

LS-A

LAND SURVEYOR - 1985

Part A - 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 A is the first section of this two-part examination. ALL PROBLEMS IN PART A ARE REQUIRED.
2. Your answers are to be completed in your workbook - use separate answer sheets for each problem.
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 below.
5. Read the instructions on the workbook cover page.
6. This portion of the Land Surveyor Examination consists of the following:

Problem A-1	10.0 points	6.0
Problem A-2	5.0 points	
Problem A-3	20.0 points	
Problem A-4	<u>15.0 points</u>	
TOTAL	50.0 points	

ALL PROBLEMS IN PART A ARE REQUIRED.

7. After you have completed this portion of the examination, check your work, assemble your answer sheets in sequential order, be sure to include all pages (including diagrams if required), and turn it in to the Examination Proctor.
8. You may keep this set of examination questions.

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

Problem A1 Wt. 10.0 points

PROBLEM STATEMENT

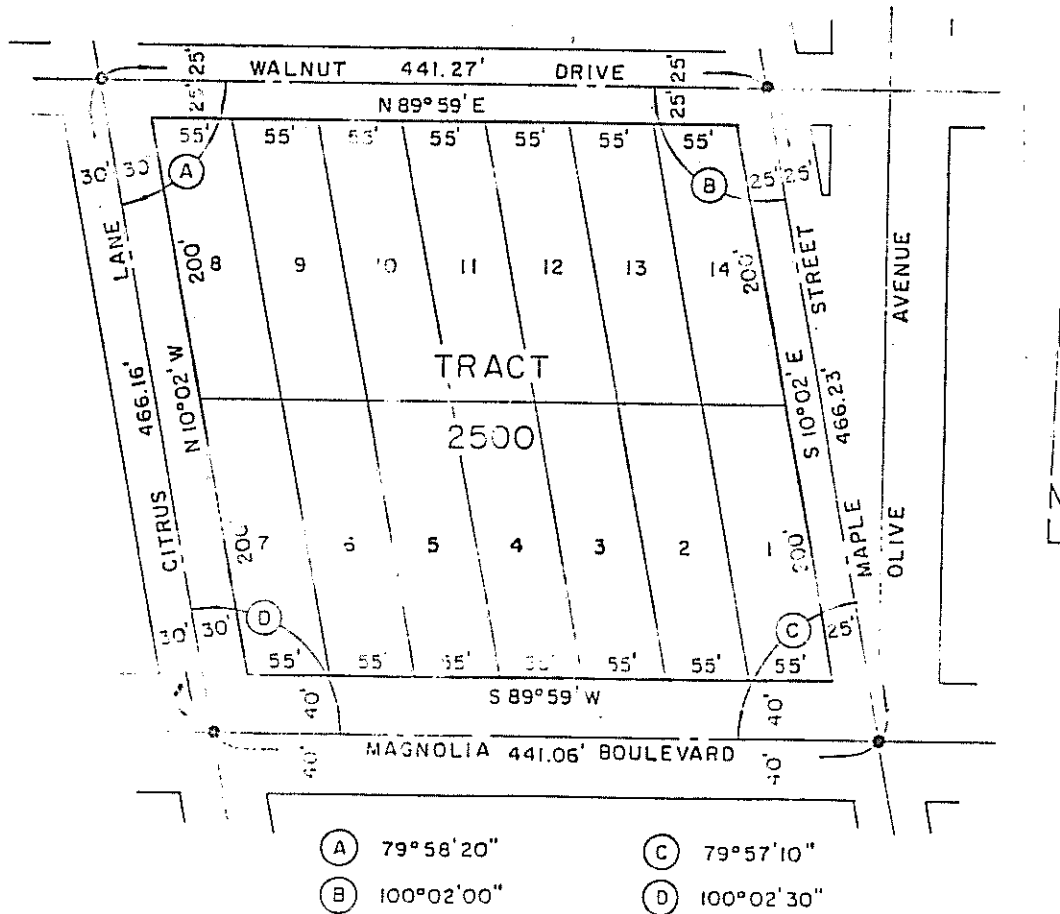
The following legal description has been provided to you for a boundary survey in a fully improved residential development.

LEGAL DESCRIPTION:

Lots 3, 4 and the East 30 feet of Lot 5, Tract No. 2500 in the County of Hope, State of California, as per map recorded in Book 3, Page 5 of maps in the office of the Recorder of said county.

REQUIRED

Show all angles, distances and notes that are necessary for complete instructions to your party chief on this project. The information should be shown on the next page, which is to be detached and included with your workbook.



● = COUNTY WELL MONUMENTS.

ANGLES AND DISTANCES SHOWN ALONG CENTER-LINE AS MEASURED BY COUNTY ENGINEER.

ALL OTHER DISTANCES AND BEARINGS ARE AS SHOWN ON TRACT MAP. TRACT MONUMENTS WERE 3/4" I.P. TARGETS U.S. 3000

Problem A2 Wt. 5.0 points

PROBLEM STATEMENT

The following questions pertain to State laws that affect the Land Surveyor.

Your client owns 200 acres in a rural portion of the County of Easy Living, California. State Highway No. 16 is the southerly boundary of the land and the Moon River (a navigable river) flows through the property.

REQUIRED

1. You divide the property into 9 lots, all over 20 acres, with each lot fronting on a street that will be dedicated on the map. Will a final map or a parcel map be required for this land division?
2. The tentative map for this project has been filed and conditionally approved. Your client disagrees with one of the conditions of approval. Outline the appeal process you must follow with the legislative body. (NOTE: This county has an appeal board.)
3. What condition of approval must be placed on this particular map by the county?
4. In the ownership certificate for this map, the streets are dedicated for public street and public utility purposes. What options does the county have regarding the acceptance or rejection of the dedication?
5. You have monumented the boundary of the subdivision but have decided to delay the setting of the interior monuments until grading and improvements are complete. Outline the delayed monumentation process. What notification are you required to give once the monuments are set?

Problem A3 Wt. 20.0 points

PROBLEM STATEMENT

(Answer the questions following the two sketches.)

You are hired by Harriet Black's nephew and executor of her estate to survey his aunt's land. Upon making a quick reconnaissance of the property, you meet Mr. James Brown IV and Susie Q. Green, the great-granddaughter of Bob Green who say, "As long as you're here, survey our lands too."

Since most of the land is open and rolling, you take your 10 second EDM total station and measure the entire perimeter of the section; recover all of the government section corners and exterior 1/4 corners beyond all doubt. See Sketch #2 of your adjusted field work. All information needed is given. No assumptions are necessary.

BACKGROUND

John Jones, by 14 Patents Page 181, issued in 1856 and signed by Franklin Pearce, described as NE 1/4 of Section 10, Township 10 South, Range 1 West, Mount Diablo Meridian, Santa Cruz County, California.

In 1862, Jones conveys to Brown by Deed recorded in Book 9 of Deeds at Page 14. Land is described as: NE 1/4 of Section 10.

In May 1875, Brown hires I. M. Goode, a local surveyor, to survey his lands and segregate a parcel to be conveyed to Bob Green. In the course of your research, you find an old hardcopy in the County Surveyor's office which depicts the following (see Sketch #1).

