and inverse between the two points. (You will notice that you only need to be quick in pressing [R/S] for the bearing; you have plenty of time for the HD.)

FIELD DATA COLLECTOR (Pages 17 and 19)

The 10 steps in the first part of this program are designed for field use without the printer, and on page 19 under COMPUTING AND PRINTING FIELD DATA, ignore the note about the printer. All instructions will work without the printer by following the suggestions given above in TRAVERSE ADJUSTMENT and AREA / INVERSE when applicable.

PREDETERMINED AREA (Page 21)

See Step 5 in PA I, and Step 6 in PA II.

STAKEOUT (Page 23)

See Step 6.

SEARCH / SET (Page 25)

This program is designed to be used in the field without the printer. Just be sure to clear Flag 07 after executing [■] [c].

QUIK–CHEK (Page 27)

This program works equally well with or without the printer. After executing Step 4, the display will show the distance in feet. Note that you may use this program solely for the purpose of converting poles/rods, chains, or meters to feet without inputting any bearings..... After executing Step 5 (The first [R/S]), the precision will be in the display and the EOC is stored in Register 07. After pressing the second [R/S], the acreage will be in the display. For the square feet, press [RCL] 05. This will be negative if the traverse was input clockwise.

PERPENDICULAR OFFSET (Page 29)

See Step 6.

INTERSECTIONS (Page 31)

Data input is the same with or without the printer unless coordinates are to be input from the keyboard. They must be stored as point numbers before the program is accessed. Point numbers 1 and 2 are convenient – store N_1 in Register 20, E_1 in Register 21, N_2 in Register 22, and E_2 in Register 23. Should these registers have data that you do not wish to disturb, use higher point numbers that will be outside your stored data. Say, you have 25 points already stored; you could use Point Numbers 30 and 31. (30 x 2 + 18 = 78) Then store N_1 in Register 78, E_1 in Register 79, etc.

To retrieve solutions:

	For the first azimuth:	[RCL] [07]
	For the first distance:	[RCL] [08]
	For the second azimuth	[RCL] [09]
	For the second distance	[RCL] [10]

If you require a second solution, copy the above down and wait until after you have executed the second solution before converting any azimuths to bearings. (See ADDENDUM program, Step 3.)

ROADSIDE (Page 33)

Execute Steps 1 through 3c. When the display shows NONEXISTENT, computation is complete. (The calculator tried to print the diamond separators shown in the example and is left in COGO. So before proceeding with the next point, re-access ROADSIDE, but do not initialize.)

To retrieve solutions:

	For HD right:	[RCL] [16]
	For HD left:	[RCL] [07]

To occupy the next point, proceed as follows:

1. Access program. Press [■] [T]
2. Store BS No. in Register 01
3. Store INST No. in Register 02.
4. Store FS No. in Register 03.
5. Press [XEQ] [00].
6. Retrieve distances and begin again with Step 1 above for the next point.

UTILITY PROGRAM (Page 35)

Steps 2 and 4 may be executed without the printer.

VERTICAL CURVE (Page 37)

Although this program is designed primarily for use with the printer, you may derive some benefit without the printer by following these restrictions: you must set Flag 04 and only one curve may be input at the time. After inputting the data (ending with the increment), wait for the calculator to ask for ODD STA? (You may speed things up a bit by inputting a large increment, say 100.) Then, input stations on the curve one at a time and press [XEQ] [08] (or [XEQ] [H]). When calculation is complete, the display will show the station. To view the elevation, press [⌧].
NOTE that G_1 and G_2 are stored in Registers 04 and 05, and the station of maximum or minimum elevation is stored in Register 14.

SOLAR / POLARIS (Page 39)

This program works equally well with or without the printer.

	For the first azimuth to mark,	[RCL] [33]
	For the second azimuth to mark,	[RCL] [34]
	For the mean azimuth to mark,	[RCL] [35]

To convert azimuths to bearings, see ADDENDUM program, Step 3.

CROSS-SECTIONS (Page 41)

This program works equally well with or without the printer.

	For area of current station,	[RCL] [09].
	For the volume between this station and the last station,	[RCL] [13].
	For the cumulative volume,	[RCL] [14].

SLOPE-STAKE (Page 43) This is a field program not designed for use with the printer.

