00583

ARD OF REGISTRATION FOR PROFESSIONAL
ENGINEERS AND LAND SURVEYORS
1428 Howe Avenue, Suite 56
Sacramento, California 95825

EXAMINEE ID NUMBER: 034790

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

Section A Test Booklet

SECTION A

153 Points of 300 Total Points
Time Allowed to Complete This Section: 4 Hours

Examination Overview

The 1991 California Professional Land Surveyor examination is given in two, 4-hour periods on the same day. Section A is the first section of this two-part examination; Section B will be given in the afternoon. Section A consists of the following:

Test Problem No.	Subject Matter	Point Value
A 1	~~Legal Description~~	30
A 2	~~Subdivision Boundary~~	36
A 3	~~Photogrammetry~~	30
A 4	Error Analysis	21
A 5	~~Public Lands~~	36

The scope of this exam relates to the principles and practice of land surveying in the various areas of practice. You will be graded on the answers specifically required and in certain cases your method of obtaining these answers as demonstrated in your solution. Therefore, show all your work including all formulae and calculations.

The questions have been designed to realistically reflect the actual conditions and practice of land surveying. The assignment of points to each question is not based on the time required to complete an answer. Instead, points have been assigned on the basis of the relative importance of each question to basic land surveying competence.

Examination Instructions

As you will take this test booklet with you when you complete the examination, do not write your answers in this test booklet. Solution booklets for each test problem have been provided with this test booklet. Present your answers on the sheets provided within each solution booklet. Only work in a solution booklet will be scored. Follow the steps listed below to present your solutions:

- Be sure to use the correct solution booklet for each test problem. The problem number is printed on the cover of each solution booklet.
- Enter the problem number in the space provided on each inside sheet of the solution booklet.
- Enter your identification number on the front cover of each solution booklet and in the upper right-hand corner of each page of the solution booklet in the spaces provided. **Do not write your name on any part of this examination.**
- Additional paper for your solution booklets can be obtained from your proctor. Enter the number of the test problem on every additional sheet you use.
- Number your solution pages 1 of 3, 2 of 3, etc.
- In addition to the answer, show all work pertinent to the problem's solution to demonstrate to the grader the method used.
- Certain problems require a specified number of answers. Where you are required to provide a specific number of answers, you must provide **only** the number of answers required. Any answers provided **beyond** the number required will not be graded.
- Clearly delineate any work that you do not want scored by lining through that part and marking VOID across it.
- When you have completed this portion of the examination, check your work, put your solution booklets in order in the envelope provided, seal your envelope, write your examinee ID number across the seal of the envelope, and give all material to your proctor.

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM A1

30 Points

PROBLEM STATEMENT

You have surveyed a pipeline route as shown on the plat on the facing page. Utilizing a property line tie that you made on the Northerly line of Sycamore Street, record map values, and the Tarantino deed, you calculated pipe lengths on the Tarantino property. You have been asked to prepare an easement description for the two pipelines as they relate to the Tarantino property.

The Tarantinos bought the Northerly 150.00 feet of the Easterly 200.00 feet of Lot 3 of Block 14 as shown on a deed recorded on August 9, 1943, in Book 27, Page 83 of Official Records.

The easement for pipeline "A" is 30.00 feet wide. The pipeline is 10.00 feet Southeasterly and Easterly of the Northwesterly and Westerly line of the easement.

Pipeline "B" is in the center of a 20.00-foot-wide easement.

PROBLEM REQUIREMENTS

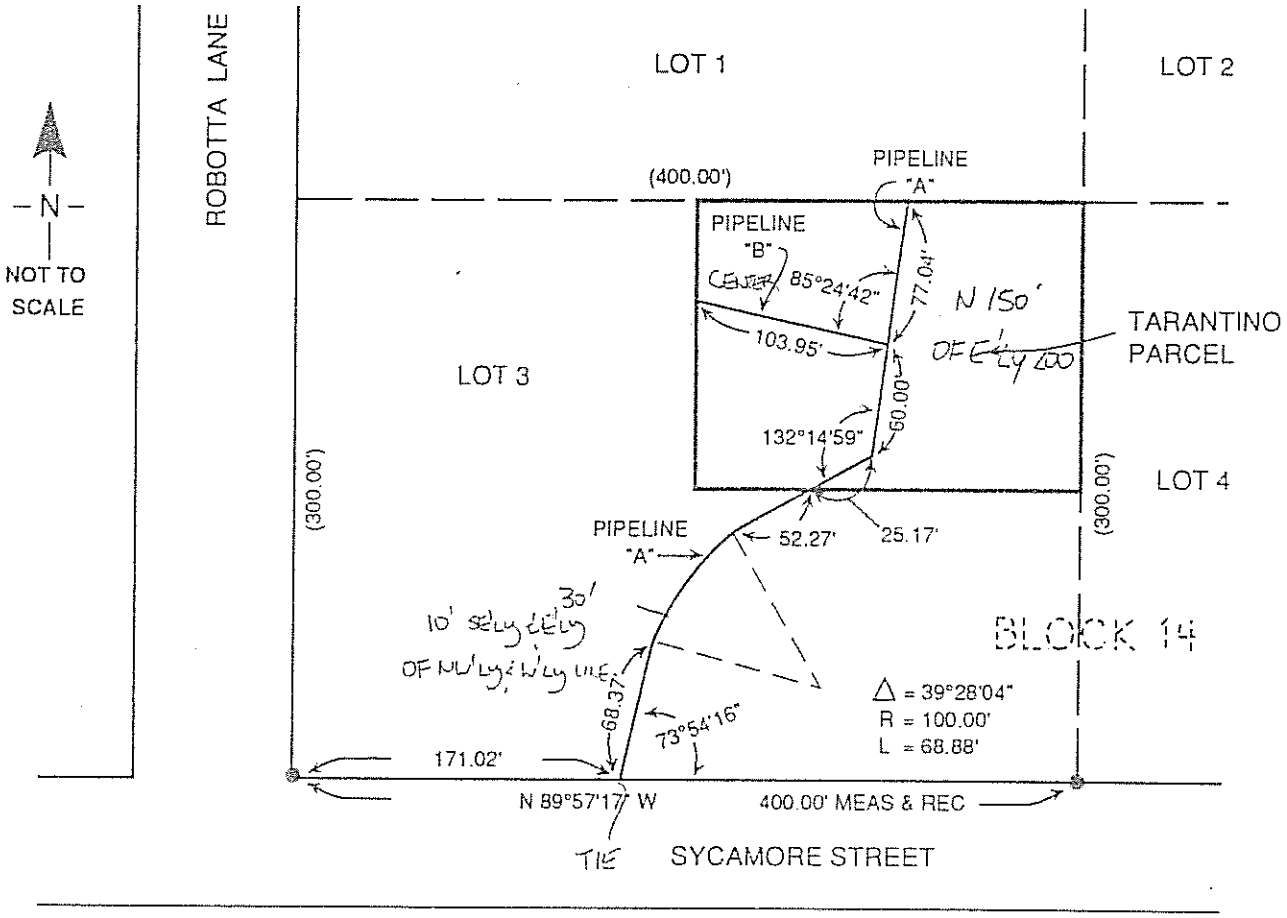
1. Calculate the bearings necessary to write the description for the two pipeline easements. 6 Points

2. Utilizing the surveyed information, prepare a complete legal description entitled "Exhibit A" for the two pipeline easements on the Tarantino parcel. The legal description will be attached to a grant deed that reads, in part, that Tarantino grants the easements for pipeline purposes as described in Exhibit A. 24 Points

   - Begin your description at the Southwest corner of Lot 3.
   - The TRUE POINT OF BEGINNING must be on the Southerly line of the Tarantino parcel.
   - No further surveying or property line calculations are required.

PROBLEM A1

A PORTION OF MAP 3619, BOOK 36, PAGE 54 OF MAPS, COUNTY OF TESTING SHOWING PIPELINES



LEGEND

● = FD 2" IP W/ DISK
LS 10,000 PER MAP 3619

( ) = RECORD VALUE
PER MAP 3619

PROBLEM A2

36 Points

PROBLEM STATEMENT

You have been retained to survey Lot 4, Tract No. 3500, MB 35–14, as shown on the plat of the block in your solution booklet. Tract 2000 and Tract 3500 as shown on the plats on pages 4 and 5 were both created from Lot 1, Tract No. 1000, MB 10–14. The original boundaries of Lot 1 are the centerlines of the streets adjacent to the newer tracts. The owner of Lot 1, Tract No. 1000, subdivided part of the property by recording Tract No. 2000, MB 20–7. The owner later sold the remainder of Lot 1, which was subdivided by Tract No. 3500, MB 35–14.

The distances and angles shown for the centerlines of the streets in your solution booklet are your measurements. All other distances and bearings shown on the plats are tract record values.

Public records indicate that the original two-inch pipes between the subdivisions set by Tract No. 2000 have not been recovered. Your field search has verified that the pipes are gone and no physical occupation exists.

PROBLEM REQUIREMENTS

Solve the following and **show all your work.**

1. a. Using the plat in your solution booklet, show the calculated distances you would use to perform the survey of Lot 4, Tract No. 3500. — 11 Points

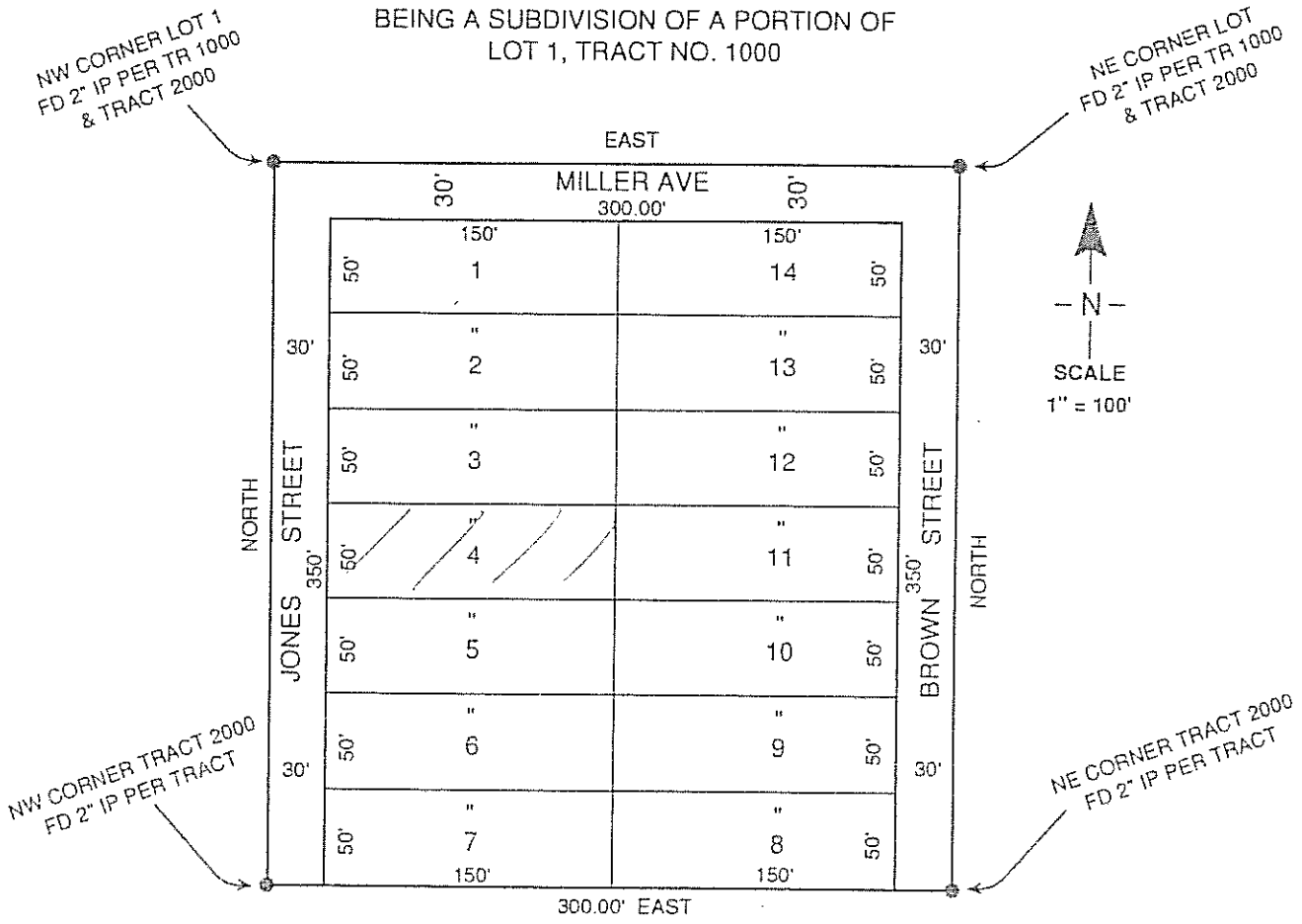
   b. Show the comparisons of your measured distances to tract record throughout the block. — 10 Points

2. Describe the principles that you would use to complete the procedure required to establish the dimensions of Lot 4, Tract No. 3500 from the monuments as shown on the plat in your solution booklet. — 9 Points

