

# LS

## LAND SURVEYOR - 1983

# C

### Part C - Wt. 50.0

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. All problems in Part C are required.
2. In the workbook, you are to work ALL Problems C-1 through C-5.
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	10	Points
Problem C-2	10	Points
Problem C-3	10	Points
Problem C-4	10	Points
Problem C-5	10	Points

---

TOTAL    50    Points

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.

Problem C-1 - Wt. 10

In your workbook show the various part numbers from 1 to 10 and provide a True or False answer to each part. In each instance provide a brief explanation for your answer.

1. When a final map is filed for public record the civil engineer or land surveyor must certify on the map that the survey was made by him/her.
2. A grading plan for a non-exempt fixed work may be signed by a licensed land surveyor.
3. A licensee (CE & LS) who provides a report to a client which is not signed, or sealed, is in violation of the California Land Surveyors' Act.
4. In an action to quiet title a licensed land surveyor may administer an oath if a notary public is not immediately available.
5. A Record of Survey map which is filed for public record may be revised at the request of the county surveyor to conform to a public record which was filed previously.
6. The approval of a tentative map must expire within three years.
7. The mapping angle  $\theta$  for any position of longitude as it is used in the California Coordinate System is always more than the difference in longitude between this position and the central meridian.
8. When a sub-tense bar is used the horizontal distance is always obtained direct even though the line of sight may be taken with a vertical angle from a horizontal plane.
9. When crossing a steep canyon which is inaccessible reciprocal leveling is used to compensate for curvature, refraction, and instrumental error.
10. If the SW corner of Section 31 R4W, T8N, MDB&M was lost it could be restored by single proportionate measure.

Problem C-2 - Wt. 10

A utility company proposes to acquire an easement across the land of a local property owner, as indicated in the plat shown below. The property owner has agreed to accept \$7500 per acre in severance fees for the area that lies Northwest of the Northwest line of the easement. The settlement for the area within the easement is a separate consideration and it may be neglected.

REQUIRED

1. What is the area for which compensation to the landowner is appropriate?
2. What fee is ultimately to be paid to the landowner?