A Deed dated June 14, 1875 and recorded January 3, 1890 in Volume 15 of Deeds at Page 124, Santa Cruz Records, from Brown to Green states as follows:

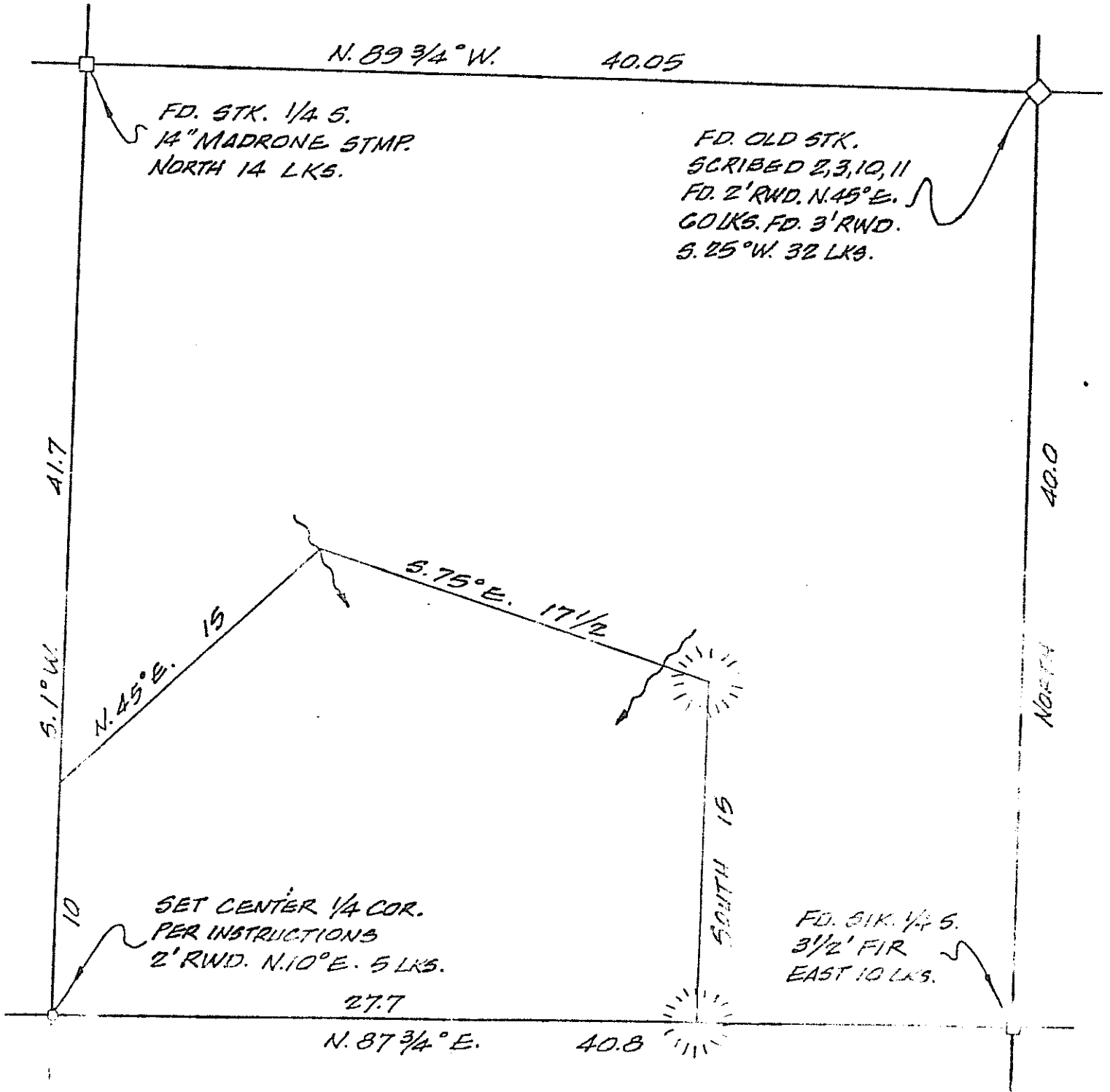
"Beginning at the southwestern corner fo the lands conveyed to Brown by that certain Deed recorded in Book 9 of Deeds at Page 14, and running thence North 1° West, 10 chains; thence leaving Brown's boundary North 45° East, 15 chains to the middle of an arroyo, course southeasterly; thence South 75° East, 17-1/2 chains to a stake on a sharp point; thence South 15 chains to a stake on a hilltop; thence westerly 27.7 chains to the place of beginning, and contining 46 acres, a little more or less."

The remaining lands remain in the Brown family until 1938 when James Brown III conveys a parcel to Harriet Black by Deed recorded in Book 756 of Official Records at Page 646, Santa Cruz County Records, described as follows:

"Beginning at the Eastern 1/4 corner of Section 10, T. 10 S, R. 1 W, MDG&M; thence from said point of beginning North 855.25 feet to a station from which a stake on a point at the Northeast corner of Green bears West; thence West 800.00 feet to the Eastern boundary of Green; thence along said last-mentioned boundary 990.00 feet to the 1/4 Section line running East and West through said Section 10, North 87° 45' East, 864.6 feet to the point of beginning."

SKETCH NO. 1

LS-A
1985
Page 5
Problem A3

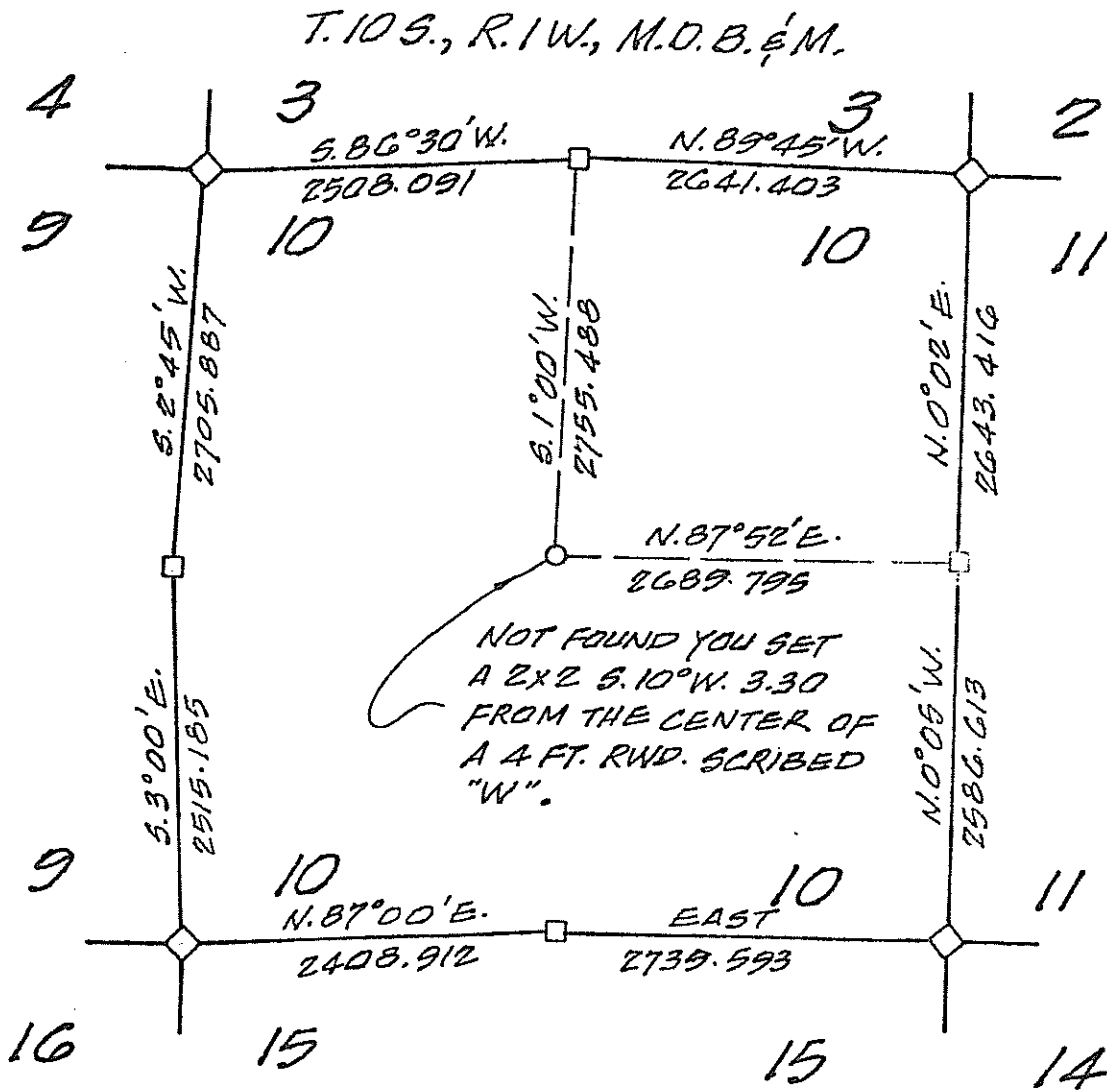




HARD COPY FOUND IN COUNTY
SURVEYORS OFFICE

MAY 1875

SKETCH NO. 2

EXAMINEES ADJUSTED FIELDWORK



ALL POINTS DESIGNATED THIS  
 ARE ORIGINAL GOVERNMENT
 SECTION CORNERS AND 1/4
 CORNERS FOUND AND VERIFIED
 BY THIS SURVEY.

