LS - A

CALIFORNIA BOARD OF REGISTRATION FOR
CIVIL AND PROFESSIONAL ENGINEERS

August 24, 1966

1966 LAND SURVEYOR EXAMINATION

PART A

Closed Book

Time Allowed - Four Hours

INSTRUCTIONS TO EXAMINEE:

The first day of this examination consists of two parts of four hours each (morning and afternoon). Each part will be weighted proportionately. The total grading weight for the first day is 100 points.

Part A consists of 75 problems. All problems have equal weight, and all problems are required.

Detach the last sheet from this booklet. This is your Answer Sheet for this part of the examination. Show only the appropriate answer in the space provided on the answer sheet. For multiple choice problems, enter only the appropriate letter in the space provided. For completion-type problems, enter the word(s), or the numerical answer, as appropriate. Grading will be based only on the answers shown.

You may use any available space in this booklet for computations. When you have completed Part A, return only the Answer Sheet to the proctor. Be sure that your identification number is shown.

No texts, notes, or any other reference material are permitted in this part of the examination. No work will be accepted after the close of the examination period. Slide rules are permitted.

You may keep the examination questions.

Calculators or computers of any type are prohibited in this part of the examination.

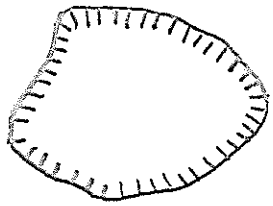
SHOW YOUR ANSWERS ON THE ANSWER SHEET

NOTE: Various types of questions are included. Enter only the appropriate answer in the space provided on the Answer Sheet.

1. Two Gunter chains will exactly equal _____ meters.

2. A steel tape that is shorter than the required standard will induce a repeating error that is _____.

3. A closed contour line which is hachured as shown is used to represent a _____.



4. The apparent altitude of the star Polaris, when measured from the horizon, is equal to what general position of the observer?

5. The generally accepted value in the United States for the standardization of steel tapes is 68°F. In order to correct for temperature differentials from this value, the coefficient of expansion applied to steel tapes is usually taken as _____.

6. On a topographic map, the contour interval is

   (A) the horizontal distance between adjacent contours

   (B) the scaled dimension between adjacent contour lines

   (C) a measure of the elevation above mean sea level

   (D) the difference in elevation between adjacent contours

   (E) a variable that will be explained in the legend

7. A topographic map was drawn to a scale of 1" = 200 feet. At a given location, the contour lines were measured as 3/8" apart. The contour interval for the map was given as 10 feet. The ground slope at the location is equal to _____ per cent.

8. The angle which is subtended by the arc measured from the geographic meridian to the line established by the magnetic needle of a compass is called the

   (A) azimuth

   (B) bearing

   (C) deviation

   (D) declination

   (E) interval

9. The bearing of a line EF is measured as S12° 34'E. The interior angle at point F measured clockwise to point G is 69° 47'. The interior angle at G measured counterclockwise to point H is 127° 09'. The bearing of line GH is _____.

10. A survey which was run in 1872 recorded the magnetic bearing of a line as N47° 32'W. At that time, the magnetic declination was 2° 47'E. The same line was rerun in 1965, when the magnetic declination was 1° 07'W. What is the magnetic bearing of the line as measured in 1965?

11. The sun crosses the celestial equator on its apparent downward movement along the ecliptic on September 21 or 22. What is the name of the position?

12. The sidereal day is equal to _____ hours _____ minutes (to the nearest minute) of mean solar time.

13. Pacific standard time bears what relationship to GCT?

14. Write in the answer space the value of 1 radian in terms of the ratio of the number of degrees and such other symbols that are commonly used.

15. A pantograph is an instrument that is generally used

   (A) in place of a beam compass

   (B) as an attachment to a geodimeter

   (C) as a device for direct reading of stadia measurements

   (D) to reduce or enlarge the scale of an existing map

   (E) to measure the area of a cross section

16. When prolonging a survey line with a transit, the process of double centering is usually done to nullify the error caused by

(A) the incidence of parallax caused by the movement of the observer at the eyepiece

(B) the vertical cross hair not being perpendicular to the horizontal axis

(C) the line of sight not being parallel to the axis of the bubble tube

(D) the line of sight not being perpendicular to the horizontal axis

(E) the vertical cross hair not being truly vertical

17. The shape of the vertical curve as used in profile adjustment for highways and railroads will follow most closely the shape of the geometric figure known as

(A) a parabola

(B) a catenary

(C) a cycloid

(D) a circular segment

(E) an elliptical segment

18. The representative fraction of a map was given in the legend as $\frac{1}{25000}$. A distance was scaled as 1½" on this map. This scaled dimension would represent _____ meters on the ground.

19. The degree of curvature for a circular highway curve is

(A) equal to the deflection angle from the PC to the first station on the curve

(B) an angle subtended by a chord of 100 feet

(C) equal to the central angle in degrees divided by 360

(D) an angle subtended by an arc of 100 feet

(E) equal to the intersection angle I divided by the length of curve

20. Regular township corners on public land surveys are placed at intervals of _____ chains.

21. Declination is an angular measurement which is always either East or West from

(A) Magnetic North

(B) True North

(C) Grid North

(D) the celestial meridian

(E) an isogonic line through this place

22. Write the representative fraction for a map which has a scale given as 1" = 2000 feet.

23. Within the continental United States, a standard time differential of two and one-half hours would be equal to _____ degrees of longitude.

24. A commercial lot was determined to be shaped in the form of a trapezoid with bases of 29 feet and 19 feet. The distance between bases is 8 feet. What is the total area in square feet?

25. A land parcel, which is rectangular in outline, was measured to be 10 chains 55 links by 12 chains 6 links. The area of this parcel is _____ acres.

26. The problem of chromatic aberration in a lens system may be almost eliminated by

(A) using concave lenses

(B) using convex lenses

(C) omitting the objective

(D) using a combination of crown glass and flint glass

(E) using a series of color filters

27. When a magnetic compass is used to run survey lines

(A) the direction of the needle can be predicted within 5 minutes of arc

(B) the northern polarity refers to the earth's magnetic pole

(C) the dip will be at right angles to the meridian

(D) the east and west symbols are reversed in their respective positions on the plate

(E) the strike will be at right angles to the base line

28. When a mass diagram is used to represent volumes of earthwork, the descending part of the curve will indicate

(A) excavation

(B) embankment

(C) free haul in advance of the station

(D) free haul to the rear of the station

(E) a change in the profile grade

29. A slope stake is generally set to mark on the ground

(A) the intersection of the side slope and the natural ground

(B) a critical point of change near the middle of a cross section

(C) the point where the profile grade intersects the ground surface

(D) a point on the center line where the grade changes

(E) the point which marks the limit of the superrelevation.

30. An auxiliary scale which lies adjacent to the main scale of a transit plate, and which provides the capability to subdivide the smallest of the marked graduations is called a

(A) retrograde scale

(B) vernier scale

(C) planimeter

(D) declination scale

(E) Beaman arc

31. A property conveyance which conveys the fee title of the land described from the grantor to the grantee is generally called

(A) a deed in fee simple

(B) a deed of trust

(C) a grant deed

(D) a quit claim deed

(E) an agreement deed

32. In a property transfer transaction, the escrow holder is usually

(A) a third party

(B) the grantee

(C) a fixed depository

(D) the grantor

(E) one of the parties executing the transaction

33. Taxes, assessments, and liens upon real property are generally called

(A) extrinsic evidence

(B) lis pendens

(C) parole evidence

(D) statutory limitations

(E) encumbrances

34. An isogonic chart is used primarily to show

(A) lines of equal magnetic declination

(B) lines of equal azimuth from due South

(C) true meridians

(D) lines of local magnetic attraction

(E) geographical boundaries of political subdivisions

35. The azimuth of a survey line

(A) is always reckoned from South

(B) may have any value between 0° and 450°

(C) is always measured in a counterclockwise direction

(D) may be based upon a reference line that is either true, assumed, or magnetic

(E) is always equal to the bearing of the line

36. A plane table sheet has a scale of $\frac{1}{96000}$. Using an engineer's scale with the least reading that is available on the U. S. Standard graduation system, what is the smallest distance equivalent that can be plotted? (Give answer in feet.)

