

KG
11366
v.984

CXXXI

131

9087

9193

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Harvard Lunar Plates

Measures and Reductions

Martha C. Burton.

Plate	Date	Page
9087	Aug 26 - '15	1
9193	Sept 18 - '15	21
9194	Sept 21 - '15	21

Sept 18 '16

1
13
1.

2
21.
23

3
23.
9.

1
23
19

2
23.
15

3
23
16

+X

9087

Star Measures

1

	α	δ	α	δ	α	δ
1	17380	18400	19086	18032		
15.3	17240	1156260	15610	11520		
13.4	40	58	0206	2221		
	88	08	9100	50		
	<u>15.3142</u>	<u>15.3154</u>	<u>13.3484</u>	<u>13.3476</u>		
2	20966	20440	20528	20004		
21.5	15592	15330	15582	14964		
23.5	9895	2226	7478	5459		
	70	52	88	08		
	<u>21.4872</u>	<u>21.4878</u>	<u>23.4954</u>	<u>23.4952</u>		
3	20172	19188	19996	18578		
23.9	1097845	1892830	10726	1782019		
9.9	42	3230	26	1819		
	78	202	96	90		
	<u>23.9232</u>	<u>23.9242</u>	<u>99270</u>	<u>9.9241</u>		

Moon Measures

1		20576	19964
23		12412	1760096
19.8		0810	59296
		72	480
		<u>19.8162</u>	<u>17.8130</u>
2	19774	18668	
23.2	1787271	1060297	
15	7071	59297	
	80	82	
	<u>23.1904</u>	<u>23.1916</u>	
3	19920	18610	
23.6	1346056	1509787	
16.1	52	80	
+X	28	30	
	<u>23.6468</u>	<u>23.6470</u>	

9087

Star Measures

1

	d	k	n	d	k	n
1	17380	18400	19086	18032		
15.3	19240	1156260	15610	11520	21	
13.4	90	58	0206	22		
	88	08	9100	50		
	<u>153192</u>	<u>153159</u>	<u>133989</u>	<u>133976</u>		
2	20966	20990	20528	20009		
21.5	15592	15330	15582	19969		
23.5	9893	2226	7978	5959		
	70	52	38	08		
	<u>219872</u>	<u>214878</u>	<u>239959</u>	<u>239952</u>		
3	20172	19188	19996	18578		
23.9	1099845	18928	10726	17820	19	
9.9	92	3230	26	18		
	78	202	96	90		
	<u>239232</u>	<u>239292</u>	<u>99270</u>	<u>99291</u>		

Moon Measures

1		20576	19969
23		12412	17600
19.8		0810	59296
		72	980
		<u>198162</u>	<u>198130</u>
2	19774	18668	
23.2	1787271	1060297	
15	7071	59297	
	80	82	
	<u>231907</u>	<u>231916</u>	
3	19920	18610	
23.6	1396056	1509787	
16.1	52	80	
+K	28	30	
	<u>236768</u>	<u>236970</u>	

9087

2

<u>4</u>	19922	17574
23.5	14978	1257849
17	7275	12550
	22	86
	<u>23.7948</u>	<u>23.4968</u>

<u>5</u>	19922	18950
23.	13069	1583231
17.7	6062	30
	32	78
	<u>17.6866</u>	<u>17.6868</u>

<u>6</u>	19130	20180	19002
22.5		18710	1046871
18		10	74
22	40	82	16
18.2		<u>18.1470</u>	<u>18.1456</u>

<u>7</u>	17096	17810
21.8	15728	974249
18.2	42029	5849
+4	100	38
	<u>18.1672</u>	<u>1614</u>

<u>8</u>	14168	16818
24.9	13910.11	704849
18	12	4049
21	86	36
18.1	<u>18.0258</u>	<u>18.0208</u>

9087

2

9	19922	17274
23.5	19978	1257849
17	7275	12550
	22	86
	<u>23.7998</u>	<u>23.4968</u>

2	19922	18950
23	13069	1583231
17.7	6062	30
	32	78
	<u>17.6866</u>	<u>17.6868</u>

6	19130	20180	19002
22.5		18710	1096871
18		10	79
12	90	82	16
8.2		<u>18.1970</u>	<u>18.1956</u>

2	17096	17810
1.8	15928	994248
8.2	72029	5648
14	100	38
	<u>18.1675</u>	<u>1619</u>

1	19168	16818
69	13970	709849
8	17158	4049
1	86	36
3.1	<u>18.0268</u>	<u>18.0208</u>

9087

Junes & Etc.

3

Aug 26

Exp. to stars	00	27		00	39
" " Moon	00	32	36.8	00	32 37.0
clock fast		1	90.0		

H. Sid June	00	30	56.9	$\theta - \alpha = +0^h 28^m$
H. Long	7	77	31.05	
G. Sid J.	5	15	27.95	
Sid. J. M. Moon	10	17	37.05	
Interval	19	00	50.90	
Reduction		3	6.90	
G. M. J.	18	57	77.00	

From Naut. Alman.	R. A.	Dec.
Moon 18 th	00 01 21.02	+7 10 52.2
Motion in 1 ^m	+1.9305	+ 14.852
" " 57.7333	+1 51.45	+19 17.5
Tabular Place	00 3 12.47	+7 25 09.7

Moon's Age 16 days

Parallax	56' 35.3"
Semid.	15' 26.8"
R.	926.8"
Aug.	112.0"
Ir. (3)	-03"
R	938.5"
R	2,011.8"
ak	-959"
Q+AR	1,915.9"
R ²	3,670.7"

$$937 = 12.2 +$$

$$a = -500.5$$

$$+27$$

$$-476.5$$

9087

Times & Etc.

3

Aug 26

Exp. to Stars	00	27		00	39
" Moon	00	32	36.8	00	32 37.0
Clock fast		1	90.0		

H. Sid Time	00	30	56.9	$\delta - \alpha = +0^h 28^m$
H. Long	7	49	31.05	
G. Sid T	5	15	27.95	
Sid T M. Moon	10	19	37.05	
Internal Reduction	19	00	50.90	
		3	6.90	
G. M. T	18	57	47.00	

From Naut. Alman.	R	A	Dec.
Moon 18 th	00	01	21.02 +9 10 52.2
Motion in 1 ^m			+1.9305 + 17.852
" 57.7333	+1	51.95	+19 17.5
Tubular Place	00	3	12.97 +9 23 09.7

Moon's Age 16 days

Parallax	58' 35.3"
Semid.	15' 26.8"
R.	926.8"
Aug	112.0"
Int	-03"
R	938.5"
R	2,011.8"
alt	-959"
Dist R	1,915.9"
R ²	3,670.7"

937 - 12.2 +

$$\begin{array}{r}
 a = -500.5 \\
 + 27 \\
 \hline
 = -476.5
 \end{array}$$

9087 Plate Constants

7

x	15,3198	21,7875	23,9237
y	15,6099	22,0945	27,6787
$x-y$	-2,951	-6,070	-7,250

x	13,3780	23,7953	9,9256
y	13,1779	23,8048	9,5521
$x-y$	+2,001	-3,095	+3,735

$$\begin{array}{rcll}
 x-y & +500x & +3y & +.5x & -9757 \\
 -2951 + 7657 & = +9706 & +90 = +9796 & +8 = +9757 & = 0 \\
 -6070 + 10778 & = +9678 & +70 = +9748 & +11 = +9755 & = +1 \\
 -7250 + 11962 & = +9712 & +30 = +9742 & +12 = +9757 & = 0 \\
 21,7327 + 10,866 & & +49 & +11 & = 22,3799
 \end{array}$$

$$\begin{array}{rcll}
 x-y & +500y & -1.5x & +3.0y & -8692 \\
 +2001 + 6677 & = +8675 & -23 = +8652 & +70 = +8692 & = 0 \\
 +3095 + 11778 & = +8653 & -32 = +8621 & +70 = +91 & = -1 \\
 +3735 + 9963 & = +8698 & -36 = +8662 & +30 = +92 & = 0 \\
 16,2797 + 8125 & & -33 & +49 & = 16,1976
 \end{array}$$

$$\begin{array}{rcll}
 \text{Tables} & a = -.3 & e = -2.5 & a-e = +2.2 & b+d = 0 \\
 \text{lbs} & = -500.5 & = -503.0 & = +2.5 & = -1.5
 \end{array}$$

$$\begin{array}{rcll}
 0-c & -500.2 & -500.5 & & -1.5
 \end{array}$$

9087 Plate Constants

9

x	15.3198	21.7875	23.9237
y	15.6099	22.0945	29.6987
$1-x$	-2951	-6070	-7250

y	13.3980	23.9953	9.9256
x	13.1979	23.8098	9.5521
$y-x$	+2001	-3095	+3735

$$\begin{array}{rclcl}
 x-y & +500x & +3y & +.5x & -975y \\
 -2951 + 7657 & = + 4706 & + 90 = + 4796 & + 8 = + 4759 & = 0 \\
 -6070 + 10799 & = + 4679 & + 70 = + 4749 & + 11 = + 4755 & = +1 \\
 -7250 + 11962 & = + 4712 & + 30 = + 4742 & + 12 = + 4759 & = 0 \\
 21.7327 + 10866 & + 99 & + 11 & = 22.3499
 \end{array}$$

$$\begin{array}{rclcl}
 y-x & +500y & -1.5x & +3.0y & -8692 \\
 +2001 + 6674 & = + 8675 & - 23 = + 8652 & + 70 = + 8692 & = 0 \\
 +3095 + 11798 & = + 8653 & - 32 = + 8621 & + 70 = + 91 & = -1 \\
 +3735 + 9963 & = + 8698 & - 36 = + 8662 & + 30 = + 92 & = 0 \\
 16.2997 + 8125 & - 24 & + 99 & = 16.1955
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tables} & a = -.3 & e = -2.5 & a-e = +2.2 & b+d = 0 \\
 \text{Obs} & = -500.5 & = -503.0 & = +2.5 & = -1.5
 \end{array}$$

$$A = +.5$$

$$B = +1.7$$



9087 Moors Center

	x	$x - x_0$	Δx	$x - x_0$	$(x - x_0) + (y - y_0)$	$y - y_0$
1	23,0000	+1,2690	-1	1,6401	3,6710	+3
2	23,1910	+1,4600	-1	2,1313	3,6973	+236
3	+23,6469	+1,9159	-0	3,6707	3,6707	0
4	23,9958	+1,7648	+0	3,1145	3,6771	+64
5	23,0000	+1,2690	+1	1,6106	3,6753	+46
6	22,0000	+0,2690	+1	0,0727	3,6695	-12
7	21,7310	0,0000	+1	0,0000	3,6657	-50
8	21,0000	-0,7310	+1	0,5392	3,6799	+92

$$R = 3,6707$$

	y	$y - y_0$	Δy	$y - y_0$	L	
1	19,8196	-1,4354	-2	2,0609	138°	
2	15,0000	-1,2500	-2	1,5630	130°	
3	16,2500	-0,0000	-0	0,0000	90°	
4	17,0000	+0,7500	+1	0,5626	67°	
5	17,6867	+1,4367	+2	2,0647	42°	
6	18,1463	+1,8963	+3	3,5971	8°	
7	+18,1643	+1,9143	+3	3,6657	0°	
8	18,0233	+1,7733	+3	3,1757	337°	161°

Approximate Center

$$x = 23 \quad y = 19,8196$$

$$17,6867$$

$$32,5013$$

$$y_0 = 16,2506$$

$$y_{\max} = 18,1643$$

$$1,9137$$

$$x_{\max} = 23,6769$$

$$\text{Moors Center } \begin{cases} x_0 = 21,7310 \\ y_0 = 16,2500 \end{cases}$$

9087 Moon's Center

	x	$x - x_0$	Δx	$x - x_0$	$(x - x_0) + (y - y_0)$	$10 - C$
1	23.0000	+1.2690	-1	1.6409	3.6710	+3
2	23.1910	+1.4600	-1	2.1313	3.6993	+231
3	+23.6969	+1.9159	-0	3.6707	3.6707	0
4	23.9958	+1.7698	+0	3.1145	3.6771	+69
5	23.0000	+1.2690	+1	1.6106	3.6753	+91
6	22.0000	+0.2690	+1	0.0729	3.6695	-1
7	21.7310	0.0000	+1	0.0000	3.6657	-5
8	21.0000	-0.7310	+1	0.5392	3.6799	+9

$$K = 3.6707$$

	y	$y - y_0$	Δy	$y - y_0$
1	19.8196	-1.7359	-2	2.0609
2	15.0000	-1.2500	-2	1.5630
3	16.2500	-0.0000	-0	0.0000
4	17.0000	+0.7500	+1	0.5626
5	17.6867	+1.9367	+2	2.0697
6	18.1963	+1.8963	+3	3.5971
7	+18.1693	+1.9193	+3	3.6657
8	18.0233	+1.7733	+3	3.1957

Approximate Center

$$\begin{aligned}
 x = 23 \quad y = & 19.8196 \\
 & 17.6867 \\
 & \hline
 & 32.5013 \\
 y_0 = & 16.2506 \\
 y_{\max} = & 18.1693 \\
 & \hline
 & 1.9137 \\
 x_{\max} = & 23.6769
 \end{aligned}$$

Moon's Center

$$\begin{cases}
 x_0 = 21.7310 \\
 y_0 = 16.2500
 \end{cases}$$

Formation of Normals.

