LS-A

LAND SURVEYOR - 1969

August 1969

PART A

Time Allowed - Four Hours

Closed Book

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 are required.

Detach the last sheet from this booklet. This is your Answer Sheet for Part A of the examination. Show only the appropriate answer in the space provided on the Answer Sheet. For multiple choice problems, enter the appropriate identifying letter in the space provided. For completion-type problems, enter the word(s), or the numerical answer, as appropriate. Your score for Part A of this examination will be based only on the answers shown on your Answer Sheet. 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 materials are permitted in this part of the examination. Calculators or computers of any type are prohibited in this part of the examination. Slide rules are permitted. No work will be accepted after you have turned in your paper to the proctor, or after the close of this examination period.

You may keep the examination questions.

SHOW YOUR ANSWERS ON THE ANSWER SHEET

INSTRUCTIONS: Enter only the appropriate answer in the space provided on the Answer Sheet. Where a choice of answers is shown, enter only the letter which identifies the answer of your choice.

1. A map of a given area was drawn to a scale of 1:1,000,000. This scale would properly be classified as

   A a small scale

   B an intermediate scale

   C a natural scale

   D a large scale

   E a geodetic scale

2. The two-peg test can be applied to either a wye or a dumpy level to

   A make the horizontal cross hair lie in a plane perpendicular to the vertical axis

   B make the axis of the bubble tube parallel to the line of sight

   C make the line of sight parallel to the centers of the eyepiece and the objective

   D have the bubble centered at the zero position

   E make the axis of the bubble tube line in the same plane as the horizontal cross hair

3. Tracing paper and tracing linen have been replaced in map work by a cellulose acetate sheet, such as mylar. This newer material

   A requires the use of harder pencils

   B is not affected by immersion in water

   C has a decreased coefficient of light transmission in photo reproduction work

   D has a more uniform scale change due to variations in atmospheric humidity

   E requires that the film be given tooth by first cleaning it with an ammonia solution

4. A device often used in map work is called a pantograph. This instrument can be used

   A most effectively with orthographic projections

   B in conjunction with a Beaman Arc

   C to measure areas of lots by DMD

   D to redraw a portion of a map to an expanded scale

   E for measuring the area of the zero circle

5. A circular curve may be measured along a series of chords (railroad method) or along the arc (highway method). In the case of the highway method, the length of curve is equal to

   A 2π radians

   B $2\pi R\Delta/360°$

   C $\frac{R^2}{2}(Q - \sin\Delta)$ (where $Q = \Delta$ in radians)

   D $\frac{LR}{2}$

   E $2R\sin\frac{\Delta}{2}$

6. A self-reading rod, as is used for differential leveling, eliminates the need for

   A a rear rodman

   B balancing the backsights and foresights

   C a level

   D subtracting the rod readings

   E a vernier

7. For this place of longitude, the mapping angle as used in the California State Coordinate System bears a relationship to the central meridian that is

   A more than the difference in longitude

   B less than the difference in longitude

   C equal to the difference in longitude

   D a function of the sine of the degrees of latitude

   E not dependent on the difference in longitude

8. An optical surveying instrument which contains a reticule also contains therein the

   A spherical aberrator

   B reinverter of the image to normal

   C combination of the crown and flint glass

   D stadia hairs and the cross hairs

   E level bubble

9. The outer edge of a curve is frequently superelevated to attempt to compensate for the horizontal centrifugal force. This force is a function of

   A mass and polar moment of inertia

   B angular velocity and polar moment of inertia

   C mass and radius of curvature

   D angular velocity, mass, and radius

   E speed, moment of inertia, gravity, and momentum

10. When a plane table is oriented in the field by resolution of the three point problem the strongest location will usually be

   A just inside the great circle

   B just outside the great circle

   C on the great circle

   D at the point of intersection of two of the rays

   E on a range line between two of the triangulation stations

11. The terms "ground rod" and "grade rod" are used when

   A running profile levels

   B running differential levels

   C setting slope stakes

   D setting grade stakes

   E working in a cross section with a self-reading rod

12. A vertical curve, usually in the form of the arc of a parabola, has the characteristic where the

    A offsets from tangent to curve are equal

    B offsets from tangent to curve vary as the square of the distance

    C offsets are measured from the loci

    D length of the long chord is equal to twice the length of the forward tangent

    E midpoint on the curve is always the point of highest elevation

13. A straight line which touches a circular curve at one point is identified as a

    A cosine

    B secant

    C geodetic line

    D tangent

    E segment

14. A foresight taken during the process of differential leveling is

    A obtained from waving the rod

    B obtained by subtracting the eye-level-height of the instrumentman from the HI

    C a rod reading taken on a bench mark of known elevation

    D a rod reading taken on bench mark of unknown elevation

    E subtracted from the B.S. to get the elevation of a T.P.

15. A base line was measured to be 1000.00 feet in length. This line was measured with a 100-foot tape when the average temperature was 60°F. Later the tape was standardized at 68°F and was found to be 100.023 feet in length. The actual length of the line should be recorded as

    A 999.77

    B 999.82

    C 1000.00

    D 1000.18

    E 1000.23

16. The error that would be identified when a 100' steel tape was found to be longer than the standard would be

A random

B accidental

C variable

D constant

E natural

17. An old map of an original survey shows a distance between two identical points as 28 chains 27 links. In order to measure this distance you would actually measure on the ground

A 2800 feet 3 inches

B 1857.49 feet

C 568.70 meters

D 187.90 rods

E 1689.49 feet

18. The standard triangular-shaped engineer's scale is graduated with six different scales. Which one of the following does not appear on the standard?

A 20

B 30

C 40

D 60

E 80

19. The value which is determined by adding all the separate measurements of a base line and dividing by the number of cases is known as the

A median

B mode

C standard deviation

D arithmetic mean

E harmonic mean

20. It is often necessary to interpolate on a topographic map. This usually involves

    A drawing in freehand smooth contour lines

    B connecting points of equal elevation with a smooth line

    C spacing contour lines by proportionate measurement

    D enlarging or reducing the map scale

    E drawing in contour lines through points of known elevation

21. The Lambert conformal conic projection with two standard parallels for each zone is the basis for the

    A geodetic true North meridian

    B California Coordinate System

    C double meridian distance method

    D plane coordinate area method

    E transverse Mercator method

22. The coefficient of thermal expansion that is used for a steel tape is taken as

    A .00065 per 1°F

    B .00065 per 1°C

    C 68°F

    D .00195 per 1°F

    E 6.5×10^{-6} per 1°F

23. The California Coordinate System is based on a projection method which involves a series of cones. The basic form of the earth that is used in the development of the grid is the

    A true geoid

    B oblate spheroid of revolution

    C plane established by mean sea level

    D Clark's spheroid of 1866

    E triaxial ellipsoid

24. The earth taken from a borrow pit can be placed in an embankment such as a highway fill. Such material will usually occupy a volume somewhat different than the original volume in place. This difference is

A shrinkage

B swell

C waste

D settlement

E subsidence

25. In the computation of volumes of earthwork which of the following conditions will point up the greatest accuracy advantage for the prismoidal formula vs. the average end area formula

A end areas are nearly equal

B end areas are exactly the same although of different configuration

C shape of one end area is long relative to its width, and the other end is wide relative to its length

D end area of one end is a horizontal line thus forming a wedge shaped volume

E end area of one end is zero thus forming a pyramidal volume

26. If a surveying instrument is constructed with a convex lens for the eyepiece and a convex lens for the objective, then

A the field will decrease as the instrument is moved away from a fixed object

B the field will increase as the instrument is moved closer to a fixed object

C the magnifying power of the instrument can be determined by the formula

$$MP = \frac{\text{diameter of eyepiece lens}}{\text{diameter of objective lens}}$$

D the magnifying power of the instrument can be determined by the formula

$$MP = \frac{\text{focal length of objective}}{\text{focal length of eyepiece}}$$

E the image of the observed object will appear erect to the viewer's eye

27. The three sides of the astronomical triangle are identified as

A polar distance, zenith distance, and altitude

B polar distance, zenith distance, and colatitude

C polar distance, declination, and coaltitude

D zenith distance, latitude, and longitude

E coaltitude, zenith distance, and hour angle

28. Observations on Polaris for determination of true North are more effective if they are made at elongation rather than at culmination because

A Polaris is apparently moving faster

B Polaris is apparently moving slower

C Parallax is minimized

D Polaris appears to be moving horizontally at the time

E Polaris appears to be moving vertically at the time

29. If horizontal control is established by a trilateration chain which covers a strip approximately 28 miles wide the strongest net would consist of

A a combination of triangles and quadrilaterals

B isoceles triangles

C central point figures

D quadrilaterals

E triangles

30. The scale of a given map was not shown in the legend. It was determined, however, that a quarter of a quarter section was represented as equivalent to exactly one square inch of area on the map. What is the scale of the map when expressed as a representative fraction?

