

SR NO. 28

AT-5

**VOL NO.1 TABLES FOR
COMPUTING AND
PROJRCTING THE
GRATICULES OF THE
SHEETS OF THE
INDIAN ATLAS
YEAR-1902.**



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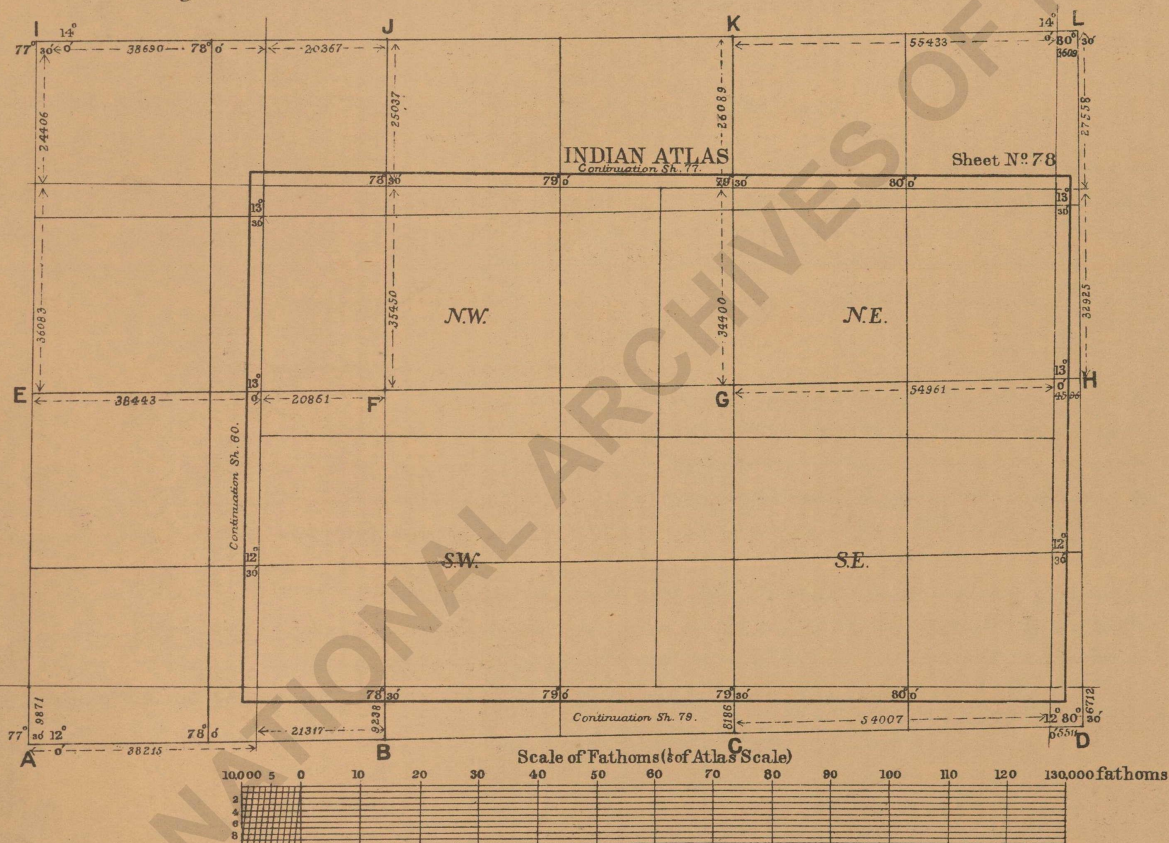
Calculation of Co-ordinates for the Projection of the Graticule of a sheet of the Atlas of India.

The rectangular co-ordinates of the points of intersection appertaining to the graticule lines of an Atlas sheet, are computed for a full sheet in the first instance, and in order to determine the intersection of the degrees, and half-degree lines on the borders, the co-ordinates of the several points falling within the continuation or marginal sheets are also computed and projected on a large sheet of paper properly stretched on a table. After the projection of the whole of the points of intersection have been completed, the lines are drawn from point to point; these again are subdivided for the half-degrees, and similarly joined so that the several lines intersecting the borders of the required sheet be finally determined.

The full sheet is then divided into four equal parts, each part representing a quarter Atlas sheet and named N.W., N.E., S.W., and S.E. (Vide figure).

An example is given below of the Calculation for all the co-ordinates of Atlas sheet 78, as well as of those of the surrounding sheets, and to facilitate reference the following figures with the computed values inserted thereon of every point is also given.

(Signed) A. Chamarett.



Type of Calculation

Calculation of point A (Vide 12° 0' 77° 30')	From Central line of projection (76° 30') to western edge of sheet 78 (Vide sheet of Elements of projection)	Fathoms.
	On Latitude 12° (Vide Tables): Sine of 1 st Degree from Central line	59,535.
	Distant from western edge of sheet 79, within sheet 61 of intersection	12° 0' 77° 30' 38215-A
		[Perpendicular Co-ordinate.]
	Intersection of southern edge of sheet 60 with central line of projection	
	(Vide sheet of elements of projection, and page 80 of the abstracts of the Reports of the Surveys of India 1870-71)	12° 10'
	Latitude line required for this projection	12° 0'
	Value of a Meridional degree between Lats. 12° & 13° = 60,484 fathoms. Diff.	0° 10'
	Then as 60: 60,484 :: 10: X ∴ X = 10081.	
	Value of 10 minutes on Cent ^l line of projection	10081.
	Versine on 12 degree of Lat: for 1 st Degree from Cent ^l line	210.
		3871 = A (Direct co-ordinate).

	2 nd Degree	3 rd Degree	4 th Degree	*97750 + 134850
Lengths of sheets	97750	232600	232600	
Lat: 12 th Degree sines	<u>119067</u>	<u>178593</u>	<u>238111</u>	
	B = <u>21317</u>	C = <u>54007</u>	D = <u>5511</u>	= Perpendicular Co-ordinate
Value of 10 Merid ^l minutes	10081	10081	10081	See 1 st Example
Lat: 12 th Degree Versines	- 843	- 1895	- 3369	
	B = <u>9238</u>	C = <u>8186</u>	D = <u>6712</u>	= Direct Co-ordinate

	1 st Degree	2 nd Degree	3 rd Degree	4 th Degree
Lengths of sheets	97750	97750	232600	232600
Lat: 13 th Degree sines	<u>59307</u>	<u>118611</u>	<u>177909</u>	<u>237198</u>
	E = <u>38443</u>	F = <u>20861</u>	G = <u>54691</u>	H = <u>4598</u> Perpendicular Co-ordinate
Value of 36 Merid ^l minutes	36293	36293	36293	36293 +
Lat: 13 th Degree Versines	- 210	- 843	- 1893	- 3368
	E = <u>36083</u>	F = <u>35450</u>	G = <u>34400</u>	H = <u>32925</u> Direct Co-ordinate

	1 st Degree	2 nd Degree	3 rd Degree	4 th Degree
Lengths of sheets	97750	97750	232600	232600
Lat: 14 th Degree sines	<u>59060</u>	<u>118117</u>	<u>177167</u>	<u>236209</u>
	I = <u>38690</u>	J = <u>20367</u>	K = <u>55433</u>	L = <u>3609</u> Perpendicular Co-ordinate
Value of 24 Merid ^l minutes	24196	24196	24196	24196 φ
Lat: 14 th Degree Versines	+ 210	+ 841	+ 1893	+ 3362
	I = <u>24406</u>	J = <u>25037</u>	K = <u>26089</u>	L = <u>27558</u> Direct Co-ordinate

Note † Intersection of northern edge of sheet 60 with Cent^l line of projection }
 Vide sheet of elements of D^o } 13-36
 Lat: line required for this projection 13-0
 Diff: 0 36
 Value of a Merid^l Degree between Lats: 13 & 14-60489 fathoms
 Then as 60: 60489 :: 36: X :: X = 36293 = Value of 36 meridional minutes.

ϕ Intersection of northern edge of sheet 60 with Cent^l line of projection..... $13^{\circ}-36'$
 Lat. line required for this projection..... $14^{\circ}-0'$
 Diff: $0-24'$
 Value of a Merid^l Degree between Lats: 13° & 14° =60489 fathoms
 Then as 60: 60489::24:X: X=24196= Value of 24 meridional minutes.

Computed by A. Chamarett Esq^r.

Table of
Eastern and Western Values of *N.Q.* in fathoms with their respective Logarithms.

Eastern Values of <i>N.Q.</i>		Western Values of <i>N.Q.</i>	
Fathoms	Logarithms	Fathoms	Logarithms
97750	4.9901168	37100	4.5693739
232600	5.3666097	171950	5.2354022
367450	5.5651983	306800	5.4868554
502300	5.7009632	441650	5.6450782
637150	5.8042417	576500	5.7607993
772000	5.8876173	711350	5.8520833
906850	5.9575355	846200	5.9274730
1041700	6.0177427		
1176550	6.0706104		
1311400	6.1177352		
1446250	6.1602434		
1581100	6.1989593		
1715950	6.2345047		

Table of Proportional parts of the Angle of Projection

Latitude	Angle of projection due to 1 degree of Longitude	Proportional parts in Seconds of Longitude due to Tenths of a degree									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
1	23-1.26	8.62	0.862	1.724	2.586	3.448	4.310	5.172	6.034	6.896	7.758
2	" 9.88	8.32	0.832	1.664	2.496	3.328	4.160	4.992	5.824	6.656	7.488
3	" 18.20	8.00	0.800	1.600	2.400	3.200	4.000	4.800	5.600	6.400	7.200
4	" 26.20	7.68	0.768	1.536	2.304	3.072	3.840	4.608	5.376	6.144	6.912
5	" 33.88	7.36	0.736	1.472	2.208	2.944	3.680	4.416	5.152	5.888	6.624
6	" 41.24	7.02	0.702	1.404	2.106	2.808	3.510	4.212	4.914	5.616	6.318
7	" 48.26	6.68	0.668	1.336	2.004	2.672	3.340	4.008	4.676	5.344	6.012
8	" 54.94	6.36	0.636	1.272	1.908	2.544	3.180	3.816	4.452	5.088	5.724
9	24-1.30	6.00	0.600	1.200	1.800	2.400	3.000	3.600	4.200	4.800	5.400
10	" 7.30	5.64	0.564	1.128	1.692	2.256	2.820	3.384	3.948	4.512	5.076
11	" 12.94	5.28	0.528	1.056	1.584	2.112	2.640	3.168	3.696	4.224	4.752
12	" 18.22	4.90	0.490	0.980	1.470	1.960	2.450	2.940	3.430	3.920	4.410
13	" 23.12	4.54	0.454	0.908	1.362	1.816	2.270	2.724	3.178	3.632	4.086
14	" 27.66	4.16	0.416	0.832	1.248	1.664	2.080	2.496	2.912	3.328	3.744
15	" 31.82	3.78	0.378	0.756	1.134	1.512	1.890	2.268	2.646	3.024	3.402
16	" 35.60	3.36	0.336	0.672	1.008	1.344	1.680	2.016	2.352	2.688	3.024
17	" 38.96	2.98	0.298	0.596	0.894	1.192	1.490	1.788	2.086	2.384	2.682
18	" 41.94	2.58	0.258	0.516	0.774	1.032	1.290	1.548	1.806	2.064	2.322
19	" 44.52	2.16	0.216	0.432	0.648	0.864	1.080	1.296	1.512	1.728	1.944
20	" 46.68	1.74	0.174	0.348	0.522	0.696	0.870	1.044	1.218	1.392	1.566
21	" 48.42	1.30	0.130	0.260	0.390	0.520	0.650	0.780	0.910	1.040	1.170
22	" 49.72	0.86	0.086	0.172	0.258	0.344	0.430	0.516	0.602	0.688	0.774
23	" 50.58	0.44	0.044	0.088	0.132	0.176	0.220	0.264	0.308	0.352	0.396
24	" 51.02	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	" 51.02	0.48	0.048	0.096	0.144	0.192	0.240	0.288	0.336	0.384	0.432
26	" 50.54	0.94	0.094	0.188	0.282	0.376	0.470	0.564	0.658	0.752	0.846
27	" 49.60	1.40	0.140	0.280	0.420	0.560	0.700	0.840	0.980	1.120	1.260
28	" 48.20	1.88	0.188	0.376	0.564	0.752	0.940	1.128	1.316	1.504	1.692
29	" 46.32	2.38	0.238	0.476	0.714	0.952	1.190	1.428	1.666	1.904	2.142
30	" 43.94	2.86	0.286	0.572	0.858	1.144	1.430	1.716	2.002	2.288	2.574
31	" 41.08	3.36	0.336	0.672	1.008	1.344	1.680	2.016	2.352	2.688	3.024
32	" 37.72	3.88	0.388	0.776	1.164	1.552	1.940	2.328	2.716	3.104	3.492
33	" 33.84	4.38	0.438	0.876	1.314	1.752	2.190	2.628	3.066	3.504	3.942
34	" 29.46	4.92	0.492	0.984	1.476	1.968	2.460	2.952	3.444	3.936	4.428
35	" 24.54	5.44	0.544	1.088	1.632	2.176	2.720	3.264	3.808	4.352	4.896
36	" 19.10	6.00	0.600	1.200	1.800	2.400	3.000	3.600	4.200	4.800	5.400
37	" 13.10										

General Walker's Formula for Computing the Corner Points of
the INDIAN ATLAS SHEETS.

In future projections of Atlas sheets, the latitudes and longitudes of the corner points should invariably be calculated, as a check on the marginal dividing of the graticule.

To find the latitudes and longitudes of the corner points of the Indian Atlas sheets:

Let OP be the fundamental meridian of the Atlas. Let P and Q be two points $1^{\circ} 26'$ apart in latitude, from which the perpendiculars to OP are set off which regulate any belt of sheets from East to West.

Draw the perpendiculars QNn and PMm indefinitely; draw MN parallel to PQ to indicate a lateral margin of any sheet. Draw the curves QBC and PAD from the centre O with the corresponding "radii of the projection" OQ and OP , then these curves will represent the parallels of latitude passing through the governing points P and Q .

Let N be a corner point of any sheet, and let it be required to find the latitude and longitude of N . With centre O and radius ON draw the curve RN , and then this curve will represent the parallel of latitude on which the point N is situated, and the latitude of N will be found by determining QR , and the longitude by determining the arc RN .

In the right-angled triangle OQN , we have OQ equal to the given radius of projection for latitude of Q , also QN the given distance of N from the fundamental meridian, hence we readily find NOQ from the equation $\tan. O = \frac{NQ}{OQ}$.

Then for the latitude we have $QR = ON - OQ$, in which $ON = \frac{OQ}{\cos. O}$; thus we obtain a value of QR expressed in fathoms which we have to convert into arc; this might be done with the aid of Auxiliary Table X; but the constants employed in the projection of the Atlas differ from those employed in the Auxiliary Tables, and there are sundry errors in the projection tables. Consequently as the object in view is not to get absolutely correct positive values of the corner points of the Atlas sheets, but values which will be exact relatively to the calculations of the co-ordinates of the intersections of the principal meridians and parallels, we must only employ the data of the projection tables; and here again we must employ Mr. Walker's data for the sheets which he projected, and Mr. Atkinson's data for the sheets projected in this Office.

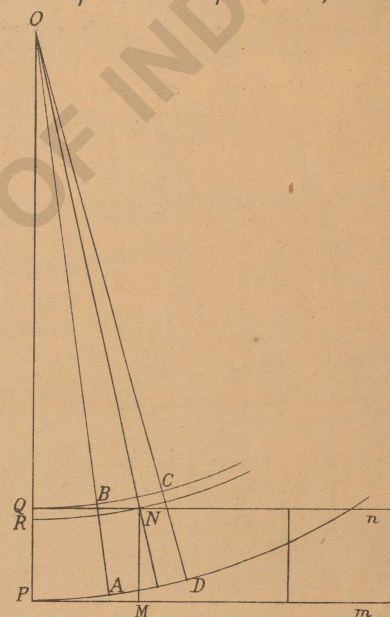
Thus putting $\Delta\lambda$ for the difference of latitude between Q and R , we have :-

$$\Delta\lambda = -86 \times \frac{QR}{QF}, \text{ which expresses } \Delta\lambda \text{ in minutes of arc.}$$

For the longitude, we know the value of the angle O , also from the tables we can find the value of θ , the angle of projection, for the parallel of projection.

Putting n for the number of degrees of longitude in the arc RN , we have $n\theta = O$,

$$\therefore n = \frac{O}{\theta}, \text{ which gives } \Delta L \text{ in degrees of arc.}$$



(signed) J. T. Walker Major-General, C.B., R.E.

Surveyor-General of India.

8th December 1882.

TABLE FOR PROJECTION OF INDIAN ATLAS SHEETS, BY MR. WALKER'S DATA.

Lengths of Meridional Arcs, and also of Radii of projection, corresponding to the points at which the governing parallels intersect the central meridian, $76^{\circ} 30'$.