REQUIRED

1. Where will you set the Center 1/4 Corner? Why?

2. In surveying Susie Q. Green's NW boundary, you find at N 45° E, 990.00 feet, you are on the top of a bank that is steep and sharply defined. The arroyo bottom is N 45° E, 65.00 feet distant. Where do you set this corner? Why?

3. From Susie Q. Green's most northern corner, you find a rock mound and a stake on a sharp spur at South 72° 05' East, 1123.405 feet distant. Where do you set the corner? Why?

4. From found stake, a hilltop bears South and is on the 1/4 Section line East and West through Section 10. No evidence of a stake is found. Where do you set the corner? Why?

5. What is the acreage to the nearest 0.1 acre of Green's lot?

6. Where do you set the Estate of Black's NE corner? Why?

7. What is Black's acreage to the nearest 0.1 acre?

8. Is it necessary to file a Record of Survey? Why?

Problem A4 Wt. 15.0 points

PROBLEM STATEMENT

See sketch below.

CRITERIA

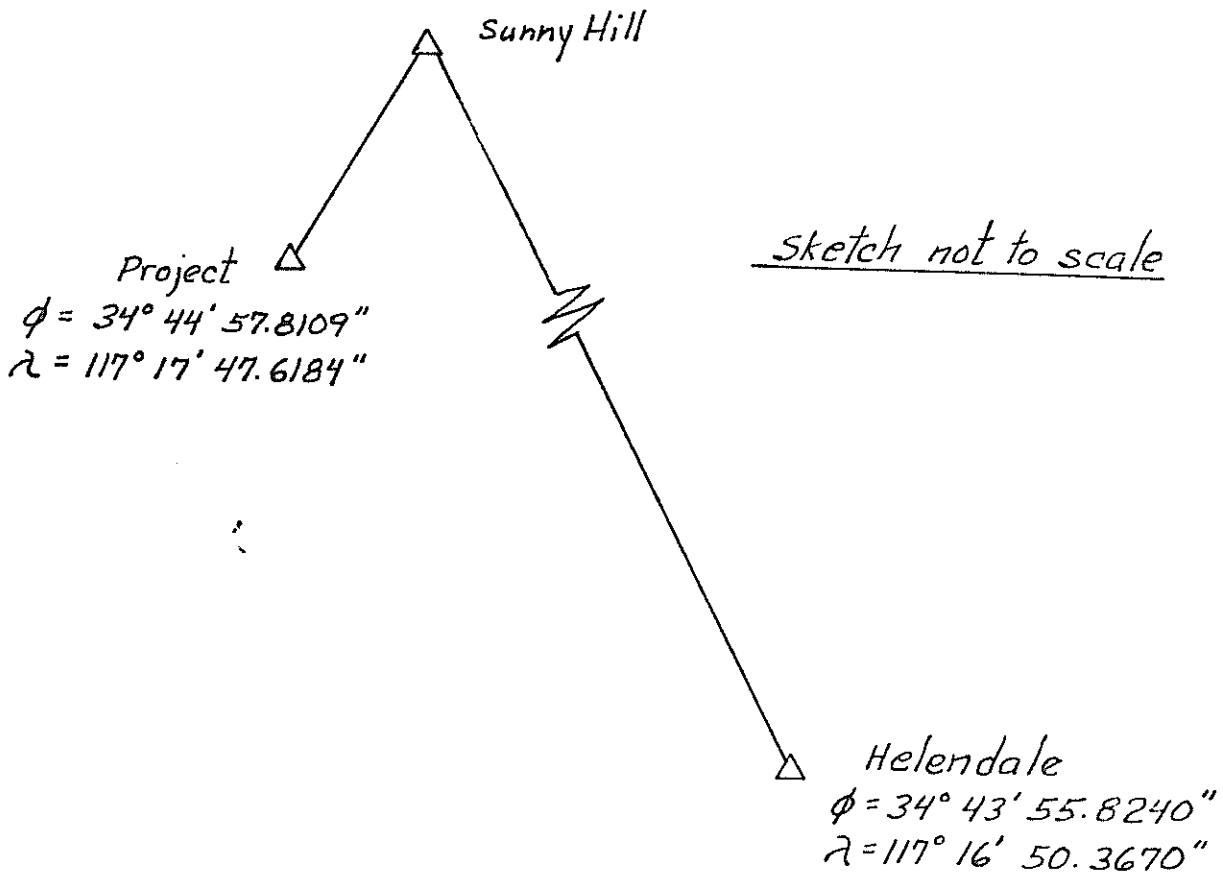
For the line Project to Sunny Hill, geodetic distance = 31.592 ft. and the geodetic azimuth = $211^{\circ} 15' 16''$

In the vicinity of the midpoint of this line, 1" of latitude = 101.098 ft. and 1" of longitude = 83.450 ft.

REQUIRED

Calculate the geodetic azimuth from Helendale to Sunny Hill. Result should be to the nearest 2". This problem falls in the area covered by the California Coordinate System, Zone V.

Show all calculations.



Lambert Projection for California-V

Table I (Cont'd)

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
34° 41'	30,218,791.73	430,632.54	101.08917	-335.2	0.9999228
42	30,212,726.38	436,697.89	101.08933	-336.5	0.9999225
43	30,206,661.02	442,763.25	101.08967	-337.4	0.9999223
44	30,200,595.64	448,828.63	101.08983	-338.0	0.9999222
45	30,194,530.25	454,894.02	101.09017	-338.2	0.9999221
34° 46'	30,188,464.84	460,959.43	101.09050	-338.0	0.9999222
47	30,182,399.41	467,024.86	101.09083	-337.5	0.9999223
48	30,176,333.96	473,090.31	101.09100	-336.6	0.9999225
49	30,170,268.50	479,155.77	101.09133	-335.3	0.9999228
50	30,164,203.02	485,221.25	101.09183	-333.7	0.9999232

Constants for California zones - continued

Constants	V	VI
C	2,000,000	2,000,000
Central Meridian	118° 00'	116° 15'
R _b	30,649,424.27	32,271,267.72
y ₀	455,278.73	424,696.79
<i>l</i>	0.57001 19219	0.54951 75982
$\frac{1}{2\rho_0^2 \sin 1''}$	2.361 x 10 ⁻¹⁰	2.362 x 10 ⁻¹⁰
$\log \frac{1}{2\rho_0^2 \sin 1''}$	0.373 0670 - 10	0.373 2022 - 10
$\log l$	9.75588 39391 - 10	9.73998 16052 - 10
$\log k$	7.63926 75454	7.64958 76331

LS-13

LAND SURVEYOR - 1985

Part B - Wt. 50.0

1. Part B is the second section of the Land Surveyor Examination and is to be completed in four hours. NOT ALL PROBLEMS IN PART B ARE REQUIRED.
2. Your answers are to be completed in your workbook - use separate answer sheets for each problem.
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 below.
5. Read the instructions on the workbook cover page.
6. This portion of the Land Surveyor Examination consists of the following:

Problem B-1	10.0 points
Problem B-2	10.0 points
Problem B-3	10.0 points
Problem B-4, B-5, or B-6	5.0 points
Problem B-7 or B-8	10.0 points
Problem B-9 or B-10	<u>5.0 points</u>
TOTAL	50.0 points
7. After you have completed this portion of the examination, check your work, assemble your answer sheets in sequential order, be sure to include all pages (including diagrams if required), and turn it in to the Examination Proctor.
8. You may keep this set of examination questions.

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

Problem B1 Wt. 10.0 points

PROBLEM STATEMENT

According to the plat, a portion of which is shown below, Section 8 was returned as being only 480 acres. A Survey made by you in 1985 discloses data as shown below. Your client has title to the NE 1/4 of the NW 1/4 of the section, and asks you to survey and monument his property.