SIMPLE CURVE DATA (Page 45) This program will NOT work without the printer.

CURVE PROBLEMS (Page 47)

This program works equally well with or without the printer. The radius is in the display when calculation is complete.

ROTATION AND TRANSLATION (Page 49) This program will NOT work without the printer.

LINEAR REGRESSION (Page 51) See ADDENDUM program, Step 4.

SUP-R-ROM © ADDENDUM				
■ a	■ b	■ c	■ d	■ e
A	B	C	D	E
F	G	H	I	J

STEP	PROCEDURE	INPUT	PRESS
1	Read magnetic card or key in ADDENDUM program into program memory.		
2	TO RECALL THE COORDINATES OF A POINT:		
	a. Access program.		[■] [R/S]
	b. Input point number.	Point No.	[XEQ] [F]
	c. North coordinate is in display. For east coordinate:		[R/S]
3	TO CONVERT AN AZIMUTH IN DECIMAL OF DEGREE TO ITS BEARING IN DD.MMSS:		
	a. Access program.		[■] [R/S]
	b. Recall azimuth from storage or key in azimuth from keyboard.	Azimuth	[XEQ] [12]
4	LINEAR REGRESSION		
	NOTE: If coordinates are to be input from keyboard, use SUP-R-ROM program as is on page 51. To retrieve data, see Step 4e below.		
	a. Access program		[■] [R/S]
	b. Initialize.		[R/S]
	c. Input point numbers as prompted by the display.		[R/S]
	Continue executing Step 4c until all points have been input.		
	d. Access LINEAR REGRESSION program and compute the regression line:		[■] [,] [E]
	Assign point number when prompted.	Point No.	[R/S]
	e. TO RETRIEVE DATA:		
	1. For regression line intercept on the north axis. (This is also stored in Register 10 and stored as the point number assigned in Step 4d above.)		[R↓]
	2. For the azimuth of the regression line. (This is also stored in Register 10.)		[R↓]
	3. To convert azimuth to bearing, execute Step 3 above.		
	FOR A NEW PROBLEM, BEGIN AGAIN AT STEP 4a.		

REGISTER CONTENTS

KEYING IN THE ADDENDUM PROGRAM

Be sure calculator is out of USER mode.

Press: [■] [GTO] [.] [.] [PRGM]
Key in program as follows:

```
01♦LBL "FP"
02 "ADD"
03 PROMPT
04 CLΣ
05 "PT NO?"
06 ASTO 01
07♦LBL 05
08 RCL 01
09 STOP
10 XEQ "S"
11 Σ+
12 GTO 05
13♦LBL 06
14 XEQ "T"
15 RCL IND X
16 STOP
17 ISG Y
18 STOP
19 RCL IND Y
20 STOP
21♦LBL 12
22 XEQ "AZ"
23 END
```

```
[■] [LBL] [ALPHA] [FP] [ALPHA]
[ALPHA] [ADD] [ALPHA]
[XEQ] [ALPHA] [PROMPT] [ALPHA]
[■] [CL Σ]
[ALPHA] [PT Space NO?]
[■] [STO] [01] [ALPHA]

[■] [LBL] [05]
[RCL] [01]
[R/S]
[XEQ] [ALPHA] [S] [ALPHA]
[ Σ+]
[■] [GTO] [05]

[■] [LBL] [06]
[XEQ] [ALPHA] [T] [ALPHA]


[RCL] [■] [.] [X]
[R/S]
[■] [ISG] [.] [Y]
[R/S]
[RCL] [■] [.] [Y]
[R/S]

[■] [LBL] [12]
[XEQ] [ALPHA] [AZ] [ALPHA]
```

With the calculator still in PRGM mode, single step [SST] through the program and check against the tape above left. Correct if necessary.

Take calculator out of PRGM mode; press [GTO] [.] [.] (TRY AGAIN will be displayed.) Assign the ADDENDUM program to the VIEW key: [■] [ASN] [ALPHA] [FP] [ALPHA] [■] [VIEW]. Place calculator in USER mode.

Press [■] [R/S]. (It's a little easier to remember the location of [R/S] than [VIEW].) You should see ADD.

If a card reader is available, place calculator in PRGM mode while still in USER mode and write a card.