1	- 1.83	+	3.5	-	7.5
2	- 1.83	+	37.5	-	29.5
3	- 0.0	+	0.0	-	0.0
4	+ 1.32	+	11.25	+	48.0
5	+ 1.83	+	58.5	+	66.2
6	+ 0.51	-	3.0	-	22.8
7	+ 0.00	-	0.0	-	95.5
8	- 1.29	-	67.0	+	163.0
	+ 3.66	+	319.0	+	277.2
	- 4.95	-	70.0	-	417.8
	- 1.29	+	449.0	-	140.6

	a	b	c	new O-C
a	- 11	+ 7	+ 11 ^v	- 38 ^v
b	- 9	- 13	+ 6	+ 8 ^v
c	- 5	- 17	+ 0	- 2 ^v
	+ 15	- 16	- 9	- 5 ^v
		- 11	- 7	- 3 ^v
		- 2	- 8	+ 5 ^v
		- 0	- 9	+ 6 ^v
	+ 6	- 9	+ 12 ^v	+ 13 ^v

.1012

$$- 1.29 + 16.66 = + 5.08$$

$$+ 2.7 - 0.13 = + 0.73$$

$$+ 16.53 = + 5.81$$

$$+ 12.74 = + 7.22 + 0.45 = + 7.67$$

9087 Conditional Equations

6

	10				10-E			
1	+ 1,27	- 1,99	= + 3	+ 49	+ 8	= + 52	- 79	
2	+ 1,96	- 1,25	= + 206	+ 51	+ 7	= + 58	+ 178	
3	+ 1,92	- 0,00	= 0	+ 67	+ 0	= + 67	- 67	
4	+ 1,76	+ 0,75	= + 64	+ 61	- 4	= + 57	+ 7	
5	+ 1,27	+ 1,47	= + 46	+ 44	- 8	= + 36	+ 10	
6	+ 0,27	+ 1,90	= - 12	+ 9	- 11	= 2	- 10	
7	+ 0,00	+ 1,91	= - 50	+ 0	- 11	= - 11	- 70	
8	- 0,73	+ 1,77	= + 92	- 25	- 10	= - 35	+ 127	
					+ 332	= - 166		

$$+ 12.74 - 1.29 = + 449.0 \quad + 7.22$$

$$- 1.29 + 16.66 = - 170.6 \quad + 37.08$$

$$+ 1.29 - 0.13 = + 95.5$$

$$+ 0.35 \Delta$$

$$+ 16.53 = - 95.1$$

$$b = - 5.7$$

$$+ 12.74 = + 449.0 - 7.4 = + 441.6$$

$$a = + 37.7$$

$$+ 0.60$$

Arc Measured 161°

$$\frac{p}{4} = .20$$

$$\frac{e v}{4} = + 19.5$$

$$\text{In } 3 \quad R \quad 1.92$$

$$- 2RC = + 0.77$$

$$\frac{+ 19.5}{20} = + 97.5 \quad \Delta R = + 1.2$$

$$\text{Corr} = 0.2$$

$$\Delta b = + 0.27$$

$$\Delta b = + 0.1$$

$$\Delta R = + 1.7$$

$$\Delta a = + 0.96$$

$$\Delta q = + 0.02$$

9087 Conditional Equations

	D						O-C
1	+ 1.27	- 1.99	= + 3	+ 49	+ 8	= + 52	- 99
2	+ 1.76	- 1.25	= + 236	+ 51	+ 7	= + 58	+ 17
3	+ 1.92	- 0.00	= 0	+ 67	+ 0	= + 67	- 6
4	+ 1.76	+ 0.75	= + 64	+ 61	- 93	= + 57	+ 7
5	+ 1.27	+ 1.99	= + 46	+ 49	- 8	= + 36	+ 16
6	+ 0.27	+ 1.90	= - 12	+ 9	- 11	= - 2	- 16
7	+ 0.00	+ 1.91	= - 50	+ 0	- 11	= - 11	- 96
8	- 0.73	+ 1.77	= + 92	- 25	- 10	= - 35	+ 12
					+ 322		- 166

$$+ 12.74 - 1.29 = + 999.0$$

$$- 1.29 + 16.66 = - 190.6$$

$$+ 1.29 - 0.13 = + 95.5$$

$$+ 16.53 = - 95.1$$

$$b = - 5.7$$

$$+ 12.74 = + 999.0 - 7.4 = + 991.6$$

$$a = + 39.7$$

Are Measured 161°

$$\frac{p}{h} = .20$$

$$\frac{\Sigma V}{h} = + 19.5$$

$$\frac{+ 19.5}{.20} = + 97.5 \quad \Delta R = + 1.2$$

9087 Moon's Mean Position.

7

$$\begin{array}{r} \gamma_0 = 21.7310'' \\ + 17'' \\ \hline 21.7327'' \end{array}$$

$$\begin{array}{r} \gamma_0 = 16.2500'' \\ - 3'' \\ \hline 16.2497'' \end{array}$$

From Plate Constants

$$\chi = 22.3499''$$

$$\eta = 16.1946''$$

$$\xi = 1.3499''$$

$$\eta = -1.8058''$$

$$\begin{array}{r} \log \xi \quad 9.54394'' \\ \text{Cos } \xi \quad 999903'' \\ \hline 8.50724'' \\ 1.03767'' \end{array}$$

$$\begin{array}{r} \log \tan \delta \quad 8.8261'' \\ \xi = 9.0879'' \\ \hline 7.0537'' \\ 4.9674'' \end{array}$$

$$\alpha - A \quad + 10.91''$$

$$\eta_1 \quad 0.0000''$$

$$A \quad 00 \quad 02 \quad 38''$$

$$\eta_0 = -1.8058''$$

$$\alpha_0 \quad 00 \quad 02 \quad 48.91''$$

$$\log \eta_0 \quad 0.25658''$$

$$\text{Red} \quad + 3.85''$$

$$\begin{array}{r} 7.33113'' \\ \hline 2.92583'' \end{array}$$

$$\alpha' \quad 00 \quad 02 \quad 52.76''$$

$$S-D \quad - 14 \quad 022$$

$$D + 09 \quad 03 \quad 47''$$

$$S_0 + 3 \quad 49 \quad 44.8''$$

$$\text{Red} \quad + 29.8''$$

$$S' + 3 \quad 50 \quad 09.6''$$

9087 Moon's Mean Position.

$$\begin{array}{r} \lambda_0 = 21.7310'' \\ + 17'' \\ \hline 21.7327'' \end{array}$$

$$\begin{array}{r} \gamma_0 = 16.2500'' \\ - 3'' \\ \hline 16.2497'' \end{array}$$

From Plate Constants

$$\lambda = 22.3999''$$

$$\gamma = 16.1996''$$

$$\xi = 1.3999''$$

$$\eta = -1.8059''$$

$$\begin{array}{r} \log \xi \quad 9.54394'' \\ \log \eta \quad 9.99903'' \\ \hline 8.50729'' \\ 1.03767'' \end{array}$$

$$\begin{array}{r} \log \tan \delta \quad 8.8261'' \\ \xi \quad 9.0879'' \\ \hline 7.0539'' \\ 4.9679'' \end{array}$$

$$A-A \quad +10.91''$$

$$H. \quad 0.0000''$$

$$A \quad 00 \quad 02 \quad 38''$$

$$\eta_0 = -1.8059''$$

$$\lambda_0 \quad 00 \quad 02 \quad 48.91''$$

$$\log h \quad 0.25658''$$

$$Red \quad +3.85''$$

$$\begin{array}{r} 7.33110'' \\ \hline 2.92583'' \end{array}$$

$$\lambda' \quad 00 \quad 02 \quad 52.76''$$

$$\begin{array}{r} -8.412'' \\ S.D. \quad -17 \quad 02.2 \end{array}$$

$$D \quad +09 \quad 03 \quad 97''$$

$$\delta_0 \quad +3 \quad 79 \quad 49.8''$$

$$Red \quad +29.8''$$

$$\delta' \quad +3 \quad 50 \quad 69.6''$$

9087 Reduction to Apparent Place.

8

$$H + \alpha \quad 7 \quad 59.2 = 119^\circ 48'$$

$$H \quad 7 \quad 56.7$$

$$\alpha \quad 00 \quad 02.8$$

$$G \quad 22 \quad 34.3$$

$$G + \alpha \quad 22 \quad 37.1 = 339^\circ 16.5$$

$$\delta + 3 \quad 99 \quad 45$$

$$\log \cos \delta \quad 9.9990$$

$$+ \quad 0.8606 +$$

$$= \quad 0.8596$$

$$\log \cos G + \alpha \quad 9.9709$$

$$g \quad 1.2879$$

$$\sin \quad 9.5489 \quad n$$

$$\tan \delta \quad 8.8256$$

$$8.8239$$

$$\log \sin \delta \quad 8.8246$$

$$\cos H + \alpha \quad 9.6963 \quad n$$

$$+ \quad 1.2820$$

$$\sin H + \alpha \quad 9.9387$$

$$\sec \delta \quad 0.0010$$

$$8.8239$$

$$\log g' \quad 1.2588$$

$$g \quad 8.4863 \quad n$$

$$h' \quad 9.8029 \quad n$$

$$h \quad 0.0453$$

$$f \quad +2.769$$

$$g \quad -0.031$$

$$h \quad +1.111$$

$$+3.849 \quad \checkmark$$

$$g' + 18.150$$

$$h' - 0.635$$

$$i \quad +7.238$$

$$+29.753 \quad \checkmark$$

9087 Reduction to Apparent Place

8

$$H + \alpha \quad 7 \quad 29.2 = 119^\circ 48'$$

$$H \quad 7 \quad 56.9$$

$$\alpha \quad 00 \quad 02.8$$

$$G \quad 22 \quad 34.3$$

$$G + \alpha \quad 22 \quad 37.1 = 339^\circ 16.2$$

$$\delta + 3 \quad 99 \quad 45$$

$$\log \cos \delta \quad 9.9990$$

$$+ \quad 0.8606 +$$

$$= \quad 0.8596$$

$$\log \cos G + \alpha \quad 9.9709$$

$$+ \quad 1.2879$$

$$\text{Sum} \quad 9.5489 \quad n$$

$$\text{tand} \quad 8.8256$$

$$8.8239$$

$$\log \sin \delta \quad 8.8246$$

$$\cos H + \alpha \quad 9.6963 \quad n$$

$$+ \quad 1.2820$$

$$\text{Sum } H + \alpha \quad 9.9384$$

$$\text{Sec } \delta \quad 0.0010$$

$$8.8239$$

$$\log g' \quad 1.2588$$

$$+ \quad 8.9863 \quad n$$

$$h' \quad 9.8029 \quad n$$

$$+ \quad 0.0753$$

$$f \quad +2.769$$

$$g \quad -0.031$$

$$h \quad +1.111$$

$$+3.849$$

$$g' \quad +18.150$$

$$h' \quad -0.635$$

$$+ \quad 7.238$$

$$+29.753$$

9087 Lunar Parallax

9

				π	56' 35" 3
L'	00	02	52.76	✓	
δ	00	30	56.9	✓	
$\delta - \alpha'$	0	28	07.17	✓	9.86913
$\frac{1}{2}(\delta - \alpha')$	+7°	1'	2.10	✓	8.21644
	+2		33.53	✓	9.08695
	6°	58'	28.57	✓	0.00129
					7.17381