Belt of central Atlas Sheets.	Intersecting parallels on the central Meridian.	Meridional minutes.	Foregoing in Fathoms.	OQ or OP. (Radii of projection due to the several intersecting parallels.)	
				Fathoms.	Logs.
63 A.	6° 26'	26'	26,200	8,757,874	6.9423987
		34	34,261		
63	7 52	52	52,402	8,671,211	6.9380797
		8	8,062		
62	9 18	18	18,141	8,584,541	6.9337171
		42	42,329		
61	10 44	44	44,347	8,497,865	6.9293099
		16	16,126		
60	12 10	10	10,081	8,411,182	6.9248571
		50	50,403		
59	13 36	36	36,296	8,324,488	6.9203573
		24	24,197		
58	15 2	2	2,016	8,237,777	6.9158101
		58	58,477		
57	16 28	28	28,224	8,151,076	6.9112149
		32	32,256		
56	17 54	54	54,458	8,064,362	6.9065700
		6	6,051		
55	19 20	20	20,174	7,977,622	6.9018735
		40	40,347		
54	20 46	46	46,405	7,890,870	6.8971249
		14	14,123		
53	22 12	12	12,108	7,804,104	6.8923230
		48	48,434		
52	23 38	38	38,348	7,717,322	6.8874666
		22	22,201		
51	25 4	4	4,038	7,630,526	6.8825545
		56	56,527		
50	26 30	30	30,286	7,543,714	6.8775852
		30	30,286		
49	27 56	56	56,542	7,456,886	6.8725576
		4	4,039		
48	29 22	22	22,210	7,370,039	6.8674698
		38	38,379		
47	30 48	48	48,456	7,283,174	6.8623208
		12	12,121		
46	32 14	14	14,146	7,196,291	6.8571087
		46	46,479		
45	33 40	40	40,423	7,109,389	6.8518323
		20	20,211		
44 A.	35 6	6	6,065	7,022,469	6.8464898
		54	54,589		
	36 32	32	32,354	6,935,526	6.8410795
		28	28,310		

S. G. O.

December 1882.

Computed and Compared,

A. C.

A. J. W.

F. A. & P. C. S.

Reg. No. 218, S. I. O.—5-5-92—50.

TABLE FOR PROJECTION OF INDIAN ATLAS SHEETS, BY MR. ATKINSON'S DATA.

Lengths of Meridional Arcs, and also of Radii of projection, corresponding to the points at which the governing parallels intersect the central meridian, $76^{\circ} 30'$.

Belt of central Atlas Sheets.	Intersecting parallels on the central Meridian.	Meridional minutes.	Foregoing in Fathoms.	OQ or OP. (Radii of projection due to the several intersecting parallels.)	
				Fathoms.	Logs.
63 A.	6° 26'	26'	26,202	8,757,922	6.9424011
		34	34,264		
63	7 52	52	52,405	8,671,253	6.9380819
		8	8,062		
62	9 18	18	18,142	8,584,578	6.9337190
		42	42,331		
61	10 44	44	44,349	8,497,898	6.9293115
		16	16,127		
60	12 10	10	10,081	8,411,210	6.9248585
		50	50,404		
59	13 36	36	36,293	8,324,513	6.9203589
		24	24,196		
58	15 2	2	2,017	8,237,808	6.9158116
		58	58,482		
57	16 28	28	28,235	8,151,091	6.9112157
		32	32,269		
56	17 54	54	54,459	8,064,364	6.9065701
		6	6,051		
55	19 20	20	20,174	7,977,623	6.9018736
		40	40,348		
54	20 46	46	46,405	7,890,871	6.8971249
		14	14,123		
53	22 12	12	12,108	7,804,104	6.8923230
		48	48,434		
52	23 38	38	38,348	7,717,322	6.8874666
		22	22,201		
51	25 4	4	4,038	7,630,526	6.8825545
		56	56,527		
50	26 30	30	30,287	7,543,713	6.8775851
		30	30,287		
49	27 56	56	56,543	7,456,884	6.8725574
		4	4,039		
48	29 22	22	22,219	7,370,036	6.8674697
		38	38,379		
47	30 48	48	48,486	7,283,171	6.8623111
		12	12,122		
46	32 14	14	14,146	7,196,287	6.8571084
		46	46,480		
45	33 40	40	40,424	7,109,384	6.8518319
		20	20,212		
44 A.	35 6	6	6,066	7,022,462	6.8464894
		54	54,589		
	36 32	32	32,354	6,935,519	6.8410790
		28	28,310		

S. G. O.

December 1882.

Computed and tabulated by

A. CHAMARETT.

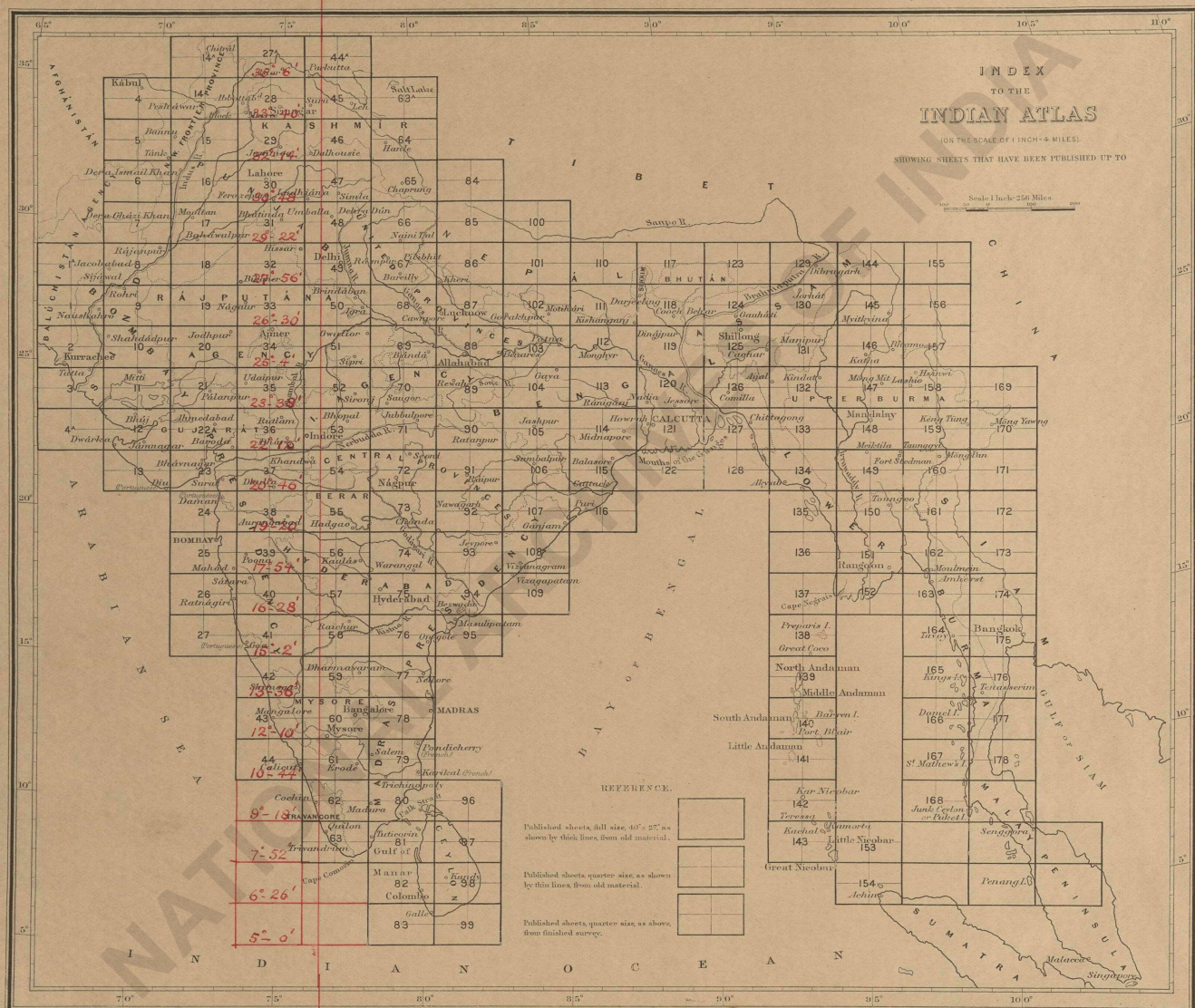
Examined by

A. J. W.

F. A. & P. C. S.

Reg. No. 219, S. I. O.—5-5-92—50.

6



REFERENCE.

Published sheets full size 40" x 27" as shown by thick lines, from old material.	
Published sheets quarter size, as shown by thin lines, from old material.	
Published sheets, quarter size, as shown, from finished survey.	

Published under the direction of MAJOR F. B. LONGE, R.E. Officiating Surveyor-General of India.

July, 1902.

N° 639-S. 1902.

Central line of Projection 76° 30'

Atlas of India

7

Length of a degree of Latitude, in Lat $30^{\circ} = 17 \frac{3}{60}$ Inches ..

Extent of work in each plate North & South $1^{\circ} - 26'$

Length of the work in each plate East & West = 134.850 fathoms

Centre line of projection $76.30'$ East Longitude.

Inside line west from $76.30' = 37100$ fathoms.

..... Do East Do = 97750 Do .

26400 fathoms in 30 Latitude Miles.

1° of latitude, as far as 21° of Lat = 60500 fathoms.

..... Do above 21° Do = 60550 Do .

Extent of work North & South in fathoms = 86716.

..... Do Do above 21° degree of Lat = 86788.

The Longitudes in this Atlas have been regulated by that of the observatory at Madras as formerly determined by Mr. Goldingham viz $80^{\circ} - 18' - 36''$ East of Greenwich.

G.T. Survey values of $\lambda = 80 - 17.21$ Do

Madras Diff = + 1 - 9, to be added to G.T.S. values

before projecting on this Atlas.

Computation of the "Angles of Projection" for the Indian Atlas.

Latitude	Meridional Distances	Radii of Projection		Value in Table of degrees of arc along parallels of latitude	Half of the Arc (A)	Logs of half the Arc Log (A)	Half the Arc - Radius Log R	Const. Log 46853749	Lat. number	Foregoing x 2	The Angle in minutes and seconds	Latitude
		Fathoms	Logs					minutes / Log of Half of the Arc - Radius	of the foregoing in seconds			
1		9086426.4	6.9583931	60847.8	30423.9	4.4832149	3.5243218	2.8392453	690.63	1381.26	23 1.26	1
2	60459	9025967.6	554937	826.2	410.1	30177	275240	419474	94.94	89.33	9.33	2
3	459	8965508.3	525749	774.2	387.1	26892	301143	445377	99.10	98.20	18.20	3
4	460	8905048.0	496363	709.8	354.9	22283	325925	470159	703.10	1406.20	26.20	4
5	462	8844588.5	466775	627.0	313.5	16361	349536	493820	706.94	13.88	33.88	5
6	463	8784128.3	436984	525.8	262.9	09106	372122	516856	10.62	21.24	41.24	6
7	465	8723668.2	406986	406.4	203.2	00530	393544	537778	14.13	28.26	48.26	7
8	468	8663190.7	376778	268.6	134.3	4.4790611	413833	553067	17.47	34.94	54.94	8
9	470	8602720.6	346358	112.6	056.3	779355	432997	577230	20.65	41.30	1.30	9
10	473	8542247.4	315721	59938.4	29969.2	766752	451031	595264	23.65	47.30	7.30	10
11	477	8481770.9	284385	746.1	273.1	752803	467938	612171	26.47	52.94	12.94	11
12	480	8421290.6	253786	535.6	267.8	737468	483822	627915	29.11	58.22	18.22	12
13	484	8360806.3	222481	307.1	153.6	720774	498293	642526	31.56	63.12	23.12	13
14	489	8300317.6	190947	060.6	530.3	702678	511731	655964	33.83	67.66	27.66	14
15	493	8239824.2	159180	58796.3	398.2	683208	524022	668260	35.91	71.82	31.82	15
16	499	8179325.8	127175	514.1	257.1	662313	535133	679370	37.80	75.60	35.60	16
17	504	8118822.0	094930	214.2	107.1	639939	545059	689291	39.43	78.96	38.96	17
18	510	8058312.6	062441	57896.6	28948.3	616231	556790	698022	40.97	81.94	41.94	18
19	515	7997777.2	029703	561.4	780.7	591014	561311	705543	42.26	84.52	44.52	19
20	522	7937275.6	6.8996715	208.8	604.4	564329	567614	711346	43.34	86.33	46.33	20
21	528	7876747.4	963469	56838.9	419.5	536165	572696	716928	44.21	88.42	48.42	21
22	535	7816212.4	929964	451.6	225.8	506462	576498	720730	44.86	89.72	49.72	22
23	542	7755670.4	896193	047.2	028.6	475239	579046	723278	45.29	90.58	50.58	23
24	549	7695121.0	862155	55625.8	27812.9	442462	580307	724539	45.51	91.02	51.02	24
25	557	7634564.0	827842	187.5	593.8	408115	580273	724505	45.51	91.02	51.02	25
26	565	7573999.2	793253	54732.4	366.2	372145	578892	723124	45.27	90.54	50.54	26
27	573	7513426.3	758380	260.6	130.3	334646	576166	720398	44.80	89.60	49.60	27
28	581	7452845.1	723221	53772.4	26886.2	295294	572073	716305	44.10	88.20	48.20	28
29	590	7392255.4	687770	267.8	638.9	254348	566578	710810	43.16	86.32	46.32	29
30	598	7331657.0	652022	52746.9	372.5	211678	569656	703888	41.97	83.94	43.94	30
31	608	7271049.6	615971	210.0	105.0	167237	561266	695498	40.54	81.08	41.08	31
32	616	7210438.1	579614	51657.2	25828.6	121009	541895	685627	38.86	77.72	37.72	32
33	626	7149807.3	542943	038.6	544.3	072940	529997	674226	36.92	73.84	33.84	33
34	635	7089172.1	505955	50804.5	252.3	023010	517055	661287	34.73	69.46	29.46	34
35	645	7028527.8	468648	49904.9	24952.5	4.8971141	502498	646731	32.27	64.54	24.54	35
36	655	6967872.8	431002	290.2	645.1	917306	486304	630537	29.55	59.10	19.10	36
37	664	6907208.4	393025	48660.3	380.2	861457	468432	612665	26.55	53.10	13.10	37

* $\log a - \log R \text{ ad. or } \sin \frac{1}{2} A = \frac{1}{2} \text{ arc}$ where A is the "L of projection" at the vertex of the cone and R the radius of the given parallel. -

† $\log R - \log \sin 1'' =$

On Latitude 1 Degree

Latitude	Angle	Log Sines	(Log sin) plus (Log Rad)	Sines in Fathoms	Log Cosines	(Log Cos) plus (Log Rad)	nat. No. of foregoing in Fathoms	Radius minus the foregoing or Ver. Sines in Faths.	Latitude
1	0-23-1.26	7.8258470	4.7842401	60847.1	9.9999903	6.9588834	9086222.9	203.5	1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21	8-3-26.46	9.1466372	6.1050305	1273591.8	9.9956915	6.9540846	8996728.6	89697.8	21
22	26-27.72	1.667008	1.250939	1333809.8	52698	536629	87995.9	98430.5	22
23	49-28.98	1.858597	1.442828	1393967.9	48283	532214	78864.6	107561.8	23
24	9-12-30.24	2041903	1.625834	1454065.5	43668	527599	69327.1	117099.5	24
25	35-31.50	2217598	1.801529	1514094.1	38853	522784	59389.6	127036.8	25
26	58-32.76	2386272	1.970203	1574056.5	33838	517769	49049.0	137377.4	26
27	10-21-34.02	2548452	2.132383	1633948.1	28622	512553	38808.2	148118.2	27
28	44-35.28	2704606	2.282537	1690767.2	23205	507136	27165.3	159261.1	28
29	11-7-36.54	2855151	2.437082	1753509.7	17586	501517	15622.9	170803.5	29
30	30-47.80	3000463	2.584394	1813173.6	11765	495696	03681.6	182744.8	30
31	53-49.06	3140882	2.724813	1872756.5	05741	489672	8891339.6	195086.8	31
32									32
33									33
34									34
35									35

10

Lat 2°

Lat	Angle	Log Sines	(Log sin) plus (Log Rad)	Secs	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of foregoing in Faths	Ver. Secs	Lat
1	8-23- 9.55	7.8285489	4.7840426	60819.5	9.9999901	6.9554838	9025760.4	207.2	1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21	8- 6-27.48	9.1493211	6.1048148	1272960.1	9.9956374	6.9511311	8935752.1	90215.5	21
22	29-37.36	.1698830	.1248767	1333142.9	52104	507041	26970.8	98996.8	22
23	52-47.26	.1885400	.1440337	1393265.0	47632	502569	17783.3	108184.5	23
24	9-15-57.12	.2068687	.1623624	1453323.7	42940	497897	68193.9	117773.7	24
25	39- 7.00	.2244362	.1799299	1513317.1	38084	493021	8898198.0	127769.6	25
26	10- 2-16.88	.2413016	.1967983	1573241.3	33005	487942	87798.0	138169.6	26
27	25-26.76	.2575174	.2130111	1633093.6	27724	482661	76998.0	148969.6	27
28	48-36.64	.2731305	.2286242	1692872.3	22237	477174	65789.8	160177.8	28
29	11-11-46.52	.2881827	.2486764	1752574.2	16548	471485	54183.7	171783.9	29
30	34-56.40	.3027115	.2582052	1812196.2	10652	465589	42171.4	183796.2	30
31	58- 6.28	.3167509	.2722446	1871736.2	04552	459489	29760.0	196207.6	31
32									32
33									33
34									34
35									35