31. A triangulation net which contains small angles

A is usually prone to errors

B is undesirable because the strength of figure may be unacceptable

C is favorable because parallax is minimized

D will usually increase the cost in the field

E will require additional turnings in order to increase accuracy

32. A device which permits an instrument man to set up accurately over a point whereby he can sight horizontally and view the point below is called

A a gradienter

B a lower motion

C a retrograde vernier

D a Beaman Arc

E optical collimator

33. One of the properties of the vertical curve is that the

A highest (or lowest) point is always at the center

B offsets from the tangent vary as the square of the distance

C offsets from the long chord are directly proportionate to the distance

D offsets from the tangent are directly proportionate to the distance

E central angle is 90° to simplify calculations

34. When a straight line is prolonged by using a transit and the double centering procedure, one type of error can be minimized or nullified - this is the error due to

A transit plates not truly in a horizontal plane

B the line of sight not perpendicular to the horizontal axis

C the line of sight not parallel to the axis of the bubble tube

D the vertical cross hairs not being truly vertical

E the lower motion being eccentric with the vertical axis

35. The horizontal direction reckoned clockwise from the meridian plane is called

A strike

B deflection

C variation

D azimuth

E deviation

36. A graphical representation of the scale of a map is usually shown in the map legend because

A maps are subject to changes in scale due to atmospheric conditions

B they enable the map reader to determine distances easier than with an equivalent scale

C it will improve the appearance of the map and will balance up the sheet

D it will provide an easily understood method to determine distances

E it will help to distinguish between large and small scale maps

37. A property parcel which borders on a small non-navigable stream will usually be bounded by

A mean low water

B the thread of the stream

C the mean high water line

D the deepest part of the channel

E the flood line

38. In the differential levelling process the elevation of an intermediate turning point may be found by

A adding the BS to the elevation of the previous BM

B subtracting the FS from the elevation of the previous BM

C subtracting the BS from the HI

D adding the FS to the HI

E subtracting the FS from the HI

39. The decrease in atmospheric air pressure for every 1000 feet of elevation increase is approximately

A 1/0 pound per square inch

B 1/2 pound per square inch

C 1/3 pound per square inch

D 2/3 pound per square inch

E 3/20 pound per square inch

40. The lines on a map which indicate the declination of the magnetic compass are known as

A magnetic north lines

B oersted lines

C magna conic lines

D isogonic lines

E gauss lines

41. Base lines for triangulation nets may be measured with a steel tape, or an Invar tape. In the event an Invar tape is selected the principal reason would be to

A minimize the reading of slope angles

B minimize the error due to reading the graduations

C take advantage of the self reading properties of Invar

D reduce the induced error due to temperature changes

E take advantage of its greater tensile strength

42. A point on the surface of the earth may be located by latitude and longitude. By relationship, a star may be correspondingly located on the celestial sphere by

A polar distance and hour angle

B declination and right ascension

C altitude and zenith distance

D solving the PZS triangle

E locating the vernal equinox in the ephemeris

43. The legend on a map showed the map scale to be $\frac{1}{60000}$. If a line on the map is scaled as $5\frac{1}{2}$" what is the corresponding distance on the ground? Give answer in feet.

44. The Star Polaris is observed to apparently rotate in a clockwise direction around the North Pole. In its highest observable position Polaris is said to be at _____, and when in its most Westerly position is said to be at _____.

45. What is the number of the section that may have fractional lots along both the North and West sides in a regular township.

46. The California Coordinate System is separated into _____ grid zones.

47. The meridian at 0° longitude passes through _____. The meridian at 180° longitude generally identifies the _____.

48. The interval of time of one apparent revolution of the vernal equinox about the earth is known as the _____.

49. Two simultaneous equations appear as follows:

$$5x + 6y = 35.61 \text{ and } 5y + 6x = 40.51$$

What is the correct value of x ?

50. The terms direct and retrograde will identify what kind of a device? _____

51. Some measuring tapes are made up of a combination of nickel and steel in order to permit a very low coefficient of thermal expansion, and thus minimize errors due to temperature changes. As used in land surveying what is the name applied to this kind of tapes? _____

52. The California Coordinate System is based on

A the transverse Mercator projection

B latitude and longitude with corresponding origins through the equator and through Greenwich.

C the "X" and "Y" coordinate system of the U.S. Coast and Geodetic Survey.

D a stereographic projection using projecting lines that are parallel, and perpendicular to, a central tangent point.

E a Lambert conformal projection of the Clarke spheroid of 1866.

53. A deed would be more aptly identified as

A a proof of ownership

B an instrument of conveyance

C a policy of title insurance

D a mortgage encumbrance

E a metes and bounds description of a land parcel

54. An old plat in the surveyor's office showed the length of a line as 46 chains 27 links. What is the corresponding length of this line in feet?

55. An Ephemeris would be necessary when

A setting slopes in the field

B using a Rhode's Arc

C using a Beaman Arc

D making solar calculations

E reducing survey data to the California Coordinate System

56. If a line measurement is recorded as 36,727.47 meters, how many feet are contained in this line. Give answer to nearest hundredth of a foot.

57. A survey instrument has a stadia interval factor of 98. The value of $c = f + c$ is given by the manufacturer as 1.0 feet. If a rod intercept is read in the field as 6.75 feet on a horizontal sight what is the distance from the instrument to the rod?

58. The terms repeating and directional are applied to what class of precision instrument?

59. When a riparian owner acquires land by the action of a river which deposits material not previously existing, he will usually acquire title to such attached land. The term used in land surveying which identifies this kind of land growth is _____.

60. The cotangent of an angle was given as $\frac{12}{5}$. What are the numerical values for the sine, cosine, secant, and cosecant for the same angle?

61. A three acre tract of land must be laid out so that it is exactly square. What is the length of one side which would be laid out on the ground? Give answer to the nearest 0.1 foot.

62. A tangent may be prolonged very precisely from a backsight by making use of the process called _____.

63. Volumes of earthwork may be calculated by using the average end area formula, or by the prismoidal formula. These two formulas will

A Give only approximate values for most volumes.

B Always be exactly equal for volumes which are wedge shaped.

C Always give the same answer within a margin of error that is acceptable.

D Usually differ with the prismoidal formula giving the more exact volume.

E Only apply to three or five level sections.

64. Some of the original public land surveys in the Western part of the United States were run with a device called the Solar Compass. This particular instrument

A usually gives inaccurate and undependable results.

B corrects itself automatically for local attraction.

C is strongly affected by local attractions or local mineral deposits.

D depends for direction upon the magnetic needle.

E is actually operated astronomically.

65. The process called interpolation when used in connection with a topographic map consists of

A connecting points of equal elevation.

B tracing the contour lines on the map.

C drawing in freehand the smoothed out contour lines.

D spacing intermediate contour lines by proportionate measurement.

