LS-A

LAND SURVEYOR - 1971

PART A - Wt. 50

CLOSED BOOK

Time Allowed - Four Hours

INSTRUCTIONS TO EXAMINEE:

The first day of this examination consists of two parts of four hours each (Part A and Part B). Each part has a total weighted score of 50 points. The maximum possible score for the first day is 100 points.

Part A consists of 75 problems. All problems are required. Each problem has a weighted value of 2/3.

Detach the last sheet from this booklet - this is your Answer Sheet fot Part A. Show the appropriate answer in the space provided on the Answer Sheet. For multiple choice problems, enter the appropriate identifying letter in the space provided. 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

(1) A triangular land parcel measures 50 feet and 130 feet with the included angle between these two sides equal to 30^{o}. What is the length of the third side?

A 42.62

B 79.43

C 87.55

D 90.23

E 98.67

(2) The linear measure of one meter equals:

A 3.280833 feet

B 39 inches exactly

C 39.40+ inches

D 1.287 yards

C 600 centimeters, nearly

(3) The value of "x" in the equation

$$201.96 = 5x + 6x^{2}$$

is

A 1.9

B 3.2

C 8.6

D 7.9

E 5.4

(4) In a regular four-sided figure (90^{o} angles), which of the following contains exactly one acre of land in area.

A 206.7 feet by 206.7 feet

B 2 chains by 5 chains

C 200 links by 495 links

D 209.7 feet by 209.7 feet

E 2 chains 10 links by 5 chains 10 links

(5) From the southwest corner of a section going north, what is the distance to the first sixteenth corner?

A 10 chains

B 16 chains

C 40 chains

D 20 chains

E 30 chains

(6) A one-sixty-fourth corner of a section relates to

A sixty corners per mile

B a corner sixty-four chains north of the section corner

C the subdivision of a section into 10 acre tracts

D a corner located half-way between the quarter corner and the quarter - quarter corner.

E distances only

(7) The secant of a given angle in a right triangle is equal to the

A $\frac{\text{opposite (side)}}{\text{hypotenuse}}$

B $\frac{\text{adjacent (side)}}{\text{opposite}}$

C $\frac{\text{hypotenuse}}{\text{adjacent}}$

D $\frac{\text{hypotenuse}}{\text{opposite}}$

E $\frac{\text{adjacent}}{\text{hypotenuse}}$

(8) $x^2 = 4ay$ is

A a slope correction formula

B the equation for the arc of a circle

C a vertical circle formula

D the type equation for a parabola

E the type equation for a hyperbola

(9) A steel tape that is supported at its two ends will assume the shape of a

A parabola

B circle

C catenary

D ellipse

E hyperbola

(10) When three sides of a triangle are given, the three interior angles can be determined by using the law of cosines. For the triangle shown, which of the following expresses the law of cosines?

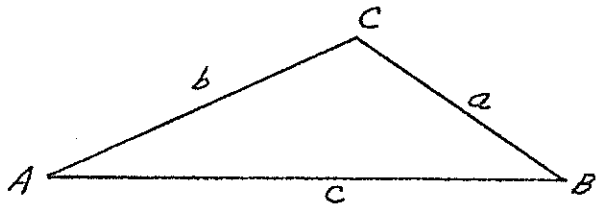
A $B = \frac{a}{2\sin a}$

B $A = s(s-a)(s-b)(s-c)$

C $b^2 = a^2 - c^2 + 2bc \cos A$

D $a^2 = b^2 + c^2 - 2bc \cos A$

E $\sin A = \frac{a \sin B}{b}$



(11) A measurement of a field distance can be carefully made using a steel tape and then recorded with significant figures shown to 0.001 foot. Such a measurement would be

A absolutely accurate

B absolutely precise

C precise but not necessarily accurate

D accurate but not necessarily precise

E an approximation

(12) A distance in the field was very carefully measured twice, and two distinctly separate readings were recorded in the field book. Later in the office the two readings were shown to be slightly different. This difference is called a

A discrepancy

B accidental error

C systematic error

D resultant error

E degree of refinement

(13) The three sides of a triangular land parcel were measured in the field as

252.79, 453.67, and 389.06 feet.

The interior angles can be computed from this information by making use of

A Burke's Law

B the transit rule

C the Prismoidal Formula

D the Three Point Method

E the Law of Cosines

(14) The figure shows a sector of a circle. The area within the sector is

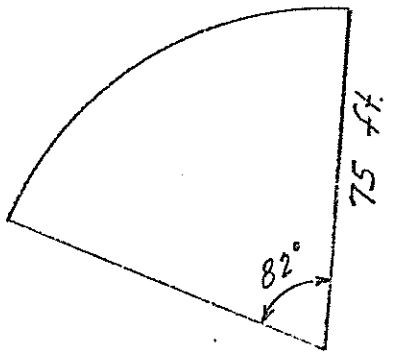
A 0.079 Acres

B 0.083 "

C 0.092 "

D 0.105 "

E 0.121 "



(15) Solve for the value of "x" in the following pair of equations

$$x + y = 9$$

$$4y + 3x = 31$$

A 3.0

B 4.0

C 4.8

D 5.0

E 6.0

(16) A property line which bears S60°00'W can also be identified, when measured clockwise from North, as an azimuth of

A 030°

B 060°

C 120°

D 240°

E 300°

(17) The log sin 2x is equal to which of the following?

A log 2x + log sin x

B 2 log sin x

C log 2 + log sin x

D log 2 + log sin x + log cos x

E log 2x + log sin x + log cos x

(18) If the function $y = 2 \cos \frac{x}{2}$ is plotted on a graph it will pass through the point where coordinates are

A $(\pi, -2)$

B $(2\pi, -2)$

C $(2\pi, +2)$

D $(\pi, +2)$

E $(\pi, +1)$

(19) The legend of a topographic map showed that the scale was $\frac{1}{20,000}$. This representation is called the

A manuscript factor

B representative fraction

C error factor

D least squares factor

E plotting fraction

(20) Determine the area of the Trapezoid shown in square feet.

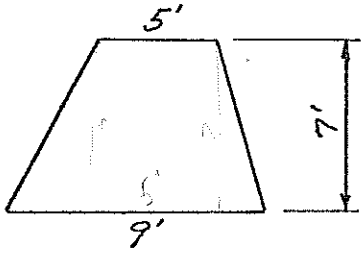
A 45 '

B 48 '

C 52 '

D 49 '

E 42 '



(21) If a right circular cone is cut by a plane parallel to the axis of symmetry the figure revealed would be

A a circle

B a hyperbola

C an ellipse

D a parabola

E a catenary

(22) A rectangular piece of land is 11 chains 4 links in length by 14 chains 35 links in width. Its area is

A 1.64 acres

B 16.36 acres

C 16 square rods

D 12.20 acres

E 43,560 square feet

(23) Which of the following conditions will show the greatest accuracy in volume calculations for the prismoidal method when compared to the average end area method -

A the two end areas are shaped differently but are equal in area

B one end area is a straight line thus forming a volume that is shaped like a wedge

C the two end areas are approximately equal

D the end area at one end of the volume is a point thus forming a volume shaped like a pyramid.

E the two end areas are both identified as five level sections

(24) A formula employed for the determination of the middle ordinate of a circular curve is:

A $2R \sin 1/2A = M$

B $R \text{ vers } 1/2A = M$

C $2R \cos 1/2A = M$

D $R \tan A = M$

E $\frac{R^2}{360^o} = M$

Legend

A= Central angle
R= Radius
M= Middle ordinate

(25) The ratio $\frac{a+b}{a-b}$ is equal to

A $2\ ab \cos C$

B $\frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)}$

C $a^2 + b^2 - 2\ ab \cos C$

D $\cos \frac{1}{2}\ ab$

E $\frac{\tan A}{\tan(90^\circ - A)}$

(26) The three sides of a triangular parcel of land measure 53 feet, 62 feet, and 45 feet respectively. What is the area of the parcel to the nearest 0.1 square feet?

A 927.9

B 1036.8

C 1092.7

D 1166.5

E 1174.3

(27) A transit was set up 112.1 feet from the base of a TV tower. A vertical angle of $32^\circ 30'$ was read on the vertical circle with the cross hair positioned on the tip of the tower. When the telescope was levelled, the rod reading at the base of the tower was 5.1 feet. The height of the tower from ground level to tip would be

A 78.2 feet

B 77.3 "

C 76.5 "

D 71.4 "

E 66.3 "

(28) Two simultaneous equations appear as follows:

$$46.57 = 5y + 6x$$
$$29.22 = 5x + 6y$$

What is the value of "x"?

A 12.12

B 11.97

C 10.43

D 9.75

E 8.26

(29) In the diagram shown the slope angle θ may be large. When this is so, the true distance "d" is equal to:

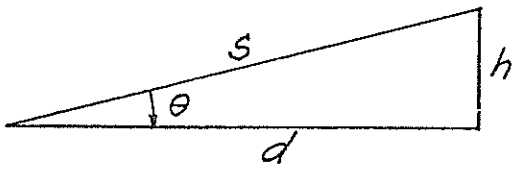
A S tan θ

B h sec θ

C s cot θ

D $(S-h)^2/\cos\theta$

E S cos θ



(30) An angle of $0^{o}01'00"$ subtends an arc of

A .03 feet at 100 feet

B .03 feet at 500 feet

C .03 feet at 1000 feet

D 6 mils at 1000 feet

E 3 mils at 1000 feet

(31) A handy device which is frequently used to transfer distances from one map to another map which is drawn to a different scale is known as

A an alidade

B a Beaman's arc

C a planimeter

D a proportional divider

E a Kelsh plotter

(32) The compass rule may be used to adjust a closed traverse. When the compass rule is applied the total correction in departure of any course is to the total correction in departure as the

A latitude of that course is to the sum of all the departures in the traverse.

B square of the length of the course is to the sum of the squares of all the lengths of the traverse.

C length of the course is to the total length of the traverse.

D departure of the course is to the sum of all the lengths of the sides of the traverse.

E departure of that course is to the sum of all the departures in the traverse.