Lat 3°

Lat	Angle	Log Sines	(Log sin) plus (Log Rad)	Line	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of foregoing in Faths	Per. Line	Lat
1	0° 23' 18" 20'	7.8311408	4.7837157	60773.7	9.9999900	6.9525649	8965302.0	206.3	1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21	8- 9- 22- 20	9.1518957	6.1044704	1271951.6	55847	431594	8874820.4	90687.9	21
22	32- 40- 40	1719559	1245308	1332081.6	51527	477276	65998.0	99510.3	22
23	55- 58- 6	1911111	1436860	1392150.0	47001	472750	56763.3	108745.0	23
24	9- 19- 16- 8	2094879	1620128	1452154.5	42272	468021	47124.5	118383.8	24
25	42- 35- 0	2270034	1795783	1512092.3	37337	463086	37075.5	128432.8	25
26	10- 5- 53- 2	2438668	1944417	1571960.9	32196	457945	26622.0	138386.8	26
27	29- 11- 4	2600806	2126558	1631757.1	26850	452599	15763.3	149745.0	27
28	52- 29- 6	2756915	2282664	1691478.2	21299	447048	04502.0	161006.3	28
29	11- 15- 47- 8	2907414	2433163	1751121.8	15539	441288	8792832.7	172675.6	29
30	39- 6- 0	3052679	2578428	1810684.6	09572	435321	80760.0	184748.3	30
31	12- 2- 24- 2	3193049	2718798	1870164.4	03397	429146	68284.0	197224.3	31
32									32
33									33
34									34
35									35

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Lat. 4°

Lat	Angle	Log Sines	(Log sine) plus (Log Rad)	Secs	Log Cosines	(Log Cos plus (Log Rad)	nat N ^o of foregoing in Fath's	Mr. Sines	Lat
1	0°-26'-26".20	7.8336186	4.7832549	60709.5	9.9999899	6.9496262	8904841.7	206.3	1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21	8-12-10.2	9.1543566	6.1039929	1270553.2	55339	451702	8813942.9	91105.1	21
22	35-36.4	1744152	1240516	1330612.2	50968	447331	05075.5	99972.5	22
23	59-2.6	1935687	1432050	1390608.9	46391	442754	8795802.0	109246.0	23
24	9-22-28.8	2118937	1615300	1450541.0	41606	437969	86116.0	118932.0	24
25	45-55.0	2294573	1790936	1510405.6	36614	432977	76022.0	129026.0	25
26	10-9-21.2	2463188	1959551	1570200.4	31414	427777	65520.4	139527.6	26
27	32-47.4	2625305	2121668	1629921.8	26006	422369	54612.0	150436.0	27
28	56-13.6	2781392	2277755	1689567.3	20390	416758	43298.0	161750.0	28
29	11-19-39.8	2931870	2428233	1749134.9	14564	410927	31577.6	173470.4	29
30	43-6.0	3077112	2573475	1808620.8	08527	404890	19448.0	185600.0	30
31	12-6-32.2	3217459	2713822	1868022.8	02280	398643	06914.3	198133.7	31
32									32
33									33
34									34
35									35

(13)

Lat 5°

Lat	Angle	Log Sines	(Log sine) plus (Log Rad)	Sines	Log Cosines	(Log cos) plus (Log Rad)	nat N ^o of fore going in Fath's	Ver. Sines	Lat
1	0°-23'-33".88	7.8359840	4.7826615	60626.4	9.9999898	6.9466673	8844377.6	208.9	1
2	47-7.76	8.1370038	5.0836813	121249.9	9.9592	66367	43755.1	831.4	2
3	1-10-41.64	3.130780	2.597555	181867.7	9.9082	65857	42716.3	1870.2	3
4	34-15.52	4.379930	3.846705	242477.0	9.8367	65142	41261.2	3325.3	4
5	57-49.40	5.348724	4.815499	303074.9	9.7449	64224	39391.8	5194.7	5
6	2-21-23.28	6.140162	5.606937	363658.6	9.6326	63101	37106.1	7480.4	6
7	44-57.16	6.809188	6.275963	424225.0	9.4999	61774	34406.1	10180.4	7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20	7-51-17.60	9.1356562	6.0823337	1208742.2	5.9059	25834	8761600.0	82986.5	20
21	8-14-51.48	1.567059	1.033834	1268771.4	5.4849	21624	53110.0	91476.5	21
22	38-25.36	1.767623	1.234403	1328741.0	5.0429	17204	44206.1	100380.4	22
23	9-1-59.24	1.959146	1.425921	1388647.8	4.5801	12576	34893.9	109692.6	23
24	25-33.12	2.142379	1.609154	1448483.7	4.0966	87739	25170.0	119416.5	24
25	49-7.00	2.317997	1.784772	1508263.5	3.5916	62691	15034.0	129552.5	25
26	10-12-40.88	2.486592	1.953367	1567966.1	3.0659	6.9397434	04492.0	140094.5	26
27	36-14.76	2.648690	2.115465	1627595.5	2.5191	91966	8693538.0	151048.5	27
28	59-48.64	2.804758	2.271533	1687148.4	1.9512	86287	82178.0	162408.5	28
29	11-23-22.52	2.955214	2.421989	1746621.8	1.3621	80396	70410.0	174176.5	29
30	46-56.40	3.100434	2.567209	1806013.3	0.7518	74293	58234.0	186352.5	30
31	12-10-30.28	3.240755	2.707533	1865319.7	0.1202	67977	45651.0	198935.5	31
32									32
33									33
34									34
35									35

Lat 6°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N. of fore going	Versines	Lat
1	0-25-41.24	7.8382388	4.7819372	60525.3	9.9999897	6.9436881	8783914.3	209.0	1
2	47-22.48	8.1392585	5.0829569	121047.8	9.9588	3.6572	83289.8	833.5	2
3	1-11-3.72	3.153326	2.590310	181564.5	9.9072	3.6056	82246.0	1877.3	3
4	34-44.96	4.402472	3.839456	242072.6	9.8350	3.5334	80786.0	3337.3	4
5	58-26.20	5.371264	4.808248	302569.2	9.7422	3.4406	78910.2	5213.1	5
6	2-22-7.44	6.162698	5.599682	363051.5	9.6288	3.3272	76618.0	7505.3	6
7	45-48.68	6.831719	6.268703	423516.5	9.4946	3.1930	73906.1	10217.2	7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20	7-53-44.80	9.1378968	6.0815952	1206688.6	5.8631	6.9395615	00846.0	83277.3	20
21	8-17-26.04	1.589450	1.026434	1266611.4	5.4376	9.1360	8692326.0	91797.3	21
22	41-7.28	1.790004	1.226988	1326474.1	4.9909	8.6893	83390.0	100733.3	22
23	9-4-48.52	1.981507	1.418491	1386274.1	4.5233	8.2217	74046.0	110077.3	23
24	28-29.76	2.164723	1.601707	1446008.0	4.0345	7.7329	64288.0	119835.3	24
25	52-11.00	2.340326	1.777308	1505673.4	3.5244	7.2228	54118.0	130005.3	25
26	10-15-52.24	2.508901	1.945885	1565267.3	2.9931	6.6915	43537.3	140586.0	26
27	39-33.48	2.670980	2.107966	1624786.9	2.4406	6.1390	32548.0	151575.3	27
28	11-3-14.72	2.827028	2.264012	1684229.2	1.8667	5.5651	21148.0	162975.3	28
29	26-55.96	2.977463	2.414447	1743591.2	1.2713	4.9697	09337.3	174786.0	29
30	50-37.20	3.122663	2.559647	1802871.4	0.6546	4.3530	8597120.0	187003.3	30
31	12-14-18.44	3.262965	2.699949	1862065.2	0.0163	3.7147	84494.1	199629.2	31
32									32
33									33
34									34
35									35

5

Lat 7°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Secs	Log Cosines	(Log Cos) plus (Log Rad)	nat N° of fore going in Faths	Per. Sines	Lat
1	0°-23'-48".26"	7.8403786	4.7810772	60405.6	9.9999896	6.9406882	8723448.0	210.2	1
2	47-36.52	8.1413982	5.0820968	120808.3	99583	06569	22820.0	838.2	2
3	1-11-24.78	8174722	2581708	181205.3	99063	06049	21776.0	1882.2	3
4	35-13.04	4423866	3830852	241593.5	98334	05320	20312.0	3346.2	4
5	59-1.30	5392658	4799639	301970.1	97397	04383	18430.0	5228.2	5
6	2-22-49.56	6184084	5591070	362332.3	96250	03236	16128.0	7530.2	6
7	46-37.82	6853101	6260087	422677.1	94896	01882	13410.2	10248.0	7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20	7-56-5.20	9.1400230	6.0807216	1204263.7	58219	6.9365205	8640134.0	83524.2	20
21	8-19-53.46	1610698	1017684	1264062.1	53922	60908	31590.0	92068.2	21
22	43-41.72	1811238	1218224	1323800.0	49412	56398	22631.6	101026.8	22
23	9-7-29.98	2002725	1409711	1383474.2	44688	51674	13256.9	110401.3	23
24	31-18.24	2185925	1592911	1443082.4	39751	46737	03470.6	120187.6	24
25	55-6.50	2361509	1768495	1502621.1	34600	41586	8593272.5	130385.7	25
26	10-18-56.76	2530068	1937054	1562087.8	29234	36220	82662.0	140996.2	26
27	42-43.02	2692129	2099115	1621479.5	23653	30639	71639.2	152019.0	27
28	11-6-31.28	2848158	2255144	1680793.8	17856	24842	60205.9	163452.3	28
29	30-19.54	2998575	2405561	1740027.6	11843	18829	48362.0	175296.2	29
30	54-7.80	3143754	2550740	1799177.6	05614	12600	36109.8	187548.4	30
31	12-17-56.06	3284035	2691021	1858241.2	9.9899167	06153	23447.1	200211.1	31
32									32
33									33
34									34
35									35

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Lat 8°

Lap	Angle	Log Sines	(Log Sin) plus (Log Rad)	Lucs	Log Cosines	(Log Cos) plus (Log Rad)	nat. N. of foregoing in Raths	Ver. Lucs	Lat
1	0° 23'-54".96	7.8424112	4.7800890	60268.3	9.9999895	6.9376673	8662980.0	210.7	1
2	47-49.92	8.1434306	5.0811084	120533.7	99580	76358	62352.0	838.7	2
3	1-11-44.88	3195044	2571822	180793.3	99054	75832	61302.0	1888.7	3
4	35-39.84	4444186	3820964	241044.1	98318	75096	59834.0	3356.7	4
5	59-34.80	5412971	4789749	301283.2	97372	74150	57948.0	5242.7	5
6	2-23-29.76	6204398	5581176	361507.8	96215	72993	55642.0	7548.7	6
7	47-24.72	6873410	6250188	421714.8	94848	71626	52918.0	10272.7	7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20	7-58-19.20	9.1420425	6.0797203	1201490.3	57825	34603	8579466.7	83724.0	20
21	22-14.16	1630880	1007658	1261147.2	53488	30266	70903.9	92286.8	21
22	46-9.12	1831404	1208182	1320742.6	48934	25712	61920.0	101270.7	22
23	9-10-40.8	2022877	1399655	1380274.6	44166	20944	52525.5	110665.2	23
24	33-59.04	2206062	1582840	1439739.7	39182	15960	42716.0	120474.7	24
25	57-54.00	2381630	1758408	1499135.2	33982	10760	32494.1	130696.6	25
26	10-21-48.96	2550172	1926950	1558457.7	28565	05343	21858.8	141331.9	26
27	45-43.92	2712216	2088994	1617705.2	22930	6.9299708	10807.8	152382.9	27
28	11-9-38.88	2868227	2245005	1676874.1	17078	93856	8499347.1	163843.6	28
29	33-33.84	3018625	2395403	1735962.4	11009	87787	87478.4	175712.3	29
30	57-28.80	3163785	2540563	1794966.1	04720	81498	75196.2	187994.5	30
31	12-21-23.76	3304046	2680824	1853883.3	9.9898210	74988	62502.0	200688.7	31
32									32
33									33
34									34
35									35

Lat 9°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of fore going in Fath's	N ^o . Sines	Lat
1	0° 24' 1" 30'	7.8443257	4.7789615	60112.0'	9.9999894	6.9346252	8602510.0'	210.6	1
2	48- 2.6'	8.1453451	5.0799809	120221.2'	99576	45934	01880.4	840.2	2
3	1-12- 3.9'	3214187	2560545	180324.4	99046	45404	00831.4	1889.2	3
4	36- 5.2'	4463327	3809685	240418.8	98303	44661	8599358.8	3361.8	4
5	2- 0- 6.5'	5432109	4778467	300501.5	97348	43706	97468.6	5252.0	5
6	24- 7.8'	6223533	5569891	360569.6	96182	42540	95160.8	7559.8	6
7	48 9.1'	9.6892541	6238899	420620.0'	94803	41161	92432.0	10288.6	7
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10									10
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14									14
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16									16
17									17
18									18
19									19
20	8- 0- 26.0'	9.1439446	6.0785804	1198340.9	57451	03809	18849.0	83871.6	20
21	24- 27.3'	1649889	0996247	1257838.0	53074	6.9299432	10266.7	92453.9	21
22	48- 28.6'	1850401	1196759	1317273.3	48480	94838	01270.6	101450.0	22
23	9-12- 29.9'	2041859	1388217	1376644.1	43669	90027	8491856.9	110863.7	23
24	36- 31.2'	2225029	1571387	1435948.0	38640	84998	82029.4	120691.2	24
25	10- 0- 32.5'	2400582	1746940	1495131.8	33394	79752	71790.2	130930.4	25
26	24- 33.8'	2569108	1915446	1554342.1	27929	74287	61134.5	141584.1	26
27	48- 35.1'	2731135	2077493	1613426.8	22244	68602	50068.6	152652.0	27
28	11-12- 36.4'	2887129	2233487	1672432.8	16339	62697	38586.3	164134.3	28
29	36- 37.7'	3037509	2383867	1731357.4	10215	56573	26696.1	176024.5	29
30	12- 0- 39.0'	3182651	2529009	1790197.1	03869	50227	14390.4	188330.2	30
31	24- 40.3'	3322893	2669251	1848949.8	9.9897302	43660	01676.9	201043.7	31
32									32
33									33
34									34
35									35

19

Lat 11

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of fore going in Faths	Ver. Sines	Lat
1	0-24-12.94	7.8478190	4.7763055	59745.5	9.9999892	6.9284757	8481558.8	212.1	1
2	48-25.88	8.1488382	5.0773247	119488.1	99569	84434	80928.8	842.1	2
3	1-12-38.82	3.249115	2.533980	179224.8	99030	83895	79876.5	1894.4	3
4	36-51.76	4.498251	3.783116	238952.5	98276	83141	78403.9	3347.0	4
5	2-1-4.70	5.467028	4.751893	298668.4	97306	82171	76509.8	5261.1	5
6	25-17.64	6.258445	5.543310	358369.5	96120	80985	74196.1	7574.8	6
7	49-30.58	6.927446	6.212311	418052.8	94718	79583	71460.8	10310.1	7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20	8-4-18.80	9.1474150	6.0759015	1190971.9	56759	41624	8397739.2	84031.7	20
21	28-31.74	1.684568	0.969433	1250095.7	52310	37175	89141.2	92629.7	21
22	52-44.68	1.835056	1.164921	1309158.1	47641	32506	80126.9	101644.0	22
23	9-16-57.62	2.076488	1.361353	1368188.0	42762	27617	70698.1	111072.8	23
24	41-10.56	2.259631	1.544496	1427084.2	37641	22506	60853.8	120917.1	24
25	10-5-23.50	2.435155	1.720020	1485942.5	32308	17175	50592.3	131173.6	25
26	29-36.44	2.603653	1.888518	1544727.8	26753	11618	39918.9	141852.0	26
27	53-49.38	2.765649	2.050514	1603435.1	2075	05840	28830.8	152940.1	27
28	11-18-2.32	2.921412	2.206477	1662064.0	14974	6.9199839	17328.8	164442.1	28
29	42-15.26	3.071959	2.356824	1720609.9	08749	93614	05415.4	176355.5	29
30	12-6-28.20	3.217066	2.501931	1779070.2	02298	87163	8293088.5	188682.4	30
31	30-41.14	3.357273	2.642138	1837442.8	9.9895623	80488	80351.9	201419.0	31
32									32
33									33
34									34
35									35

Lab. 13th

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of fore going in Faths	Verines	Lat
1	0°-24'-23".14	7.8508571	4.7731052	59306.9	9.9999891	6.9222372	8360596.1	210.2	1
2	48-46-28	8.1518762	5.0741245	118610.8	99563	22044	59963.5	842.8	2
3	1-13-9.42	3279492	2501975	177908.7	99017	21498	58913.5	1892.8	3
4	37-32.56	4528625	3751106	237197.8	98251	20732	57438.5	3367.8	4
5	2-1-55.70	5497397	4719878	296474.8	97268	19749	55548.1	5258.2	5
6	26-18.84	6288809	5511290	355737.0	96068	18546	53232.7	7573.6	6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20	8-7-42.80	9.1504329	6.0726310	1182173.0	56148	6.9178629	8276807.7	23998.6	20
21	32-5.94	1714727	0937208	1240854.8	51635	74116	68211.5	92594.8	21
22	56-29.08	1915192	1137675	1299473.1	46901	69382	59203.8	101602.5	22
23	9-20-52.22	2106602	1329083	1358026.6	41941	64422	49776.9	111029.4	23
24	45-15.36	2289721	1512202	1416511.8	36758	59239	39937.7	120868.6	24
25	10-9-38.50	2465221	1687702	1474925.9	31349	58830	29681.1	131125.2	25
26									26
27									27
28									28
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30									30
31									31
32									32
33									33
34									34
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22