37. The trace-point method is used to

(A) measure compass declination due to local attraction

(B) establish bench marks

(C) follow a line of equal elevation along the ground

(D) measure the area of a cross section

(E) enlarge a preliminary map into another of larger scale

38. If it is desired to maintain plotting errors within the nearest 20 feet on a map where a standard engineer's scale is used, the smallest scale of the map should be 1" = _____ feet.

39. When working with topographic maps, the process of interpolation consists of

(A) connecting points of equal elevation

(B) tracing the contour lines on the map

(C) drawing in freehand smooth contour lines

(D) connecting the radial azimuths that originate at a common point

(E) spacing contour lines by proportionate distance measurement

40. Much of original work done in the western part of the United States made use of the solar compass. This compass

(A) is guided by the magnetic needle

(B) corrects itself automatically for strike variations

(C) gives results which are generally quite inaccurate and undependable

(D) operates astronomically

(E) is materially affected by minerals and other local attractions

41. A Deputy United States Mineral Surveyor is required to supervise the work and sign the maps in

(A) all resurveys of public lands

(B) surveys of mining claims for patent

(C) original surveys of unsurveyed public lands

(D) surveys to establish code lines

(E) surveys to establish boundaries for mining claims on public lands

42. When the regular corners of a land tract happen to fall in water, an open traverse is usually run generally paralleling the bank of the stream or lake shore. The line thus established identifies a process called _____.

43. If a stream removes a large quantity of soil from the land of one owner and deposits it upon the land of another by the action of the water, assuming no interference from other types of forces, this process is called _____.

44. An owner who holds lands bordering on a body of water is generally recognized to have the _____ rights thereto.

45. An alinement where the ruling grade has been adjusted to permit decreased resistance around curves in order to allow for the increased resistance of the curve itself is said to be _____.

46. The method of least squares is adapted to survey work for

(A) the placing of slope stakes

(B) the adjustment of triangulation nets

(C) finding the root mean square

(D) determining the minimum value of the square root

(E) minimizing the correction to the actual observations

47. Assume that the latitude of place is 40°, the longitude is 120° West, and the time is 12:00 Noon, then the angle measured along the meridian from the nadir of an observer to zenith is equal to _____.

48. The gradual taking possession of land which is not owned is called

(A) acquiescence

(B) avulsion

(C) emminent domain

(D) condemnation

(E) encroachment

49. The prismoidal formula and the average end area formulas, when used to calculate volumes of earthwork will

(A) always give the same answer within an acceptable margin of error

(B) will both be exactly correct for a wedge-shaped volume

(C) be different by an amount known as the prismoidal correction for most cases

(D) be used only as approximations for most volume calculations

(E) always work out to give the desired answer in cubic yards

50. A basic characteristic of the Lambert projection is that

(A) the projection for local maps always shows equal areas

(B) the grid declinations are constant

(C) it uses a grid system in which the S-N measurements are not always positive

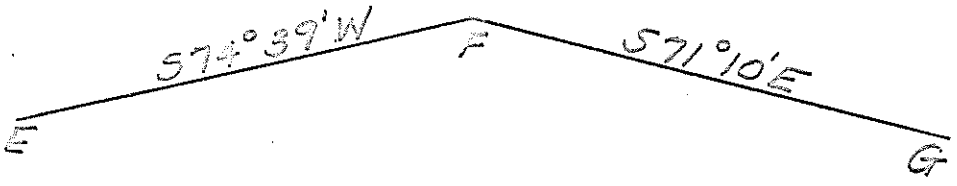
(D) the scale between standard parallels is less than one

(E) the cylinder is the geometric form used for the projection

51. If a man is 5'-10" high, what is the shortest vertical plane mirror in which he can see his full size? Give answer in inches.

52. The distance on a circular curve layout from the center point O to the PI is equal to _____.

53. Two sides of an open traverse are shown. What is the deflection angle at Point F?



54. It is possible to prolong a straight line very precisely from a backsight by making the use of the process of _____.

55. When an optical system fails to bring all the light rays that are received from a point object to a single image point, or to a prescribed geometric position, we then have a condition called _____.

56. A device attached to a transit which will reduce stadia readings directly is called a _____.

57. When taking survey notes in the field book, the sketches are generally drawn on the _____ hand page.

58. In the reduction to coordinates of a traverse sighting, the length of the measured line multiplied by the sine of the bearing angle will give the _____.

59. A polar planimeter will touch the paper at _____ points.

60. A hockey field was measured by making use of a Gunter's chain, and was measured to contain 20 acres. After comparing the chain with the standard, it was found to be one link too short. What is the true area of the field? Assume the error in chain length to be uniformly distributed throughout the length. Give answer in acres.

61. A property owner desires to lay out a two-acre tract such that it is exactly square. What will be the length of each side? Give answer to the nearest 0.1 foot.

62. If the length of an arc is 1.5708 feet on a circle of 1.0 feet radius, what is the central angle subtended in degrees?

63. An aerial photo was taken with a camera which had a focal length of 6 inches. If the altitude above the average ground surface was 12,000 feet, and the negative format was 9" x 9", what was the area of the ground included in the photograph? Give answer in acres.

64. When Polaris is observed at its uppermost position in its orbit around the North Pole, it is said to be at _____.

65. What is the proper name of the Federal agency currently charged with the administration of United States public lands that is contained within the Department of the Interior?

66. Which of the following is correct?

(A) 360° = 100 grads

(B) 1000 mils = 100 grads

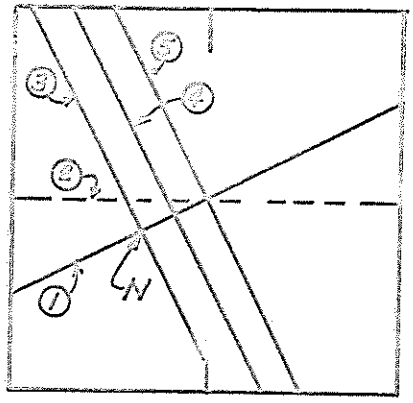
(C) 0.9° = 1 grad

(D) 1.0 mils = 1.0 grads

(E) 1.0° = 0.9 grads

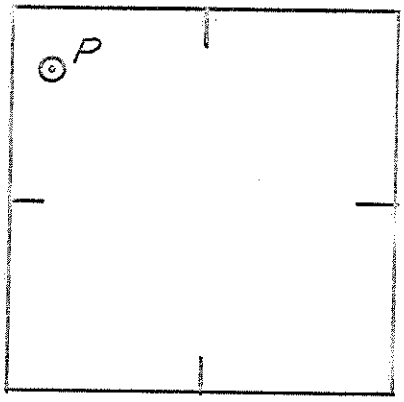
67. On this diagram of an aerial photograph, N represents the plumb point. The line which depicts the axis of tilt is

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5



68. On this diagram of an aerial photograph, point P represents an image of a ground object. If the flying height is 1500 feet and the elevation of the object is 500 feet, its relief displacement is

(A) .35 inches
(B) 1.06 "
(C) .80 "
(D) .71 "
(E) Not possible to find because focal length is not given.

