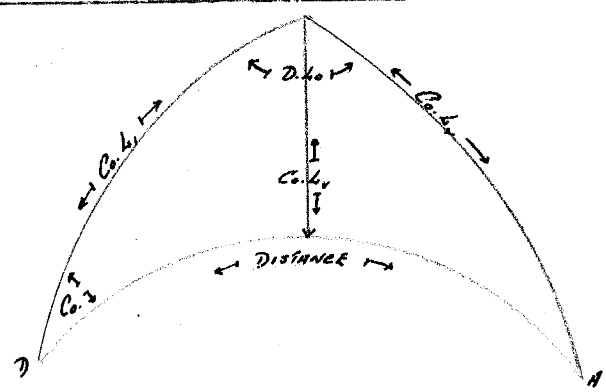
COMPLETE GREAT CIRCLE SOLUTION

Diagram of Component Parts



1. To determine the Distance and the Initial Course the Cosine-Haversine Formula is applied as follows;

(a) To Determine Distance

$$\text{Hav Dist} = \text{Hav}(\text{CoL}_1 \sim \text{CoL}_2) + \text{Sin CoL}_1 \cdot \text{Sin CoL}_2 \cdot \text{Hav DLo}$$

or,

$$\text{Hav Dist} = \text{Hav}(L_1 \sim L_2) + \text{Cos } L_1 \cdot \text{Cos} L_2 \cdot \text{Hav DLo}$$

(b) To Determine Initial Course

$$\text{Hav Co} = \text{Hav CoL}_2 \cdot \frac{\text{Csc CoL}_1 \cdot \text{Csc Dist}}{\text{Hav}(\text{Dist} \sim \text{CoL}_1)}$$

2. In order to determine the Latitude and the Longitude of the Vertex of the Great Circle in question Napier's rules for the solution of the right spherical triangle are used as follows;

(a) For the Co-Latitude of the Vertex

$$\text{Sin CoL}_v = \text{Cos } \overline{\text{IC}} \cdot \text{Cos } \overline{\text{CoL}_1}$$

or, $\text{Sin CoL}_v = \text{Sin IC} \cdot \text{Sin CoL}_1$

(b) For the Difference of Longitude of the Vertex

$$\sin \overline{CoL_1} = \tan DLo \cdot \tan \overline{IC}$$

$$\cos CoL_1 = \cot DLo \quad \cot IC$$

$$\text{or, } \cot DLo = \frac{\cos CoL_1}{\cot IC}$$

$$\text{or, } \cot DLo = \cos CoL_1 \; \tan IC$$

3. Having determined the Latitude and the Longitude of the Vertex of the Great Circle the Longitude of the Equator Crossing may be determined by applying ninety degrees to the Longitude of the Vertex.

4. In order to determine the Latitudes of a series of Points on the computed Great Circle Track at equally spaced intervals of Longitude the following formula derived from Napier's Rules may be employed;

(a) For the Latitude of a Point a given Difference of Longitude from the Vertex

$$\sin \overline{DLo} = \tan CoL_v \cdot \tan \overline{CoL_p}$$

$$\cos DLo = \tan CoL_v \cdot \cot CoL_p$$

$$\frac{\cos DLo}{\cot CoL_p} = \tan CoL_v$$

$$\frac{1}{\cot CoL_p} = \frac{\tan CoL_v}{\cos DLo}$$

$$\tan CoL_p = \tan CoL_v \cdot \sec DLo$$

or since, $\tan CoL_p = \cot(90 - CoL_p)$ or Lat_p

then, $\cot Lat_p = \tan CoL_v \cdot \sec \cdot DLo$

Great Circle - Course, Distance, & Equator Crossing - New York to Capetown

Position - Ambrose Light Vessel Lat. 40-27 N. Long. 73-49 W
Green Point Light 33-54 S. 18-24 E.
92-13 E.

			Distance	Course		Dlo ~~[struck]~~ Equator Crossing	
Dlo	92-13	l.hav.	9.71545	l.sin.	9.99967		
Lat1	40-27	l.cos.	9.88137			l.sin.	9.81210
Lat2	33-54	l.cos.	9.91908	l.cos.	9.91908		
		l.hav.	9.51590				
		n.hav.	.32803				
L1 ± L2	74-21	n.hav.	.36512				
		n.hav.	.69315				
Dist	112-44 ←		→	l.csc.	.03512		
Dist.	6764 miles			l.sin.	9.95387		

Co. S 64-03 E ←
180
Course 115-57 → (-) l.cot. 9.68722
l.tan. .12488

Dlo Eq Crossing 53-07-35 E.
73-49-00 W.
Long. 20-41-25 West