(33) A tract of land was identified by a closed traverse which consists of 8 straight lines. If the interior angles were measured, the sum of all the angles would be equal to

A 360°

B 420°

C 720°

D 1080°

E 1260°

(34) The effect of temperature must often be considered when using a steel tape particularly in base line work. The coefficient of thermal expansion for a steel tape is

A .0000065 per unit length per degree Centigrade

B .0000065 " " " " " Fahrenheit

C " " " " " " Kelvin

D 30×10^6 psi

E the value of $E = \frac{P\,l}{A\,E}$

(35) Most transits used in the United States are designed such that the stadia interval factor is

A 50

B 100

C 200

D 300

E 1000

(36) The double meridian distance (DMD) of a line is always equal to

A the departure

B the latitude

C the departure times two

D the meridian distance of its midpoint

E the sum of the meridian distances of the two ends

(37) A horizontal angle may be measured by repetition in order to

A approach a trial and error limitation

B reduce the effect of errors in reading individual angles

C reduce the reading error by proportioning it to several observations

D substitute a mechanical operation in lieu of mathematical computations

E increase the accuracy of the instrument

(38) In the layout of a circular curve for a route survey the middle ordinate distance is equal to the

A radius plus the tangent distance

B long chord

C radius minus the external distance

D radius multiplied by the versine of one half the central angle

E radius multiplied by the secant of one half the central angle

(39) A map might be classified as a topographic map if it shows

A contours of natural features and artificial works

B cities, towns, railroad, and highways

C the various property ownership for taxing purposes

D plans and profiles of principal freeway routes

E the location of all known boundary lines, and all real property located within the boundaries.

(40) The planimetric map of a land parcel which indicates relief is also referred to as a

A quad sheet

B plat

C record of survey

D parcel map

E topographic map

(41) From the longitude of this place the mapping angle that is used in connection with the California Coordinate System bears a relationship to the central meridian that is

A a function of the sine of angle measuring degrees of latitude

B less than the longitude difference

C more than the " "

D equal to the difference in longitude

E not dependent on the longitude difference

(42) The California Coordinate System is set up so that the scale ratio of grid to sea level distance does not differ by more than

A 1 in 20,000

B 1 in 15,000

C 1 in 25,000

D 1 in 10,000

E 1 in 7,500

(43) The California Coordinate System is based on which of the following projections?

A orthographic

B Mercator

C Gnomonic

D Lambert conformal conic

E stereographic

(44) The various systems of State Plane Coordinates as adopted for use in the United States have been computed and compiled by the

A U.S. Corps of Engineers

B U.S. Geological Survey (USGS)

C State Board of Registration

D U.S. Bureau of Land Management

E U.S. Coast and Geodetic Survey

(45) In the United States the two most common projections used in the development of the various State Plane Coordinate Systems are

A Gnomonic and Stereographic

B transverse Mercator and Lambert conformal

C Orthographic and Stereographic

D Polyconic and Orthographic

E Lambert conformal and True Azimuth

(46) When the Gnomonic projection method is used, a straight line will always

A Show a parallel of latitude

B " " meander line

C " " meridian line

D " the arc of a great circle

E be drawn through the poles

(47) The interval of time that would elapse between the sun's position at the vernal equinox and its position at the winter solstice would be

A 7 days

B 1 month

C 3 months

D 6 months

E 9 months

(48) If an angular distance is measured along the celestial equator between the vernal equinox and the hour circle through a body, it is called the

A declination

B right ascension

C hour angle

D polar distance

E equinoctial colure

(49) The interval of time between two successive upper transits of the vernal equinox over the same meridian is called

A an apparent solar day

B a solar year

C a sidereal day

D a mean solar day

E a sidereal year

(50) The closing corners found along a north township line

A may be relied on as the true location of the section corners

B must be used exclusively to determine the true location of the interior section corners.

C are generally established by double proportionate measurement

D control the direction of the North-South range line in an East-West position.

E are set at one mile intervals along the range line

(51) Meander lines were run in surveying fractional portions of the public lands bordering on navigable rivers

A as the boundary of the tract

B as a means of ascertaining the quantity of land

C to see if their traverses would close

D as a means of locating the rivers so they can be shown on the plat

E to determine the lower low water mark

(52) The corrected vertical angle measured from the horizon to Polaris gives

A time

B latitude

C the zenith distance

D the correction for refraction

E longitude

(53) The position of a star can be identified on the celestial sphere by measurements taken from the celestial equator and the vernal equinox. The measurements are called respectively

A latitude and longitude

B declination and right ascension

C altitude and observers horizon

D zenith distance and hour angle

E vertical circle and polar distance

(54) Data for the determination of latitude and longitude, as prepared by the United States Naval Observatory, can be obtained from

A the dictionary

B a thesaurus

C an encyclopedia

D the astronomical almanac

E an ephemeris

(55) The longitude of Sacramento, California is given as $121^{o}27'44"$ West. If this is expressed as an hour angle from Greenwich it would be shown as

A $9^{h}0^{m}00^{s}$

B $8^{h}9^{m}51^{s}$

C $8^{h}7^{m}53^{s}$

D $8^{h}5^{m}51^{s}$

E $8^{h}3^{m}49^{s}$

(56) A natural boundary line is frequently determined by the water's edge such as a lake shore line. If the water withdraws and exposes previously inaccessible and perhaps unclaimed land, this process is called

A duces tecum

B reliction

C avulsion

D accretion

E alluvium

(57) A land surveyor may be called to appear at a hearing as an expert witness. He will usually be asked preliminary questions which are intended to establish his

A experience and intelligence quotient

B patience and fortitude

C initiative and judgment

D experience and qualification

E cooperation or hostility

58 Private property may be taken for public use under certain circumstances. This power of the state to take property is called

A escrow

B Omnibus Rex

C lis pendens

D an easement

E eminent domain

59 A meander line may also be described as one which marks

A a demarcation between two riparian owners

B a rough definition of the sinuosity of a shore line

C the limit of the property for measurement of area

D the thread of a stream

E an actual property line

60 A parol contract is identified as

A one which waives some of an owner's rights

B the seal placed on a document by a Notary Public

C one that is unwritten or unwitnessed

D one signed by the grantee only

E one signed by both the grantor and grantee

(61) Parties to a land boundary disagreement may fix a disputed boundary through a

A warranty deed

B deed of trust

C grant deed

D quit claim deed

E agreement deed

(62) In the transfer of title to property it is a common practice to deposit a grant with a third party who will deliver the deposit upon the performance of previously stated conditions. This practice is called

A estoppel

B escrow

C a tort proceeding

D title insurance

E a deed of trust

(63) The base-height ratio of a 6 inch focal length photograph on a 9" x 9" format with 60% overlap is

A 5.40

B 3.60

C 0.90

D 0.60

E 0.40

(64) The formula $C_s = \frac{W^2 l^3}{24 P^2}$ where

W = weight of a tape per foot
l = unsupported length of a tape
P = applied tension

expresses a correction to be applied for

A sag

B incorrect tension

C changes in temperature

D tape not held horizontal

E the discrepancy between field condition and standard

(65) A subtense bar may produce distance measurements of second order accuracy up to

A 1500 feet

B 1000 "

C 750 "

D 500 "

E 300 "

(66) A vertical collimator will

A eliminate parallax

B reflect sunlight on a bright day

C usually be grouted into bedrock

D contain internal batteries

E contain a 45° mirror

(67) If the vertical angle is measured at this place from the horizon to Polaris the uncorrected measured angle is equal to the

A right ascension

B latitude of place

C longitude of place

D lower culmination

E zenith distance

(68) A plane table may be oriented in the field by resection from known points. It is common to produce a triangle of error which will have the strongest resolution when the point sought is

A on the great circle

B near the great circle, and near a known station

C inside the great circle and near the center of gravity of the triangle of error.

D outside the great circle

E coincident with a known station

(69) Which of the following instruments can be used to measure directly the area of a cross section that is plotted to scale?

A a stereoplanigraph

B a Kelsh

C an alidade

D a polar planimeter

E a distomat

(70) The North American Datum of 1927

A is the currently acceptable datum upon which the U.S.C. & G.S. level circuits are based.

B places all U.S.C. & G.S. triangulated distances at sea level elevation

C is based on the Clarke Spheroid of 1886

D has no present-day significance

E is used as a base of reference for vertical control surveys

(71) An assembly of photographs trimmed to show the center portion of each photograph is called a

A contact print

B oblique photograph

C uncontrolled mosaic

D stereoscopic model

E photomap

(72) In the United States the generally accepted temperature for the standardization of a steel tape is

A 0° F

B 32° F

C 50° F

D 68° F

E 72° F

(73) In a circular curve where the length of curve is measured along the arc the degree of curve would be

A the central angle subtended by a chord of 100 feet

B the length of arc divided by πR^2

C equal to the angle PC-O-PT

D one half the central angle subtended by an arc of 100 feet

E equal to the central angle subtended by an arc of 100 feet

(74) In a second order triangulation net the presence of small angles is deemed undesirable because

A additional repetitions are necessary to accurately measure the angles

B they will weaken the strength of the figure

C they cannot be read directly unless a theodolite is available

D they may reduce the order of work from second order to third order

E they make fewer observable points available for sightings

(75) The Mercator projection is distinguished by the fact that

A all land areas appear to true scale

B all direction lines appear in true direction

C adjoining charts drawn to the same scale and joined N - S will fit without much adjustment.

D a unit of area near the equator will be represented near the pole as an area of infinity.

E the distance between any two points appears in true scale

ID. NO. _____

ANSWER SHEET

LAND SURVEYOR - 1971

Enter only the key letter as described in the instructions.

1. _____	26. _____	51. _____
2. _____	27. _____	52. _____
3. _____	28. _____	53. _____
4. _____	29. _____	54. _____
5. _____	30. _____	55. _____
6. _____	31. _____	56. _____
7. _____	32. _____	57. _____
8. _____	33. _____	58. _____
9. _____	34. _____	59. _____
10. _____	35. _____	60. _____
11. _____	36. _____	61. _____
12. _____	37. _____	62. _____
13. _____	38. _____	63. _____
14. _____	39. _____	64. _____
15. _____	40. _____	65. _____
16. _____	41. _____	66. _____
17. _____	42. _____	67. _____
18. _____	43. _____	68. _____
19. _____	44. _____	69. _____
20. _____	45. _____	70. _____
21. _____	46. _____	71. _____
22. _____	47. _____	72. _____
23. _____	48. _____	73. _____
24. _____	49. _____	74. _____
25. _____	50. _____	75. _____

TURN IN THIS ANSWER SHEET TO THE PROCTOR WHEN YOU HAVE COMPLETED PART A

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LAND SURVEYOR - 1971

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.