A PROGRAM TO INVERSE BETWEEN INPUT COORDINATES USING ONLY THE STACK

(No registers will be disturbed. But if you interrupt a program, be sure to re-access the program but do not initialize.)

KEY IN THE PROGRAM. Be sure Calculator is NOT in USER mode! (If you have several inverses to do, you may wish to assign "DB" to a key.)

01♦LBL "DB"	01	[LBL] [ALPHA] [DB] [ALPHA]
02 X<>Y	02	[XY]
03 R↑	03	[XEQ] [ALPHA] [R] [■] [ENTER] [ALPHA]
04 -	04	[−]
05 RDN	05	[R↓]
06 -	06	[−]
07 CHS	07	[CHS]
08 R↑	08	[XEQ] [ALPHA] [R] [■] [ENTER] [ALPHA]
09 R-P	09	[■] [R → P]
10 STOP	10	[R/S]
11 X<>Y	11	[XY]
12 XROM "AZ"	12	[XEQ] [ALPHA] [AZ] [ALPHA]
13 END		

TO OPERATE PROGRAM	INPUT	PRESS
1. Input Coordinates:	N_1	[ENTER]
	E_1	[ENTER]
	N_2	[ENTER]
	E_2	(Do not press enter)
2. For the distance:		[XEQ] [ALPHA] [DB] [ALPHA] or call for preassigned label key
3. For the bearing		[R/S]

SUP-R-ROM LABELS

Column A: Global Label **Column B: Program Location** **Column C: Local Label**

A	B	C	FUNCTION
FT	FT		Accesses Field Traverse program.
R	FT		Initialization: Clears Reg 00 - 19, clears Flags 01 - 10, stores 1 in Reg 06,10,11,12; sets Flag 27; stores 4 in Reg 19; Fix 4,; ends with beep.
W	FT	[b]	First time: Stores beginning coordinates in Reg 13, 14 & 20, 21. Executes" " Sets Flag 05. Second time: Used for end coordinates. The difference between Ne and Nb is summed to Reg 17; and the difference between Ee and Eb is summed to Reg 18; Flag 05 is cleared.
AA	FT	[A]	Computes and stores azimuth in Reg 15 and displays NE bearing.
BB	FT	[B]	Computes and stores azimuth in Reg 15 and displays SE bearing.
CC	FT	[C]	Computes and stores azimuth in Reg 15 and displays SW bearing.
DD	FT	[D]	Computes and stores azimuth in Reg 15 and displays NW bearing.
X	FT		Adds 360 to contents of X-register until a positive result is obtained.
aa	FT	[a]	Displays and stores azimuth in Reg 15; sets Flag 01.
T	FT		Applies MOD (140) function to point number; sets Flag 08 if MOD = 0. (This in turn sounds alarm later.)
U	FT		Applies temperature and grid factor corrections to entered distance if Flag 06 is clear; executes "?" if Flag 03 is set; flows into "O".
O	FT		Stores HD in Reg 07; recalls azimuth; executes P - R function; stores Lat in Reg 08, Dep in 09; sums Lat in Reg 17, Dep in 18; increments Reg 06.
?	FT		Computes HD and vertical difference; displays slope distance and vertical difference.
L	FT		Computes area by DMD.
P	FT		Executes "U"; flows into "↑".
↑	FT		Prompts for point number if Flag 02 is set; executes "T"; computes coordinates and stores them indirectly. Flows into "K".
K	FT		Prints point number and coordinates of point ahead.
JJ	FT	[J]	Displays V/ZA; stores the SIN or COS of angle in Reg 12; sets Flag 03 to indicate that V/ZA has been entered.
Q	FT	[E]	Executes " P "; computes data for balancing by the Crandall Rule; sums HD in Reg 16; executes " L "; sounds alarm if point number is 140, 280, etc.
V	FT	[c]	Computes and prints closure data; (only stack is changed)
M	FT		Displays and prints area in square feet and acres.
AZ	FT		Converts azimuth to bearing and displays bearing. (If Flag 01 is set, azimuth is displayed.)
GG	FT	[G]	Enters deflection angle; adds to contents of Reg 15; displays bearing or azimuth.
FF	FT	[F]	Same as GG except for CWBS angle.
HH	FT	[H]	Computes temperature correction factor and stores in Reg 10.
CG	CG		Accesses Coordinate Geometry program. Initialization: executes "R".
Σ	CG		Prints diamond separators for sideshot.
S	CG		Executes "T"; stores point number in Reg 06; recalls the coordinates of the point: N in Y-register, E in X-register.
Y	CG	[c]	Stores coordinates of entered point number in Reg 17 & 18.
Z	CG	R/S	Uses entered point number and finds the bearing or azimuth from the point number entered in "Y" to this point number. Stores computed azimuth in Reg 15; distance in Y-register.
SO	CG		Accesses Stakeout program. Initialization: Executes "R"; sets Flag 05.
SS	CG		Accesses Search / Set program. Initialization; Executes "R"; sets Flag 04.