E drawing in the meridian lines parallel to, and equidistant from, the central meridian.

66. The position of a star on the celestial sphere is usually identified by measurements from the vernal equinox, and from the celestial equator. These two identities are identified respectively as _____ and _____.

67. A camera with a 6" focal length was used to take some aerial photographs. If the flight altitude above average ground surface was 9000 feet and the negative was 9" x 9", how many acres of ground were included in a single photograph? Give answer to the nearest acre.

68. A reference point on the celestial sphere where the sun crosses the equator in the Spring is called the _____.

69. A side hill which forms a sloping plane surface would be represented in a map by contour lines which are

A straight converging lines

B straight parallel lines

C uniformly spaced concentrically curved lines

D straight lines spaced at varying distances

E coincident because of the superposition of one over the other

70. At a given location on the ground, the angle between the magnetic needle and the geographic meridian through that place, is called the

A deflection angle

B angle of incidence

C angle of deviation

D strike

E declination

71. The term "eminent domain" is applied in the field of the land surveyor to

A the denial of trespass rights

B the right of the State to seize private property for public use

C identify large land holdings such as those of a large corporation or land company

D the exclusive right of the riparian owner

E the right of a "squatter" to gain title after a 20 year term of occupation of another's land

72. A surveyor who establishes a meander line will usually do so to

A identify the thread of a stream

B outline the edge of tillable soil

C establish the center dividing line of a land parcel

D reference the irregular bank of a river or lake

E establish riparian ownership

73. The area of a land parcel, when described by metes and bounds in a deed, can be calculated by

A triangulation

B double meridian distance

C pantograph

D metes and bounds

E trilateration

74. The base height of a 6" focal length photograph on a 9" x 9" format with a 60% overlap is

A 0.40

B 0.60

C 0.90

D 3.60

E 5.40

75. A land parcel which is held in fee simple

A has been acquired through an inheritance, but the title is held in trust by the estate of the endower

B is encumbered by a mortgage

C is attached by a mechanic's lien

D has been passed through escrow, but has not yet been deeded and recorded

E is not encumbered by anything other than taxes

END OF PART A

LS

LAND SURVEYOR - 1969

B

PART B - Wt. 50

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

The general instructions are shown on the cover page of the workbook which you have already received. Please read them.

All of the work which will be scored must be included in your workbook. No work will be accepted or considered that is not in the hands of the proctor at the close of the examination period.

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.

NOTE: All Problems are Optional.

Problem B1 - Wt. 2

What is the arc length of a circular curve if the radius is 200 feet and the central angle is 33°?

Problem B2 - Wt. 2

Distinguish between an obliterated corner and a lost corner.

Problem B3 - Wt. 2

A compass bearing was read in the field as S 67°39'E. The magnetic declination was determined to be 18°30'E. What is the true bearing of the observed line?

Problem B4 - Wt. 2

Describe the advantages, and the disadvantages of each of the following:

a Policy of title insurance.

b Abstract of title.

Problem B5 - Wt. 3

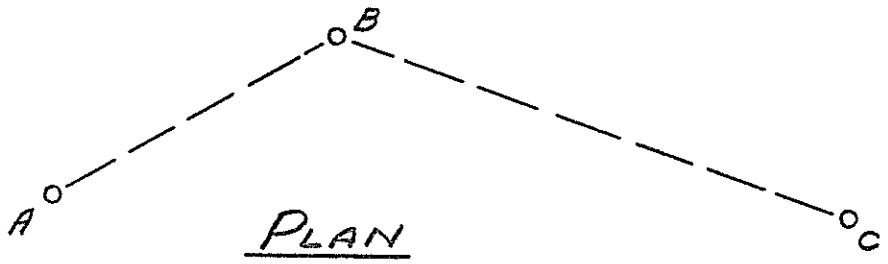
What is the area that is defined by the lines $y = o$, $y = 2x$, and $y = -\frac{2}{3} x + 8$?

Problem B6 - Wt. 2

What is the error that will result if a 100' tape is used to locate two points, and one end of the tape is 2' off the intended true line?

Problem B7 - Wt. 2

A property line must be laid out along a circular arc on the ground so that it will pass through three points which do not lie on a straight line. Show by a graphical method how this can be accomplished. The three points are in a relative location as indicated by A B and C.



Problem B8 - Wt. 3

A boundary line was surveyed in 1874. The recorded magnetic bearing was S54°17'W. The declination at that time was 1°27'W. The line was resurveyed last year, the true bearing was recorded as S52°48'W, and the declination was 1°32'E.

a What was the apparent true bearing of the line in 1874?

b What is the present magnetic bearing?

c What is the total change in declination?

Problem B9 - Wt. 2

A parcel of land was sold, and the title was transferred from one owner to another. The parcel was described by area, and also by metes and bounds. In the event the two descriptions are found to disagree which would take precedence? Explain.

Problem B10 - Wt. 4

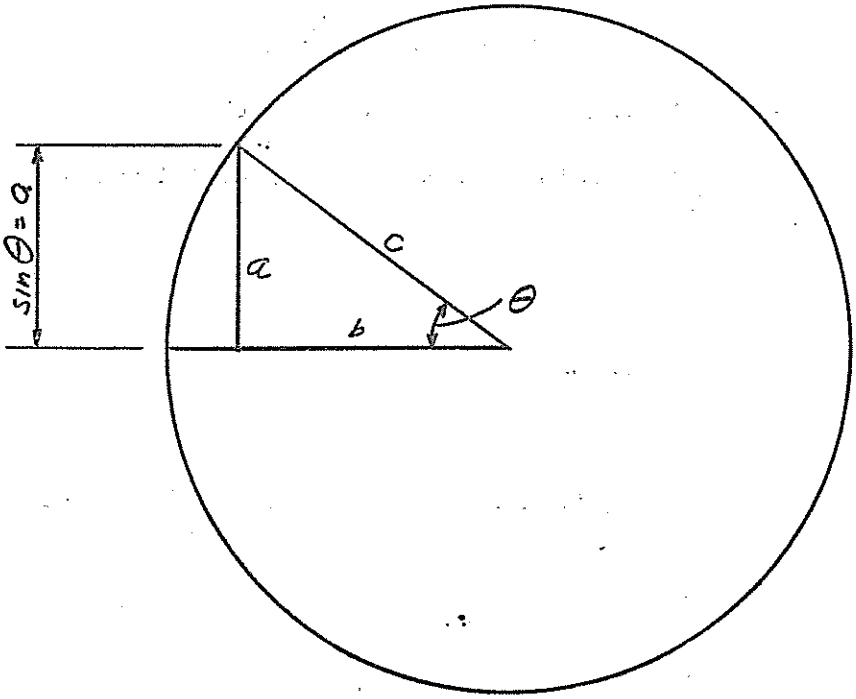
Traverses may be balanced by either the Compass Rule or the Transit Rule. What are the principles that are involved in each of the two methods. Why is balancing necessary? Which method is preferred, and why?

Problem B11 - Wt. 4

Functions of angles are important to the land surveyor. The diagram below is a circle of unit radius (R = 1). The sine of the angle θ is equal to $\frac{a}{c} = \frac{a}{R} = \frac{a}{1} = a$. This value is indicated by dimension as shown.

Identify each of the following by an equivalent linear value:

cosine	secant	versine
tangent	exsecant	



Problem B12 - Wt. 3

Errors are of continuing concern to a land surveyor. Each of the following terms identifies a type of error. Define each of the terms, and give a typical example that one might experience in his practice.

a random	d systematic
b accidental	e natural
c personal	

Problem B13 - Wt. 2

A certain airfield has an initial point with coordinates of 0.00 North, and 0.00 East. Grid lines have been extended from this point in the four cardinal directions.

The Base Engineering Officer desires to run a water line from a pump whose coordinates are 400.00 North, 200.00 East, to a tank whose coordinates are 400.00 South, 600.00 West.