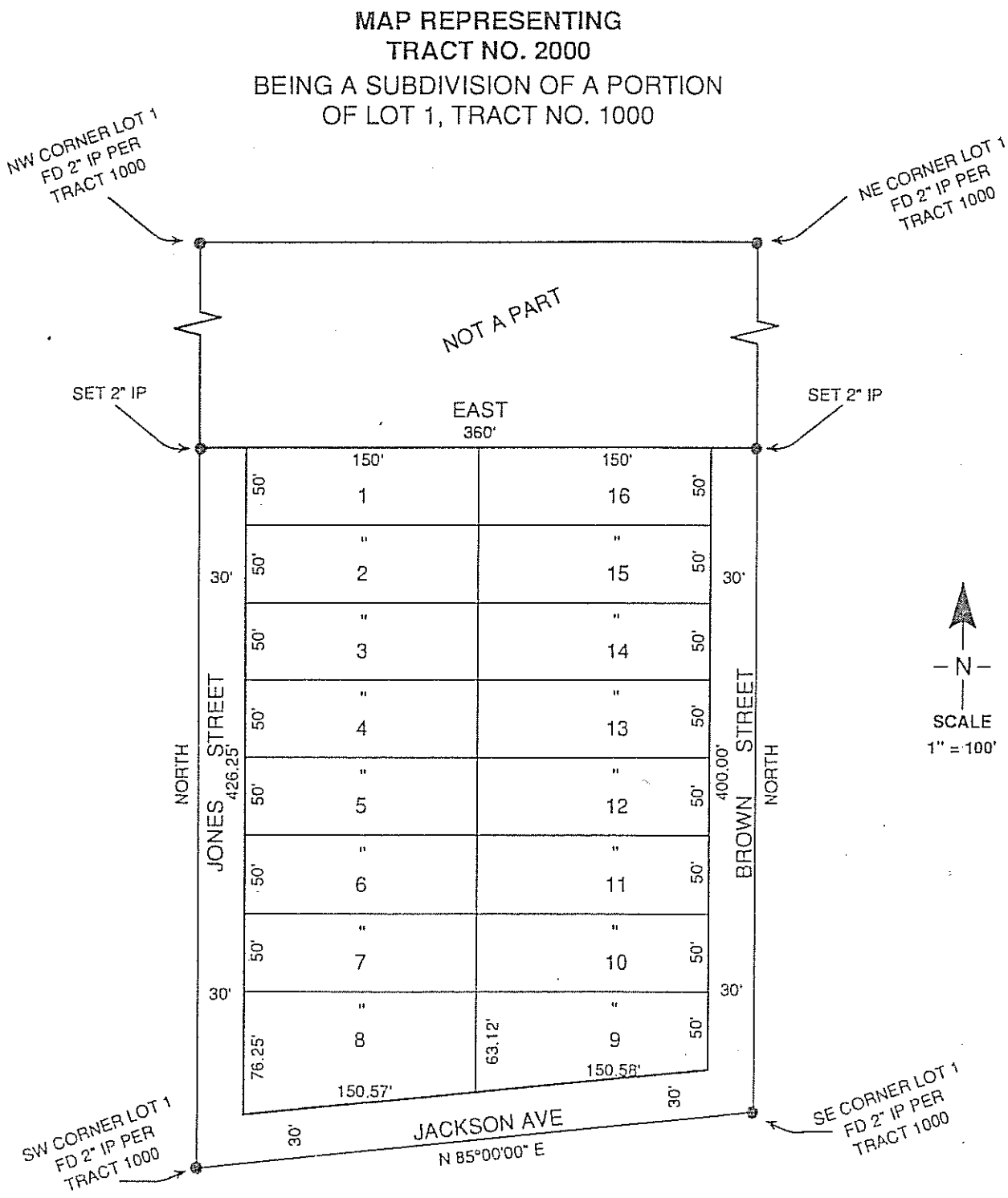
3. Is a Corner Record or Record of Survey required by state law? Cite the statute section that verifies your answer. — 6 Points

PROBLEM A2

MAP REPRESENTING
TRACT NO. 3500
BEING A SUBDIVISION OF A PORTION OF
LOT 1, TRACT NO. 1000



PROBLEM A2


MAP REPRESENTING
TRACT NO. 2000
BEING A SUBDIVISION OF A PORTION
OF LOT 1, TRACT NO. 1000
NW CORNER LOT 1
FD 2" IP PER
TRACT 1000
NE CORNER LOT 1
FD 2" IP PER
TRACT 1000
NOT A PART
SET 2" IP
SET 2" IP
EAST
360'
150'
150'
50'
50'
1
16
"
"
2
15
3
14
4
13
5
12
6
11
7
10
8
9
30'
30'
JONES STREET
NORTH
426.25'
BROWN STREET
NORTH
400.00'
76.25'
150.57'
63.12'
150.58'
30'
30'
JACKSON AVE
N 85°00'00" E
SW CORNER LOT 1
FD 2" IP PER
TRACT 1000
SE CORNER LOT 1
FD 2" IP PER
TRACT 1000
N
SCALE
1" = 100'

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM NO. A2

POINTS 36

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

CANDIDATE NUMBER

FOLDER NUMBER

GRADER NUMBER

GRADING PLAN

	CORRECT	WRONG

1. a. Distance 150.22', on ℄ Jones St., to N. line Lot 4 shown as 1-a on solution sheet. ① Answer: 5 Points

   Distance 50.07', on ℄ Jones St. between N & S lines of Lot 4, shown as 1-b on solution sheet. ② Answer: 5 Points

   Distance 50.07', on rear line Lot 4, shown as 1-c on solution sheet. ③ Answer: 1 Point

   b. Distance 807.49' or 427.49' plus 380.00', tract record on Brown St. between Jackson Ave. and Miller Ave., shown as 1-d on solution sheet. ④ 5 Points

   Distance 838.98' or 458.99' plus 380.00', tract record on Jones St. between Jackson Ave. and Miller Ave., shown as 1-e on solution sheet. ⑤ 5 Points

   Note: An answer of + or – 0.01' is acceptable.

2. In the absence of the original monuments between Tracts No. 2000 and 3500 and the absence of physical occupation, the senior tract retains its record dimensions and the remaining parcel, in this case Tract No. 3500, receives the surplus and the excess amount is pro-rated only within Tract No. 3500. ⑥ 9 Points

3. a. Yes. Either Record of Survey or Corner Record would be appropriate. ⑦ 3 Points

   b. Section 8773–a or Section 8762 of Land Surveyors Act. ⑧ 3 Points

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GO ON TO THE NEXT PAGE

PROBLEM A3

30 Points

PROBLEM STATEMENT

Your client owns Sections 9 and 16, and the Westerly 4000 feet of Sections 10 and 15, T4S, R23W, S.B.M. You have been asked to provide horizontal and vertical control for the topographic mapping that is to be used for planning purposes. Vertical photography, taken with a 6-inch focal length camera on a 9" x 9" focal plane, is to be used. Analytical bridging is not to be considered.

The following factors control the project. **Make no assumptions.**

1. A 5-foot contour interval is required.
2. Model size is 3.6" x 7.0" for a single flight line and 3.6" x 6.3" for two or more adjacent flight lines.
3. The "C" factor to be used for this project is 1,800'.
4. The map is to be compiled at a 5 to 1 ratio.
5. The average terrain elevation is 2,500' above sea level.
6. The minimum target size to be used for premarking the ground is not to be less than 0.001" x 0.01" at the photo scale.
7. Per a recent Record of Survey, each section has been found to be standard dimensions.

PROBLEM REQUIREMENTS

1. Based on the above specifications, determine the following; **show all work.**
   a. The minimum number of flight lines required. — 3 Points
   b. The required flying height above sea level. — 3 Points
   c. The minimum number of models required. — 3 Points
   d. The minimum number of photographs required. — 3 Points
   e. The minimum number of horizontal and vertical control stations required to provide for adequate checks. — 5 Points
   f. The negative scale. — 3 Points
   g. The nominal map scale. — 3 Points
   h. The minimum length and width of the target placed on the ground as a premark. — 4 Points
2. Give the accuracy requirements for each of the following based on requirements of the National Map Accuracy standards:
   a. Contours — 1 Point
   b. Spot elevations — 1 Point
   c. Planimetric features — 1 Point

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

CANDIDATE NUMBER | FOLDER NUMBER | GRADER NUMBER

PROBLEM NO. A3

POINTS 30

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

GRADING PLAN

	CORRECT	WRONG

1. a. Minimum number of flight lines required = 1
   Overall length = 10,560'
   Overall width = 9,280'
   Model length = 5,400'
   Model width = 10,500'
   9,280'/10,500' = 0.88' = 1
   ① Method: 2 Points
   ② Answer: 1 Point

   b. Flying height above sea level = 11,500'
   "C" factor x contour interval + elevation
   1800' x 5' + 2,500' = 11,500'
   ③ Method: 2 Points
   ④ Answer: 1 Point

   c. Minimum number of models required = 2
   Terrain width ÷ model length = 10,560' ÷ 5,400 = 1.96 = 2
   ⑤ Method: 2 Points
   ⑥ Answer: 1 Point

   d. Minimum number of photographs required = 3
   Photos required = models + flight lines
   2 models + 1 flight line = 3
   ⑦ Method: 2 Points
   ⑧ Answer: 1 Point

   e. Minimum number of horizontal control stations required = 4
   ⑨ Answer: 1 Point

   Minimum number of vertical control stations required = 6
   ⑩ Answer: 1 Point

   Control for scale/model = 2 + 1 for check
   Control for elev/model = 3 + 1 for check
   ⑪ Method: 3 Points

   f. Negative scale = 1,500'
   "C" factor x contour interval ÷ 6
   (1800' x 5') ÷ 6 = 1500' or 1:18,000
   ⑫ Method: 2 Points
   ⑬ Answer: 1 Point

   g. Nominal map scale = 1" = 300'
   Mapping scale = (Photo scale) (Ratio)
   Photo scale = flying/focal length
   Photo scale = (9,000/6) (1/5) = 300
   ⑭ Method: 2 Points
   ⑮ Answer: 1 Point

   h. Minimum length (180" is acceptable) = 15.0'
   = 1500' x 0.01'
   ⑯ Method: 1 Point
   ⑰ Answer: 1 Point

   Minimum width (18" is acceptable) = 1.5'
   = 1500' x 0.001'
   ⑱ Method: 1 Point
   ⑲ Answer: 1 Point

TURN OVER

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DO NOT MARK IN THIS SPACE

GRADING PLAN	CORRECT	WRONG

2. a. Accuracy = 90%
Value = +/– 1/2 contour interval

or

Accuracy = not more than 10% exceed
Value = +/– 2.50'

(20) Answer: 1 Point

b. Accuracy = 90%
Value = +/– 1/4 contour interval

or

Accuracy = not more than 10% exceed
Value = +/– 1.25'

(21) Answer: 1 Point

c. Accuracy = 90% of features
Value = +/– 1/30" @ map scale

or

Accuracy = not more than 10% exceed
Value = +/– 10'

(22) Answer: 1 Point

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM NO. A4

POINTS 21

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

CANDIDATE NUMBER | FOLDER NUMBER | GRADER NUMBER

GRADING PLAN

CORRECT	WRONG

1. a. See Solution Sheet.
Semiminor axis = error in distance

$$= \pm\left(.02 + \left(\frac{2000}{1{,}000{,}000} \times 5\right)\right) = \pm 0.030$$

or

$$= \pm\sqrt{(.02)^2 + \left(\frac{2000}{1000000} \times 5\right)^2} = \pm 0.022$$ ① 2 Points

Semimajor axis = error in angle

$$= \frac{20''}{206265} \times 2000 = \pm 0.194$$ ② 3 Points

Orientation angle (θ) is angle between semimajor axis and the x or easting axis
$\therefore 40° + 90° = \underline{130°}$ ③ 1 Point

Sketch of ellipse. ④ 1 Point

b. Probability $P[U \leq C^2]$ is represented by the volume under the bivariate normal density surface within the region defined by the error ellipse. For the standard error ellipse C = 1, there the probability is. 0.394 or 39.4%. ⑤ 3 Points

c. For $P[U \leq C^2] = 0.95$, C = 2.447
= data from published tables

$\therefore$ semimajor axis = 0.194 x 2.447 = 0.475
or = 0.030 x 2.447 = 0.073 ⑥ 1 Point

semiminor axis = 0.022 x 2.447 = 0.054 ⑦ 1 Point

d. Number of angle sets needed =

$$\frac{0.194}{\sqrt{n}} = 0.12$$

n = 2.61, therefore 3 sets ⑧ 3 Points

2. See Solution Sheet.

⑨ A: 1 Point
⑩ B: 1 Point
⑪ C: 1 Point
⑫ D: 1 Point
⑬ E: 1 Point
⑭ F: 1 Point

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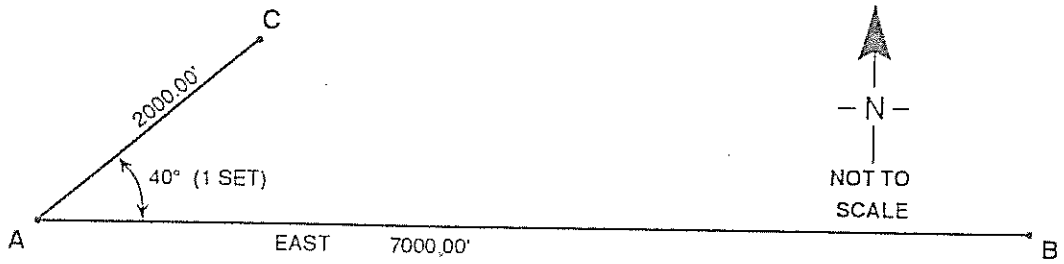
PROBLEM A4

21 Points

PROBLEM STATEMENT

Your measurements to Point C are shown below. A 6" theodolite with a measured standard error of +/– 20" per angle set (direct and reverse) from all sources and an EDM with a standard error of +/– (.02 + 5 PPM) was used.



