4/88

1988 LAND SURVEYOR EXAMINATION

EXAMINATION ID NUMBER_____

PART B - 48.0 POINTS OF 102.0 TOTAL POINTS

TIME ALLOWED TO COMPLETE THIS SECTION - FOUR HOURS

WORKBOOK INSTRUCTIONS

This examination is given in two, four-hour periods on the same day. The subject matter relates to the principles and practice of land surveying. Part B is the second section of this two-part examination. **YOU ARE ASKED TO CONCENTRATE YOUR WORK ON THOSE PROBLEMS IN WHICH YOU MAY DO WELL. ALTHOUGH ALL PROBLEMS SHOULD BE ATTEMPTED, YOU ARE NOT EXPECTED TO EXCEL IN ALL OF THEM.**

Each test item is contained in a separate folder appropriately marked on the front. Your answers must be completed on papers provided within each folder. **IMPORTANT: ALL SHEETS MUST BE CONTAINED IN THE APPROPRIATE FOLDER WHEN YOU TURN IN YOUR EXAMINATION.** If you need additional grid sheets, ask your proctor. Secure these additional pages within the appropriate folder.

Enter your identification number in the upper right-hand corner on **EACH PAGE** of the answer sheets where space is provided and **INDICATE THE APPROPRIATE PROBLEM NUMBER.** Do not write your name on any part of this examination.

Show all work in the folder provided for each problem. **ANY WORK NOT CONTAINED IN THE APPROPRIATE FOLDER WILL NOT BE SCORED.** Use one side of the page and do not put more than one problem in a folder. Be sure to mark your pages 1 of 3, 2 of 3, etc. Any work you do not want scored must be clearly lined through and marked "VOID" across it. Delineate the voided part clearly.

YOUR WORK IS A LAND SURVEYOR REPORT. YOUR SOLUTIONS, FINDINGS, AND STATEMENTS MUST BE ARRANGED IN AN ORDERLY MANNER WHICH IS ORGANIZED AND LEGIBLE.

After you have completed this portion of the examination, check your work, assemble the folders containing your answer sheets, and turn it in to your proctor.

This portion of the Land Surveyor Examination consists of the following:

Test Item No.	Subject Matter	Weight	Pages
B1	Construction	6.0	_____
B2	Boundary	12.0	_____
B3	Astronomy	10.0	_____
B4	Legal Description	10.0	_____
B5	Public Lands	5.0	_____
B6	Boundary	5.0	_____

FOR OFFICE USE ONLY

Department of Consumer Affairs
State Board of Registration for Professional Engineers and Land Surveyors

PROBLEM B-1 (Part A) - Wt. 2.0 points

PROBLEM STATEMENT

A proposed sewer line to service an existing easement is to be constructed on a curve as shown on the diagram below.

The radius of the curve connecting the two manholes is to be 90 feet.

Assume the B.C. of the 90' radius tangent curve is to be the center of the manhole to be constructed 6' Lt. of the road centerline.

REQUIRED

What is the centerline station of M.H. No. 1?

Show your work or no credit will be given!

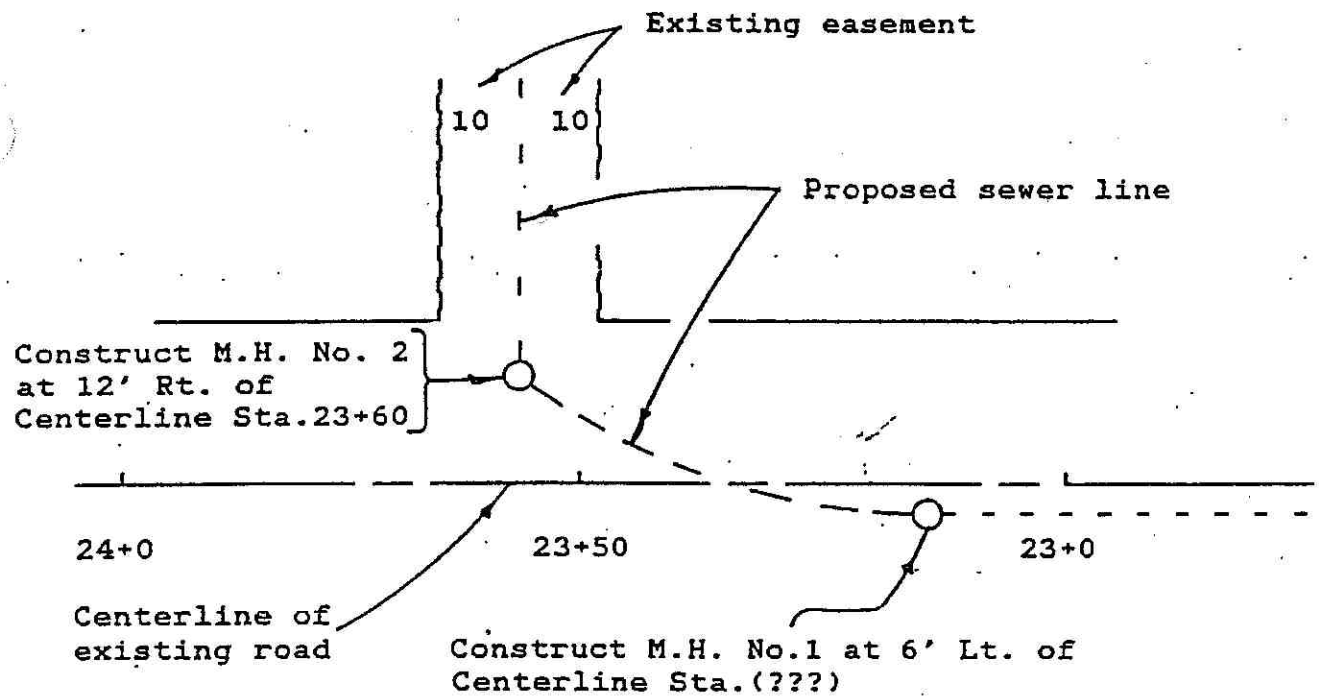


DIAGRAM IS NOT TO SCALE

****

PROBLEM B-1 (Part B) - Wt. 2.0 points

PROBLEM STATEMENT

A road is to be constructed on a uniform grade of + 4.88 percent and with a cross section as shown in the diagram.

The centerline profile grade at Station 4 + 19.88 is 378.59.

At Station 12 + 50 the ground elevation is 439.6 at the left catchpoint.