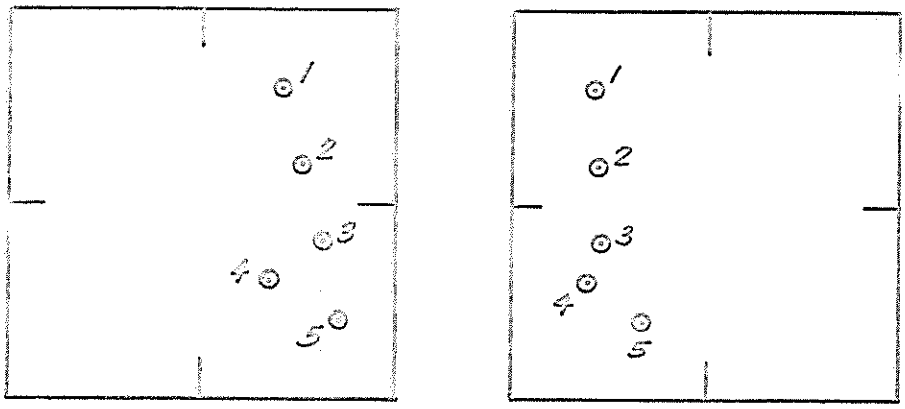


69. Which of the following lens aberrations is of particular concern to the photogrammetrist?

(A) spherical aberration
(B) radial distortion
(C) coma
(D) astigmatism
(E) curvature of field

70. In this stereogram below, which point has the greatest parallax?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5



71. The nadir point on a 6" focal length photograph tilted 20° is _____ inches radial from the principal point.

(A) 2.05 inches
(B) 5.64 "
(C) 16.50 "
(D) 6.38 "
(E) 2.18 "

Functions

20°		70°
.34202	- sin -	.93969
.93969	- cos -	.34202
.36397	- tan -	2.74748
2.74748	- ctn -	.36397
1.06418	- sec -	2.92380
2.92380	- csc -	1.06418

72. A superwide angle photograph with a 3.5 inch focal length will cover an area of _____ square miles from a flying height of 20,000 feet.

(A) 97.5
(B) 81
(C) 57.5
(D) 75
(E) 87.5

73. The image made by a double convex lens used as a magnifier will be

(A) projected
(B) enlarged in ratio of object distance to image distance
(C) real
(D) inverted
(E) virtual

74. A reseau camera is one which

(A) is designed for infrared photography

(B) is usable only for analytic photogrammetry

(C) incorporates a built-in grid

(D) is usable only with optical train plotters

(E) has special use in photo-interpretation

75. A 6-inch focal length aerial camera in an airplane going 132 ft/sec at an altitude of 3000 feet above the ground must have a shutter speed of _____ seconds to keep image motion in the range of .0007 inch.

(A) 1/300

(B) 1/350

(C) 1/400

(D) 1/375

(E) 1/385

END OF PART A

CALIFORNIA BOARD OF REGISTRATION FOR CIVIL AND PROFESSIONAL ENGINEERS

1966 LAND SURVEYOR EXAMINATION

August 24, 1966

LS

PART B

B

Closed Book

Time Allowed - Four Hours

This booklet contains the problems for Part B of this examination.

Follow the instructions that are given on the cover page of the work-book which you have already received.

All of the work which is to be graded must be included in your work-book. No work will be considered that is not completely included at the close of the examination.

If the meaning of a problem is not clear to you, or if it appears to be incomplete, note such assumptions as you think necessary and proceed with the solution.

No books, notes, or reference material may be used in this part of the examination. Slide rules and minor drafting aids, such as triangles, scales, french curves, and compasses are permitted.

You may keep this set of examination questions.

Work any combination of problems for a total of 50 points.

Problem B1 - Wt. 3

What is the name of the geometric form that is used for the layout of vertical curves? This particular construction has a mathematical property which is used to calculate the elevation of the points along the curve. Describe the property, and indicate how the construction is applied.

Problem B2 - Wt. 4

Distinquish between the direct and the retrograde verniers. Draw a sketch of each to show the relative positions of the respective scales that identify each.

Problem B3 - Wt. 3

Determine the value of each of the unknowns in the following set of equations:

$$3a - 3b - C = -6$$
$$9a + b - 3C = 2$$
$$6a + 3b + 2C = 8$$

Problem B4 - Wt. 4

A property boundary line in wooded country was found to run directly through a large tree that could not be cut. Describe, and draw a sketch of two methods that could be used to prolong the line and the correct distance around and beyond the obstruction.

Problem B5 - Wt. 3

Describe what is meant by magnetic declination. What are three ways to determine the value for a particular locality? If you are to resurvey an old original line, how would you determine what the magnetic declination was at the time the original survey was made?

Problem B6 - Wt. 4

Draw a suitable sketch and show the position of the S½ of the NE¼ of the SW¼ of Section 26, T2N, R4W, M.D.B.M. Show sufficient distances and dimensions to locate the parcel described. What is the area of the parcel in acres?

Problem B7 - Wt. 5

(A) What is a deed, and what is its primary purpose?

(b) What are the essential elements of a deed?

(c) Where and why are deeds recorded?

(d) Describe the relationship, or differences, of the "Abstract of Title" and the policy of "Title Insurance."

Problem B8 - Wt. 2

Explain the terms "declination" and "variation" as they are applied in land surveying practice.

Problem B9 - Wt. 4

Define each of the following terms:

(a) witness corner

(b) closing corner

(c) meander corner

(d) obliterated corner

Problem B10 - Wt. 3

A parcel of land is shaped like a right triangle. The base is exactly 100.00 feet longer than the altitude. What is the length of the base if the length of the perimeter of the parcel is 1000.00 feet?

Problem B11 - Wt. 2

A property owner wants to sell a parcel of land which is exactly square, and which will contain exactly 3 acres. What are the dimensions of the boundary lines that you would recommend? (Give answer to nearest 0.01 ft)

Problem B12 - Wt. 4

An existing embankment which carries a railroad grade has a top width of 24 feet, and has side slopes of 2:1, with a centerline height of 30 feet. A pedestrian tunnel must be cut at right angles through this fill which is 15 feet wide at the top, the top of the cut being 20 feet below the top of the existing fill. The side slopes of the excavation will be 1½:1. What is the volume in cu yds that will be excavated? The bottom of the tunnel will be at the same level as the bottom of the existing fill.

Problem B13 - Wt. 3

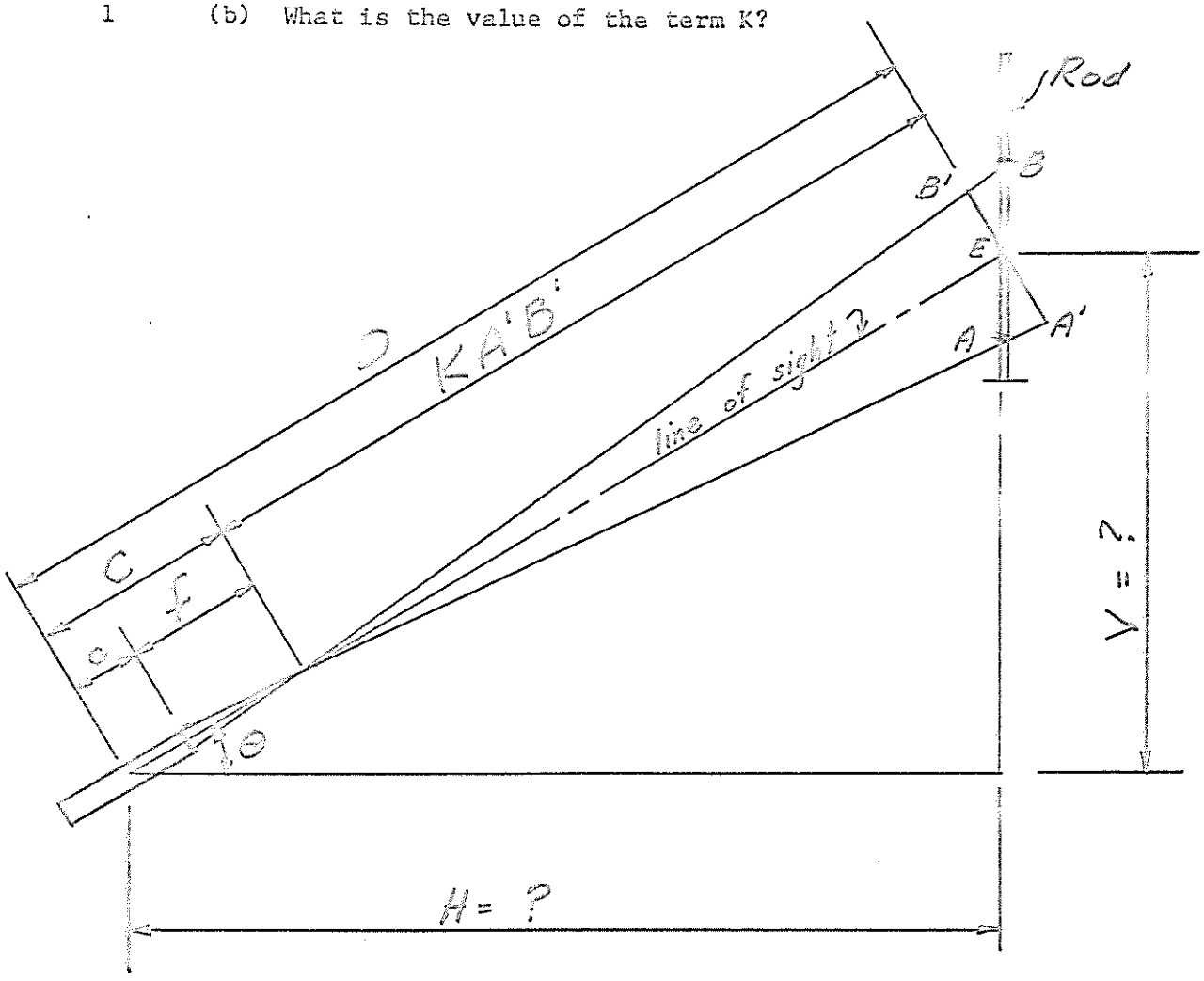
A field survey crew is employed at a location where the extremes of temperature may vary from -40°F to +100°F. The steel tape which is in use has been standardized at 68°F. What are the maximum errors, expressed as ratios, that would be inducted by these extremes if corrections for temperature were ignored?

