Further Comments on the Calculation of Position Line Data with a Computer Calculator

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MR. PODMORE's article[1] will certainly cause several people to write to you, as he is not suggesting the best use of the HP-35. One advantage of the Hewlett-Packard calculators is that one does not need to convert degrees and minutes to degrees and fractions of a degree before beginning the problem. Also one should use the cosine law again to find the azimuth. The usefulness of the calculator is that it can find with ease, both the calculated zenith distance and azimuth (no more tables!).

Beginning with the same basic spherical cosine formula as Mr. Podmore, only replacing the Local Hour Angle by the angle at Z (which gives Azimuth) we have:

$$\cos Z = (\cos PX - \cos PZ \cos XZ)/(\sin PZ \sin XZ)$$

where as before ZX = Zenith distance

PZ = Co-lat

PX = Polar distance

Again replacing PZ by 90-Lat and PX by 90-Dec (or 90 + Dec) we find that, when Lat and Dec have the same name;

$$\cos Z = (\sin (\text{Dec}) - \sin (\text{Lat}) \cos XZ)/\cos (\text{Lat}) \sin XZ$$

and when Lat and Dec have different names:

$$\cos Z = (-\sin (\text{Dec}) - \sin (\text{Lat}) \cos XZ)/\cos (\text{Lat}) \sin XZ.$$

Let us finish the problem begun in the last article in which

DR Lat = 53° 10′ N

Dec = 15° 0·3′ N

XZ = 39° 7·6′

Substituting in the above formula (Lat and Dec Same Name) we get:

$$\cos Z = \{\sin (15^\circ\ 0{\cdot}3') - \sin (53^\circ\ 10') \cos (39^\circ\ 7{\cdot}6')\}/\{\cos (53^\circ\ 10') \sin (39^\circ\ 7{\cdot}6')\}$$

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The necessary sequence of operations on the calculator is shown below.

	Press		*See*
1)	.3 ENTER	0·3000	
2)	60 ÷	0·0050	min to degrees
3)	15 +	15·0050	
4)	SIN	0·2589	
5)	10 ENTER	10·0000	
6)	60 ÷	0·1667	min to degrees
7)	53 +	53·1667	
8)	SIN	0·8004	
9)	7.6 ENTER	7·6000	
10)	60 ÷	0·1267	min to degrees
11)	39 +	39·1267	
12)	COS	0·7758	
13)	X	0·6209	product of sine and cosine
14)	—	−0·3620	value of top line
15)	10 ENTER	10·0000	
16)	60 ÷	0·1667	min to degrees
17)	53 +	53·1667	
18)	COS	0·5995	
19)	7.6 ENTER	7·6000	
20)	60 ÷	0·1267	min to degrees
21)	39 +	39·1267	
22)	SIN	0·6310	
23)	X	0·3783	
24)	÷	−0·9569	
25)	COS^{-1}	163·1174	

The Azimuth is 163·1° or 196·9°.

Although only four decimal places are shown the calculator computes with 10 significant figures. The HP model used above is the HP-21 which is one half the cost of the HP-35.

One final comment, the HP-35 is also far less expensive than the HP-65 and again is more useful for a navigator, especially with its built in 'stop-watch'. I find it amusing that the revolution in calculators is occurring so fast that Mr. Podmore's article refers to out-dated equipment—and next month this article will possibly be out of date too!

REFERENCE

[1] Podmore, H. L. (1975). The calculation of position line data with a computer calculator. This *Journal*, 28, 101.