HP-33S Calculator Program   Closure   3

Two Missing Distances Calculation

Programmer: Dr. Bill Hazelton

Date: March, 2005.   *Store 360 in Register Z before starting*

Line	Instruction	Display	User Instructions
B0001	LBL B	1st side bearing	Enter known traverse sides using Program A
B0002	→HR		Then enter bearing of 1st unknown side.
B0003	STO U	Bg in dec. deg.	Press XEQ B.
B0004	STOP		(Bearings entered in DDD.MMSS format)
B0005	→HR	2nd side bearing	Enter bearing of 2nd unknown side.
B0006	STO V		Press R/S.
B0007	–		
B0008	SIN		
B0009	ABS		
B0010	1/x		
B0011	STO T		
B0012	Σy		(Enter using SUMS Σx)
B0013	Σx		(Enter using SUMS Σy)
B0014	y,x → θ,r		
B0015	STOx T		
B0016	x < > y		
B0017	STO S		
B0018	RCL– V		
B0019	SIN		
B0020	ABS		
B0021	RCLx T		
B0022	STOP	1st missing side	Length of first missing side displayed
B0023	RCL S		
B0024	RCL– U		
B0025	SIN		
B0026	ABS		
B0027	STOx T		
B0028	CLx		
B0029	STO U		
B0030	STO V		
B0031	STO S		
B0032	RCL T	2nd missing side	Length of second missing side displayed
B0033	RTN		

Notes

(1) Enter all the known sides of the traverse using the program stored under A, i.e., the closure program with area (Closure 1).

(2) When all known sides have been entered and processed, enter the bearing of the first missing line, then press XEQ B. This will take you to the start of the 2MD program.

(3) Enter the bearing of the second missing line, then press R/S. The length of the first missing distance is displayed.

(4) Press R/S. The length of the second missing distance is displayed.

(5) The value 360 should be stored in the Z memory register before running the A traverse closure program. It is used to correct negative bearings.

(6) Bearings are entered and displayed in HP notation, i.e., DDD.MMSS

(7) Several memory registers are using during computation (S, U, V). These are cleared at the end of the program. T retains a value after the program completes.

Theory

Once all the known sides have been entered (order does not matter), the resultant vector is known. This forms one side of a triangle, with the two unknown lines forming the other two sides. We know the length of the resultant vector, and the bearings of all three sides. So we can deduce all three angles.

The triangle is solved using the Sine Rule. The ratio of the sine of the angle opposite the resultant vector and the vector's length are stored and used with the sines of the other two angles to compute the lengths of the two missing sides.

Note that all misclosure (errors) in the known part of the traverse will be included in the lengths of the unknown sides. The resulting traverse should close perfectly, but this is meaningless information as far as the traverse is concerned, as there is no redundant data to allow computation of a misclosure.

Sample Computations

Bearing	Distance
6° 53' 10"	72.00
112° 37' 20"	102.23
185° 39' 50"	29.04
181° 30' 00"	Missing distance 1
283° 54' 30"	Missing distance 2

Results Missing distance 1 = 27.883

Missing distance 2 = 102.403

Two Missing Distances Calculation

Bearing	Distance
231° 06' 56"	199.123
7° 07' 30"	201.556
166° 30' 16"	Missing distance 1
63° 26' 06"	Missing distance 2

Results Missing distance 1 = 128.549

Missing distance 2 = 111.804

Storage Registers Used

S Intermediate results. Cleared at end.

T Sine Rule Ratio and 2nd missing distance.

U Bearing of first missing side. Cleared at end.

V Bearing of second missing side. Cleared at end.

Z 360

Plus those used by the Traverse Closure and Area program (A).

Statistical Registers: Σx = Current ΔY or ΔN from starting point

Σy = Current ΔX or ΔE from starting point

n = Number of sides entered from start

Labels Used

Label **B** Length = 99 Checksum = A99B

Use the length (LN=) and Checksum (CK=) values to check if program was entered correctly. Use the sample computation to check proper operation after entry.