How many feet of pipe must he order?

Problem B14 - Wt. 4

In measuring distance between Points A and B with a tellurometer

a What measurement is made and indicated on the master unit?

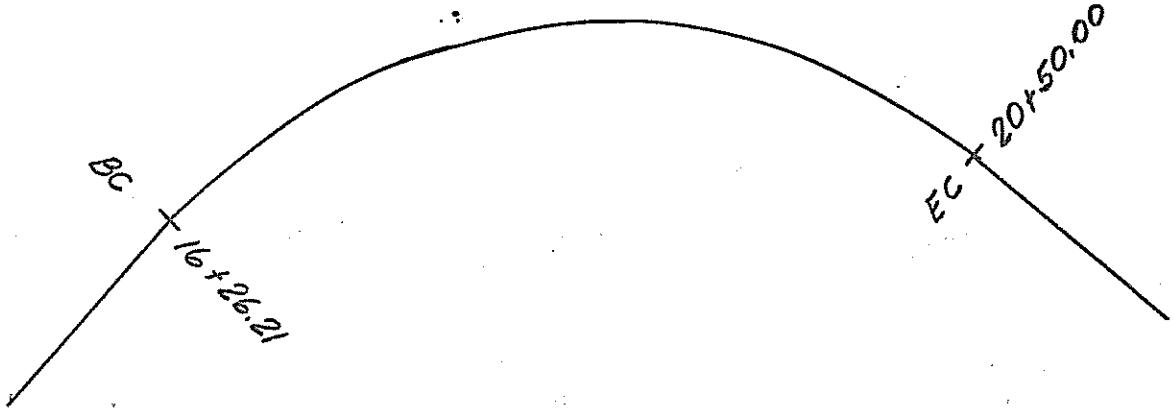
b What other data is necessary to obtain a geodetic distance between A and B, and how is this data secured?

Problem B15 - Wt. 3

The sketch below shows a 01° curve (arc definition).

You are set up at the B.C.

What are the deflection angles you must turn to set Stations 17+00, 18+00, 19+00 and 20+50?



Problem B16 - Wt. 6

The cross section notes taken at two different stations is given below. Calculate the volume of earthwork between the two cut sections by (a) average end areas, and (b) the prismoidal formula or prismoidal correction method if the roadway width is 30 feet and side slopes are 1 to 1.

Station 56 + 50	6.2 / 21.2	4.5 / 15.0	3.6 / 0	4.8 / 15.0	4.1 / 19.1
Station 57 + 50	7.1 / 22.1	6.7 / 15.0	5.8 / 0	6.2 / 15.0	6.0 / 21.0

Problem B17 - Wt. 4

What is the difference between "intersection", "radiation", and "resection" as applied in plane table survey work. Illustrate each with an appropriate diagram.

Problem B18 - Wt. 4

On June 6, 1963, Jones deeds to Black ... "Lot 16, Louisiana Tract" ...

On June 7, 1963, in an instrument naming Black as grantee, Jones ... "quitclaims all right, title and interest in and to a strip of land 20 feet in width adjoining said Lot 16 on the West ...".

A copy of the deed conveying the 20 foot strip to Jones is delivered to Black on June 10, 1963. Upon reading this deed, Black notes that it is dated June 8, 1963.

What are Black's rights in the 20 foot strip?

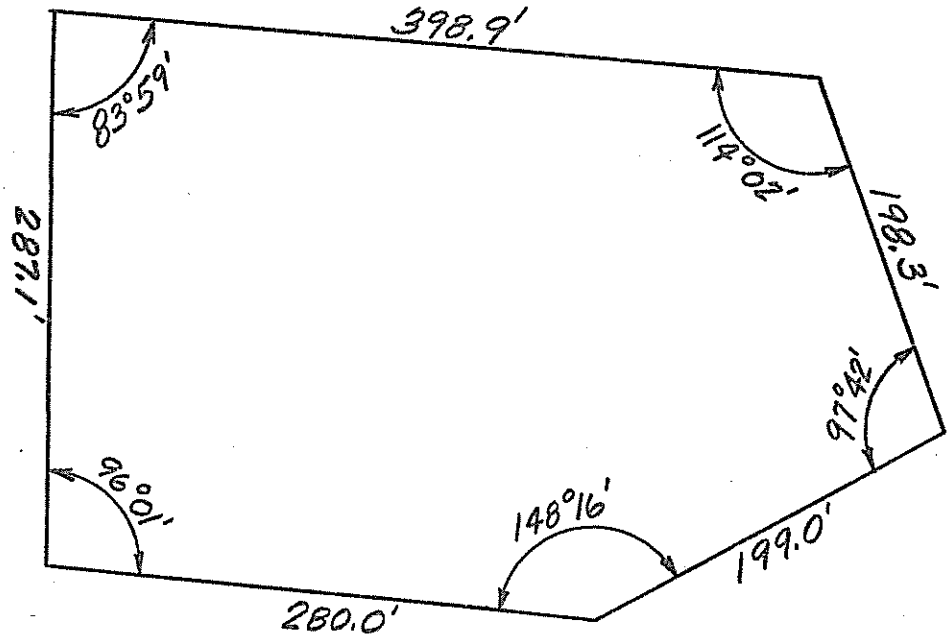
Problem B19 - Wt. 3

Describe the method used to establish the center of a standard section of land.

Problem B20 - Wt. 2

A closed traverse is shown in the figure below. The magnetic declination is 4° 39' E.

Compute the true bearings of all sides.



Problem B21 - Wt. 6

The following questions are with reference to the telescope of a surveying instrument:

a What is a reticule?

b Why do some eyepiece assemblies have four lenses rather than two?

c What is the purpose in using an achromatic doublet?

d Where are these achromatic lenses used?

e How is an achromatic lens constructed?

f Are the stationary lenses in the eyepiece concave or convex?

Problem B22 - Wt. 4

The sensitivity of the level vial on an engineer's level is 20 seconds per 0.01 foot division.

a What is the radius of curvature of the vial in feet?

b If the bubble in this level vial is 2 divisions off center when a rod reading is taken on a rod 300 feet from the level, what error in reading will result?

c Would a 30 second bubble be more or less sensitive than this 20 second bubble?

Problem B23 - Wt. 3

A vertical aerial photograph is taken with a 6.00 inch focal length camera from a height of 5650 feet above sea level. Two points of equal elevation of 850 feet above sea level appear on the photograph at a distance of 2.02 inches apart.

a What is the scale of the photograph at these points?

b What is the ground distance in feet between these two points?

Problem B24 - Wt. 4

Draw a sketch to represent the ecliptic. Identify the following:

vernal equinox

autumnal equinox

summer solstice

winter solstice

maximum positive declination

approximate dates for the first four

Problem B25 - Wt. 2

The grade elevation of station 65 + 42.00 is 3792.65. If the grade is a minus 3.25 percent, what is the grade elevation at station 74 + 26.50.

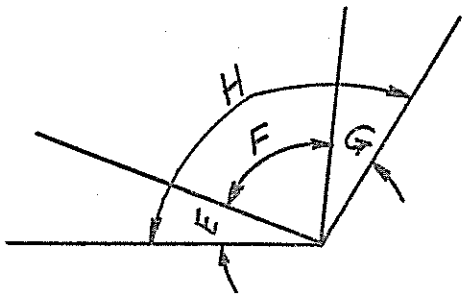
Problem B26 - Wt. 4

A setup was made over a point in the field, and three angles were turned with an apparently equal degree of precision. The three measured angles are indicated in the figure as E, F, and G.

The angles were recorded as follows:

∠E 22° 10' 10"
∠F 71° 05' 50"
∠G 24° 16' 00"

The total angle - H - was measured as 117° 33' 40". What correction should be applied to each angle and what are the adjusted values for each?