PROBLEM REQUIREMENTS

1. a. Compute and sketch the standard error ellipse for Point C. Label and dimension the semimajor axis, semiminor axis, and the orientation angle, θ. Assume uncorrelated measurements. 7 Points

   b. What is the probability that your measured point is within or on the standard ellipse? 3 Points

   c. What are the dimensions of the semimajor and semiminor axis if you want a probability of 95%? 2 Points

   d. What is the minimum number of angle sets needed to decrease the semimajor axis to 0.12' on your standard error ellipse? 3 Points

2. Each of the error ellipses shown in your solution booklet indicates the relative comparative accuracy of establishing a point location with one of the following instrument combinations, A through F. In the spaces provided in your solution booklet, indicate the letter corresponding to the instrument combination that best works with the ellipses.

	Angle Measured With:	Distance Measured With:
A	Transit	EDM
B	Compass	Steel Tape
C	Theodolite	EDM
D	Compass	Gunter's Chain
E	Transit	Steel Tape
F	Theodolite	Steel Tape

Assume the line is 2000' at an azimuth of 45°. 6 Points

PROBLEM A5

36 Points

PROBLEM STATEMENT

You have been commissioned to survey fractional Section 8, T4S, R6W as shown on the official plat on the facing page, which was approved on April 3, 1893. Your client has requested that all corners be monumented.

PROBLEM REQUIREMENTS

1. Identify the method and the positions and/or monuments you would hold for control to establish each of the corners denoted as **a** through **f** below. No calculations are required.

   a. Southwesterly section corner — 4 Points

   b. Northwesterly corner of government Lot 2 — 4 Points

   c. North corner common to government Lots 1 and 2 — 4 Points

   d. Northeasterly corner of government Lot 1 — 4 Points

   e. East 1/4 corner — 4 Points

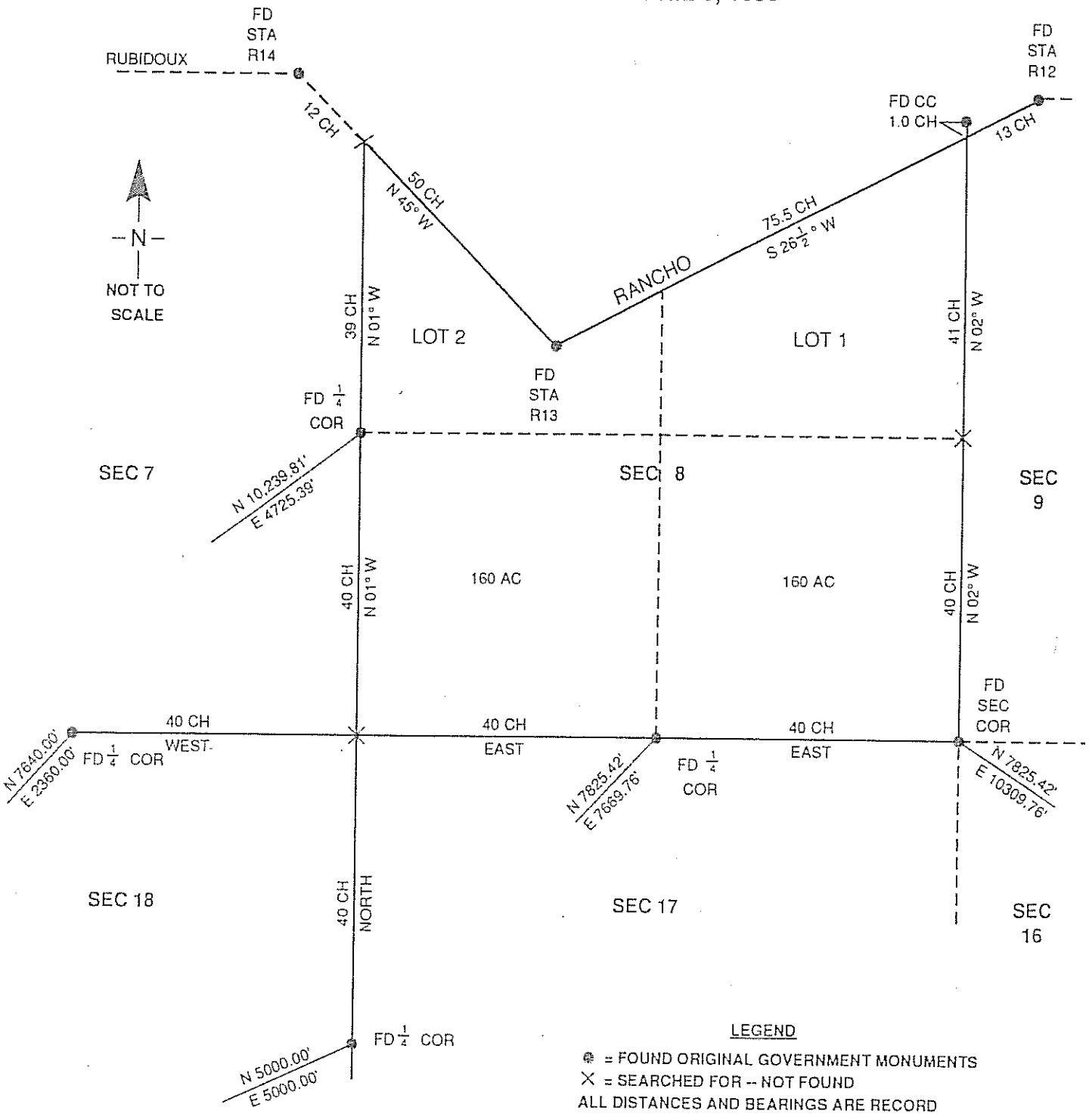
   f. Center 1/4 corner — 4 Points

2. Cite the governing reference that verifies the method of establishing the corners. — 2 Points

3. Calculate the coordinates for the Southwesterly corner of Section 8. **Show all work.** — 10 Points

PROBLEM A5

PLAT APPROVED APRIL 3, 1893



LEGEND

● = FOUND ORIGINAL GOVERNMENT MONUMENTS

X = SEARCHED FOR -- NOT FOUND

ALL DISTANCES AND BEARINGS ARE RECORD

1991 A5

1

9) SOUTHWESTERLY SECTION COR WOULD BE RESTORED BY DOUBLE PROPORTIONATE METHOD USING CARDINAL EQUALIVANT LENGHT BETWEEN THE 4 FOUND 1/4 SECTION CORNERS 7/18, 7|18, 8/17, 18|17.

b) NORTHWESTERLY CORNER OF LOT 2 SECTION 8 WOULD BE ESTABLISHED ON THE RANCHO LINE PROPORTIONATE 12 CH SE'LY FROM STA R14. ON LINE TO R13

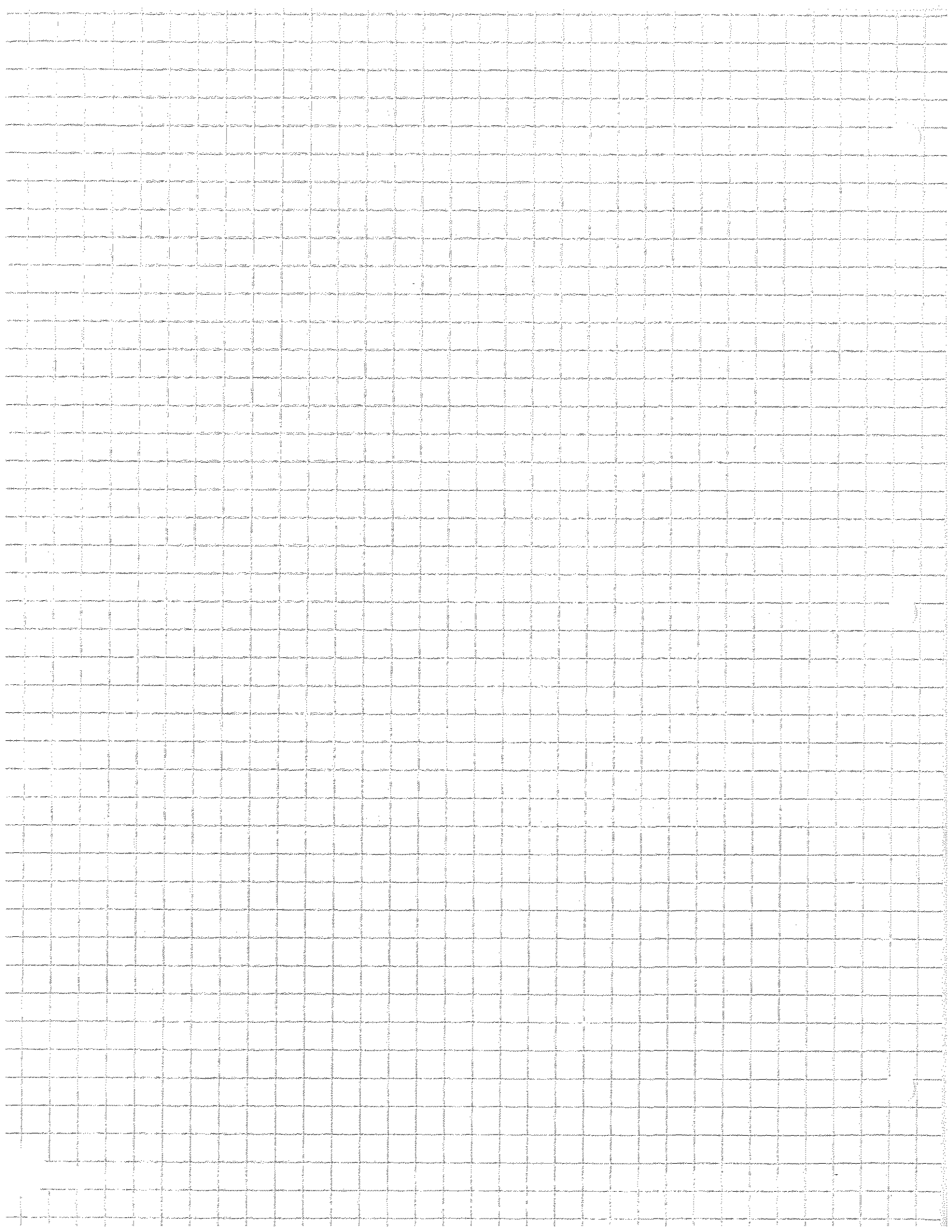
9) NORTH CORNER COMMON TO LOTS 1 AND 2 WOULD BE ESTABLISHED AT THE INTERSECTION OF THE STA'S R12&R13 RANCHO BOUNDARY AN A LINE FROM THE SOUTH 1/4 CORNER S8 ON A MEAN BEARING OF THE SECTION LINES.

d) NE'LY CORNER OF GOVERNMENT LOT 1. WOULD BE ESTABLISHED AT THE INTERSECTION OF THE LINES BETWEEN STA'S R12 & R13 AND THE SE COR SECTION 8 & THE FOUND CLOSING CORNER SECTIONS 8/9

E) EAST 1/4 CORNER WOULD BE RESTORED BY SINGLE PROPORTIONATE METHOD, PROPORTIONATE 40 CH NORTH OF THE SE COR SECTION 8 ON LINE TO THE CLOSING CORNER 8/9.

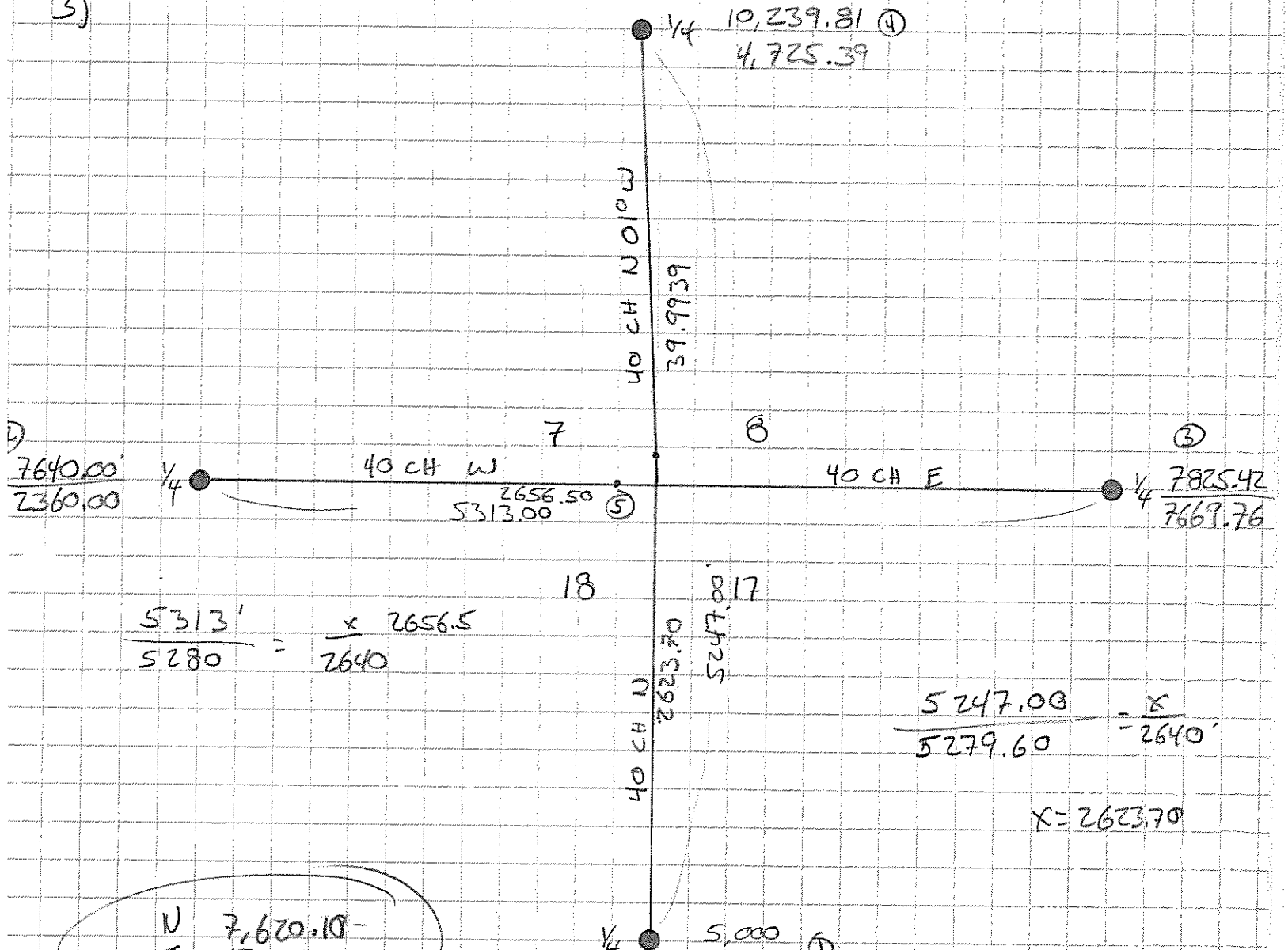
F) CENTER 1/4 CORNER WOULD BE ESTABLISHED AT THE INTERSECTION OF A LINE FROM THE E 1/4 COR S8 TO THE W 1/4 COR S8 WITH A LINE DRAWN FROM THE SOUTH 1/4 COR S8 ON A MEAN BEARING OF THE EAST & WEST LINES OF S8.