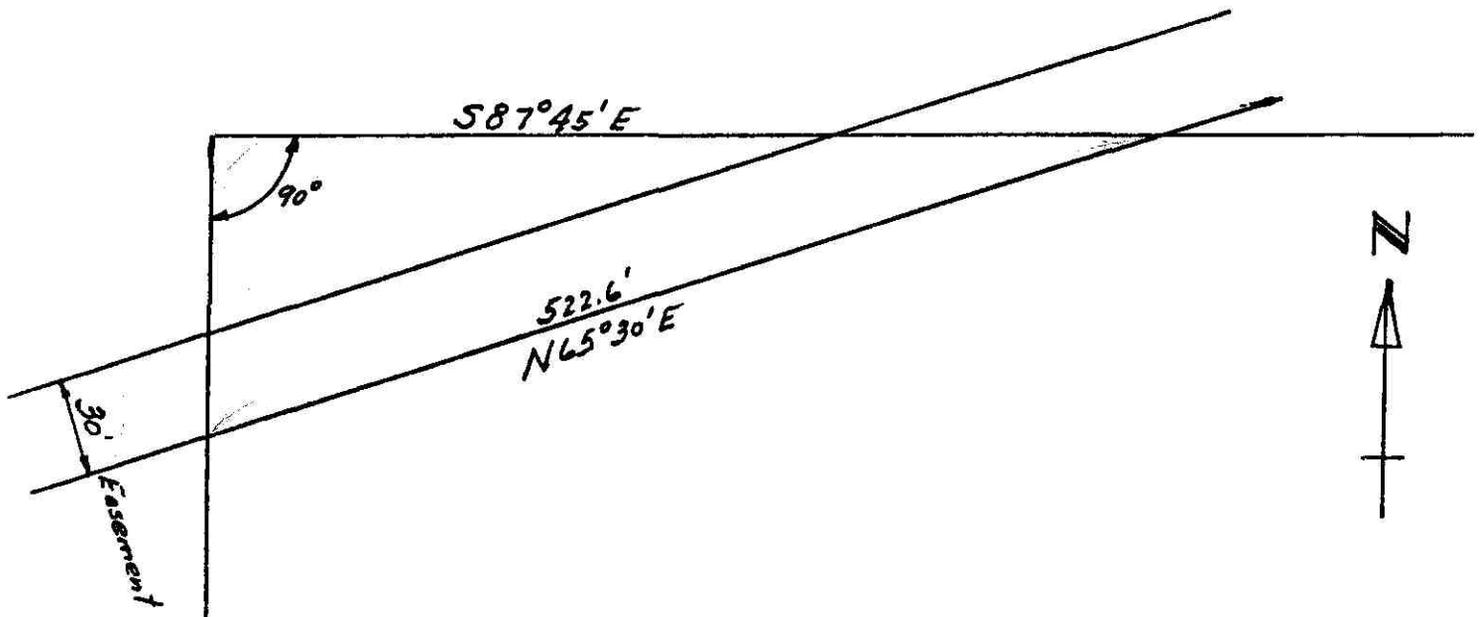


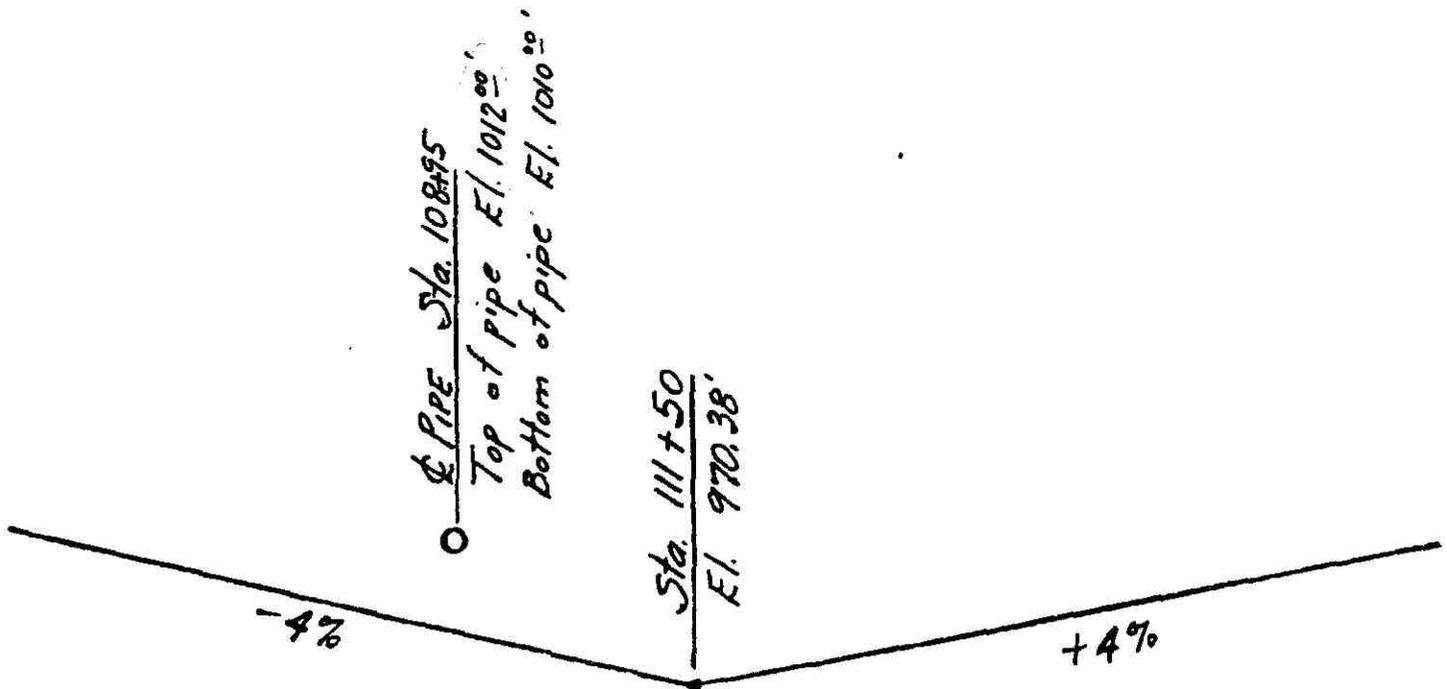
Fig. C2

Problem C-3 - Wt. 10

Two grade lines intersect at Station 111+50 at an elevation of 970.38 feet. The entering grade is -4% and the exiting grade is +4%. A pipeline crosses the grade line at right angles at Station 108+95. Two sag vertical curves must be identified, one of which passes under the pipe, and one of which passes over the pipe. The clearances required are: (A) 18 feet between the bottom of the pipe and the lower vertical curve; and (B) 5 feet between the top of the pipe and the higher vertical curve. Elevations are shown on the elevation below.