Problem B27 - Wt. 3

The image of a ground point on a vertical aerial photograph may be displaced due to ground relief. How does this displacement vary with

a The distance of the point from the principal point of the photograph?
b Change in elevation of the point?
c Change in flying height?

Problem B28 - Wt. 3

The following page of profile level notes was extracted from a field book. Reproduce the outline of the various columns in your workbook. Complete the missing data, and show your method of checking the computations.

Sta	B S	H I	I F S	F S	Elev
BM 78	1.56				764.81
16+00			0.7		
17+00			2.9		
18+00			3.5		
19+00			6.7		
20+00			11.9		
TP #8	0.41			11.63	
20+50			3.2		
21+00			8.6		
21+40			9.0		
21+50			12.2		
21+75			9.3		
22+00			8.4		
BM 79	8.02			2.73	
23+00			9.7		

END OF PART B

LS

LAND SURVEYOR - 1969

C

PART C - Weight 50

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

The general instructions are shown on the cover page of your workbook. Please read them.

When you have completed your work for Part C arrange the problems in your workbook in proper sequence, and check your workbook to see that it is complete. No work will be accepted or scored that is not turned in to the proctor at the close of the examination period.

You are to work the problems that are given in the examination booklet. You may make appropriate assumptions where they are asked for, or if a problem is incomplete, or is obviously in error. If an assumption is necessary, you should provide sufficient explanation so that the examiner can judge the reasons therefor. Assumptions must generally follow the logic and the requirements of the problem.

At the end of each problem, list any reference book, diagram, or tables which you have used. Give book title, edition, and page number.

Mechanically-operated calculators may be used in this part of the examination. Calculators permitted include only those that are operated by a hand crank. Electrically-powered calculators and computers are excluded. Proctors are instructed to prohibit the use of all electrically-powered machines.

You may keep this set of examination questions.

You are required to work Problems C1, C2, and C3, plus any two chosen from the remaining problems, for a total of 50 points.

NOTE: Problems C1 - C2 - C3 are Required.

Problem C1 - Wt. 10

Three sketches representing parcels of land are shown below. The original condition dates back to 1902 when six lots were laid out as shown in the first sketch.

In the year 1918 the river changed its position from natural causes, and the same tract looked like sketch number 2.

Several years later in 1947 the river again changed course and the various owners, who are identified by the letters A, B, C, etc., claim riparian ownership as shown in sketch number 3.

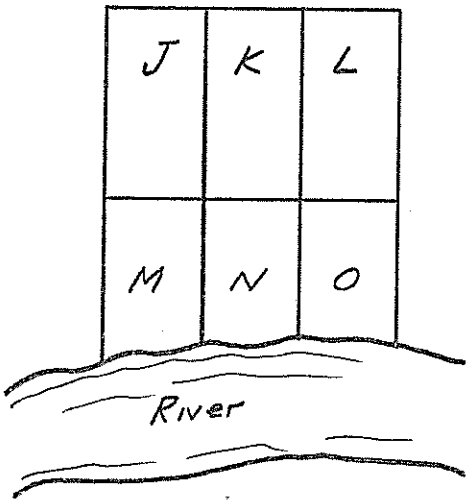
REQUIRED:

a What is name applied to the process which destroyed the property of M and N in 1918?

b What is the name of the process which restored property in 1947.

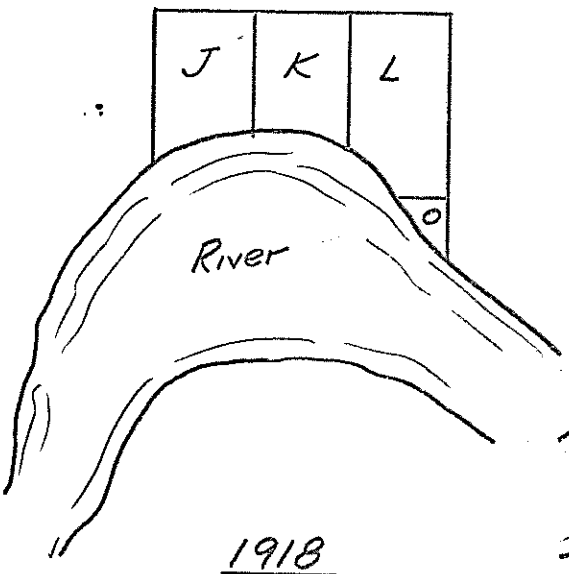
c In 1947 what has happened to the property rights of M and N? Do they have a claim? Discuss their situation now (1947).

d Can JKL and O claim property as shown in the third sketch? Discuss their rights as they now apply (1947).



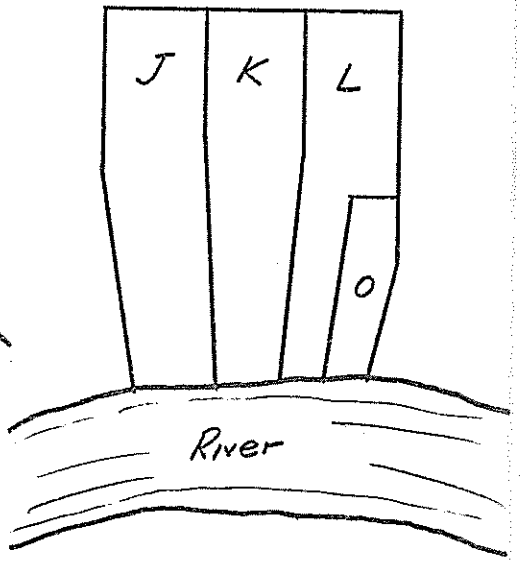
1902

Fig. 1



1918

Fig. 2



1947

Fig. 3

Problem C2 - Wt. 10

A property owner named Jones conveyed to another party named Hill the "easterly two acres" of a land parcel which had been originally conveyed in a deed as 20 acres.

At a later date Jones conveyed the "westerly 18 acres" of this parcel to another party named King.

Last month a land surveyor was engaged to survey the various land parcels, and he made the finding that the original 20 acre tract actually contained 25 acres.

REQUIRED:

a How would you describe the owners and the acreage of their respective parcels now that a survey has been made?

b If Jones had initially deeded the "easterly quarter" of the supposed 20 acre tract to Hill, and subsequently the "westerly 15 acres" to King, what then is the situation with respect to the owners and their land parcels?

Problem C3 - Wt. 10

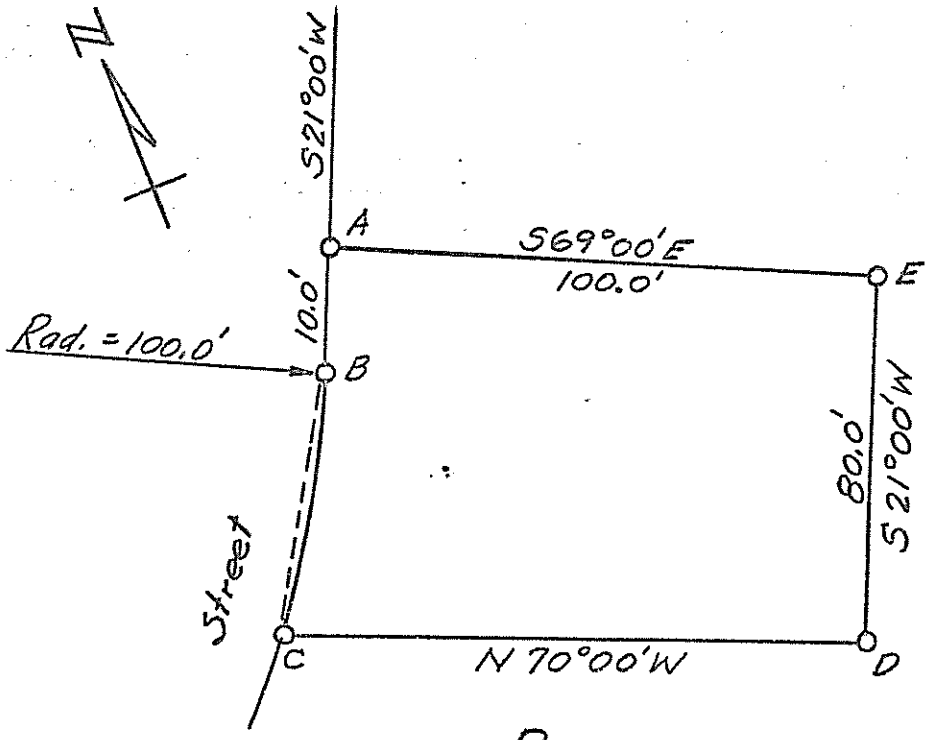
One of the lots in a subdivision adjoins a curve in the street. The West boundary is thus comprised of a short length of tangent and a circular curve as shown in the plan below. The known courses and distances are also shown.