2) MANUAL OF SURVEYING INSTRUCTIONS 1973



1991 AS

3)



$\frac{5313'}{5280} = \frac{x}{2640}$ $\quad x = 2656.5$

$\frac{5247.08}{5279.60} = \frac{x}{2640'}$

$x = 2623.70$

N 7,620.10 -
E 5,014.88'

NOT USING CARDINAL EQUIVALENTS

⑤ 7,732.71
5,014.88 -

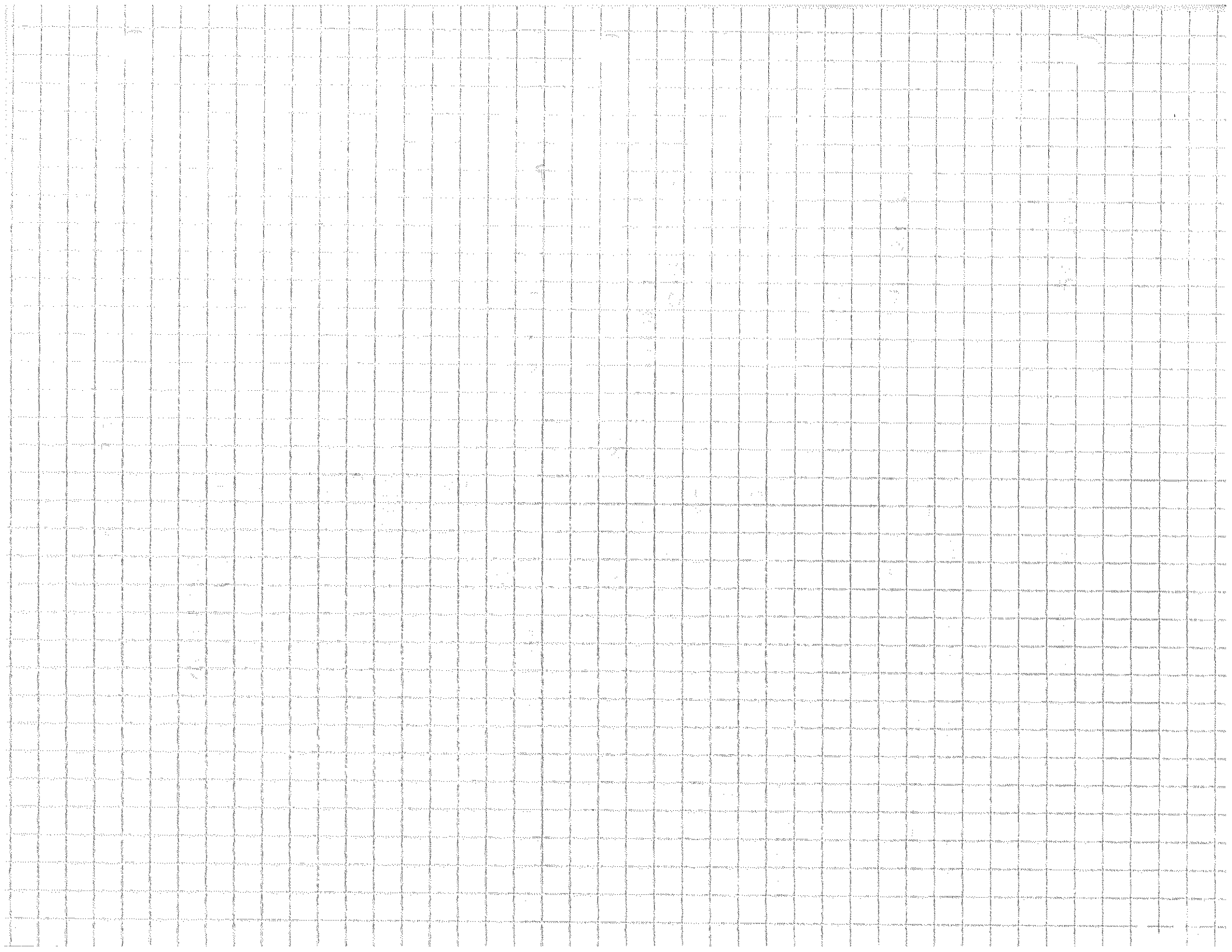
N 7619.91
E 5014.89

THIS ANSWER IS ON THE GRADING PLAN

⑥ $\frac{7,620.10 -}{4,862.69}$

$\frac{5247}{5280} = \frac{2623.5}{2640}$

⑦ $\frac{7619.91}{4862.70}$



1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM NO. A5

POINTS 36

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

CANDIDATE NUMBER

GOLDEN NUMBER

GRADER NUMBER

GRADING PLAN

	CORRECT	WRONG

1. a. S.W. section corner:
   Double proportion between 1/4 Corner 7 and 18 and 1/4 Corner 8 and 17; between 1/4 Corner 17 and 18 and 1/4 Corner 7 and 8 — ① 4 Points

   b. N.W. corner of government Lot 2:
   Single proportion between Station R13 and Station R14 — ② 4 Points

   c. North corner common to government Lots 1 and 2:
   From the 1/4 Corner 8 and 17, run mean bearing of East and West section lines to intersect Rancho line between Station R12 and Station R13 — ③ 4 Points

   or

   From the center 1/4 corner, run mean bearing of West 1/4 corner to N.W. corner of government Lot 2 and East 1/4 corner and N.E. corner of government Lot 1, to the intersection with the Rancho line between Stations R12 and R13

   d. N.E. corner of government Lot 1:
   Intersection of the line between Closing Corner 8 and 9 and S.E. Corner of Section 8 with line between Station R12 and Station R13 — ④ 4 Points

   e. East 1/4 corner:
   Single proportion between Closing Corner 8 and 9 and the S.E. Corner of Section 8 — ⑤ 4 Points

   f. Center 1/4 corner:
   From the 1/4 Corner 8 and 17, run mean bearing of East and West section lines to intersect with line between 1/4 Corner 7 and 8 and 1/4 Corner 8 and 9 — ⑥ 4 Points

2. *Manual of Surveying Instructions* or *Restoration of Lost and Obliterated Corners* booklet (BLM) — ⑦ 2 Points

3. Coordinates for S.W. Corner $\frac{\text{N7619.91'}}{\text{E5014.88'}}$ — ⑧ Method: 4 Points; ⑨ Answer: 6 Points

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SECTION B

147 Points of 300 Total Points
Time Allowed to Complete This Section: 4 Hours

Examination Overview

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Test Problem No.	Subject Matter	Point Value
B 1	Legal Description	29
B 2	Water Boundary	27
B 3	Solar	21
B 4	Boundary	33
B 5	Construction	27
B 6	Survey Law	10

The scope of this exam relates to the principles and practice of land surveying in the various areas of practice. You will be graded on the answers specifically required and in certain cases your method of obtaining these answers as demonstrated in your solution. Therefore, show all your work including all formulae and calculations.

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PROBLEM B1

29 Points

PROBLEM STATEMENT

Your client owns a portion of the Southwest 1/4 of Section 5, T7N, R12E, M.D.M, and has provided you with the plat on the facing page. You have been asked to prepare a legal description for a proposed 40.00-foot-wide easement across your client's property.

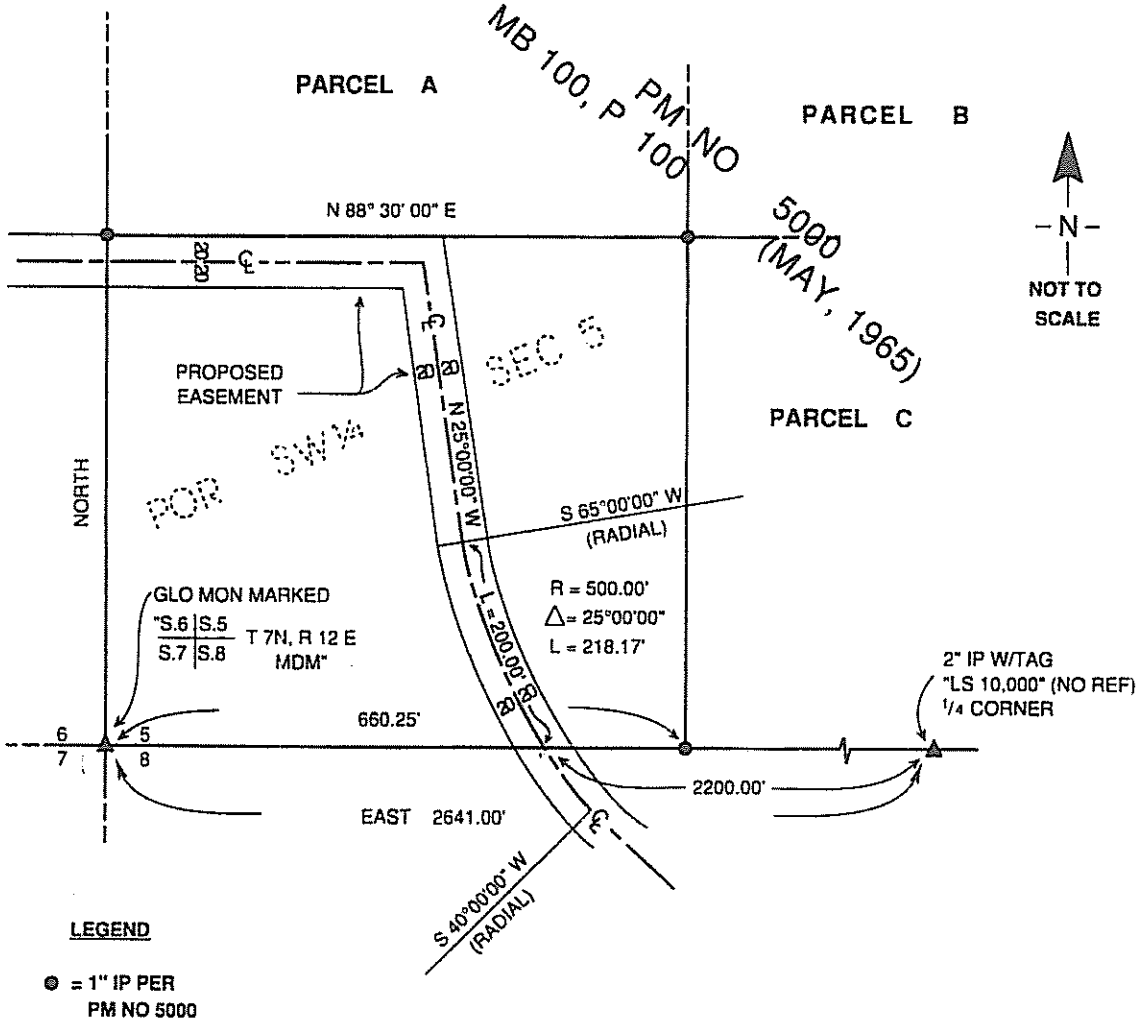
PROBLEM REQUIREMENTS

1. Prepare a strip legal description, including caption (preamble), for the proposed easement. **29 Points**

   - **Begin your description at the Southwest corner of Section 5.**

   - **Use only** the information provided on the plat. Do not make assumptions.

PROBLEM B1


PARCEL A
MB 100, P 100
PM NO 5000 (MAY, 1965)
PARCEL B
N 88° 30' 00" E
NOT TO SCALE
PROPOSED EASEMENT
SEC 5
PARCEL C
NORTH
N 25°00'00" W
S 65°00'00" W (RADIAL)
R = 500.00'
Δ = 25°00'00"
L = 218.17'
GLO MON MARKED "S.6 | S.5 / S.7 | S.8 T 7N, R 12 E MDM"
2" IP W/TAG "LS 10,000" (NO REF) 1/4 CORNER
660.25'
2200.00'
EAST 2641.00'
S 40°00'00" W (RADIAL)
LEGEND
= 1" IP PER PM NO 5000

PROBLEM B2

27 Points

PROBLEM STATEMENT

Your client owns Lot 9 of Sandy Beach Tract, a beachfront lot. The front corners have been monumented as shown on the facing page. You have been retained to locate the Westerly property corners. Assume uniform tidal flow and a regular shoreline. Assume a constant grade between Points A and B and Points C and D.