Lat 14°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad.)	Sines	Log Cosines	(Log Cos) plus (Log Rad.)	nat N° of fore going in Faths	V. Sines	Lat
1	0-24-27.66	7.8521967	4.7712914	59059.7	9.9999890	6.9190837	8300107.5	210.1	1
2	48-55.32	8.1532157	5.0723104	118116.5	99560	90507	8299476.9	340.7	2
3	1-13-22.98	3292886	2483833	177167.2	99010	89957	98425.0	1892.6	3
4	37-50.64	4542017	3732964	236209.0	98241	89188	96955.8	3361.8	4
5	2-2-18.30	5510787	4701734	298238.8	97251	88198	95065.4	5252.2	5
6	26-45.96	6302196	5493143	354253.6	96041	86988	92753.8	7563.8	6
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11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20	8-9-13.20	9.1517634	6.0703581	1177221.4	55874	46821	16409.4	83908.2	20
21	33-40.86	1728023	0918970	1236654.4	51335	42282	07826.4	92491.2	21
22	58-8.52	1928479	1119426	1294024.8	46570	37517	8198826.4	101491.2	22
23	9-22-36.18	2119878	1310825	1352329.5	41580	32527	89411.3	110906.3	23
24	477 3.84	2302986	1493933	1410565.6	36365	27312	79583.0	120734.6	24
25	10-11-31.50	2478475	1669422	1468730.7	30922	21869	69333.9	130978.7	25
26									26
27									27
28									28
29									29
30									30
31									31
32									32
33									33
34									34
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Lat 15°

Lat	Angle	Log Sines	(Log Sine) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of fore going in Faths	V. Sines	Lat
1	0° 24' 31.82"	7.8534259	4.7693439	58795.5	9.9999889	6.9159069	8239615.1	209.1	1
2	49' 3.44"	8.1544448	5.0703628	117587.9	99558	58738	38986.8	837.4	2
3	1° 13' 35.46"	3305177	2464357	176374.5	99005	58185	37937.7	1886.5	3
4	38' 7.28"	4554306	3713486	235151.9	98231	57411	36469.8	3354.4	4
5	2° 2' 39.10"	5523074	4682252	293917.5	97236	56415	34581.1	5243.1	5
6	27' 10.92"	6314482	5473662	352668.1	96018	55198	32273.6	7550.6	6
7	51' 42.74"	6983476	6142650	411400.7	94580	53760	29549.1	10275.1	7
8	3° 16' 14.56"	7562837	6722017	470112.4	92920	52100	26403.8	13420.4	8
9									9
10									10
11									11
12									12
13									13
14	5° 43' 25.48"	9988350	9147530	821775.1	78293	37473	8198743.4	41080.8	14
15	6° 7' 37.30"	9.0286913	9446093	880256.6	75075	34255	92669.8	47154.4	15
16	32' 29.12"	0566057	9725237	938693.3	71636	30814	86181.5	53642.7	16
17	57' 0.94"	0828129	9987309	997082.0	67968	27148	79275.5	60548.7	17
18	7° 21' 32.76"	1075073	6.0234253	1055420.0	64078	23258	71951.9	67872.5	18
19	46' 4.58"	1308519	0467699	1113704.4	59963	19143	64213.0	75611.2	19
20	8° 10' 36.40"	1529844	0689024	1171931.9	55624	14804	56060.4	83763.8	20
21	35' 8.22"	1740224	0899404	1230100.0	51057	10237	47487.0	92337.2	21
22	59' 40.04"	1940670	1099850	1288205.0	46266	05446	38503.8	101320.4	22
23	9° 24' 11.86"	2132060	1291240	1346244.7	41247	00427	29103.8	110720.4	23
24	48' 43.68"	2315159	1474339	1404215.9	36002	6.9095182	19292.6	120531.6	24
25	10° 13' 16.50"	2490638	1649818	1462115.8	30528	89708	09064.8	130759.4	25
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24

Lat 16°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of foregoing in Paths	Verse Sines	Lat
1	0-24-38.60	7.8545398	4.7672573	58513.7	9.9999889	6.9127064	8179117.0	208.8	1
2	49-11.2	8.1555587	5.0682762	117024.4	99556	26731	78488.9	836.9	2
3	1-13-46.8	3316314	2443489	175329.0	99000	26175	77442.6	1883.2	3
4	38-22.4	4545142	3692617	234024.7	98222	25397	75977.4	3348.4	4
5	2-2-58.0	5534209	4661384	292508.4	97221	24396	74094.3	5231.5	5
6	27-33.6	6325616	5452789	350977.2	95998	23173	71792.5	7533.3	6
7	52-9.2	6974600	6121775	409427.9	94552	21727	69071.7	10254.1	7
8	3-16-44.8	7573964	6701139	467857.8	92883	20058	65932.1	13393.7	8
9									9
10									10
11									11
12									12
13									13
14	5-44-18.4	9999453	9126628	817829.6	78181	05356	38335.8	40990.0	14
15	6-8-54.0	9.0298010	9425185	876029.0	74947	02122	32277.4	47048.4	15
16	33-29.6	0577142	9704323	934183.7	71488	6.9098663	25803.7	53522.1	16
17	58-5.2	0839213	9966388	992290.6	67803	94978	18911.3	60414.5	17
18	7-22-40.8	1086151	6.0213326	1050346.6	63893	91068	11605.6	67720.2	18
19	47-16.4	1319590	0446765	1108349.0	59757	86932	03883.3	75442.5	19
20	8-11-52.0	1540907	0668082	1166294.3	55394	82569	8095746.3	83579.5	20
21	36-27.6	1751279	0878454	1224180.3	50805	77920	87196.3	92129.5	21
22	9-1-3.2	1931718	1078893	1282003.8	45988	73163	78231.5	101094.3	22
23	25-38.8	2143100	1270275	1339761.4	40944	68119	68854.7	110471.1	23
24	50-14.4	2326189	1453364	1397450.5	35470	62845	59062.3	120263.5	24
25	10-14-50.0	2501658	1628833	1455068.1	30169	57344	48861.1	130464.7	25
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Lab 17.

[illegible]

Lat 19°

Lat	Angle	LogSines	(LogSin) plus (LogRad)	Sines	LogCosines	(LogCos) plus (LogRad)	nat N ^o of foregoing in Paths	Wines	Lat
1	0°-24'-44".52	7.8571572	4.7601275	57560.9	9.9999887	6.9029590	7997587.3	209.9	1
2	49'-29.04	8.1581709	5.0611462	115118.8	99550	29253	96966.7	830.5	2
3	1-14'-13.56	3342484	2372187	172670.7	98987	28690	95929.6	1867.6	3
4	38'-58.08	4591609	3621312	230213.7	98200	27903	94481.5	3315.7	4
5	2-3'-42.60	5560372	4590075	287744.8	97187	26890	92616.7	5180.5	5
6	28'-27.12	6351772	5381475	345261.0	95950	25653	90840.7	7456.3	6
7	53'-11.64	7020753	6050456	402759.4	94486	24489	87648.1	10149.1	7
8	3-17'-56.16	7400109	6629812	460236.6	92797	22500	84541.8	13255.4	8
9	42'-40.68	8110997	7140700	517690.2	90883	20586	81023.6	16773.6	9
10	4-7'-25.20	8567859	7597562	575117.0	88743	18446	77092.6	20704.6	10
11	32'-9.72	8980999	8010702	632514.1	86376	16079	72745.5	25051.7	11
12	56'-54.24	9358021	8387724	689878.1	83783	13486	67987.0	29810.2	12
13	5-21'-38.76	9704704	8734407	747206.5	80963	10666	62814.5	34982.7	13
14	46'-23.28	9.0025538	9055241	804496.4	77916	07619	57229.6	40567.6	14
15	6-11'-7.80	0324082	9353785	861744.4	74642	04345	51233.5	46563.9	15
16	35'-52.32	0603206	9632909	918947.9	71141	00844	44825.9	52971.3	16
17	7-0'-36.84	0865258	9894961	976104.0	67411	6.8997114	38005.5	59791.7	17
18	25'-21.36	1112179	6.0141882	1033209.0	63454	93157	30776.4	67020.8	18
19	50'-5.88	1345602	0375305	1090261.0	59267	88970	23134.5	74662.7	19
20	8-14'-50.40	1566901	0596604	1147256.1	54852	84555	15083.6	82713.6	20
21	39'-34.92	1777255	0806958	1204192.2	50206	79909	06620.0	91177.2	21
22	9-4'-19.44	1977674	1007377	1261065.7	45331	75034	789750.9	100046.3	22
23	29'-3.96	2169035	1198738	1317873.6	40224	69927	88469.1	109328.1	23
24	53'-48.48	2352104	1381807	1374613.9	34887	64590	78780.0	119017.2	24
25	10-18'-33.00	2527551	1557254	1431282.6	29317	59020	68681.8	129115.4	25
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34									34
35									35

(28)

Lat. 20°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Luc	Log Cosines	(Log Cos) plus (Log Rad)	nat ^N of foregoing in fathoms	Luc	Lat
1	0°-24'-46".68	7.8577886	4.7574601	57208.4	9.9999887	6.8996602	7937069.1	206.5	1
2	49'-33".36	8.1588078	5.0584788	114413.9	99549	96264	36452.7	822.9	2
3	1°-14'-20".04	8.348798	2345513	171613.5	98985	95700	35421.8	1853.8	3
4	39'-6".72	4.597922	3594637	228804.1	98195	94910	33978.2	3297.4	4
5	2°-3'-53".40	5.566684	4.563399	285982.8	97779	93894	32121.8	5153.8	5
6	28'-40".08	6.358082	5.354797	343146.6	95938	92653	29856.4	7419.2	6
7	53'-26".76	7.027061	6.023776	400292.7	94470	91185	27176.4	10099.2	7
8	3°-18'-13".44	7.606417	6.603132	457418.0	92777	89492	24087.0	13188.6	8
9	43'-0".12	8.117303	7.114018	514519.4	90856	87571	20581.8	16693.8	9
10	4°-7'-46".80	8.574163	7.570878	571594.2	88709	85424	16667.3	20608.3	10
11	32'-33".48	8.987299	7.984014	628639.1	86336	83051	12343.6	24932.0	11
12	57'-20".16	9.364320	8.361035	685651.6	83736	80451	97607.3	29668.3	12
13	5°-22'-6".84	9.711000	8.707715	742628.3	80907	77622	82458.2	34817.4	13
14	46'-53".52	9.0031831	9.028546	799566.5	77852	74567	7896901.8	40373.8	14
15	6°-11'-40".20	9.330373	9.327088	856463.3	74569	71284	90934.5	46341.1	15
16	36'-26".88	0.609493	9.606208	913315.4	71057	67772	84554.5	52721.1	16
17	7°-1'-13".56	0.871541	9.868256	970120.2	67317	64032	77767.9	59507.7	17
18	26'-0".24	1.118459	6.0115174	1026874.5	63347	60062	70570.9	66704.7	18
19	50'-46".92	1.351877	0.348592	1083375.5	59148	55863	62963.6	74312.0	19
20	2°-15'-33".60	1.573172	0.569887	1140220.0	54720	51435	54950.9	82324.7	20
21	40'-20".28	1.783522	0.780237	1196805.8	50060	46775	46527.3	90748.3	21
22	9°-5'-6".96	1.983936	0.980651	1253329.1	45171	41886	37700.0	99575.6	22
23	29'-53".64	2.175292	1.172007	1309787.0	40049	36764	28460.7	108814.9	23
24	54'-40".32	2.358355	1.355070	1366177.0	34696	31411	18817.9	118457.7	24
25	10°-19'-27".00	2.533797	1.530512	1422496.4	29110	25825	08767.9	128507.7	25
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27									27
28									28
29									29
30									30
31									31
32									32
33									33
34									34
35									35

Lat 21°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat. N° of foregoing in Faths	V. Sines	Lat
1	0-24-48.42	7.8582966	4.7546435	56838.6	9.9999887	6.8963356	7876541.8	205.6	1
2	49-56.82	8.1593153	5.0566622	112674.3	99548	63017	75927.3	820.1	2
3	1-14-25.26	8353877	2317346	170504.0	98982	62451	74901.8	1345.6	3
4	39-13.68	4603001	3566470	227324.9	98190	61659	73465.5	3281.9	4
5	2-4-2.10	5571761	4535230	284133.9	97173	60642	71621.8	5125.6	5
6	28-50.52	6363159	5326628	340928.1	95928	59397	69365.5	7381.9	6
7	53-38.94	7032137	5995606	397704.6	94457	57926	66700.0	10047.4	7
8	3-18-27.36	7611491	6574960	454460.3	92760	56229	63627.3	13120.1	8
9	43-15.78	8122376	7085845	511192.6	90834	54303	60140.0	16607.4	9
10	4-8-4.20	8579234	7542703	567897.9	88683	52152	56248.2	20499.2	10
11	32-52.62	8992369	7955838	624573.9	86304	49773	51945.5	24801.9	11
12	57-41.04	9369388	8332857	681217.3	83697	47166	47233.9	29513.5	12
13	5-22-29.46	9716066	8679535	737825.8	80865	44332	42114.5	34632.9	13
14	47-17.88	9.0036894	9000363	794394.6	77800	41269	36585.7	40161.7	14
15	6-12-6.30	0335432	9298901	850922.7	74509	37978	30650.0	46097.4	15
16	36-54.72	0614550	9578019	907406.5	70989	34458	24305.5	52441.9	16
17	7-1-43.14	0876595	9840064	963843.3	67240	30709	17554.5	59192.9	17
18	26-31.56	1123510	6.0086979	1020229.5	63261	26703	10394.6	66352.8	18
19	51-19.98	1356925	0320394	1076542.9	59052	22521	02829.1	73918.3	19
20	8-16-8.40	1578217	0541686	1132840.0	54613	18082	7794858.2	81889.2	20
21	40-56.82	1788562	0752031	1189058.1	49944	13413	86482.1	90265.3	21
22	9-5-45.24	1988973	0952442	1245214.6	45042	08511	77698.2	99049.2	22
23	30-33.66	2180325	1143794	1301306.0	39908	03377	68508.9	108238.5	23
24	55-22.08	2363385	1326854	1357330.0	34543	6.8898012	58917.9	117829.5	24
25	10-20-10.50	2538822	1502291	1413282.8	28943	92412	48919.6	127827.8	25
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Lat 22°

Lat	Angle	Log Sines	(Log Sine) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N° of foregoing in Paths	V. Sines	Lat
1	0°-24'-49".72	7.8586758	4.7516722	56451.1	9.9999887	6.8929851	7816009.1	203.3	1
2	49-39.44	8.1596944	5.0526908	112899.2	99547	29511	15398.2	814.2	2
3	1-14-29.16	3357668	2287632	169341.4	98981	28945	14380.0	1832.4	3
4	39-18.88	4606791	3536755	225774.8	98187	28151	12950.9	3261.5	4
5	2-4-8.60	5575551	4505515	282196.4	97167	27131	11116.1	5096.3	5
6	28-58.32	6366949	5296913	338603.4	95921	25885	08875.0	7837.4	6
7	53-48.04	7035926	5965890	394992.6	94447	24411	06225.5	9986.9	7
8	3-18-37.76	7615279	6545243	451361.3	92746	22710	03169.1	13043.3	8
9	43-27.48	8126162	7056126	507706.4	90819	20783	7799707.1	16505.3	9
10	4-8-17.20	8583019	7512983	564024.9	88665	18627	95835.7	20376.7	10
11	33-6.92	8996133	7926117	620314.1	86280	16244	91560.0	24652.4	11
12	57-56.64	9373170	8303134	676571.1	83669	13633	86876.8	29335.6	12
13	5-22-46.36	9719846	8649810	732792.5	80829	10793	81785.7	34426.7	13
14	47-36.08	9.0040673	8970637	788975.8	77761	07725	76291.1	39921.3	14
15	6-12-25.80	0339209	9269175	845117.9	74464	04428	70389.3	45823.1	15
16	37-15.52	0618325	9548289	901216.0	70938	00902	64083.9	52123.5	16
17	7-2-5.24	0880367	9810331	957267.1	67182	6.88 97146	57371.4	58841.0	17
18	26-54.96	1127281	6.0057245	1013268.4	63197	93161	50257.1	65955.3	18
19	51-44.68	1360692	0290656	1069216.3	58981	88945	42737.5	73474.9	19
20	8-16-34.40	1581982	0511946	1125109.0	54534	84498	34812.5	81399.9	20
21	41-24.12	1792325	0722289	1180943.0	49856	79820	26485.7	89726.7	21
22	9-6-18.84	1992732	0922696	1236714.8	44945	74909	17753.6	98458.8	22
23	31-3.56	2184082	1114046	1292422.8	39803	69767	08621.4	107591.0	23
24	55-53.28	2367138	1297102	1348063.0	34427	64391	7699084.2	117128.2	24
25	10-20-43.00	2542572	1472536	1403633.0	28818	58782	89147.4	127065.0	25
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Lat 23°