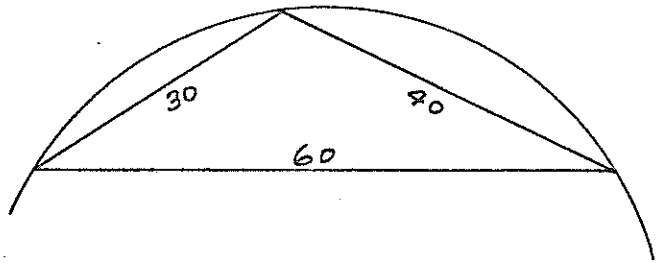
You may keep this set of examination questions.

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

Problem B1 - Wt. 3

If the three sides of a triangle are respectively 30, 40, and 60 feet, what is the area of the circle that will circumscribe the triangle, and which will contain all three of the vertices?

(Graphical solution acceptable)



Problem B2 - Wt. 3

Determine the resultant numerical value that is equal to each expression given.

a $81^{\frac{1}{4}}$

b $25^{\frac{1}{2}}$

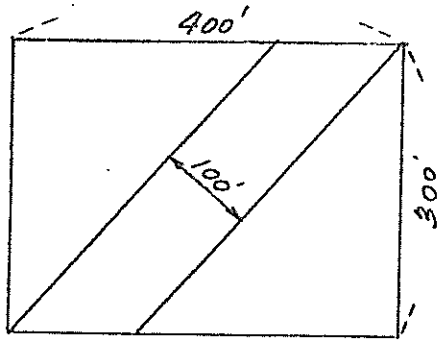
c $(-3)^{-5}$

d $(0.0001)^{+\frac{1}{4}}$

e 16^{-1}

Problem B3 - Wt. 3

A rectangular land parcel will be crossed diagonally by a new right of way which is 100 feet wide. What is the area contained within the strip to be taken?

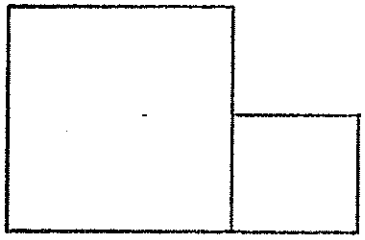


Problem B4 - Wt. 2

What are the values of X that will satisfy the equation $X^4-13X^2+36 = 0$?

Problem B5 - Wt. 4

A farmer owns two tracts of land which are unequal in area. Taken together the total area is equal to 16,400 square feet. If the two tracts are square, and are located side by side, the farmer can fence his property in a single enclosure of six sides with 560 feet of fence. What are the respective areas of the two tracts?



Problem B6 - Wt. 4

Two important factors to be considered when determining a meridian are respectively parallax and refraction. These two factors, among others, affect observation of the sun and the stars.

Explain in your own words, and by a diagram, what each of these two terms means, and what effect each has on the reduction of computations.

Problem B7 - Wt. 3

The astronomical triangle or PZS triangle is frequently used in field astronomy.

What is P ?

What is S ?

What is Z ?

Explain how the numerical value of the following sides can be obtained when performing a solar observation.

Side ZS

Side PZ

Side SP

Problem B8 - Wt. 6

This problem has three parts. Work all parts.

a Convert the following distances to feet and hundredths of a foot to the nearest 1/100 foot.

1) 27 rods 19 links

2) 15 chains 3 rods and 7 links

3) 47 meters

b Convert the following areas to acres to the nearest 1/100 acre.

1) 92,523 square feet

2) 975 square rods

3) 427 square meters

c Convert the following north azimuths to bearings.

1) 10° 19' 27"

2) 107° 24' 10"

3) 253° 12' 57"

4) 317° 21' 39"

Problem B9 - Wt. 4

A parcel of land was surveyed by the traverse method in which the interior angles were measured. The readings taken in the field are as follows.

Point	Angle recorded
1	172° 30' 30"
2	94° 29' 45"
3	85° 49' 30"
4	177° 02' 15"
5	93° 54' 30"
6	96° 12' 00"

a What is the angular error of closure of this traverse?

b Adjust the traverse angles giving equal weight to each reading.

Problem B10 - Wt. 4

A highway level cross section was taken in the field and recorded as follows:

Roadway width = 30 feet

H.I. = 628.40'

Elevation of subgrade = 625.18'

Side slopes = 1½ to 1

Ground rod = 6.2 feet

Distance of rod from to slope stake = 20.0 feet

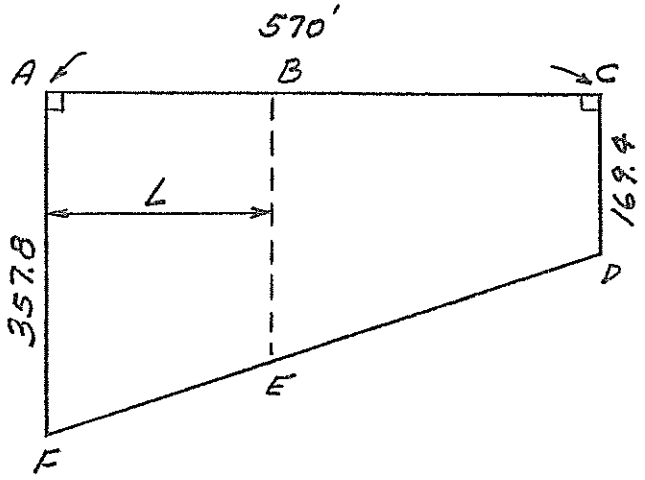
a Is this particular section located in cut or in fill?

b Is the slope stake established in the correct location?

c Where would you set the slope stake?

Problem B11 - Wt. 4

The figure shows a tract of land which must be divided into two areas that are exactly equal. Determine the distance "L" which will divide the equal areas if the line BE is parallel to the end property lines.



Problem B12 - Wt. 3

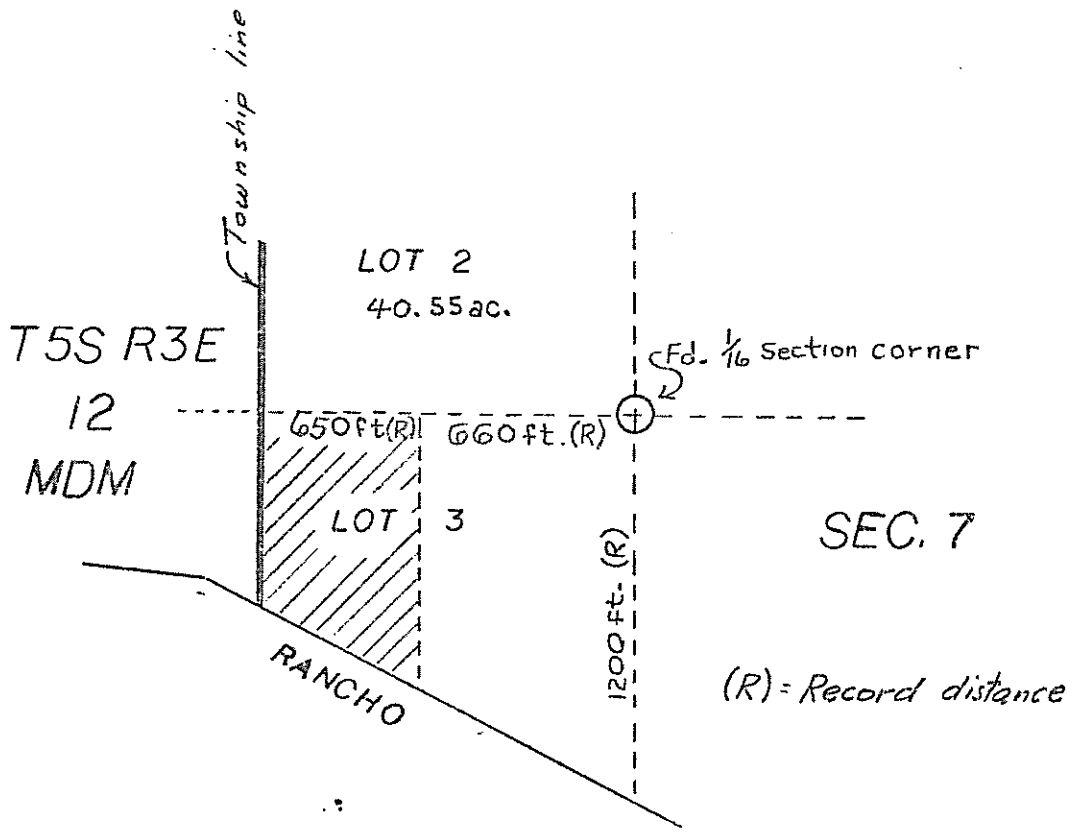
The following symbols or abbreviations are frequently used in surveying practice. Identify each.

BLM	POT
GLO	L
T3N R9E MDM	△
PT	HI
PCC	FS
PZS	TP

Problem B13 - Wt. 3

Prepare a land description for the cross hatched area shown in the figure below.

(Note: Section 7 is subdivided in the usual manner North of the Rancho Line)



Problem B14 - Wt. 3

Some monuments may provide better evidence of boundary location than others. Thus monuments are recognized to have relative values. In the case of a conflict a monument which possesses certain characteristics will control over presumed infirm title elements. Name three of these characteristics.

Problem B15 - Wt. 3

A circular curve may be defined by the degree of curve ("D"):

a. chord definition, or

b. arc definition.

Draw a sketch which indicates each condition and write the equation for "D" in each case, in terms of the radius "R".

If the degree of curve of a particular layout is given as 6^{o} and the central angle is 40^{o}, what is the length of the curve-chord definition?

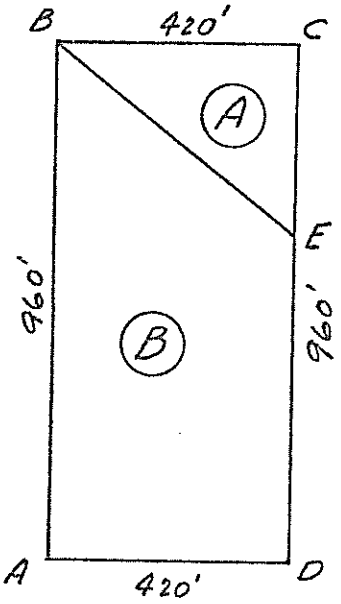
Problem B16 - Wt. 4

A large lot in a suburban area must be subdivided as shown in the figure - line BE.

What is the length of the line BE if the area of Tract (B) is 7.5 acres?

What is the tangent value of the bearing angle CEB for the course BE?

