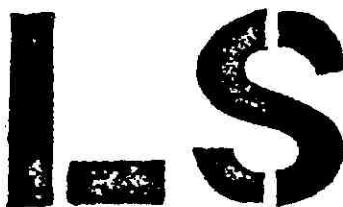


CALIFORNIA STATE BOARD OF REGISTRATION
FOR PROFESSIONAL ENGINEERS



1982

LAND SURVEYOR

PRINCIPLES AND PRACTICE

1. 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 "C" is the first of two parts.
2. In the workbook, you are to work ALL Problems C-1 through C-7. There are no optional questions.
3. You may withdraw from scoring any part of your work by isolating that part, and writing "VOID" across it. Delineate the voided part clearly.
4. Enter your identification number in the upper right-hand corner on EACH PAGE of the workbook where space is provided and IDENTIFY THE PROBLEM NUMBER according to the schedule given in (6) below.
5. Read the instructions on the workbook cover page.
6. This portion of the Land Surveyors Examination consists of the following:

Problem C-1	5	Points
Problem C-2	5	Points
Problem C-3	10	Points
Problem C-4	7.5	Points
Problem C-5	7.5	Points
Problem C-6	5	Points
Problem C-7	10	Points
<hr/>		
TOTAL	50	Points

YOU ARE TO WORK ALL 7 PROBLEMS

7. After you have completed this portion of the examination, check the problem order, include all pages, and turn it in to the Examination Proctor.
8. You may keep this set of examination questions.

**LS-C
1982
Page 1**

**TURN THIS PAGE IMMEDIATELY AND BEGIN YOUR
EXAMINATION**

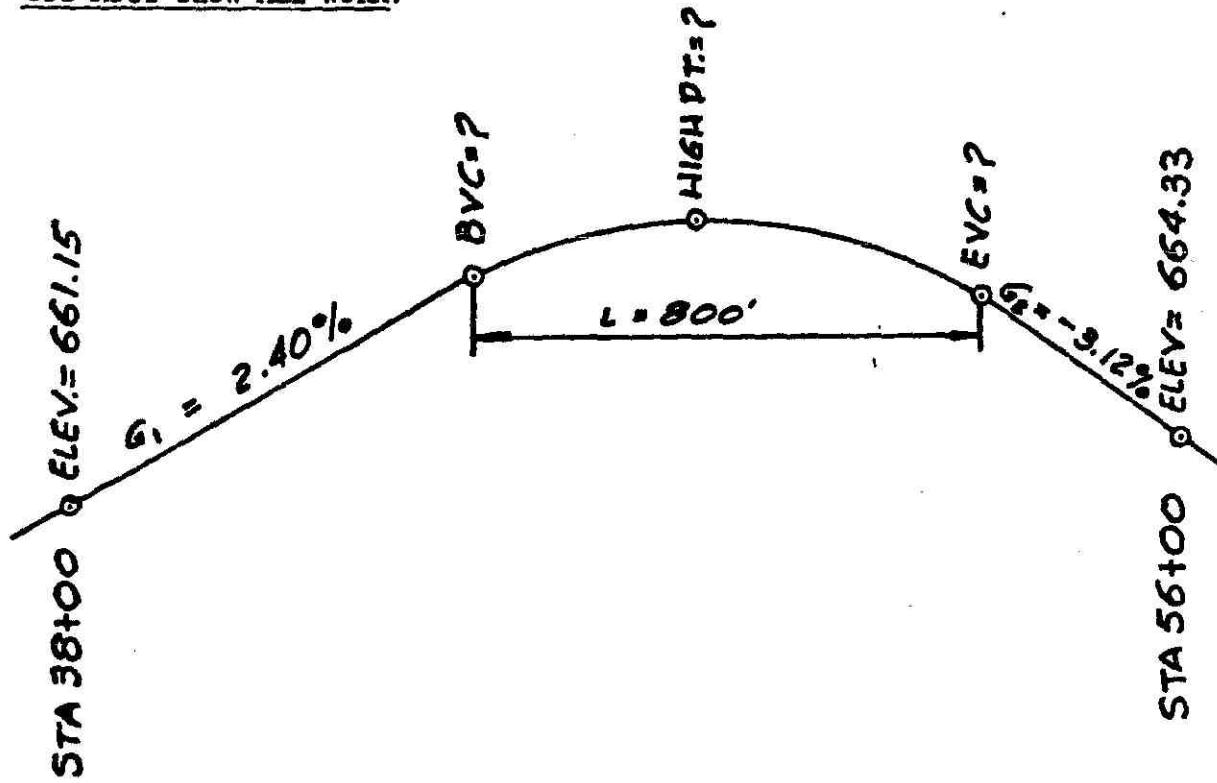
Problem C-1 (5 Points)

REQUIRED

VERTICAL CURVE

Given the data shown below, calculate the STATIONING AND ELEVATION at the B.V.C., E.V.C., and the HIGH POINT. Answers are to be given to the nearest 1/100 of a foot.

YOU MUST SHOW ALL WORK:



GIVEN:

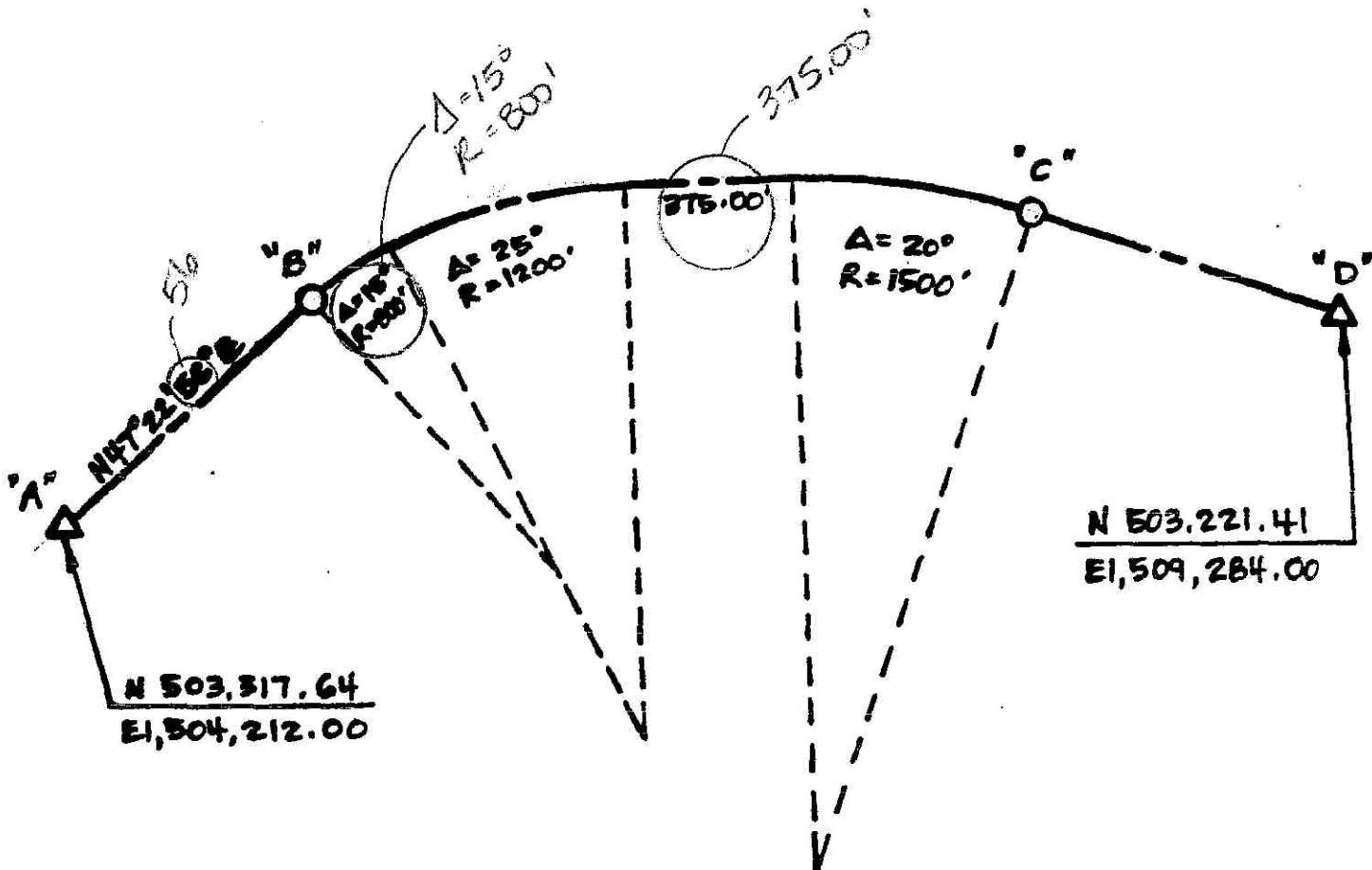
1. DATA SHOWN ON THIS SHEET. MAKE NO ASSUMPTIONS.
2. SCALE FACTOR = 0.9999612.
3. REDUCTION FACTOR = 0.99997608. (TO SEA LEVEL)
4. ALL DISTANCES SHOWN ARE GROUND DISTANCES.
5. ALL BEARINGS SHOWN ARE GRID BEARINGS.

SOLVE, TO THE NEAREST HUNDREDTH, FOR:

1. GROUND DISTANCE A-B.
2. GROUND DISTANCE C-D.
3. LAMBERT COORDINATES FOR POINT B.
4. LAMBERT COORDINATES FOR POINT C.

YOU MUST SHOW ALL WORK

NOT TO SCALE



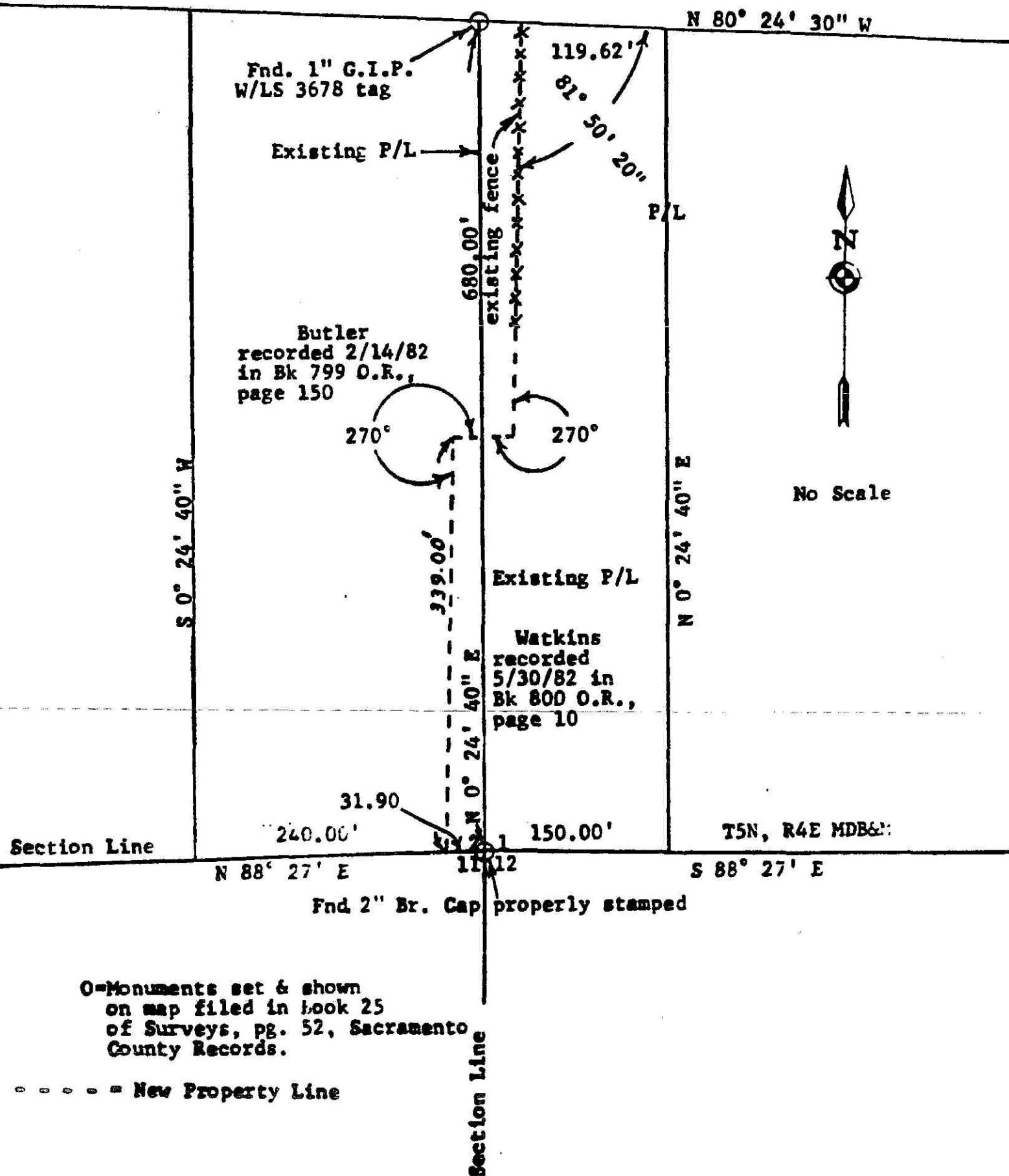
NOTE: ALL CURVES ARE TANGENT.

Problem C-3 (10 Points)

REQUIRED

You have been commissioned to monument the angle points for a lot line adjustment and prepare a legal description for both owners. Mrs. Butler and Mr. Watkins have agreed that the location of the existing fence will control the location of the new property line in the front of the property and approximately equal areas will be exchanged. Refer to attached sketch for field and record information. Scaled distances are NOT acceptable. Work need not be shown. Calculate all necessary information and write a complete metes and bounds description for both parcels.

Greenpoint Rd Co. No. 123



Problem C-4 (7.5 Points)

REQUIRED

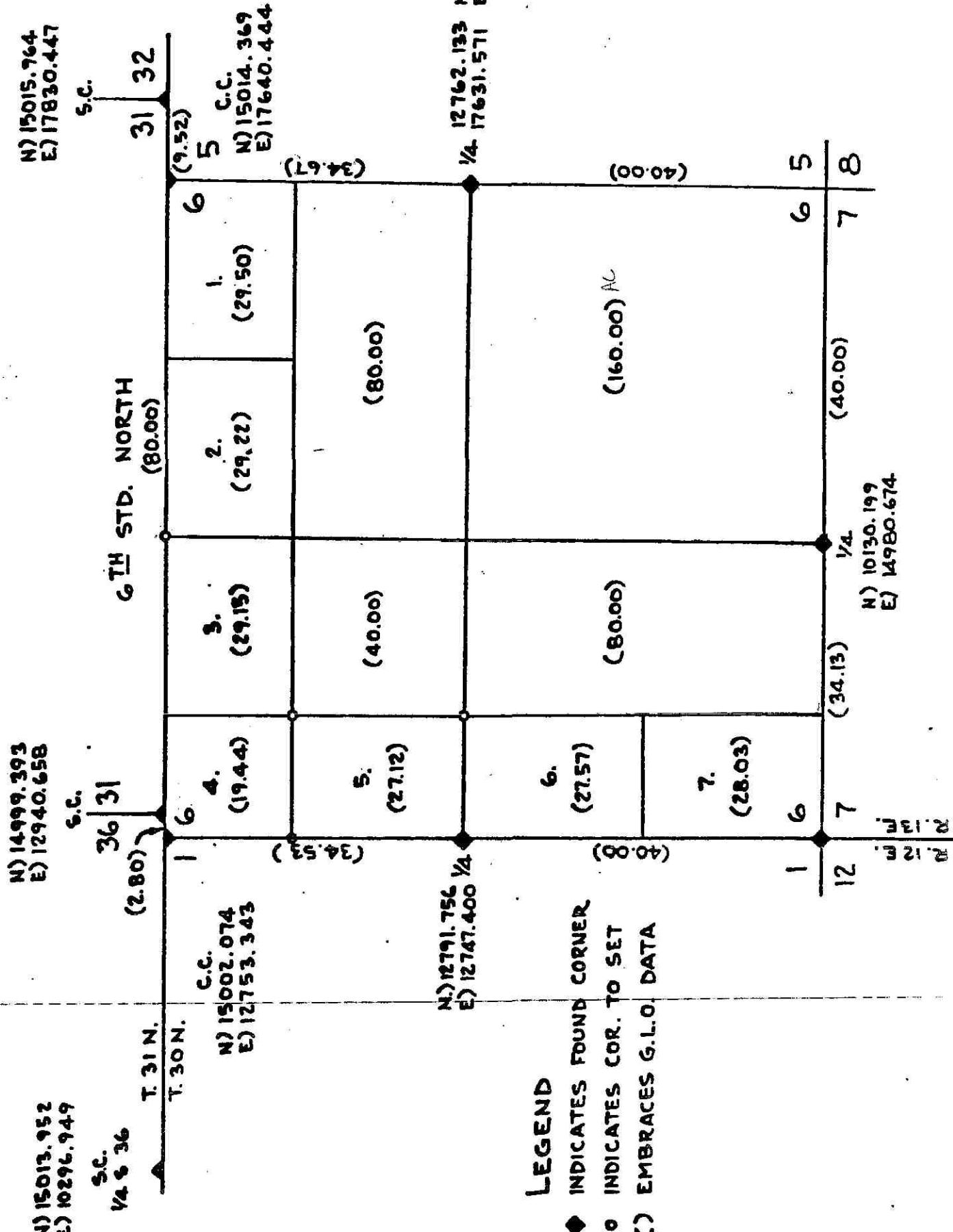
You have been retained to locate and monument Government Lot 5 of Section 6 as shown on the sketch. Coordinates of existing monuments are shown. All other monuments are considered lost. G.L.O. Data is shown in brackets.

What are the coordinates of the following corners?

1. Northwest corner Section 6.
2. Northeast corner Section 6.
3. North Quarter corner Section 6.
4. Center Quarter corner Section 6.
5. Northwest corner of Lot 5.
6. Southeast corner of Lot 5 (CW1/16).
7. CN1/16 corner Section 6.
8. Northeast corner Lot 5.

Problem C-4 (7.5 Points)

REQUIRED



Problem C-5 (7.5 Points)

REQUIRED

The following questions pertain to existing State Law, U.S. Government Law and principles of boundary control. Complete the sentence by providing the missing words. Use only the number of words indicated.

1. Owners of a parcel of land created prior to March 4, 1972 may be required to obtain a _____ prior to obtaining a permit or other grant of approval for development of the parcel.
2. A final map shall be required for all subdivisions creating five or more parcels except where each parcel created has a gross area of _____ or more, and has an approved access to a _____ or _____.
3. If the surveyor or engineer of record dies prior to setting the monuments shown on a recorded map, another surveyor or engineer may set the monuments but must file a _____ or an _____, prior to setting.
4. A record of survey may not show the division of a parcel of land shown on the latest adapted county assessment roll as a unit or as contiguous units unless there is attached there to a _____ by the county surveyor or city engineer.
5. A "lost" interior section corner in a township must be restored by the _____ method.
6. An _____ right that grows into a fee right extinguishes all other rights and ranks first in importance of conflicting elements in boundary determination.
7. A quit claim deed carries no _____ rights.
8. A _____ law takes precedence over common law.

Problem C-5 (7.5 Points)

REQUIRED

9. The county recorder shall not have more than _____ within which to examine a final or parcel map and either _____ or _____ it for filing.
10. A _____ corner determines the direction of a line, not necessarily its terminus. (public lands)
11. Monuments called for in a deed, either directly or by reference to a plat which the parties acted by are subordinate to _____ rights, but are superior to _____, _____ and _____.
12. The filing for record of a final or parcel map by the county recorder shall automatically and finally determine the validity of such map and when recorded shall impart _____ notice thereof.
13. Every licensed land surveyor or registered civil engineer may administer and certify _____ when it becomes necessary to take testimony for the identification and establishment of _____ or _____ corners.
14. Excess or deficiency occurring within a block should not be _____ among other blocks.
15. When the end lot measurement is not given, all the excess or deficiency is presumed to be given to _____.
16. Proportionate measurement can not be used to alter an acceptable original _____ position.
17. An approved or conditionally approved tentative map shall expire _____ after its approval or conditional approval or after such additional period of time as may be prescribed by local ordinance, not exceed an additional _____.

Problem C-5 (7.5 Points)

REQUIRED

18. _____ refers to a map made for the purpose of showing the design and improvement of a proposed subdivision.
- 19.. The term _____ is applied to a new measurement made on a line to determine one or more positions on that line.
20. A lost closing corner will be re-established on the _____ that was closed upon and at the proper proportional interval between the _____ _____ to the right and left.

Problem C-6 (5 Points)

REQUIRED

- A) Give five examples of current State and National problems being discussed in the surveying profession:

B) Give seven examples of criteria generally discussed as a requirement in being a Professional Land Surveyor:

C) List five periodical publications available to Land Surveyors, which relate directly to land surveying in the nation and State of California.

Problem C-7 (10 Points)

REQUIRED

- (A) You have received the topographic map shown from a photogrammetric firm and have made a field check to determine its accuracy by running diagonal profiles from the northwest corner to the southeast corner and from the northeast corner to the southwest corner. The distances and elevations of your check profiles are shown.

Assume that National Map Accuracies require that 90% of all contours must check within one half of a contour interval and all contours must check within one contour interval. Further 90% of all spot elevations determined photogrammetrically must check within one quarter of a contour interval and all spot elevations must check within one half of a contour interval.

Compute the differences between the photogrammetric contours or the spot elevations determined photogrammetrically and your check profiles. Show the differences in the space provided next to the field elevations. Indicate which check elevations meet National Map Accuracy Standards for the indicated contour interval or spot elevation in the space next to the elevation differences. Does the map pass or fail this test for National Map Accuracies?