9.95727 ✓
 0.00000 ✓
 0.00322 ✓
 9.96079 ✓

$$\alpha - L' = +5' 07.97''$$

$$= +0 20.47''$$

$$\gamma \quad 42 \quad 23 \quad 50.5''$$

$$\delta \quad +3 \quad 50 \quad 09.6''$$

$$\gamma - \delta \quad 38 \quad 3.3 \quad 40.9''$$

9.82670 ✓
 8.21647 ✓
 9.79473 ✓
 0.17117 ✓
 8.00874 ✓

$$\delta - \delta' \quad +35 \quad 07.6''$$

$$\delta \quad +4 \quad 25 \quad 17.2''$$

$$\alpha \quad 00 \quad 03 \quad 13.23''$$

$$\text{Ann Eph. } \delta \quad +4 \quad 25 \quad 09.7''$$

$$\text{Ann Eph. } \delta \quad 00 \quad 03 \quad 12.47''$$

$$b - c \quad +7.5''$$

$$b - c \quad +0.76''$$

Curv. of Plate 0

2nd Order Ref 0.0

$$\text{In Corr} \quad +0.1$$

$$+0.02$$

$$\delta \quad +7 \quad 25 \quad 17.3''$$

$$\alpha \quad 00 \quad 03 \quad 13.25''$$

$$b - c \quad +7.6''$$

$$b - c \quad +0.78''$$

9087 Lunar Parallax

9

 π 56' 35" 3

$$L' \quad 00 \quad 02 \quad 52.76^-$$

$$L \quad 00 \quad 30 \quad 56.9^-$$

$$L-L' \quad 0 \quad 28 \quad 04.14^-$$

$$\frac{1}{2}(L-L') \quad 7^\circ \quad 1' \quad 2.10^-$$

$$L \quad +2 \quad 33.83^-$$

$$6^\circ \quad 58' \quad 28.57^-$$

$$9.86913^-$$

$$8.21649^-$$

$$9.08695^-$$

$$0.00129^-$$

$$7.17381^-$$

$$9.95727^-$$

$$0.00000^-$$

$$0.00322^-$$

$$9.96049^-$$

$$L-L' = +5' \quad 07.97^-$$

$$= +0 \quad 20.97^-$$

$$L \quad 72 \quad 23 \quad 50.5^-$$

$$L \quad +3 \quad 50 \quad 08.6^-$$

$$L-L \quad 38 \quad 33 \quad 40.9^-$$

$$9.82690^-$$

$$8.21649^-$$

$$9.79973^-$$

$$0.17113^-$$

$$8.00878^-$$

$$L-L' \quad +35 \quad 09.6^-$$

$$L \quad +4 \quad 25 \quad 17.2^-$$

$$L \quad 00 \quad 03 \quad 13.23^-$$

$$\text{Am Ephs} \quad +4 \quad 25 \quad 09.7^-$$

$$\text{Am Ephs} \quad 00 \quad 03 \quad 12.97^-$$

$$O-C$$

$$+9.5^-$$

$$O-C$$

$$+0.76^-$$

$$\text{Corr. of Plate} \quad 0$$

$$2 \text{nd Order Ref.} \quad 0.0$$

20220

1177873

12

0 14.1561

16 20368

70 114887

3236

8687

80

78

2.1140 22.1110

20380

18777

1089084

1817674

78

7274

90

04

4 13.9506 13.9460

Measures

19832

20936

1959084

1068088

78

9688

14

38

14.0248 14.0250

19836

19720

1925056

999992

62

9092

26

10

14.0580 14.0582

19876

19390

1730902

1501812

300

0612

80

92

14.5576 17.5620

9193

Star Measures

11

L	16200	19922	10452	20220
13.3	12652	1348286	1387873	1177873
14.1	5453	90	6873	6873
	200	36	62	12
	<u>13.3548</u>	<u>13.3554</u>	<u>14.1580</u>	<u>14.1561</u>
2	20632	20432	19676	20368
22.1	19248	11840	18570	119887
22.1	4677	4844	3236	8687
	42	90	80	78
	<u>22.1386</u>	<u>22.1904</u>	<u>22.1140</u>	<u>22.1110</u>
3	19218	19312	20380	18778
30.5	14526	14028	10890	1817674
13.9	2224	28	7884	7274
	14	14	90	04
	<u>30.4692</u>	<u>30.4714</u>	<u>13.9506</u>	<u>13.9460</u>

Moon Measures

1	19832	20936
23.7	1959084	1068088
14	78	96
-4	14	38
	<u>14.0248</u>	<u>14.0250</u>
2	19836	19720
23	1925056	999992
14.1	62	9092
	26	10
	<u>14.0580</u>	<u>14.0582</u>
3	19876	19390
22	1730902	1501812
14.6	300	06
	80	92
	<u>14.0576</u>	<u>17.5620</u>

9193

Star Measures

11

1	1.6200	14922	15452	20220
13.3	12652	1348286	13878	11778
19.1	5453	90	6873	6873
	200	36	62	12
	<u>13.3598</u>	<u>13.3559</u>	<u>19.1580</u>	<u>19.1561</u>
2	20632	20432	19676	20368
22.1	19248	11890	18590	11988
22.1	9677	4849	3236	8687
	42	90	80	78
	<u>22.1386</u>	<u>22.1909</u>	<u>22.1190</u>	<u>22.1110</u>
3	19218	19312	20380	18778
30.5	19526	19028	1089044	1817679
13.9	2229	28	78	727
	14	14	90	09
	<u>30.9692</u>	<u>30.9719</u>	<u>13.9506</u>	<u>13.9460</u>

Moon Measures

1		19832	20936
23.7		1959089	1068088
19		78	96
		14	38
		<u>19.0248</u>	<u>19.0250</u>
2		19836	19720
23		1925056	999992
19.1		62	9092
		26	10
		<u>19.0580</u>	<u>19.0582</u>
3		19876	19390
22		1730902	1501812
19.6		300	060
		80	92
		<u>19.5576</u>	<u>19.5620</u>

9193

Moon Measures

12

4	19582	17142
21.6	13100	13622
15	9477	1217
	70	48
	<u>21.6478</u>	<u>21.6472</u>

5	19620	16132
21.4	15802	9950
16	9800	4849
-7	18	32
	<u>21.3820</u>	<u>21.3818</u>

6	19660	16129
21.6	13116	12660
17	1616	5055
	54	30
	<u>21.6590</u>	<u>21.6528</u>

7		19230	19028
22		14948	13296
17.9		3240	9495
		28	28
		<u>17.9290</u>	<u>17.9268</u>

8	20178	18902	19958	19030
22.5	14698	12374	12036	16996
17.7	8491	7072	4038	9093
	78	12	80	30
SC	<u>22.5488</u>	<u>22.5466</u>	<u>17.7936</u>	<u>17.7917</u>

7193

Wron Measures

12

1	19582	17142
21.6	1310097	1362217
15	9977	12
	70	98
	<u>21.6478</u>	<u>21.6472</u>

5	19620	16132
21.4	15802	9950
16	9800	9849
	18	32
-7	<u>21.3820</u>	<u>21.3818</u>

6	19660	16129
21.6	1311616	1266055
17	1616	50
	54	30
	<u>21.6590</u>	<u>21.6528</u>

7		19230	19028
22		1999890	13296
17.9		32	9995
		28	28
		<u>17.9290</u>	<u>17.9268</u>

8	20178	18902	19958	19030
22.5	14698	123792	1203638	16996
17.7	8991	7072	4038	4093
	78	12	80	30
50	<u>22.5488</u>	<u>22.5466</u>	<u>17.7936</u>	<u>17.7919</u>

9193. *Times & Etc.*

13

Sept. 18-15⁻

Exp. to stars	21	23	00	21	35	00
" " Moon	21	29	22.7	21	29	22.6
Clock fast		2	15.8			
H. Sid Time	21	27	06.7	8-X = +1 ^h 11 ^m		
H. Long	7	44	31.05			
G. Sid Time	26	11	37.75			
G. T. M. Noon	11	45	17.79			
Disturnal	19	26	19.96			
Reduction		2	21.93			
G. M. Time	19	23	58.03			

From Naut. Alman	R.A.	Dec.			
Motion H	20	15	15.08	-21	15
Motion 1 ^m			23608		+10.621
" 23,9672			56.58	+4	14.5
Tabular Place	20	16	11.66	-21	11

Moon's age 9 days

Parallax	58' 37.00"
Semid.	15' 59.0"
R.	959.0
ang	6.9
Lin. (5)	-0.8
R.	965.1
R	2,068.8
AK	-986
1+AK	1970.2
R	3,881.7

$$939 = 6.5$$

$$a = -500.7$$

$$\begin{array}{r} 27 \\ -476.7 \end{array}$$

9193 *Terres & Etc.*

13

Sept 18-15^m

Exp. to Stars	21	23	00	21	35	00
" " Moon	21	29	22.9	21	29	22.6
Clock fast		2	15.8			
H. Sid Time	21	27	06.7	8-2 = +1 ^m 11 ^m		
H. Long	9	44	31.05			
G. Sid Time	26	11	37.75			
G. T.M. Moon	11	45	17.79			
Internal	19	26	19.96			
Reduction		2	21.93			
G. M. Time	19	23	58.03			

From Hand Alon	R A		Hec.			
Moon 14	20	15	15.08	-21	15	19.1
Moon 1 ^m			236.08			+10.621
" " 23,9672			56.58		+9	19.6
Tabular Place	20	16	11.66	-21	11	04.5

Moon's	Age	9 days
Parallax	58'	39"00
Semi-d	15'	59"0
R		959.0
ang		6.9
Lat 137		-08
R		965.1
R		2,068.8
ak		-98.6
11+4/R		1970.2
R ²		3,881.7

$$939 = 6.5$$

$$a = -500.7$$

$$\begin{array}{r} 29 \\ -976.7 \end{array}$$

9193

Plate Center & Plate Constants.

19

X	Y	R	S
13.3551	19.1571	20 09 18.20	-22 17 46.5
22.1395	22.1125	20 19 28.27	21 13 01.7
30.9703	13.9483	20 19 22.27	22 19 26.5
3) 65.9649	50.2179	3) 60 42 48.71	65 49 78.7
21.9883	16.7393	20 19 22.90	-21 56 49.9
22	18	+0.37	+11 27.8
+ 0.0117	+ 1.2607	20 19 23.27	-21 45 17.1
31.5	766.5		
+ 0.37	+ 687.8		
	= 11' 27.8		

Plate Center } A = 20 19 23.
 { D = -21 45 17.

$$\begin{array}{rclcl}
 X - \gamma & +500X & +7.37 & +.7X & -10995 \\
 +4277 & +6678 & = +10925 & +61 = +10986 & +9 = +10995 = 0 \\
 -185 & +11070 & = +10885 & +95 = +10980 & +15 = +10995 = 0 \\
 -4321 & +15235 & = +10914 & +60 = +10974 & +21 = +10995 = 0 \\
 23.3892 & +11675 & & +69 & +16 = 23.4257
 \end{array}$$

$$\begin{array}{rclcl}
 Y - \eta & +500Y & +3.7X & +11.8Y & -11038 \\
 +3792 & +7079 & = +10821 & +99 = +10870 & +167 = +11037 = -1 \\
 -361 & +11056 & = +10695 & +82 = +10777 & +261 = +11038 = 0 \\
 +3787 & +6974 & = +10761 & +112 = +10873 & +165 = +11038 = 0 \\
 15.9938 & +7997 & & +86 & +189 = 15.7172
 \end{array}$$

Tables
 Obs. $a = +.0$ $e = -12.6$ $a - e = +12.6$ $b + d = -7.$
 $= -500.7$ $= -571.8$ $= +11.1$ $= -8.$

$$-500.7 - 499.2 - 1.0$$

9193

Plate Center & Plate Constants

19

x	y	κ	δ
13.3551	19.1571	20 09 18.20	-22 17 46.5
22.1395	22.1125	20 19 28.27	21 13 01.7
30.9703	13.9983	20 19 22.29	22 19 26.5
365.9649	50.2179	360 42 68.71	65 99 79.7
21.9883	16.7393	20 19 22.90	-21 56 49.9
22	18	+0.39	+11 27.8
+0.0117	+1.2607	20 19 23.29	-21 45 17.1
<u>31.5</u>	<u>766.3</u>		
+0.39	+687.8		
	= 11' 27.8		