TIDE STATION DATA

	STA CHARLIE (10 MILES NORTH OF LOT 9)		STA TUNA (5 MILES SOUTH OF LOT 9)
MHHW	4.43		4.39
MHW	3.61	3.67	3.52
MTL	2.41		2.58
MSL (NGVD 1929)	1.02		1.02
MLW	0.80		0.78
MLLW	0.00		0.00

NOTE: The values above are local tidal datum at the given station based on MLLW.

PROBLEM REQUIREMENTS

1. Compute the location of your client's Westerly property corners showing dimensions to the found iron pipe monuments and the bearing and distance between the Northwesterly and Southwesterly corners. **Show all work.** — **22 Points**

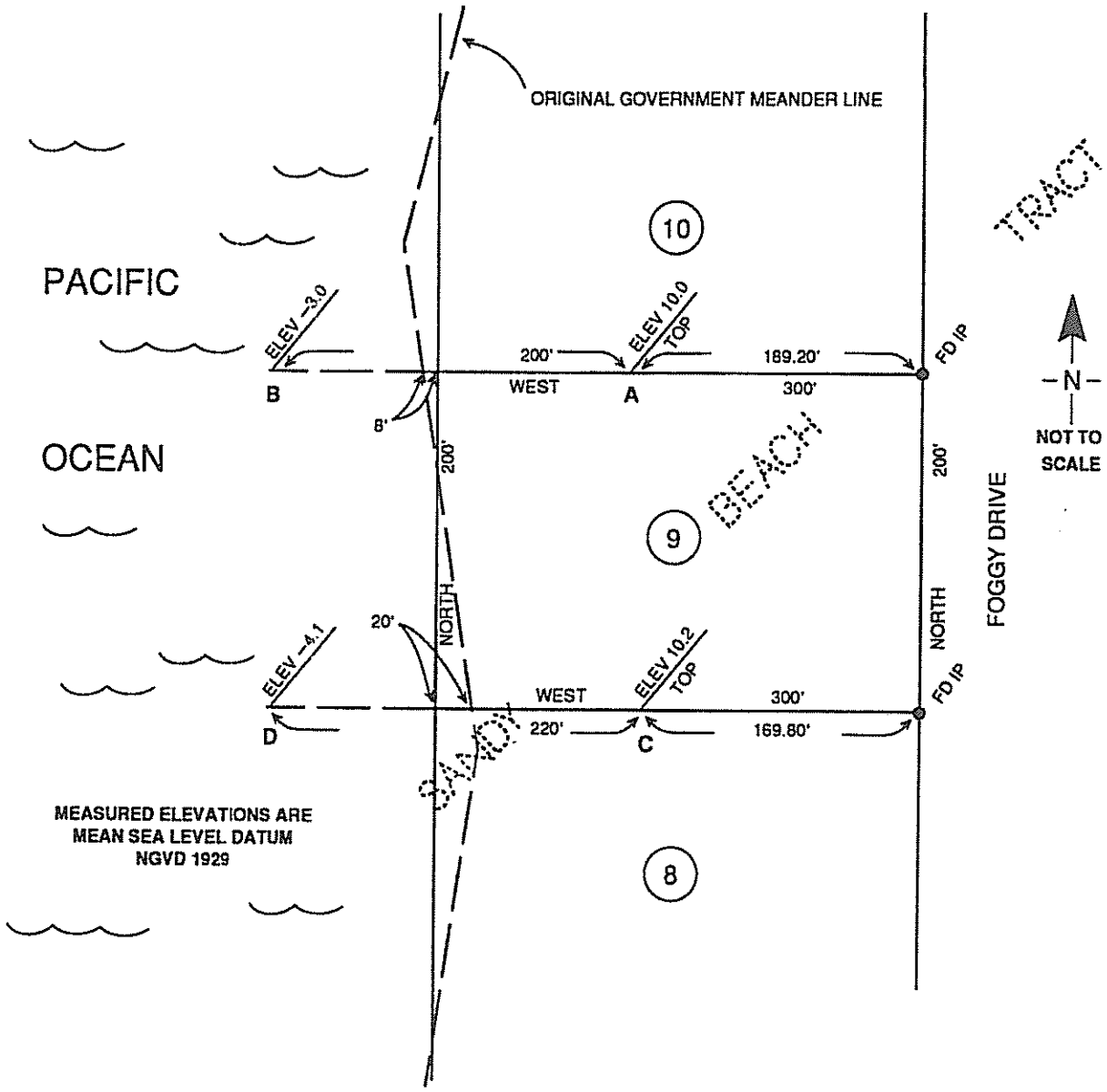
2. What is the purpose of the original government meander line and what is its impact on boundary location? — **2 Points**

3. In the event of a boundary conflict with the West line, which state agency would have authority? — **1 Point**

4. Which state agency would regulate the development of your client's lot? — **1 Point**

5. Of the water lines indicated in the table above, which water line would govern the location of the Westerly line of the property if Sandy Beach Tract were at a natural inland navigable lake? — **1 Point**

PROBLEM B2


ORIGINAL GOVERNMENT MEANDER LINE
PACIFIC
OCEAN
10
9
8
TRACT
BEACH
ELEV −3.0
ELEV 10.0
TOP
200'
WEST
189.20'
300'
FD IP
B
A
8'
200'
NORTH
20'
ELEV −4.1
ELEV 10.2
TOP
WEST
300'
220'
169.80'
FD IP
D
C
FOGGY DRIVE
N
NOT TO SCALE
MEASURED ELEVATIONS ARE
MEAN SEA LEVEL DATUM
NGVD 1929

PROBLEM B3

21 Points

PROBLEM STATEMENT

There are two methods by which azimuth can be determined by observation of the sun. Answer the following questions concerning these methods.

PROBLEM REQUIREMENTS

1. Name the two methods that can be used to determine Azimuth by observations of the sun. **2 Points**

2. Which method is more accurate? Explain your answer. **2 Points**

3. The following two questions concern the method that uses vertical angle observations:

   a. How would inconsistencies of the angular (vertical and horizontal) observations be detected? **2 Points**

   b. How would calculations for the effect of the semi-diameter of the sun be eliminated? **2 Points**

4. For each method, indicate whether parallax and refraction are taken into account. Explain your answer. **2 Points**

5. When using the method that uses only the horizontal angle, what is the single most important area where errors, excluding time and angular measurements, would most likely occur? **1 Point**

6. What is an appropriate source for accurate time determination? **1 Point**

7. When using the method that uses only the horizontal angle, if observations are made on the trailing limb of the sun, how does that affect your angular calculations? **1 Point**

8. For each method, describe how the time of day of your observations affects azimuth determination. **4 Points**

9. For each method, describe how averaging your observations for calculation purposes would affect your final azimuth determination. **4 Points**

PROBLEM B4

33 Points

PROBLEM STATEMENT

In 1900, the Spanish Rancho was subdivided into lots, one of which is denoted on the facing page as Exhibit "A." In 1940, a portion of this lot was sold using the following description, the preamble for which has been omitted. The 1940 deed was the first conveyance within Lot 70 and has senior rights. There are no occupational issues to be considered.

> Beginning at the Northeast corner of said lot marked by stake number S63; thence S 80°00'00" W, along the North line of said lot 800.00 feet; thence S 45°00'00" E, 500.00 feet; thence N 80°00'00" E, 800.00 feet to the Westerly line of Wagon Road; thence N 45°00'00" W, along Wagon Road, 500.00 feet to the point of beginning.

Exhibit "B" is the result of your partial retracement of Lot 70 in the Spanish Rancho.

PROBLEM REQUIREMENTS

1. Describe two different methods that might be employed to survey the 1940 deed. **12 Points**

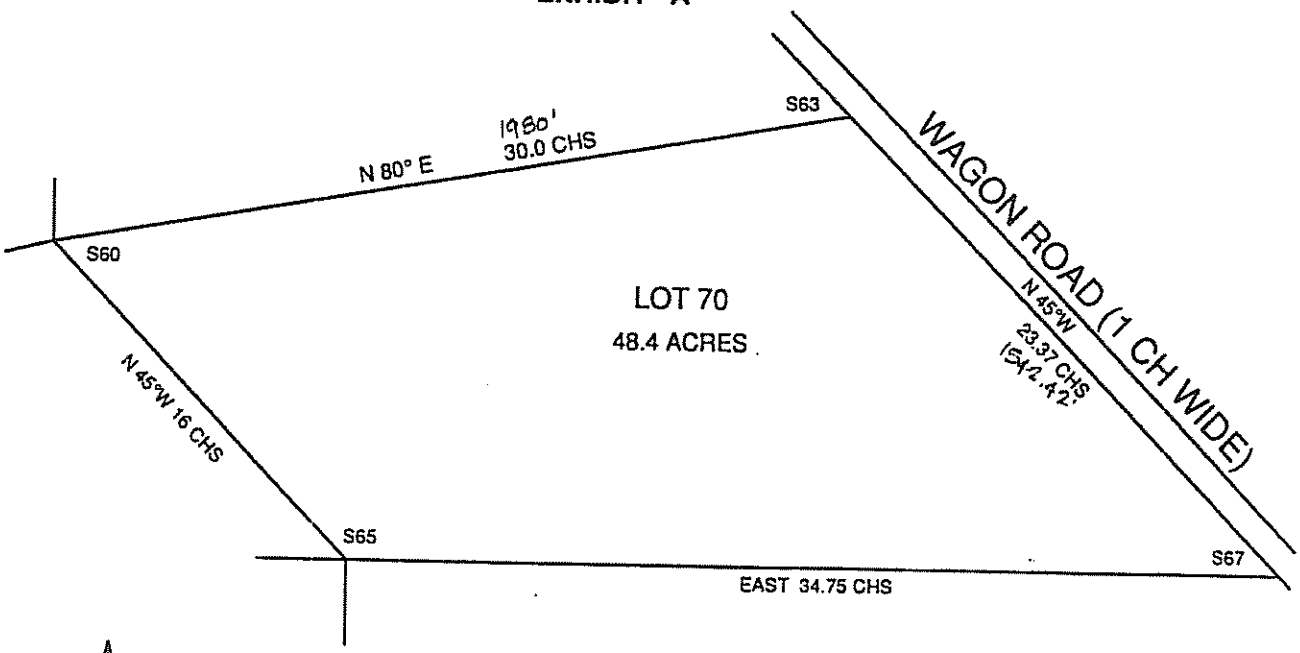
2. What would be the major differences between boundaries determined by the two methods? **5 Points**

3. a. Given the differences, describe what issues you would draw your client's attention to if you were asked to survey the boundary of the parcel described in the 1940 deed. **8 Points**

   b. What would you suggest to your client to resolve any boundary issue? **8 Points**

PROBLEM B4

EXHIBIT "A"



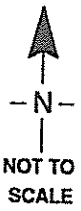
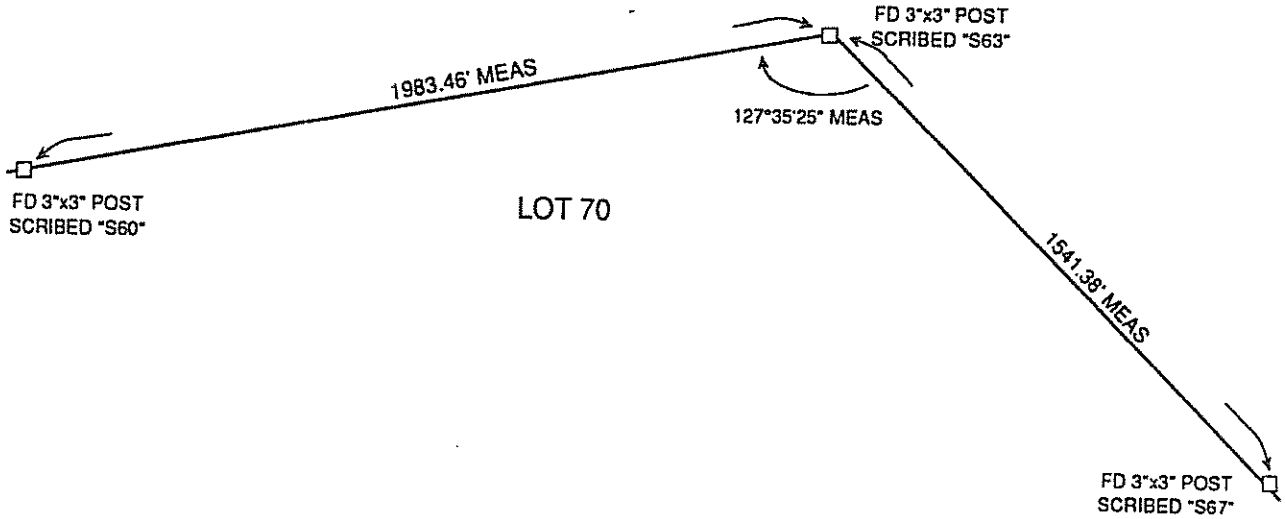


EXHIBIT "B"



PROBLEM B5

27 Points

PROBLEM STATEMENT

During the rough grading phase of construction, you discovered a 12" water pipe crossing the roadway at Station 18 + 50. The elevation on top of the pipe is 730.92'. You have communicated this information to the project engineer who has asked you to calculate and lay out an equal tangent vertical curve so that the top of pavement passes 36" above the top of the water pipe with the following design elements:

Vertical curve beginning at Station 16 + 50 (Vertical Curve #2)
$G_1 = +8.75\%$
$G_2 = -1.50\%$

A drop inlet needs to be installed at the lowest possible elevation between the beginning and end of horizontal Curve #1 along the flowline.

PROBLEM REQUIREMENTS

Show all work in completing the following requirements.