REQUIRED:

a What is the length of the South boundary line of the lot?

b What is the length of the chord BC?

c What is the bearing of the chord BC?



PLAN
Not to scale

FIG. C3

Problem C4 - Wt. 10

This problem contains 5 parts. Work all parts.

a A survey party which was working in an area with steep side hills measured a course with a tape and assumed it to be level. Later it was found that the measurement was in error and that the course was actually on a 6% slope. How much error would be introduced into 1000 feet of distance by this assumption?

b A survey line A-B is measured to have a magnetic bearing of S18°E. If the magnetic declination at this particular location is 18°E, what is the time bearing of line A-B?

c If a 300 foot steel tape is affected by a 95° change in temperature what is the change in length that results? Assume the temperature rises from a low to a high.

d A steel tape 200 feet long is supported only at the ends. What difference in length will occur when a 20# pull is applied vs a 30# pull? The cross sectional area of the tape is 0.005 sq. in.

e A 100 ft. steel tape was kinked and broken in the field between the 19 and the 20 foot marks. A field splice was made which was found later to have shortened the tape to 99.97 feet. A line in the field was measured with the spliced tape to be 1827.29 feet long. What is the correct length of the line?

Problem C5 - Wt. 10 (work both parts)

Part A - Wt. 8

A triangulation network is shown in the figure below. The base line AB was measured as 500.00 feet. The various angles are noted as recorded in the field notes. All angles noted are in even degrees (00'00").

REQUIRED:

Compute the length of the side CD.

PART B - Wt. 2

In the net shown below a diagonal line AE was run, and all angles of all the triangles were measured. It was found that all triangles added to 180°. If the length of CE were calculated (1) by going through diagonal AE, and (2) by going through diagonal BC, would the length of CE by the same regardless of the calculation route? Explain briefly.

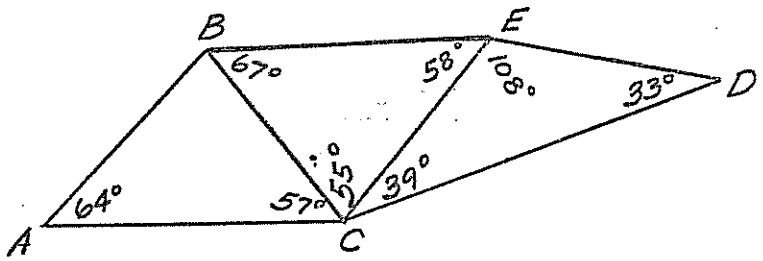


FIG. C5

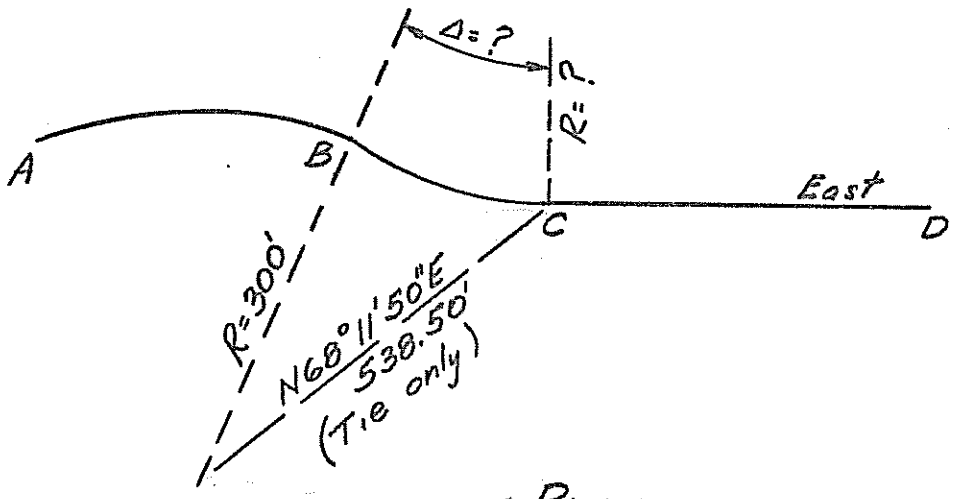
Problem C6 - Wt. 10

A 300' radius curve AB is to be connected with a tangent CD at Point B with a circular curve of radius = R.

REQUIRED:

a What is the radius of the connecting curve?

b What is the central angle of the connecting curve?



PLAN
Not to scale

Problem C7 - Wt. 10

A legal description of a land parcel reads in part as follows:

"thence South 89° 30' West 400 feet to the Pacific Ocean;
thence along said ocean ..."

An investigation in the field reveals that there is no physical evidence of any man made groins or jetties in the area which might create artificial accretion.

REQUIRED:

a What constitutes the boundary line between the upland owner and the offshore submerged lands in this area?

b Discuss in detail how the surveyor would establish this boundary line on the ground.

c Once this line has been established, does it become a fixed line? Explain.

L S

LAND SURVEYOR - 1969

D

PART D - Weight 50

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

The general instructions are shown on the cover page of your workbook. Please read them.

When you have completed your work for Part D arrange the problems in your workbook in proper sequence, and check your workbook to see that it is complete. No work will be accepted or scored that is not turned in to the proctor at the close of the examination period.

You are to work the problems that are given in the examination booklet. You may make appropriate assumptions where they are asked for, or if a problem is incomplete, or is obviously in error. If an assumption is necessary, you should provide sufficient explanation so that the examiner can judge the reasons therefor. Assumptions must generally follow the logic and the requirements of the problem.

At the end of each problem, list any reference book, diagram, or tables which you have used. Give book title, edition, and page number.

Mechanically-operated calculators may be used in this part of the examination. Calculators permitted include only those that are operated by a hand crank. Electrically-powered calculators and computers are prohibited. Proctors are instructed to prohibit the use of electrically-powered machines.

You may keep this set of examination questions.

Problem D1 is required. Choose one problem from D2 or D3. Choose one problem from D4 or D5.