If the North azimuth of the side BC is 90^{o}, what is the South azimuth of the side AD?



Problem B17 - Wt. 5

A subdivision contains several streets which terminate in a circular cul-de-sac. If the area of one of these circles is 8,942 square feet,

a What is the diameter of the circle?

b The circumference of the circle?

c The length of one side of a regular hexagon which can be inscribed in the circle?

Problem B18 - Wt. 4

Two corners of a farmer's property were located in the field. The distance between the two points was later measured to be 1,918.65 feet. The 100' tape used was then compared to the standard, and it was found to be actually 99.86 feet long. What is the distance between the two property corners corrected for index?

Problem B19 - Wt. 4

A field crew turned in the following set of notes for a local road:

Station					
7+40	C18.5 / 57.0	C27.0 / 30.0	C19.6 / 0	C8.0 / 18.0	C10.3 / 40.5
8+00	C4.0 / 28.0	C8.2 / 12.4	C9.5 / 0.0	C18.0 / 32.0	C19.0 / 58.0

The roadway width is 40 feet and the side slopes are 2:1.

a Compute the area of cross section at each station.

b Compute the volume in cubic yards by the average end area method between the two stations.

Problem B20 - Wt. 6

A field crew turned in a series of measurements that were taken between two found monuments set during an old survey. The readings are as follows:

877.343	877.337	877.313
877.353	877.318	877.345
877.350	877.325	877.329
		877.341

a What is the most probable distance between the two points?

b What is the standard error of one of these measurements?

c " " " probable error " " " " " ?

d What is the probable error of the mean?

e What is the 90 percent error?

Problem B21 - Wt. 3

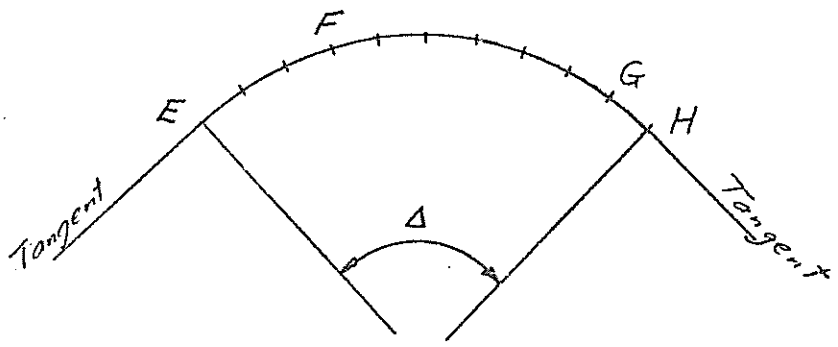
A land parcel was photographed from a height of 7,850 feet above sea level. Two hills appear in the photo which are equal in elevation at 890 feet above sea level. On the photograph the tops of the two hills appear to be 2.34 inches apart. The camera has a 6" focal length.

What is the photograph scale?

What is the distance between the two hills on the ground?

Problem B22 - Wt. 3

A route survey contains one circular curve with a central angle of 100°. The curve is divided into ten equal arcs. If the transit is set up at station F, BS is made upon the PC (station E) and the forward deflection angle is turned to point G on the curve, what is the angle that must be turned?



Problem B23 - Wt. 3

Each of the following definitions can be summarized in a single term that is used in land surveying practice. Identify the proper term for each case.

a The line midway between stream banks.

b Land left uncovered by the gradual receding of a body of water.

c The gradual deposit of new land by the deposition of material due to action by water.

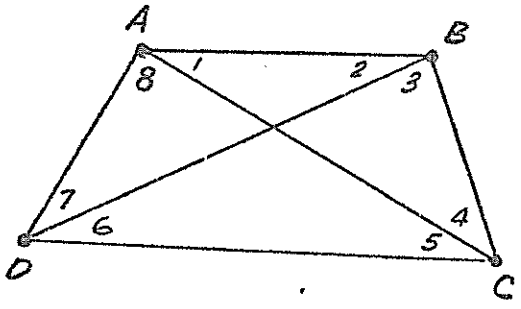
d The testimony gathered from witnesses as it relates to monuments.

e The sudden removal of a considerable quantity of soil from the land of a riparian owner by a violent action of water.

f The power of the state to take land from private ownership for public use.

Problem B24 - Wt. 4

The figure shown is a quadrilateral that is typical in a triangulation net. In the adjustment of the angles there are two conditions to be satisfied:



(1) the geometric condition, and
(2) the trigonometric condition.

a Explain the meaning of each condition.

b Explain how the geometric condition adjustment is accomplished.

Problem B25 - Wt. 3

It was recently revealed that the quarter section corner on the East side of Section 6 is lost. A search of the past record discloses that the original field notes record the East side of Section 6 as 80.24 chains. Field measurement between the found section corners shows the measured distance to be 5308.72 feet. From this data compute by longhand the distances that should be measured to restore the quarter corner.

Problem B26 - Wt. 6

Each of the following terms has an application in the practice of photogrammetry. In your own words define each of the terms.

a relief displacement

b ground nadir

c meridional plane

d negative lens

e lateral oblique

f principal plane

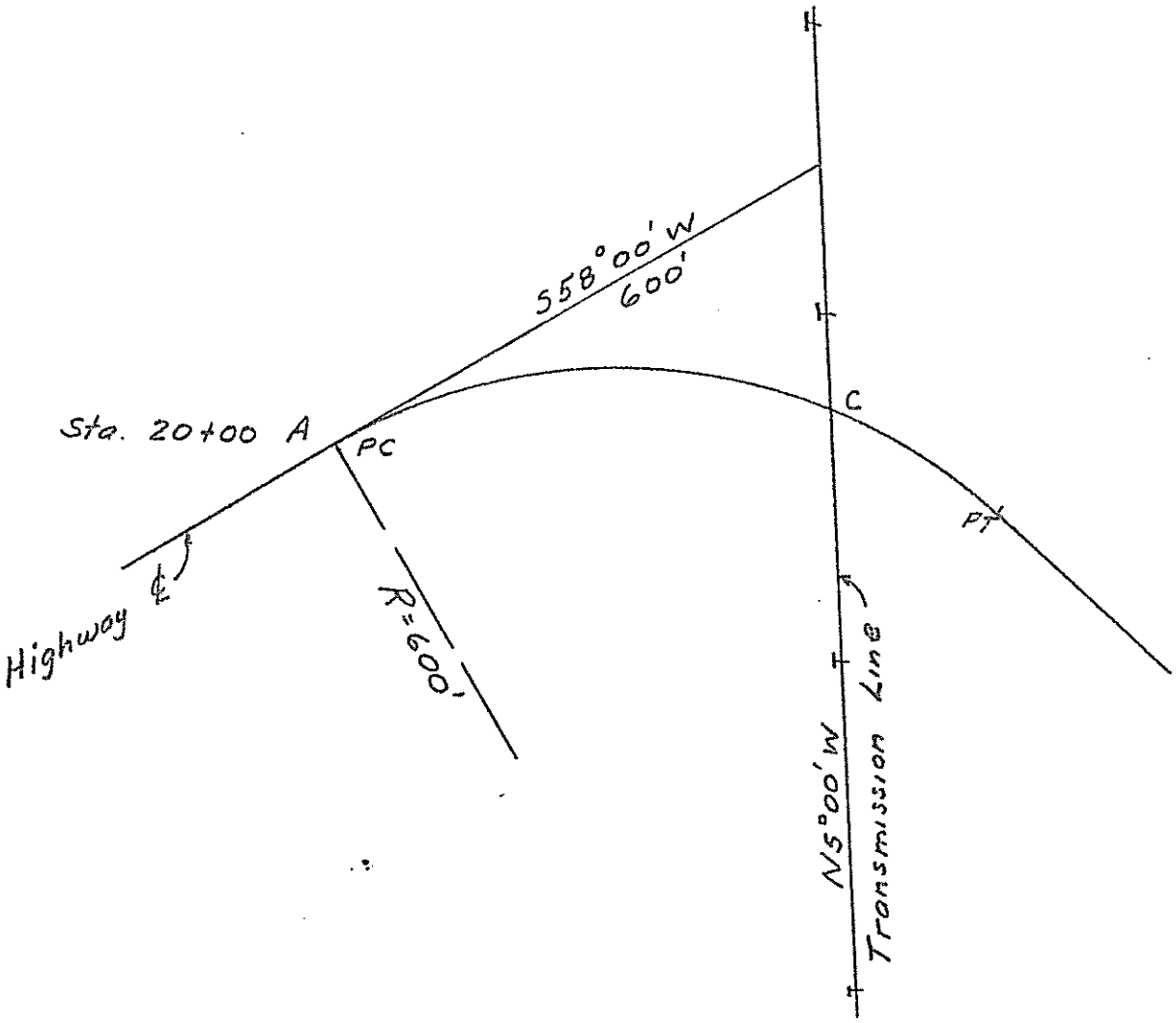
g stereocomparator

h isocenter

i swing

Problem B27 - Wt. 4

The plat below shows a transmission line crossing a highway curve at Point C. The station on the highway ℄ at the PC (Point A) is 20+00. If the stationing increases toward the right, what is the station at Point C?



Problem B28 - Wt. 5

The figure shown below represents the celestial sphere. Identify each of the following terms by the appropriate letter or combination of letters which correspond with the principal intersections or points shown on the figure.

a altitude of the star shown

b coaltitude

c latitude

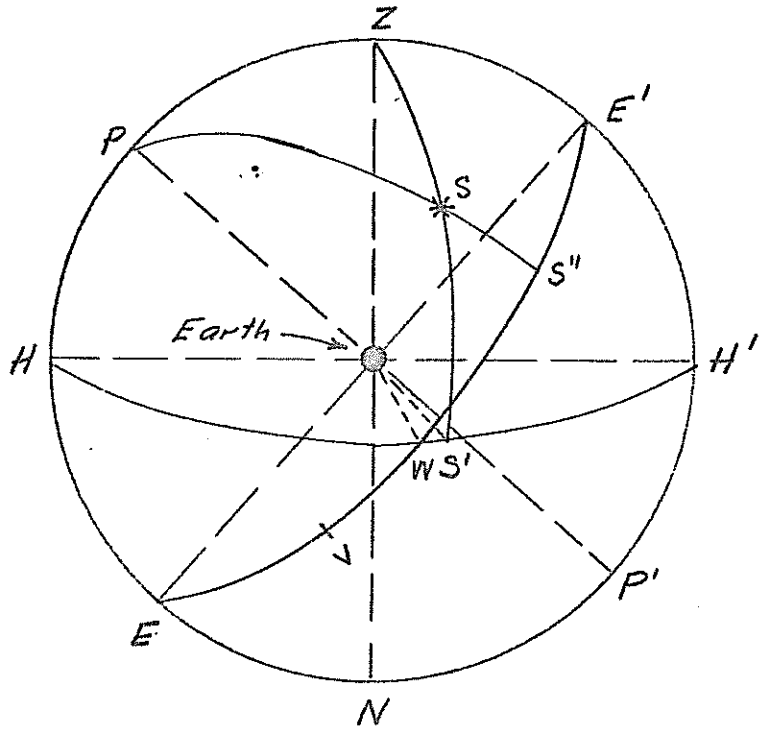
d colatitude

e declination

f codeclination

g zenith

h spherical triangle



L S C

LAND SURVEYOR - 1971

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 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 if a problem 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 statement.