REQUIRED

- a. What is the maximum length of the vertical curve to provide 18 feet clearance under the pipe?
- b. What is the minimum length of the vertical curve to provide 5 feet clearance above the pipe?



Problem C-4 - Wt. 10

1. What is meant by a conformal projection? Give an example.
2. Why is a Lambert projection applied in some states, in the U.S.A. and a Transverse Mercator projection applied in others?
3. What is a rhumb line?
4. What is the legal status of the California Coordinate System in California?
5. Distinguish between the following:
  - Grid North
  - Geodetic North
  - Astronomic North
  - True North
  - Orthometric North
6. What is the geoid?
7. What is the importance, or significance, of Meade's Ranch?
8. What is the significance of the grid scale factor?
9. What maximum width has been assigned to a grid zone?
10. What projections are used other than those identified in part 2 above?

Problem C-5 - Wt. 10

- a. What astronomical survey method is best suited to determine:
- (1) azimuth during daytime hours?
  - (2) latitude during daytime hours?
  - (3) azimuth during nighttime hours?
  - (4) latitude during nighttime hours?
- b. If you had to determine azimuth and latitude tonight what time would you plan for each? (Give a two hour interval as your answer for each)
- c. What are the maximum and minimum values during 1983 of the sun's altitude for an observer at the center of Zone VII? (Include a sketch as part of your answer)
- d. Show by a sketch why the altitude of the pole is equal to the observer's latitude.
- e. What is meant by the equation of time?
- f. How does the solar day relate to the sidereal day? In one year's time what might be the difference between the two?
- g. What is the position of Greenwich? Why is it significant to the land surveyor?

**LS**

## LAND SURVEYOR - 1983

**D**

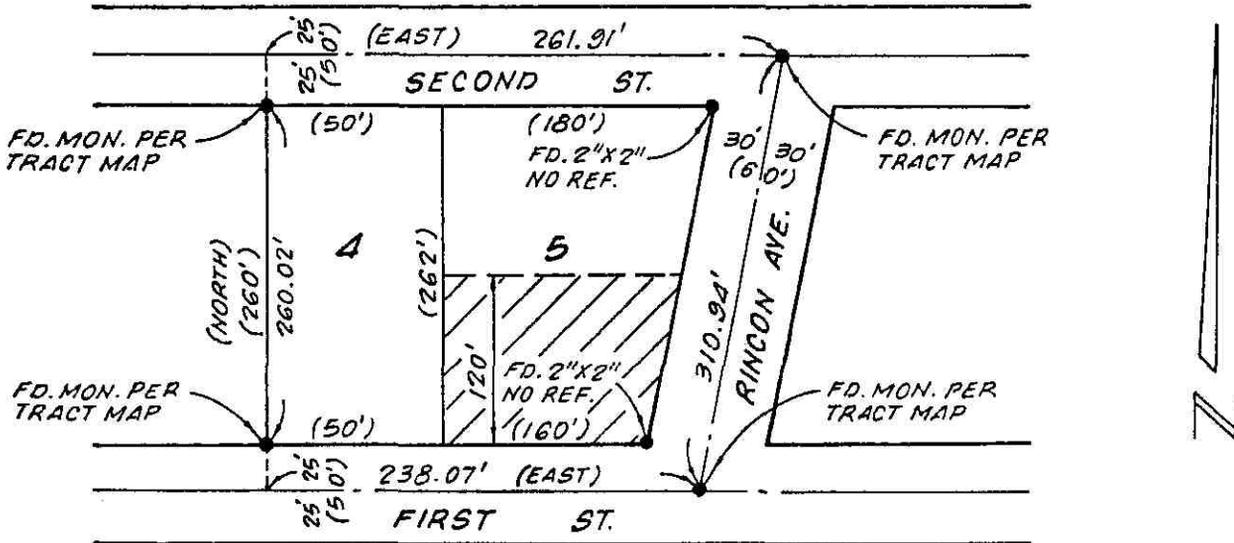
## Part D - Wt. 50.0

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.
3. This portion of the Land Surveyor examination consists of the following:

Problems 1,2,3 Required	Problem D-1	12.5	Points
	Problem D-2	12.5	Points
	Problem D-3	12.5	Points
Problems 4 & 5 Choose 1	Problem D-4	12.5	Points
	Problem D-5	12.5	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. Read the instructions on the workbook cover page.
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 D1 - Wt. 12.5



The 2" x 2" stakes found on the easterly line of Lot 5 were found at the record distances per the original subdivision.