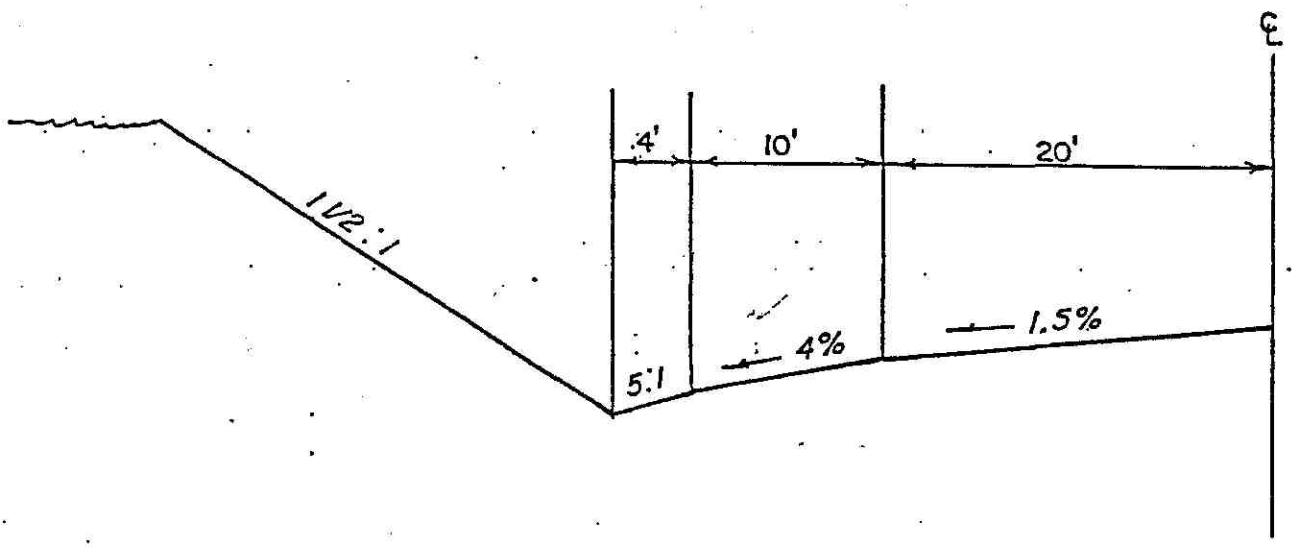
REQUIRED

What is the distance from centerline to catchpoint.

Show your work or no credit will be given!

****

DIAGRAM IS NOT TO SCALE



PROBLEM B-1 (Part C) - Wt. 2.0 points

PROBLEM STATEMENT

You have been given an improvement plan, a portion of which is shown below. The data for curves ① and ② is missing from your plan.

Assume that curves ① and ② are equal reversing curves.

REQUIRED

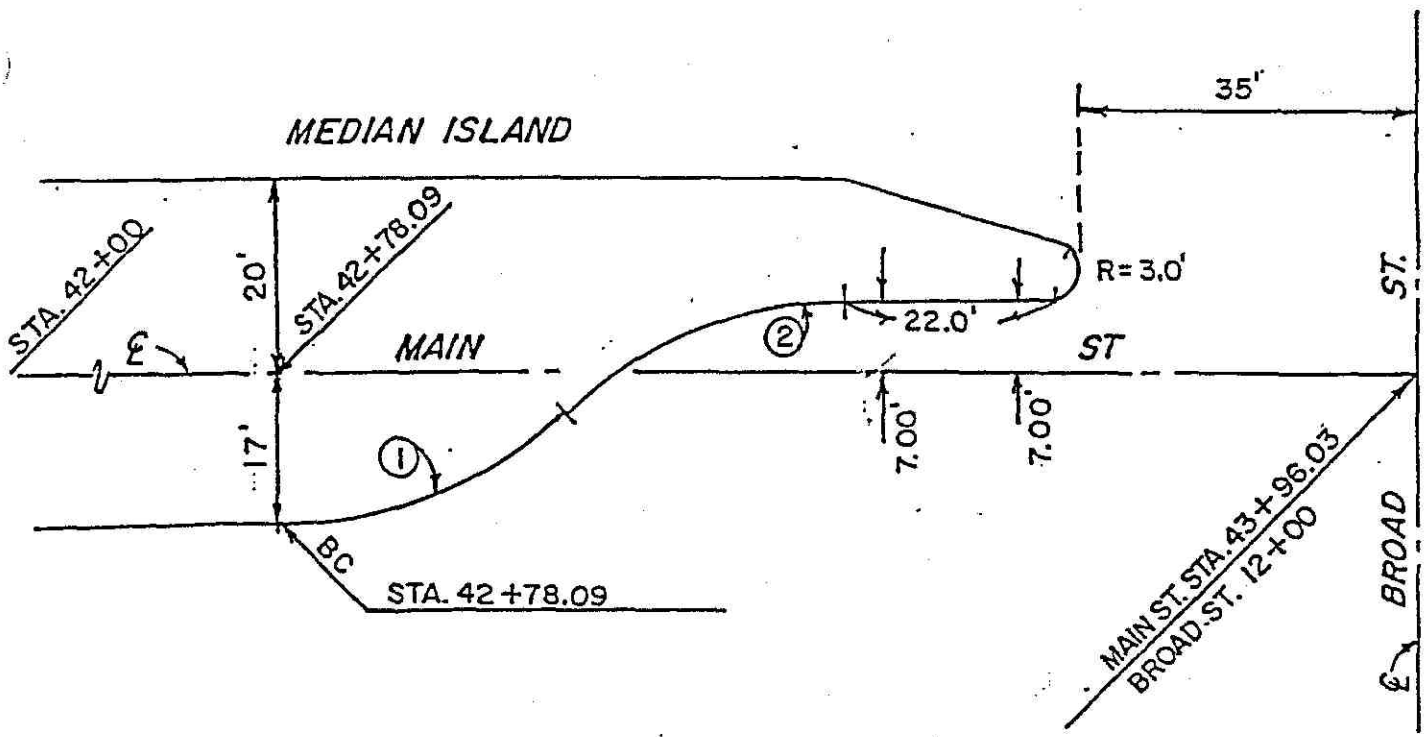
Solve for the following curve parts:

DELTA ?

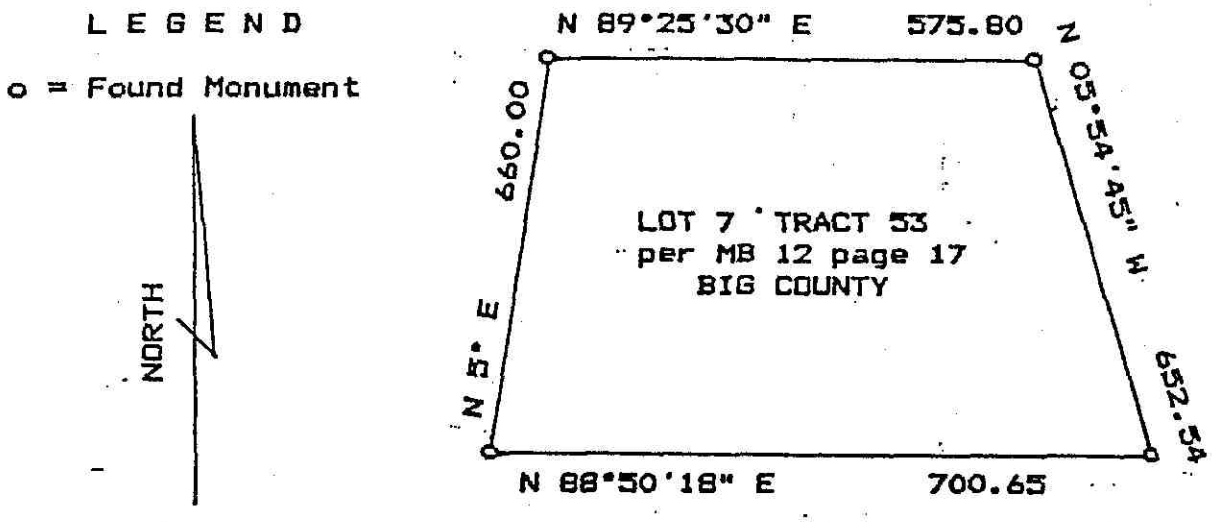
RADIUS ?