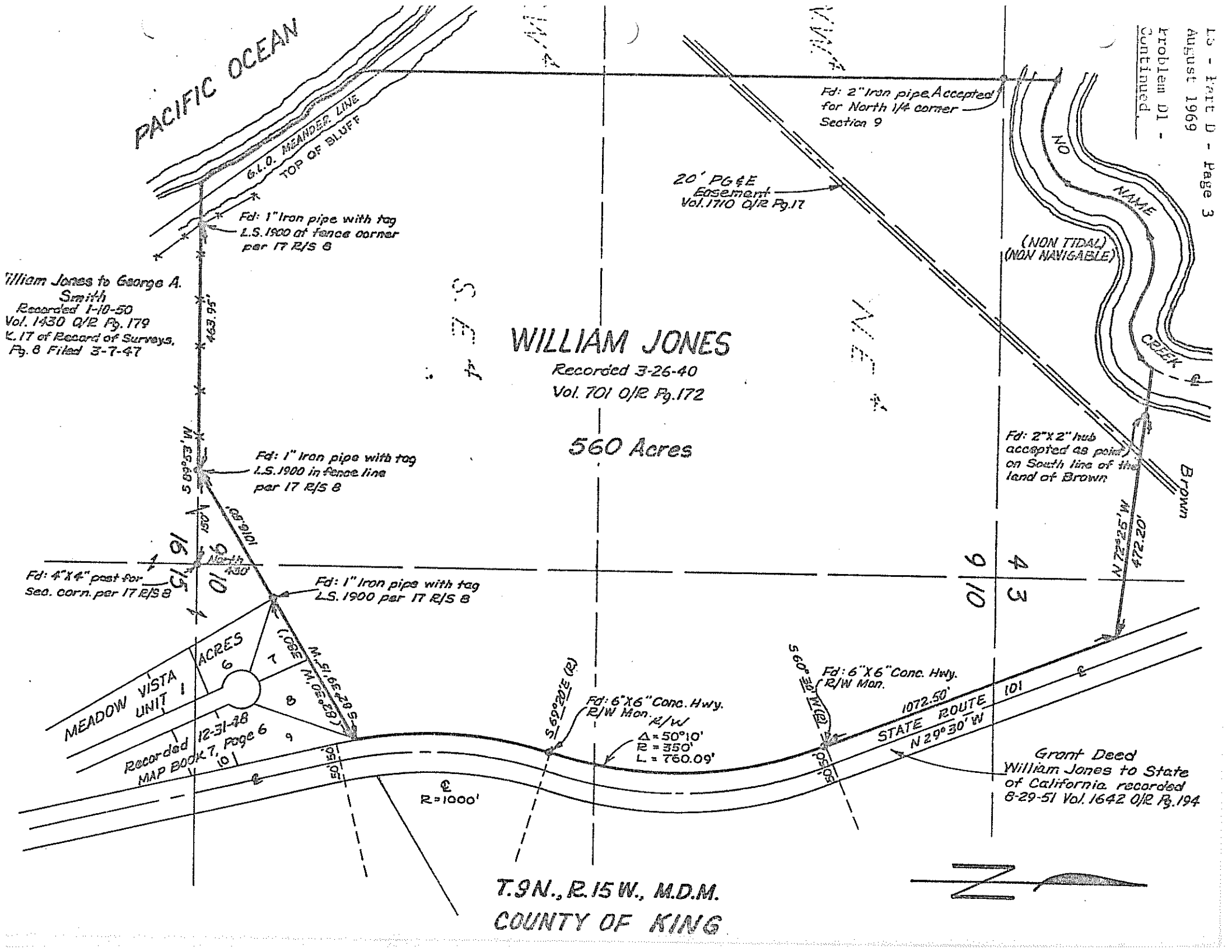
INSTRUCTIONS TO EXAMINEE:

Turn immediately to Page 2 and begin the examination.

Problem D1 - Wt. 15

Write a metes and bounds description of the area outlined on the attached sheet using only the information given on the plat.

Make no assumptions.


PACIFIC OCEAN
G.L.O. MEANDER LINE
TOP OF BLUFF
Fd: 1" Iron pipe with tag L.S. 1900 at fence corner per 17 R/S 8
William Jones to George A. Smith Recorded 1-10-50 Vol. 1430 O/R Pg. 179 & 17 of Record of Surveys, Pg. 8 Filed 3-7-47
463.95'
S 69°53' W
Fd: 1" Iron pipe with tag L.S. 1900 in fence line per 17 R/S 8
150'
North
101.63'
Fd: 4"X4" post for Sec. corn. per 17 R/S 8
Fd: 1" Iron pipe with tag L.S. 1900 per 17 R/S 8
WILLIAM JONES
Recorded 3-26-40
Vol. 701 O/R Pg. 172
560 Acres
Fd: 2" Iron pipe Accepted for North 1/4 corner Section 9
20' PG&E Easement Vol. 1710 O/R Pg. 17
NO NAME
(NON TIDAL)
(NON NAVIGABLE)
CREEK
Fd: 2"X 2" hub accepted as point on South line of the land of Brown
Brown
N 72°25' W
472.20'
MEADOW VISTA UNIT 1
Recorded 12-31-48
MAP BOOK 7, Page 6
ACRES
6
7
8
9
10
1050' (Rec.)
N. 15°39' E.
S 62°28' E.
50'
S 69°22'E (R)
Fd: 6"X6" Conc. Hwy. R/W Mon. R/W
Δ = 50°10'
R = 350'
L = 760.09'
S 60°30' E (R)
Fd: 6"X6" Conc. Hwy. R/W Mon.
1072.50'
STATE ROUTE 101
N 29°30' W
Grant Deed William Jones to State of California recorded 8-29-51 Vol. 1642 O/R Pg. 194
℄
R=1000'
T.9N., R.15W., M.D.M.
COUNTY OF KING

NOTE: Answer either Problem D2 or Problem D3 for 10 points.

Problem D2 - Wt. 10

Show a set up of typical notes similar to those that were run prior to 1885 by the original U.S. Public Domain land surveyors for the line between Sections 30 & 31, and for the North lines of Sections 30 & 31.

NOTE: Answer either D3 or D2 for 10 points.

Problem D3 - Wt. 10

The physical properties of the media in which measurements are made (gravity, atmospheric pressure, humidity, temperature, velocity of light, etc.) may affect distance or direction measurements.

What variations in these natural physical factors (other than instrument errors) may cause errors in measurement?

Explain what the variations are: How they cause errors; and the approximate magnitude for each variation.

NOTE: Choose Problem D4 or D5 for 25 points.

Problem D4 - Wt. 25

The plat shown below represents a parcel of land adjoining the Pacific Ocean. You are to locate the North half of Section 10. Explain in detail how you would do it. Include in your discussion how you would provide for tidal considerations. A full answer to this question is expected.