CHECK PROFILE FROM A TO C

Dist.	Elev.	Diff.	Pass	Fail
0	54.2	—	—	—
321	56.5	—	—	—
402	57.0	—	—	—
555	57.2	—	—	—
642	56.3	—	—	—
867	54.1	—	—	—
902	52.9	—	—	—
921	53.5	—	—	—
1006	55.2	—	—	—
1148	57.0	—	—	—
1268	59.3	—	—	—
1380	59.2	—	—	—
1543	61.3	—	—	—
1722	62.0	—	—	—
1739	63.8	—	—	—
1761	66.3	—	—	—
1780	68.8	—	—	—
1799	71.3	—	—	—

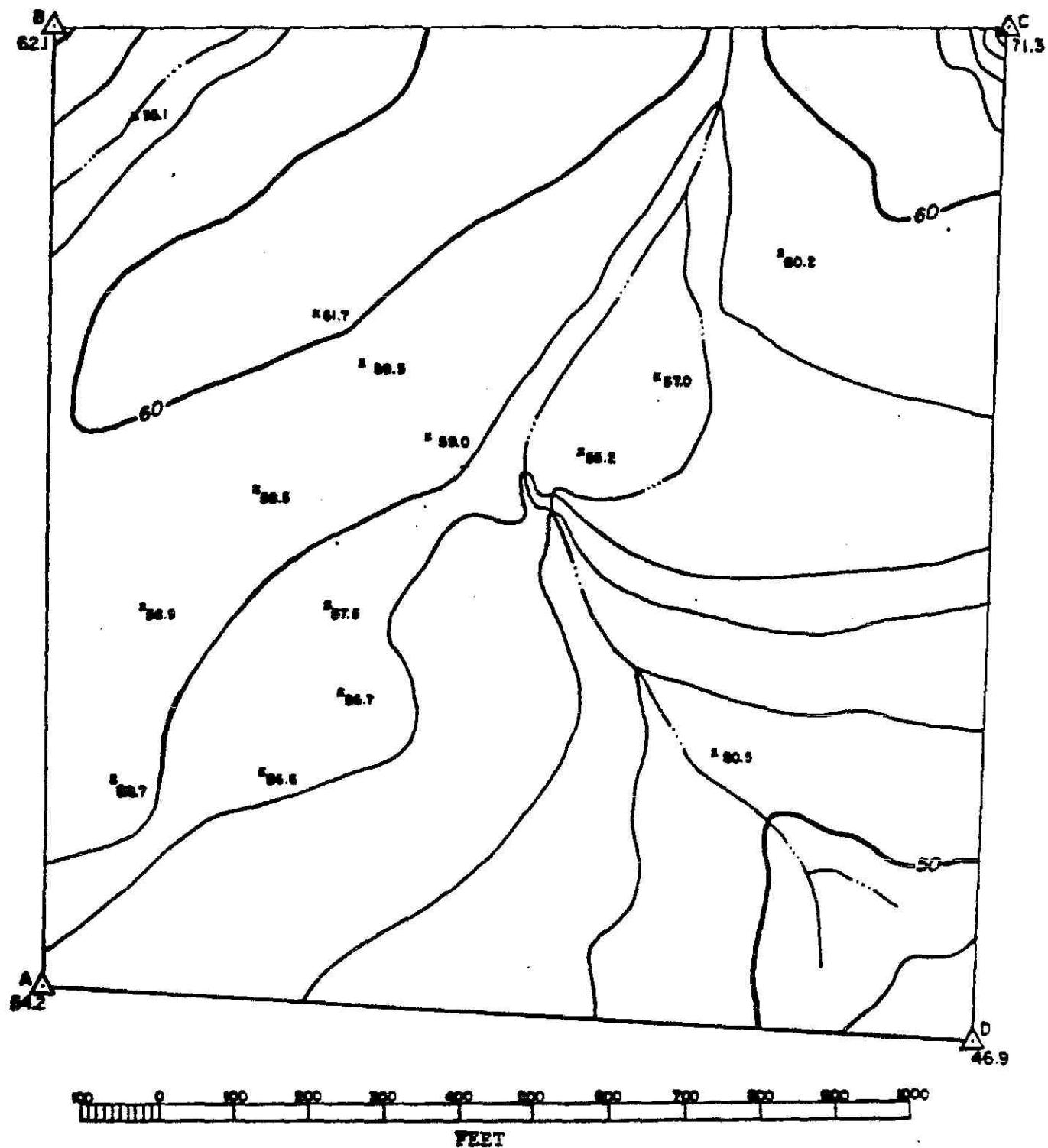
CHECK PROFILE FROM B TO D

Dist.	Elev.	Diff.	Pass	Fail
0	62.1	—	—	—
20	59.7	—	—	—
103	57.0	—	—	—
161	53.9	—	—	—
205	57.4	—	—	—
343	59.3	—	—	—
518	61.7	—	—	—
560	61.3	—	—	—
607	60.2	—	—	—
739	59.3	—	—	—
804	56.1	—	—	—
966	53.8	—	—	—
1158	52.4	—	—	—
1308	50.8	—	—	—
1421	50.4	—	—	—
1682	47.7	—	—	—
1820	46.9	—	—	—

- (B) What is the maximum permitted error in a spot elevation for this mapping contour interval ?
- (C) What is the allowable error in 90% of all contour checks for this mapping contour interval ?

Problem C-7 (10 Points)

REQUIRED



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1982

LAND SURVEYOR

PRINCIPLES AND PRACTICE

1. This part of the examination - "Part D" - is the second part of the Land Surveyor examination, and is to be completed in 4 hours.
2. Your answers are to be completed in your workbook - use separate answer sheets for each problem, unless otherwise instructed.
3. This portion of the Land Surveyor examination consists of the following:

Problem D-1	REQUIRED	10.0 Points
Problem D-2 <u>OR</u> Problem D-3	CHOOSE ONE	10.0 Points
Problem D-4 <u>OR</u> Problem D-5	CHOOSE ONE	5.0 Points
Problem D-6	REQUIRED	5.0 Points
Problem D-7	REQUIRED	10.0 Points
Problem D-8	REQUIRED	5.0 Points
Problem D-9	REQUIRED	5.0 Points
TOTAL	50.0 Points	

4. Do not work both problems where a choice is offered. Credit will be allowed for one (1) problem only.
5. Problem D-3 requires that you remove one sheet that is to be attached to your workbook.
6. After you have completed this portion of the examination, check the problem order, include all pages (including diagrams if required) and turn it in to the examination proctor.
7. You may keep this set of examination questions.

Problem D-1 (10 Points)

REQUIRED

Radio Station KPLN is installing a new radio tower and is required to give the F.C.C. the geographic position (to the nearest 10") of the tower. You have been asked to establish the position of the tower; to do this you will set on control point "Green", backsight control point "Red" and tie in the radio tower. The data gathered is as follows:

"Green" : State Plane Coordinates (zone IV) $x=1,453,181.23$

$y=11,287.00$; Elevation = 1850' Geodetic Azimuth to
"Red" (north) = $358^{\circ}22'59.9''$

Field angle (right) to radio tower $210^{\circ}15'04''$

Horizontal ground distance to radio tower = 10,368.074'
radio tower elevation = 2250'

What is the latitude and longitude of the radio tower ?

Constants	IV	V
C	2,000,000	2,000,000
Central Meridian	$119^{\circ} 00'$	$118^{\circ} 00'$
R_b	26,652,931.96	30,649,424.27
γ_0	470,526.63	455,278.73
ℓ	0.59658 71443	0.57001 19219
$\frac{1}{2P_0^2 \sin 1''}$	2.360×10^{-10}	2.361×10^{-10}
$\log \frac{1}{2P_0^2 \sin 1''}$	0.372 8843 - 10	0.373 0670 - 10
$\log \ell$	9.77567 38907 - 10	9.75588 39391 - 10
$\log k$	7.62714 43424	7.63926 75454

Lambert Projection for California IV

Problem D-1 (10 Points)

Table I

REQUIRED

LAT.	R feet	y ¹ y value on central meridian fact	Tabular difference for 1 sec. of lat.	Scale in units of 7th place of logs	Scale expressed as a ratio
35° 20'	28,652,931.96	0	101.12700	+536.6	1.0001926
21	28,646,664.34	6,067.62	101.12667	+808.6	1.0001862
22	28,640,796.74	12,135.22	101.12673	+781.1	1.0001799
23	28,634,729.16	18,202.80	101.12600	+753.8	1.0001735
24	28,628,661.60	24,270.36	101.12567	+727.0	1.0001674
25	28,622,594.06	30,337.90	101.12533	+700.4	1.0001613
35° 26'	28,616,526.54	36,405.42	101.12500	+674.3	1.0001553
27	28,610,459.04	42,472.92	101.12467	+648.5	1.0001493
28	28,604,391.56	48,540.40	101.12433	+623.1	1.0001435
29	28,598,324.10	54,607.86	101.12417	+598.0	1.0001377
30	28,592,256.65	60,675.31	101.12383	+573.3	1.0001320
35° 31'	28,586,189.22	66,742.74	101.12350	+548.9	1.0001264
32	28,580,121.81	72,810.15	101.12317	+524.9	1.0001209
33	28,574,054.42	78,877.54	101.12300	+501.3	1.0001154
34	28,567,987.04	84,944.92	101.12283	+478.0	1.0001101
35	28,561,919.67	91,012.29	101.12250	+455.1	1.0001048

Table II (Cont'd)

1° of Long. = 0859658714 of 8

Long.	θ	Long.	θ	Long.	θ
120° 46'	-1° 03' 14.2942	121° 21'	-1° 24' 07.1272	121° 56'	-1° 44' 59.9602
47	-1 03 50.0895	22	-1 24 42.9225	57	-1 45 35.7555
48	-1 04 25.8847	23	-1 25 18.7177	58	-1 46 11.5507
59	-1 05 01.6799	24	-1 25 54.5129	59	-1 46 47.3459
50	-1 05 37.4752	25	-1 26 30.3082	122° 00'	-1 47 23.1412
120° 51'	-1 06 13.2704	121° 26'	-1 27 06.1034	122° 01'	-1 47 58.9364
52	-1 06 49.0656	27	-1 27 41.8986	02	-1 48 34.7316
53	-1 07 24.8605	28	-1 28 17.6938	03	-1 49 10.5268
54	-1 08 00.6561	29	-1 28 53.4891	04	-1 49 46.3221
55	-1 08 36.4513	30	-1 29 29.2843	05	-1 50 22.1173
120° 56'	-1 09 12.2465	121° 31'	-1 30 05.0795	122° 06'	-1 50 57.9125
57	-1 09 48.0418	32	-1 30 40.8748	07	-1 51 33.7078
58	-1 10 23.8370	33	-1 31 16.6700	08	-1 52 09.5030
59	-1 10 59.6322	34	-1 31 52.4652	09	-1 52 45.2982
121° 00'	-1 11 35.4274	35	-1 32 28.2604	10	-1 53 21.0934

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Page 3
Lambert Projection for California V

Table I (Cont'd)

Problem D-1 (10 Points)