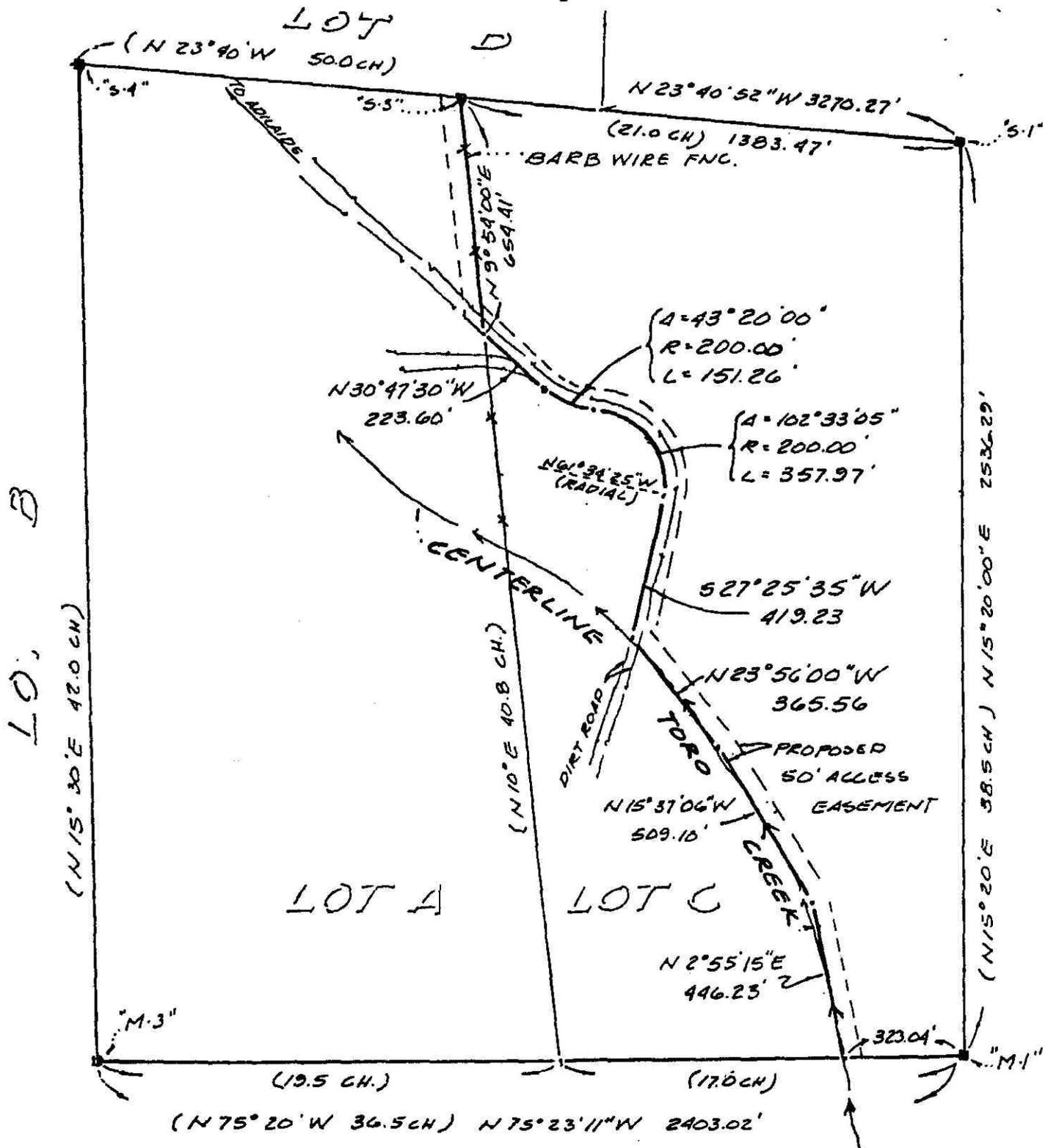
Your Client has purchased lot 4 and the southerly 120.00 feet of lot 5 of a subdivision. The west line of lot 4 is the tract boundary and the dimensions shown thus (456.89') are record per the original tract map. You are to prepare a legal description of your Client's property and calculate the actual boundary dimensions and area of the purchase to the nearest square foot.