Plate Center } $A = 20 19 23.$
 } $D = -21 45 17$

$$\begin{array}{rclcl}
 x-y & +500x & & +9.34 & +.7x & -10993 \\
 +4297 & +6678 & = +10925 & +61 & = +10986 & +.9 = +10995 = 0 \\
 -185 & +11070 & = +10885 & +95 & = +10980 & +12 = +10992 = 6 \\
 -4321 & +15235 & = +10914 & +60 & = +10974 & +21 = +10995 = \\
 233792 & +11675 & & +69 & & +16 = 23.920
 \end{array}$$

$$\begin{array}{rclcl}
 y-y & +500y & & +3.7x & +11.84 & -11038 \\
 +3792 & +7079 & = +10821 & +99 & = +10870 & +167 = +11037 = -1 \\
 -361 & +11056 & = +10695 & +82 & = +10777 & +261 = +11038 = 0 \\
 +3787 & +6979 & = +10761 & +112 & = +10873 & +165 = +11038 = 0 \\
 159938 & +7997 & & +86 & & +189 = 15.717
 \end{array}$$

Tables $a = +.0$ $c = -12.6$ $a-c = +12.6$ $b+d = -7.$
 (lbs.) $= -500.7$ $= -511.8$ $= +11.1$ $= -8.$

	3	2	Δ5	-293	0
1	-9.07	-8.18	-22	+22	2
2	+0.16	+8.15	0	-0	2
3	+8.90	-8.39	+22	-21	~ +1
11	+1.73	-2.28	-3	=	<u>-5</u>

	Δ4	-107	0
-10	+6	-4	
+2	-6	-4	
-11	+6	-4	
0	+3	=	<u>+3</u>

9193

Standard Coordinates

15

Cape No	2791-Mq7.9	Cape No 2809-Mq6.6	Cape No 2815-Mq8.0
C	20 08 25.13	20 13 35.68	20 18 29.35
L	25.13	35.72	29.90
B	25.18	35.68	29.39
Mean	20 08 25.15	20 13 35.69	20 18 29.38
Prec	+53.05	+52.58	+52.86
a	20 09 18.20	20 14 28.27	20 19 22.24
A	20 19 23	20 19 23	20 19 23
ΔA	-05 04.80	+05.27	+09 59.29
$\sin(A)$	-3 04.78	+5.27	+299.22
$\log(A-A)$	2.48398 n	0.72181	2.47599
$\log S$	9.96626	9.96952	9.96617
γ_0	0.95798 n	9.19857	0.94940
γ_0	-9.0674	+0.1580	+89 002
γ	-22	0	+22
$\frac{1}{\gamma}$	129304	221580	309024
X	13.3551	221395	309703
X- γ	+7287	-185	-7321
C	-22 20 26.4	-21 15 48.1	-22 22 17.6
L	27.0	47.9	18.4
B	27.0	47.1	17.4
Mean	-22 20 26.8	-21 15 47.7	-22 22 17.8
Prec	+290.3	+296.0	+251.3
a	-22 17 46.5	-21 13 01.7	-22 19 26.5
D	-21 45 17	-21 45 17	-21 45 17
S-D	-32 29.5	+32 15.3	-34 09.5
$\tan(S-D)$	-1949.5	+1935.3	-2099.6
$\log n$	3.28992 n	3.28675	3.31167 n
n_0	0.62107 n	0.61790	0.64282 n
$\log \tan D$	9.6128 n	9.5881 n	9.6137 n
γ_0	19.149	83971	18988
n_1	8.3811 n	5.0396 n	8.3656 n
n_0	-41790	+41486	-43936
n_1	-00381	-00000	-00368
n	13.7829	221786	135696
γ	171571	221125	139783
$\gamma-n$	+3742	-361	+3787

9193 Standard Coordinates

Cape No	2791-Mg7.9	Cape No 2809-Mg6.6	Cape No 2815-Mg8
C	20 08 25.13	20 13 35.68	20 18 29.35
L	25.15	35.72	29.90
B	25.18	35.68	29.39
Mean	20 08 25.15	20 13 35.69	20 18 29.38
Pre	+53.05	+52.58	+52.86
A	20 09 18.20	20 19 28.27	20 19 22.29
A	20 19 23	20 19 23	20 19 23
ΔA	-05 09.80	+05.27	+09 59.29
$\sin(\Delta A)$	-3 09.78	+5.27	+299.22
$\log(\Delta A)$	2.98398 n	0.72181	2.97599
$\log \delta$	9.96626	9.96952	9.96647
γ_0	0.95798 n	9.19857	0.99990
γ_0	-9.0674	+0.1580	+89.002
γ	-22	0	+2.2
$\frac{1}{\gamma}$	12.9309	22.1580	309029
χ	13.3551	22.1395	309703
$\chi - \gamma$	+7.297	-1.85	-7.321
ϵ	-22 20 26.9	-21 15 98.1	-22 22 17.6
L	27.0	97.9	18.9
B	27.0	97.1	17.9
Mean	-22 20 26.8	-21 15 97.7	-22 22 17.8
Pre	+290.3	+296.0	+251.3
S	-22 17 96.5	-21 13 01.7	-22 19 26.5
D	-21 45 17	-21 45 17	-21 45 17
S-D	+32 29.5	+32 15.3	-34 09.5
$\tan(S-D)$	-1999.5	+1935.3	-2099.6
$\log "$	3.28992 n	3.28675	3.31167 n
μ_0	0.62107 n	0.61790	0.64282 n
$\log \tan \delta$	9.6128 n	9.5881 n	9.6139 n
$\frac{1}{\gamma_0}$	1.9189	8.3971	1.8988
μ_1	8.3811 n	5.0396 n	8.5656 n
μ_0	-9.1790	+4.1986	-4.3936
μ_1	-0.0381	-0.0000	-0.0368
μ	13.7829	22.1986	13.5696
μ	19.157.1	22.1125	13.9983
$\mu - \mu$	+3.792	-3.61	+3.787

$$A = +7 -$$
$$B = +12.5$$



9193

Moon's center.

16

	x	$x-x_0$	Δx	$(x-x_0)^2$	$(x-x_0)(y-y_0)$	ΔC
1	23.3510	-0.0000	-13	0.0000	3.8872	+55
2	23.0000	-0.3510	-13	0.1241	3.8772	+95
3	22.0000	-1.3510	-10	1.8279	3.8900	+83
4	21.6975	-1.7035	-7	2.9043	3.8947	+130
5	-21.3819	-1.9691	0	3.8779	3.8774	-43
6	21.6534	-1.6976	+7	2.8795	3.8941	+124
7	22.0000	-1.3510	+10	1.8225	3.8837	+20
8	22.5477	-0.8033	+12	0.6434	3.8859	+42

3.8817

	y	$y-y_0$	Δy	$(y-y_0)^2$	Δ
1	-19.0249	-1.9691	-25	3.8872	+180
2	19.0581	-1.9359	-24	3.7531	191.90
3	19.5598	-1.4342	-18	2.0621	223
4	15.0000	-0.9940	-12	0.9904	270
5	15.9990	0.0000	0	0.0000	270
6	17.0000	+1.0060	+13	1.0176	301
7	17.4279	+1.4339	+18	2.0612	317
8	17.7925	+1.7985	+22	3.2425	336 15°6'

Approx center

$$\begin{aligned}
 x &= 22 & y &= 19.5598 \\
 & & & 17.4279 \\
 & & & 31.9877 \\
 y_0 &= 15.9939 \\
 y_{min} &= 17.0279 \\
 R &= 1.9690 \\
 x_{min} &= 21.3819 \\
 x_0 &= 23.3509
 \end{aligned}$$

Moon's center $\begin{cases} x_0 = 23.3510 \\ y_0 = 15.9990 \end{cases}$

9193

Moon's center

1

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	y
1	23.3510	-0.0000	-13	0.0000	3.8872	+55
2	23.0000	-0.3510	-13	0.1241	3.8772	+90
3	22.0000	-1.3510	-10	1.8279	3.8900	+83
4	21.6975	-1.7035	-7	2.9043	3.8947	+130
5	21.3819	-1.9691	0	3.8779	3.8774	+43
6	21.6539	-1.6976	+7	2.8795	3.8941	+129
7	22.0000	-1.3510	+10	1.8225	3.8837	+20
8	22.5977	-0.8033	+12	0.6434	3.8859	+92

38817

	y	$y - y_0$	Δy	$(y - y_0)^2$	
1	19.0299	-1.9691	-25	3.8872	+180
2	19.0581	-1.9359	-24	3.7531	191
3	19.5598	-1.4342	-18	2.0421	223
4	15.0000	-0.9940	-12	0.9904	270
5	15.9990	0.0000	0	0.0000	270
6	17.0000	+1.0060	+13	1.0196	301
7	17.9279	+1.4339	+18	2.0612	317
8	17.7925	+1.7985	+22	3.2425	336

Approx center

$$\begin{aligned}
 x &= 22 & y &= 19.5598 \\
 & & & 17.9279 \\
 & & & 31.9877 \\
 y_0 &= 15.9939 \\
 y_{\text{mean}} &= 17.0299 \\
 R &= 1.9690 \\
 x_{\text{mean}} &= 21.3819 \\
 x_0 &= 23.3509
 \end{aligned}$$

$$\text{Moon's center} \begin{cases} x_0 = 23.3510 \\ y_0 = 15.9990 \end{cases}$$

Formation of Normals.

1	+ 0.00	-	0.0	-	108.5
2	+ 0.68	+	15.5	+	87.5
3	+ 1.93	-	112.0	-	119.0
4	+ 1.68	-	226.0	-	129.0
5	+ 0.00	+	85.0		0.0
6	- 1.72	-	216.0	+	125.5
7	- 1.93	-	27.0	+	28.5
8	- 1.77	-	33.5	+	75.5
	+ 4.29	+	100.5	+	317.0
	- 50.9	-	604.5	-	356.5
	- 0.80	-	504.0	-	39.5

	a	b	c	new a-c
a	-26	+ 0	+ 12	-27 ^v
b	- 6	+ 9	+ 12	-18 ^v
c	-39	+35	+ 8	+ 7 ^v
		+44	+ 6	+11 ^v
		+51	0	+12 ^v
		+88	- 6	- 1 ^v
		+35	- 8	-12 ^v
		+21	-11	-29 ^v

$$- 0.80 + 17.01 = - 2.09 \Delta$$

$$+ [] - 105 = - 0.52 \Delta$$

$$+ 16.96 = - 2.61 \Delta$$

$$+ 19.08 = - 9.22 \Delta - .12 \Delta = - 9.37$$

9193

Conditional Equations

17

				0		C	b-C		
1	-	0.00	-	1.97	=	+	55	+ 0 + 8 = +8	+ 77
2	-	0.35	-	1.97	=	-	45	+ 13 + 8 = +21	- 66
3	-	1.35	-	1.73	=	+	83	+ 78.6 + 6 = +54	+ 29
4	-	1.70	-	0.99	=	+	130	+ 61 + 4 = +65	+ 65
5	-	1.97	0.00	=	-	93	+ 71 0 = +71	- 117	
6	-	1.70	+ 1.01	=	+	127	+ 61 - 4 = +57	+ 67	
7	-	1.35	+ 1.73	=	+	20	+ 78 - 6 = +72	- 22	
8	-	0.80	+ 1.80	=	+	72	+ 29 - 7 = +22	+ 20	
								+ 228 - 202	
								average = 57	