REQUIRED

Lat.	R feet	y value on central meridian feet	Tabular difference for 1 sec. of lat.	Scale in units of 7th place of logs	Scale expressed as a ratio
35° 16'	30,006,492.15	642,932.12	101.10317	-162.8	0.9999625
17	30,000,425.96	645,998.31	101.10367	-151.2	0.9999652
18	29,994,359.74	655,064.53	101.10417	-139.3	0.9999679
19	29,988,293.49	661,130.78	101.10483	-127.0	0.9999708
20	29,982,227.20	667,197.07	101.10533	-114.4	0.9999737
35° 21'	29,976,160.58	673,263.39	101.10600	-101.4	0.9999767
22	29,970,094.52	679,329.75	101.10667	-86.0	0.9999797
23	29,964,028.12	685,396.15	101.10717	-74.3	0.9999829
24	29,957,961.69	691,462.58	101.10783	-60.2	0.9999861
25	29,951,895.22	697,529.05	101.10833	-45.7	0.9999895
35° 26'	29,945,828.72	703,595.55	101.10900	-30.8	0.9999929
27	29,939,762.18	709,662.09	101.10983	-15.6	0.9999964
28	29,933,695.59	715,728.68	101.11033	0.0	1.0000000
29	29,927,628.97	721,795.30	101.11100	+16.0	1.0000037
30	29,921,562.31	727,861.96	101.11167	+32.3	1.0000074
35° 31'	29,915,495.61	733,928.66	101.11233	+49.0	1.0000113
32	29,909,428.87	739,995.40	101.11300	+66.0	1.0000152
33	29,903,362.09	746,062.18	101.11383	+83.5	1.0000192
34	29,897,295.26	752,129.01	101.11433	+101.3	1.0000233
35	29,891,228.40	758,195.87	101.11517	+119.5	1.0000275

Table II (Cont'd)

1° of Long. = 0.57001192 of e

Long.	e	Long.	e	Long.	e
119° 36'	-0° 54' 43.2687	120° 11'	-1° 14' 40.2937	120° 46'	-1° 34' 37.3187
37	-0 55 17.4694	12	-1 15 14.4944	47	-1 35 11.5195
38	-0 55 51.6701	13	-1 15 48.6951	48	-1 35 45.7202
39	-0 56 25.8705	14	-1 16 22.8959	49	-1 36 19.9209
40	-0 57 00.0715	15	-1 16 57.0966	50	-1 36 54.1216
119° 41'	-0 57 34.2722	120° 16'	-1 17 31.2973	120° 51'	-1 37 28.3223
42	-0 58 08.4730	17	-1 18 05.4980	52	-1 38 02.5230
43	-0 58 42.6737	18	-1 18 39.6987	53	-1 38 36.7217
44	-0 59 16.8744	19	-1 19 13.8994	54	-1 39 10.9245
45	-0 59 51.0751	20	-1 19 48.1001	55	-1 39 45.1252
119° 46'	-1 00 25.2753	120° 21'	-1 20 22.3009	120° 56'	-1 40 19.3249
47	-1 00 59.4765	22	-1 20 56.5016	57	-1 40 53.5266
48	-1 01 33.6773	23	-1 21 30.7023	58	-1 41 27.7273
49	-1 02 07.8780	24	-1 22 04.9030	59	-1 42 01.9269
50	-1 02 42.0787	25	-1 22 39.1037	121° 00'	-1 42 36.1284

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IMPORTANT

YOU MUST WORK EITHER D-2 OR D-3 BUT

DO NOT WORK BOTH

Problem D-2 (10 Points)

OPTIONAL

In setting out aerial control you decide to establish the vertical control by trigonometric leveling. Below is the reduced data for the control. The aerial survey is for a topographic map with a 5 foot contour interval. Establish the unadjusted elevations for the control points; determine if the data should be adjusted and if so perform an adjustment explaining your reasons for the adjustment, if no adjustment is required explain why.

<u>Point</u>	<u>HI</u>	<u>Horizontal Dist.</u>	<u>Vertical Angle</u>	<u>Elevation</u>
A	5.20			1123.05
B	5.49	8,323.25	+0°49'16"	
C	5.15	5,529.64	+0°31'03"	
D	5.38	10,436.78	-0°29'32"	
E	5.72	4,991.67	-0°18'40"	
A	5.20	3,875.11	-0°48'57"	1123.05

(HI indicates height for both instrument and sight)

YOU MUST SHOW ALL WORK

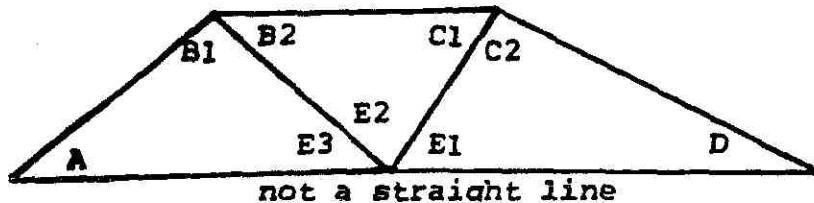
Problem D-3 (10 Points)

OPTIONAL

You are in responsible charge of executing a control survey contract which requires measurement of angles A through E3 shown in the network below. The contract requires that each angle be observed at least 5 times with the precision which will yield a standard error for the mean of each angle not to exceed ± 2.5 seconds.

Your survey crews have observed the raw angles shown below with a one second theodolite

- a. Compute and show the mean of each angle after rejecting all blunders and the standard error of the mean. Does the standard error of each angle observed meet the contract specifications?
- b. Assume that the contract specifications have been met after rejecting all blunders in the data. Adjust angles A through E3 to the nearest 0.1 second weighting the adjustment to each angle in proportion to the standard error of that angle. Round the weights up or down to the nearest integer before making your corrections. Please write your answers in the spaces provided on the next page. This page is to be removed and turned in with your workbook.



Angle A

47° 08' 02"
47° 07' 58"
47° 08' 01"
47° 07' 59"
47° 18' 00"
47° 07' 57"

Angle B1

92° 33' 33"
92° 33' 32"
92° 33' 29"
92° 33' 30"
92° 33' 32"
92° 33' 28"

Angle E3

40° 18' 30"
40° 08' 30"
40° 18' 29"
40° 18' 32"
40° 18' 30"
40° 18' 29"

Angle B2

43° 02' 04"
43° 02' 04"
43° 02' 00"
43° 01' 59"
43° 02' 02"
43° 02' 01"

Angle C1

71° 48' 25"
71° 48' 25"
71° 48' 26"
71° 48' 27"
71° 48' 24"
71° 48' 26"

Angle E2

65° 09' 37"
65° 09' 38"
65° 09' 36"
65° 09' 38"
65° 09' 39"
65° 09' 36"

Angle C2

66° 35' 59"
66° 36' 04"
66° 36' 03"
66° 36' 00"
66° 36' 04"
66° 36' 02"

Angle D

38° 51' 50"
38° 51' 48"
38° 51' 47"
38° 51' 49"
38° 51' 49"
38° 51' 50"

Angle E1

74° 32' 00"
74° 31' 57"
74° 31' 56"
74° 32' 01"
74° 31' 00"
74° 32' 01"

Problem D-3 (10 Points)

OPTIONAL

<u>ANGLE</u>	<u>MEAN VALUE</u>	<u>STD ERROR</u>	<u>WEIGHT</u>	<u>CORRECTED ANGLE</u>	<u>FAIL PAS</u>
A	_____	_____	_____	_____	_____
B1	_____	_____	_____	_____	_____
B2	_____	_____	_____	_____	_____
C1	_____	_____	_____	_____	_____
C2	_____	_____	_____	_____	_____
D	_____	_____	_____	_____	_____
E1	_____	_____	_____	_____	_____
E2	_____	_____	_____	_____	_____
E3	_____	_____	_____	_____	_____

NOTE: REMOVE THIS PAGE FROM BOOKLET AND TURN
IN WITH YOUR ANSWERS.

ENTER YOUR I.D. NO. IN SPACE PROVIDED ABOVE

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Page 8

IMPORTANT

YOU MUST WORK EITHER D-4 OR D-5 BUT
DO NOT WORK BOTH

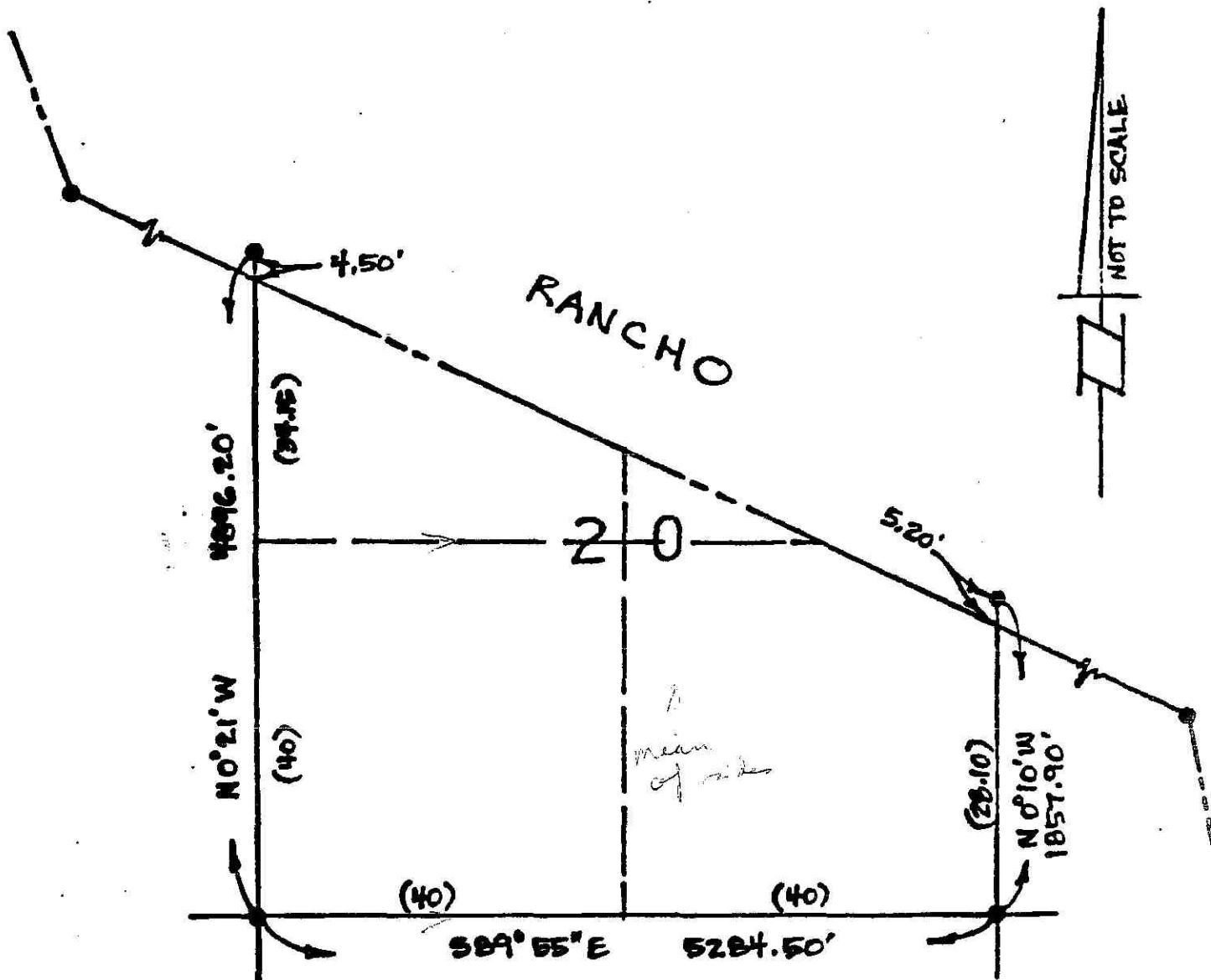
Problem D-4 (5 Points)

OPTIONAL

The plat shown below shows fractional Section 20. The meridian and range are not identified. The bearings and distances given in feet are the results of your survey. The information in parentheses is record per the Government Plat.