A	B	C	FUNCTION
VC	VC		Accesses Vertical Curve program. Initialization: Clears all registers; clears Flags 04, 05, 06, 08, 09; Stores 28 in Reg 00, 31 in Reg 20, 32 in Reg 21, 33 in Reg 22.
PA	PA		Accesses Predetermined Area program. Initialization: Executes "R".
QC	QC		Accesses Quik-Chek program. Initialization: Executes "R".
UT	UT		Accesses Utility Program. Accessing stores 4 in Reg 19.
FD	FD		Accesses Field Data Collector program. Initialization: Clears all registers; executes "R"; stores 23 in Reg 00; .003333333 in Reg 03; 299 in Reg 20, zero in Reg 06.
SLS	SLS		Accesses Slope-Stake program. (No initialization)
CP	CP		Accesses Curve Problem program. (No initialization)
IN	IN		Accesses Intersection program. Initialization: "A" or "B" stores 4 in Reg 19; clears Reg 13, 14; prompts " BEG PT NO?".
SP	SP		Accesses Solar / Polaris Observation program. Initialization: "A" or "B" stores 1 in Reg 00 and 4 in 37. "A" also sets Flag 09.
LR	LR		Accesses Linear Regression program. Initialization: Clears summation registers; clears Flag 10; prompts "PTS?".
CD	CD		Accesses Curve Data program. Initialization: Executes "R"; stores 100 in Reg 14; stores radius of one-degree curve in Reg 11; clears Flags 04 & 09; stores 4 in 19; and prompts "DEF INC?".
RT	RT		Accesses Rotation / Translation program. Initialization: Clears Flags 08,09; prompts "ROT ∠".
XS	XS		Accesses Cross-Section Areas and Volumes program. Initialization: Executes "R";Fix 2; prompts "PRT INPUT?".
MS	MS		Accesses Mass Storage program. No initialization.
TA	TA		Accesses Traverse Adjustment program. Initialization: Clears Flag 00; prompts "1ST PT NO?".
N	TA		Recalls the coordinates of the point number stored in Reg 06; exchanges these with the coordinates stored in Reg 13 & 14; finds the difference between these two sets of coordinates; computes and stores the distance in Reg 07. The difference between the northings and eastings are left in Y-register and X-register.
PO	PO		Accesses Perpendicular Offset program. Initialization: Stores 4 in Reg 19; prompts "BASE NO= ".
RS	RS		Accesses Roadside program. Initialization: Stores 4 in Reg 19; clears Flag 10; sets Flag 02; prompts "OFST: RT↗LT?".

DOUBLING THE SUP-R-ROM CAPACITY BY USING THE "SWAP" PROGRAM

By adding the EXTENDED FUNCTIONS MODULE and one EXTENDED MEMORY MODULE to your 41-CV, or adding one EXTENDED MEMORY MODULE to the 41-CX, you may increase the capacity such that 280 points may be stored at one time: 140 in MAIN MEMORY and 140 in EXTENDED MEMORY.

The points stored in the EXTENDED MEMORY are not directly addressable and must be brought into MAIN MEMORY before using. The following program expedites the procedure.