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

You may use a self-contained mechanical calculator in this part of the examination. This means a hand operated type, or a battery operated type. Proctors are instructed to prohibit the use of any machine which requires a plug-in type power source.

You may keep this set of examination questions.

You are required to work Problems C1, C2, and C3, plus a choice of one.

Problem C1 - Wt. 12.5 (Answer all parts) (Required)

SECTION 1

a How many Board members are provided in law for the State Board of Registration for Professional Engineers?

b How many land surveyor members are on the Board?

c A licensed land surveyor is required to pay a renewal fee to continue his license in effect. What is the amount of the renewal fee, and when does it become due?

d Under what circumstances should a Record of Survey map be filed.

SECTION 2

e Describe the role a land surveyor may assume when he administers an oath within his license as a land surveyor.

f What is your understanding of the land surveying term called "material evidence?"

g Name at least four significant matters that must be covered on a record of survey map.

h Describe the role of the land surveyor when he is called into court as an expert witness.

i What is a monument?

j What is a surveyor's responsibility toward monumentation of a survey performed by him?

Problem C2 - Wt. 12.5 (Required)

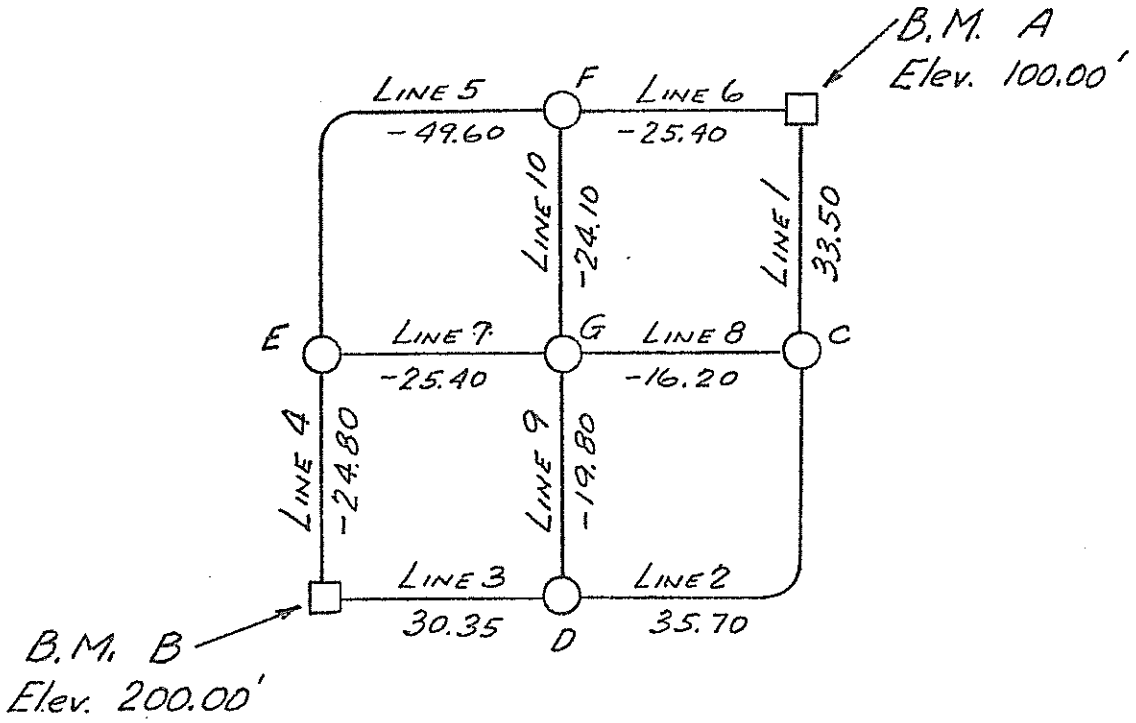
The diagram shown below represents a level net. The direction of travel, and the differences in elevation between the junction points are shown. Bench marks A and B are to be held fixed.

REQUIRED:

a How many condition equations will be required to make a simultaneous least squares adjustment of the net?

b Reproduce the diagram in your workbook, complete it, and identify (or label) the conditions.

c What are the condition equations?



LEVEL NET

FIG. C2

Problem C3 - Wt. 12.5 (Required)

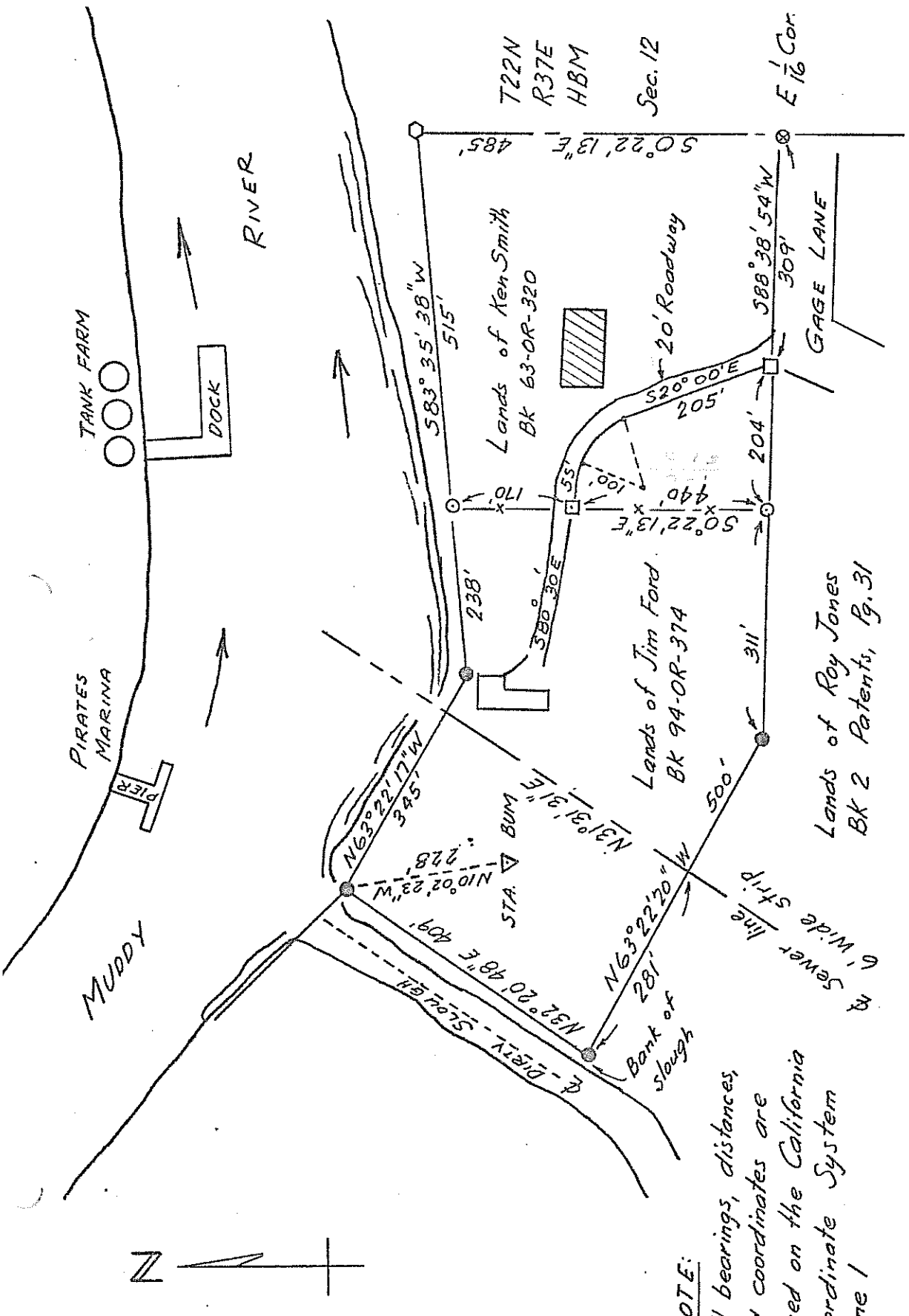
Mr. Roy Jones sold the land parcel represented on the following page to Ken Smith on January 21, 1953. On February 4, 1953 Jones sold an adjacent parcel to Jim Ford. You are commissioned to survey and describe Ford's land. The results of your survey are shown on the sketch.

The road connection across the lands of Smith is appurtenant to the lands of Ford. Muddy River is non-tidal, and Dirty Slough is non-navigable. The sewer line easement has been in effect for thirty years.

REQUIRED:

Prepare a metes and bounds description for Ford's land based on the California Coordinate System. No calculations are required.

Problem C3 - Wt. 12.5 (Continued)



Problem C4 - Wt. 12.5 (Optional)

The alignment of an existing street must be changed from the present reversed curve condition to a single radius curve connecting the same tangents.

The existing alignment is shown as Curve #1 and Curve #2 in the sketch below. The proposed new alignment is indicated as Curve #3.

REQUIRED:

a Compute the distance from the PT of Curve #2 to the PT of the new Curve #3.

b Compute the distance from the PC of Curve #1 to the PC of new Curve #3.