Lat	Angle	LogSines	(LogSines) plus (LogRad)	Sines	LogCosines	(LogCos) plus (Log Rad)	nat N° of fore going in Paths	Residue	Lat
1	0°-24'-50".60	7.8589322	4.7485515	56046.9	9.9999887	6.8896080	7755467.9	202.5	1
2	49-41.2	8.1599508	5.0495701	112090.8	99546	95739	54858.9	811.5	2
3	1-14-31.8	3360232	2256425	168129.0	98979	95172	53846.4	1824.0	3
4	39-22.4	4609355	3505348	224158.5	98186	94379	52430.4	3240.0	4
5	2-4-13.0	5578115	4474308	280175.9	97164	93357	50607.1	5063.3	5
6	29-3.6	6369512	5265705	336178.9	95916	92109	48320.4	7290.0	6
7	53-54.2	7038488	5934681	392164.3	94441	90634	45748.2	9922.2	7
8	5-18-44.8	7617840	6514033	448129.3	92738	88931	42712.5	12957.9	8
9	43-35.4	8128723	7024916	504070.8	90808	87001	39271.4	16399.0	9
10	4-8-26.0	8585579	7481772	559986.0	88650	84843	35426.8	20243.6	10
11	33-16.6	8998712	7894905	615872.1	86264	82457	31178.6	24491.8	11
12	58-7.2	9375727	8271920	671725.8	83650	79843	26526.8	29143.6	12
13	5-22-57.8	9722408	8618596	727544.6	80806	76999	21467.9	34202.5	13
14	47-48.4	9.0048229	8939422	783325.4	77735	73928	16010.7	39659.7	14
15	6-12-39.0	0341764	9237957	839065.2	74434	70627	10148.2	45522.2	15
16	37-29.6	0620878	9517071	894761.0	70904	67097	03883.9	51786.5	16
17	7-2-20.2	0882919	9779112	950410.4	67144	63337	7697216.1	58454.3	17
18	27-10.8	1129831	0026024	1006010.2	63153	59346	90146.4	66524.0	18
19	52-1.4	1363241	0259434	1061557.2	58932	55125	82675.4	72995.0	19
20	8-16-52.0	1584529	0480722	1117048.8	54480	50673	74803.6	80866.8	20
21	41-42.6	1794870	0691663	1172482.4	49796	45989	66531.6	89138.8	21
22	9-6-33.2	1995275	0891468	1227854.2	44880	41073	57857.9	97812.5	22
23	31-23.8	2186623	1082816	1283162.2	39732	35925	48786.0	106884.4	23
24	56-14.4	2369677	1265870	1338403.4	34349	30542	39310.5	116359.9	24
25	10-21-5.0	2545108	1441301	1393574.3	28734	24927	29440.4	126230.0	25
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Lat 24°

Lat	Angle	LogSines	(LogSin) plus (LogRad)	Sines	LogCosines	(LogCos) plus (LogRad)	nat N° of fore going in Paths	Verities	Lat
1	0-24-51.02	7.8590545	4.7452700	55625.0	9.9999887	6.8862042	7694921.4	199.6	1
2	49-42.04	8.1600732	5.0462887	111247.1	99546	61701	94317.5	803.6	2
3	1-14-33.06	3361455	2223610	166863.4	98979	61134	93312.5	1808.6	3
4	39-24.08	4610578	3472733	222470.9	98184	60339	91905.3	3215.7	4
5	2-4-15.10	5579338	4441493	278066.9	97168	59318	90096.5	5024.5	5
6	29-6.12	6370734	5232889	333648.3	95914	58069	87885.7	7235.8	6
7	53-57.14	7039710	5901865	389212.3	94438	56593	85273.2	9847.8	7
8	3-18-48.16	7619062	6481217	444755.9	92734	54889	82267.9	12863.1	8
9	43-39.18	8129944	6992099	500276.3	90803	52958	78842.9	16278.1	9
10	4-8-30.20	8586800	7448955	555770.5	88644	50799	75026.8	20094.2	10
11	33-21.22	8999933	7862088	611235.8	86256	48411	70807.1	24313.9	11
12	58-12.24	9376948	8239103	666669.1	83641	45795	66191.1	28929.9	12
13	5-28-3.26	9723623	8585778	722067.5	80793	42950	61168.4	33952.6	13
14	47-54.28	9.0044448	8906603	777428.2	77722	39877	55749.1	39371.9	14
15	6-12-45.30	0342983	9205138	832748.5	74419	36574	49928.6	45192.4	15
16	37-36.32	0622096	9484251	888024.9	70827	33042	43710.5	51410.5	16
17	7-2-27.34	0884136	9746291	943255.0	67125	29280	37091.2	58029.8	17
18	27-18.36	1131047	9993202	998435.9	63132	25287	30073.7	65047.3	18
19	52-9.38	1364457	6.0226612	1053564.6	58909	21064	22657.9	72463.1	19
20	8-17-0.40	1585744	0447899	1108638.5	54454	16609	14842.1	80278.9	20
21	41-51.42	1796084	0658239	1163654.1	49768	11923	06629.8	88491.2	21
22	9-6-42.44	1996489	0858644	1218609.0	44849	07004	7598019.3	97101.7	22
23	31-33.46	2187835	1049995	1273500.3	39697	01852	89010.3	106110.5	23
24	56-24.48	2370888	1233043	1328324.8	34312	6.8796467	79607.0	115514.0	24
25	10-21-15.50	2546319	1408474	1383030.3	28693	90848	69807.0	125314.0	25
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Lat 25°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of foregoing in Parts	V. Sines	Lat
1	0°-24'-51".02"	7.85990545	4.7418387	55187.2	9.9999887	6.8827729	7634364.9	199.1	1
2	49-42.06	8.1600732	5.0428574	110371.6	99546	27388	33764.9	799.1	2
3	1-14-33.06	3361455	2189297	165550.2	98979	26821	32768.4	1795.6	3
4	39-24.08	4610378	3438420	220720.2	98184	26026	31371.9	3192.1	4
5	2-4-15.10	5579338	4407180	275878.6	97163	25005	29577.2	4986.8	5
6	29-6.12	6370734	5198576	331022.6	95914	23756	27384.2	7179.8	6
7	53-57.14	7039710	5867552	386149.3	94438	22280	24791.2	9772.8	7
8	5-18-48.16	7619062	6446904	441255.8	92734	20676	21801.8	12762.2	8
9	43-39.18	8129944	6957786	496339.2	90803	18645	18412.3	16151.7	9
10	4-8-30.20	8586800	7414642	551396.7	88644	16486	14626.3	19937.7	10
11	33-21.22	8999933	7827775	606425.6	86256	14098	10440.4	24123.6	11
12	58-12.24	9376948	8204790	661422.6	83641	11483	05859.6	28704.4	12
13	5-23-3.26	9723423	8561465	716385.0	80795	08637	00877.2	33686.8	13
14	47-54.28	9.0044448	8872290	771310.0	77722	05564	7595500.0	39064.0	14
15	6-12-45.30	0342983	9170825	826194.9	74419	02261	89726.3	44837.7	15
16	37-36.32	0622096	9449938	881036.3	70887	6.8798729	83556.1	51007.9	16
17	7-2-27.34	0884136	9711978	935831.7	67125	94967	76989.5	57574.5	17
18	27-18.36	1131047	9958889	990578.4	63132	90974	70026.3	64507.7	18
19	52-9.38	1364457	6.0192299	1045273.4	58909	86751	62669.0	71895.0	19
20	8-17-0.40	1585744	0413586	1099913.6	54454	82296	54915.5	79648.5	20
21	41-51.42	1796084	0623926	1154496.5	49768	77610	46768.4	87795.6	21
22	9-6-42.44	1996489	0824331	1209018.9	44849	72691	38224.6	96339.4	22
23	31-33.46	2187835	1015677	1263478.1	39697	67539	29287.9	105276.1	23
24	56-24.48	2370888	1198730	1317871.2	34312	62154	19957.9	114606.1	24
25	10-21-15.50	2546319	1374161	1372195.9	28698	56535	10234.5	124329.5	25
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Lat 26°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N° of fore going in Parts	V. Sines	Lat
1	0-24-50.54	7.8589147	4.7382400	54731.8	9.9999887	6.8793140	7573803.4	195.8	1
2	49-41.08	8.1599334	5.0392587	109460.8	99546	92799	73208.6	790.6	2
3	1-14-31.62	8360057	2153310	164184.1	98979	92232	72219.8	1779.9	3
4	39-22.16	4609180	3402433	218898.7	98186	91439	70836.8	3162.4	4
5	2-4-12.70	5577940	4371193	273602.0	97164	90417	69056.1	4943.1	5
6	29-3.24	6369337	5162590	328291.0	95917	89170	66882.5	7116.7	6
7	53-53.78	7038313	5831566	382962.8	94441	87694	64312.1	9687.1	7
8	3-18-44.32	7617665	6410918	437614.6	92789	85992	61347.4	12651.8	8
9	43-54.86	8128548	6921801	492243.6	90808	84061	57986.2	16013.0	9
10	4-8-25.40	8585404	7378657	546846.8	88651	81904	54233.3	19765.9	10
11	33-15.94	8998537	7791790	601421.5	86265	79518	50084.2	23915.0	11
12	58-6.48	9375533	8168806	655964.8	83651	76904	45341.4	28457.8	12
13	5-22-57.02	9722228	8515481	710473.9	80808	74061	40603.4	33395.8	13
14	47-47.56	9.0043054	8836307	764945.9	77737	70990	35273.7	38725.5	14
15	6-12-38.10	0341589	9134842	819377.7	74436	67689	29548.3	44450.9	15
16	37-28.64	0620704	9413957	873767.1	70906	64169	23429.8	50569.4	16
17	7-2-19.18	0882745	9675998	928110.7	67146	60399	16919.0	57080.2	17
18	27-9.72	1129657	9922910	982405.9	63156	56409	10017.2	63982.0	18
19	52-0.26	1363068	6.0156321	1036649.8	58935	52188	02720.7	71278.5	19
20	8-16-50.80	1584355	0377608	1090839.5	54484	47737	7495036.2	78968.3	20
21	41-41.34	1794696	0887949	1144972.1	49800	43053	86956.9	87042.3	21
22	9-6-31.88	1995102	0788355	1199045.0	44884	38137	78486.2	95513.0	22
23	31-22.42	2186450	0979703	1253055.5	39736	32989	69627.1	104372.1	23
24	56-12.96	2369504	1162757	1307000.3	34355	27608	60377.6	113621.6	24
25	10-21-3.50	2544936	1338189	1360877.1	28740	21995	50757.0	123261.3	25
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Lat 29°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Secs	Log Cosines	(Log Cos) plus (Log Rad)	nat. N ^o of fore going in Faths	No. Secs. Lat
1	0°-24'-46".32	7.8576834	4.7264604	53267.5	9.9999887	6.8687657	7392063.8	191.6
2	49-32.64	8.1587021	5.0274791	106531.8	99549	87319	91488.1	767.3
3	1-14-18.96	3347746	2035516	159790.7	98985	86755	90528.8	1726.6
4	39-5.28	4596870	3284640	213041.4	98196	85966	89186.4	3069.0
5	2-3-51.60	5565633	4253402	266281.0	97180	84950	87457.6	4797.8
6	28-37.92	6357031	5044801	319506.8	95940	83710	85349.2	6906.2
7	58-24.24	7026010	5713780	372716.0	94473	82243	82854.2	9401.2
8	3-18-10.56	7605366	6293136	425905.9	92779	80549	79974.6	12280.8
9	42-56.88	8116252	6804022	479073.6	90860	78630	76715.3	15540.1
10	4-7-43.20	8573112	7260882	532216.3	88715	76485	73072.9	19182.5
11	32-29.52	8986250	7674020	585331.6	86342	74112	69044.1	23211.3
12	57-15.84	9363271	8051041	638416.5	83743	71513	64635.6	27619.8
13	5-22-2.16	9709952	8397722	691468.2	80917	68687	59845.8	32409.6
14	46-48.48	9.0030783	8718553	744483.9	77863	65635	54671.2	37584.2
15	6-11-34.80	0329325	9017095	797461.1	74581	62351	49115.3	43140.1
16	36-21.12	0608446	9296216	850396.7	71071	58841	43178.3	49077.1
17	7-1-7.44	0870494	9558264	903288.3	67333	55103	36861.0	55394.4
18	25-53.76	1117415	9805183	956133.0	63366	51135	30161.0	62094.4
19	50-40.08	1350831	6.0038601	1008927.9	59169	46939	23081.7	69173.7
20	8-15-26.40	1572128	0259898	1061670.7	54742	42512	15620.3	76635.1
21	40-12.72	1782477	0470247	1114357.9	50085	37855	07780.0	84475.4
22	9-4-59.04	1982892	0670662	1166987.6	45197	32967	7299560.0	92695.4
23	29-45.36	2174250	0862020	1219556.7	40079	27849	90963.3	101292.1
24	54-31.68	2357314	1045084	1272062.3	34723	22498	81985.0	110270.4
25	10-19-18.00	2532756	1220526	1324501.8	29145	16915	72630.0	119625.4
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33								
34								
35								

32

Lat 30°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat. N° of fathoms going in Faths	Verbuies	Lat
1	8-24-43.96	7.8569933	4.7221955	52746.7	9.9999888	6.8651910	7331469.5	187.5	1
2	49-27.92	8.1580121	5.0232143	105490.7	9.9550	51572	30398.3	758.7	2
3	1-14-11.88	3340846	1992868	158229.3	98982	51010	29950.0	1707.0	3
4	38-55.84	4589971	3241993	210959.6	98201	50223	28622.0	3035.0	4
5	2-3-39.80	5658734	4210756	263679.0	97189	49211	26913.6	4743.4	5
6	28-23.76	6350134	5002156	316384.8	96952	47974	24827.1	6829.9	6
7	53-7.72	7019115	5671137	369074.2	94490	46512	22362.7	9294.3	7
8	3-17-51.68	7598472	6250494	421744.5	92803	44825	19518.6	12138.4	8
9	42-35.64	8109361	6761383	474393.0	90889	42911	16293.3	15363.8	9
10	4-7-19.60	8566223	7218245	527016.8	88751	40773	12691.7	18965.3	10
11	32-3.56	8979363	7631385	579613.5	86386	38408	08711.7	22945.3	11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21									21
22									22
23									23
24									24
25									25
26									26
27									27
28									28
29									29
30									30
31									31
32									32
33									33
34									34
35									35

39

Lat 31°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N° of fore going in fathoms	Per Sines	Lat
1	0°-24'-41".10	7.8561556	4.7177526	52209.9	9.9999888	6.8615859	7270861.7	187.9	1
2	49-22.2	1571743	5.0187714	104417.0	99552	15523	70300.0	749.6	2
3	1-14-3.8	3332469	1948440	156618.8	98992	14963	69361.7	1687.9	3
4	38-44.4	4581595	3197565	208812.5	98209	14180	68031.7	2997.9	4
5	2-3-25.5	5550360	4166331	260995.5	97200	13171	66363.3	4686.3	5
6	28-6.6	6341761	4957732	313165.0	95968	11939	64301.7	6747.9	6
7	52-47.7	7010744	5626715	365318.4	94511	10482	61865.0	9184.6	7
8	3-17-28.8	7590104	6206075	417452.9	92830	08801	59055.0	11994.6	8
9	42-9.9	8100994	6716965	469565.9	90925	06896	55871.7	15177.9	9
10	4-6-51.0	8557860	7173831	521654.7	88794	04765	52311.9	18737.7	10
11	31-32.1	8971003	7586974	573716.6	86439	02410	48380.0	22669.6	11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21									21
22									22
23									23
24									24
25									25
26									26
27									27
28									28
29									29
30									30
31									31
32									32
33									33
34									34
35									35

Lat 32°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sine	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of fore going in Paths	P. Sine	Lat
1	0° 24' 37".72	7.8551633	4.7131247	51656.5	9.9999889	6.8579503	7210250.0	183.1	1
2	49' 15.44	8.1561821	5.0141435	103310.3	99554	79168	09693.3	739.8	2
3	1- 13- 53.16	3.322549	1902163	154958.8	98997	78611	08768.3	1664.8	3
4	38- 30.88	4.571676	3151290	206599.4	98216	77830	07472.1	2961.0	4
5	2- 3- 8.60	5.540441	4120055	258229.3	97213	76827	05808.3	4624.8	5
6	37- 46.32	6.331845	4911459	309846.8	95987	75601	03775.0	6658.1	6
7	52- 24.04	7.000830	5580444	361446.8	94537	74151	01370.0	9063.1	7
8	3- 17- 1.76	7.580192	6159806	413029.0	92863	72477	7198595.0	11838.1	8
9	41- 39.48	8.091035	6670699	464590.0	90966	70580	75450.8	14982.3	9
10	4- 6- 17.20	8.547955	7127569	516127.4	88846	68460	91939.3	18493.8	10
11	30- 54.92	8.961101	7540715	567638.1	86500	66114	88055.0	22378.1	11
12									12
13									13
14									14
15									15
16									16
17									17
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20									20
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29									29
30									30
31									31
32									32
33									33
34									34
35									35

Lat 34°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N° of foregoing in Paths	P. Sines	Lat
1	0°-24'-29".46	7.8527289	4.7033244	50503.8	9.9999890	6.8505845	7088991.9	180.2	1
2	48-58.72	8.1537480	5.0043435	101005.2	99559	05514	88452.5	719.6	2
3	1-13-28.38	3298208	1804163	151501.3	99008	04963	87552.5	1619.6	3
4	37-57.84	4547339	3053294	201989.8	98236	04191	86293.4	2878.7	4
5	2-2-27.30	5516108	4022063	252468.0	97244	03199	84674.2	4497.9	5
6	26-56.76	6307516	4813471	302933.4	96031	01986	82694.7	6475.4	6
7	51-26.22	6976507	5482462	353383.4	94598	00553	80359.0	8813.1	7
8	3-15-55.68	7555875	6061830	403815.5	92943	6.8498898	77661.3	11510.8	8
9	40-25.14	8066775	6572730	454227.1	91067	97022	74604.9	14567.2	9
10	4-4-54.60	8523652	7029607	504615.6	88970	94925	71190.2	17981.9	10
11	29-24.06	8936807	7442762	554978.6	86651	92606	67414.8	21757.3	11
12									12
13									13
14									14
15									15
16									16
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33									33
34									34
35									35

Lat 35°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N ^o of foregoing in Faths	V. Sines	Lat
1	0°-24'-24".56'	7.8512783	4.6981426	49904.8'	9.9999890	6.8468533	7028348.4	178.9	1
2	48-49.12	8.1622974	9991617	99807.2	99562	68205	27817.7	709.6	2
3	1-13-13.68	3283705	5.1752348	149704.5	99014	67657	26930.6	1596.7	3
4	37-38.24	4532837	3001480	199594.2	98248	66891	25691.9	2835.4	4
5	2-2-2.80	5501608	3970251	249473.9	97262	65905	24096.8	4430.5	5
6	26-27.36	6293019	4761662	299341.0	96058	64701	22150.0	6377.3	6
7	50-51.92	6962012	5430655	349193.0	94633	63276	19846.8	8680.5	7
8	3-15-16.48	7541385	6010028	399027.5	92990	61633	17190.3	11337.0	8
9	39-41.04	8052289	6520932	448841.7	91126	59769	14180.3	14347.0	9
10	4-4-5.60	8509171	6977814	498633.4	89043	57686	10816.1	17711.2	10
11	28-30.16	8922331	7390974	548400.0	86740	55383	07100.0	21427.3	11
12									12
13									13
14									14
15									15
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28									28
29									29
30									30
31									31
32									32
33									33
34									34
35									35

Lat. 36°

[illegible]

Lat 37°

Lat	Angle	Log Sines	(Log Sin) plus (Log Rad)	Sines	Log Cosines	(Log Cos) plus (Log Rad)	nat N° of fore going in Fathms	Ver Sines	Lat
1	0°-24'-13".10	7.8478668	4.6871693	48659.7	9.9999892	6.8392917	6907035.5	172.9	1
2	48-26.2	8.1488860	9.881885	97317.0	99569	92594	06522.2	686.2	2
3	1-12-39.3	3249593	5.1642618	145969.4	99030	92055	05665.1	1543.3	3
4	36-52.4	4498729	2891754	194614.6	98276	91301	04466.7	2741.7	4
5	2-1-5.5	5467506	3860531	243250.2	97305	90330	02922.2	4286.2	5
6	25-18.6	6258923	4651948	291873.6	96119	89144	01038.1	6170.3	6
7	49-31.7	6927924	5320949	340482.6	94717	87742	6898809.7	8398.7	7
8	3-13-44.8	7507304	5900329	389074.6	93099	86124	96241.3	10967.1	8
9	37-57.9	8018219	6411244	437647.5	91265	84290	93328.6	13879.8	9
10	4-2-11.0	8475111	6868136	486198.4	89214	82239	90074.6	17133.8	10
11	26-24.1	8888283	7281308	534725.4	86947	79972	86478.1	20730.3	11
12									12
13									13
14									14
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33									33
34									34
35									35

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IOS

SR NO. 28

VOL NO.1 TABLES FOR

COMPUTING AND

PROJRECTING THE

GRATICULES OF THE

SHEETS OF THE

INDIAN ATLAS

YEAR-1902.