SUP-R-ROM uses registers 0–299 as working registers and storage registers; registers 300–306 are free; registers 307–319 are used by SUP-R-ROM to assign the keys which access the various programs. The "SWAP" program requires more than the available seven registers; so we have to "STEAL" some of the assignment registers. This may be done in two ways:

A. IF YOU HAVE NOTHING IN THE CALCULATOR THAT YOU WISH TO PRESERVE,

Proceed as follows:

1. Turn Calculator off.
2. Remove SUP-R-ROM.
3. Do a "MEMORY LOST". (Hold down the "CLR" (←) Key while turning the calculator back on.)
4. Key in the "SWAP" Program or use the card reader to enter the program. If the card reader is used, be sure the calculator is in "USER" mode.
5. Check program thoroughly by single stepping through the program or print the program. To print, press (XEQ)(ALPHA)(PRP)(ALPHA) and check the tape against the listing below.
6. Size the calculator to 300: (Press (XEQ)(ALPHA)(SIZE)(ALPHA)(300).
7. If the card reader is used, key assignment is automatic. Otherwise press (■)(ASN)(ALPHA)(SWAP) (ALPHA)(■)(VIEW)
8. Turn the calculator off and replace SUP-R-ROM.

Now, since we've used some of SUP-R-ROM's assignment registers, the following programs must be accessed as shown:

SLOPE–STAKE:	(XEQ)(ALPHA)(SLS)(ALPHA)
CURVE DATA:	(XEQ)(ALPHA)(CD)(ALPHA)
CURVE PROBLEMS:	(XEQ)(ALPHA)(CP)(ALPHA)
MASS STORAGE:	(XEQ)(ALPHA)(MS)(ALPHA)
ROTATION AND TRANSLATION:	(XEQ)(ALPHA)(RT)(ALPHA)
LINEAR REGRESSION:	(XEQ)(ALPHA)(LR)(ALPHA)

IF YOU HAVE DATA IN THE CALCULATOR THAT YOU WISH TO PRESERVE,

Proceed as follows:

1. If you have another program in the calculator clear it out: Press (XEQ)(ALPHA)(CLP)(ALPHA)(ALPHA) (PROGRAM NAME)(ALPHA)
2. Be sure calculator is out of user mode.
3. Take assignments off the two bottom rows of keys:

PRESS (■)(ASN)(ALPHA)(ALPHA)(■)(:)
PRESS (■)(ASN)(ALPHA)(ALPHA)(■)(SPACE)
PRESS (■)(ASN)(ALPHA)(ALPHA)(■)(,)
PRESS (■)(ASN)(ALPHA)(ALPHA)(■)(Y)
PRESS (■)(ASN)(ALPHA)(ALPHA)(■)(=)
PRESS (■)(ASN)(ALPHA)(ALPHA)(■)(?)
PRESS (■)(GTO)(.)(.)
EXECUTE STEPS A4, A5, A6 and A7 ABOVE.

HOW TO USE THE "SWAP" PROGRAM

1. Create a file in EXTENDED MEMORY named "XX;" (actual name is "XX") as follows:

   PRESS (ALPHA)(XX)(ALPHA)(300)(XEQ)(ALPHA)(CRFLD)(ALPHA)

2. Use "TRAVERSE" or "COORDINATE GEOMETRY" to enter the first 140 points.
3. When the alarm sounds, PRESS (R/S) to silence it.
4. Access the "SWAP" program by pressing (■)(VIEW).
5. "PT NO?" will be displayed. Now, press (R/S) and the contents of registers 20–299 will be swapped with those same registers in EXTENDED MEMORY.
6. When transfer is complete (allow 4 to 5 minutes the calculator beeps and "PT NO?" is again displayed.
7. Re-access your TRAVERSE or COORDINATE GEOMETRY program, but:

**************** DO NOT INITIALIZE ******************

8. Resume entering courses continuing to number points 141, 142, etc.

Now, you will probably want to swap the registers again in order to have the first 140 points in main memory. Simply press (■)(VIEW)(R/S). You may now go to "TRAVERSE ADJUSTMENT" and balance the first 140 points. Then back to "SWAP to bring the last points into main memory. Then, back to "TRAVERSE ADJUSTMENT" to complete the balancing. Whether you adjusted the traverse or not, you want to end up with the first 140 points in main memory and the remainder in extended memory.