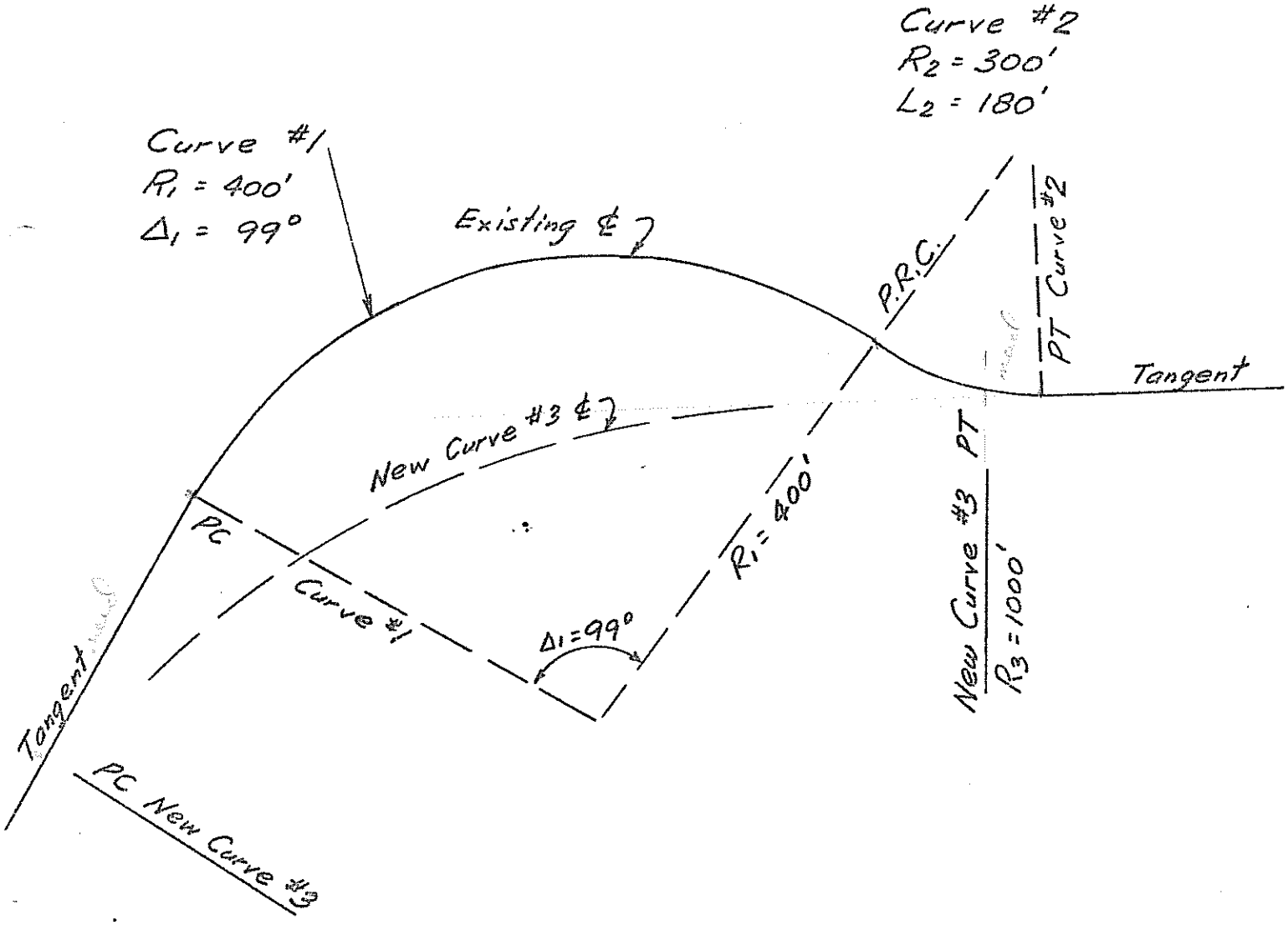


FIG. C4

Problem C5 - Wt. 12.5 (Work both parts.) (Optional)

Part A

The plat shown below represents Swampland Survey 5. You have been commissioned to prepare a map which shows the bounds of this property. Monuments are to be set, or reestablished, at all angle points. Your field work has resulted in the lost and found situation as shown by the plat. Where would you position monuments A, B, and C? Explain the method, and show calculations.

Part B

Your firm has been commissioned to compile cadastral maps to facilitate land use and environmental planning. All ownership boundaries will be projected to the common plane of the California Coordinate System, Zone 4, and will be plotted to the same scale. Referring to the plat shown below, explain how you would establish coordinate values for monuments A, B, and C. As part of your explanation, you should convert the bearings to reference the grid meridian. You should also determine the correction that must be applied to the ground distances. Do not calculate the coordinates.

Note: Assume that lines AB and AD were terminated with measurement in one direction only during the original survey in 1948.

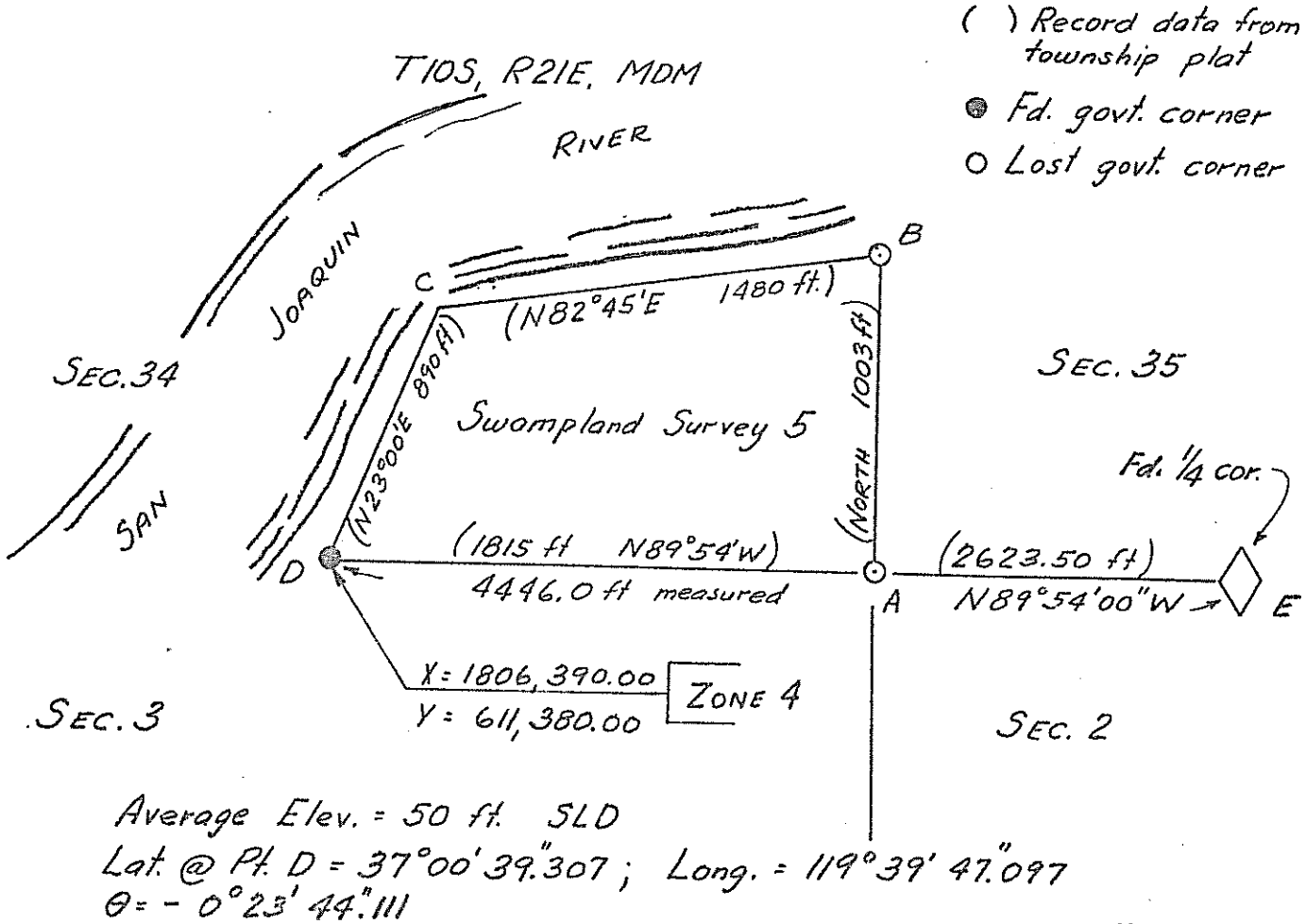


FIG. C5

L S

LAND SURVEYOR - 1971

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.

You may use a self-contained mechanical calculator in this part of the examination. This means a hand operated type, or a battery operated type. Proctors are instructed to prohibit the use of any machine which requires a plug-in type power source.

You may keep this set of examination questions.

Choose any 50 points.

Problem D1 - Wt. 12.5

The control traverse shown below originates at USC&GS first-order station "RED" and terminates at USC&GS first-order station "SPRUCE". All distances were measured with an electronic distance measuring device, and have been corrected for local atmospheric conditions. All angles were measured with a one second theodolite. Vertical angles were measured at each station only in the direction of the traverse. The adjusted bearings are as shown on the sketch. The coordinates for the USC&GS stations are State Plane Coordinates, Zone II, and the combined sea level and scale factor is 0.9999776.

REQUIRED:

a Compute the field closure of the traverse, and state the order of accuracy of the traverse.

b Is the order of accuracy meaningful considering field observation procedures? Explain your reasoning.