REQUIRED:

Compute the courses for the SW $\frac{1}{4}$ of Section 20. Explain briefly the steps in the procedure you have followed in your solution.



Problem D-5 (5 Points)

OPTIONAL

Ground survey control is frequently required for medium and large scale engineering photogrammetric mapping, particularly in cases where analytical control extension is not cost justified. In most of the cases where large scale ($1''$ to $100'$ varying to $1'' = 20'$) mapping is used, the type selection of targets, their size and location procedures becomes important in map accuracy production.

The following are not trick questions. They are based on logical understanding of the photogrammetric process and knowledge of the peculiarities of contemporary wide-angle mapping cameras. The most correct answers would respond to the minimum sufficient, accuracy and survey cost considerations.

For all of the following, select the nearest correct answer, assuming the following criteria: $6''$ f.l. Pleogon or Aviogon lens camera; photo scale $1''$ to $240'$ ($1:2880$); Mapping scale $1''$ to $40'$ ($1:480$); the terrain and planimetric feature types in the area to be photogrammetrically mapped: semi-urban as may be found in the periphery of most medium sized cities in California, with a mixture of developed portions along with areas of flat, open field and grasslands free of trees, along with areas of tall conifers (60 to 100 feet in height) and slopes varying from $1\frac{1}{2}$ to 45% .

No. 1 Wt. 0.5 The targets should be placed as a minimum condition:

- a) Always free of any tree shadows.
- b) Free of tree shadows at least between 8:00 A. M.
and 4:00 P. M.
- c) Free of tree shadows between 10:00 A. M. and 2:00 P. M.
sun time.

Problem D-5 (5 Points)

OPTIONAL

No. 2 Wt. 0.5 When it is required that targets be placed close to trees,
the surveyor needs to be concerned with:

- a) Only with the potential of hiding the target with tree shadows.
- b) That the targets should never be placed within a horizontal distance less than the height of the trees adjoining.
- c) Only, that either shadows or photo displacement of tall trees in the outer edges of the stereo model might hide the target.

No. 3 Wt. 0.5 Choose one answer from the following target visibility considerations; in the correct order of their photogrammetric importance:

- a) Length of target legs, width of legs, contrast, and number of legs of the target.
- b) Width of legs, number of legs, contrast, and length of legs.
- c) Contrast, length of legs, width of legs, number of legs.

No. 4 Wt. 0.5 Target size: In order to clearly identify targets, the overall target length and the leg width expressed as a measurement in feet of a portion of the photo scale is used as a criteria. The correct answer is the minimum size of the choices below considering the 5 diameter magnification of the projection type "Kalsch" plotter and the photo scale of 1" to 240'.

- a) Target leg 0.01" for length; 0.002" for leg width of the photo scale.

Problem D-5 (5 Points)

OPTIONAL

- b) 0.1" for length; 0.01" for leg width of the photo scale.
- c) 0.005" for length; 0.0025" for leg width of the photo scale.

No. 5 Wt. 0.5 Terrain selection with targets is a consideration. One of the following is the most correct assumption:

- a) A good target, with the correct size and contrast will be good for both horizontal and vertical control in all cases.
- b) A target of correct size and contrast may be adequate for horizontal, but dubious for vertical control if placed on a steep slope.
- c) Targets of correct size and contrast should always be separate for horizontal and vertical control because their function is so different that photogrammetric and optic needs would so require.

No. 6 Wt. 1.0 Target density: Only one of the following statements is most correct for the majority of large scale mapping projects:

- a) Since economics in survey control costs are very important, targets should be spaced to attempt to only straddle the area to be mapped, particularly with narrow strips such as road right-of-way strip mapping.
- b) Economical surveying control is important. However, to please the stereo operator of the photogrammetric machine if control spread selected is narrow, it is only necessary to increase the density of points to compensate.

Problem D-5 (5 Points)

OPTIONAL

- c) Control density requires a minimum of three vertical and two horizontal points per stereo model. Four vertical points and three horizontal points provide a check in each model. Consistent with survey economy, widespread control is generally the best answer regardless of the width of the mapping strip.

No. 7 Wt. 0.5 Accuracy of horizontal control: In terms of economics the surveyor will choose one of the following position closures as a working guide in providing large scale mapping control. The criteria is 1" to 40' final scale mapping, assuming a mapping strip of approximately two miles.

- a) 1:50,000
- b) 1:36,000
- c) 1:10,000
- d) 1:5,000
- e) 1:3,000

No. 8 Wt. 0.5 One of the following statements regarding vertical control points is most correct. The prudent surveyor will:

- a) Always loop levels and give elevation data to the top of monument at the target.
- b) In addition to "a)", he will furnish a sketch of the target.
- c) He will loop levels, give elevation to the top of monument, sketch and determine elevation of the top of target panel if it is different than the monument at the target.
- d) He will perform all of the above in "c)" and take two views in polaroid color of the target in every case.

Problem D-5 (5 Points)

OPTIONAL

No. 9 Wt. 0.5 Targets set out prior to photography eliminate uncertainties of the elevation and/or horizontal location of the required survey control to the stereo plotter operator. Only one of the following statements is true considering the majority of large scale mapping projects:

- a) Effective and accurate aerial mapping should always be pre-targeted, with panel location and panel size carefully selected. A loss of (or unusability of) more than 30% of the panels may seriously affect the mapping accuracy completion.
- b) Pre-targeting is usually cost effective because the pre-selection of traverse and level routes can be determined. The loss of, or unsuitability of, 30% of the panels may increase the survey control costs. However, control identification without targets is normally easily possible in large scale photography.
- c) In areas requiring control, particularly where fields are freshly cultivated, control targets are mandatory. If they are lost or obliterated, the stereo plotter operator will have no other option than to order new mapping flights.

Problem D-6 (5 Points)

REQUIRED

PUBLIC LAND LAWS

- 1.) Where does one find the authority for the Public Land Laws?
- 2.) Where does one find the authority for, and range of powers of, the Bureau of Land Management?
- 3.) If you are contracted by the Bureau of Land Management to perform a boundary survey of Public Lands, do you need to be a Licensed Land Surveyor? (of which state?) Cite authority for your answer.
- 4.) Where does one find that the township is the basis of subdividing the Public Lands?
- 5.) Is it possible for the U. S. Government to re-survey an entire township in which over 50% of the land is in private ownership, re-setting all section corners and make or have the new corners control over the originals?

Problem D-7 (10 Points)

STATEMENT OF CONDITIONS

REQUIRED

With their common boundary in dispute, both parties, jointly, have hired you to establish in the field their property line.

You have performed a diligent preliminary records search for data and located or determined the following:

- 1) Your clients own lots #10 and #11 of block 'B'.
 - 2) You have obtained from public records a copy of the original subdivision (dated 1912) - portions containing the relevant information are shown on the attached page(s).
 - 3) There are no records or monumentation data available from either the City or the County.
 - 4) While field examination discloses an existing fenceline, it is too deteriorated to retrace.
 - 5) A preliminary field survey has determined that, based upon measurements of the existing improvements which confirm the 60' right-of-way widths, the field distance from the centerline of High Street to the centerline of Bayo Vista Avenue, along the centerline of Fairview Avenue, is 654.06 feet.
- All streets are fully improved.

* * * * *

PROBLEM

- A) Review the existing data. If there are other steps which could be taken, outline them with reasons and/or possible goals.
- B) You are to determine the location of your clients' common southerly property corner (common with the Fairview Ave. Right-of-Way). For consistency of answers, this must be expressed as measured along the centerline of Fairview from the centerline of Bayovista and thence 90° to the corner. Show, carefully, your calculations, any reasonings, and all intermediate results.
- C) If you must make any assumptions, state them clearly, citing your reasoning and/or authority.

**A PORTION OF
WATERSIDE TERRACE
ALAMEDA, CAL.**

六
一九

卷之三

NORTHERLY
1" = 60'

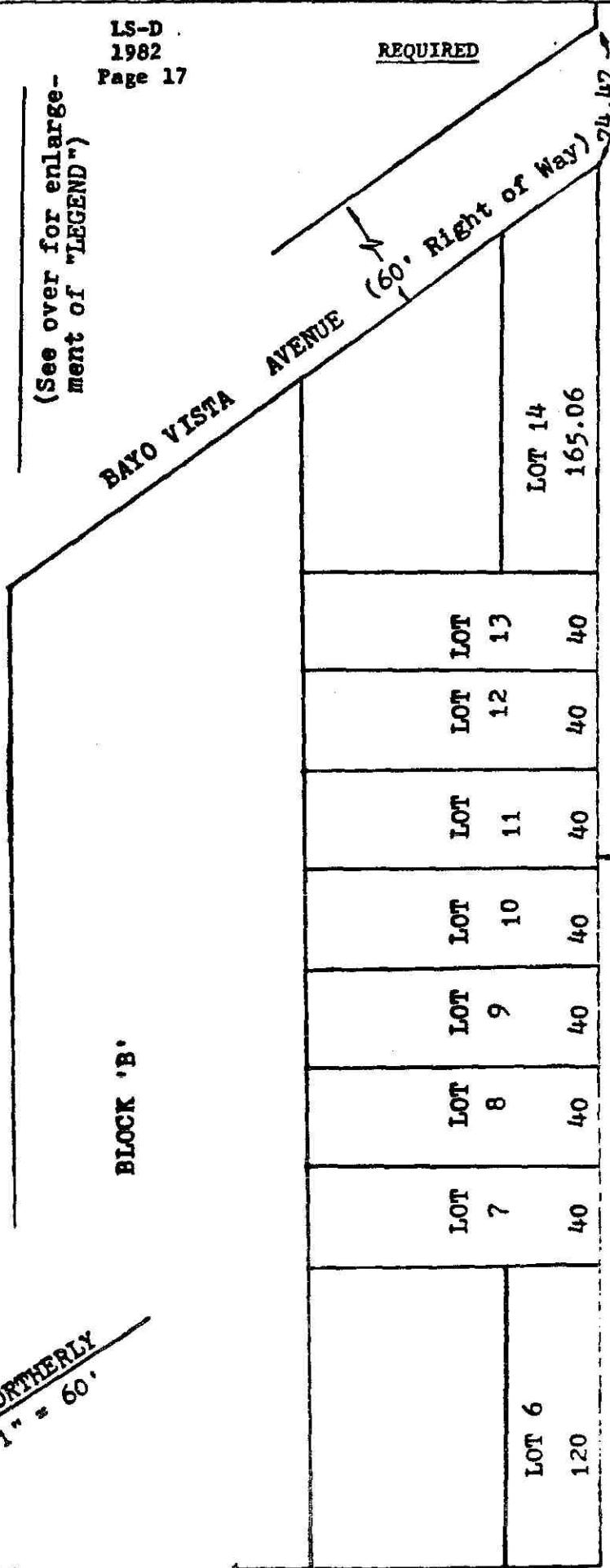
Problem D-7 (10 Points)