Problem B14 - Wt. 5

Wt.

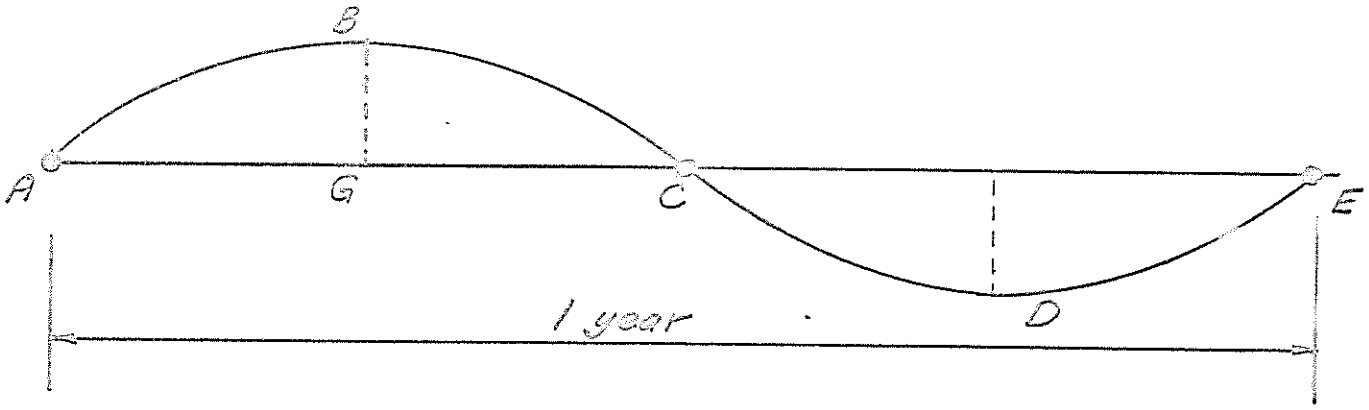
4 (a) The diagram shown below represents an inclined stadia sighting. Write the complete equation for H and V in terms of the given data, and the observed rod intercept = S.

1 (b) What is the value of the term K?



Problem B15 - Wt. 5

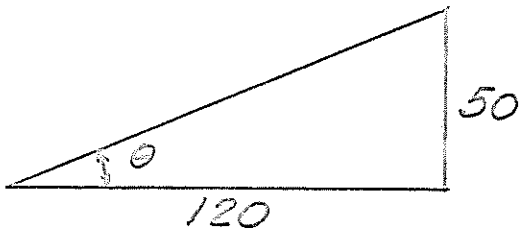
The diagram represents the sun's ecliptic. If point A is the vernal equinox, identify the name and approximate date of the points B, C, D, and E. What is the distance BG in degrees of latitude?



Problem B16 - Wt. 3

In the triangle shown below, calculate the value to the nearest thousandth of each of the following functions of θ.

Sine	secant	cotangent
cosine	cosecant	tangent



Problem B17 - Wt. 5

A triangulation net was laid out with a base line that was measured carefully with a 300-foot steel tape. The distance measured was determined to be 2474.92 feet, but the tape was discovered to be actually 299.96 feet long. What is the true length of the base line, neglecting other correction factors than those described.

What kind of an error is introduced by such a condition?

If the three sides of a triangle are measured as base lines, using a geodimeter, and none of the angles are turned, a complete solution is possible. What is the name of this procedure?

Problem B18 - Wt. 5

Define each of the following terms:

(a) encroachment

(b) easement

(c) right-of-way

(d) adverse possession

(e) quiet title action

Problem B19 - Wt. 2

The following equation is not an identity as written. What is the sign and value of the term that should be added to the right side of the equation to make an identity?

$$\cos^2\beta + \sec^2\beta = \sin^2\beta \tan^2\beta + ?$$

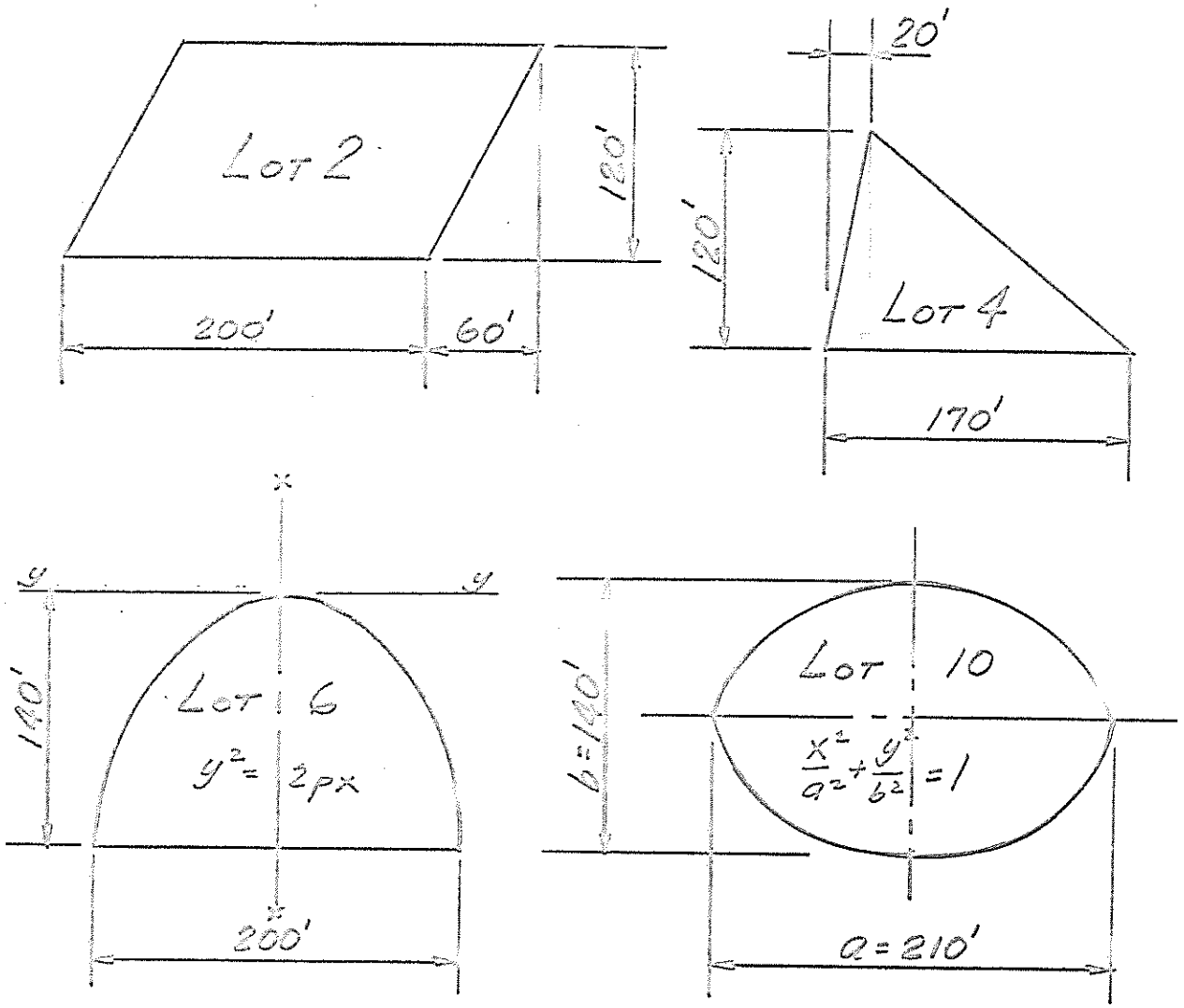
Show sufficient calculations to develop and support your answer.