Normal equations

Normal equations

average = 57

$$+17.08 - 0.80 = -507.0 - 922 \Delta$$

$$- 0.80 + 17.01 = - 39.5 - 2.09 \Delta$$

$$+ 0.80 - 0.05 = - 28.6$$

$$- 0.15 \Delta$$

$$+ 16.96 = - 68.1$$

$$b = - 7.0$$

$$+17.08 = -507.0 - 3.2 = -507.2$$

$$a = -36.1$$

$$- 0.66 \Delta$$

Arc Measured 156°

$$\frac{P}{q} = .17$$

$$\frac{\pm V}{q} = +3.2$$

$$Im = 5^- R 1.97$$

$$+3.2 = +18.8 \quad \Delta P = +0.3$$

$$-2RC = -1.97$$

$$\frac{17}{17}$$

$$Corr = +0.5^-$$

$$\Delta b = +0.29$$

$$\Delta \delta = +0.1$$

$$\Delta P = -0.2$$

$$\Delta a = +1.30$$

$$\Delta q = +0.05^-$$

9193

Conditional Equations

17

					C	U-C
1	- 0.00	- 1.97	= +	55	+ 0 + 8 = +8	+ 9.7
2	- 0.35	- 1.99	= -	93	+ 13 + 8 = +21	- 66
3	- 1.35	- 1.93	= +	83	+ 98.6 + 6 = +104.6	+ 29
4	- 1.70	- 0.99	= +	130	+ 61 + 9 = +70	+ 65
5	- 1.97	0.00	= -	93	+ 71 0 = +71	- 119
6	- 1.70	+ 1.01	= +	129	+ 61 - 4 = +57	+ 67
7	- 1.35	+ 1.83	= +	20	+ 94 - 6 = +88	- 22
8	- 0.80	+ 1.80	= +	92	+ 9 - 7 = +2	+ 20
						+ 2.28 - 20.2

average = 59

Normal equations

$$+ 19.08 - 0.80 = - 509.0$$

$$- 0.80 + 17.01 = - 39.5$$

$$+ 0.80 - 0.03 = - 28.6$$

$$+ 16.76 = - 68.1$$

$$b = - 9.5$$

$$+ 19.08 = - 509.0 - 3.2 = - 507.2$$

$$a = - 36.1$$

Arc Measured 156°

$$\frac{b}{a} = .17$$

$$\frac{b}{a} = + 3.2$$

$$\frac{+ 3.2}{.17} = + 18.8 \quad \Delta R = + 0.3$$

9193

Moon's Mean Position

18

$$\begin{array}{r}
 X = 23.3510^{\circ} \\
 \quad - 18^{\circ} \\
 \hline
 23.3792^{\circ}
 \end{array}$$

$$\begin{array}{r}
 \eta = 15.9990^{\circ} \\
 \quad - 2^{\circ} \\
 \hline
 15.9938^{\circ}
 \end{array}$$

From Plate Constants

$$X = 23.4257^{\circ}$$

$$\eta = 15.7772^{\circ}$$

$$\xi + 1.4257^{\circ}$$

$$\eta - 2.2828^{\circ}$$

$$\begin{array}{r}
 \log \xi \quad 0.15403^{\circ} \\
 \log \eta \quad 9.96701^{\circ} \\
 \hline
 8.50727^{\circ} \\
 + 1.67978^{\circ}
 \end{array}$$

$$\begin{array}{r}
 \log \tan \delta \quad 9.6075^{\circ} \\
 \xi^2 \quad 0.3081^{\circ} \\
 \hline
 7.0537^{\circ} \\
 6.9690^{\circ}
 \end{array}$$

$$\alpha - A \quad + 77.87^{\circ}$$

$$\eta_1 - 0.0009^{\circ}$$

$$A \quad 20 \quad 19 \quad 23^{\circ}$$

$$\eta_0 - 2.2819^{\circ}$$

$$\alpha_0 \quad 20 \quad 15 \quad 10.84^{\circ}$$

$$\begin{array}{r}
 \log \eta_0 \quad 0.35830^{\circ} \\
 \hline
 7.33115^{\circ} \\
 3.02715^{\circ}
 \end{array}$$

$$\text{Red} \quad + 7.32$$

$$- 1067.5^{\circ}$$

$$\alpha' \quad 20 \quad 15 \quad 15.18^{\circ}$$

$$S-D \quad - 17 \quad 47.5^{\circ}$$

$$D \quad - 21 \quad 75^{\circ} \quad 17^{\circ}$$

$$S_0 \quad - 22 \quad 03 \quad 0.15^{\circ}$$

$$\text{Red} \quad + 6.9^{\circ}$$

$$S' \quad 22 \quad 02 \quad 57.6^{\circ}$$

9193

Moon's Mean Position

19

$$X = 23.3510^{\circ}$$

$$y = 15.9990^{\circ}$$

$$-18^{\circ}$$

$$-2^{\circ}$$

$$23.3492^{\circ}$$

$$15.9938^{\circ}$$

From Plate Constants

$$X = 23.4257^{\circ}$$

$$y = 15.7772^{\circ}$$

$$\frac{1}{2} + 1.9757^{\circ}$$

$$n = 2.2828^{\circ}$$

$$\log \pi, 0.15903^{\circ}$$

$$\log \pi, 9.6075^{\circ}$$

$$\text{and } 9.96701^{\circ}$$

$$\pi = 0.3031^{\circ}$$

$$8.50729^{\circ}$$

$$7.0534^{\circ}$$

$$+1.67978^{\circ}$$

$$6.9690^{\circ}$$

$$A-A + 77.87^{\circ}$$

$$h. = 0.0009^{\circ}$$

$$A \quad 20 \quad 19 \quad 23^{\circ}$$

$$h_0 = 2.2819^{\circ}$$

$$d_0 \quad 20 \quad 15 \quad 10.89^{\circ}$$

$$\log h_0 \quad 0.35830^{\circ}$$

$$7.33115^{\circ}$$

$$Red + 9.32$$

$$3.02715^{\circ}$$

$$-10.675^{\circ}$$

$$d' \quad 20 \quad 15 \quad 15.18^{\circ}$$

$$S-D -17.745^{\circ}$$

$$D - 21 \quad 93 \quad 17^{\circ}$$

$$S_0 - 22 \quad 03 \quad 0.13$$

$$Red \quad 6.9$$

$$S' \quad 22 \quad 02 \quad 59.6$$

$$\begin{array}{r}
 19 \quad 57 \quad 30.78 \\
 \underline{26.02} \\
 + 7.76 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -27 \quad 56 \quad 76.1 \\
 \underline{49.3} \\
 + 3.2 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 20 \quad 27 \quad 5.04 \\
 \underline{0.88} \\
 + 7.23 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -18 \quad 05 \quad 37.7 \\
 \underline{83.55} \\
 + 8.86 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 20 \quad 41 \quad 8.97 \\
 \underline{3.97} \\
 + 7.53 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -25 \quad 39 \quad 28.3 \\
 \underline{36.8} \\
 + 8.5 \\
 \hline
 \end{array}$$

.2

-18°

-20

22

29

26

.3

.1

-28°

361

204 50 194

9193 Reduction to Apparent Place

19

$$\begin{array}{rcl}
 H + \alpha & 2 & 36.6 = 39^{\circ} 09.0 \text{ S } -22 \quad 03.0^{\circ} \\
 H & 6 & 21.7^{\circ} \\
 \alpha & 20 & 15.2^{\circ} \\
 G & 22 & 39.7^{\circ} \\
 G + \alpha & 18 & 54.6 = 283^{\circ} 39.0 \quad \mu' 10.8763
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos(G + \alpha) & 9.3729 \\
 g & 1.3106^{\circ} \\
 \sin G + \alpha & 9.9876^{\circ} \\
 \tan \delta & 9.6075^{\circ} \\
 & 8.8239^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 \log g' & 0.6835 \\
 g & 9.7296
 \end{array}$$

$$\begin{array}{rcl}
 f & +2.928^{\circ} \\
 h & +0.858^{\circ} \\
 g & +0.537^{\circ} \\
 \hline
 & +4.313^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin \delta & 9.5745^{\circ} \\
 \cos H + \alpha & 9.8896^{\circ} \\
 h & 1.2770^{\circ} \\
 \sin H + \alpha & 9.8003^{\circ} \\
 \sec \delta & 0.0330^{\circ} \\
 & 8.8239^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 \log h' & 0.7381^{\circ} \\
 h & 9.9312
 \end{array}$$

$$\begin{array}{rcl}
 g' & +4.825^{\circ} \\
 h' & -5.472^{\circ} \\
 \hline
 & +7.522^{\circ} \\
 & +6.875^{\circ}
 \end{array}$$

9192 Reduction to Apparent Place

19

$H + \lambda$ 2 366 = $39^{\circ} 09.0$ S -22 03.0
 H 6 21.7
 λ 20 15.2
 G 22 39.9
 $G + \lambda$ 18 59.6 = $283^{\circ} 39.0$ L 10.8763

$\log \cos \delta$ 9.9670
 \sin 0.9093 +
 L 10.8763

$\log(G + \lambda)$ 9.3729
 q 1.3106
 $\sin(G + \lambda)$ 9.9876
 $\tan \delta$ 9.6075
 8.8239

$\log \sin \delta$ 7.5775
 $\cos H + \lambda$ 9.8896
 \sin 1.2770
 $\sin H + \lambda$ 9.8000
 $\sec \delta$ 0.0330
 8.8239

$\log q$ 0.6835
 q 9.7296

$\log \tan$ 0.7381
 \tan 9.9312

f +2.928
 h +0.853
 g +0.537
 $+4.318$

g' +9.525
 h' -5.772
 l +7.522
 $+6.875$

9193

Lunar Parallax

20

$$\begin{array}{rcl}
 \alpha' & 20 & 15 \quad 15.29^{\circ} \quad \pi \quad 58' \quad 39''.00^{\circ} \\
 \delta & 21 & 27 \quad 06.7^{\circ} \\
 \delta - \alpha' & +1 & 11 \quad 51.56^{\circ} \quad 9.86913^{\circ} \\
 = & 170 & 57' \quad 53.90 \text{ Sin } \delta \alpha' \quad 9.78915^{\circ} \\
 & + 7 & \quad \quad \quad \pi \quad 8.23136^{\circ} \\
 \frac{1}{2}(\alpha') & + 7 & 09.95^{\circ} \quad 0.03038^{\circ} \\
 & & \quad \quad \quad \quad \quad 7.62002^{\circ}
 \end{array}$$

$$(\delta - \alpha') - \frac{1}{2}(\alpha') = 17 \quad 50 \quad 43.95^{\circ}$$

$$\delta - \alpha' + 14' \quad 19.9^{\circ}$$

$$9.95727^{\circ}$$

$$0.00000^{\circ}$$

$$0.02142^{\circ}$$

$$9.97869^{\circ}$$

$$= +57.33^{\circ}$$

$$\delta \quad 43 \quad 35 \quad 41.5^{\circ}$$

$$\delta - 22 \quad 02 \quad 57.6^{\circ}$$

$$\delta - \delta \quad 65 \quad 38 \quad 35.9^{\circ}$$

$$9.82670^{\circ}$$

$$8.23136^{\circ}$$

$$9.95952^{\circ}$$

$$0.16173^{\circ}$$

$$8.17871^{\circ}$$

$$\delta - \delta' \quad +51 \quad 52.8^{\circ}$$

$$\delta - 21 \quad 11 \quad 01.8^{\circ} \quad \alpha \quad 20 \quad 16 \quad 12.77^{\circ}$$

$$\text{AmEphs} - 21 \quad 11 \quad 07.5^{\circ} \quad \text{AmEphd} \quad 20 \quad 16 \quad 11.66^{\circ}$$

$$D-C \quad +2.9^{\circ} \quad D-C \quad +0.84^{\circ}$$

$$\text{Cover of Plate} \quad +0.1$$

$$\text{2nd Order Ref} \quad +0.1$$

$$-0.02$$

$$\text{Fin Corr} \quad +0.1$$

$$\delta - 21 \quad 11 \quad 01.7$$

$$D-C \quad +2.8$$

$$\alpha \quad 20 \quad 16 \quad 12.52^{\circ}$$

$$+0.05^{\circ}$$

$$+0.86^{\circ}$$

9193

Lunar Parallax

2

$$\alpha' \quad 20 \quad 15' \quad 15.18'' \quad \pi \quad 58' \quad 39.00''$$

$$\phi \quad 21 \quad 27 \quad 06.7''$$

$$\delta - \alpha' \quad +1 \quad 11 \quad 51.56'' \quad 9.86913''$$

$$= \quad 170 \quad 57' \quad 53.905'' \quad \delta \quad 9.98915''$$

$$+ \quad 7 \quad \pi \quad 8.23136''$$

$$\frac{1}{2}(\delta - \alpha') \quad + \quad 7 \quad 09.95'' \quad 0.03038''$$

$$7.62002''$$

$$(\delta - \alpha') - \frac{1}{2}(\delta - \alpha') \quad 17 \quad 50 \quad 43.95''$$