Problem D-2 - Wt. 12.5

Mr. Able owns Lots A & C of the Garcia Tract. The Garcia Tract is shown on the plat following. Mr. Body owns Lot D of the Garcia Tract. Mr. Able has agreed to allow a 50 foot access easement over his lots for the use of Lot D. Mssrs. Able and Body have agreed on the following location of the easement: The West edge of the easement will run along the centerline of Toro Creek to the dirt road that leads to the town of Adilaide, then the West edge will run along the West edge of the dirt road until it crosses the barbed wire fence at the lot line between Lots A and C, then the East edge will follow the fence to Lot D.

REQUIRED

You are to write a complete metes and bounds description of the easement.



■ = FOUND 3"x4" STAKE MARKED AS SHOWN PER GARCIA TR. MAP  
( ) = RECORD DIMENSIONS PER MAP RECORDED IN BOOK A OF MAPS AT PAGE 103. "GARCIA TRACT"

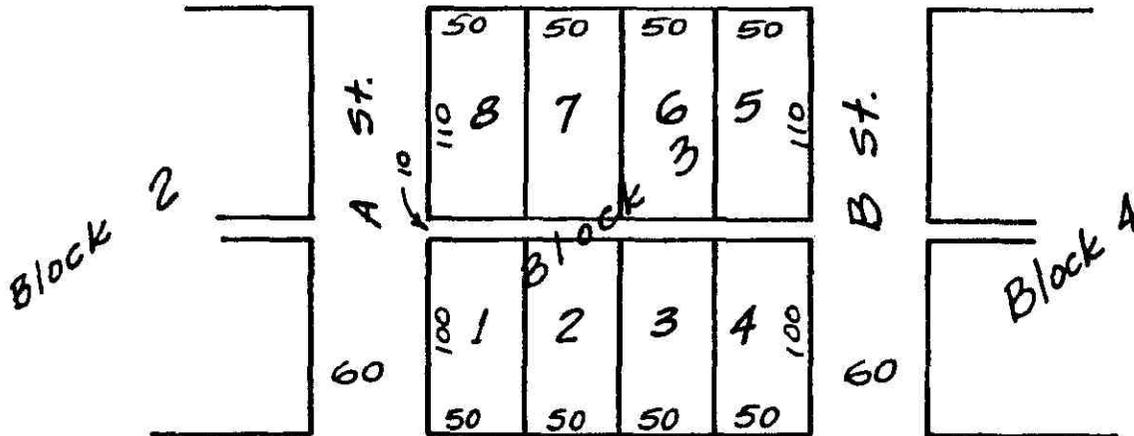
EASEMENT SKETCH  
LOT A; C OF THE GARCIA TRACT, COUNTY OF SAN

Problem D-3 - Wt. 12.5

Mr. Wright contracts with you to survey his property. He provides you with the following recorded deed:

Doe to Wright (1974) - Beginning at the southeast corner of Lot 4 Block 3 of the Johnson Tract, thence west 60 feet, thence north 100 feet, thence east 60 feet, thence south 100 feet to the point of beginning.

After researching the record you find the following:



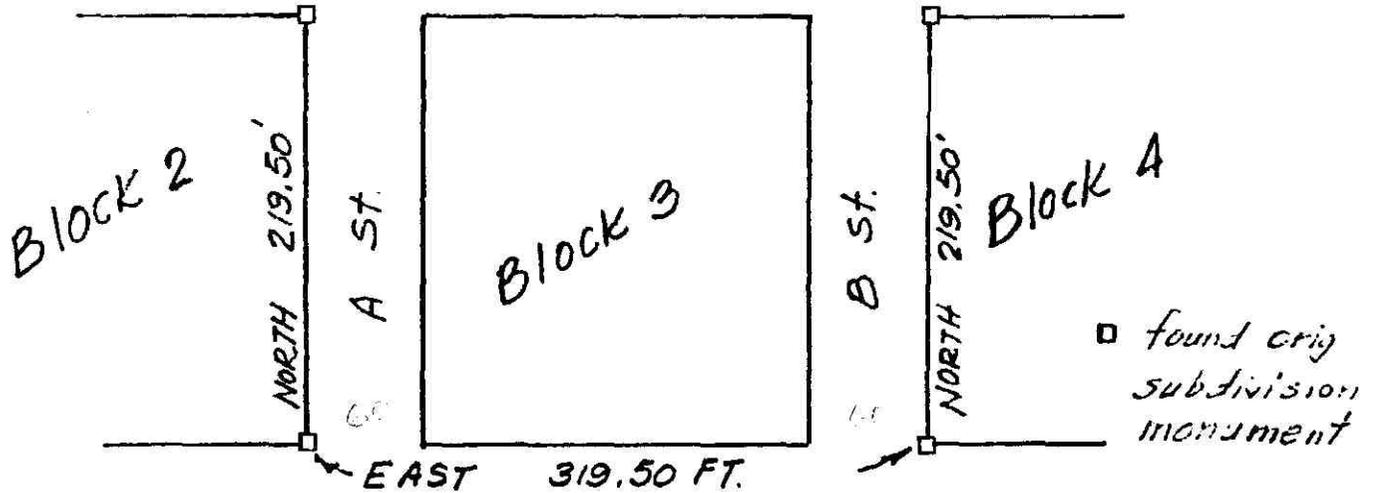
Map of  
Johnson Tract 1960

Chain of Title

- |                                  |  |
|----------------------------------|--|
| Johnson to Jones (January 1961)  | Lot 1, Block 3 of the Johnson Tract  |
| Johnson to Smith (February 1961) | East half of Lot 2, Block 3 of the Johnson Tract                                     |
| Johnson to Smith (March, 1961)   | Lot 3, Block 3 of the Johnson Tract, excepting the easterly 10 feet of said lot      |
| Johnson to Doe (December, 1961)  | Lot 4 and the easterly 10 feet of lot 3 of Block 3 of the Johnson Tract              |
| Smith to Sanchez (May, 1967)     | East half of lot 2 and the westerly 40 feet of lot 3 of Block 3 of the Johnson Tract |
| Johnson Estate to Miller (1972)  | Westerly 25 feet of lot 2, Block 3 of the Johnson Tract                              |
| Doe to Wright (1974)             | See above  |
| City Resolution No. 846 (1977)   | Vacates the alley in Block 3 of the Johnson Tract                                    |

Problem D-3 (Continued)

You find the following conditions following field measurements:



REQUIRED

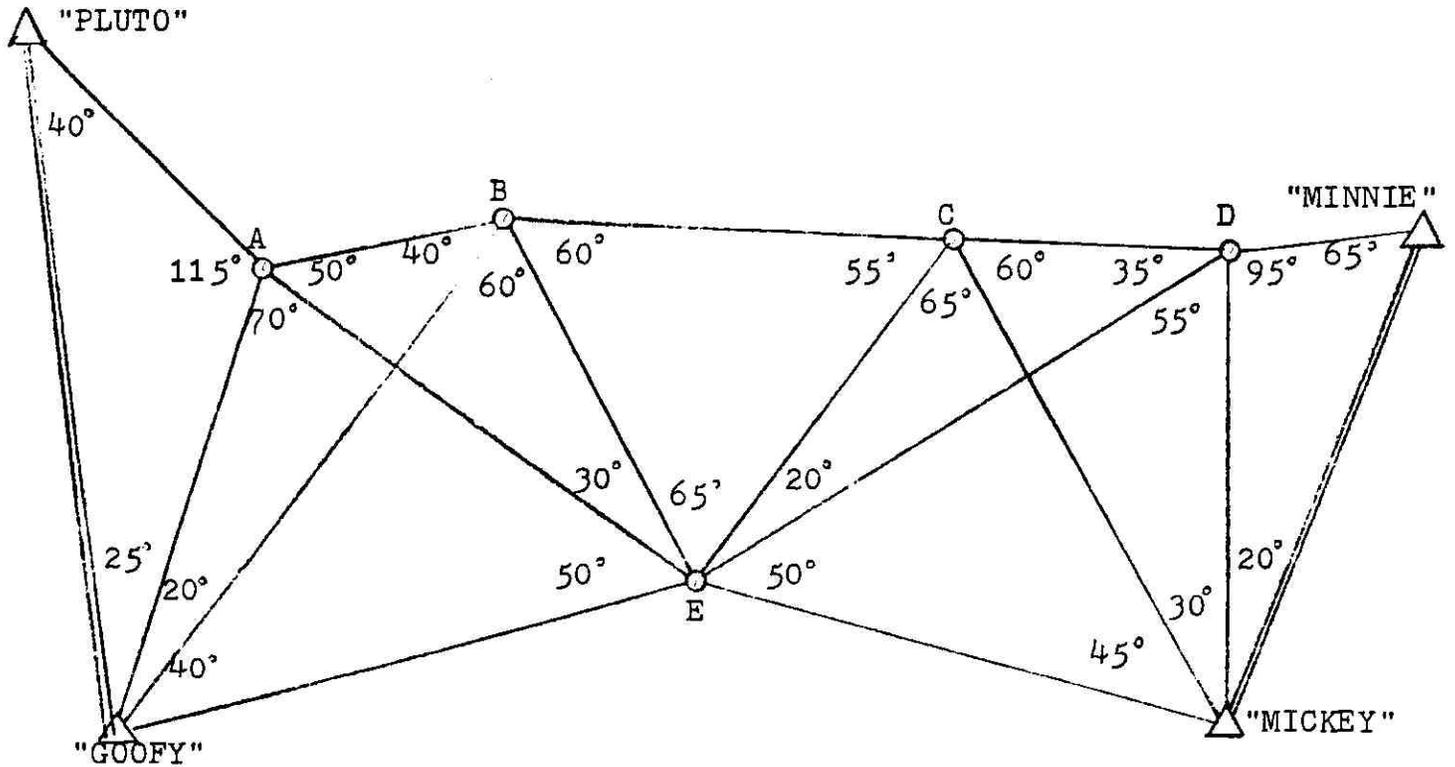
In your workbook label and dimension the ownerships in the South half of Block 3.

State any assumptions you may make, and show all calculations.

Problem D-4 - Wt. 12.5

NOTE: Choose D4 OR D5

You have established stations A-B-C-D-E in the sketch below so that A,B,C,D & "MINNIE" can be used for future traverse control along a project route.



Scale: 1" = 2 miles

△ = Existing First Order Station    ○ = New Station

- What order and class of triangulation would this scheme satisfy? (Assume all stations occupied and all directions observed for this part)
- Which is the weakest figure in the scheme?
- Which is the strongest figure in the scheme?
- What equipment would you use to measure this net?  
(Give your answer by stating specifications not brand names)
- What methods and procedures would you use? Be brief.
- What can be done to change the results to Second Order Class II?

Problem D-5 - Wt. 12.5NOTE: Choose D4 OR D5

Using the following information, you are to determine the geodetic azimuth from the South ( to the nearest 05" ) and horizontal ground distance ( to the nearest 0.5' ) between control point "TRI" and control point "GLEN".

Show all intermediate values and procedures.

## Zone I

Control Point "TRI"

$$X = 1,646,026.01'$$

$$Y = 35,926.30'$$

$$\text{Elev.} = 5,230.0'$$

## Zone II

Control Point "GLEN"

$$X = 1,652,148.17'$$

$$Y = 624,505.65'$$

$$\text{Elev.} = 4,010.0'$$

Mean Radius of the Earth = 20,906,000'

Problem D-5 (Continued)

Constants for California zones

Constants	I	II
C	2,000,000	2,000,000
Central Meridian	122° 00'	122° 00'
R <sub>b</sub>	24,792,436.23	26,312,257.65
y <sub>0</sub>	547,078.17	516,407.35
<i>l</i>	0.65388 43192	0.63046 79732
$\frac{1}{2\rho_0^2 \sin 1''}$	2.358 x 10 <sup>-10</sup>	2.359 x 10 <sup>-10</sup>
log $\frac{1}{2\rho_0^2 \sin 1''}$	0.372 4621 - 10	0.372 6393 - 10
log <i>l</i>	9.81550 09227 - 10	9.79966 30299 - 10
log k	7.60515 70526	7.61359 91422