Problem B20 - Wt. 3

A survey line that is 837.71 feet long must be laid out on the ground. The tape to be used has been determined to be 100.06 feet long. What is the taped length that must be measured on the ground to stake out the desired distance?

Problem B21 - Wt. 2

Four geometric areas are shown. Identify each figure by its proper name, and determine the area in square feet for each.



Problem B22 - Wt. 4

The invert of a concrete sewer pipe was measured in the field as elevation 398.17 at station 35 + 00. The sewer pipe was 36" inside diameter, with a 4" thick shell. The pipe is on a minus 1½ per cent grade. What is the elevation at the top of the concrete at station 46 + 00?

Explain what the invert is, and why it is used.

Problem B23 - Wt. 4

A manhole is located in a street that is 40 feet wide. The manhole is 15 feet from center line, and the street has a 5" crown which is in the shape of a parabola. What is the elevation at the manhole if the center-line elevation is 21.74?

Problem B24 - Wt. 3

Define each of the following terms:

(a) nadir

(b) horizon

(c) right ascension

(d) culmination

(e) hour angle

(f) meridian of place

Problem B25 - Wt. 6

The following field notes are given for a road cross section:

Station	Cross Section		
409	C2.4	C1.2	C0.4
	16.8	0.0	12.8
410	C12.2	C9.2	C4.8
	36.4	0.0	21.6

The width at road level is 24 feet, and side slopes are 2:1.

Wt.

1.5 (a) Compute the cross sectional areas at each station in sq ft.

1.5 (b) Compute the volume by the average end area method in cu yds.

1.5 (c) Compute the volume by the prismoidal method in cu yds.

1.5 (d) Describe why the results in (b) and (c) are the same, or are not the same, as the case may be.

END OF PART B

Problem C1 - Wt. 10 (Required)

The plan shown below represents a newly designed land parcel. The found stakes on the East side are of unknown origin. The adjoiners deed to the East reads: E½ SW¼ SW¼, Section 36, T12S, R40W, SBM, excepting any portion in Clear Lake. Your owner has the W½ of the same portion of the section.

REQUIRED:

Write the correct title description for the land parcel shown.

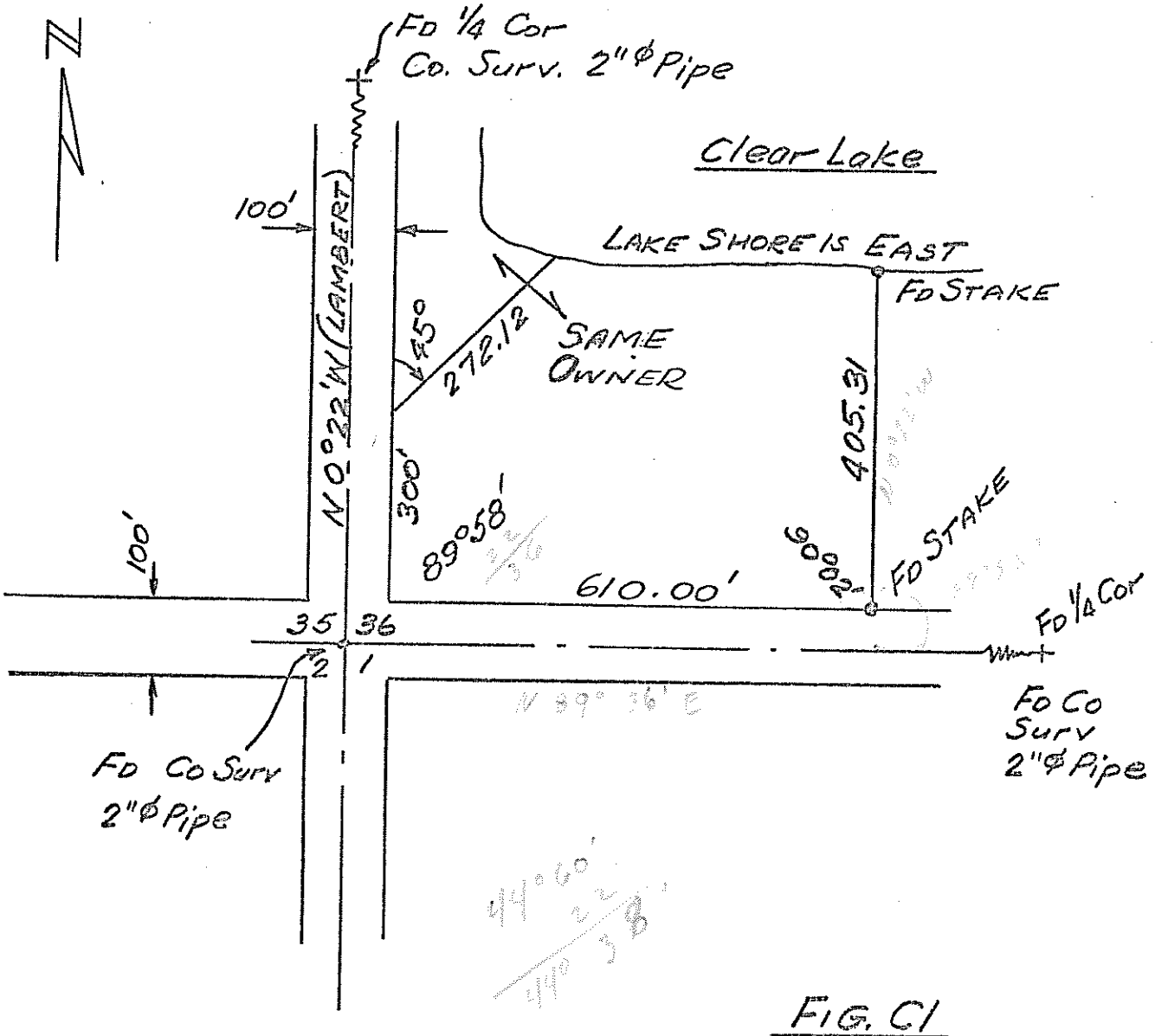


FIG. C1

Problem C2 - Wt. 10 (Required)

You have completed a field measurement from point A (elev. 1950') to point B (elev. 2050') with a tape which is .008' too long. The field temperature was uniform at 82°F, and the measured distance was recorded as 2127.36' (uncorrected). Standard temperature is 60°F, and tape is 100' nominally.

The Lambert coordinates at point A for Zone III are:

x = 2,020,000 y = 351,963.81

The geodetic bearing from point A to point B is N79° 50' 05"E.

REQUIRED:

Compute the correct Lambert coordinates for point B.

Problem C3 - Wt. 10 (Required)

Wt.

8 PART A - You have completed the field measurement of a base line, and have recorded the following results:

2127.613	2127.601	2127.628
2127.585	2127.631	2127.579
2127.654	2127.641	2127.628
2127.596	2127.641	2127.627

Compute: (1) the most probable length

(2) the standard error

(3) the 40% error

1 PART B - What type errors are not accounted for in the solution to Part A above?

1 PART C - A random error of probable magnitude of .01' (plus or minus) has 16 opportunities to occur. What is the probable error from this source after the 16 measurements are completed?

See ACSM Newsletter Sept. Oct 1967

Problem C4 - Wt. 10 (Optional)

Wt.

9 PART A - Making use of an electronic distance measuring device, you have determined the distance between point A (elev. 2421.67') and point B to be 58,100.31'. Due account was taken of the usual corrections for temperature, barometric pressure, and humidity.