CRITERIA

- △ = Original government monument, found as described.
- = Approximate position of original monument, not found.

REQUIRED

Discuss briefly what you must do to accomplish this and to satisfy the requirements for making a dependent resurvey of a section and for subdividing a section in the light of the BLM Manual and the surveying laws of the State of California.

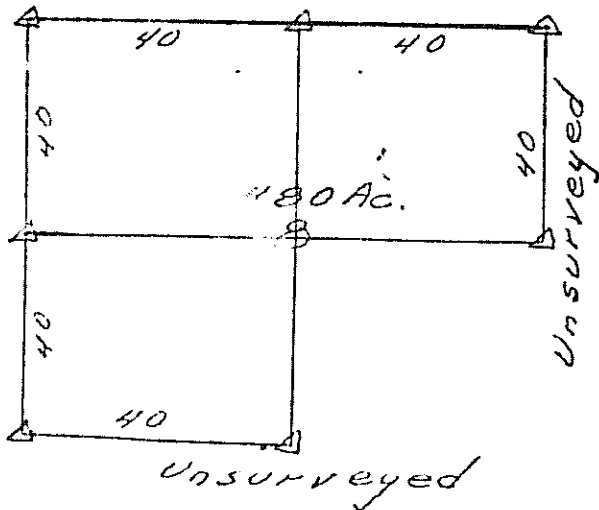
To pin this down, you may cite references from the Manual, the Land Surveyors' Act, and other laws you deem appropriate.

You are not required to do any involved calculations, but if proportioning is involved, show the elements of the proportions.

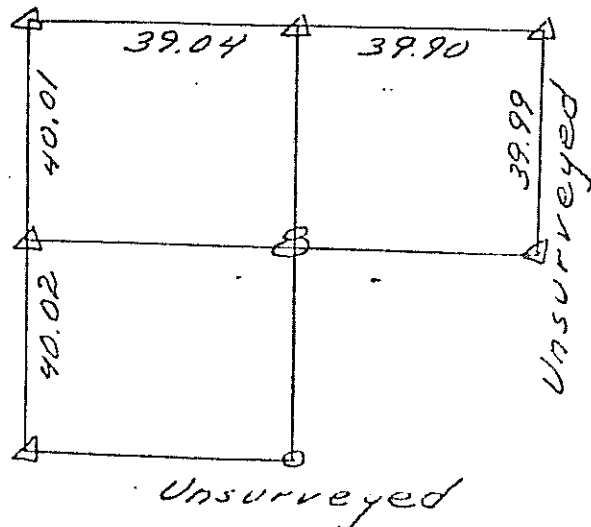
ASSUMPTIONS

You may assume the original government notes and plat are in agreement.

Portion of Plat of Township
Surveyed in 1885



Survey of 1985



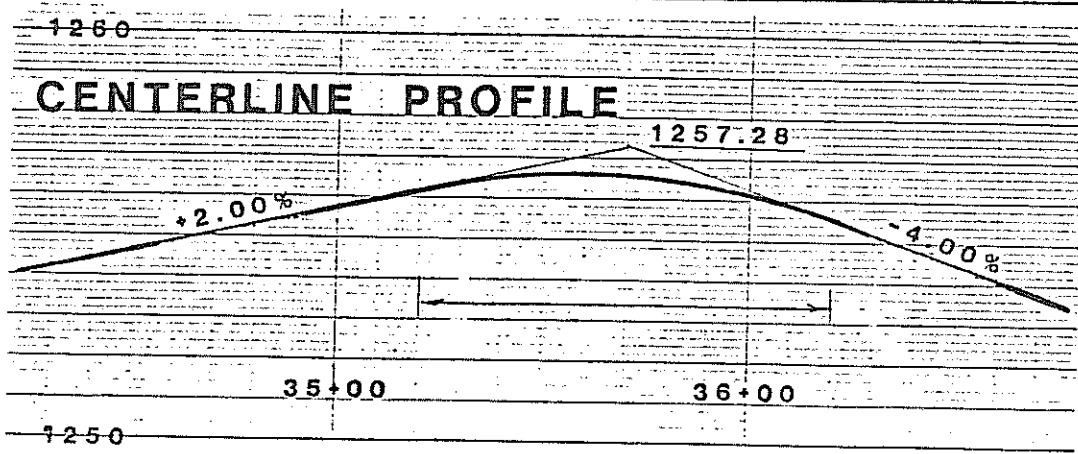
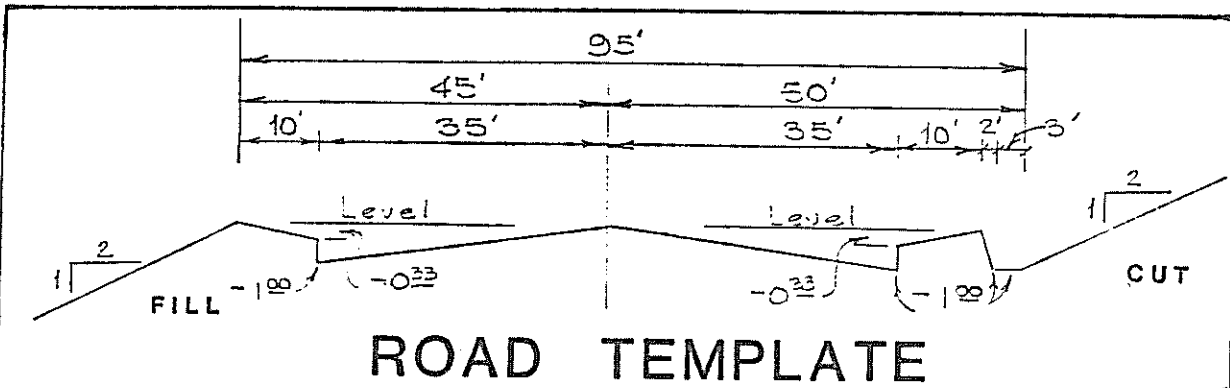
Problem B-2 - Wt. 10.0 points

PROBLEM STATEMENT

You are provided with the following Road Template, Centerline Template and Excerpts.

REQUIRED

From Cross-sections, calculate the earthwork volumes from Station 35+00 to Station 36+00. Show logic and method to arrive at your solution.



$\frac{58^2}{55}$	$\frac{55^2}{25}$	$\frac{1254.4}{36+00}$	$\frac{54^2}{5}$	$\frac{54^2}{30}$	$\frac{51^2}{60}$
$\frac{55^2}{55}$		$\frac{1255.6}{35+60}$			$\frac{55^2}{60}$
$\frac{54^2}{55}$	$\frac{53^2}{10}$	$\frac{1254.2}{35+00}$			$\frac{57^2}{60}$