Lambert Projection for California I

Table I

Lat.	R feet	Y' 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
39° 20'	24,792,436.23	0	101.20050	+1016.9	1.0002341
21	24,786,364.20	6,072.03	101.20000	+984.5	1.0002267
22	24,780,292.20	12,144.03	101.19967	+952.4	1.0002193
23	24,774,220.22	18,216.01	101.19917	+920.7	1.0002120
24	24,768,148.27	24,287.96	101.19867	+889.4	1.0002048
25	24,762,076.35	30,359.88	101.19817	+858.4	1.0001977
39° 26'	24,756,004.46	36,431.77	101.19783	+827.7	1.0001906
27	24,749,932.59	42,503.64	101.19750	+797.5	1.0001836
28	24,743,860.74	48,575.49	101.19717	+767.6	1.0001767
29	24,737,788.91	54,647.32	101.19650	+738.0	1.0001699
30	24,731,717.12	60,719.11	101.19633	+708.8	1.0001632

Problem D-5 (Continued)

LAMBERT PROJECTION FOR CALIFORNIA II

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
39° 21'	25,699,212.42	613,045.23	101.16983	-324.1	0.9999254
22	25,693,142.23	619,115.42	101.17050	-318.1	0.9999268
23	25,687,072.00	625,185.65	101.17083	-311.7	0.9999282
24	25,681,001.75	631,255.90	101.17133	-305.0	0.9999298
25	25,674,931.47	637,326.18	101.17183	-297.8	0.9999314
39° 26	25,668,861.16	643,396.49	101.17217	-290.4	0.9999331
27	25,662,790.83	649,466.82	101.17283	-282.5	0.9999350
28	25,656,720.46	655,537.19	101.17317	-274.3	0.9999368
29	25,650,650.07	661,607.58	101.17367	-265.7	0.9999388
30	25,644,579.65	667,678.00	101.17433	-256.7	0.9999409

LAMBERT PROJECTION FOR CALIFORNIA II

1" of Long. = 0"63046797 of  $\theta$

Long.	$\theta$	Long	$\theta$	Long	$\theta$
122° 36'	-0 22 41.8108	123° 11'	-0 44 45.7936	123° 46'	-1 06 49.7763
37	-0 23 19.6389	12	-0 45 23.6216	47	-1 07 27.6044
38	-0 23 57.4670	13	-0 46 01.4497	48	-1 08 05.4325
39	-0 24 35.2951	14	-0 46 39.2778	49	-1 08 43.2605
40	-0 25 13.1231	15	-0 47 17.1059	50	-1 09 21.0886
122° 41'	-0 25 50.9512	16	-0 47 54.9340	123° 51'	-1 09 58.9167
42	-0 26 28.7793	17	-0 48 32.7620	52	-1 10 36.7448
43	-0 27 06.6074	18	-0 49 10.5901	53	-1 11 14.5729
44	-0 27 44.4354	19	-0 49 48.4182	54	-1 11 52.4009
45	-0 28 22.2635	20	-0 50 26.2463	55	-1 12 30.2290

LAMBERT PROJECTION FOR CALIFORNIA I

1" of Long = 0" 65388432 of  $\theta$

Long.	$\theta$	Long	$\theta$	Long.	$\theta$
123° 11'	-0 46 25.5472	123° 46'	-1 09 18.7043	124° 21'	-1 32 11.8613
12	-0 47 04.7803	47	-1 09 57.9373	22	-1 32 51.0944
13	-0 47 44.0133	48	-1 10 37.1704	23	-1 33 30.3275
14	-0 48 23.2464	49	-1 11 16.4035	24	-1 34 09.5605
15	-0 49 02.4794	50	-1 11 55.6365	25	-1 34 48.7936
123° 16'	0 49 41.7125	123° 51'	-1 12 34.8696	124° 26'	-1 35 28.0266
17	-0 50 20.9456	52	-1 13 14.1026	27	-1 36 07.2597
18	-0 51 00.1786	53	-1 13 53.3357	28	-1 36 46.4928
19	-0 51 39.4117	54	-1 14 32.5687	29	-1 37 25.7258
20	-0 52 18.6447	55	-1 15 11.8018	30	-1 38 04.9589