$$\delta - \alpha' \quad + \quad 19' \quad 19.9''$$

$$9.95727''$$

$$0.00000''$$

$$0.02192''$$

$$9.97869''$$

$$= \quad + \quad 57.33''$$

$$\delta \quad 43 \quad 35 \quad 41.5''$$

$$\delta - \alpha' \quad 22 \quad 02 \quad 57.6''$$

$$\delta - \alpha' \quad 65 \quad 38 \quad 35.7''$$

$$9.82690''$$

$$8.23136''$$

$$9.95952''$$

$$0.16193''$$

$$8.17876''$$

$$\delta - \alpha' \quad 51 \quad 52.8''$$

$$\delta - \alpha' \quad 21 \quad 11 \quad 01.8'' \quad \alpha \quad 20 \quad 16 \quad 12.97''$$

$$\text{Amplitude} - 21 \quad 11 \quad 09.5'' \quad \text{Amplitude} \quad 20 \quad 16 \quad 11.66''$$

$$D-C \quad + \quad 2.9'' \quad D-C \quad + \quad 0.84''$$

$$\text{Error of Plate} \quad + \quad 0.1$$

$$\text{2nd Order Ref} \quad + \quad 0.1$$

$$- \quad 0.02$$

9194

x Star Measures

21

	λ	μ	λ	μ	λ	μ	λ	μ
1	18237	19762	18788	18928				
18.3	1598290	1251.0	193.1613	1783039				
9.9	98	04	10	78				
	98	90	32	30				
	<u>18.2798</u>	<u>18.2729</u>	<u>9.9450</u>	<u>9.9711</u>				
2	16607	19426	18638	18896				
25+	1646254	958283	1796862	956261				
30.1	76	84	56	60				
	22	77	72	902				
	<u>23.0150</u>	<u>23.0170</u>	<u>30.0677</u>	<u>30.0660</u>				
3	19248	18310	17800	18682				
33.1	1865251	894841	1520610	1125259				
19.7	50	34	14	66				
	72	32	20	88				
	<u>33.0598</u>	<u>33.0610</u>	<u>19.2597</u>	<u>19.2572</u>				

Moon Measures

1	19992	15940
23	1535250	1059086
13.6	48	82
	10010	52
	<u>13.7650</u>	<u>13.7640</u>
2	19796	14896
22.8	1527039	976055
13.6	38	50
4-	817	4908
	<u>13.4566</u>	<u>13.4552</u>
3	18812	17012
22	1255958	1327637
13.8	62	28
	10	18
	<u>13.6257</u>	<u>13.6222</u>

9179

Star Measures

21

	1	2	3	4
	18239	19762	18728	18428
8.3	1598290	1251007	1931613	1783039
9.9	98	09	10	7839
	98	70	32	30
	<u>18.2778</u>	<u>18.2729</u>	<u>9.9950</u>	<u>9.9911</u>
2	16604	19926	18638	18896
25.1	1696254	958283	1796862	956261
30.1	96	89	56	60
	22	99	92	702
	<u>23.0150</u>	<u>23.0190</u>	<u>30.0679</u>	<u>30.0660</u>
2	19298	18310	17800	18682
33.1	1865251	894891	1520610	1120259
19.7	50	39	17	86
	72	32	20	88
	<u>33.0598</u>	<u>33.0610</u>	<u>19.2299</u>	<u>19.2572</u>

Moon Measures

1	19992	15940
23	1335250	1039086
13.6	98	82
	10	52
	<u>13.4650</u>	<u>13.4640</u>
2	14796	14896
22.8	1527039	99605
13.6	34	50
9	819	9908
	<u>13.4566</u>	<u>13.4552</u>
2	18812	17012
22	1255958	1329637
13.8	62	28
	10	18
	<u>13.6259</u>	<u>13.6222</u>

21
193
20
156
20
15
X-7
20
168
2
17

9199

Moon Measures

22

<u>4</u>	14210	15860
21.5	986877	1016877
18	86	8077
	04	68
	<u>21.7330</u>	<u>21.7310</u>

<u>5</u>	19968	18706
20.9	1109096	1762220
15.0	02	18
	80	08
	<u>20.8882</u>	<u>20.8918</u>

<u>6</u>	19974	18688
20.8	10526	1716058
15.7	1822	56
X-	90	90
	<u>20.8468</u>	<u>20.8468</u>

<u>7</u>	18998	17682
20.9	954051	17602
16.0	62	02
	86	78
	<u>20.9958</u>	<u>20.9720</u>

<u>8</u>	18988	18658
22	1676767	1035877
17.2	70	38
	998	70
	<u>17.1722</u>	<u>17.1676</u>

15
3
20
1
2
20
12
16
2
2
17

9179

Moon Measures

22

4	17210	13860
21.5	786877	10168
19	86	4079
	04	68
	<u>217330</u>	<u>219310</u>

5	19968	18706
20.9	1109076	17622
15.0	02	1820
	80	08
	<u>208882</u>	<u>208918</u>

6	19979	18688
20.8	11026	1716058
15.9	1822	56
1-	90	90
	<u>208968</u>	<u>208468</u>

7	18998	17682
20.9	959051	17102
16.0	62	02
	86	78
	<u>209958</u>	<u>209920</u>

8	18458	18658
22	1614967	103594
17.2	10	70
	498	70
	<u>171722</u>	<u>171676</u>

9194 Dunes 7 Etc 9197 23
 Exp to Stars Sept. 21-15 21 25 21 37
 " Moon 21 30 40.0 21 30 40.3
 Clock fast 2 20.8

H. Sid time 21 28 19.35 $\delta - \alpha = -1^h 22^m$
 H. Long. 7 44 31.05
 G. Sid " 26 12 50.40
 Sid J. M. Noon 11 57 07.45
 Interval 14 15 42.95
 Reduction 02 02 20.19
 G. M. T. 14 13 22.76

From Naut. Alm. R. A. Dec.
 Moon 17^h 22 50 07.76 -5 02 42.9
 Motion in 1^m 1.9865 15.123
 " " 13.3793 26.58 3 22.3
 Tabular Place 22 50 34.04 -4 59 20.6

Moon's Age 13 days +
 Parallax 57' 16.07
 Semidiameter 15 37.8
 R. 937.8
 Aug. + 10.0
 L^r 3 - 0.3
 R. 947.5
 R. 2,0311
 aR - 965
 (1+a)R 1,9346
 R² 3,7427

937 = 9.9

$$\begin{array}{r} \alpha = -799.3 \\ + 29 \\ \hline -475.3 \end{array}$$

Dunes 7 Etc 9199 23
 Exp To Stars Sept 21.15 21 23 21 37
 " Moon 21 30 90.0 21 30 90.3
 Clock fast 2 20.8

H. Sid Time 21 28 19.35 $\pm \epsilon = -1^h 22^m$
 H Long 9 44 34.05
 G Sid 26 12 50.40
 Sid J M. Noon 11 57 07.45
 Interval 19 15 42.95
 Reduction 0 02 20.19
 G M. J 19 13 22.76

Moon Mant alm. R.A. Dec.
 Moon 19^h 22 50 07.76 -5 02 42.9
 Moon in 1^m 1.9865 15.123
 " 13.37923 26.58 3 22.3
 Tabular Place 22 50 39.04 -9 59 20.6

Moon's Age 13 days +
 Parallax 57' 16.07"
 Semidiameter 15' 37.8"
 R 937.5
 Aug +10.0
 ΔR 3 -0.3
 R 947.5
 R 2.0311
 ΔR -963
 (1+ ΔR) 1937.6
 R 37427

959: 9.9

$$\begin{array}{r}
 a = -999.3 \\
 + 29 \\
 \hline
 -475.3
 \end{array}$$

\bar{x}	\bar{y}	$\Delta \bar{x}$	-2.63	-2.4	-8
1	-7.09	-8.56	-2	+11	-2
2	+2.96	+12.59	+13	-8	+3
3	+11.92	+1.25	+39	-30	+9
M	+0.63	-2.83	-2	+1	<u>-9</u>
		$\Delta \bar{y}$	-3.74	$+1.63$	<u>-9</u>
		-18	+29	+11	-2
		+51	-93	+8	+2
		+9	-3	+1	+7
			+10	+0	<u>+1</u>

Standard				Coordinates				24
Cape No	3173	mg	6.8-	No	3184-	mg	6.6-	No 3204 mg. 6.1
C	22	98	16.27	22	51	56.98	22	56 21.17
L			16.31			57.03		21.23
E			16.20			56.96		21.16
Mean	22	98	16.26	22	51	56.99	22	56 21.19
Prec			+ 86.78			+ 86.97		+ 86.59
X	22	99	03.04	22	52	83.46	22	57 07.78
A	22	51	11.2	22	51	11.2	22	51 11.2
X-A			-02 08.16			+01 32.26		+05 56.58
Sum (XA)			-128.16			+92.26		+356.55
Log "	2	10	775 n		1	96501	2	55212
" Cos	9	99	725		9	99909		9.99823
" Σ_0	0	6	1228 n		0	77134		1.05759
Σ_0	-	8	0949		+	29633		+11.7179
Σ_1			-2			+13		+39
Σ	17	90	49		24	9646		33.4218
X	18	27	36		25	0195		33.0604
X- Σ	+	3	687		+	799		- .3614
C	-6	31	06.25	-3	46	48.0	-5	17 56.4
L			06.61			47.7		57.0
E			07.45			47.5		56.3
Mean	-6	31	06.87	-3	46	47.7	-5	17 56.6
Prec			+08 46.24			+7 47.7		+7 49.3
S	-6	26	20.63	-3	42	00.0	-5	10 07.3
D	-5	19	49.5	-5	19	49.5	-5	19 49.5
S-D	-1	06	31.13	+1	37	49.5	+	09 42.2
Sum (S-D)			-3991.6			+3871.1		+582.2
Log "	3	60	115 n		3	76872		2.76507
" No	9	93	230 n		1	09987		0.09622
Log tan δ	9	05	25 n		8	8107 n		8.9564 n
" Σ_0	1	22	45		0	9424		2.1152
" Σ_1	7	33	04 n		6	8068 n		8.1250 n
Σ_0	-8	55	66		+	125854		+1.2480
Σ_1	-0	00	21		-	00006		-0.0133
Σ	19	77	13		3	05848		19.2377
Σ	9	97	30		3	00667		19.2583
Σ - Σ	+	5	017		-	5181		+ .236

Standard				Comparison				29
Capt No	3173	mg	6.8	no	3189	mg	6.6	no 3208
C	22	98	16.27	22	51	56.98	22	56 21.7
L			16.31			57.03		21.23
C			16.20			56.96		21.16
Mean	22	98	16.26	22	51	56.99	22	56 21.19
Prob			+96.75			+96.97		+96.59
C	22	99	03.04	22	52	73.96	22	57 07.73
A	22	51	11.2	22	51	11.2	22	51 11.2
X-A			-02 08.16		+01	32.26		+05 56.3
S (T)			-1.8.16			+92.26		+35.65
Log	2.10775	n			1.96501		2.55212	
Coef	999725				999909		999723	
h	0.61228	n			0.97139		1.05739	
T	-9.0999				+29.633		+119.179	
T	-2				+13		+39	
T	179019				247646		337218	
X	18.2736				250195		330609	
X-T	+3687				+999		-3619	
C	-6	31	06.25	-3	96	98.0	-5	19 56.4
L			06.61			97.7		57.0
C			07.75			97.5		56.3
Mean	-6	31	06.87	-3	96	97.7	-5	19 56.6
Prob			+07 96.29		+9	97.7		+9 99.3
d	-6	26	50.63	-3	92	00.0	-5	10 07.3
D	-5	-19	99.5	-5	19	99.5	-5	19 97.5
D	-1	06	31.13	+1	37	49.5	+09	92.2
h (D)			-39916			+5871.1		+5822
Log	3.60115	n			3.76872		2.76507	
h	0.93230	n			1.09987		0.09622	
Log	9.0525	n			9.8107	n	8.9569	n
h	1.2295				0.9427		2.1152	
h	7.3309	n			6.8068	n	8.1250	n
h	-85556				+125859		+12980	
h	-0.0021				-0.0006		-0.0133	
h	179773				305898		192387	
h	99730				300667		192583	
h	+5017				-5181		+236	