1. Calculate the following elements of horizontal Curve #1:

   a. Tangent — **1 Point**
   b. Length — **1 Point**
   c. EC Station — **1 Point**

2. Calculate the delta of horizontal Curve #2. — **1 Point**

3. Calculate

   a. the station and — **6 Points**
   b. the elevation of the top of the drop inlet to be installed between the beginning and end of horizontal Curve #1. — **5 Points**

4. Calculate the following elements of the equal tangent vertical Curve #2:

   a. Total length — **6 Points**
   b. Point of Vertical Intersection Station — **3 Points**
   c. Pavement elevation at the intersection of the centerline and the water pipe. — **3 Points**

PROBLEM B5

PLAN VIEW OF FUTURE ROADWAY

TYPICAL CROSS SECTION NOT TO SCALE

PROBLEM B6

10 Points

PROBLEM STATEMENT

For each of the following statements, cite the appropriate section number and the applicable government code.

PROBLEM REQUIREMENTS

1. A licensed land surveyor may offer to practice civil engineering incidental to his or her practice provided that the work is performed under the direction of a registered civil engineer. **1 Point**

2. A licensed land surveyor may correct certain minor errors denoted on a filed Record of Survey. **1 Point**

3. A licensed land surveyor has the right to enter upon private property to investigate and utilize boundary evidence. **1 Point**

4. The land surveyor or civil engineer responsible for a road reconstruction project must protect and perpetuate monuments of record. **1 Point**

5. All maps, plats, reports, descriptions, or other documents issued by a licensed land surveyor must be signed, sealed, or stamped, and must indicate expiration dates. **1 Point**

6. Photogrammetry is within the practice of licensed land surveyors. **1 Point**

7. A Record of Survey can be recorded even though the County Surveyor does not agree with its contents. **1 Point**

8. When a City Engineer is not authorized to practice surveying, the surveying duties may be assigned to the County Surveyor. **1 Point**

9. An adjustment of boundary line(s) between two or more parcels is exempt from the Subdivision Map Act. **1 Point**

10. When California coordinates are to be shown on a map, two second order or better monuments must be used to control the coordinate values generated. **1 Point**

00583

BOARD OF REGISTRATION FOR PROFESSIONAL
ENGINEERS AND LAND SURVEYORS
1428 Howe Avenue, Suite 56
Sacramento, California 95825

EXAMINEE ID NUMBER: 034790

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

Section B Test Booklet

SECTION B

147 Points of 300 Total Points
Time Allowed to Complete This Section: 4 Hours

Examination Overview

The 1991 California Professional Land Surveyor examination is given in two, 4-hour periods on the same day. Section B is the second section of this two-part examination. Section B consists of the following:

Test Problem No.	Subject Matter	Point Value
~~B-1~~	Legal Description	29
B 2	Water Boundary	27
~~B-3~~	Solar	21
~~B-4~~	Boundary	33
~~B-5~~	Construction	27
~~B-6~~	Survey Law	10

The scope of this exam relates to the principles and practice of land surveying in the various areas of practice. You will be graded on the answers specifically required and in certain cases your method of obtaining these answers as demonstrated in your solution. Therefore, show all your work including all formulae and calculations.

The questions have been designed to realistically reflect the actual conditions and practice of land surveying. The assignment of points to each question is not based on the time required to complete an answer. Instead, points have been assigned on the basis of the relative importance of each question to basic land surveying competence.

Examination Instructions

As you will take this test booklet with you when you complete the examination, do not write your answers in this test booklet. Solution booklets for each test problem have been provided with this test booklet. Present your answers on the sheets provided within each solution booklet. Only work in a solution booklet will be scored. Follow the steps listed below to present your solutions:

- Be sure to use the correct solution booklet for each test problem. The probelm number is printed on the cover of each solution booklet.
- Enter the problem number in the space provided on each inside sheet of the solution booklet.
- Enter your identification number on the front cover of each solution booklet and in the upper right-hand corner of each page of the solution booklet in the spaces provided. **Do not write your name on any part of this examination.**
- Additional paper for your solution booklets can be obtained from your proctor. Enter the number of the test problem on every additional sheet you use.
- Number your solution pages 1 of 3, 2 of 3, etc.
- In addition to the answer, show all work pertinent to the problem's solution to demonstrate to the grader the method used.
- Certain problems require a specified number of answers. Where you are required to provide a specific number of answers, you must provide only the number of answers required. Any answers provided beyond the number required will not be graded.
- Clearly delineate any work that you do not want scored by lining through that part and marking VOID across it.
- When you have completed this portion of the examination, check your work, put your solution booklets in order in the envelope provided, seal your envelope, write your examinee ID number across the seal of the envelope, and give all material to your proctor.

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM B1

29 Points

PROBLEM STATEMENT

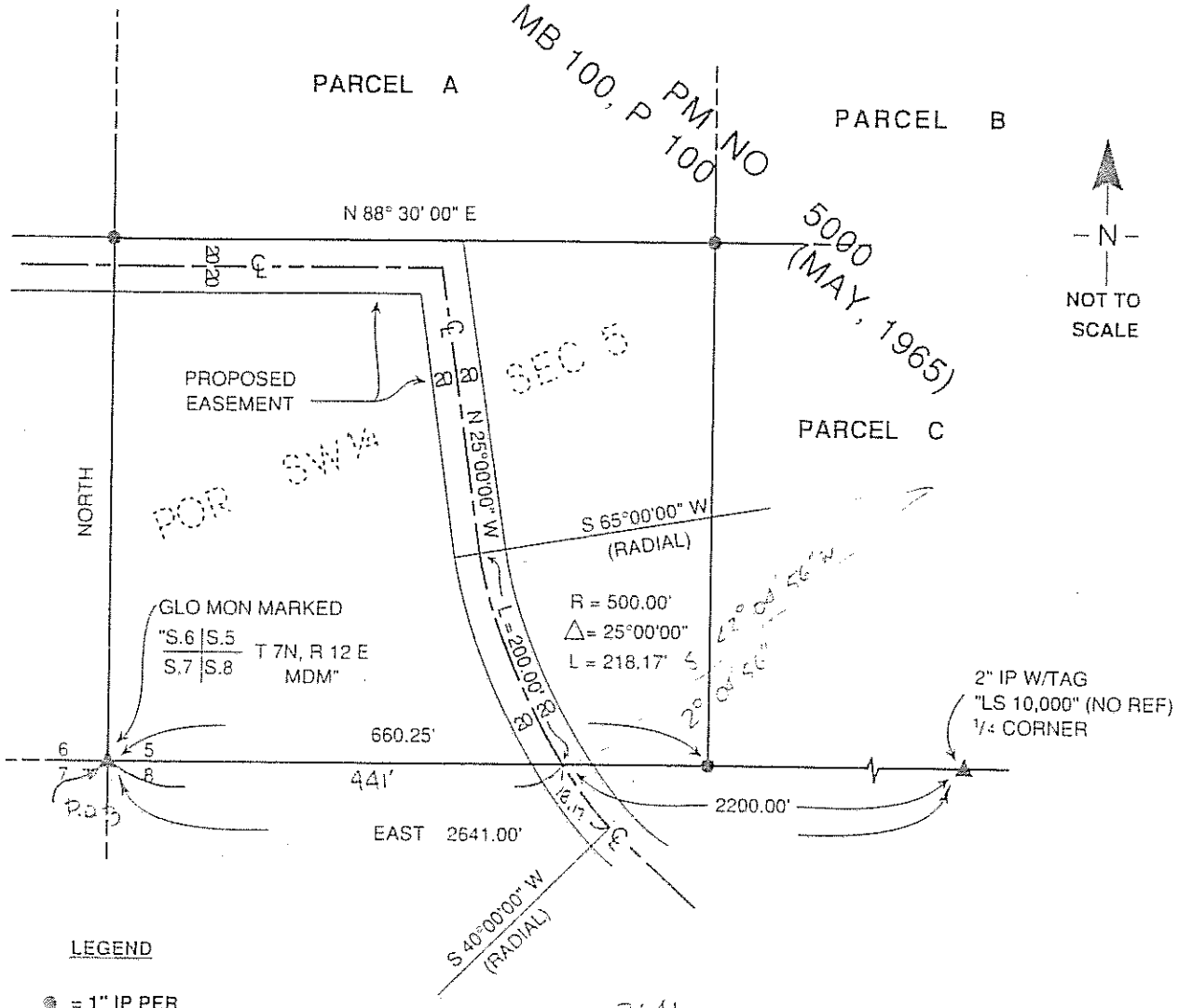
Your client owns a portion of the Southwest 1/4 of Section 5, T7N, R12E, M.D.M, and has provided you with the plat on the facing page. You have been asked to prepare a legal description for a proposed 40.00-foot-wide easement across your client's property.

PROBLEM REQUIREMENTS

1. Prepare a strip legal description, including caption (preamble), for the proposed easement. 29 Points

   - Begin your description at the Southwest corner of Section 5.
   - Use only the information provided on the plat. Do not make assumptions.

PROBLEM B1



2641
2200
441

S = Rθ

18.17 / 500 = θ

θ = 2°04'56"

PROBLEM B2

27 Points

PROBLEM STATEMENT

Your client owns Lot 9 of Sandy Beach Tract, a beachfront lot. The front corners have been monumented as shown on the facing page. You have been retained to locate the Westerly property corners. Assume uniform tidal flow and a regular shoreline. Assume a constant grade between Points A and B and Points C and D.

TIDE STATION DATA

	STA CHARLIE (10 MILES NORTH OF LOT 9)	STA TUNA (5 MILES SOUTH OF LOT 9)
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MSL (NGVD 1929)	1.02	1.02
MLW	0.80	0.78
MLLW	0.00	0.00

NOTE: The values above are local tidal datum at the given station based on MLLW.

PROBLEM REQUIREMENTS

1. Compute the location of your client's Westerly property corners showing dimensions to the found iron pipe monuments and the bearing and distance between the Northwesterly and Southwesterly corners. Show all work. — 22 Points

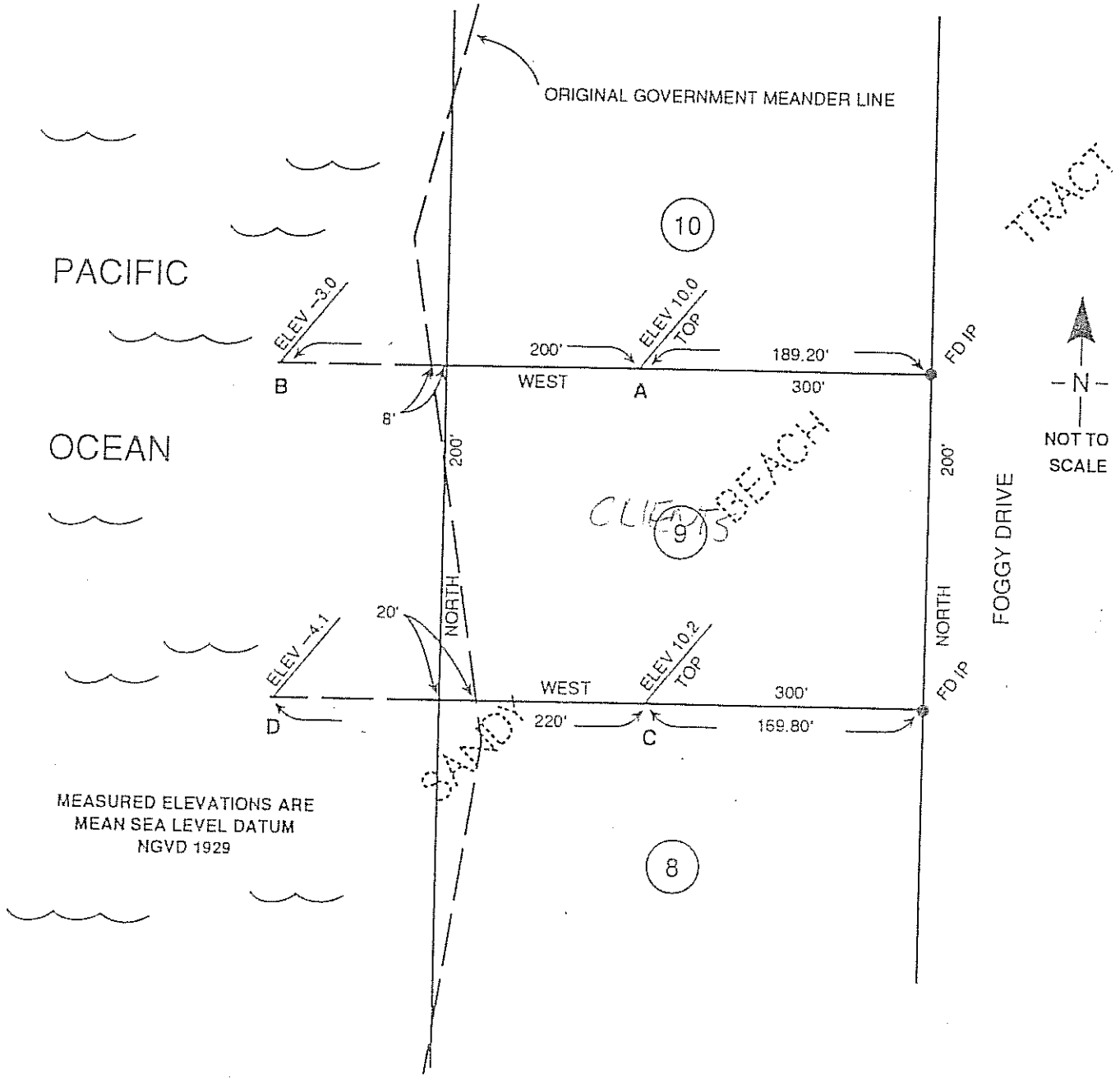
2. What is the purpose of the original government meander line and what is its impact on boundary location? — 2 Points

3. In the event of a boundary conflict with the West line, which state agency would have authority? — 1 Point

4. Which state agency would regulate the development of your client's lot? — 1 Point

5. Of the water lines indicated in the table above, which water line would govern the location of the Westerly line of the property if Sandy Beach Tract were at a natural inland navigable lake? — 1 Point

PROBLEM B2


ORIGINAL GOVERNMENT MEANDER LINE
PACIFIC
OCEAN
10
9
8
ELEV −3.0
ELEV 10.0
TOP
200'
189.20'
FD IP
B
WEST
A
300'
8'
200'
NORTH
20'
ELEV −4.1
ELEV 10.2
TOP
WEST
300'
D
220'
C
169.80'
FD IP
NORTH
200'
FOGGY DRIVE
TRACT
CLIFF BEACH
N
NOT TO SCALE
MEASURED ELEVATIONS ARE
MEAN SEA LEVEL DATUM
NGVD 1929

PROBLEM B3

21 Points

PROBLEM STATEMENT

There are two methods by which azimuth can be determined by observation of the sun. Answer the following questions concerning these methods.