EXCERPTS FROM CROSS-SECTIONS

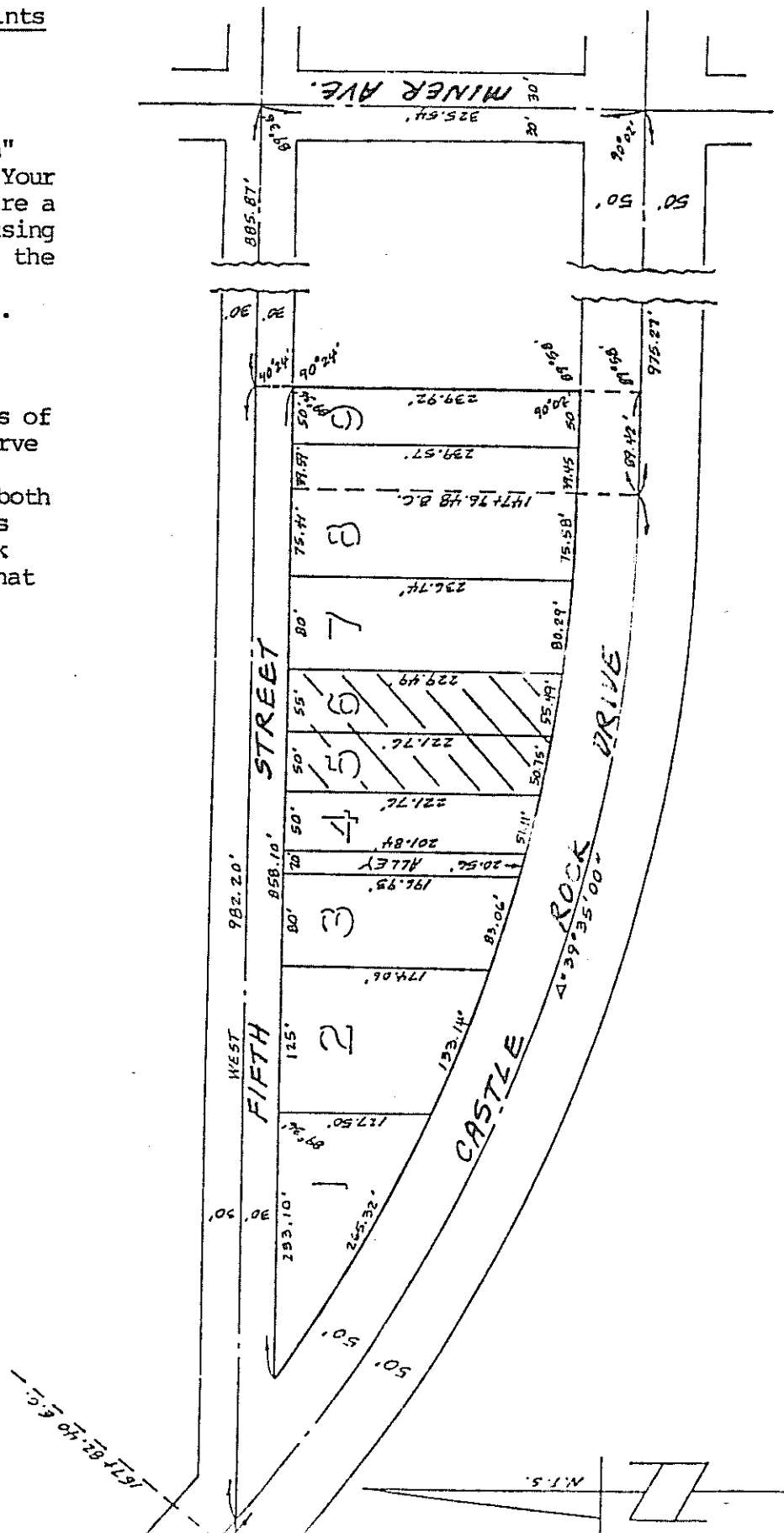
Problem B3 Wt. 10.0 points

PROBLEM STATEMENT

The plat shown is of the "Smith & Jones Subdivision" recorded April 16, 1922. Your client wishes you to prepare a plat of his Lots 5 and 6 using the old tract map, showing the correct dimensions of the lots, including curve data.

REQUIRED

Find the correct dimensions of Lots 5 and 6, including curve data for both lots, and prepare a brief sketch of both lots showing the dimensions and acreage. Show all work and note any assumptions that are made.



Optional Questions B4, B5, B6

YOU MUST ANSWER ONE OF THE FOLLOWING THREE ITEMS.

Weight: 5.0 points

Problem B4, Optional Wt. 5.0 points

PROBLEM STATEMENT

Given the following cross section data, prepare a contour plot to scale; using your finished plot, provide information about the percent of grade.

REQUIRED

1. Plot the cross section data on your paper using a scale of 1" = 50'.
(Suggestion: Draw the center line vertically through the center of your paper and begin Station 10+00 at the bottom.)
2. Interpolate the data and plot 10 foot contours.
3. Scaling from your plot, determine the percent of slope (rounded to tenths) for the following:
 - A) Between the 270 and 280 contour and normal to both.
 - B) Between the 250 and 260 contour and normal to both.

NOTE: Record your answers in the upper left-hand corner of the working area of your paper using this format:

3A 270 to 280 = _____ %

3B 250 to 260 = _____ %

CROSS SECTION NOTES

STATION	LEFT		CENTERLINE		RIGHT		
10+00	257.5 150	262.5 100	265.0 50	275.0 0	285.0 50	295.0 100	296.0 150
11+00	252.5 150	257.5 100	262.5 50	265.0 0	275.0 50	285.0 100	295.0 150
12+00	247.5 150	252.5 100	257.5 50	262.5 0	265.0 50	275.0 100	285.0 150
13+00	242.5 150	247.5 100	252.5 50	257.5 0	262.5 50	265.0 100	275.0 150
14+00	237.5 150	242.5 100	247.5 50	252.5 0	257.5 50	262.5 100	265.0 150
14+50	235.0 150	240.0 100	245.0 50	250.0 0	255.0 50	260.0 100	265.0 150

Problem B5, Optional Wt. 5.0 points

PROBLEM STATEMENT

Mr. David recently purchased two acres of land from Mr. and Mrs. Brown, Jr. He seeks your expertise to clarify what he suspects are differences between a legal description and an assessor's parcel map, both of which were once a part of a Preliminary Title Report depicting his property.

LEGAL DESCRIPTION:

BEGINNING at a point on the north boundary of the lands of Black from which the southeast corner of the 5.5 acre tract of land conveyed to A. Brown, Jr. et ux, by Decree of Distribution of the Estate of A. Brown, Sr. recorded in 1940 bears East 177.5 feet distant; thence along said boundary West 177.5 feet; thence leave said boundary North 11° 00' West 500.0 feet to a point on the south boundary of the lands of White from which the easterly sideline of Old Town Road conveyed to the County by A. Brown, Sr., et al, by deed recorded in 1929 bears West 55 feet more or less; thence West 177.5 feet to the northeast corner of the 2.0 acres of lands conveyed by A. Brown, Jr. et ux, to Charles by deed recorded in 1982; thence leave said boundary of A. Brown, Jr. along the west boundary of Charles South 11° 00' West 500.0 feet to the point of beginning.

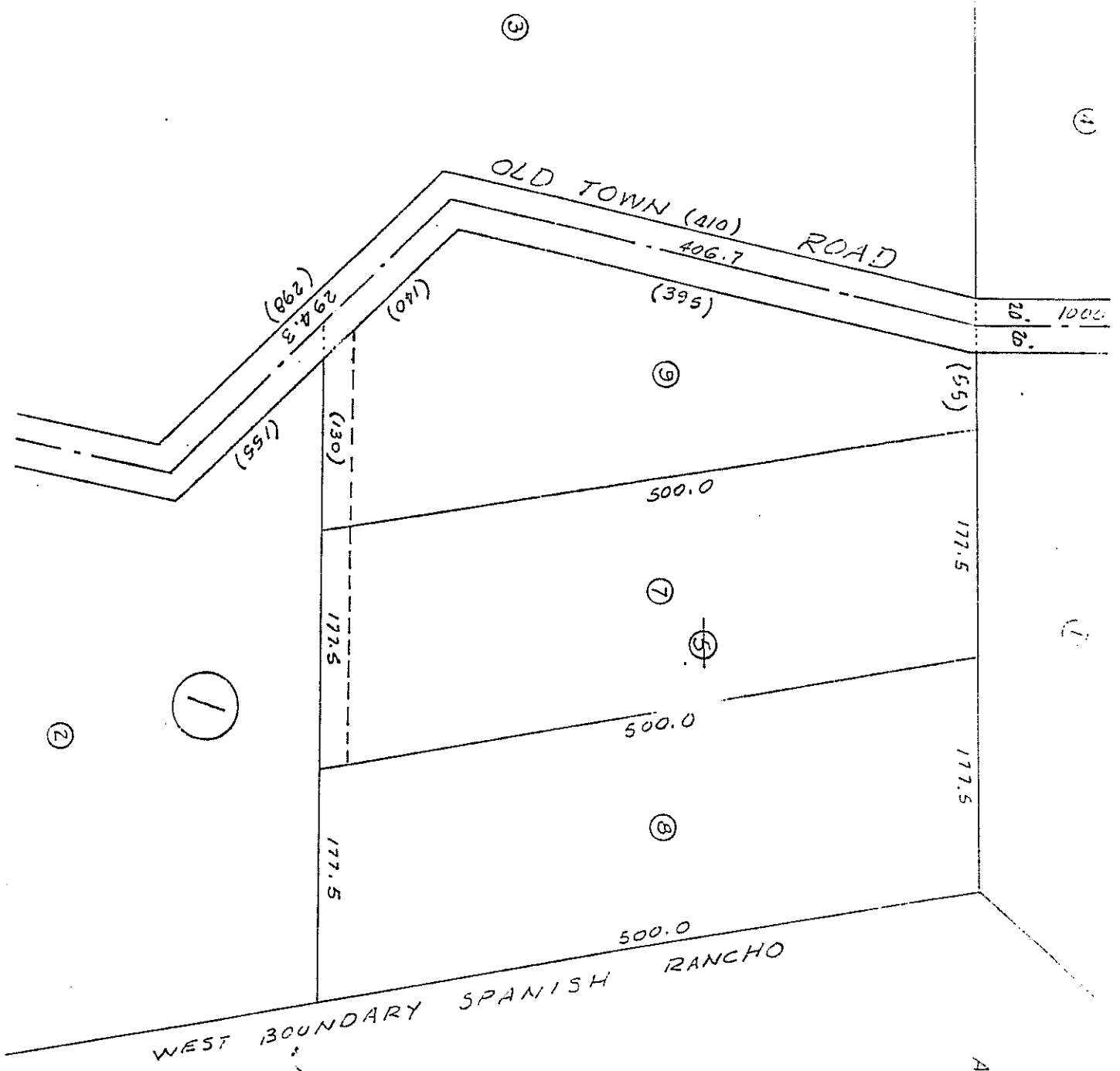
BEING the same property as described in that certain deed of trust recorded by A. Brown, Jr. in 1970 and containing 2.0 acres.