Plate Center & Plate Constants

25

x	y	α	δ
18.2736	9.9430	22 49 03.09	-6 26 20.6
25.0195	30.0667	52 43.46	-3 42 0.0
33.0608	19.2583	57 07.78	-5 10 07.3
3) 76.3785	59.2680	3) 158 54.28	-14 48 27.9
25.449	19.756		
22	18	22 52 58.09	-5 06 09.3
- 3.479	- 1.756	- 1 46.9	- 13 40.2
315	466.5	22 51 11.19	-5 19 49.5
- 106.9	- 820.2		

$$\text{Plate Center } \begin{cases} A = 2.2 & 51 & 11.2 \\ D = -5 & 19 & 49.5 \end{cases}$$

$$\begin{aligned} x - \bar{x} + 500x &= -8.84 & -7x &= -1272.4 \\ +3687 + 9137 &= 12824 - 87 & = 12737 - 13 &= +12724 & 0 \\ +499 + 12507 &= 13006 - 260 & = 12746 - 18 &= +12728 & -1 \\ -3614 + 16530 &= 12916 - 169 & = 12747 - 23 &= +12724 & 0 \\ 22.7805 + 11390 &= -135 & -16 &= 22.6320 \end{aligned}$$

$$\begin{aligned} y - \bar{y} + 500y &= +5.2x & +5.14 &= 1013.5 \\ +5017 + 4941 &= 9958 + 95 & = 10053 + 51 &= +10104 & -1 \\ -5181 + 15033 &= 9852 + 130 & = 9982 + 153 &= 35 & 0 \\ +236 + 9629 &= 9865 + 172 & = 10037 + 78 &= 35 & 0 \\ 15.3917 + 7696 &= +118 & +78 &= 15.1674 \end{aligned}$$

$$\begin{aligned} \text{Tables } a &= +2 & c &= -3.3 & a-c &= +3.5 & b+d &= +2.8 \\ \text{Obs } &= +499.3 & &= -505.1 & &= +5.8 & &= +3.6 \end{aligned}$$

$$b-c = -499.5 \quad -501.8 \quad +0.8$$

Plate Center + Plate Constants

25

1	4	2	3
18.2736	9.9730	22 79 03.09	-6 26 20.6
25.0195	30.0667	52 73.96	-3 92 0.0
33.0602	19.2583	57 07.28	-5 10 07.3
376.3985	59.2680	2 158 59.28	-19 78 21.9
25.999	19.756		
22	18	22 52 58.09	-5 06 09.3
- 3.999	- 1.756	- 1 96.9	- 13 90.2
15	76.5	22 51 11.19	-5 19 99.5
106.9	- 820.2		

$$\text{Plate Center } \begin{cases} A = 22 51 11.2 \\ D = -5 19 99.5 \end{cases}$$

$$22.7805 + 11.390 - 1.35 - 16 = 22 6320$$

$$15.3917 + 76.96 + 118 + 78 = 15 1674$$

$$\begin{array}{l} \text{Tables } a = +1.2 \quad c = -3.3 \quad a-c = +3.5 \quad b+d = +2.8 \\ \text{Obs } = -999.3 \quad = -505.1 \quad = +5.4 \quad = +3.6 \end{array}$$

$$A = -2.6$$

$$B = +3.2$$



9194 *Moons Center.*

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$	26
1	23.0000	+0.2170 + 5	0.0473	3.7649	+222		
2	22.7830	0.0000 + 5	0.0000	3.7508	+81		
3	22.0000	-0.7830 + 5	0.6123	3.7410	-17		
4	21.8320	-1.3510 + 4	1.8241	3.7629	+202		
5	20.8898	-1.8932 + 1	3.5838	3.7376	-51		
6	-20.8468	-1.9362 + 0	3.7489	3.7489	+62		
7	20.9739	-1.8391 - 2	3.3830	3.7529	+102		
8	22.0000	-0.7830 - 5	0.6139	3.7769	+372		

$$R = 3.7427$$

	y	$y - y_0$	Δy	$(y - y_0)^2$	L
1	13.4645	-1.9275 - 6	3.7176	+174	
2	-13.4559	-1.9361 - 6	3.7508	180	
3	13.6238	-1.7682 - 6	3.1287	208	
4	14.0000	-1.3920 - 4	1.9388	228	
5	15.0000	-0.3920 - 1	0.1538	238	
6	15.3920	0.0000 0	0.0000	270	
7	16.0000	+0.6080 + 2	0.3699	288	
8	17.1699	+1.7779 + 6	3.1630	336	1620

Approx. Center

$$x = 22$$

$$y = 13.6238$$

$$17.1699$$

$$30.7937$$

$$y_0 = 15.3968$$

$$y_{\text{min}} = 13.4559$$

$$1.9346$$

$$R = 1.9709$$

$$x_{\text{min}} = 20.8468$$

$$\text{Moons Center} \begin{cases} x_0 = 22.7830 \\ y_0 = 15.3920 \end{cases}$$

9194	Moons	Center					26
	λ	$\lambda - \lambda_0$	$\Delta \lambda$	$\lambda - \lambda_0$	$(\lambda - \lambda_0)(\lambda - \lambda_0)$	$\lambda - \lambda_0$	
1	23.0000	+0.2170	1	0.0973	3.7697	+0.223	
2	22.7830	0.0000	2	0.0000	2.7508	+0.86	
3	22.0000	-0.7830	3	0.6123	3.7910	-0.17	
4	21.9320	-1.3510	4	1.8291	3.7629	+2.02	
5	20.8898	-1.9932	5	2.5838	3.7376	-0.51	
6	20.8968	-1.9362	6	3.1489	3.7789	+0.62	
7	20.9739	-1.8391	7	3.3830	3.7329	+1.02	
8	22.0000	-0.7830	8	0.6139	3.7769	+3.92	

$$R = 3.7927$$

	λ	$\lambda - \lambda_0$	$\Delta \lambda$	$\lambda - \lambda_0$	λ	
1	13.7695	-1.9275	1	0.1176	+1.79	
2	13.9559	-1.9361	2	3.7508	180	
3	13.6238	-1.7692	3	2.1287	207	
4	19.0000	-1.3720	4	1.9388	229	
5	15.0000	-0.3920	5	0.1538	258	
6	14.0000	0.0000	6	0.0000	270	
7	16.0000	+0.6000	7	0.5699	288	
8	17.1699	+1.7779	8	3.1630	336	1620

Approx. Center

$$\lambda = 22 \quad \lambda = 13.6238$$

$$\frac{17.1699}{30.7937}$$

$$\lambda_0 = 15.3968$$

$$\lambda_{\min} = 13.9559$$

$$R = -1.9709$$

$$\lambda_{\max} = 20.8968$$

$$\text{Moons} \left\{ \begin{array}{l} \lambda_0 = 22.7830 \\ \lambda_0 = 15.3920 \end{array} \right.$$

Formation of Normals

1	- 0.42	+ 49.0	- 433.0
2	+ 0.00	- 0.0	- 157.0
3	+ 1.38	+ 13.0	+ 30.0
4	+ 1.88	- 273.0	- 281.0
5	+ 0.74	+ 96.5	+ 20.0
6	+ 0.00	- 120.0	0.00
7	- 1.12	- 188.0	+ 62.0
8	- 1.39	- 267.0	+ 609.0
	+ 4.00	+ 158.5	+ 721.0
	- 293	- 848.2	- 871.0
	+ 1.07	- 689.5	- 150.0

+15

a - 9
b - 4
c + 15

a	b	c
+ 19	- 8	+ 26
- 0	- 8	+ 7
- 4	- 7	+ 1
- 12	- 5	- 2
- 14	- 1	- 3
- 17	+ 0	- 2
- 17	+ 2	+ 0
- 7	+ 7	+ 15

.0777

$$\begin{aligned}
 +1.07 + 16.22 &= -5.03 \\
 +27 + 0.12 &= -0.65 \\
 +16.10 &= -7.38
 \end{aligned}$$

$$13.81 = -8.36 + 0.38 = -7.98$$

9194

Conditional Equations

27^{new}
D-C

1 + 0.22 - 1.93 = +222	- 11 + 12 = +1	+ 221 + 247
2 - 0.00 - 1.94 = + 81	+ 0 + 12 = +12	+ 69 + 76
3 - 0.78 - 1.77 = - 17	+ 39 + 11 = +50	- 67 - 66
4 - 1.35 - 1.39 = +202	+ 67 + 8 = +75	+ 127 + 125
5 - 1.89 - 0.39 = - 51	+ 93 + 2 = +95	- 146 - 149
6 - 1.94 0.00 = + 62	+ 96 0 = +96	- 34 - 36
7 - 1.84 + 0.61 = + 102	+ 94 - 4 = +90	+ 15 + 15
8 - 0.78 + 1.78 = + 392	+ 39 - 11 = +28	+ 314 + 329
	+ 746 - 247	

Normal equations

$$13.81 + 1.07 = -689.5 - 8.36$$

$$+1.07 + 16.22 = -150.0 - 5.03$$

$$+1.07 + 0.08 = -53.5$$

$$- .27 \Delta$$

$$+16.14 = -96.5$$

$$b = -5.98$$

$$13.81 = -689.5 + 6.4 = -683.1$$

$$a = -4.93$$

$$= -0.58$$

Arc Measured 162°

$$\frac{p}{h} = .21$$

$$\frac{EV}{h} = +62.7$$

$$\text{Im } 3 \quad R \quad 1.93$$

$$-2RC = +0.77$$

$$+62.7 = +297$$

$$\Delta R = +3.7$$

$$.21$$

$$\text{Corr} = -0.2$$

$$\Delta b = -0.21$$

$$\Delta s = -0.1$$

$$\Delta R = +3.9$$

$$\Delta q = -0.45$$

$$\Delta x = -0.02$$

9199

Conditional Equations

27

A-C

1	+	0.22	-	1.93	=	+ 2.22	- 11	+	12	=	+ 1	+ 2.21
2	-	0.00	-	1.99	=	+ 8.1	- 0	+	12	=	+ 12	+ 6.9
3	-	0.18	-	1.77	=	- 1.7	- 39	+	11	=	+ 5.0	- 6.7
4	-	1.22	-	1.39	=	+ 2.02	+ 67	+	8	=	+ 7.5	+ 1.27
5	-	1.89	-	0.39	=	- 5.1	+ 93	+	2	=	+ 9.5	- 1.86
6	-	1.99	-	0.00	=	+ 6.2	+ 96	0	=	+ 9.6	- 3.9	
7	-	1.89	+	0.61	=	+ 1.02	+ 98	-	9	=	+ 8.7	+ 1.5
8	-	0.78	+	1.78	=	+ 3.2	+ 39	-	11	=	+ 2.8	+ 3.14
											+ 7.46	- 2.91

Normal equations

$$13.81 + 1.07 = -6.89.5$$

$$+1.07 + 16.22 = -13.0.0$$

$$+1.07 + 0.08 = -53.5$$

$$+16.19 = -96.5$$

$$b = -5.98$$

$$13.81 = -6.89.5 + 6.4 = -6.83.1$$

$$a = -19.5$$

Arc Measured 162°

$$\frac{p}{h} = .20$$

$$\frac{\Sigma v}{h} = +62.9$$

$$\frac{+62.9}{.20} = +314.5$$

$$\Delta R = +3.8$$

9197 Moon's Mean Position 28

$$\begin{array}{r} \chi_0 = 22.7830^{\circ} \\ - 25^{\circ} \\ \hline 22.7805^{\circ} \end{array}$$

$$\begin{array}{r} \eta_0 = 15.3920^{\circ} \\ - 3^{\circ} \\ \hline 15.3917^{\circ} \end{array}$$

From Plate Constants.