The vertical angle from point A to point B was measured as + 2° 27' 01" with a T3.

REQUIRED:

Compute the geodetic distance between points A and B.

1 PART B - What procedure would you use to improve upon the accuracy of the data given in Part A?

Problem C5 - Wt. 10 (Optional)

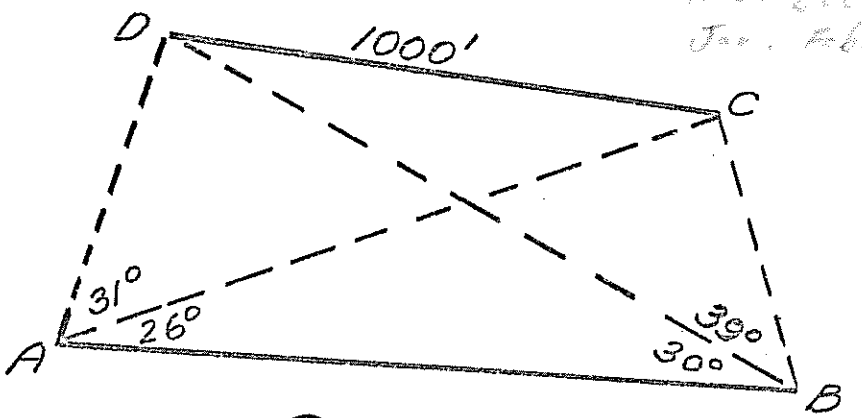
The diagram below shows a part of a triangulation net. You have set up at point A, and at point B, and have turned the angles that are given.

The distance from point D to point C is known to be 1000'.

REQUIRED:

What is the correct length of line AB? (to nearest 0.1 ft)

See ACSM Newsletter Nov. Dec. 1967 Jan. Feb. 1968



PLAN
Not to scale

FIG. C5

Problem C6 - Wt. 10 (Optional)

You have been assigned to stake a 600' parabolic vertical curve which has a plus grade of 5%, and a minus grade of 3%. The elevation at the beginning is 250.00' (on the 5% grade approach).

REQUIRED:

Wt.

7 (a) What are the elevations on the curve at 100' intervals?

1.5 (b) What is the elevation at the highest point on the curve?

1.5 (c) What is the station and plus at the highest point on the curve?

Problem C7 - Wt. 10 (Optional)

The area shown on the Figure C7 is to be mapped at a compilation scale of 1:1440 with a standard 5-diameter Kelsh plotter.*

REQUIRED: Plan aerial photography to provide stereoscopic coverage of the project area, and

(a) draw the planned flight lines NEATLY on the figure (see instructions below)

(b) on the figure show the necessary flight altitudes above sea level. (You must support these altitudes with computations)

(c) specify horizontal and vertical tolerance for positioning actual flight lines

(d) specify type of camera and its focal length

(e) determine an estimate of photography cost if the price of each exposure is $10.00 (not including travel costs to and from project area)

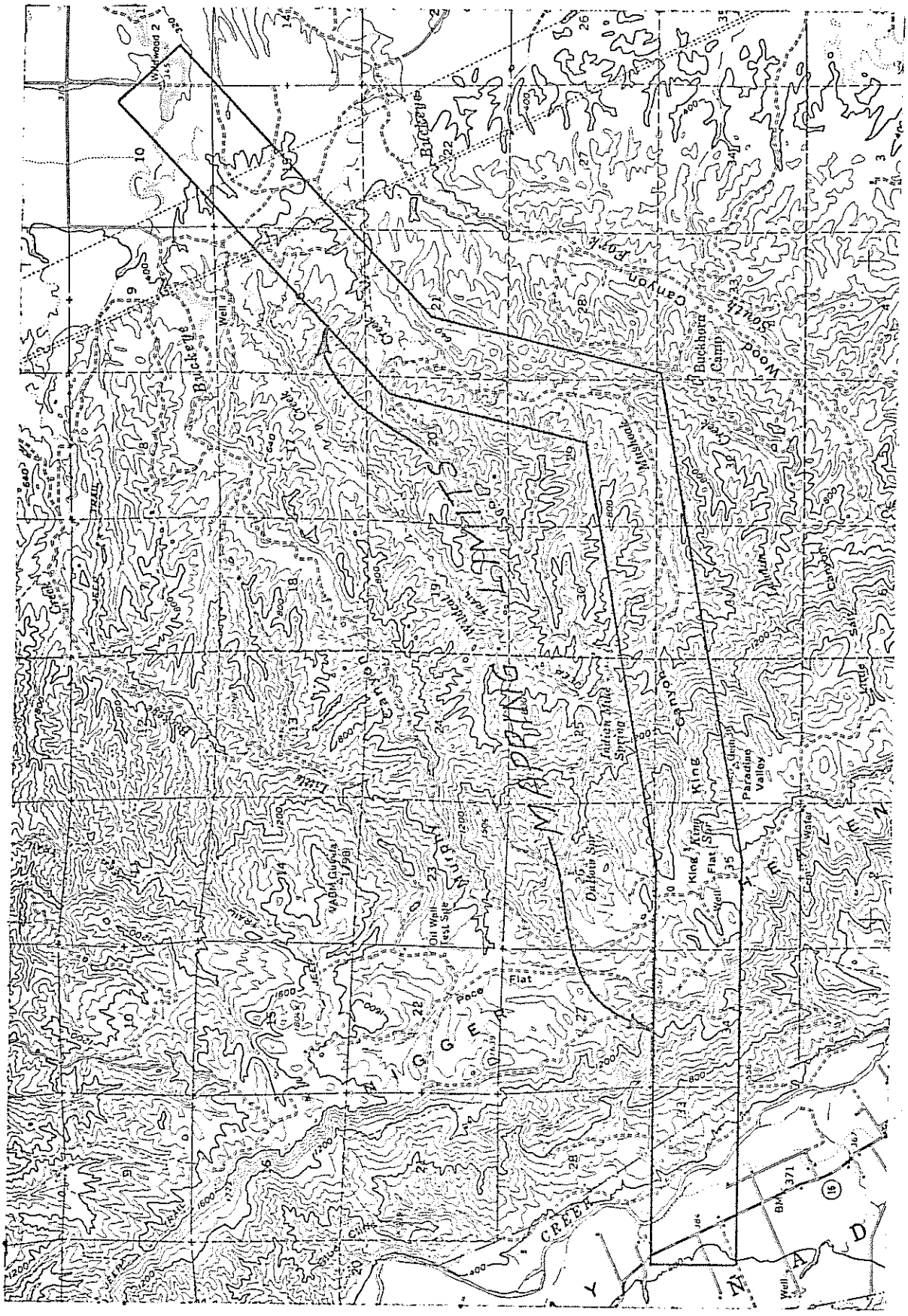
*NOTE: Assume projection limits of 24 inches minimum and 33 inches maximum.

INSTRUCTIONS:

Detach the following map on Page 5 as your work sheet. Show your work for Part B directly on this map. Include Page 5 as part of your workbook when you have completed this problem.

Prob. C7 contd on next page

Problem C7 contd



Problem D1 - Wt. 15 (Required)

PART A - Wt. 6

The coordinate data shown on Figure D1 is assumed to be correct. Where would you set the lost corner marked "A"? Compute the coordinates for point "A".

PART B - Wt. 5

Assume that you find the original monument position at "A" to have coordinates 5,206.3 N, and 26.1 W. Compute the correct bearing and distance from the Northeast corner of Section 2 to the South one-quarter corner of Section 36. (Give distances to nearest 0.1 ft)

PART C - Wt. 4

Assume that you find the original position at "A" to have coordinates as previously noted in Part B (above). Assume that you also find rock mounds at "E" and "H".

What location would you accept, or where would you set the North one-quarter corner to Section 1? This is generally assuming the usual original survey conditions found in California.