TOGETHER WITH and SUBJECT TO and easement twenty feet wide for ingress and egress the northerly sideline of which is the south boundary of the lands of A. Brown, Jr. leading from the southeast corner of the above described parcel of land west to the County road.

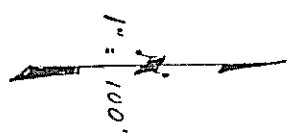
REQUIRED

1. On the assessor's map provided, write those statements in the legal description which are in conflict with said map and arrow them to the appropriate places where they occur.
2. Write the ownership names within the appropriate parcels as those ownerships are indicated in the legal description for assessor's parcels: ①, ②, ⑦, ⑧, and ⑨.

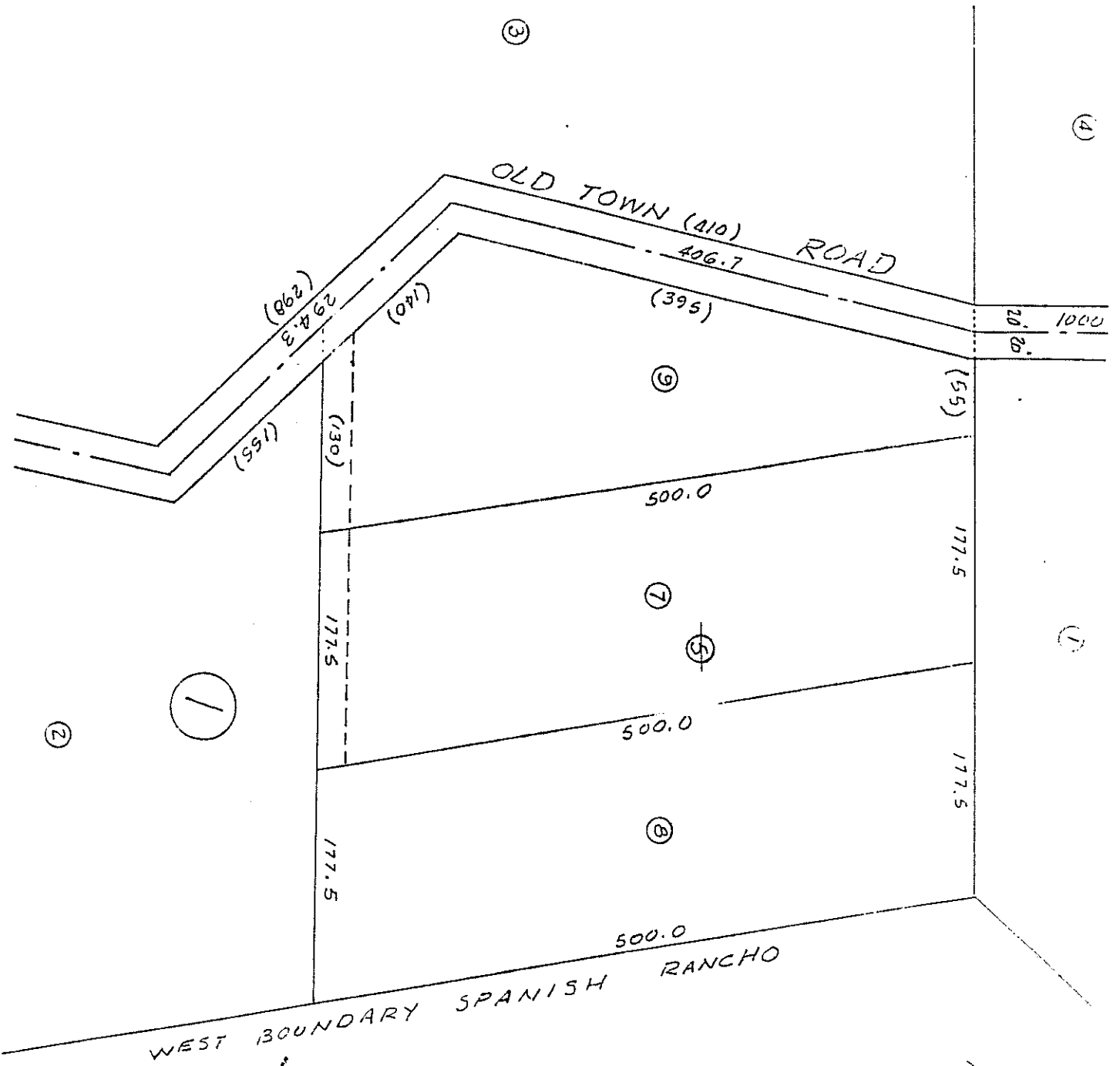
NOTE: Two copies of the assessor's map are provided -- fill in the first, detach and include it with your answer sheets.



Data in parentheses has been scaled.



Assessor's Map No. 28-09



Assessor's Map No. 28-09



*Data in parentheses
has been scaled.*

Problem B6, Optional Wt. 5.0 points

PROBLEM STATEMENT

Using the field notes on the attached form, "NOAA, Form 76-191," and the current standards as published in the manual, "NOAA Manual NOS NGS3 Geodetic Leveling," make the required determinations based upon First Order Class II Leveling using centimeter rods.

CRITERIA

S_B = Backsight Stadia Distance
 S_F = Foresight Stadia Distance
 Δh_L = Elevation Difference of Low Scales
 Δh_H = Elevation Difference of High Scales
 d = Rod Constant Difference

REQUIRED

1. A) Determine the imbalance for lines of sight of each set up.
B) What is maximum imbalance tolerance?
2. A) Determine the section imbalance.
B) What is maximum imbalance tolerance?
3. Determine elevation difference of the section in meters.
4. Determine the length of the section in kilometers.

Optional Questions B7 and B8

YOU MUST ANSWER ONE OF THE FOLLOWING TWO ITEMS.