LS-D
1982
Page 17

REQUIRED

(See over for enlargement of "LEGEND")

BLOCK 18



-LEGEND-

Soy Vista Ave S side - BCIP-30.63 ft angle from High Street
Radius - 216.87
Curve Angle of intersect - $45^{\circ}16'30''$ Thence parallel
with distance 340 from the E of Fernside
Boulevard to an intersect with Fairview
Due of an angle of $30^{\circ}40'30''$
N side - BCIP-50.83 ft angle from High St.
Radius - 276.87
Angle of intersect - $45^{\circ}16'30''$ Thence parallel
with distance 340 from the E of Fernside
Boulevard to an intersect with Fairview
Due of an angle of $50^{\circ}40'30''$
Division Curve BCIP-120 North easterly and 120 South
in Block E - easterly from the N.E cor. of High Street
8 & 8240 Vista Ave - Thence a long curve Radius
- 432.02. Angle intersect - SE 41 20'. Thence parallel
with distance 160 from the E of Fernside Boulevard
Curve BCIP-120 Westerly and 120 North from Fernside
Boulevard - Radius - 74.41
Tangent - 24.43
S side - BCIP-15.89 ft angle from Fernside
Boulevard
Radius - 138.47 - Tangent - 44.11
Small Curves - Radius of a intersected corner line of property
with Westerly line of U.S. Tidal Canal
Radius - 30

MAP OF
WATERSIDE TERRACE
Alameda Co., Calif.
1912

Problem D-8 (5 Points)

REQUIRED

The Subdivision Map Act was originally a part of the Business and Professions Code until it was recodified into the Government Code in March of 1975. Answer the parts of this question according to the current Government Code of the Subdivision Map Act.

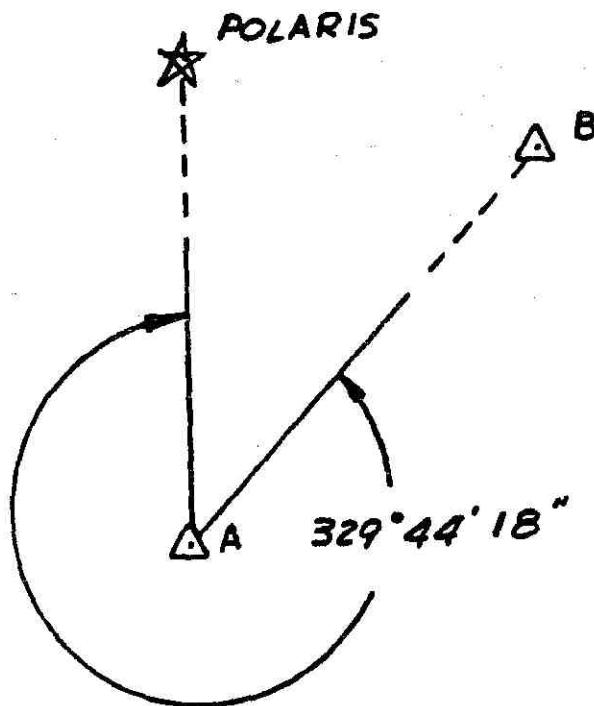
- A. What is a subdivision?
- B. Name two examples where a Parcel Map is required instead of a tentative and final Subdivision Map?
- C. When a Parcel Map is required, the surveyor shall base the map upon a field survey made in conformity with the Land Surveyor's Act. What is another method allowed of indicating the boundaries of a Parcel Map?
- D. After a final map or parcel map is filed in the office of the County Recorder, what are the reasons that would cause it to be amended by certificate of correction or amending map?
- E. Describe the procedure for setting monuments for a subdivision on which the original engineer or surveyor has died?
- F. Name the types of improvement security allowed by the Subdivision Map Act?
- G. Name three types of offers of dedication within the Subdivision which may be imposed by local ordinance?

Problem D-9 (5 Points)

AZIMUTH DETERMINATION

You are to determine the astronomic bearing of line AB to the nearest second based on the following data:

1. Station 'A' is occupied
2. Scaled Latitude = $36^{\circ} 10' 42''$ N
3. Scaled Longitude = $118^{\circ} 36' 24''$ W
4. Date of the observation, May 17, 1982
5. Mean chronometer time of the observation is 8:20:42 PM PDST
6. Chronometer is 0:03:18 fast
7. Barometric pressure is at 30.2 inches
8. Temperature is at 65° F
9. Mean measured altitude of POLARIS is $35^{\circ} 37' 06''$



SEE EPHEMERIS TABLES NEXT 4 PAGES

Problem D-9 (5 Points)

REQUIRED

POLARIS AT ANY TIME

27. Example. Time of observation May 5, 1982; watch reading 8:28:23 PM. 90th Meridian time; watch known to be 0:02:03 slow; latitude (from map) N42° 22.6'; longitude (from map) W92° 58.3'; clockwise angle, mark to star 25° 53.0'.

Find the LHA and r (see Box M) as shown below.

Watch time	8:28:23	PM
Watch correction (slow is plus)	<u>2:03</u>	slow
Standard time (90 ^o h meridian)	8:30:26	PM
Correction to 24 hour basis	+ <u>12</u>	
90 ^o meridian time	20:30:26	
Correction for time zone	+ <u>6</u>	
GCT (Sec. 5)	26:30:26	
GCT May 6, 1982	2:30:26	
GHA (Sec. 2) 0 ^h May 6, 1982 Table 1	190° 27.3'	
Correction for 2 ^h 30m (Table 5)	+ <u>37</u> 36.2	
Correction for 26° (Table 5)	+ <u>6.5</u>	
GHA	228° 10.0'	
Less west longitude (from map)	- <u>92° 58.3'</u>	
LHA (Sec. 14)	135° 11.7'	
$t = LHA \text{ or } 360 - LHA$ (use smaller)	135° 11.7'	

CELESTIAL OBSERVATIONS

28. Computation. The bearing of Polaris (Z) (Sec. 15) is found from the formula:

where

δ (Sec. 14) is the meridian angle just computed above.

A (Sec.20) is the true altitude. It is usually obtained from the known latitude L , using Table 6, and then it need not be observed.

p (Sec. 17) is the polar distance.

Four optional procedures for the computation are given below. Procedure A is the solution which is familiar to K&E Solar Ephemeris users. Procedures B, C and D are added to give a more precise solution under different conditions of latitude and instrumentation.

Procedure A

Table 10 gives values of Z for selected values of LHA and i when $p=0^\circ 49.00'$. By a two-way interpolation the value of Z can be found from the known values of LHA and i . Table 11 gives the correction to be applied for values of p other than $0^\circ 49.00'$.

Example.

LHA =	$l = 42^\circ$	$42^\circ 22.6'$	44°
135°	$46.2'$	$46.5'$	$47.7'$
$135^\circ 11.7'$		$46.3'$	
140°	$42.0'$	$42.2'$	$43.3'$

Problem D-9 (5 Points)

REQUIRED

TABLE 1

SOLAR EPHEMERIS APRIL 1982

For On Universal Time or Greenwich Civil Time^c

Day of Month & Week	The Sun's Apparent Declination	Diff. in Declin. for 1 hour	Equation of Time		Diff. for 1 hour	GHA of Future
			True Sol. Time = LCT + Eq. of Time	m s		
1 TH	M04 19.7	0.45	-04 07.1	0.75	155 56.9	
2 FR	M04 22.9	0.46	-03 49.2	0.74	154 56.1	
3 SA	M05 06.0	0.46	-02 31.4	0.74	157 55.4	
4 SU	M05 28.9	0.45	-03 13.6	0.73	158 54.7	
5 M	M05 51.0	0.45	-02 56.3	0.73	159 54.0	
6 TU	M06 14.6	0.44	-02 38.7	0.72	160 53.3	
7 W	M06 37.3	0.44	-02 21.4	0.71	161 52.5	
8 TH	M06 59.8	0.43	-02 04.6	0.70	162 51.8	
9 FR	M07 22.3	0.43	-01 47.6	0.69	163 51.0	
10 SA	M07 44.6	0.42	-01 31.1	0.68	164 50.2	
11 SU	M08 06.8	0.42	-01 14.8	0.67	165 49.4	
12 M	M08 28.8	0.41	-00 58.6	0.65	166 48.6	
13 TU	M09 50.7	0.41	-00 43.1	0.64	167 47.7	
14 W	M09 12.3	0.40	-00 27.8	0.63	168 46.9	
15 TH	M09 34.1	0.39	-00 12.8	0.61	169 46.0	
16 FR	M09 55.3	0.39	+00 01.9	0.59	170 45.2	
17 SA	M10 16.8	0.38	+00 18.2	0.58	171 44.4	
18 SU	M10 37.9	0.37	+00 30.0	0.56	172 43.6	
19 M	M10 59.9	0.37	+00 43.5	0.54	173 42.7	
20 TU	M11 19.6	0.36	+00 56.6	0.53	174 41.9	
21 W	M11 40.2	0.35	+01 09.2	0.51	175 41.1	
22 TH	M12 00.0	0.34	+01 21.4	0.49	176 40.3	
23 FR	M12 20.8	0.33	+01 33.2	0.47	177 39.4	
24 SA	M12 40.8	0.32	+01 44.4	0.45	178 38.5	
25 SU	M12 59.6	0.32	+01 55.3	0.43	179 37.6	
26 M	M13 20.1	0.31	+02 05.6	0.41	180 36.6	
27 TU	M13 39.5	0.30	+02 19.5	0.39	181 35.7	
28 W	M13 58.4	0.29	+02 24.9	0.37	182 34.7	
29 TH	M14 17.3	0.28	+02 33.8	0.35	183 33.6	
30 FR	M14 36.2	0.27	+02 42.2	0.33	184 32.8	
31 SA	M14 56.6		+02 50.1		185 31.9	

Hourly differences in declination and equation of time are for the 24 hours following 0-hours of date in left column.