TANGENT ?

Show your work or no credit will be given!



Problem B-2 - Wt. 12 points



The sketch above shows Lot 7 of Tract 53. All of the original corners have been found and accepted. The dimensions shown are from your field survey. Lot 7 was subdivided by deeds as stated below. Mr Brown was the original owner.

1. Jan. 15, 1953 - Brown to Smith; The s'ly 200 feet of Lot 7, Tract 53, Bk 1135, Pg 3 of Deeds.

2. March 11, 1954 - Brown to Jones; The westerly 400.00 feet of Lot 7, Tract 53, as measured along the N'ly line thereof. Excepting therefrom the S'ly 200.00 feet of said Lot. Bk 1318, Pg 165 of Deeds.

3. Feb. 12, 1956 - Brown to Green; The E'ly 200.00 feet of Lot 7, excepting the S'ly 200.00 feet of said Lot 7. Bk 1827, Pg 171 of Deeds

In June of this year the County Water District wishes to purchase the remainder of Lot 7 from Jane Brown, the heir of the original owner. You have been hired by the District to monument the parcel they will purchase, prepare a legal description for it and prepare a plat map showing the dimensions of the parcel.

REQUIRED

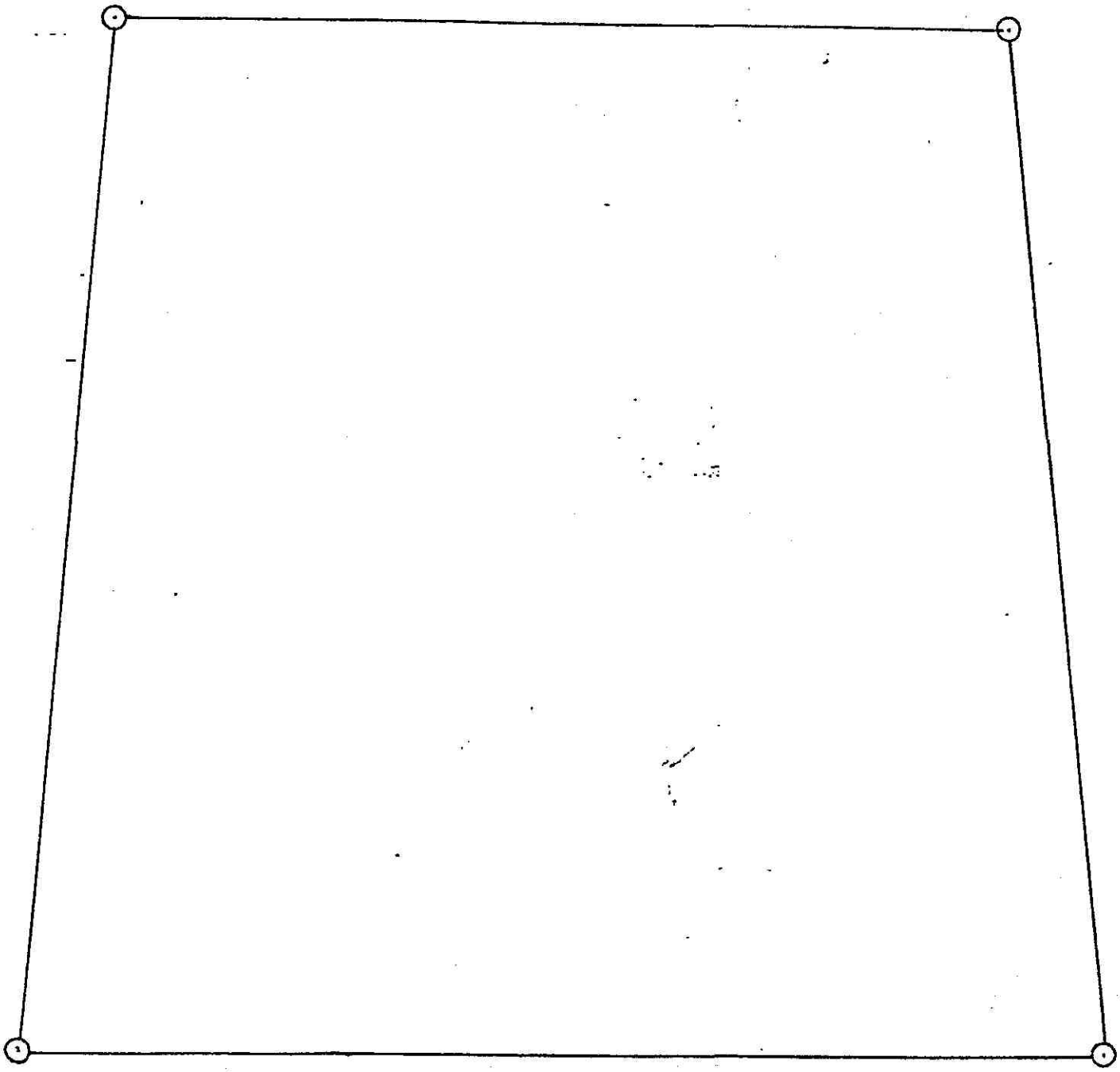
1. On the sketch provided plot the dimensions (bearings and distances) needed to properly delineate the parcel in question. Show which monuments you used for control and which ones you set.

2. Prepare a complete legal description for the parcel in question.

3. What requirements of State Law, if any, must be satisfied when your survey is completed.

Problem B-2 - Wt- 12.0 points

WORK SKETCH



Scale: 1"= 100'

Problem B-3 - Wt. 10.0 points

Answer the following questions T (true) or F (false).

NOTE : FALSE STATEMENTS REQUIRE A BRIEF EXPLANATION.

1.____ Astronomic azimuth is based on true north.
2.____ Grid azimuth is based on true north.
3.____ Geodetic azimuth is astronomic azimuth - θ + 2nd term.
4.____ To determine true north from observations on Polaris, the latitude of the observer must be known.
5.____ GHA = LHA - west longitude.
6.____ The best time to observe the sun to determine azimuth using the altitude method is 1/2 hour after sunrise or 1/2 hour before sunset.
7.____ Exact time is more important when using the hour angle method versus the altitude method.
8.____ The hour angle method requires both horizontal and vertical observations to determine the azimuth.
9.____ It is not necessary to know the latitude of the observer when using the hour angle method.
10.____ The best time to observe the sun to determine azimuth using the hour angle method is just after sunrise or just before sunset.
11.____ Standard time must be converted to local time to determine Greenwich time.
12.____ Local time is increased (in California) by 8 hours to determine Greenwich time.
13.____ True solar time is local civil time minus the equation of time.
14.____ A level line at sea level is parallel with a level line at 8000 feet.
15.____ One sidereal day is longer than one solar day measured in civil time.