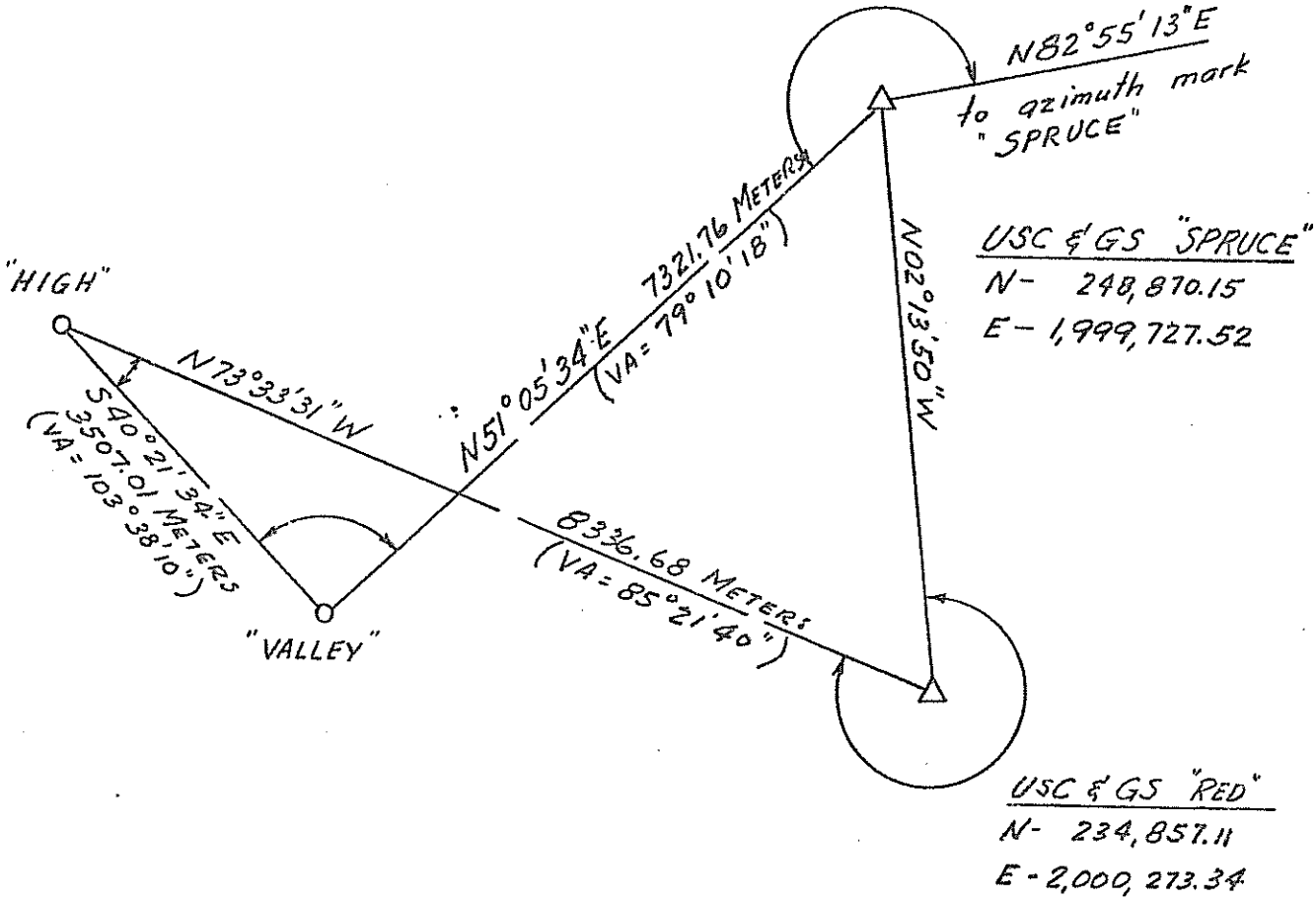


FIG. D1

Problem D2 - Wt. 12.5

In 1855 a deputy surveyor was commissioned to run the North line of Township 1 South, Range 16 East, M.D.B.& M. Instead of the usual survey procedure, he ran the following lines on an offset because of impassable mountains: East along the North line of Section 6, South along the East line of Section 6, and East along the North lines of Sections 8, 9, 10, 11, and 12.

In 1877, the subsequent subdivision of the Township (a partial copy of the original accepted Township Plat is shown below) was run from the North and closed on the South boundary of the Township, with the exception of the East half-mile lines of Sections 4, and 3, which were run to the North.

A survey by you discloses the following:

a) Corners found and accepted - E 1/4 S4, N 1/4 S10, E 1/4 S9, SE Cor. S9, S 1/4 S9, SW Cor. S9 and the N 1/4 S8.

b) You are able to reset the obliterated S 1/4 S9 from calls in the government field notes, and the found remains of Carlon's House.

REQUIRED:

a By what methods would you restore the following missing corners?
   1) NW Cor. S9?
   2) NE Cor. S9?
   3) N 1/4 S9?

b Define the terms "dependent" resurvey, and "independent" resurvey as they relate to the U.S. Public Land Surveys.

O---- Designates Found and Accepted Corners

X---- Designates Obliterated Corner Reset from Collateral Evidence.

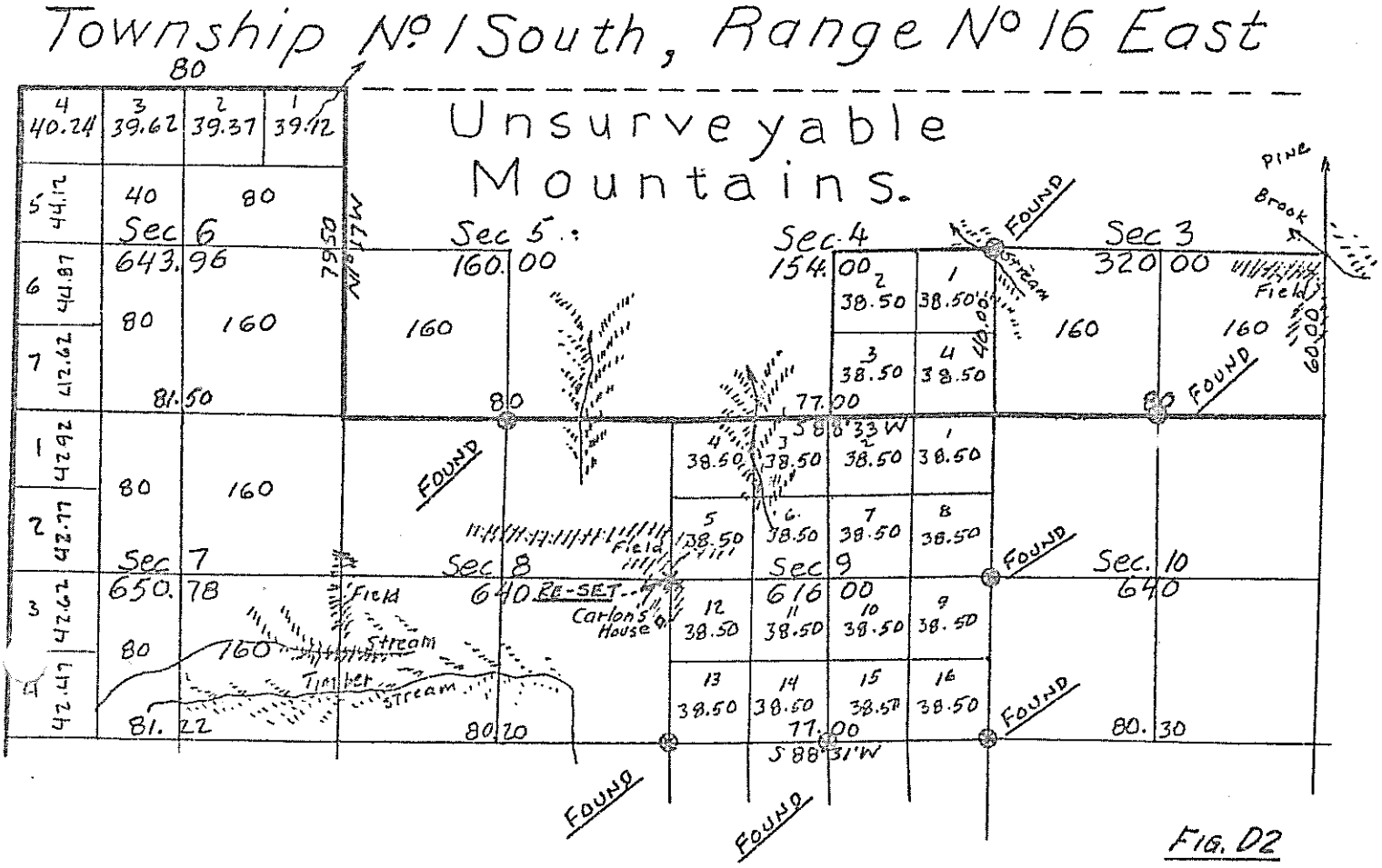


FIG. D2

Problem D3 - Wt. 12.5

The map of PINE FLAT SUBDIVISION was recorded in 1920. Smith acquired Lot 1 from the subdivider in 1922. In 1935 Smith conveyed "Lot 1 except the West 400 feet" to Jones. In 1965 Smith conveyed "the West 400 feet of Lot 1" to Green. Green retains you to survey this conveyance. The subdivision map shows the west line of the subdivision to be the section line. The original subdivider held title to land only in section 10.

REQUIRED:

The plat below shows the pertinent findings of your survey. Discuss the findings of your survey, explain how you would inform your client of your findings, and how you would complete the survey.