TABLE 1

SOLAR EPHEMERIS MAY 1982

For On Universal Time or Greenwich Civil Time^c

Day of Month & Week	The Sun's Apparent Declination	Diff. in Declin. for 1 hour	Equation of Time		Diff. for 1 hour	GHA of Future
			True Sol. Time = LCT + Eq. of Time	m s		
1 SA	M15 34.6	0.76	+02 50.1	0.31	185 31.9	
2 SU	M15 12.7	0.79	+02 57.4	0.29	186 31.0	
3 M	M15 30.7	0.74	+03 04.3	0.26	187 30.1	
4 TU	M15 48.3	0.72	+03 10.6	0.24	188 29.2	
5 W	M16 05.7	0.73	+03 16.4	0.22	189 28.3	
6 TH	M16 22.6	0.70	+03 21.6	0.20	190 27.3	
7 FR	M16 39.7	0.69	+03 28.3	0.17	191 26.3	
8 SA	M16 56.2	0.68	+03 35.5	0.15	192 25.3	
9 SU	M17 12.5	0.67	+03 34.0	0.12	193 24.3	
10 M	M17 28.5	0.65	+03 37.0	0.10	194 23.3	
11 TU	M17 44.2	0.64	+03 36.4	0.08	195 22.2	
12 W	M17 59.7	0.63	+03 41.2	0.05	196 21.2	
13 TH	M18 14.8	0.62	+03 42.5	0.03	197 20.2	
14 FR	M18 29.6	0.60	+03 43.1	0.00	198 19.2	
15 SA	M18 44.1	0.59	+03 43.2	0.02	199 18.2	
16 SU	M18 58.2	0.58	+03 42.6	0.05	200 17.2	
17 M	M19 12.1	0.56	+03 41.5	0.07	201 16.2	
18 TU	M19 25.6	0.55	+03 39.6	0.09	202 15.2	
19 W	M19 38.9	0.54	+03 37.6	0.12	203 14.2	
20 TH	M19 51.7	0.52	+03 34.8	0.14	204 13.1	
21 FR	M20 04.3	0.51	+03 31.4	0.16	205 12.1	
22 SA	M20 18.5	0.49	+03 27.4	0.19	206 11.0	
23 SU	M20 26.3	0.48	+03 22.9	0.21	207 09.6	
24 M	M20 39.8	0.46	+03 17.9	0.23	208 08.7	
25 TU	M20 51.0	0.45	+03 12.4	0.25	209 07.4	
26 W	M21 01.7	0.43	+03 06.6	0.27	210 06.4	
27 TH	M21 12.2	0.42	+03 00.0	0.29	211 05.3	
28 FR	M21 22.2	0.40	+02 53.0	0.31	212 04.3	
29 SA	M21 31.9	0.39	+02 45.6	0.32	213 03.2	
30 SU	M21 41.2	0.37	+02 37.8	0.34	214 02.1	
31 M	M21 50.2	0.36	+02 29.6	0.36	215 01.0	
32 TU	M21 58.7	+02 21.0			216 00.0	

Hourly differences in declination and equation of time are for the 24 hours following 0-hours of date in left column.

Problem D-9 (5 Points)

REQUIRED

TABLE 1
SOLAR EPHEMERIS DECEMBER 1982
For On Universal Time or Greenwich Civil Time

Day of Month & Year	The Sun's Apparent Declination	Diff. in Decl. for 1 hour	Equation of Time		Diff. for 1 hour	GHA of Right Ascension
			Time Sol. Time	+ LTT -		
1 W 521 43.0	0.29	+01 13.1	0.93	035 20.4		
2 TH 521 52.3	0.27	+01 30.8	0.95	036 28.6		
3 FR 522 01.3	0.35	+01 27.9	0.98	037 37.9		
4 SA 522 09.5	0.34	+01 54.4	1.02	038 37.2		
5 SU 522 17.9	0.31	+00 40.3	1.03	039 16.9		
6 M 522 25.5	0.39	+00 15.4	1.05	040 25.9		
7 TU 522 32.7	0.29	+00 50.4	1.08	041 25.9		
8 W 522 39.5	0.26	+00 26.4	1.10	042 34.7		
9 TH 522 45.8	0.25	+00 58.3	1.12	043 34.0		
10 FR 522 51.7	0.23	+00 71.3	1.14	044 33.4		
11 SA 522 57.1	0.21	+00 04.2	1.15	045 32.8		
12 SU 523 02.1	0.19	+00 36.4	1.17	046 32.1		
13 M 523 06.6	0.17	+00 08.6	1.18	047 21.5		
14 TU 523 10.7	0.15	+00 40.2	1.20	048 20.8		
15 W 523 14.3	0.13	+00 11.5	1.21	049 19.1		
16 TH 523 17.6	0.11	+00 42.5	1.22	050 29.5		
17 FR 523 20.1	0.09	+00 19.3	1.23	051 28.4		
18 SA 523 22.3	0.07	+00 43.9	1.23	052 28.3		
19 SU 523 24.1	0.05	+00 14.3	1.24	053 27.7		
20 M 523 25.3	0.03	+00 44.5	1.24	054 27.1		
21 TU 523 26.1	0.01	+00 14.7	1.24	055 26.6		
22 W 523 26.3	0.01	+00 44.9	1.25	056 26.1		
23 TH 523 26.3	0.03	+00 14.9	1.24	057 25.5		
24 FR 523 25.7	0.05	+00 45.1	1.24	058 25.0		
25 SA 523 24.6	0.04	+00 15.2	1.24	059 24.5		
26 SU 523 23.1	0.06	-00 14.5	1.24	060 23.4		
27 M 523 21.0	0.10	-00 44.1	1.23	061 23.3		
28 TU 523 19.3	0.12	-00 13.6	1.22	062 22.7		
29 W 523 19.6	0.14	-00 42.5	1.21	063 22.1		
30 TH 523 18.2	0.14	-00 12.0	1.20	064 21.5		
31 FR 523 09.3	0.16	-00 40.9	1.19	065 20.9		
32 SA 523 03.6		-00 09.5		066 20.4		

Hourly differences in declination and equation of time are for the 24 hours following 0-hour of date in left column.

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	Refrac-tion	Sun's Par.	Measured Altitude	Refrac-tion	Sun's Par.
7 30	0.99	0.15	17 30	2.02	0.14
7 40	0.75	0.15	18 30	2.03	0.14
7 51	0.62	0.15	19 30	2.05	0.14
8 02	0.50	0.15	20 30	2.07	0.14
8 12	0.37	0.15	21 30	2.08	0.14
8 25	0.25	0.15	22 30	2.10	0.14
8 35	0.15	0.15	23 30	2.10	0.14
8 42	0.13	0.15	24 30	2.10	0.14
8 50	0.02	0.15	25 30	2.10	0.14
8 59	0.02	0.15	26 30	2.10	0.14
9 08	0.02	0.15	27 30	2.10	0.14
9 16	0.02	0.15	28 30	2.10	0.14
9 25	0.02	0.15	29 30	2.10	0.14
9 33	0.02	0.15	30 30	2.10	0.14
9 42	0.02	0.15	31 30	2.10	0.14
9 50	0.02	0.15	32 30	2.10	0.14
9 59	0.02	0.15	33 30	2.10	0.14
10 08	0.10	0.15	34 30	2.10	0.14
10 16	0.05	0.14	35 30	2.10	0.14
10 25	0.01	0.14	36 30	2.10	0.14
10 33	0.01	0.14	37 30	2.10	0.14
10 42	0.01	0.14	38 30	2.10	0.14
10 50	0.01	0.14	39 30	2.10	0.14
10 59	0.01	0.14	40 30	2.10	0.14
11 08	0.01	0.14	41 30	2.10	0.14
11 16	0.01	0.14	42 30	2.10	0.14
11 25	0.01	0.14	43 30	2.10	0.14
11 33	0.01	0.14	44 30	2.10	0.14
11 42	0.01	0.14	45 30	2.10	0.14
11 50	0.01	0.14	46 30	2.10	0.14
11 59	0.01	0.14	47 30	2.10	0.14
12 08	0.01	0.14	48 30	2.10	0.14
12 16	0.01	0.14	49 30	2.10	0.14
12 25	0.01	0.14	50 30	2.10	0.14
12 33	0.01	0.14	51 30	2.10	0.14
12 42	0.01	0.14	52 30	2.10	0.14
12 50	0.01	0.14	53 30	2.10	0.14
12 59	0.01	0.14	54 30	2.10	0.14
13 08	0.01	0.14	55 30	2.10	0.14
13 16	0.01	0.14	56 30	2.10	0.14
13 25	0.01	0.14	57 30	2.10	0.14
13 33	0.01	0.14	58 30	2.10	0.14
13 42	0.01	0.14	59 30	2.10	0.14
13 50	0.01	0.14	60 30	2.10	0.14
13 59	0.01	0.14	61 30	2.10	0.14
14 08	0.01	0.14	62 30	2.10	0.14
14 16	0.01	0.14	63 30	2.10	0.14
14 25	0.01	0.14	64 30	2.10	0.14
14 33	0.01	0.14	65 30	2.10	0.14
14 42	0.01	0.14	66 30	2.10	0.14
14 50	0.01	0.14	67 30	2.10	0.14
14 59	0.01	0.14	68 30	2.10	0.14
15 08	0.01	0.14	69 30	2.10	0.14
15 16	0.01	0.14	70 30	2.10	0.14
15 25	0.01	0.14	71 30	2.10	0.14
15 33	0.01	0.14	72 30	2.10	0.14
15 42	0.01	0.14	73 30	2.10	0.14
15 50	0.01	0.14	74 30	2.10	0.14
15 59	0.01	0.14	75 30	2.10	0.14
16 08	0.01	0.14	76 30	2.10	0.14
16 16	0.01	0.14	77 30	2.10	0.14
16 25	0.01	0.14	78 30	2.10	0.14
16 33	0.01	0.14	79 30	2.10	0.14
16 42	0.01	0.14	80 30	2.10	0.14
16 50	0.01	0.14	81 30	2.10	0.14
16 59	0.01	0.14	82 30	2.10	0.14
17 08	0.01	0.14	83 30	2.10	0.14
17 16	0.01	0.14	84 30	2.10	0.14
17 25	0.01	0.14	85 30	2.10	0.14
17 33	0.01	0.14	86 30	2.10	0.14
17 42	0.01	0.14	87 30	2.10	0.14
17 50	0.01	0.14	88 30	2.10	0.14
17 59	0.01	0.14	89 30	2.10	0.14

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.