PROBLEM REQUIREMENTS

1. Name the two methods that can be used to determine Azimuth by observations of the sun. — 2 Points

2. Which method is more accurate? Explain your answer. — 2 Points

3. The following two questions concern the method that uses vertical angle observations:

   a. How would inconsistencies of the angular (vertical and horizontal) observations be detected? — 2 Points

   b. How would calculations for the effect of the semi-diameter of the sun be eliminated? — 2 Points

4. For each method, indicate whether parallax and refraction are taken into account. Explain your answer. — 2 Points

5. When using the method that uses only the horizontal angle, what is the single most important area where errors, excluding time and angular measurements, would most likely occur? — 1 Point

6. What is an appropriate source for accurate time determination? — 1 Point

7. When using the method that uses only the horizontal angle, if observations are made on the trailing limb of the sun, how does that affect your angular calculations? — 1 Point

8. For each method, describe how the time of day of your observations affects azimuth determination. — 4 Points

9. For each method, describe how averaging your observations for calculation purposes would affect your final azimuth determination. — 4 Points

GO ON TO THE NEXT PAGE

PROBLEM B4

33 Points

PROBLEM STATEMENT

In 1900, the Spanish Rancho was subdivided into lots, one of which is denoted on the facing page as Exhibit "A." In 1940, a portion of this lot was sold using the following description, the preamble for which has been omitted. The 1940 deed was the first conveyance within Lot 70 and has senior rights. There are no occupational issues to be considered.

> Beginning at the Northeast corner of said lot marked by stake number S63; thence S 80°00'00" W, along the North line of said lot 800.00 feet; thence S 45°00'00" E, 500.00 feet; thence N 80°00'00" E, 800.00 feet to the Westerly line of Wagon Road; thence N 45°00'00" W, along Wagon Road, 500.00 feet to the point of beginning.

Exhibit "B" is the result of your partial retracement of Lot 70 in the Spanish Rancho.

PROBLEM REQUIREMENTS

1. Describe two different methods that might be employed to survey the 1940 deed. — 12 Points

2. What would be the major differences between boundaries determined by the two methods? — 5 Points

3. a. Given the differences, describe what issues you would draw your client's attention to if you were asked to survey the boundary of the parcel described in the 1940 deed. — 8 Points

   b. What would you suggest to your client to resolve any boundary issue? — 8 Points

PROBLEM B4

EXHIBIT "A"

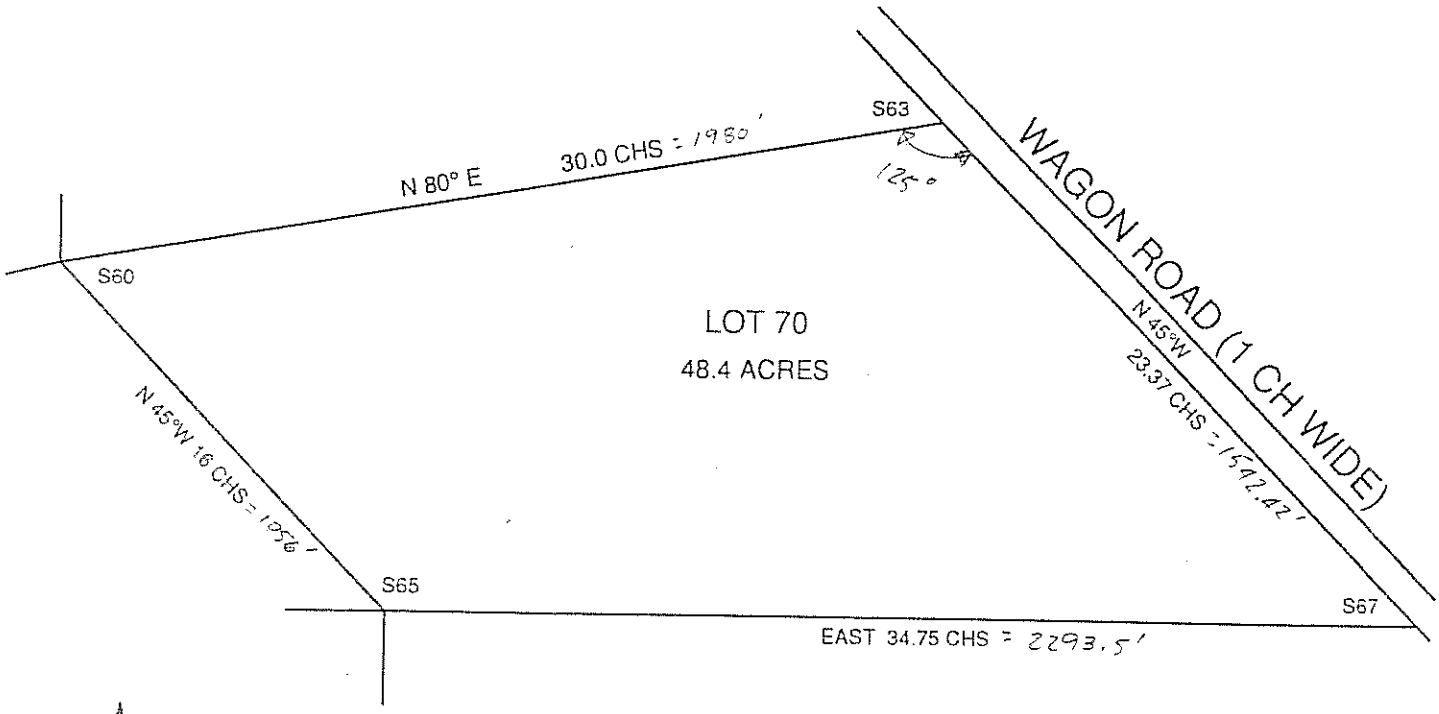
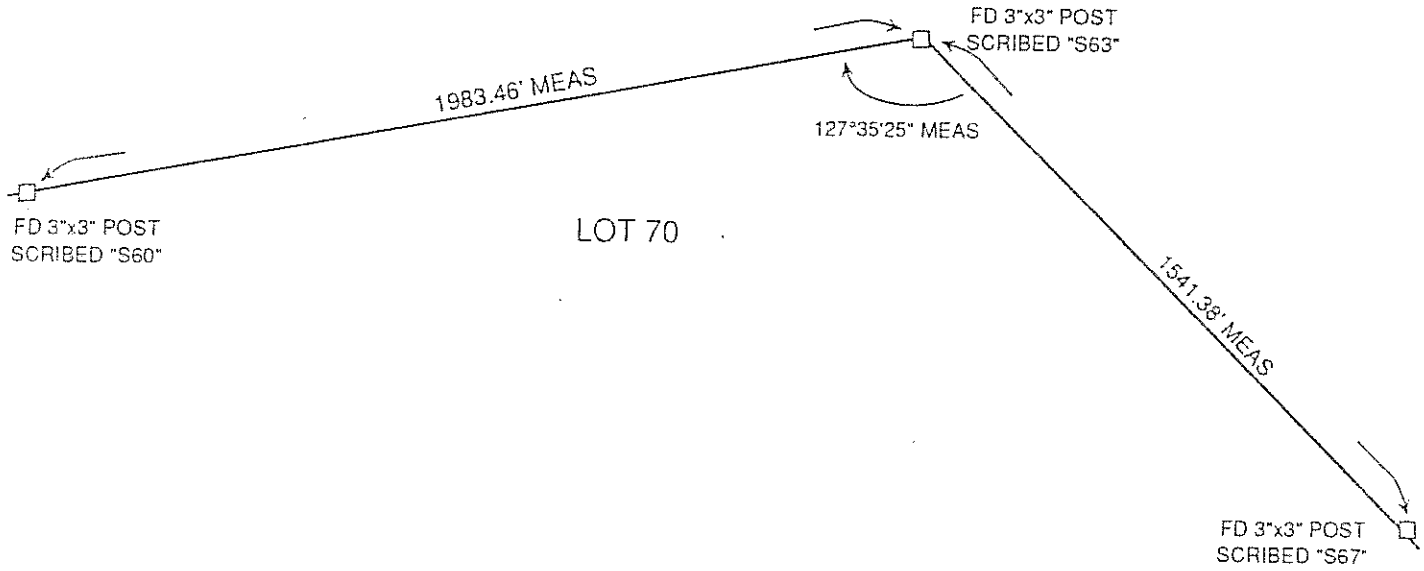


EXHIBIT "B"



PROBLEM B5

27 Points

PROBLEM STATEMENT

During the rough grading phase of construction, you discovered a 12" water pipe crossing the roadway at Station 18 + 50. The elevation on top of the pipe is 730.92'. You have communicated this information to the project engineer who has asked you to calculate and lay out an equal tangent vertical curve so that the top of pavement passes 36" above the top of the water pipe with the following design elements:

Vertical curve beginning at Station 16 + 50 (Vertical Curve #2)
$G_1 = +8.75\%$
$G_2 = -1.50\%$

A drop inlet needs to be installed at the lowest possible elevation between the beginning and end of horizontal Curve #1 along the flowline.

PROBLEM REQUIREMENTS

Show all work in completing the following requirements.

1. Calculate the following elements of horizontal Curve #1:

   a. Tangent — 1 Point
   b. Length — 1 Point
   c. EC Station — 1 Point

2. Calculate the delta of horizontal Curve #2. — 1 Point

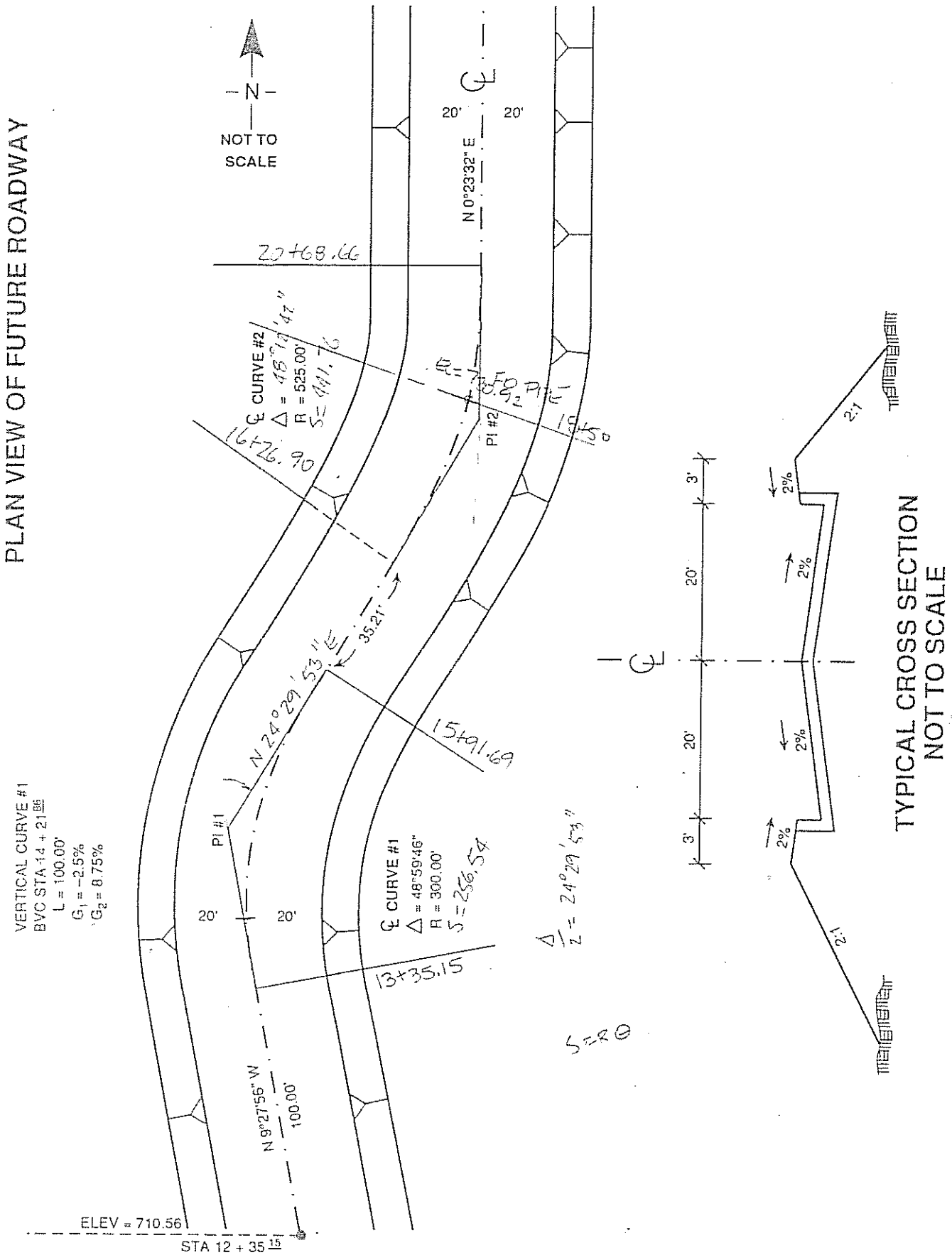
3. Calculate

   a. the station and — 6 Points
   b. the elevation of the top of the drop inlet to be installed between the beginning and end of horizontal Curve #1. — 5 Points

4. Calculate the following elements of the equal tangent vertical Curve #2:

   a. Total length — 6 Points
   b. Point of Vertical Intersection Station — 3 Points
   c. Pavement elevation at the intersection of the centerline and the water pipe. — 3 Points

PROBLEM B5


PLAN VIEW OF FUTURE ROADWAY
N
NOT TO SCALE
20'
20'
N 0°23'32" E
20+68.66
℄ CURVE #2
Δ = 48°19'47"
R = 525.00'
S = 441.76
16+26.90
PI #2
PI #1
N 24°29'53" E
35.21'
15+91.69
℄ CURVE #1
Δ = 48°59'46"
R = 300.00'
S = 256.54
13+35.15
Δ/2 = 24°29'53"
S = Rθ
VERTICAL CURVE #1
BVC STA 14 + 21.86
L = 100.00'
G1 = -2.5%
G2 = 8.75%
N 9°27'56" W
100.00'
ELEV = 710.56
STA 12 + 35.15
3'
20'
20'
3'
2%
2%
2%
2%
2:1
2:1
TYPICAL CROSS SECTION
NOT TO SCALE

PROBLEM B6
10 Points

PROBLEM STATEMENT

For each of the following statements, cite the appropriate section number and the applicable government code.