Now, you may use most any of the programs and recall points from both main memory and extended memory:

1. Access "SWAP" program: PRESS (■)(VIEW).
2. "PT NO?" is displayed. Input the point number and PRESS (R/S).
3. When transfer is completes (about 3 seconds) the calculator beeps and again displays "PT NO?".
4. You may enter another point number, or re-access the program you were working.
5. On returning to your main program DO NOT INITIALIZE!
6. Re-enter the point number and press the appropriate key.
7. Return to "SWAP" and transfer the coordinates back to their original locations. (STEP 2 ABOVE)

********************** NOTE **********************

A WORD OF CAUTION: SUPPOSE YOU INTEND TO TRANSFER A SINGLE POINT AND DO NOT ENTER THE POINT NUMBER. OF COURSE, THE SWAP-ALL OPERATION BEGINS. DON'T INTERRUPT THE PROGRAM. (YOU WOULD HAVE A MESS; SOME OF THE POINTS THAT SHOULD BE IN MAIN MEMORY WOULD BE IN EXTENDED MEMORY AND VICE VERSA.) SIMPLY LET THE TRANSFER BE COMPLETED AND THEN SWAP THEM BACK. HOWEVER IF YOU SHOULD INADVERTENTLY STOP THE PROGRAM, IF YOU MAKE NO KEYBOARD ENTRIES, YOU MAY RESUME THE TRANSFER BY PRESSING <R/S>.

PROGRAM STEPS FOR THE "SWAP" PROGRAM

		TAKE OUT OF USER MODE
		PRESS:
		(PRGM)
01	LBL "SWAP	(■)(LBL)(ALPHA)(SWAP)(ALPHA)
02	CLX	(■)(CLX)
03	"PT NO?	(ALPHA)(PT SPACE NO?)(ALPHA)
04	PROMPT	(XEQ)(ALPHA)(PROMPT)(ALPHA)
05	X≠Ø?	(XEQ)(ALPHA)(X ■ H ■ Ø?)(ALPHA)
06	SFØ8	(■)(SF)(Ø8)
07	FS? Ø8	(■)(FS?)(Ø8)
08	XROM "T"	(XEQ)(ALPHA)(T)(ALPHA)
09	FC? Ø8	(XEQ)(ALPHA)(FC?)(ALPHA)*(Ø8)
10	20.299	(20.299)
11	"XX"	(ALPHA)(XX)(ALPHA)
12	LBL ØØ	(■)(LBL)(ØØ)
13	RCL IND X	(RCL)(■)(●)(X)
14	RCL Y	(RCL)(●)(Y)
15	SEEKPTA	(XEQ)(ALPHA)(SEEKPTA)(ALPHA)
16	GETX	(XEQ)(ALPHA)(GETX)(ALPHA)
17	STO IND Y	(STO)(■)(●)(Y)
18	RDN	(R↓)
19	SEEKPTA	(XEQ)(ALPHA)(SEEKPTA)(ALPHA)
20	RDN	(R↓)
21	SAVEX	(XEQ)(ALPHA)(SAVEX)(ALPHA)
22	RDN	(R↓)
23	ISG X	(■)(ISG)(●)(X)
24	GTO ØØ	(■)(GTO)(ØØ)
25	FS?C Ø8	(XEQ)(ALPHA)(FS?C)(ALPHA)*(Ø8)
26	GTO ØØ	(■)(GTO)(ØØ)
27	BEEP	(■)(BEEP)
28	GTO "SWAP"	(■)(GTO)(ALPHA)(SWAP)(ALPHA)

* WAIT A SECOND FOR CALCULATOR TO REACT!

Underlined characters in the above program steps are individual keystrokes.

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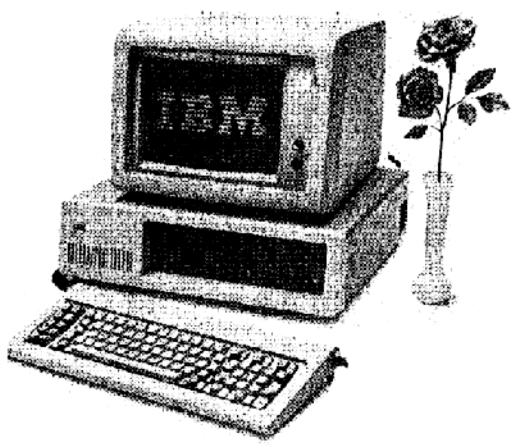

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