WHICH OF THE FOLLOWING IS THE BEST ANSWER?

16.____ At what time will the effects of a small error in the determination of observers latitude be minimized when making azimuth observations on Polaris?
(a) 12:00 midnight
(b) when Polaris is at elongation
(c) When Polaris is at culmination
(d) when the LHA is 90 degrees
(e) when the GHA is 90 degrees

17.____ At what time will the effects of a small error in the determination of the time of observation be minimized when making azimuth observations on Polaris?
(a) 12:00 midnight
(b) when Polaris is at elongation
(c) when Polaris is at culmination
(d) when LHA is 180 degrees
(e) when GHA is 180 degrees

PROBLEM B-4 - WT. 10.0 points

PROBLEM STATEMENT

Mr. Giraf, who owns Parcels 1 thru 3 inclusive of Parcel Map No. 12,000 in the County of Calaveras, State of California as shown on the map recorded in Book 14 of Parcel Maps at page 35. He is selling Parcel 1 to Mr. Moosehead.

He needs to retain a Well easement, a pipeline easement and an access easement.

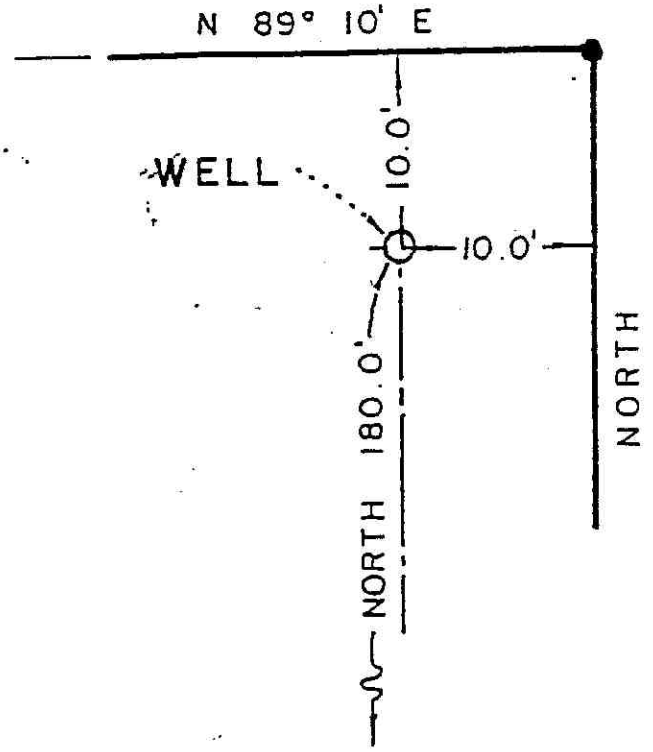
The well easement is to be 25 feet by 25 feet at the northeast corner of Parcel 1. The pipes have not been installed. Provide a 10 foot easement along the easterly line for them. The access easement is to follow the existing access road to the well and should be 20 feet wide.

The owner is not interested in doing a boundary survey of any of the parcels.

The sketch below shows the information gathered from a field survey for the easements. The road and well information shown below were not on the filed Parcel Map.

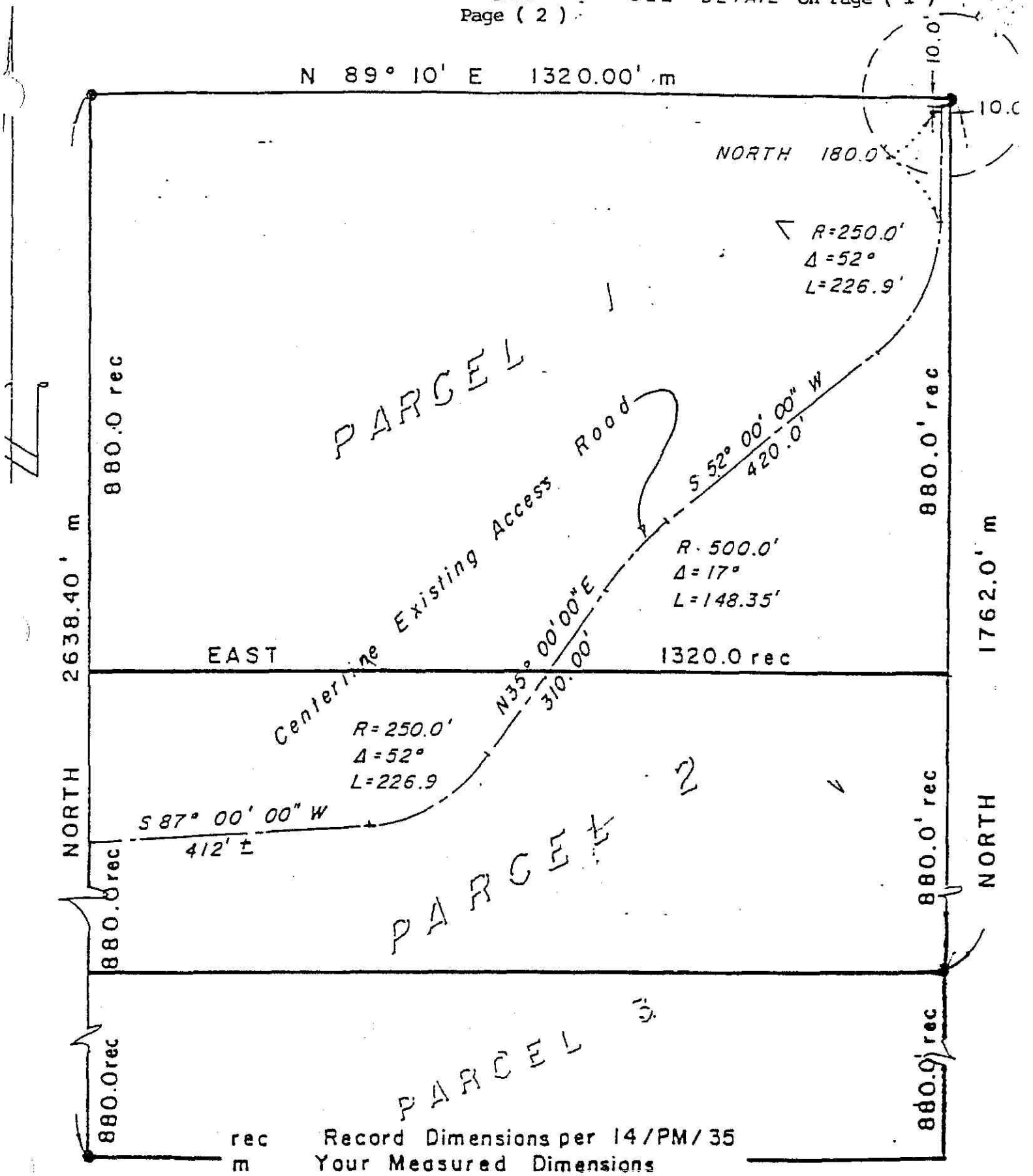
REQUIRED

Write complete descriptions for the requested easements.