$$\chi = 22.6320^{\circ}$$

$$\eta = 15.1677^{\circ}$$

$$\xi = +0.6320^{\circ}$$

$$\eta = -2.8326^{\circ}$$

$$\log \xi = 9.80072^{\circ}$$

$$\log \tan \delta = 8.9830^{\circ}$$

$$\cos \delta = 9.99785^{\circ}$$

$$\xi = 9.6014^{\circ}$$

$$8.50729^{\circ}$$

$$7.0537^{\circ}$$

$$1.29563^{\circ}$$

$$5.6538^{\circ}$$

$$\log d - A$$

$$19.75^{\circ}$$

$$\eta_1 = -0.0000^{\circ}$$

$$\eta_0$$

$$\chi - A$$

$$A \quad 22 \quad 51 \quad 11.20^{\circ}$$

$$\log H_0 = 0.75229^{\circ}$$

$$7.33115^{\circ}$$

$$3.12108^{\circ}$$

$$\chi_0 \quad 22 \quad 51 \quad 30.95^{\circ}$$

$$-1321.8^{\circ}$$

Red

$$+ 8.27^{\circ}$$

$$\delta - D \quad -22 \quad 01.8^{\circ}$$

$$D - 5 \quad 19 \quad 49.5^{\circ}$$

$$\chi' \quad 22 \quad 51 \quad 35.19^{\circ}$$

$$\delta_0 - 5 \quad 41 \quad 50.8^{\circ}$$

Red

$$+ 23.9^{\circ}$$

$$\delta' - 5 \quad 41 \quad 27.0^{\circ}$$

9199 Morris Measure Position 28

$$\begin{array}{r} \gamma_0 = 22.7830'' \\ - 25'' \\ \hline 22.7805'' \end{array}$$

$$\begin{array}{r} \gamma_0 = 15.3920'' \\ - 3'' \\ \hline 15.3817'' \end{array}$$

from Plate Constants

$$1 = 22.6320''$$

$$\gamma = 15.1679''$$

$$q_1 + 0.6320''$$

$$n - 2.8326''$$

$$\log \tau = 9.80072''$$

$$\log \tan \delta = 8.99990''$$

$$\log \delta = 9.99785''$$

$$\tau = 9.6019''$$

$$8.50729''$$

$$7.0539''$$

$$1.29563''$$

$$9.6538''$$

$$\log \delta - A$$

$$19.75''$$

$$n. - .0000''$$

$$X - 14$$

$$n_0$$

$$A \quad 22 \quad 51 \quad 11.20''$$

$$\log n_0 = 0.95229''$$

$$7.23115''$$

$$3.12109''$$

$$\gamma_0 \quad 22 \quad 51 \quad 30.95''$$

$$\delta - 1.9''$$

$$\delta - D \quad - 22.018''$$

$$Red$$

$$+ 9.29''$$

$$D - 5 \quad 19 \quad 49.5''$$

$$\delta' \quad 22 \quad 51 \quad 33.19''$$

$$\delta_0 - 5 \quad 41 \quad 30.9''$$

$$Red$$

$$+ 23.9''$$

$$\delta' - 5 \quad 41 \quad 27.0''$$

$$\begin{array}{r}
 22 \quad 26 \quad 13.35 \\
 \quad \quad 9.09 \\
 \hline
 + 7.31
 \end{array}$$

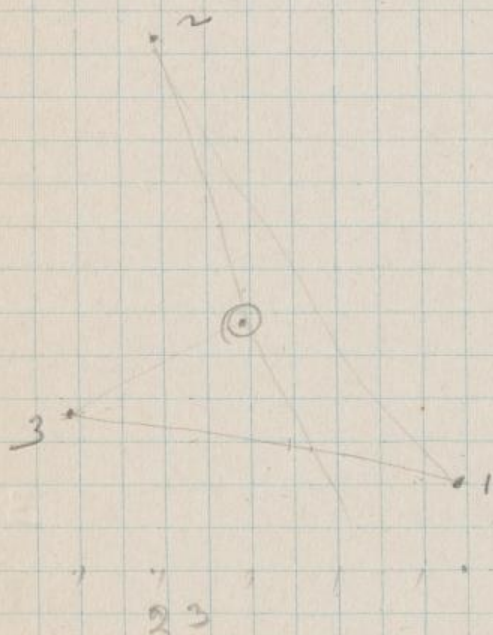
$$\begin{array}{r}
 -11^{\circ} \quad 06 \quad 26.2 \\
 \quad \quad 47.6 \\
 \hline
 + 21.7
 \end{array}$$

$$\begin{array}{r}
 23 \quad 02 \quad 47.36 \\
 \quad \quad 43.30 \\
 \hline
 + 7.06
 \end{array}$$

$$\begin{array}{r}
 +8 \quad 57 \quad 25.6 \\
 \quad \quad 56 \quad 85.6 \\
 \quad \quad 57 \quad 00.1 \\
 \hline
 + 25.5
 \end{array}$$

$$\begin{array}{r}
 23 \quad 11 \quad 30.71 \\
 \quad \quad 26.38 \\
 \hline
 + 7.33
 \end{array}$$

$$\begin{array}{r}
 -9 \quad 32 \quad 38.9 \\
 \quad \quad 33 \quad 03.2 \\
 \hline
 + 27.8
 \end{array}$$



+ 80

+ 70

+ 0

- 70

- 80

- 120

22

9194

Reduction to Apparent Place 29

H + α	7	55.8 = 73° 57' S	- 57.1	51.0
H	6	07.3		
α	22	51.530.95	log cos δ	9.9978
γ	22	38.5		10.9109 +
G + α	21	30.0 = -37° 30'		10.9087

ℓ Cos (G+L)	9.8995	
$\cdot g$	1.3132	
Sum G+L	9.7874	n
tan S	8.9980	n
	8.8239	

-log Σ 8.9978 n
 lns H+d 9.4417
 h 1.2737
 Σ H+d 9.9827
 Sec d 0.0022
 8.8239

$\log g^*$	8.9205
" $g^{\#}$	1.2127

log k^+ 0.0825
log k^- 9.7132

~~$$\begin{array}{r} f + 2,953 \\ g + 16.32 \\ h + 0.514 \\ \hline + 19.790. \end{array}$$~~

$$\begin{array}{r} 91 + 8.083 \\ 741.209 \\ 148.109 \\ \hline + 9.396 \end{array}$$

$$\begin{array}{r} f + 2,953 \\ g + 0,083 \\ h + 1,209 \\ \hline + 4,245 \end{array}$$

$$\begin{array}{r} 2' + 16.32 \\ h' - 0.517 \\ r' \quad 8.104 \\ \hline + 23.907 \end{array}$$

9194

Reduction to Apparent Place. 29

$$H_{\text{rel}} = 25.8 = 73^{\circ} 57' S - 571 \text{ m.l.}$$

H	b	09.3
---	---	------

α 22 ~~5153075~~ $\log \cos 89.9978$

$\alpha = 21 \quad 30.0 = -37^{\circ} 30' \quad \mu = 0.9087$

P.L. (G+H) 9.8995

Sum Gr 6 9, 7894 n

Page 8	8	9	9	9	0
--------	---	---	---	---	---

8 8 2 3 2

log sin δ 89978 m.

Ans H + L 949 17

			1	2	7	3	7
--	--	--	---	---	---	---	---

$$\Sigma H + 29.9827$$

Sec 2 0 0 0 2 2

88239

1.2127

Eng τ_{∞}^+ 0,0825

6	9	7	1	3	2	5
---	---	---	---	---	---	---

~~$$\begin{array}{r} f + 295.3 \\ g + 16.32 \\ h + 951.4 \\ \hline + 1979.0 \end{array}$$~~

~~$$\begin{array}{r} 9' 10083 \\ 4' 1209 \\ 2' 10109 \\ \hline + 9396 \end{array}$$~~

$f + 2,953$

9 + 0.083

$2 + 1 = 209$

$+ 7.245$

$2' + 16.32$

$\ln 0,517$

$x' = 8.109$

$$+ \overline{23907}$$

9194 Lunar Parallax

30

$$\begin{array}{rcl}
 \alpha' & 22 & 51 & 35.19'' & \delta' \\
 \delta & 21 & 28 & 19.35'' & \\
 \alpha - \alpha' & -1 & 23 & 15.84'' & \pi \quad 57' 16.04'' \\
 = & -20^{\circ} & 48' & 57.60'' & \\
 \frac{1}{2} \alpha - \alpha' & -7 & 33.38'' & 9.86913'' & \\
 \frac{1}{2} & & & 8.22162'' & \\
 \alpha - \alpha' - \frac{1}{2}(\alpha - \alpha') - 20 & 41 & 28.22'' & 9.55068'' & \\
 & & & 0.00164'' & \\
 & & & 7.64307'' & \\
 9.95727'' & & & & \\
 0.00000'' & & & & \\
 0.02895'' & & & & \\
 \hline
 9.98622'' & & & & \\
 \alpha - \alpha' & -15' & 06.77'' & & \\
 = & -1'' & 00.75'' & &
 \end{array}$$

$$\begin{array}{rcl}
 \delta & 44 & 05'' & 28.8'' \\
 \delta - \delta & 5 & 41 & 27.0'' \\
 \delta - \delta & 49 & 46 & 35.8''
 \end{array}$$

$$\begin{array}{rcl}
 9.82640'' & & \\
 8.22162'' & & \\
 9.88288'' & & \\
 0.15752'' & & \\
 \hline
 8.08840'' & &
 \end{array}$$

$$\delta - \delta' + 82 + 08.9''$$

$$\delta - \delta \quad 59 \quad 18.6'' \quad \alpha \quad 22 \quad 50 \quad 38.78''$$

$$\text{Am Eph} - \delta \quad 59 \quad 20.6'' \quad \text{A. Eph.} \quad 22 \quad 50 \quad 37.07''$$

$$\text{O-C} \quad + \quad 2.2'' \quad +0.70''$$

$$\begin{array}{rcl}
 \text{Curv. of Plate} & 0.0 & -0.03 \\
 2^{\text{nd}} \text{ Order Ref} & +0.1 &
 \end{array}$$

$$\text{Im Corr} \quad -0.1 \quad -0.02$$

$$\begin{array}{rcl}
 \delta - \delta & 59 & 18.7 \quad \alpha \quad 22 \quad 50 \quad 37.72 \\
 \text{O-C} & +1.9 & +0.68
 \end{array}$$

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$$\begin{array}{rcl}
 \alpha' & 22 & 51 \quad 35' 19'' \quad \delta' \\
 \delta & 21 & 28 \quad 19' 35'' \\
 \alpha - \alpha' & -1 & 23 \quad 15' 89'' \quad \pi \quad 57' 16'' 09'' \\
 & & -20'' 48' 57'' 60'' \\
 \frac{1}{2} (\alpha - \alpha') & -7 & 33' 38'' \quad 9.86913'' \\
 & & 8.22162'' \\
 \alpha - \alpha' - \frac{1}{2} (\alpha - \alpha') - 20 & 41 & 28' 22'' \quad 9.55068'' \\
 & & 0.00169'' \\
 & & 9.95727'' \\
 & & 0.00000'' \\
 & & 0.02895'' \\
 & & 9.98622''
 \end{array}$$

$$\begin{array}{rcl}
 \alpha - \alpha' & -15' & 06.87'' \\
 & & -1'' 00.95''
 \end{array}$$

$$\begin{array}{rcl}
 \delta & 99 & 05' 28.8'' \\
 \delta - \delta & 5 & 91' 27.0'' \\
 \delta - \delta & 99 & 46' 55.8''
 \end{array}$$

$$\begin{array}{rcl}
 9.82670'' \\
 8.22162'' \\
 9.88286'' \\
 0.10702'' \\
 8.08890''
 \end{array}$$

$$\delta - \delta' = +92 + 089''$$

$$\delta - \delta = 9 \quad 58 \quad 18.6'' \quad \alpha \quad 22 \quad 50 \quad 37.79''$$

$$\text{Ann Eph} - 3 \quad 59 \quad 20.6'' \quad \text{A. Eph.} \quad 22 \quad 50 \quad 39.07''$$

$$\text{C-C} \quad + \quad 2.2'' \quad +0.70''$$

$$\begin{array}{rcl}
 \text{Cur. of Plate} & 0.0 & -0.03 \\
 2^{\text{nd}} \text{ Order Ref} & +0.1 &
 \end{array}$$