PROBLEM REQUIREMENTS

1. A licensed land surveyor may offer to practice civil engineering incidental to his or her practice provided that the work is performed under the direction of a registered civil engineer. 1 Point

2. A licensed land surveyor may correct certain minor errors denoted on a filed Record of Survey. 1 Point

3. A licensed land surveyor has the right to enter upon private property to investigate and utilize boundary evidence. 1 Point

4. The land surveyor or civil engineer responsible for a road reconstruction project must protect and perpetuate monuments of record. 1 Point

5. All maps, plats, reports, descriptions, or other documents issued by a licensed land surveyor must be signed, sealed, or stamped, and must indicate expiration dates. 1 Point

6. Photogrammetry is within the practice of licensed land surveyors. 1 Point

7. A Record of Survey can be recorded even though the County Surveyor does not agree with its contents. 1 Point

8. When a City Engineer is not authorized to practice surveying, the surveying duties may be assigned to the County Surveyor. 1 Point

9. An adjustment of boundary line(s) between two or more parcels is exempt from the Subdivision Map Act. 1 Point

10. When California coordinates are to be shown on a map, two second order or better monuments must be used to control the coordinate values generated. 1 Point

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM NO. B2

POINTS 27

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

CANDIDATE NUMBER | FOLDER NUMBER | GRADER NUMBER

GRADING PLAN | CORRECT | WRONG

1. a. Recognize MHW as appropriate water line. ① 2 Points

b. Determine MHW at client's lot by proportion between two tide stations.

$$\frac{3.61 - 3.52}{15} = \frac{X}{10}$$

$$X = 0.06$$

∴ MHW @ Lot 9 =
3.61 – 0.06 = 3.55

② Method: 1 Point
③ Answer: 1 Point

c. Transform local tidal datum MHW to MSL datum:

3.55 – 1.02 = 2.53 ④ Method: 3 Points

d. (1) Compute grade from top of bank to measurement in ocean

$$\text{(Lines A and B)} = \frac{10.00 - (-3.00)}{200'} = .065$$

(2) Compute grade from top of bank to measurement in ocean

$$\text{(Lines C and D)} = \frac{10.2 - (-4.1)}{220'} = 0.65$$

Note: Same answer for both lines. ⑤ Method: 3 Points

e. Compute difference in the elevation between MHW and the elevation of Point A and Point C.

For Point A, 10.00 – 2.53 = 7.47
For Point C, 10.20 – 2.53 = 7.67 ⑥ Method: 3 Points

f. (1) Distance from top of bank to state lands

$$\text{(Lines A and B)} = \frac{6.5}{100} = \frac{7.47}{X}$$

X = 114.92

(2) Distance from top of bank to state lands

$$\text{(Lines C and D)} = \frac{6.5}{100} = \frac{7.67}{X}$$

X = 118.00 ⑦ Method: 3 Points

TURN OVER

69471

DO NOT MARK IN THIS SPACE

GRADING PLAN		CORRECT	WRONG
g. Length of line from IP's to state ownership = 189.20 + 114.92 = 304.12' for North line	⑧ Answer: 2 Points		
169.80 + 118.00 = 287.80' for South line	⑨ Answer: 2 Points		
h. Bearing and distance for Westerly property corners			
Bearing = N 4° 39' 54" W	⑩ 1 Point		
Distance = 200.66'	⑪ 1 Point		
2. a. The meander line was originally used for calculating the area of usable land.	⑫ 1 Point		
b. It has no significance to boundary location.	⑬ 1 Point		
3. State Lands Commission.	⑭ 1 Point		
4. Coastal Commission.	⑮ 1 Point		
5. The MLW line.	⑯ 1 Point		

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM NO. B3

POINTS 21

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

CANDIDATE NUMBER | FOLDER NUMBER | GRADER NUMBER

GRADING PLAN		CORRECT	WRONG
1. a. Altitude Method	① 1 Point	○	○
b. Hour Angle Method	② 1 Point	○	○
2. a. Hour Angle Method	③ 1 Point	○	○
b. Because time can be very accurately determined.	④ 1 Point	○	○
3. a. By plotting the horizontal/vertical angles vs. time.	⑤ 2 Points	○	○
b. Sighting the sun in opposite quadrants or Roeloff's Prism.	⑥ 2 Points	○	○
4. a. Hour Angle Method–No. There is no vertical angle.	⑦ 1 Point	○	○
b. Altitude Method–Yes. It is applied only to the vertical angle.	⑧ 1 Point	○	○
5. In the determination of the latitude and longitude of the Point. Example: Scaling on a U.S.G.S. quad sheet.	⑨ 1 Point	○	○
6. Time cube – monitoring WWV.	⑩ 1 Point	○	○
7. The method does not take account of the semi-diameter of the sun.	⑪ 1 Point	○	○
8. a. Hour Angle Method – because a vertical angle is not being measured, time-of-day of observation, except as an extreme, does not affect the determination of the azimuth.	⑫ 2 Points	○	○
b. Altitude Method – best time is 8 a.m. – 10 a.m. and 2 p.m. – 4 p.m. Vertical angle not changing enough from 10:00 a.m. – 2:00 p.m. and refraction correction becomes very large and uncertain at low altitudes.	⑬ 2 Points	○	○
9. a. Altitude Method – averaging of adjusted data would not have any measurable affect on the final azimuth.	⑭ 2 Points	○	○
b. Hour Angle Method – averaging will give errors due to the fact that the sun travels in an apparent curved path and the change in semi-diameter correction with altitude.	⑮ 2.Points	○	○

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1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM NO. B4

POINTS 33

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

CANDIDATE NUMBER

FOLDER NUMBER

GRADER NUMBER

GRADING PLAN

	CORRECT	WRONG
1. One method involves holding deed angles, going to the road along the South line and then along the Road to the point of beginning. ① 6 Points	○	○
The other method is based on the belief that the "intent" of the deed was to provide a parallelogram and hold distances. ② 6 Points	○	○
2. The position of the South and West lines, or Southwest Corner. ③ 5 Points	○	○
3. a. Review the possible double solution with client and how this will affect adjoiner. ④ 8 Points	○	○
b. Resolve boundary differences by listing one of the following: lot line adjustment or agreement/or quiet title or quit claim. ⑤ 8 Points	○	○

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1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

PROBLEM NO. B5

POINTS 27

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

CANDIDATE NUMBER | FOLDER NUMBER | GRADER NUMBER

GRADING PLAN

CORRECT	WRONG

1. Given: $\Delta = 48° 59' 46"$ $R = 300.00'$

   a. $T = R \tan \Delta/2 = (300.00)(\tan 24° 29' 53") = 136.7056$ or 136.71

   ① Answer: 1 Point

   b. $L = 2\pi R\Delta/360 = \dfrac{2\pi (300)\ 48° 59' 46"}{360} = 256.5430$ or 256.54

   ② Answer: 1 Point

   c. Station
   12 + 35.15 given
   1 + 00.00 given to BC
   13 + 35.15
   2 + 56.54 L
   15 + 91.69 EC

   ③ Answer: 1 Point

2. First tangent (+)N 9° 27' 56" W
   First Δ (–) 48° 59' 46"
   N 39° 31' 50" E

   N 39° 31' 50" E
   Last Tangent N 0° 23' 32" E
   Δ Curve #2 39° 08' 18"

   ④ Answer: 1 Point

3. a. $X = \dfrac{LG_1}{G_1 - G_2}$

   $X = \dfrac{(100.00)(-2.5\%)}{-2.5\% - 8.75\%} = \dfrac{2.5}{0.1125} = 22.222'$

   Station Given 12 + 35.15
   Given 1 + 00.00
   13 + 35.15
   First Tangent 1 + 36.71
   14 + 71.86
   –L/2 50.00
   BVC 14 + 21.86
   + 22.22
   Station of lowest point 14 + 44.08

   ⑤ Method: 2 Points
   ⑥ Answer: 4 Points

   b. $y = ax^2 + G_1X + C$
   $y = 5.625\ (.222)^2 + (-2.5)\ (.222) + 705.89$
   $y = 705.61$

   ⑦ Method: 2 Points

   Top Inlet = 705.61 – (2% x 20) = 705.21

   ⑧ Answer: 3 Points

TURN OVER

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DO NOT MARK IN THIS SPACE

GRADING PLAN

CORRECT	WRONG

4. a. Given: $G_1 = 8.75\%$ $G_2 = -1.50$ STA. P = 18 + 50 Elev. (730.92 + 3.00) = 733.92

PVI #1 STA 14 + 71.86 — Elev. 710.56
STA 12 + 35.15
236.71 @ (G_1) – 2.5% = –5.92
704.64

PVI #1 STA. 14 + 71.86 Elev. 704.64

BVC #2 Station 16 + 50.00
PVI #1 Station 14 + 71.86
178.14' @ 8.75% = 15.59

PVI #1 Elev. = 704.64
+ 15.59
BVC #2 Elev. 720.23

Solution = $y = a X^2 + G_1 X$ where y = Elev.p – Elev. BVC

$y = a X^2 + G_1 X$ y = Elev.p – Elev. BVC = 734.31 – 720.23 = +14.08

$a = [100 (G_2 - G_1)]/2L = [100 (-1.50 - 8.75)]/2L = 1025/2L$

$y = (-1025/2L) (2)^2 + 8.75 (2)$
$14.08 = (-512.5/L) 4 + 17.50$
$14.08 = -2050/L + 17.50$
$3.42 = -2050/L$
$L = -20.50/-3.42$
$L = 599.415'$ (+/– .02) or 600.00'

⑨ Method: 2 Points
⑩ Answer: 4 Points

b. PVI #2 Station

BVC #2 Station 16 + 50.00
299.71
PVI #2 Station 19 + 49.71 (+/–.02)

or

16 + 50.00
300.00
PVI #2 Station 19 + 50.00 (+/–.02)

⑪ Answer: 3 Points

(Note: Candidate must state that answer is rounded.)

c. Existing pipe Elev. 730.92
Plus 3.00 3.00
Pavement centerline over pipe 733.92'

⑫ Answer: 3 Points

1991 CALIFORNIA PROFESSIONAL LAND SURVEYOR EXAMINATION

CANDIDATE NUMBER | FOLDER NUMBER | GRADER NUMBER

PROBLEM NO. B6

POINTS 10

READER ROUND ① ② ③ ④ ⑤ ⑥

SOLUTION NOT ATTEMPTED ○

GRADING PLAN

Note: The candidate must correctly cite both the appropriate section number and government code to receive credit for the following:

		CORRECT	WRONG
L.S. Act 8726.1	1. A licensed land surveyor may offer to practice civil engineering incidental to his or her practice provided that the work is performed under the direction of a registered civil engineer. ① 1 Point	○	○
L.S. Act 8770.5	2. A licensed land surveyor may correct certain minor errors denoted on a filed Record of Survey. ② 1 Point	○	○
L.S. Act 8774 or 846.5 of Civil Code	3. A licensed land surveyor has the right to enter upon private property to investigate and utilize boundary evidence. ③ 1 Point	○	○
L.S. Act 8771	4. The land surveyor or civil engineer responsible for a road reconstruction project must protect and perpetuate monuments of record. ④ 1 Point	○	○
L.S. Act 8761	5. All maps, plats, reports, descriptions, or other documents issued by a licensed land surveyor must be signed, sealed, or stamped, and must indicate expiration dates. ⑤ 1 Point	○	○
L.S. Act 8775 or LS. Act 8726(b)	6. Photogrammetry is within the practice of licensed land surveyors. ⑥ 1 Point	○	○
L.S. Act 8768	7. A Record of Survey can be recorded even though the County Surveyor does not agree with its contents. ⑦ 1 Point	○	○
SMA 66431	8. When a City Engineer is not authorized to practice surveying, the surveying duties may be assigned to the County Surveyor. ⑧ 1 Point	○	○
SMA 66412	9. An adjustment of boundary line(s) between two or more parcels is exempt from the Subdivision Map Act. ⑨ 1 Point	○	○
Public Resources Code 8813	10. When California coordinates are to be shown on a map, two second order or better monuments must be used to control the coordinate values generated. ⑩ 1 Point	○	○

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