DETAIL N.T.S.

SEE DETAIL on Page (1)



rec Record Dimensions per 14/PM/35

m Your Measured Dimensions

● Found Monument as shown on 14/PM/35

All Road & Well Dimensions are Your Measurements

Problem B-5 - Wt. 5.0 points

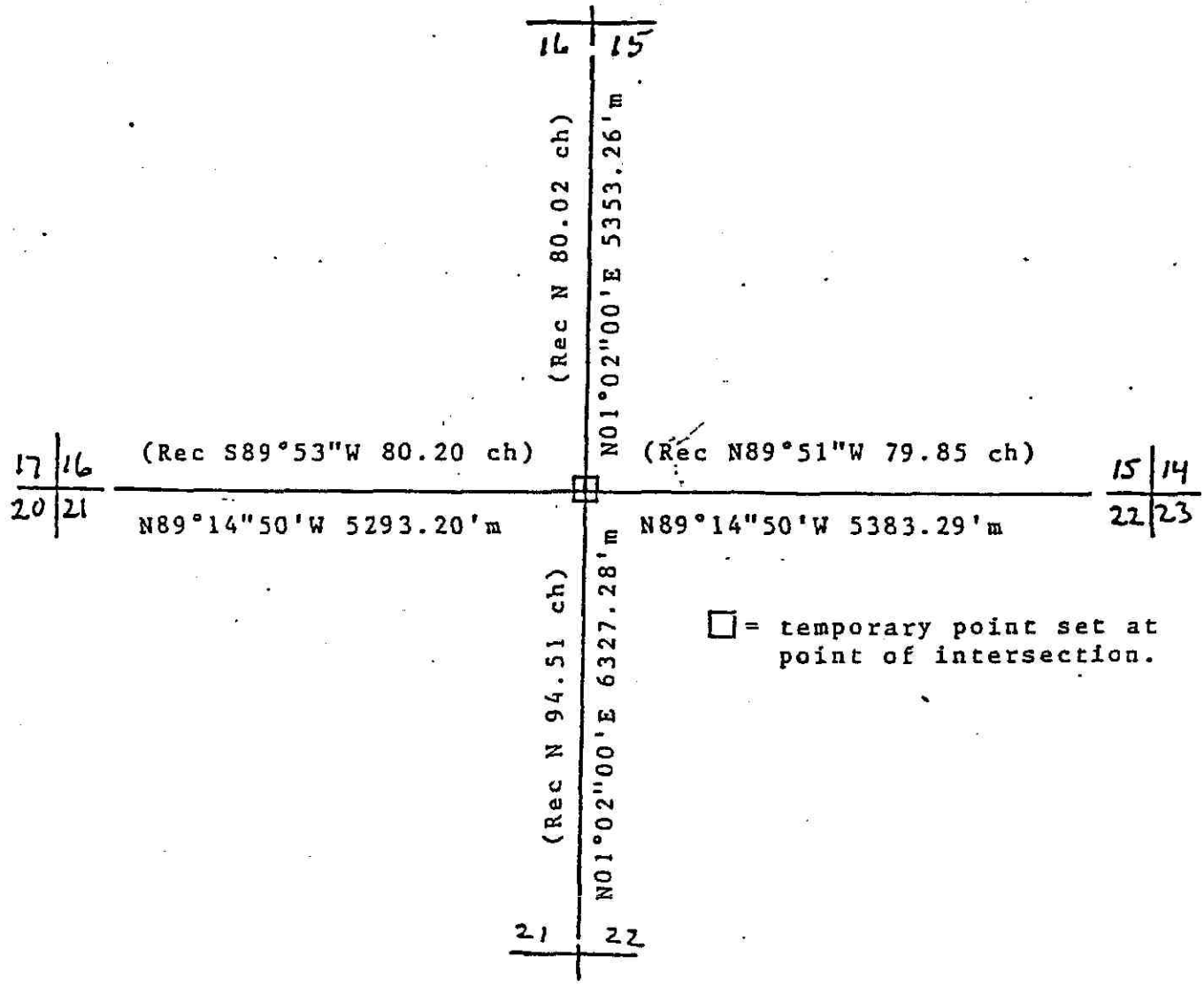
PROBLEM STATEMENT

The below data indicates record data and field measurements performed in order to reset Section Corner

16	15
21	22

REQUIRED

1. What method (name) would you use to reset this corner?
2. Describe in detail your proceedure.
3. Show all your calculations & sketch the location of the reset Section Corner.



PROBLEM B-6 - Wt. 5.0 points

PROBLEM STATEMENT

Mr. Jones owns Blackacre per map book and page which was recorded in 1929 and is a parcel of land, per record being 208 feet by 208 feet with sides north and south, east and west.

In 1933 Mr. Jones conveys by grant deed the east 100 feet to Mr. Smith.

In April 1934 Mr. Jones conveys by grant deed the west 100 feet of the east 200 feet to Mr. Brown.

In May 1934 Mr. Jones dies. His will, which is valid, leaves all of his property to his son, Mr. Jones, Jr. A Decree of Distribution takes effect in February 1935.

In June 1934 Mr. Brown conveys Blackacre, except the east 100 feet, to Mr. Green. Mr. Green discovers there may be a strip on the west still owned by Mr. Jones and obtains a quitclaim deed from Mr. Jones, Jr. in August 1934.

No other transactions appear of record.

REQUIRED

Your assignment is to survey Mr. Green's parcel. To do so you must determine Mr. Green's record of ownership of Blackacre. A field survey shows original monuments still exist and the dimensions measure 207.88 north-south and 208.05 east-west.

On the attached worksheet plot and dimension Mr. Green's parcel and explain your solution.

Problem B-6

Work Sheet

Scale: 1" = 40'

Problem B8 – continued:

APPARENT PLACE OF POLARIS AND APPARENT SIDEREAL TIME 0 HOUR UT
APRIL 1986

GCD	RIGHT ASCENSION			DECLINATION			SIDEREAL TIME		
1.0	2	15	27.843	89	12	17.217	12	36	14.042
2.0	2	15	27.419	89	12	16.977	12	40	10.603
3.0	2	15	26.901	89	12	16.737	12	44	7.163
4.0	2	15	26.302	89	12	16.487	12	48	3.720
5.0	2	15	25.658	89	12	16.220	12	52	0.273
6.0	2	15	25.015	89	12	15.931	12	55	56.824
7.0	2	15	24.420	89	12	15.621	12	59	53.373
8.0	2	15	23.910	89	12	15.293	13	3	49.920
9.0	2	15	23.510	89	12	14.954	13	7	46.468
10.0	2	15	23.226	89	12	14.611	13	11	43.017
11.0	2	15	23.050	89	12	14.271	13	15	39.567
12.0	2	15	22.962	89	12	13.940	13	19	36.121
13.0	2	15	22.932	89	12	13.623	13	23	32.676
14.0	2	15	22.929	89	12	13.320	13	27	29.234
15.0	2	15	22.922	89	12	13.032	13	31	25.792