Weight: 10.0 points

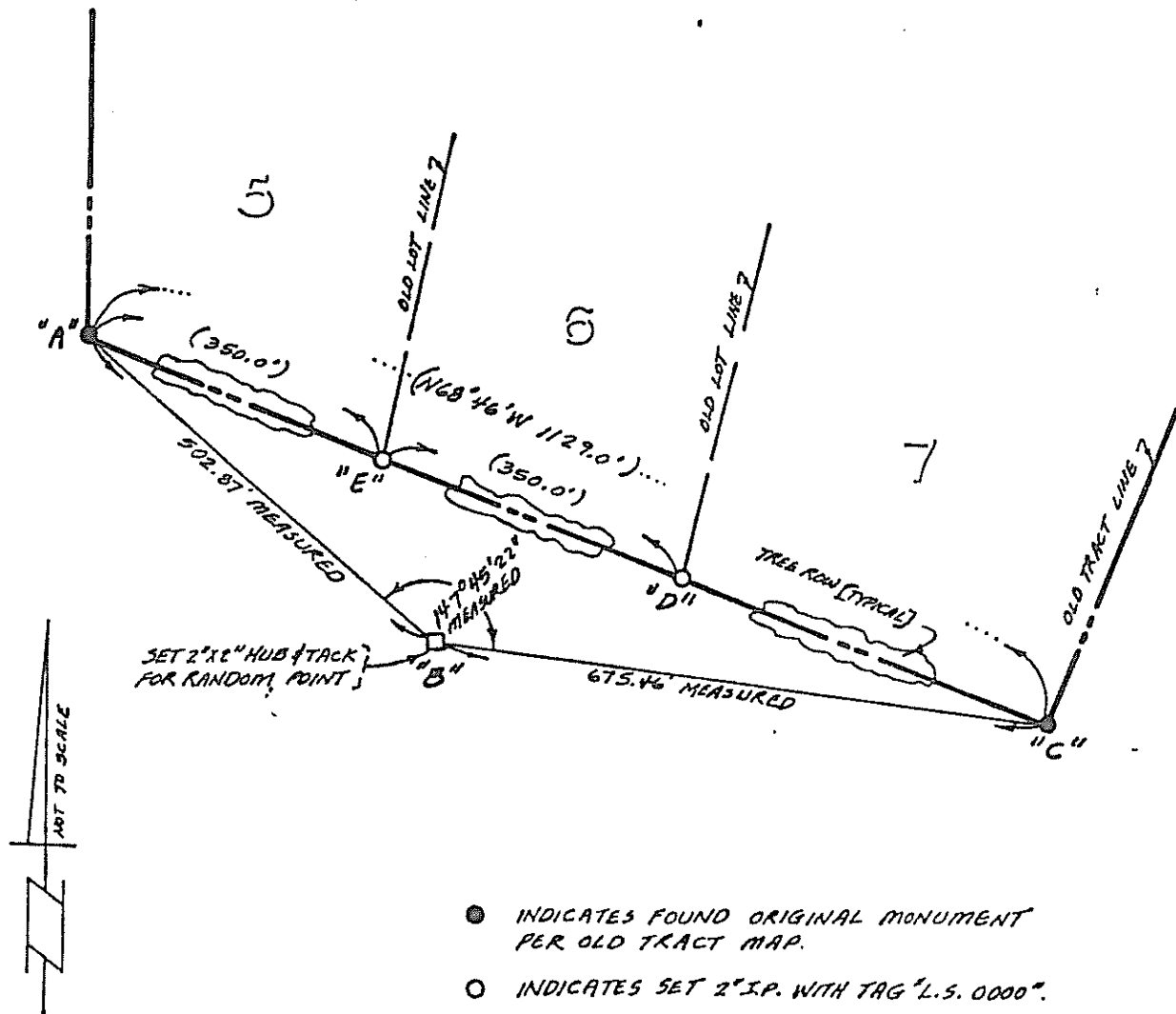
Problem B7, Optional Wt. 10.0 points

PROBLEM STATEMENT

The plat below shows a portion of the boundary of an old tract map. Your job is to re-establish the old lot corners at "D" and "E".

REQUIRED

1. Where would you set points "D" and "E"? Why?
2. How would you physically set the monuments at points "D" and "E" from point "B"? Indicate which angles and distances you would use. Show angles to the nearest second and distances to the nearest hundredth.
3. Are there any alternate positions where points "D" and "E" could be set? Explain.



- INDICATES FOUND ORIGINAL MONUMENT PER OLD TRACT MAP.
- INDICATES SET 2" I.P. WITH TAG "L.S. 0000".
- () INDICATES RECORD PER OLD TRACT MAP.

Problem B8, Optional Wt. 10.0 points

PROBLEM STATEMENT

You are employed by a state agency as a right-of-way surveyor. The state has purchased the Smith parcel in order to construct a new road. The road right of way will be 80.00 feet in width, centered on the surveyed L-line, with fee ownership of the strip by the state.

CRITERIA

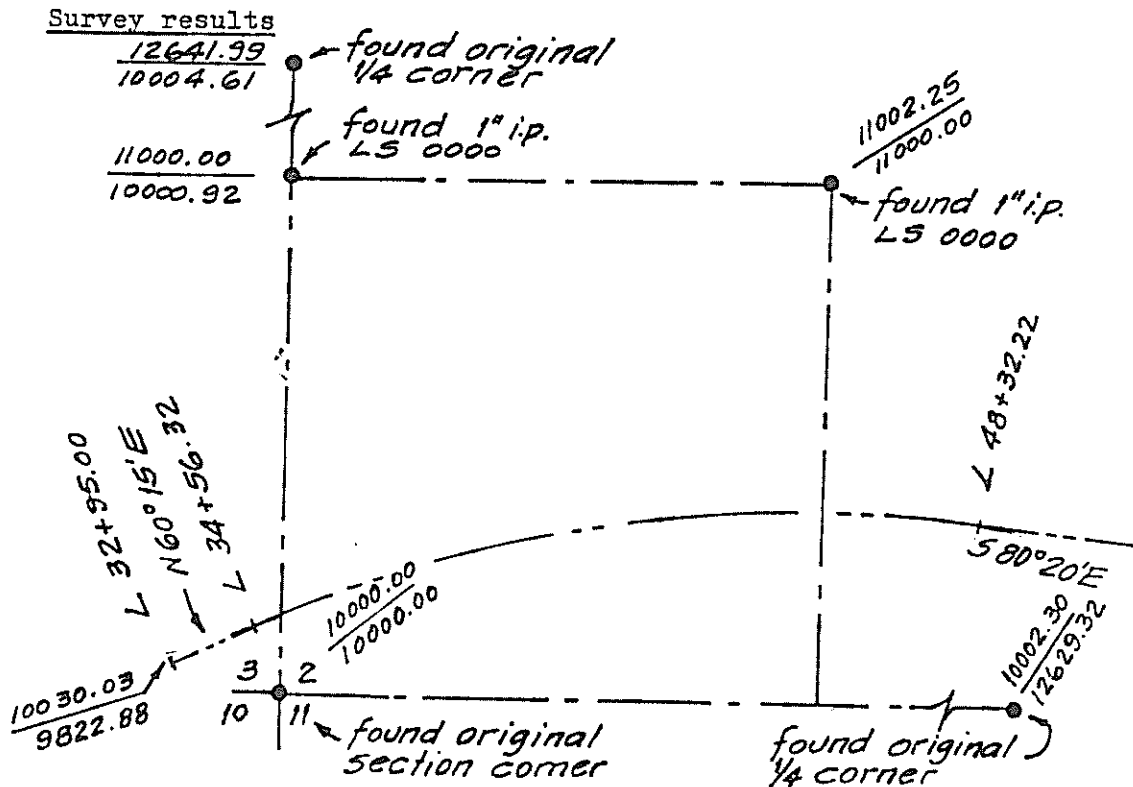
Deed History:

- 1942 Jones acquires the SW 1/4 of Section 2, T3N, R2W, X.M.
- 1944 Book 100 Official Records, Page 289 Jones to Smith, described as follows:

Beginning at the southwest corner of the southwest quarter of Section 2, T3N, R2W, X.M.;
 thence North along the section line 1000.00 feet to a one-inch iron pipe survey monument stamped LS 0000;
 thence East 1000.00 feet to a one-inch iron pipe survey monument stamped LS 0000;
 thence South 1000.00 feet to the South line of Section 2;
 thence West along said line 1000.00 feet to the point of beginning.

REQUIRED

The results of the survey are shown below. On your answer sheet, draw and dimension the road right of way and the two resultant parcels from the original Smith parcel. Prepare a legal description for the southerly parcel using metes and bounds.



Optional Questions B9 and B10

YOU MUST ANSWER ONE OF THE FOLLOWING TWO ITEMS.