Problem D-9 (5 Points)

REQUIRED

TABLE 2a

To correct Table 2. See Examples below.
MULTIPLIERS FOR OBSERVED BAROMETRIC PRESSURE OR ELEVATION

Bar. (Inches)	Elev. (Feet)	Multil- plic.	Bar. (Inches)	Vtch. (feet)	Multil- plic.
29.9	- 400	.992	29.9	+ .0181	.991
29.9	- 800	.981	29.9	+ .0328	.970
29.9	+ 91	.961	29.9	+ .0487	.979
29.9	+ 364	.955	29.9	+ .0700	.975
29.9	+ 612	.959	29.9	+ .0890	.976
29.9	+ 924	.966	29.9	+ .1037	.978
29.9	+ 207	.977	29.9	+ .1297	.977
29.9	+ 1492	.985	29.9	+ .1567	.976
29.9	+ 2712	.986	29.9	+ .1837	.975
29.9	+ 3675	.984	29.9	+ .2097	.971
29.9	+ 3770	.985	29.9	+ .2267	.970
29.9	+ 3775	.985	29.9	+ .2437	.969
29.9	+ 3777	.985	29.9	+ .2597	.968
29.9	+ 3778	.985	29.9	+ .2757	.968
29.9	+ 3779	.985	29.9	+ .2917	.968
29.9	+ 3780	.985	29.9	+ .3077	.968
29.9	+ 3781	.985	29.9	+ .3237	.968
29.9	+ 3782	.985	29.9	+ .3397	.968
29.9	+ 3783	.985	29.9	+ .3557	.968
29.9	+ 3784	.985	29.9	+ .3717	.968
29.9	+ 3785	.985	29.9	+ .3877	.968
29.9	+ 3786	.985	29.9	+ .4037	.968
29.9	+ 3787	.985	29.9	+ .4197	.968
29.9	+ 3788	.985	29.9	+ .4357	.968
29.9	+ 3789	.985	29.9	+ .4517	.968
29.9	+ 3790	.985	29.9	+ .4677	.968
29.9	+ 3791	.985	29.9	+ .4837	.968
29.9	+ 3792	.985	29.9	+ .4997	.968
29.9	+ 3793	.985	29.9	+ .5157	.968
29.9	+ 3794	.985	29.9	+ .5317	.968
29.9	+ 3795	.985	29.9	+ .5477	.968
29.9	+ 3796	.985	29.9	+ .5637	.968
29.9	+ 3797	.985	29.9	+ .5797	.968
29.9	+ 3798	.985	29.9	+ .5957	.968
29.9	+ 3799	.985	29.9	+ .6117	.968
29.9	+ 3800	.985	29.9	+ .6277	.968
29.9	+ 3801	.985	29.9	+ .6437	.968
29.9	+ 3802	.985	29.9	+ .6597	.968
29.9	+ 3803	.985	29.9	+ .6757	.968
29.9	+ 3804	.985	29.9	+ .6917	.968
29.9	+ 3805	.985	29.9	+ .7077	.968
29.9	+ 3806	.985	29.9	+ .7237	.968
29.9	+ 3807	.985	29.9	+ .7397	.968
29.9	+ 3808	.985	29.9	+ .7557	.968
29.9	+ 3809	.985	29.9	+ .7717	.968
29.9	+ 3810	.985	29.9	+ .7877	.968
29.9	+ 3811	.985	29.9	+ .8037	.968
29.9	+ 3812	.985	29.9	+ .8197	.968
29.9	+ 3813	.985	29.9	+ .8357	.968
29.9	+ 3814	.985	29.9	+ .8517	.968
29.9	+ 3815	.985	29.9	+ .8677	.968
29.9	+ 3816	.985	29.9	+ .8837	.968
29.9	+ 3817	.985	29.9	+ .8997	.968
29.9	+ 3818	.985	29.9	+ .9157	.968
29.9	+ 3819	.985	29.9	+ .9317	.968
29.9	+ 3820	.985	29.9	+ .9477	.968
29.9	+ 3821	.985	29.9	+ .9637	.968
29.9	+ 3822	.985	29.9	+ .9797	.968
29.9	+ 3823	.985	29.9	+ .9957	.968
29.9	+ 3824	.985	29.9	+ .10117	.968
29.9	+ 3825	.985	29.9	+ .10277	.968
29.9	+ 3826	.985	29.9	+ .10437	.968
29.9	+ 3827	.985	29.9	+ .10597	.968
29.9	+ 3828	.985	29.9	+ .10757	.968
29.9	+ 3829	.985	29.9	+ .10917	.968
29.9	+ 3830	.985	29.9	+ .11077	.968
29.9	+ 3831	.985	29.9	+ .11237	.968
29.9	+ 3832	.985	29.9	+ .11397	.968
29.9	+ 3833	.985	29.9	+ .11557	.968
29.9	+ 3834	.985	29.9	+ .11717	.968
29.9	+ 3835	.985	29.9	+ .11877	.968
29.9	+ 3836	.985	29.9	+ .12037	.968
29.9	+ 3837	.985	29.9	+ .12197	.968
29.9	+ 3838	.985	29.9	+ .12357	.968
29.9	+ 3839	.985	29.9	+ .12517	.968
29.9	+ 3840	.985	29.9	+ .12677	.968
29.9	+ 3841	.985	29.9	+ .12837	.968
29.9	+ 3842	.985	29.9	+ .12997	.968
29.9	+ 3843	.985	29.9	+ .13157	.968
29.9	+ 3844	.985	29.9	+ .13317	.968
29.9	+ 3845	.985	29.9	+ .13477	.968
29.9	+ 3846	.985	29.9	+ .13637	.968
29.9	+ 3847	.985	29.9	+ .13797	.968
29.9	+ 3848	.985	29.9	+ .13957	.968
29.9	+ 3849	.985	29.9	+ .14117	.968
29.9	+ 3850	.985	29.9	+ .14277	.968
29.9	+ 3851	.985	29.9	+ .14437	.968
29.9	+ 3852	.985	29.9	+ .14597	.968
29.9	+ 3853	.985	29.9	+ .14757	.968
29.9	+ 3854	.985	29.9	+ .14917	.968
29.9	+ 3855	.985	29.9	+ .15077	.968
29.9	+ 3856	.985	29.9	+ .15237	.968
29.9	+ 3857	.985	29.9	+ .15397	.968
29.9	+ 3858	.985	29.9	+ .15557	.968
29.9	+ 3859	.985	29.9	+ .15717	.968
29.9	+ 3860	.985	29.9	+ .15877	.968
29.9	+ 3861	.985	29.9	+ .16037	.968
29.9	+ 3862	.985	29.9	+ .16197	.968
29.9	+ 3863	.985	29.9	+ .16357	.968
29.9	+ 3864	.985	29.9	+ .16517	.968
29.9	+ 3865	.985	29.9	+ .16677	.968
29.9	+ 3866	.985	29.9	+ .16837	.968
29.9	+ 3867	.985	29.9	+ .16997	.968
29.9	+ 3868	.985	29.9	+ .17157	.968
29.9	+ 3869	.985	29.9	+ .17317	.968
29.9	+ 3870	.985	29.9	+ .17477	.968
29.9	+ 3871	.985	29.9	+ .17637	.968
29.9	+ 3872	.985	29.9	+ .17797	.968
29.9	+ 3873	.985	29.9	+ .17957	.968
29.9	+ 3874	.985	29.9	+ .18117	.968
29.9	+ 3875	.985	29.9	+ .18277	.968
29.9	+ 3876	.985	29.9	+ .18437	.968
29.9	+ 3877	.985	29.9	+ .18597	.968
29.9	+ 3878	.985	29.9	+ .18757	.968
29.9	+ 3879	.985	29.9	+ .18917	.968
29.9	+ 3880	.985	29.9	+ .19077	.968
29.9	+ 3881	.985	29.9	+ .19237	.968
29.9	+ 3882	.985	29.9	+ .19397	.968
29.9	+ 3883	.985	29.9	+ .19557	.968
29.9	+ 3884	.985	29.9	+ .19717	.968
29.9	+ 3885	.985	29.9	+ .19877	.968
29.9	+ 3886	.985	29.9	+ .20037	.968
29.9	+ 3887	.985	29.9	+ .20197	.968
29.9	+ 3888	.985	29.9	+ .20357	.968
29.9	+ 3889	.985	29.9	+ .20517	.968
29.9	+ 3890	.985	29.9	+ .20677	.968
29.9	+ 3891	.985	29.9	+ .20837	.968
29.9	+ 3892	.985	29.9	+ .20997	.968
29.9	+ 3893	.985	29.9	+ .21157	.968
29.9	+ 3894	.985	29.9	+ .21317	.968
29.9	+ 3895	.985	29.9	+ .21477	.968
29.9	+ 3896	.985	29.9	+ .21637	.968
29.9	+ 3897	.985	29.9	+ .21797	.968
29.9	+ 3898	.985	29.9	+ .21957	.968
29.9	+ 3899	.985	29.9	+ .22117	.968
29.9	+ 3900	.985	29.9	+ .22277	.968
29.9	+ 3901	.985	29.9	+ .22437	.968
29.9	+ 3902	.985	29.9	+ .22597	.968
29.9	+ 3903	.985	29.9	+ .22757	.968
29.9	+ 3904	.985	29.9	+ .22917	.968
29.9	+ 3905	.985	29.9	+ .23077	.968
29.9	+ 3906	.985	29.9	+ .23237	.968
29.9	+ 3907	.985	29.9	+ .23397	.968
29.9	+ 3908	.985	29.9	+ .23557	.968
29.9	+ 3909	.985	29.9	+ .23717	.968
29.9	+ 3910	.985	29.9	+ .23877	.968
29.9	+ 3911	.985	29.9	+ .24037	.968
29.9	+ 3912	.985	29.9	+ .24197	.968
29.9	+ 3913	.985	29.9	+ .24357	.968
29.9	+ 3914	.985	29.9	+ .24517	.968
29.9	+ 3915	.985	29.9	+ .24677	.968
29.9	+ 3916	.985	29.9	+ .24837	.968
29.9	+ 3917	.985	29.9	+ .24997	.968
29.9	+ 3918	.985	29.9	+ .25157	.968
29.9	+ 3919	.985	29.9	+ .25317	.968
29.9	+ 3920	.985	29.9	+ .25477	.968
29.9	+ 3921	.985	29.9	+ .25637	.968
29.9	+ 3922	.985	29.9	+ .25797	.968
29.9	+ 3923	.985	29.9	+ .25957	.968
29.9	+ 3924	.985	29.9	+ .26117	.968
29.9	+ 3925	.985	29.9	+ .26277	.968
29.9	+ 3926	.985	29.9	+ .26437	.968
29.9	+ 3927	.985	29.9	+ .26597	.968
29.9	+ 3928	.985	29.9	+ .26757	.968
29.9	+ 3929	.985	29.9	+ .26917	.968
29.9	+ 3930	.985	29.9	+ .27077	.968
29.9	+ 3931	.985	29.9	+ .27237	.968
29.9	+ 3932	.985	29.9	+ .27397	.968
29.9	+ 3933	.985	29.9	+ .27557	.968
29.9	+ 3934	.985	29.9	+ .27717	.968
29.9	+ 3935	.985	29.9	+ .27877	.968
29.9	+ 3936	.985	29.9	+ .28037	.968
29.9	+ 3937	.985	29.9	+ .28197	.968
29.9	+ 3938	.985	29.9	+ .28357	.968
29.9	+ 3939	.985	29.9	+ .28517	.968
29.9	+ 3940	.985	29.9	+ .28677	.968
29.9	+ 3941	.985	29.9	+ .28837	.968
29.9	+ 3942	.985	29.9	+ .28997	.968

Problem D-9 (5 Points)

REQUIRED

TABLE 9
Increase in GIIA for Elapsed Time.

No.	Hours of Greenwich Civil Time			Per
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TABLE 6—(Continued)
Increase in GHA for Elapsed Time.