APRIL 1986

GREENWICH HOUR ANGLE FOR THE SUN AND POLARIS FOR 0 HOUR UNIVERSAL TIME

SUN, POLARIS

DAY	GHA (SUN)	DECLINATION	EQ. OF TIME APPT-MEAN	SEMI-DIAM.	GHA (POLARIS)	DECLINATION	GREENWICH TRANSIT
	° ′ ″	° ′ ″	M S	′ ″	° ′ ″	° ′ ″	H M S
1 TU	178 58 30.9	4 20 29.7	-04 05.94	16 01.9	155 11 32.5	89 12 17.24	13 37 00.
2 W	179 02 59.6	4 43 39.0	-03 48.03	16 01.7	156 10 47.3	89 12 17.01	13 33 03.
3 TH	179 07 26.3	5 06 43.5	-03 30.25	16 01.4	157 10 03.6	89 12 16.77	13 29 07.
4 F	179 11 50.7	5 29 42.6	-03 12.62	16 01.1	158 09 21.3	89 12 16.53	13 25 10.
5 SA	179 16 12.5	5 52 36.1	-02 55.16	16 00.8	159 08 39.7	89 12 16.28	13 21 14.
6 SU	179 20 31.6	6 15 23.6	-02 37.90	16 00.5	160 07 58.1	89 12 15.97	13 17 17.
7 M	179 24 47.6	6 38 04.6	-02 20.83	16 00.2	161 07 15.7	89 12 15.66	13 13 21.
8 TU	179 29 00.3	7 00 38.9	-02 03.98	16 00.0	162 06 31.8	89 12 15.32	13 09 24.
9 W	179 33 09.6	7 23 06.0	-01 47.36	15 59.7	163 05 46.1	89 12 14.98	13 05 28.
10 TH	179 37 15.1	7 45 25.7	-01 30.99	15 59.4	164 04 58.6	89 12 14.63	13 01 32.
11 F	179 41 16.8	8 07 37.5	-01 14.88	15 59.1	165 04 09.4	89 12 14.28	12 57 36.
12 SA	179 45 14.3	8 29 41.1	-00 59.05	15 58.9	166 03 16.8	89 12 13.95	12 53 40.
13 SU	179 49 07.5	8 51 36.2	-00 43.50	15 58.6	167 02 27.2	89 12 13.63	12 49 44.
14 M	179 52 56.1	9 13 22.3	-00 28.26	15 58.3	168 01 35.3	89 12 13.32	12 45 48.
15 TU	179 56 40.0	9 34 59.1	-00 13.33	15 58.1	169 00 43.5	89 12 13.03	12 41 52.
16 W	180 00 19.0	9 56 26.3	00 01.26	15 57.8	169 59 52.2	89 12 12.76	12 37 56.
17 TH	180 03 52.7	10 17 43.6	00 15.52	15 57.6	170 59 01.6	89 12 12.49	12 34 00.
18 F	180 07 21.1	10 38 50.5	00 29.41	15 57.3	171 58 12.0	89 12 12.23	12 30 04.
19 SA	180 10 44.0	10 59 46.7	00 42.93	15 57.0	172 57 23.2	89 12 11.96	12 26 08.
20 SU	180 14 01.0	11 20 31.9	00 56.07	15 56.8	173 56 34.9	89 12 11.67	12 22 12.
21 M	180 17 12.0	11 41 05.8	01 08.80	15 56.5	174 55 46.5	89 12 11.37	12 18 16.
22 TU	180 20 16.8	12 01 28.1	01 21.12	15 56.3	175 54 57.1	89 12 11.05	12 14 20.
23 W	180 23 15.1	12 21 38.4	01 33.01	15 56.0	176 54 05.8	89 12 10.70	12 10 24.
24 TH	180 26 06.7	12 41 36.4	01 44.45	15 55.8	177 53 11.8	89 12 10.35	12 06 28.
25 F	180 28 51.4	13 01 21.9	01 55.42	15 55.5	178 52 15.2	89 12 10.01	12 02 32.
26 SA	180 31 28.8	13 20 54.7	02 05.92	15 55.2	179 51 16.6	89 12 09.68	11 58 37.
27 SU	180 33 58.8	13 40 14.3	02 15.92	15 55.0	180 50 17.0	89 12 09.39	11 54 41.
28 M	180 36 21.2	13 59 20.6	02 25.41	15 54.7	181 49 17.8	89 12 09.13	11 50 46.
29 TU	180 38 35.7	14 18 13.2	02 34.38	15 54.5	182 48 19.9	89 12 08.88	11 46 51.
30 W	180 40 42.3	14 36 51.7	02 42.82	15 54.2	183 47 23.9	89 12 08.65	11 42 55.

Problem B8 – continued:

TABLE 5

Increase in GHA for Elapsed Time.

Min.	Hours of Greenwich Civil Time 0h		1h		2h		3h	
	°	′	°	′	°	′	°	′
0	0	0.0	15	2.5	30	4.9	45	7.4
1	0	15.0	15	17.5	30	19.9	45	22.4
2	0	30.1	15	32.5	30	35.0	45	37.5
3	0	45.1	15	47.6	30	50.1	45	52.5
4	1	0.2	16	2.6	31	5.1	46	7.6
5	1	15.2	16	17.7	31	20.1	46	22.6
6	1	30.2	16	32.7	31	35.2	46	37.6
7	1	45.3	16	47.8	31	50.2	46	52.7
8	2	0.3	17	2.8	32	5.3	47	7.7
9	2	15.4	17	17.8	32	20.3	47	22.8
10	2	30.4	17	32.9	32	35.3	47	37.8
11	2	45.5	17	47.9	32	50.4	47	52.8
12	3	0.5	18	3.0	33	5.4	48	7.9
13	3	15.5	18	18.0	33	20.5	48	22.9
14	3	30.6	18	33.0	33	35.5	48	38.0
15	3	45.6	18	48.1	33	50.5	48	53.0
16	4	0.7	19	3.1	34	5.6	49	8.0
17	4	15.7	19	18.2	34	20.6	49	23.1
18	4	30.7	19	33.2	34	35.7	49	38.1
19	4	45.8	19	48.2	34	50.7	49	53.2
20	5	0.8	20	3.3	35	5.7	50	8.2
21	5	15.9	20	18.3	35	20.8	50	23.3
22	5	30.9	20	33.4	35	35.8	50	38.3
23	5	45.9	20	48.4	35	50.9	50	53.3
24	6	1.0	21	3.4	36	5.9	51	8.4
25	6	16.0	21	18.5	36	21.0	51	23.4
26	6	31.1	21	33.5	36	36.0	51	38.5
27	6	46.1	21	48.6	36	51.0	51	53.5
28	7	1.1	22	3.6	37	6.1	52	8.5
29	7	16.2	22	18.7	37	21.1	52	23.6
30	7	31.2	22	33.7	37	36.2	52	38.6
31	7	46.3	22	48.7	37	51.2	52	53.7
32	8	1.3	23	3.8	38	6.2	53	8.7
33	8	16.4	23	18.8	38	21.3	53	23.7
34	8	31.4	23	33.9	38	36.3	53	38.8
35	8	46.4	23	48.9	38	51.4	53	53.8
36	9	1.5	24	3.9	39	6.4	54	8.9
37	9	16.5	24	19.0	39	21.4	54	23.9
38	9	31.6	24	34.0	39	36.5	54	39.0
39	9	46.6	24	49.1	39	51.5	54	54.0
40	10	1.6	25	4.1	40	6.6	55	9.0
41	10	16.7	25	19.1	40	21.6	55	24.1
42	10	31.7	25	34.2	40	36.7	55	39.1
43	10	46.8	25	49.2	40	51.7	55	54.2
44	11	1.8	26	4.3	41	6.7	56	9.2
45	11	16.8	26	19.3	41	21.8	56	24.2
46	11	31.9	26	34.4	41	36.8	56	39.3
47	11	46.9	26	49.4	41	51.9	56	54.3
48	12	2.0	27	4.4	42	6.9	57	9.4
49	12	17.0	27	19.5	42	21.9	57	24.4
50	12	32.1	27	34.5	42	37.0	57	39.4
51	12	47.1	27	49.6	42	52.0	57	54.5
52	13	2.1	28	4.6	43	7.1	58	9.5
53	13	17.2	28	19.6	43	22.1	58	24.6
54	13	32.2	28	34.7	43	37.1	58	39.6
55	13	47.3	28	49.7	43	52.2	58	54.6
56	14	2.3	29	4.8	44	7.2	59	9.7
57	14	17.3	29	19.8	44	22.3	59	24.7
58	14	32.4	29	34.8	44	37.3	59	39.8
59	14	47.4	29	49.9	44	52.4	59	54.8
60	15	2.5	30	4.9	45	7.4	60	9.9