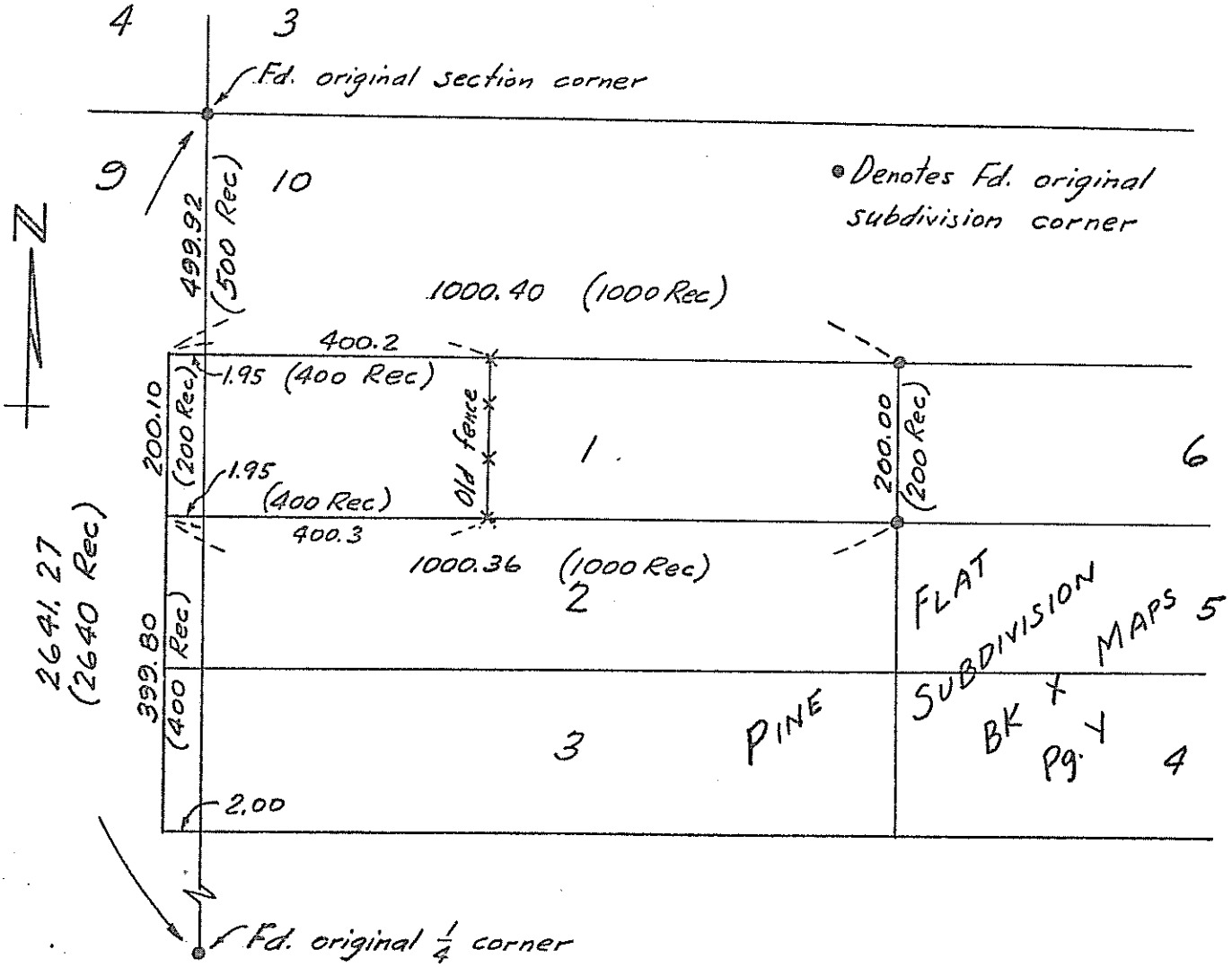


FIG. D3

Problem D4 - Wt. 12.5

A street is to be constructed for a recreational subdivision. The contour map, profile, and cross section for a portion of this street are shown on the following page.

REQUIRED:

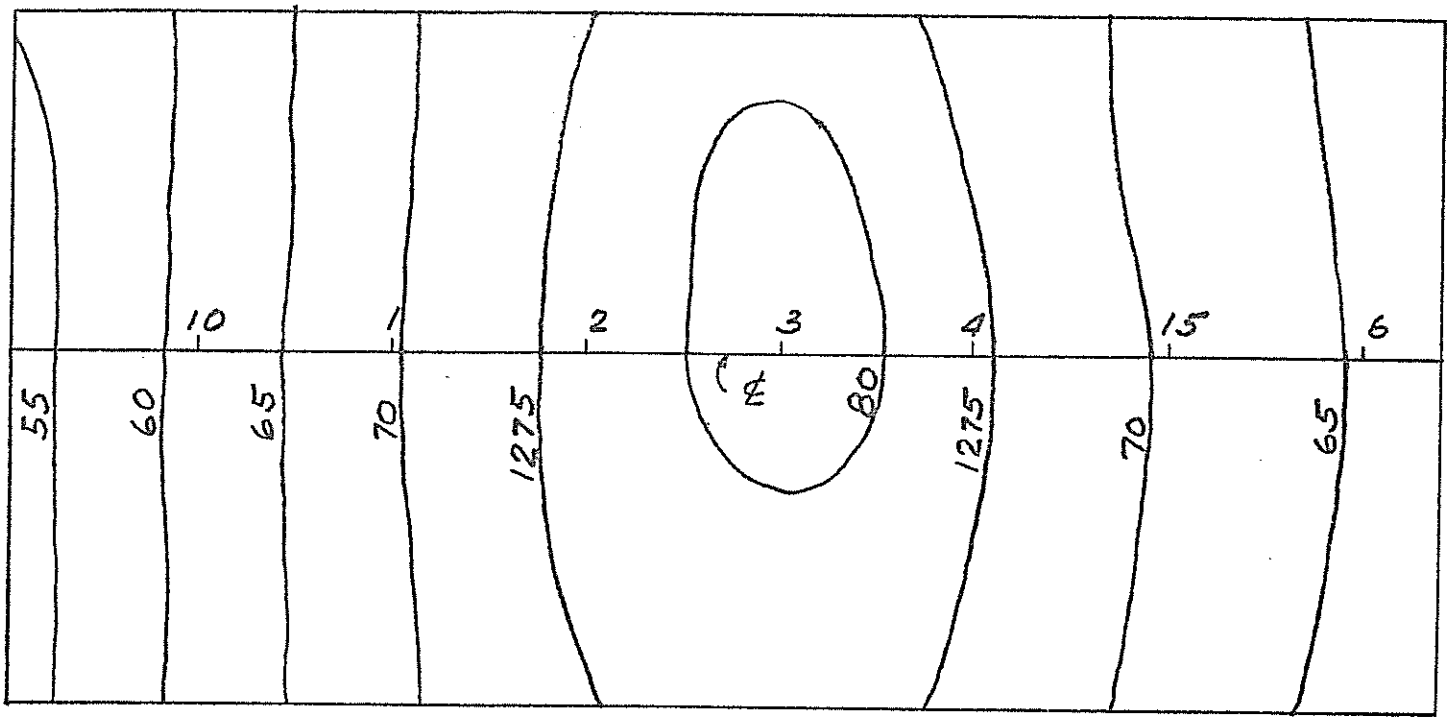
a What is the cut at Station 12 + 50 to finish grade at centerline?

b The centerline is in cut between what stations? (Give answer to nearest foot.)

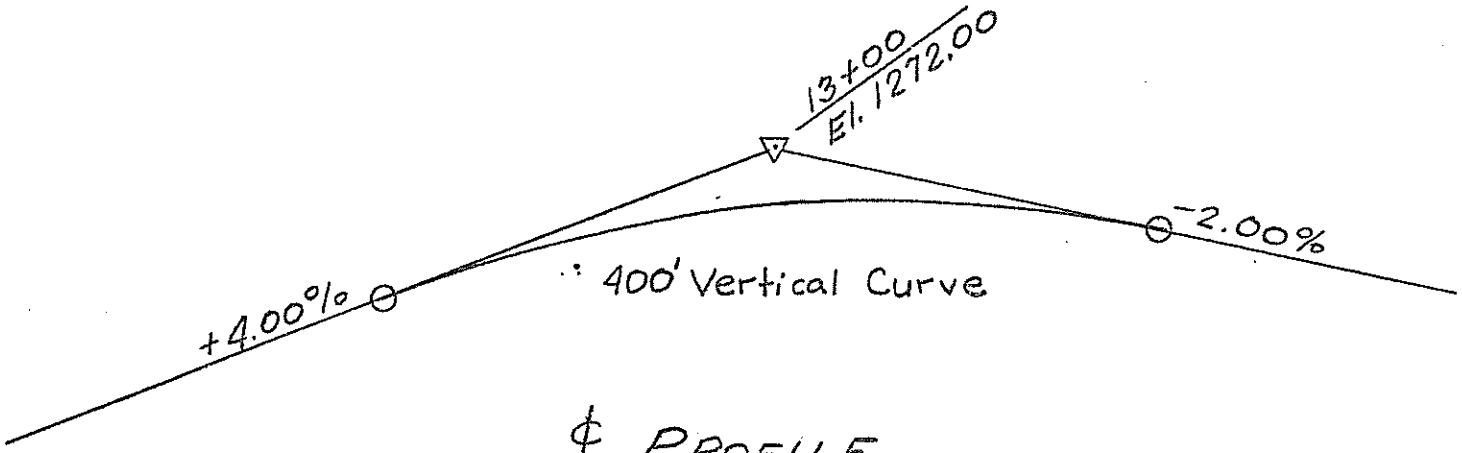
c At Station 10 + 50, the right slope stake is how many feet from the centerline?

d How many cubic yards of excavation are required between Stations 10 + 00 and 10 + 50?

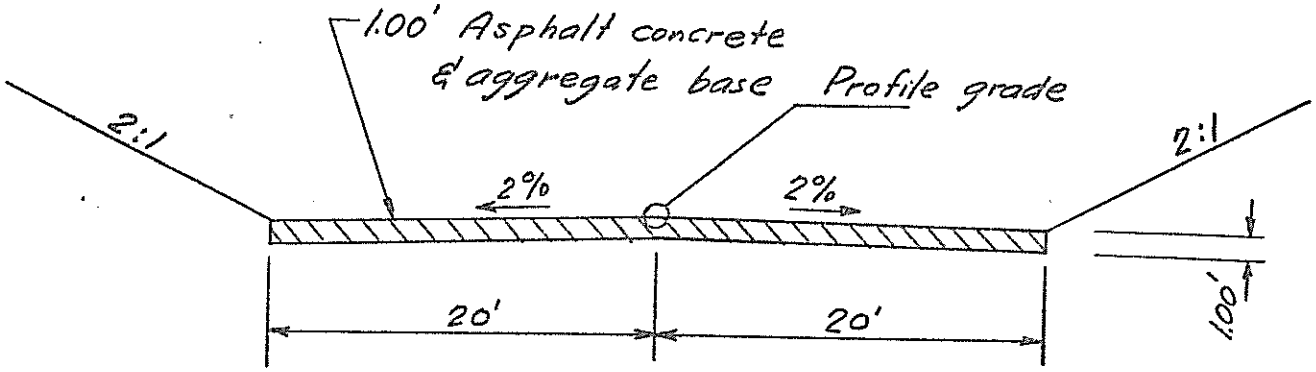
Problem D4 - Wt. 12.5 (Continued)



CONTOUR MAP



℄ PROFILE



CROSS SECTION

Problem D5 - Wt. 12.5

A flight of aerial photography is to be taken for the purpose of determining earthwork quantities by the method of photogrammetric cross sections. The nominal focal length of the aerial camera will be 6 inches to produce an average photo-scale of 1:3000. Mean ground elevation is 6000 feet, and the control survey is based on California Coordinates at a location where the average grid scale factor is 0.9998946. The cross sections are to be taken on a centerline at full stations calculated on the ground, and a five diameter plotter with electronic digitizing equipment will be used.

REQUIRED:

a What flight altitude should be shown on the flight map?

b What design and dimensions would you recommend for pre-marked photo-control?

c What will be the scale of the cross section manuscript?

d What kind of material would you use for the cross section manuscript? Outline the steps necessary to prepare the manuscript.

e What is the interval in inches of each full station on the manuscript?