NAIDLB00092229

AT-5

Page - 2

9871

Calculation of Co-ordinates for the Projection of the Graticule of a sheet of the Atlas of India.

The rectangular co-ordinates of the points of intersection appertaining to the graticule

lines of an Atlas sheet, are computed for a full sheet in the first instance, and in arder to determine the intersection of the degrees, and half-degree lines on the borders, the co-ordinates of the several points falling within the continuation or marginal sheets are also computed and projected on a large sheet of paper properly stretched on a table. After the projection of the whole of the points of intersection have been completed, the lines are drawn from point to point; these again are subdivided for the half-degrees, and similarly joined

so that the several lines intersecting the borders of the required sheet be finally determined.

The full sheet is then divided into four equal parts, each part representing a quarter Atlas sheet and named N.W., N.E., S.W., and S.E. (Vide figure).

An example is given below of the Calailation for all the co-ordinates of Atlas sheet 78, as well as of those of the surrounding sheets, and to facilitate reference

the following figures with the computed values inserted thereon of every point

is

also given.

(Signed) A. Chamarett.

14°

J

77 300

38690780

-20367-

A

-36083

24406

E

38443-

77

38215

A

Calculation of point A (Vide

12 0

77 30

786

Continuation Sh. 60.

10,000 5

4

6

8

12

30

9300

-20861-

F

21317-6

O

10

78 30

8

3

2

B

25037

7830

790

↑

-35450

SW

N.W.

796

INDIAN ATLAS

Continuation Sh. 77.

79 30

G

34400-

Continuation Sh. 79.

8186

V

Scale of Fathoms (t of Atlas Scale)

20

30

40

50

60

K

14 L

55433-

08030

3609

-68092--A

Sheet No 78

79 30

800

13

30

70

80

90

g0

N.E.

54961

13

121

SE

30

800

54007

0

6712

12 80 30

0

4596

32925

0551

100

110

120

130,000 fathoms

27558-

Type of Calculation

Fathoms.

From Central line of projection (7630) to western edge of sheet 78 (Vide sheet of Elements of projection) 97,750.

"On latitude 12° (Vide Tables): Sine of 1st Degree from Central line.

Distant from western edge of sheet 79, within sheet 61 of intersection....

Intersection of southern edge of sheet 60 with central line of projection (Vide sheet of elements of projection, and page 80 of the abstracts of the Reports

of the Surveys of India 1870-71)

a P

12-0

77-30

=12-10'

59,535.

38215-A

[Perpendicular Co-ordinate.

Latitude line required for this projection

=12-0

Value of a Meridional degree between Lats. 12 & 13-60,484 fathoms. Diff: 0-10

Then as 60: 60484: 10: X. X- 10081.

Value of 10 minutes on Cent! line of projection.....

Versine on 12 degree of Lat; for 1 Degree from Cent line....

...10081.

.-210.

9871-A (Direct co-ordinate).

Θ

Page - 3

2

On Lat: 12-0

12-0

0-21

79-30

80-30

On Lat: 14-0

a

Lat: 14-0 14-0 14-0 14-0

Long:77-30 78-30 79-30 80-30

On Lat: 13-0

Lat: 13-0 13-0 13-0 13-0

Long:77-30 78-30 79-30 80-30

Lat: 12-0

Long:78-30

From the foregoing example the following Calculation for every point of intersect will be obvious.

4th Degree

*97750+134850

2nd Degree

3rd Degree

Lengths of sheets

Lat: 12th Degree sines

97750

119067

232600

232600

B. 2/317

178593

C= 54007

238/11

D=

5511

=

Perpendicular Co-ordinate

Value of 10 Merd! minutes

Lat: 12th Degree Versines

B. =

10081

- 843

9238

C =

1008/

-1895

8186

D=

10081

3369

6712

See 1 Example

=

Direct Co-ordinate

Lengths of sheets

Lat: 13th Degree sines

Value of 36 Merd! minutes

Lat: 13th Degree Versines

Lengths of sheets

Lat: 14th Degree sines

1st Degree

2nd Degree

3rd Degree

4th Degree

97750

59307

97750

118611

232600

177909

=

E 38443

F= 20861
G= 54691
232600
237198
H= 4598 Perpendicular Co-ordinate
36293
- 210
E = 36083
36293
- 843
F= 35450
36293
- 1893
G= 34400
36293
-3368
+
H=32925 Direct Co-ordinate
1st Degree
2nd
97750
59060
38690
J =
Degree
97750
118117
20367
3rd Degree
4th Degree
232600
177167
K= 55433
232600
236209
L =
3609 Perpendicular Co-ordinate
Value of 24 Merd! minutes
Lat: 14th Degree Versines

24196
 + 21 0
 1= 24406
 J =
 24196
 +841
 25037
 24196
 +1893
 K= 26089
 24196
 +3362
 L= 27558 Direct Co-ordinate
 Note + Intersection of northern edge of sheet 60 with lent line of projection
 tion}
 13-36
 Diff: 0 36
 Vide sheet of elements of Do
 Lat: line required for this projection 13-0.
 Value of a Merid! Degree between Lats: 13 & 14-60489 fathoms
 Then as 60: 60489:36:= 36293- Value of 36 meridional minutes.
 Intersection of northern edge of sheet 60 with Cent line of projection.....13-36
 Lat: line required for this projection....14-0.
 Value of a Merid! Degree between Lats: 13 & 14-60489 fathoms
 Then as 60: 60489:24:.=24196= Value of 24 meridional minutes.
 Diff: 0-24
 Computed by A. Chamarett Esq

Page - 4
 For Projection of Indian Atlas Sheets.
 Table of
 Eastern and Western Values of N.Q. in fathoms with their respective Logarithms.
 Eastern Values of N.Q.
 Western Values of N. Q.
 3
 Fathoms
 Logarithms
 97750

232600
4.9901168
5.3666097
Fathoms
Logarithms
37 100
171950
4.5693739
5.2354022
502300
637150 5.8042417
367450 5.5651983
5.7009632
306800
5.4868554
441650
5.6450782
57 6500
5.7607993
772000
906850
1041700
1176550
1311400
5.8876173
5.9575355
6.01 77427
6.07061 04
6.1177352
711350
846 200
5.8520833
5.9274730
1446250 6.1602434
1581100
6.1989593
1715950
6.2345047
Latitude

Angle of
projection
due to 1 degree
of Longitude

Table of Proportional parts of the Angle of Projection

Proportional parts in Seconds of Longitude due to Tenths of a degree

0.1

0.2

0.3

8.4

0.5

0.6

0.7

0.8

0.9

I

23-126

"

If

"1

8.62 0.862

1.724

2 3

"9

9.88

8.32 0.832

1.664

» 18.20

8.00 0.800

1.600

2.586

2. 496

2.400

.4

" 26.20

7.68 0.768

1.536

567

97

99
33-88
41.24
7.36 0.736
7.02 0.702
91
48.26
6.68 0.668
8
"
54.94
9
24-1-30
6.36 0 6 36
6.00 0.600
10
90
11
99
7.30
12.94
564 0.564
5.28 0.528
12
37
13.
99
18.22
23.12
4.90 0.490
4.54 0.454
1.-4
91
27.66
416 0.416
0.832
15
99
31.82

3.78 0.378

0-756

1.134

16

35.60

3.36 0.336

0.672

1.00 8

1.680

17

38.96

2.98 0.298

0.596

1.490

18

97

41.94

19

"

20

21

"

22

"8

33

23

99

24

99

25

26

"9

27

99

28

99

4452

46.68

48.42

49.72
50.58
51.02
" 51.02
50.54
49-60
48.20
29
" 46.32
30
» 43.94
31
99
32
"
33
"
34
"1
35
"
36
"
37
41.08
37.72
33.84
29-46
24-54
19.10
13-10
2.58 0.258
2.16 0.216
1-74 0.174
1.30 0.130
0.86 0.086
0.44 0.044
0.00 0.000
0.48 0.048

0.94 0.084
1.40 0.140
1.88 0.188
2.38 0.238
2.86 0.286
3.36 0.336
3.88 0.388
4.38 0.438
4.92 0.492
5.44 0.544
6.00 0.600
1.476 1.968 2.460 2:952 3.444
1-632
1.800
2.176 2720 3.264
2.400 3.000 3.600
3.448 4.310 5.172 6.034
3.328 4.160 4.992 5.824
3.200 4.000 4.800 5.600
2.304 3.072 3.840 4.608 5.376 6-144
1.472
2.208 2.944 3.680 4.416 5.152 5.888
1-404
2.106 2.808. 3.510 4212 4.914
1.336 2.004 2.672 3:340 4.008
1.272 1.908 2.544 3.180 3.816 4.452
1200 1.800 2.400 3.000 3.600 4.200 4.800
1.128 1.692 2.256 2.820 3.384 3.948 4.512.
1.056 1.584 2.112 2.640 3.168 3.696
0.980 1.470 1.960 2.450 2.940 3.430
0.908 1.362 1-816 2.270 2.724 3.178
1.248 1.664 2.080 2.496
1.512 1.890 2.268
1.344
0.894
1.192
0.516 0.774 1.032 1.290 1.548 1.806 2-064 2-322
0.432 0.648 0.864 1.080 1.296 1.512.
0.348 0.522 0.696 0.870

1.044 1.218
0.260 0.390 0.520 0.650 0.780 0.910
0.172 0.258 0.344 0.430 0.516 0.602
0.132
0.088
0.176 0.220 0.264 0.308 0.352
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
0.096 0.144 0.192 0.240 0.288 0.336 0.384 0.432
0.188 0.282 0.376 0.470 0.564 0.658 0.752 0.846
0.280 0.420 0.560 0.700 0.840 0.980 1.120 1.260
0.376 0.564 0.752 0.940 1.128 1.316 1.504 1.692
0.476 0.714 0.952 1.190 1.428 1.666 1.904 2.142
0.572 0.858 1.144 1.430 1.716
2.288
2.002
2.574
0.672 1.008 1.344 1.680 2.016 2.352
3.024
2.688
0.776 1.164 1.552 1.940 2.328
3.104
2.716
3.492
0.876 1.314 1.752 2.190 2.628 3.066 3.504 3.942
0.984
1.088
1.200
6.896
6.6 56
7.758
7.488
6.400
7.200
6.912
6.624
5.616
6.3 18
4.676
5.344

5.088 5.724

6.012

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4.800

4.428

4.896

5.400

Computed

by Babú Purna Chunder Sen & A. Chamarett Esquire. Ex! by G.A. Mc Gill Esqr.

Page - 5

General Walker's Formula for Computing the Corner
the INDIAN ATLAS SHEETS.

Points of

In future projections of Atlas sheets, the latitudes and longitudes of the corner
points should

invariably be calculated, as a check on the marginal dividing of the graticule.

To find the latitudes and longitudes of the corner points of the Indian Atlas
sheets:

Let OP be the fundamental meridian of the Atlas. Let P and Q be two points 1°
26' apart

in latitude, from which

which the perpendiculars to OP are set off which regulate any belt of sheets
from East to West.

the

66

Draw the perpendiculars QNn and PMm indefinitely; draw MN parallel to PQ to
indicate

lateral margin of any sheet. Draw

curves QBC and PAD from the centre

poning "radii of the projection" OQ and OP then these curves will represent the
parallels of latitude

passing through the governing points P and Q.

a

O with the corres-

O

Let N be a corner point of any sheet, and let it be

required to find the latitude and longitude of N. With centre

O and radius ON draw the curve RN, and then this curve will re-

present the parallel of latitude on which the point N is. situated, and

the latitude of N will be found by determining QR, and the longitude
by determining the arc RN.

In the right-angled triangle OQN, we have OQ equal

to the given radius of projection for latitude of Q, also QN the given distance of N from the fundamental meridian hence we readily find NOQ from the equation

OQ

9

Then for the latitude we have QR-ON-OQ, in which

OQ

cos. O thus we obtain

$\tan. \theta = NQ.$

ON=-

a value of QR expressed in fathoms

which we have to convert into

OR

C

B

N

arc; this might be done with the

in

P

A

D

M

n

aid of Auxiliary Table X; but the constants employed the projection of the Atlas differ from those employed in the Auxiliary Tables and there are

9

m

sundry errors in the projection tables. Consequently as the object in view is not to get absolutely correct positive values of the corner points of the Atlas

sheets, but values

which will be exact relatively to the calculations of the co-ordinates of the intersections of the prin-

cipal meridians and parallels, we must only employ the data of the projection tables; and here again

must employ Mr. Walker's data for the sheets which he projected, and Mr. Atkinson's data for

the sheets projected in this Office.

we

value of

Thus putting AM for the difference of latitude between Q and R, we have :-

$A\lambda = -86\times$, which

QR

QP

, which expresses A in minutes of arc.

For the longitude, we know the value of the angle O, also from the tables of e, the angle of projection, for

Putting

n

the parallel of projection.

we can find the

for the number of degrees of longitude in the arc RN, we have $n e = 0$,

.. $n =$, which

gives AL

AL in degrees

in degrees of arc.

(signed)

J.T.Walker Major-General, C.B., R.E.

Reg. No. 186, S. 1. D.-Mar. 02.-50.

Surveyor-General of India.

8th. December

1882.

Helio. S. I. O., Calcutta.

No. 471-S. 02.

Page - 6

Meri-

dional

minutes.

Foregoing in Fathoms.

(Radii of projection due to the several intersecting parallels.)

Fathoms.

Logs.

TABLE FOR PROJECTION OF INDIAN ATLAS SHEETS, BY MR. WALKER'S DATA.

Lengths of Meridional Arcs, and also of Radii of projection, corresponding to the

points

at which the governing parallels intersect the central meridian, $76^{\circ} 30'$.

Belt of cen-

tral Atlas

Sheets.

Intersecting

parallels on

the central

Meridian.

OQ or OP.

TABLE FOR PROJECTION OF INDIAN ATLAS SHEETS, BY MR. ATKINSON'S DATA.

Lengths of Meridional Arcs, and also of Radii of projection, corresponding to the points

at which the governing parallels intersect the central meridian, $76^{\circ} 30'$.

OQ or OP.

(Radii of projection due to the several intersecting parallels.)

Belt of cen-

tral Atlas

Sheets.

Intersecting

parallels on

the central

Meridian.

Meri-

dional

minutes.

Foregoing in Fathoms.

Fathoms.

Logs.

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$6^{\circ} 26'$

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S. G. O.
December 1882.
Reg. No. 218, S. I. O.-8-5-02.-50.
Computed and Compared,
S. G. O.
A. C.
A. J. W.,
December 1882.
F. A. & P. C. S.
Reg. No. 219, S. I. O.-8-5-02-50.
Computed and tabulated by
Examined by
A. CHAMARETT.
A. J. W.,
F. A. & P. C. S.

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INDEX

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INDIAN ATLAS

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Singapore

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Central line of Projection

76°-30'

80°

85°

9.0°

Published under the direction of MAJOR F. B. LONGE, R. E., Officiating Surveyor-General of India.

July, 1902.

95°

100°

Engraved at the Survey of India Office, Calcutta.