Sec.	Corr.
	′
0	0.0
1	0.3
2	0.5
3	0.8
4	1.0
5	1.3
6	1.5
7	1.8
8	2.0
9	2.3
10	2.5
11	2.8
12	3.0
13	3.3
14	3.5
15	3.8
16	4.0
17	4.3
18	4.5
19	4.8
20	5.0
21	5.3
22	5.5
23	5.8
24	6.0
25	6.3
26	6.5
27	6.8
28	7.0
29	7.3
30	7.5
31	7.8
32	8.0
33	8.3
34	8.5
35	8.8
36	9.0
37	9.3
38	9.5
39	9.8
40	10.0
41	10.3
42	10.5
43	10.8
44	11.0
45	11.3
46	11.5
47	11.8
48	12.0
49	12.3
50	12.5
51	12.8
52	13.0
53	13.3
54	13.5
55	13.8
56	14.0
57	14.3
58	14.5
59	14.8
60	15.0

TABLE 5—(Continued)

Increase in GHA for Elapsed Time.

Min.	Hours of Greenwich Civil Time 4h		5h		6h		7h		8h		9h	
	°	′	°	′	°	′	°	′	°	′	°	′
0	60	9.9	75	12.3	90	14.8	105	17.2	120	19.7	135	22.2
1	60	24.9	75	27.4	90	29.8	105	32.3	120	34.8	135	37.2
2	60	39.9	75	42.4	90	44.9	105	47.3	120	49.8	135	52.3
3	60	55.0	75	57.4	90	59.9	106	2.4	121	4.8	136	7.3
4	61	10.0	76	12.5	91	14.9	106	17.4	121	19.9	136	22.3
5	61	25.1	76	27.5	91	30.0	106	32.5	121	34.9	136	37.4
6	61	40.1	76	42.6	91	45.0	106	47.5	121	50.0	136	52.4
7	61	55.1	76	57.6	92	0.1	107	2.5	122	5.0	137	7.5
8	62	10.2	77	12.6	92	15.1	107	17.6	122	20.0	137	22.5
9	62	25.2	77	27.7	92	30.2	107	32.6	122	35.1	137	37.5
10	62	40.3	77	42.7	92	45.2	107	47.7	122	50.1	137	52.6
11	62	55.3	77	57.8	93	0.2	108	2.7	123	5.2	138	7.6
12	63	10.3	78	12.8	93	15.3	108	17.7	123	20.2	138	22.7
13	63	25.4	78	27.9	93	30.3	108	32.8	123	35.2	138	37.7
14	63	40.4	78	42.9	93	45.4	108	47.8	123	50.3	138	52.8
15	63	55.5	78	57.9	94	0.4	109	2.9	124	5.3	139	7.8
16	64	10.5	79	13.0	94	15.4	109	17.9	124	20.4	139	22.8
17	64	25.6	79	28.0	94	30.5	109	32.9	124	35.4	139	37.9
18	64	40.6	79	43.1	94	45.5	109	48.0	124	50.4	139	52.9
19	64	55.6	79	58.1	95	0.6	110	3.0	125	5.5	140	8.0
20	65	10.7	80	13.1	95	15.6	110	18.1	125	20.5	140	23.0
21	65	25.7	80	28.2	95	30.6	110	33.1	125	35.6	140	38.0
22	65	40.8	80	43.2	95	45.7	110	48.2	125	50.6	140	53.1
23	65	55.8	80	58.3	96	0.7	111	3.2	126	5.7	141	8.1
24	66	10.8	81	13.3	96	15.8	111	18.2	126	20.7	141	23.2
25	66	25.9	81	28.3	96	30.8	111	33.3	126	35.7	141	38.2
26	66	40.9	81	43.4	96	45.8	111	48.3	126	50.8	141	53.2
27	66	56.0	81	58.4	97	0.9	112	3.4	127	5.8	142	8.3
28	67	11.0	82	13.5	97	15.9	112	18.4	127	20.9	142	23.3
29	67	26.0	82	28.5	97	31.0	112	33.4	127	35.9	142	38.4
30	67	41.1	82	43.6	97	46.0	112	48.5	127	50.9	142	53.4
31	67	56.1	82	58.6	98	1.1	113	3.5	128	6.0	143	8.4
32	68	11.2	83	13.6	98	16.1	113	18.6	128	21.0	143	23.5
33	68	26.2	83	28.7	98	31.1	113	33.6	128	36.1	143	38.5
34	68	41.2	83	43.7	98	46.2	113	48.6	128	51.1	143	53.6
35	68	56.3	83	58.8	99	1.2	114	3.7	129	6.1	144	8.6
36	69	11.3	84	13.8	99	16.3	114	18.7	129	21.2	144	23.7
37	69	26.4	84	28.8	99	31.3	114	33.8	129	36.2	144	38.7
38	69	41.4	84	43.9	99	46.3	114	48.8	129	51.3	144	53.7
39	69	56.5	84	58.9	100	1.4	115	3.9	130	6.3	145	8.8
40	70	11.5	85	14.0	100	16.4	115	18.9	130	21.4	145	23.8
41	70	26.5	85	29.0	100	31.5	115	33.9	130	36.4	145	38.9
42	70	41.6	85	44.0	100	46.5	115	49.0	130	51.4	145	53.9
43	70	56.6	85	59.1	101	1.5	116	4.0	131	6.5	146	8.9
44	71	11.7	86	14.1	101	16.6	116	19.1	131	21.5	146	24.0
45	71	26.7	86	29.2	101	31.6	116	34.1	131	36.6	146	39.0
46	71	41.7	86	44.2	101	46.7	116	49.1	131	51.6	146	54.1
47	71	56.8	86	59.2	102	1.7	117	4.2	132	6.6	147	9.1
48	72	11.8	87	14.3	102	16.8	117	19.2	132	21.7	147	24.1
49	72	26.9	87	29.3	102	31.8	117	34.3	132	36.7	147	39.2
50	72	41.9	87	44.4	102	46.8	117	49.3	132	51.8	147	54.2
51	72	56.9	87	59.4	103	1.9	118	4.3	133	6.8	148	9.3
52	73	12.0	88	14.5	103	16.9	118	19.4	133	21.8	148	24.3
53	73	27.0	88	29.5	103	32.0	118	34.4	133	36.9	148	39.3
54	73	42.1	88	44.5	103	47.0	118	49.5	133	51.9	148	54.4
55	73	57.1	88	59.6	104	2.0	119	4.5	134	7.0	149	9.4
56	74	12.2	89	14.6	104	17.1	119	19.5	134	22.0	149	24.5
57	74	27.2	89	29.7	104	32.1	119	34.6	134	37.0	149	39.5
58	74	42.2	89	44.7	104	47.2	119	49.6	134	52.1	149	54.6
59	74	57.3	89	59.7	105	2.2	120	4.7	135	7.1	150	9.6
60	75	12.3	90	14.8	105	17.2	120	19.7	135	22.2	150	24.6