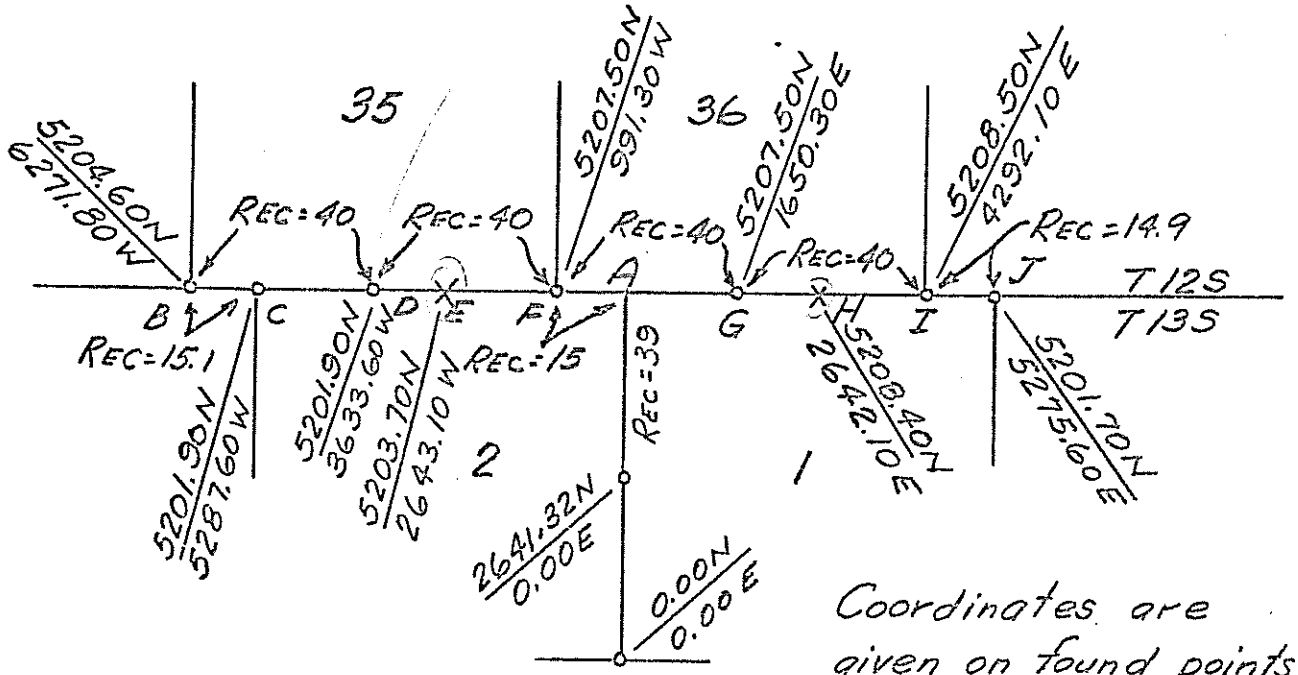


FIG. D1

NOTE: Choose Problem D2 or D3 for 10 points.

Problem D2 - Wt. 10

You are set up at a point B, and have recorded the following data after observing the sun:

Time of observation: 3 hrs 22 min 30 sec P.M. (Standard Time)
Date: March 18, 1966
Temperature: 60°F
Barometer: 30"
Latitude: 32° 45'
Longitude: 117° 07'
Vertical angle to center of sun: 30° 36'
(average of 6 shots)

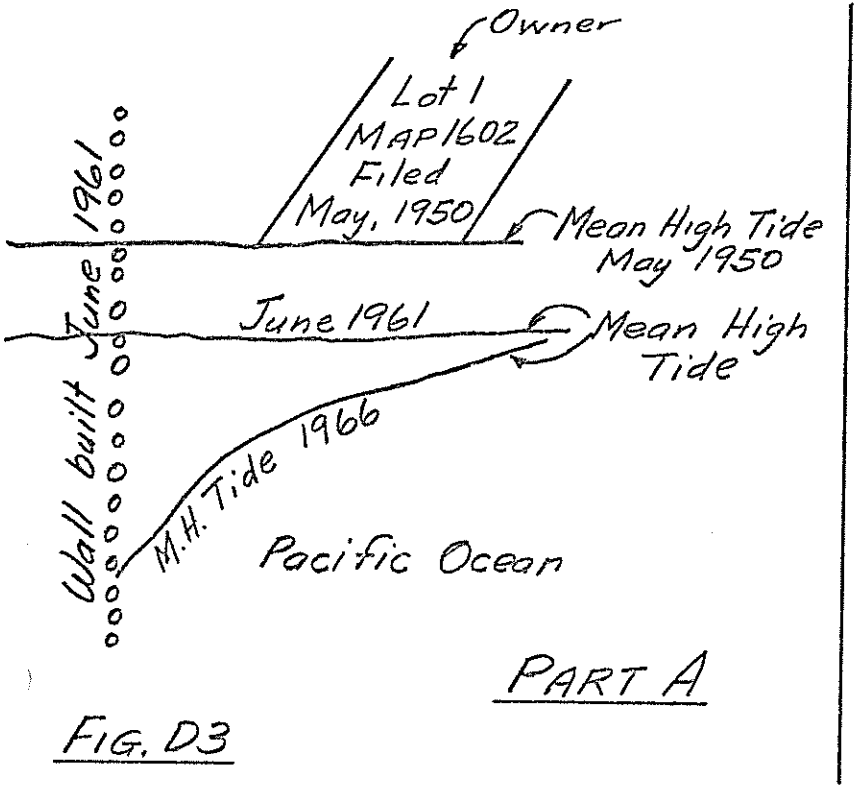
REQUIRED:

Calculate the bearing from point B to the sun.

Problem D3 - Wt. 10 (5 parts at 2 points each)

Show the limits of the owner's fee title rights for each of the following:

(Reproduce enough of each plot in your workbook to clarify each part.)



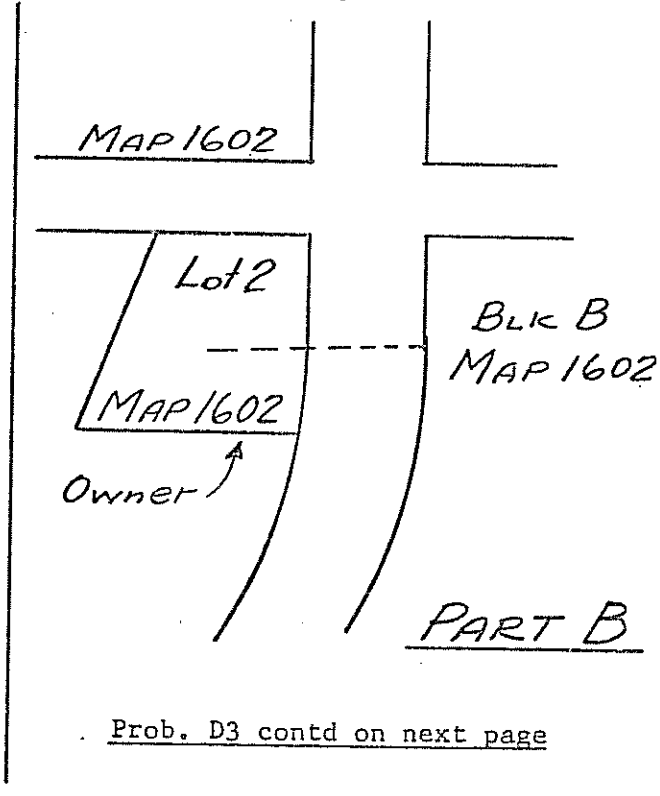
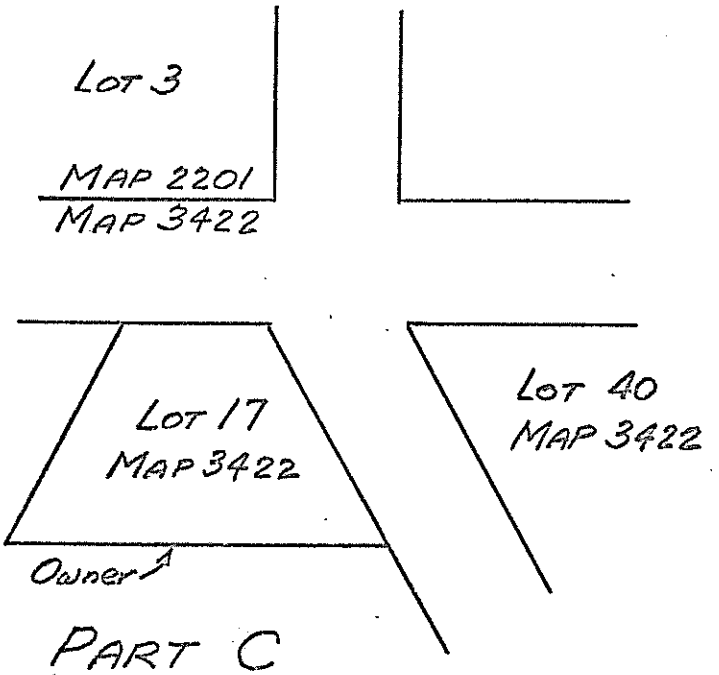