No 639 S. 1902.

Page - 8

Atlas of India

Lat

Length of a degree of datitude, in Lat 35=

30=172 Inches...

a

of work in Each plate North & South 1 – 26

Extent of work

Length of the work in Each plate East & West = 134850 fathous

Centre line of projection 76:30 East Longitude.

Inside line west from 76-30 = 37100 fathomes.

Do.....

Do. = 97750 Do

26400 fathoms in 30 Statute Miles

1° of Latitude, as far

25 of dat = 60500 fathours.

above 21.

Do. 60550 De

=

Extent of work north & South in fathoms = 86716.

Do....

Do above 21th depee of dat=86788.

teat

The Longitudes in this Atlas have been regulated by
the observatory at Madras a, formerly determined by
adras as

Mr. Goldingham Viz 80-18-36 East of Greenwich.

G. J. Survey value of 2 = 80-17.21.

Madras.

Do.

8

Diff: +1-9. Wbe added u G.7.5. values
before propiting
où dus atlas.

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Reg. No. 207, S. I. D.-June 91.-25.

Photo., S. I. O., Calontta.

7

Page - 9

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Computation of the "Angles of Projection for the Indian Atlas.

Radii of Projection

Logs

Meridional

Distances Fathoms

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Linear value in Fath

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* Log a-Log Rad, or Sin

A= arc where A is the

2

vertex of the cone and r

"L of projection" at the

the radius of the guen parallel.-

Log-Log sine /

Photo., S. I. O., Calcutta.

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Log Sines

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or

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Photo., S. 1. O., Calcutta

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Photo., S. I. O., Calcutta.

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Photo., S. I. O., Calcutta.

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9-10-4-08
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33-59.04
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6.0797203
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1.320742.6
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8579466.7
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1735962.4
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Photo., 8. I. O., Calcutta.

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Angle

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Log Sines

8443257,

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8. 1453451

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5432109

6223533

9.6892541

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LogSin plusLogRad)

4.7789615

5.0799809

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4778467

5569891

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Log Cosines

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Log Cosplus (Log Rad) nat N of fore going

6.9346252

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2731135
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1257838.0
1317273.3
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6.9299432
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8.491856.9
1571387,
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84998
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1554342.1
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Photo., S. I. O., Calcutta.

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18

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Angle

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36-29.2.
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24-43:8
48-51.1
Log Sines
LogSin) plus (Log Rad)
Suies
7.8461298.
8.1471492
3232226
4481364.
5450143
6241564.
6910569
4.7777019
5.0787213
59938.0
9.9999893
119873.0
99572
2547947,
179802.1
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6.9315614
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3797085
239722.3.

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Log Cos) plus (Log Rad) natN of fore going
in Faths

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Log Cosines

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9.1457370
1667800,
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6.0773091
0983251
1184020
1194838.1
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27-9.8
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11-15-24:4
39-31.7,
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2242901
2418439
2586950
2748961
2904939
3055302
3200426
3340650
1375465
1558622
1734165
1372607.9
1431733.6
43197
6.9272816
68402
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8458270.6
49678.4
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1726244.4.
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1784903.3
03061
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1843474.5
9.9896438
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40957.7
77911.5
66003.8
53686.5
141759.2,
152839.7,
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Iboto, S. AO, Galoutta

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19

Angle

Log Sines

Log Sin plus(LogRad

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48-25.88

1-12-38-82

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7.8478190

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4.7763055

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Log Cosines LogCosplus(Log Rad) nat No of fore going

6.9284757

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4-18.80
28-31.74
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9-16-57-62
9.1474150
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41-10.56
2259631
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5-23.50
2435155
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29-36.44
2603653
53-49.38
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11-18- 2.32
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42-15.26
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6-28.20
30-41-14.
6.0759015
1684568
1885056
076488
2765649,
2921612
3071959,
217066
3357273
1361353
1544496
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172
1888518
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0969433.
1169921
1190971.9
1250095.7
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1427084.2
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111072-8
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1603435.1
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131178.6
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141852.0
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1662064.0
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6.9199839.
2356824
1720609.9.
08749
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1779070.2
02298,
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87163
2642138
1837442.8
9.9895623
80488
17328.8
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164442.1,
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20

37-12.88

Lat

1234

Angle

0-24-18. 22

48 36.44

1-12-5466

Log Sines

7.8493943

8.1504134.

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LogSin)plus(LogRad

4.7747729

5.0757920

Lab 12°

Sunes.

LogCosines

59535.

119067.2

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Log Cosplus(Log Rad) nat N of fore going

6.9253678
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19396.1
3767787
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5482775
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297615.9
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51072
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30-22 62
54 40.84
9-18-59.06.
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43-17.28
31-53.72
56-11.94
11-20-30.16
44-48.38
9-6.60
33-24 82
9.1489799
1700206
1900683
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2275233
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2937160,
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6.0743585
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1186748.1
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6.9196119
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2626560.
1830863.7
1597716.5
1656130.5
1714461.7
1772707.3

9.9894857
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141863.7.
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Angle

LogSines

Log Sin) plus(LogRad)

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Lines

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LogCosines

Log Cosplus/LogRad) nat Nof foregoing
in Faths

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0-24-23.14.

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8.1518762

4.7731052

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59306.9

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8360596. I

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118610.8

177908.7

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21498
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37-32.56.
58913.5
4528625
3751106
237197.8
98251
20732
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5497397
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26-18.84
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9-20-52.22
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1416511.5.
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8276807.7.
68211.5.
59203.8
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Photo., S. I. O., Calcutta.

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22

123

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Lat

8-24-27.66.

48-55.32

1-13-22.98

37-50-64

Angle

Log Sines

(Log Sin plus(LodRad)

7.8521967

8.1532157

4.7712914.

5.0723104.

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LogCosines

Log Cos)plus (LogRad) nat Neof fore going
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9.1517634
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6.0708581
0918970
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1493933,
1669422
1177221.4.
1235654.4
1294024. 8.
135 23 29.5
1410565.6.
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Photo., S. 1. O. Calcolta.

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23
Lat
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0-24-31.82
49- 3.64
LogSines
LogSin plus(Lod Rad)
7.8534259
8.1544448
3305177.
4.7693439
5.0703628°
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58795.5

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Log Cosines

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LogCos) plus LogRad) nut N of fore going

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51-42.74
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1462115.8
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6.9095182
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24

Lat 16.

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Lat

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0-24-3560

49-11.2

1-13-46.8

38-22.4.

Angle

LogSines

Log Sin plus Log Rad)

Suner

LogCosines

in Faths

7.8545398

4.7672573

58513.7.

9.9999889

8.1555587,

5.0682762

117024.4

99556

26731,

3316314

2443489.

175529.0

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4565442

3692617.

234024'7

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553420
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4661384.
292508.4
97221
24396
Log Cos plus Log Rad) nat Neof foregoing
6.9127064
8179117.0
78488.9
77442.6.
75977.4
74094.3
Verties Lat
208.8
836.9
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33-29.6
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7-2240.8
47-16.4
8-11-52.0
36-27-6
9-1-
25 38.8
3.2
1951718
1078873
2143100
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50-14.4
2326189
1270275
1453364
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10-14-50. 0.
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9999453
9126628
9.0298010.
0577148
0839213
108615.
1319590,
1540907.

1751279
9966388
6.0213326
0446765
0668082
0878454

9425185
817829.6
876029.0
78181
74947,
05356
02/22
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9704323
934183.7
71488
6.9098663
32277 4,
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40990.0
47048.4
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992290.5
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1050346.6.
63893
1108349.0
59757,
1166294.3
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1224180.3.
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1339761.4.

1397450.5
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77980
73163
68119
62845
87196.3
78231.5
688547
94978
91068
86932,
82569
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18911.3
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11605.6.
038833
8095746.3
53522.1
60414.5.
67720.2
75442.5
83579.5
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92129.5
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1455068.1
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48861.
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130464.7

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3'3
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Lat

Angle

LogSines

LogSin plus LogRad

Lives

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0-24-38.98
49-17:96
1-13-56.94.
38- 35.92
3-1490
27-53.88
52-32.86
7.8555334
8.1565523
4.7650264
5.0660453
58213.9
116424.8.
9.9999888
6.9094818
99555
3326249
2421179
174629.6.
98995
V
8
3-17-11-84
4575376
5544141
6335544.
7004528
7583889
3670396
232825.5.
98213
94483
93925
93143
4639071
291009.5
97208
92138

5430474
349178.4.
95980
90910
6099458
407329.4.
94527
89457
6678819
465459.5
92851
87781
9
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41-50.82
46-29.80
8094782
7189712
523565.7
90950
85880
8551649
7646579
581644.9.
88826
83756
Lab 17"
LogCosines LogCosplus(Log Rad) natN: of foregoing
in Faths
8118613.0
17986.8
16943. 4.
15481.5.
13603.8"
V. Suces
209.0
835.2
1878.6

3340
5218
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7512.6
10225.7
13354d
16901
2°
20862.7
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11309.4.
08596.3
05467.9
01920.8
8097959.3
/ 0
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12
/3
14
J
46914.6
533 70.1
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60242.4
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67527.6
18.

75227.6
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833 40.5.
20
91868.3
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100807.2
22
110157.2
23
119920.1
130092.4
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9-44.75
34-23.68
2.66
59-
7-2341.64.
48-20.62
8-12-59.60
9 0307908
0587040
0849101
1096033

1329465
1550776
9402838
871533.0
74832
9681970
929387.9
71357'
69762
66287
994403/
987195.5
67655
62585
6.0190963.
1044951.9
63727
58657
2/
37-38.58
1761145
0424395
0645706
0856071
22
9- 2-17.56
1961572
1056502
23
26-56.54.
2152946
24
51-35.52.
N N N N N
25
10-16-14.50
2336028
2511488
1247876

1430958
1606418
1102654.6.
1160300.8
1217887.4.
1275411.
1332869.3
1390259.3
1447577.3
59572
54502
71907.4
65451.9
58579.6
51294.4.
43594.4,
55189
50119
35481.5
50578
45508
26953.7
45739
40669
40671
35601
35374
3°
29847
26
30304
24777
5
18014.8.
08664.8
7998901.9.
88729.6
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Lab 18

Angle

LogSines LogSinplus LogRad)

Log Cosines

LogCostplus (Log Rad)

Lat

Suici

2

7.8564075

8.1574264

3

4

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52-53.72

3-17-35-68

6344281
7013263
8-24-41.95.
49-23.92
1-14-
5.88
38-47.84
3- 29.80
28-11.76
3334990
4584116
5552880
7626517
5.0636705
2397431
115789.8
173677.3
57896.4
9.9999888
99552
98991
3646557
231555.8
98206
4615321
289422.4.
97197
5406722
347273.9.
95963
6075704
405107
6
94505
7592622
6655063
462920.4
42-17.64
8103512

4-6-59.60

8560376

7165953

7622817

520709.3

578471.2

92822

90914

88781

6.9062329

61993

61432

60647

59638

58404

56946

55 263

53355

51222

8058103.8

57481.5

56440.7,

54984.9

P

53 113

50825.9

48 / 22.2

45005.6.

41470.4.

37522.2

nat No of foregoing

in Faths

V. Suis

208.8

831 1

Lat

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13
14
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6-10-29.40.
9.0316615.
9379057
866773.6
74730
16
35-11.36.
37171
0595744
9658185
924311.7
71241
33682
17
59-53 32
.
0857799,
9920240
981802 20
67524
118
19
20
2/
22
2.3
25
24
7-24-35.28.
49-17.24
8-13-59.20
38-41.16
9-3-23.12
28-
52-47.04

10-17-29.00.

5.08

1104725

1338153

1559457

1769816

1970241

2161608

0167166

1039241.7°

63580

29965

26021

0400594.

2344683

2520136

0621898

0832257

1032682

1224049

1407124

1582577

1096628

1153957.4.

12/1227.4

2

59408

55007

50379

21849

17448

12820

1268435.0.

1325576.8

1382650.3.

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1439652.6

35112

29562

6.8997553

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11560.0

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27

Lat 19°

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0-24-4452

49-29.04.

1-14-13.56

7.8571572

8.1581759

3342484.

4.7601275

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Angle

Logsines

LogSin plus (LogRad)

Sius

Log Cosines

Log Cos) plus (LogRad) natN of foregoing
in Faths

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38-58.08

3-42.60.

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28-27.12
53-11.64
3-17-56-16
42-40.68°
47-25-20
9.72
6351772
7020753
760010
2372187
3621312
4590075
5381475
6050456
6629812
57560.9
115118.8
172670.7
230 213 7
287744.8
9.9999887
99550
6.9029590,
7997587.3
29253
98987
28690,
98200
27903
97187
26890
96966.7.
95929.6
94481.5
92616.7",

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209.9
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33157,
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345261.0
95950
25653
402759.4
94486
24189
460236.6.
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22500
90340.7
87648.1
84541.8
7456.5
10149.1
13255.4.
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6-11-
35-52.32
70-36.84
46-23.28
7.80
8110997
8567859
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9704704
9.0025538
0324082
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1112179
1345602
1566901
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8010702
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8734407
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517690.2
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16773.6
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93157,
88970,
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57229.6.
51233.3
44825.9
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Photo., S. I. O., Calcutta.

Page - 29
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Angle

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1-14-20.04

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23-53.40.

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3-18-13.44

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57-20·16

46-53.52

6-11-40·20

36-26.88

7-1-13-56

7.8577886

8.1588073

3348798

4597922

5566684

4.7574601
5.0584788
2345513
LogSines
(LogSin) plus Log Rad)
LogCosines
Suves
LogCos) plus (Log Rad) nat N of foregoing
in Faths
57208.4
+14413.9.
171613.5
9.9999887
99549
6.8996602
96264
7937069.1
36452.7
98985
95700
3594637
228804.1
98195
94910
35421.8
33978-2
4. Lunes Laz
206.5
822.9
1863.8
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285982.8
97179
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32121 8
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6358082
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95938
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457418.0
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8117303
7114018
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571594.2
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628639.1
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20581.8
16667.3
12343.6
685651.6.
83736,
80451
9711000
07607.3,
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13188.6
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799566.5
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7896901.8
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856463.3
74569

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913315.4
71057
67772
90934.5.
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46341.1
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0871541
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970120.2
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77767.9
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63347
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70570.9
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66704.7
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1083575.5
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55863
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1573172
0569887
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54720
51435

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1783522
0780237
1196805.8
50060
46775
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41886
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40049
36764
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5440.32
2358355
1355070
1366177.0
34696
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10-19-27.00
2533797
15305/2
1422496.4.
29110
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25825
37700.0
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18817.9
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118457.7, 24
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Photo., S. 1. O., Calcutta.

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29.

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Angle

0-24-48" 42

49-36.84

1-14-25.25

39-13.68

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28-50-52

53-38.94

3-18-27.36

7.8582966

8.1593153

Log Sines

LogSin plus (LogRad)

Suves

Log Cosines

3353877

4603001

4.7546435

5.0556622

2317346

3566470°

56838.6

9.9999887

113674.3

99548

oglos) plus(Log Rad) nat N of foregoing

6.8963356

63017
in Faths
V. Sinies
7876541.8
75927.3
170504.0
98982
62451
227324.9
98190
61659
74901.8
73465.5
205.6
820-1
1845.6.
123
5571765
6363159
4535230
5326628"
((284133.9
97173
60642
71621.8
340928.1
95928
59397
69365.5
3281.9
5125.6
7381.9.
4
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b
7032137
5995606
397704.6
94457

57926
66700.0
7611491
6574960
454460.3
92760
56229
9
43-15.78
8122376
7085845
511192.6
90834
54303
10
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3-
4.20
8579234
7542703
567897.9
88683
52152
63627.3
60140.0
56248.2
10047.4
13/20.7
8
16607.4
20499.2
10
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32-52.62
8992369
7955838
624573.9
86304
49773

51945.5
/ 2
5741.04
9369388"
8332857,
681217.3
83697.
47166
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5-22-29.46
47-17.88
6-12 6.30
36-54.72
7-1-43-14
26-31.56
51-19.98
40-56.82
9-5-45.24
30-33.66
9716066
8679535
737825.5
80863
44332
47233.9
42114.5
9.0036894
9000363

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77800
41269.
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0614550
0876595
1123510
9298901
850922.7
74509
37978
36585.7
30650.0
24801.9
29513.5
34632.9
40161.7
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9578019
907406.5
70989
34458
24305.5
9840064
963843.3
67240
6.0086979
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8-16- 8.40°
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66352.8.
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Photo., S. I. O., Calcutta.

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Lat 22.

Angle

Log Sines

LogSin/plus(LogRad)

Lah

8-17.20

123456

8-24-49-72

49-39.44

1-14-29.15.

39-18.88"

8.60°

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b

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28-58 32

a

53-48.04.

3-18-37.76

43-27.48

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7.8586758

8.1596944.

3357668
4606791
5575551
4.7516722
5.0526908
2287632
3536755
56451.1
1/2899
169341.4.
225774.8
2
98981
29511,
28945
LogCosines
9·9.999887
99547.
LogCosplus(Lod Rad) nat Ne of foregoing
6.8929851
in Faths
7816009.i
V. Luces
203.3
V
98187
4505515
282196.4
97167
6366949.
7035926
5296913
338603.4.
95921
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5965890
394992.5
94447.
28151

27/31
25885
24411
15398.2
14380.0
12950.9
814.2
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1832.4
3261.5
3
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11116.1
08875.0
06225.5
5096.5 5
7337.4
9986.9
b
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90819
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7799707.7
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16505.3
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8583019
7512983
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33-6.92
8996155
7926117
620314.
86280
16244
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76291.1
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50257.1
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34812.5
26485.7.
65955.3 18
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81399.9
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89726.7

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2184082
24
55-53.28°
2367138
0922696
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08621-4
98458.8 22
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Photo., S. 1. O., Calcutta.