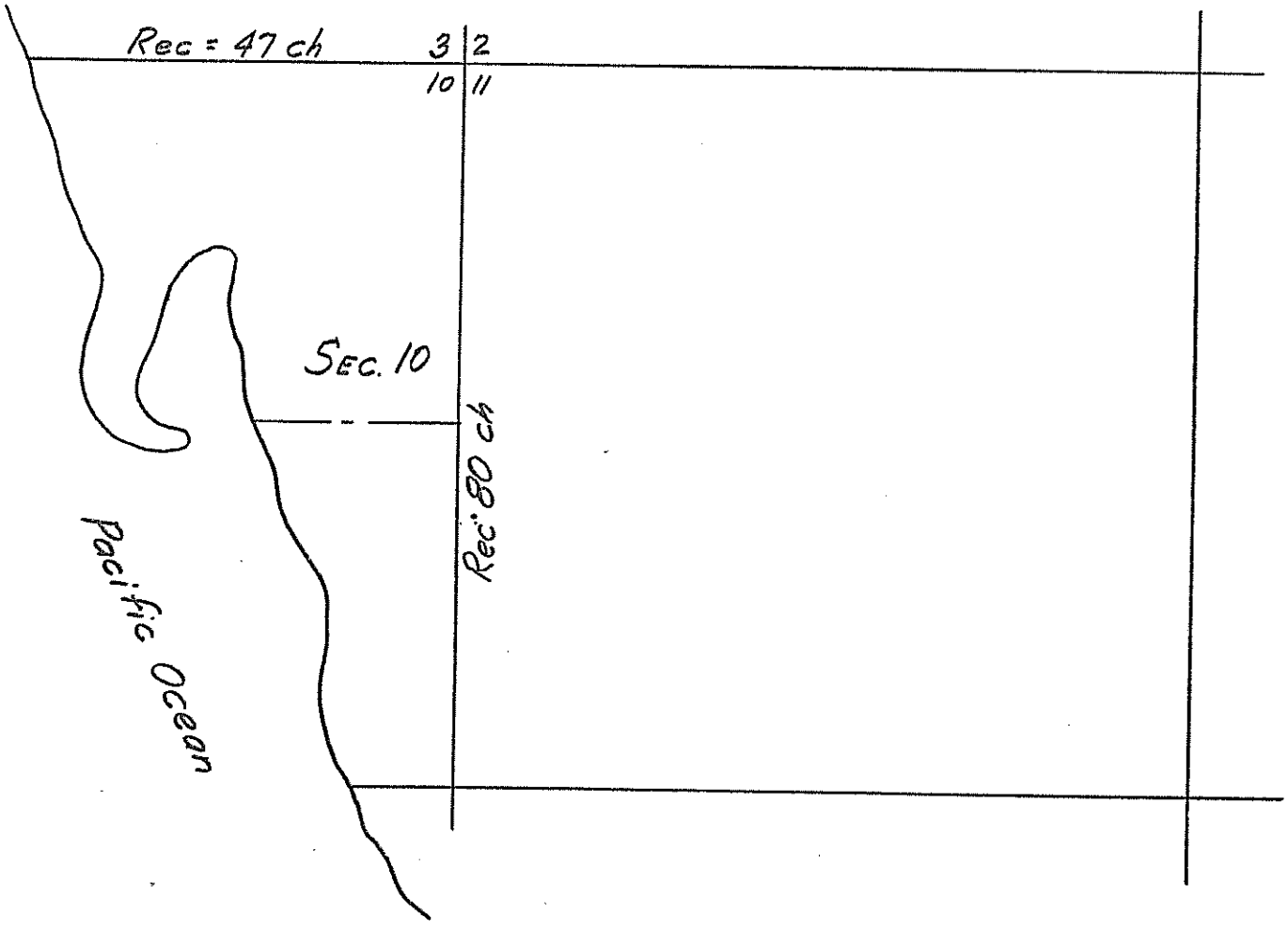


FIG. D4

NOTE: Choose one problem from D4 or D5 for 25 points.

Problem D5 - Wt. 25 (Optional)

A large tract of land which is owned by the ABC Oil Company is shown on the following diagram to a scale of 1" = 6000 feet. You have been requested to submit a proposal which will cover the following:

a to make a boundary survey.

b to establish the position of all section corners and to place permanent monuments. Corners should be positioned in the California Coordinate System within ± 0.6 feet (RMS error).

c to prepare a topographic map which will be used for general developmental and planning purposes.

The engineering people at ABC are interested in your ideas to use a combination of field and photogrammetric procedures to complete the project. They have asked that you discuss and explain some of the methods and procedures. The following series of questions establishes the scope of this discussion. You must be explicit in your answers, and support them with appropriate sketches where they may serve to explain the methods and procedures. As this is an important consideration for the future of the proposed project the staff engineer will not be satisfied with over simplifications. They want to know what you propose to do in meaningful detail.

REQUIRED:

1. Explain the general procedures that you intend to use to accomplish the program outlined in a, b, and c above.

2. What kind of photography would you take? How high would you fly? Explain your considerations for each.

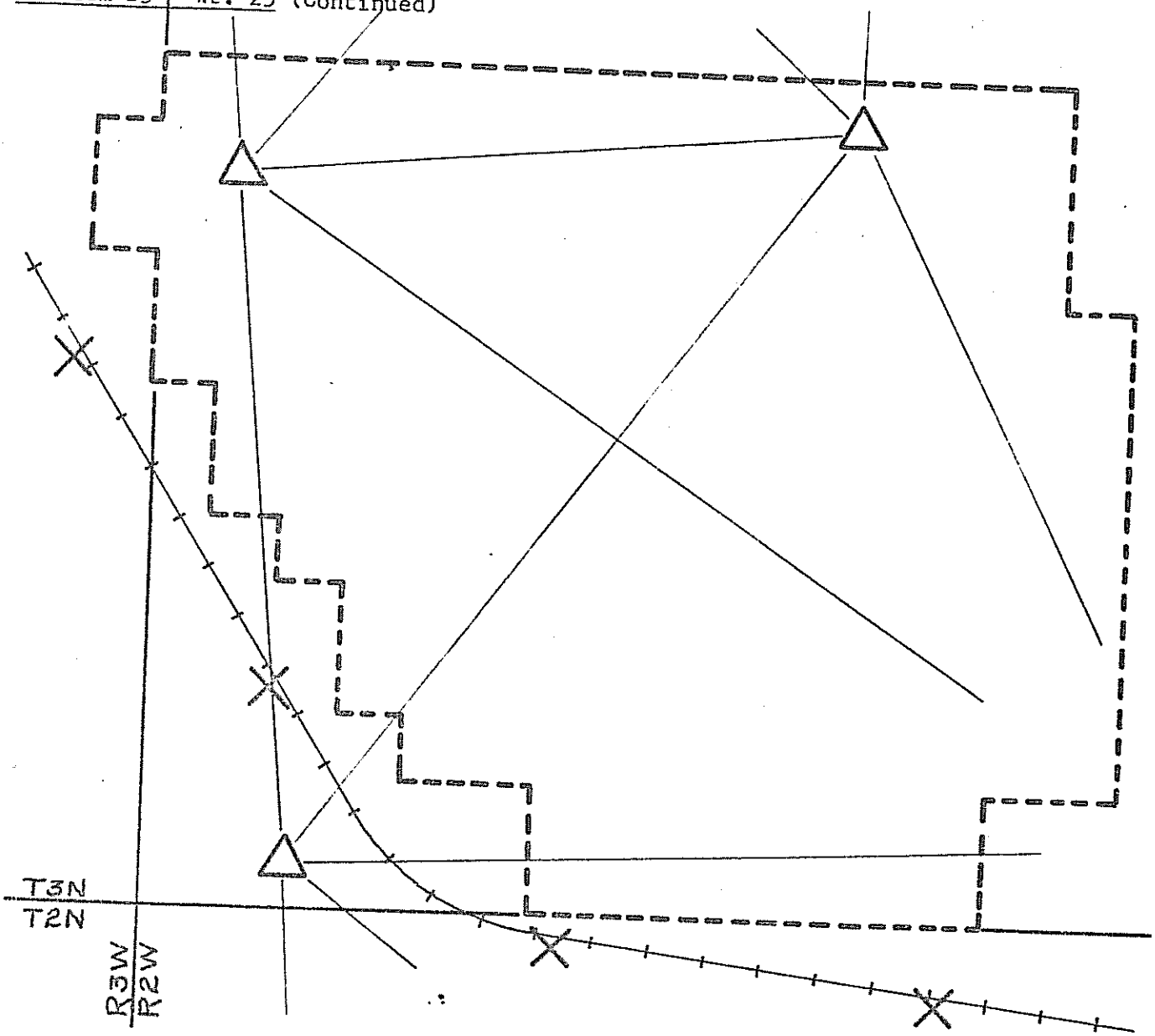
3. How many supplemental horizontal and supplemental vertical control points would you establish? Why? Explain how they would be distributed. What field survey methods would you use for the horizontal control? and for the vertical control?

4. How would you establish existing corners? How would you reestablish the position of lost corners? Would you rely entirely on field procedures or would you consider the application of photogrammetry?

5. What scale topographic map would you furnish? What contour interval would you use? Would you attempt to use the same photography? Explain each part.

6. What are the major computational steps that are required for the field surveys? for the photogrammetry? Prepare this in an outline to cover all the steps to complete the requirements of the project.

Problem D5 - Wt. 25 (Continued)



ABC Oil Co.

Approx. Scale: 1"=6000'

△ Trig Sta.(C&GS)

✕ BM (C&GS)

– – – Boundary – – –

CPRR

Terrain - rolling to moderately rough. Largest differences in elevation range up to 1000 ft.

Cover - grass lands, some scattered brush, dense overgrowth sparsely grouped in a few stream beds. Some areas of strewn boulders.

Previous Surveys - GLO 1883. Estimate that about 75% of original S.C. & 1/4 S.C. are recoverable.