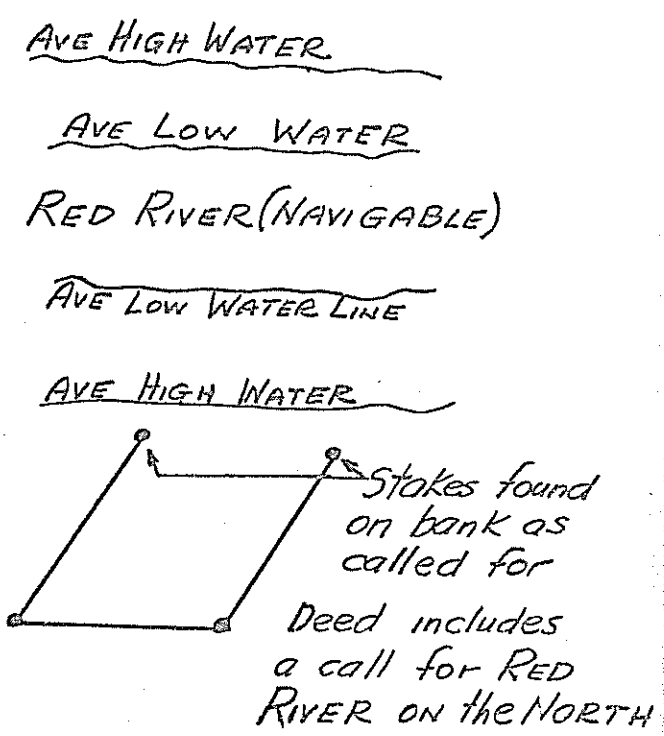
FIG. D3

Prob. D3 contd on next page

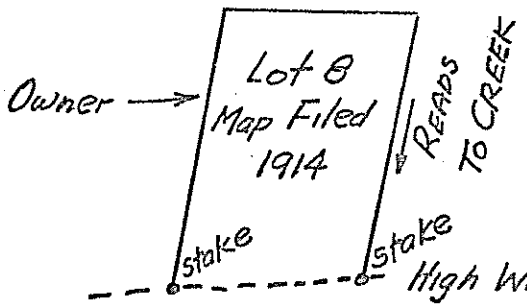
Problem D3 (contd)

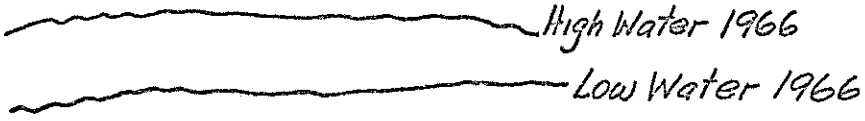


PART C



PART D





NON-NAVIGABLE STREAM

PART E

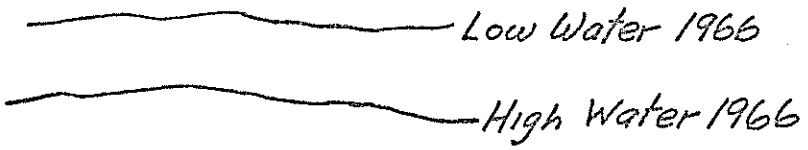


FIG D3 cont'd

NOTE: Choose Problem D4 or D5 for 25 points.

Problem D4 - Wt. 25

Write a discussion of the proration of excess or deficiency as used in land surveying. Your discussion should include a review of when proration should be used, and when it should not. The time allowed for this problem should permit you to provide an organized discussion in your own words, and you are expected to provide more than a bare outline, or a partial discussion on one phase of the subject.

Grading will be based on your organization, understanding, and comprehensiveness of your discussion. Your discussion should include primarily linear excess or deficiency as related to public lands, subdivisions, metes and bounds, etc. Do not attempt to include geodesy, photogrammetry, or spherical relationships. Identified quotations are acceptable on a limited basis.

Problem D5 - Wt. 25 (Answer all Sections)

SECTION A - Wt. 5

The following observations were made in the field:

$\bigwedge$ at Station BEAR ECC

To Station	Direction	Distance
Wolf	0°00'00"	38,180' (approx.)
Bear	139°51'28"	10.93'
Cat	277°38'45"	40,120' (approx.)

REQUIRED: What are the directions from Bear to Wolf?
What are the directions from Bear to Cat? (Answer to nearest second)

SECTION B - Wt. 5

Two premarked points, A and B, were photographed on a pair of overlapping aerial photographs at a scale of 1" = 1000'. The following observations were made in the field:

$\bigwedge$ at B (H.I. = 5.2')

To Station	Height of Target	Vertical Angle
A	12.3'	-5°43'27"

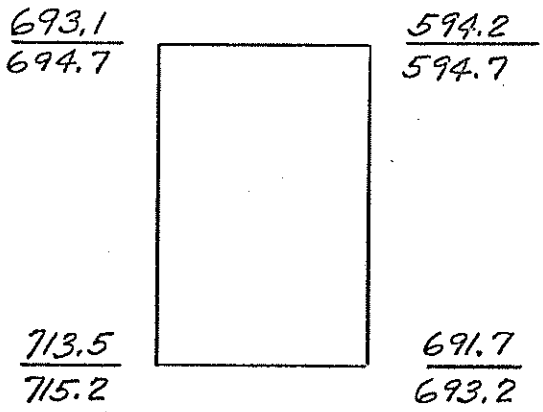
The distance between A and B, as measured in the stereomodel formed by a 5-diameter direct projection plotter, was 16.26".

REQUIRED: What is the difference in elevation of points A and B? (Answer to nearest 0.5 feet)

Prob. D5 contd on next page

Problem D5 (contd)

SECTION C - Wt. 2



Immediately after scaling a stereomodel, the corner elevations were read as shown in the diagram. Values are in feet, with field value above the line and photogrammetric value below the line.

REQUIRED: What are the numerical corrections necessary to arrive at the best possible level solution?

SECTION D - Wt. 2

A micrometer depth gage was used to determine the principal distance of a projector of a plotting instrument. The following constants are given:

Node to vertex of lens - - - - - - - - - - - - - - - -	0.497"
Thickness of lens tissue (to protect lens) - - - - -	0.001"
Thickness of glass plate (to support gage) - - - - -	0.248"

REQUIRED: Determine the gage reading for a principal distance of 153.00 mm on the P.D. adjustment ring, for emulsion down diapositives.

SECTION E - Wt. 3

Ten elevation readings were taken of a single point in a stereomodel, with the following results:

76.5, 76.3, 76.5, 76.4, 76.7, 76.6, 76.5, 76.4, 76.8, 76.6

REQUIRED: What is the most probable value of the point, and what is the standard deviation?

Prob. D5 contd on next page

Problem D5 (contd)

SECTION F - Wt. 3

Ten separate points were read in a stereomodel and were later checked in the field. The results were as follows:

Field	Phtgrm.
97.1	97.2
115.5	115.2
110.2	110.4
111.3	111.3
89.6	89.7
93.2	93.1
96.4	96.5
101.8	101.4
105.7	106.0
112.3	112.5

REQUIRED: What are the average error and the standard error of the photogrammetric values?

SECTION G - Wt. 5

Aerial photography was taken at an altitude of about 13,000 feet above sea level with a 6" focal length camera for use in a 5-diameter direct projection plotter. Average terrain elevation was 10,000 feet above sea level, and horizontal control was computed on the California Coordinate System. The average grid scale factor in the project area was 0.9999187.

REQUIRED: What is the theoretically correct model scale?

END OF PART D