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31

Lat 23°

Lab

Angle

LogSines

Log Sines plus LogRad

Luis

Log Cosines

123456

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0-24-50"-60

49-41.2

1-14-31.8

39-22.4

4-13.0

7.8589322
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3360232
4609355
2256425
56046.9
112090.8
168129.0
9.9999887
99546
95739
Logos plus (Log Rad) nat No of fore going
6.8896080
in Faths
7755467.9
Vesives
202.5
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811 5
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98979
95172
54858.9
53846.4
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3505548
224158.3
98186
94379
52430.4.
1824.0
3240.0
3
4
5578115
4474308
29-3.6

53-542
7
8
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7038488
3-18-44.8
7617840
9
43-35.4.
8128723
5265705
5934681
6514033
7024916
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336178.
392164.3
97164
93357
50607.1
5063.3
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448129.3
92738
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42712.5
12957.9
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39271.4
16399.0
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33-16.6
8998712
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58-7.2
5-22-57.8
47-48.4
37-29.
7- 2-20-2
9375727
7481772
7894905
8271920
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615872.1
88650
86264
84843
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83650
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79843
35426.8

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41-42.5
2.2.
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6-33.2
2.3
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31-23.8
56-14.4.
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1363241
1584529

1794870
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9779112
950410.4
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29143.6
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39659.7.
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10148.2
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03883.9
51786.5
16.
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6.0026024
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58932
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0480722
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54480

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74803.6
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58454.3
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32

Lat 24°

Lah

Zah
Angle
LogSines
Log Sin plus (Lod Rad)
Suces
LogCosines
(LogCos) plus(Log Rad) nat No of foregoing
in Faths
Versiner
Lah
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6-24-51.02
49-42.04
1-14-33.06
39-24.08
7.8590545
8.1600732
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4-15 10
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3361455
4610578
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4.7452700
5.0462887"
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9.9999887
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29-6.12
53-57.14
3-18-48.15.
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33-21 22
58-12 24
5-23- 3.26.
47-54.28
6-12-45.30
37-36.32
7- 2-27.34.
27-18.36
8999933
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9723623
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11/247°
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59318
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33

Lat 25°

Lah

Angle

LogSines

LogSin plus (Log Rad)

Smes

Log Cosines

LogCos) plus (Log Rad nat No. of foregoing
in Faths

V. Suis

Laz

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1-14-33.06
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2-415.10.
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53-57.14
3-18-48-16
43-39-18
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49-42.04.
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4610578
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4407180
55187.2
110371.6
165550.2
220720.2
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7634364.9
33764.9
98979

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98184
26025
32768.4
31371.9
275878.6°
97163
25005
6.12
29577.2
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95914
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88644.
16486
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33-21 22

8999933
7827775
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58-12.24
9376948
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5-23-
3.26
9723623
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8551465
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Photo., S. I. O., Calcutta.

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34

Lat 26"

Angle

Log Sines

LogSin plus(Log Rad)

Lines.

LogCosines

Log Cos) plus(logRad) nat N of fore going

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4.

8-24-58-54

49-41.08

1-14-31.62

39-22.16

7.8589147

1599334,

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8/28548
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5162590
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6410918
6921801
328291.0
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89170
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33-15.94
58-6.48
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37-28.64
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8515481
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79518
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Lah 27.

123

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49-39.2

1-14-28.8

39-18.4

28-57.6
53-47.2
3-18-36.8
43-26.4
4- 8-16.0
Angle
LogSines
LogSin) plus(LogRad
Lives
0° 24-49.60
7.8586408
8.1596594,
3357318,
4606441
4.7344788
5.0354974,
54259.9
Log Cosines
LogCos)plus (LodRad) nat No of foregoing
in Faths
Vertais
9.9999887
6.8758267
8.0
5575202
6366599
7035576
7614929
8125812
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5.6
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57-55.2
8582670
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9372820
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4333582
5124979
5793956
637330
68841920
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7754183
108516.
162768.3
217011 2
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11663.2
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83672,
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47-34.4
6-12-24.0
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26-52.8
51-42.4.
8-16-32.0
41-21.6
9-6-11-2
31 0.8.
9.0040324
8477877,
8798704
704348.7,
80832
758351.2
77765
39212
36145
80337.7
0338861
9097241,
8/23/4.3
J
74468
32848
0617977
9376357
866235.0
70943

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0880019
1126933
1360345.
1581635
10-20-40.0
1791978
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1992385
2183735
2366792
2542226
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0942115
1125172
1300606
1188711.6
1242257.1
1295737.9
1349151.2
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9885313
6.0118725
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1027714.5
1081437.8.
1135104.5.
920110.2
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29323
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21583
75056.9
69384.5
633241

58987.
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49863
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12921,
08243
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6.8698193
92818
50034.5
42806.8
35189.8
27186.
18794.9
10018.6
00853. 4.
56872.4,
19584.9
24695.3 //
28195.3 12
33088.6
38369.4-
44041.
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63391.
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36

Lat. 28°

Angle

LogSines

LogSin plus (LogRad)

LogCosines

LogCos) plus(Log Rad) nat N of fore going

123456

Lat

0-24-48".20

49-36.4

1-14-246

39-12.8

28-49.2

Suref

in Faths

7.8582324

8.1592511

3353 235

4602359

4.7305545

5.0315732

2076456

53771.8

9.9999887

6.8723108

7452651.7

107540.8

99548

22769

52069.5

161304.2

98982

22203

51098.3

3325580
215059.2
98191
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49741.4
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1.0
5571/20
4294341
268803.0
97173
20394,
47994.9.
6362517
5085738
322532 7
95930
19151
45863.8
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53-37.4
7031496
5754717
376245.8
94459
17680
43 342.4.
ver. Suies Lat
193.4.
775.6
1746.8
3103.7
4850 2
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6981.3
9502.7
123456
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3-18-25.6.
7610850
6334071
429939.2
92761
43-13.8
8121734
6844955
483610.2
90837
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14058.
40432.8.
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15707.8
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8578593
7301814
537256.2
88686
11907.
33455.2
19389.9
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57-38.4
5-22-26.6
47-14.8
36-51.2
7-1-39.4.
26-27.6
51-15.8.
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8991728
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29386.2
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74517,
6.8697738
0613911
9337132
858446.5
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94219
24928.8
20086.4
14865.9
09242.4
03241.4.
27916.3
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32758.7
37989.2
43602.7
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0875956
1122872
1356287
1577579
9599177
911838.1
67250
90471
7396855.2
9846093
6.0079508
965182.2
63272
86493
1018476.0
59065
82286
0300 800

1071716.8
54627
77848
21.
40-52.2
1787926
0511147
1/24902/
49958
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95-40·4
30-28.6.
1988336
0711557
1178028.1
45058
73179
68279,
2179690
0902911
1231093.8
39926
63147,
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55-16.8
2362749
1085970
12840947
34562
57783
591542
50462.7.
41389.8
90083.1
82927.1
75386.4
67462.7
49603.7,

55989.9
62762.0
69918.0
77458.7
85382.4
93690.9.
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111455.3
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Lat

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0-24-4632

49-32.64

1-14 18.96

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2-3-51.60

28-37.92

53-24.24.

3-18-10.56.

4256.88

7.8576834

8.1587021

Angle

LogSines

LogSin)plus(LogRad)
4.7264604
5.0274791
Luier
53267.3
106531.8
Lah 29°
Log Cosines
LogCos) plus (LogRad) nat N of fore going
6.8687657"
in Faths
7392063.8°
Mr. Lines Lat
9.9999887"
191.6
/
99549,
87319.
3347746
5.28
4596870
2035516.
3284640
159790.7
98985
86755
2/3041.4.
98196
85966
5565632
4253402
266281.0.
97180
84950
6357031
5044801
319506.8
95940
83710

7026010
5713780
372716.0
94473
82243
91488.
90528.8
89186.4
87457.6
85349.2
828542°
767.3°
1726.5
3069.0
4797.8
7605366
6293136
425905.9.
92779
80549
79974.6
8116252
6804022
479073.6
90860
78630
76715.3
6906.2
9401.2
12280 8°
15540.1
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2345678
9
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4- 7-43.20
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32-29.52
12

57-15.84
13
5-22-
2.16
857.31
8986250
936327
75
9709952
112
7260882
532216.3
88715
76485
73072.9
19182.5
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7674020
585331.5.
86342
74112
69044.1
232113
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8051041
8397722
638416.5
83743
71513
64635.6
27619.8 / 2
691468.2
80917°
68687
14
9.0030783
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8-15-26.40

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46-48.48
6-11-34.80
36-21.12.
7-17.44
25-53.76
50-40.08
0329325
0608446
0870494
1117413
1350831
1572128
9805183
6. 003860i
956133.0
1008927.9
1061670.7
8718553
744483. g
77863
65633
9017095
797461.1
74581
62351
59845.8
54671.2
49115.3
32409.6
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9296216
850396.7
71071
9558264
903288.3

67333
63365°
58841
55103
51135
43178.3.
36861.0
30161.0
0259898
59169
54742
46939
21
40-12.72
1782477
0470247
1114357.9.
50085
425/2
37855
23081.7
15620.3
76635.1
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37584.2
43140.7
49077.1
55394.4
62094.4
69173.7,
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97780.0
84475.4.
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2.2
9-4-59.04
1982892
0670662
1166987
6
45197
32967
7299560.0
92695.4
22
23
29-45.36
2174250
0862020
24
54-31.68
2357314
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10-19-18.00
2532756
1045084
1220526
1219556.7.
1272062.3
1324501.8
40079"
27849
34728"
22498
90963.3
81985.0
101292./
23
110270.4.
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29145
16915
72630.0

119625.4

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11

Photo., S. I. O.. Calcutta.

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3

Lat

Angle

Log Sines

(LogSin) plus (Log Rad)

123

49-27.92

1-14-11.88

4

8-24-43.96

38-55.84

.8569933

8.1580121.

3340846.

4589971

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23-39.80,

5658734

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6350134

1992868

3241993.

4210756

5002156

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53-7.72

3-17-51·68

42-35.64

7019115

5671137

3

7598472

8109361

6250494

6761383

47-19.60

8566223

7218245

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32- 3.56

8979363

7631385

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Sines

Lat 30°

52746.7

1054907

158229 3

210959.6

263679.0

316384.8.

Log Cosines (LogCos) plus (LogRad) nat No of fore going

9.9999888

in Faths

99550

98988

98201

6.8651910

51572

51010

50223

7331469.5

30898 3

29950.0

28622.0

97189

49211

95952

47974

369074.2

94490°

46512

4217445.

474393.0

527016.8

579613.5

92803

90889

J

88751

44825

42911

40773

26913.6

24827.1

223627

19518.6

16293.2

12691.7.

86386

38408

08711.7

versies Lat

187.5

758.7

1707.0

3035.5.

4743.4

6829.9

9294.3

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Photos, J., Calcutta.

Angle

LogSines

LogSin) plus (Log Rad)

123

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Lat

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0-24-41.10

49-22.2

1-14- 3.3

38-44.4.

2- 3-25.5

52-47.7.

3-17-28.8

Suves

Lat 31°

LogCosines

(Log Cos) plus (LogRad) nat N of fore going
in Faths

Ver Lines Lat

7.8561555

1571743

4.7177526

5.0187714.

52209.9

104417.0

9.9999888

6.8615859,

7270861.7

187.9

99552

15523

70300.0

749.6

2.

3332469
1948440
156618.8
98992
14963
69361.7
4581595
3197566
2088/2.5
98209
14180
68051.7
5550360
4166331
260995.5
97200
13171
28.-
6.6
6341761
4957732
313165.10
95968
7010744,
5626715
365318.4
94511
11939
10482
66363.3
64301.7
1687.9
2997.9
4686.3
2345
6747.9
61865.0"
7590104
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417452.9,
92830
08801
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42-9.9.
46-51·0,
8100994
6716965
469565.9
90925
06896
8557860
7173831
521654.7
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31-32 /
8971003
7586974
573716.6
86439
02410
59055.0
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52311.9
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Photo., 8. J. O., Calcutta.

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46

Angle

LogSines

Log Sin) plus Log Rad)

Lucien

Lat 320

LogCosines

Lat

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0-24-37.72

49.15.44.

1-13-53.16

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38-30 88
8.60
27-46.32
7.8551633
8.156182/
3322549.
4571676
4.7131247
5.0141435
1902163
3151290
5540441
6331845.
7000830
4/20055
7580192
41-39.48.
8091085
4911459,
5580444
6159806
6670699
4-
6-17.20
8547955
30-54.92
7127569
51656.5
103310.3
154958.8
206599.4
258229.3
309846.0
361446.8

413029.0
464590.0,
516127.4

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8961101
7540715
567638.1
52 24.04.
3-17-1.76

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Log Cos) plus Log Rad) nat N of foregoing
inFaths

J. Luier

9.9999889

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08768.3

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77830

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97213,
76827
058083
1664.8
2961.0
4624.8
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95987,
75601
03775.0
6658.1
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94537.
74151
01370.0
9063.1
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72477
7198595.0
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68460
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Photo., S. 1. O., Calcutta.

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1890

51-57.02

Lat

12

S

Angle

Log Sines

Log Sin) plus (Log Rad)

0-24-3386

49-7.72

1-13- 41.58

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7
38-15.44.
249.30
27-23-16
7.8540274
8. 1550463
Luier
Lat 334
Log Cosines
3311197
4560320
1854134
3103265
5529087
4.7083217
5.0093406.
4072030
51088.3
102174.0
153254. 6.
204327.3°
255389.
9.9999889
99556
6.8542832
99002
42499
41945
Log Cos) plus (Log Rad) nat N of foregoing
in Faths
7149624.6
49075.4
98226
41169.
97228
40171
6320493
4863436

306438.7
96008
38951
6989480
5532423"
357472.2
94565
37508
3-16-30-88
7568846
41-
4.74
8079742
6111789
6622685
408487.6
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35843
459482.0"
91013
33956
4- 5-38.60
8536614
7079557
510452.9
88903
31846
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8949765
7492708
561397.9
86571
29514
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182.7

731.9°

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48163.9

1643.4

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46886.

45244.3

43237.7

40863.9

38127.9.

35026. 2

31560.7

27732.8

14781.1

2920.4

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Photo., 3. t. O., Calcutta,

Lab 34°
Angle
Log Sines
Let
Log Sin) plus/1og Rad)
LogCosines
Log Cos) plus (Log Rad)
123
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18 40
0-24-29.46
48-58.72
1-13-28.38
4.
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2-
b
7
37-57.84
2- 27.30
26-56-76
51-26-22
3-15-55.68
40-25.14
4-4-54.60
7.8527289
8.1537480
4.7033244
5.0043435
3298208
1804163
4547339
3053294
5516108
4022063
6307516
6976507.
7555875

4813471
5482462
6061830
50503.8
101005. 2
151501.3
201989.8
252468.0
302933.4
353383.4
9.9999890
6.8505845
7088991.9
99559
05514
99008
04963
87552.5
98236
04195
86293.4
97244
03199
84674.2
3
96031
01986
82696.7
nat No of foregoing
in Faths
88452.5
2. Suies
180.2
719.6
1619.6
2878 7
4497.9
6475.4
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403815.5.
94598
92943
6.8
00553
.8498898
80359.0
8066775
6572730
454227.1
91067
8523652
7029607
504615.6
88970
29-24.06
8936807
7442762
554978.6
86651
97022
94925
92606
77661.3°
74604.9
71190.2
67414.8
8813'
11510.8
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14567.2
17981.9
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21757.3 //

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Lat 350

Angle

LogSines

(LogSin) plus(LogRad)

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b

2.80

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Blah.

0-24-24-56

48-49.12

1-13-13.68

37-38.24

26-27.36

50-51.92

7.8512783

8.1522974

Suves

LogCosines

Log Cas) plus (LogRad) nat Ne of foregoing

in Faths

4.6981426

9991617

49904.8

99807.2

9.9999890

6.8468533

7028348.4.

99562

68205

3283705

4532837

5.1752348

149704.5

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8052289
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448841.7.
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28-30.16
8509171
8922331
6977814
498633.4.
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14180.3.
10816.1
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V. Sunes Laz
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Lat.36

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1-12-57.3

37-76.4

7.8496563

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Log Sines

Log Sin plus (LogRad)

Suves

4.6927565

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98577.0

9.9999891

6.8430893

99565

30567

3267486

4516620

5.1698488

147859.4.

99022

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2947622

197134.3

98261

29263

LogCosines

LogCos) plus (Loghad) nat No of foregoing
in Faths

V. Sures

6967698.4

174.4

698.2

1569.6

2790.3

67174.6

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2-1-35.5
5485394
3916396
246399.4.
97283
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25-54.6
6276808
4707810
295652.1
96087
27089
66303.2
65082.5
63514.5
61596.8
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4358 3
6276.0
123456
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38-51.9
4-3-11.0
50-13.7
3-14-32.8
6945805
5376807
344890.
94673
25675
7525181
5956183
394110.7
93042
8036090

6467092
443311.7.
91192
8492977
6923979
492490.6
89125
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27-30.1
8906143
7337145
5416448
86839
24044.
22194
20127
17841
59330.6
56717.7
53754.8
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Lat 37°

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Log Sines

LogSin plus (Log Rad)

Sines

Log Cosines

LogCos) plus (Log Rad) natN of fore going

Ver Sines

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Lat:

in Faths

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6898809.7
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86124
96241.3
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13879.8
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