Weight: 5.0 points

Problem B9, Optional Wt. 5.0 points

PROBLEM STATEMENT

The diagram shown below indicates some of the information required for flight planning and photogrammetric mapping.

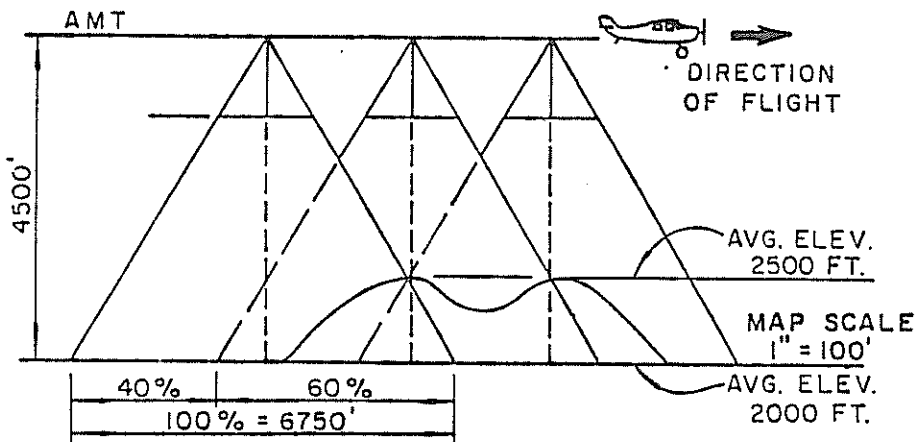
REQUIRED

FILL IN BLANKS FOR QUESTIONS 1 THROUGH 6:

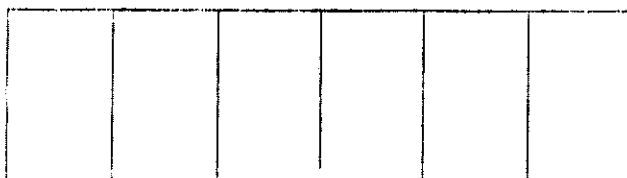
1. Approximate air base = _____ ft.
2. Size of neat model + _____ ft. X _____ ft.
3. ASL = _____ ft.
4. Photo scale _____ ft.
5. Camera focal length = _____ in.
6. Photo scale at the top of mountains (2,500 ft.) = _____ ft.

Show how you would set ground control points on the six model strips at the bottom of the page.

NOTE: This is a duplicate page. Place all work on the following page - detach and place it in your workbook.

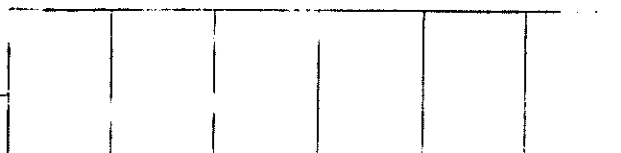


PHOTOGRAPHY 9" x 9"
NEAT MODEL 3.6" x 6.3"
PLOTTER ENLARGEMENT = 7.5x
C FACTOR = 2000
60% FORWARD LAP



WITH
CONVENTIONAL
GROUND CONTROL

WITH
ANALYTICAL
CONTROL

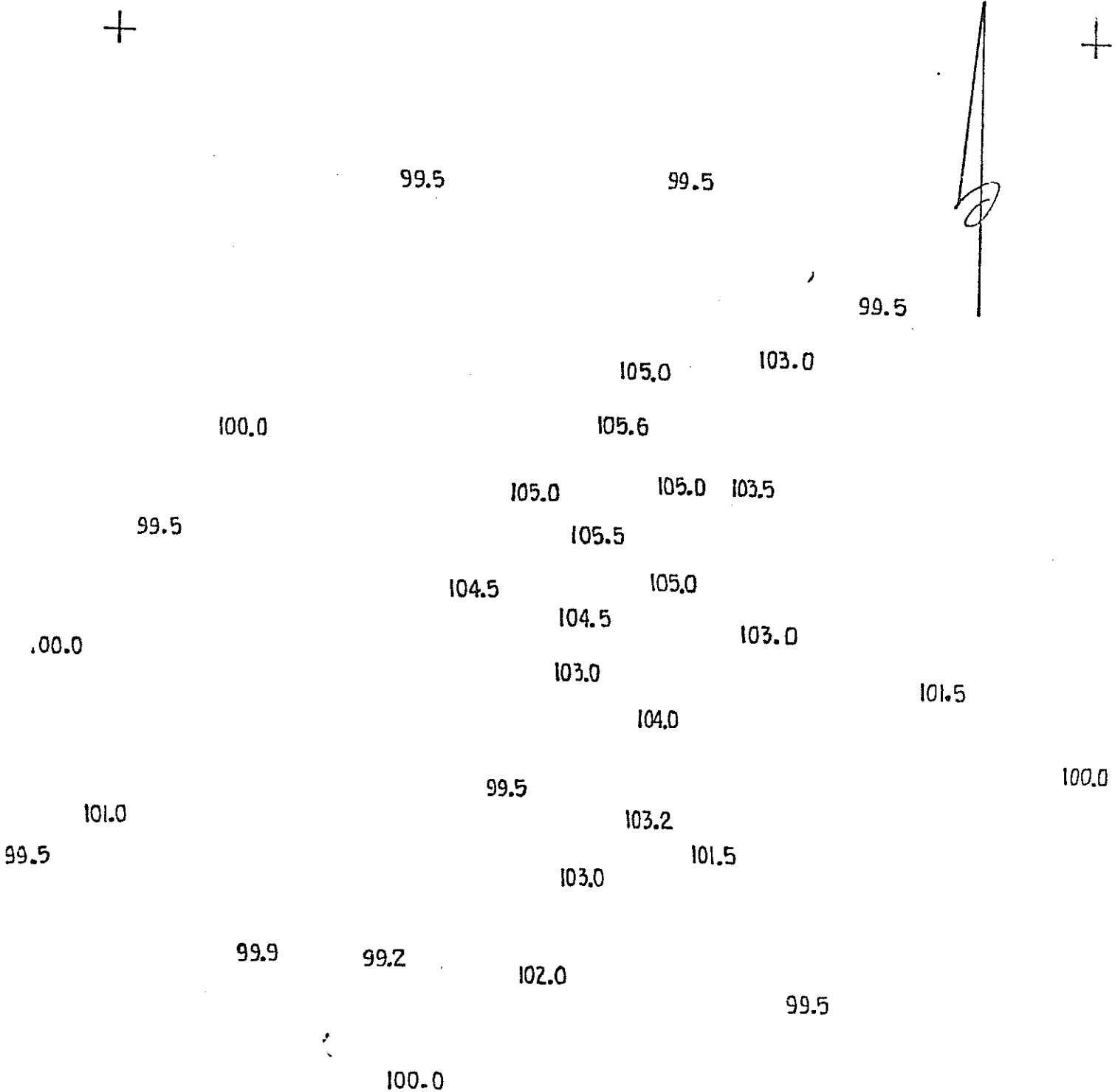



Problem B10, Optional Wt. 5.0 points

PROBLEM STATEMENT


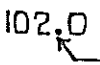
Using the sketch showing elevations plotted to scale, draw a one-foot interval contour map. Two copies of the sketch are included. One may be used for preliminary sketching and may be retained by the examinee. Detach your final drawing and place in your workbook.

I.D. # _____



 BENCHMARK SPIKE IN POWER POLE
ELEV= 100.00 (ASSUMED)

LEGEND

  POINT AT WHICH ELEVATION WAS TAKEN

SCALE - 1" = 20'

FOR CHECKER'S USE 

I.D. # _____



99.5

99.5

99.5



105.0

103.0

100.0

105.6

105.0

105.0

103.5

99.5

105.5

104.5

105.0

100.0

104.5

103.0

103.0

101.5

104.0

100.0

99.5

101.0

103.2

99.5

103.0

101.5

99.9

99.2

102.0

99.5

100.0



BENCHMARK SPIKE IN POWER POLE
ELEV= 100.00 (ASSUMED)

LEGEND

102.0



POINT AT WHICH ELEVATION WAS TAKEN

SCALE - 1" = 20'

FOR CHECKER'S USE