Problem B8 - continued:

TABLE 2

REFRACTION AND SUN'S PARALLAX

(To be applied to observed altitudes. See page 16)

Bar. = 29.6 in. Temp. = 50° F

Measured Altitude	Refraction	Sun's Par.	Measured Altitude	Refraction	Sun's Par.
° ′	′	′	° ′	′	′
7 30	6.88	0.15	17 30	3.02	0.14
7 40	6.75	0.15	18 00	2.93	0.14
7 50	6.62	0.15	18 30	2.85	0.14
8 00	6.50	0.15	19 00	2.77	0.14
8 10	6.37	0.15	19 30	2.70	0.14
8 20	6.25	0.15	20 00	2.62	0.14
8 30	6.13	0.15	21 00	2.48	0.14
8 40	6.02	0.15	22 00	2.36	0.14
8 50	5.92	0.15	23 00	2.25	0.14
9 00	5.82	0.15	24 00	2.15	0.14
9 10	5.72	0.15	25 00	2.05	0.14
9 20	5.63	0.15	26 00	1.96	0.13
9 30	5.53	0.15	27 00	1.88	0.13
9 40	5.43	0.15	28 00	1.80	0.13
9 50	5.34	0.15	29 00	1.73	0.13
10 00	5.26	0.15	30 00	1.66	0.13
10 20	5.10	0.15	32 00	1.53	0.13
10 40	4.95	0.14	34 00	1.42	0.12
11 00	4.81	0.14	36 00	1.32	0.12
11 20	4.67	0.14	38 00	1.23	0.12
11 40	4.54	0.14	40 00	1.15	0.11
12 00	4.42	0.14	42 00	1.07	0.11
12 30	4.25	0.14	44 00	1.00	0.11
13 00	4.09	0.14	46 00	0.93	0.10
13 30	3.93	0.14	48 00	0.86	0.10
14 00	3.78	0.14	50 00	0.80	0.09
14 30	3.65	0.14	55 00	0.67	0.08
15 00	3.53	0.14	60 00	0.55	0.07
15 30	3.42	0.14	65 00	0.45	0.06
16 00	3.32	0.14	70 00	0.35	0.05
16 30	3.22	0.14	80 00	0.17	0.03
17 00	3.12	0.14	90 00	0.00	0.00

The refraction values in Table 2 are corrected by multiplying them by the multipliers in Table 2a when the barometric pressure and the temperature differ from those on which Table 2 is based, i. e. 29.6 inches and 50° F.

If the barometric pressure is not known, it may be estimated from the elevation of the locality in accordance with the values given in Table 2a. Otherwise the elevations are disregarded.

TABLE 2a

To correct Table 2. See Examples below.

MULTIPLIERS FOR OBSERVED BAROMETRIC PRESSURE OR ELEVATION

Bar. (Inches)	Elev. (Feet)	Multiplier	Bar. (Inches)	Elev. (Feet)	Multiplier
30.5	− 451	1.03	23.9	+ 6194	0.81
30.2	− 181	1.02	23.6	6538	0.80
30.0	00	1.01	23.3	6887	0.79
			23.0	7239	0.78
29.9	+ 91	1.01			
29.6	366	1.00	22.7	7597	0.77
29.3	643	0.99	22.4	7960	0.76
29.0	924	0.98	22.1	8327	0.75
28.7	1207	0.97	21.8	8700	0.74
28.4	1493	0.96	21.5	9077	0.73
28.1	1783	0.95	21.2	9460	0.72
27.8	2075	0.94	20.9	9848	0.71
27.5	2371	0.93	20.6	10242	0.70
27.2	2670	0.92	20.3	10642	0.69
			20.0	11047	0.68
26.9	2972	0.91			
26.6	3277	0.90	19.7	11458	0.67
26.3	3586	0.89	19.4	11875	0.66
26.0	3899	0.88	19.1	12299	0.65
25.7	4215	0.87	18.8	12729	0.64
25.4	4535	0.86	18.5	13165	0.63
25.1	4859	0.85	18.2	13608	0.62
24.8	5186	0.84	17.9	14058	0.61
24.5	5518	0.83			
24.2	5854	0.82			

MULTIPLIERS FOR TEMPERATURE

Temp. Deg. F	Multiplier	Temp. Deg. F	Multiplier	Temp. Deg. F	Multiplier
− 20	1.16	+ 30	1.04	+ 80	0.94
− 10	1.13	+ 40	1.02	+ 90	0.93
0	1.11	+ 50	1.00	+100	0.91
+ 10	1.08	+ 60	0.98	+110	0.90
+ 20	1.06	+ 70	0.96	+120	0.88

Example. Sun: Meas. Alt. = 30°; Bar. = 26 in. or Elev. 3900 ft.; Temp. 70° F.
Refraction = 1.66′ (0.88) (0.96) = 1.40′. Parallax = 0.13′.
True Alt. = 30° 00.00′ − 1.40′ + 0.13′ = 29° 58.73′.

Example. Star: Meas. Alt. = 25°; Bar. = 24.5 or Elev. 5518 ft.; Temp. 10° F.
Refraction = 2.05′ (0.83) (1.09) = 1.84′.
True Alt. = 25° 00.00′ − 1.84′ = 24° 58.16′.