LS-A

August 1968

LAND SURVEYOR - 1968

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 If a tape is read on the wrong side of the foot mark, for example - as 60.03 rather than 59.97, this would be classed as

A a random error

B a systematic error

C an accidental error

D a human error

E a mistake

2 The right that an owner of land bordering on a river has with respect to the water flowing in the river is called RIPARIAN right.

3 An instrument using a modulated light wave pulse to determine distance in land surveying is a Geodimeter.

4 To determine the true altitude of the sun by measurement with a transit, the observed vertical angle to the center of the sun must be corrected by

A subtracting the parallax angle

B subtracting both parallax and refraction angles

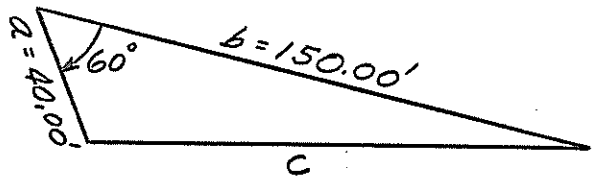
C subtracting the parallax angle and adding the refraction angle

D adding both parallax and refraction angles

E adding the parallax angle and subtracting the refraction angle

5 In the triangle shown below, the length of side c is _____ feet. (Give answer to nearest 0.1 foot)

60° Functions
sin = .86603
cos = .50000
tan = 1.73205



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

6 The magnetic bearing of a line which was run in 1875 was recorded as S52°16'W. At that time the magnetic declination was 3°53'E. What magnetic bearing should be used in retracing this line in 1968, if the magnetic declination is now 0°42'W? S 56 51 W

7 In subdividing a township into sections, the government surveyors segregated a large lake and ran a meander line around it. The owner of a parcel of land contiguous to the lake would take title to

A the meander line

B the high water line

C the low water line

D the thread of the lake

E the mean water level line

8 In ordinary leveling procedure the horizontal lengths of the backsights and foresights are balanced as nearly as possible to neutralize possible error due to

A the bubble not being exactly centered at the instant of sighting

B the horizontal cross hair not being in a plane perpendicular to the vertical axis

C the line of sight not being horizontal when the bubble is centered

D parallax

E inconsistency in plumbing the rod

9 An aerial photograph was taken with a 8.25 inch focal length camera. If the altitude above the average ground surface was 10,000 feet, and the negative was 9"x 9", how many acres of ground were included in the photograph? 2732 A

10 The common method used to prolong precisely a straight line from a backsight with a transit is called Double 0.

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

A an agreement deed

B a deed of trust

C a warranty deed

D a grant deed

E a quit claim deed

12 A field party measured the atmospheric temperature with a centigrade thermometer and found the reading to be 40°C. This indicated a temperature difference of 36 °F. from the usual temperature of standardization of a steel tape.

13 The three sides of the PZS spherical triangle which are used as the basis for determining the azimuth of the sun are

(A) polar distance, zenith distance, and co-latitude

B polar distance, co-declination, and latitude

C co-latitude, co-declination, and polar distance

D zenith distance, co-latitude, and co-altitude

E latitude, declination, and altitude

14 A fundamental difference in boundary location procedure of metes and bounds descriptions and subdivision lot descriptions is the absence of junior and senior rights in the metes and bounds descriptions.

15 In the quadratic equation $6x^2+7x= 193.13$, the value of x is equal to _____.

16 The government field notes for the line between sections 7 and 18 show the distance between section corners to be 78.35 chains. Your measurement between the same two corners is 5230.50 feet. The N¼ corner is lost. You would set the 1/16 corner on the north line of the NW¼ of Section 18, _____ feet east of the NW corner of Section 18.

17 Monuments that can neither be proved to be correct, nor incorrect, and which are commonly accepted as being correct may be accepted by USE.

18 A parcel of land was measured with a steel tape at a temperature of 54°F. With no correction for temperature, the land area was found to be 35.164 acres. Assuming that no other corrections were necessary, what is the area of this parcel after correction for temperature? 35.158A

19 A map of the United States, on which is superimposed lines of equal magnetic declination, and lines of annual change in declination, is called a Isogonic chart.

20 The permanent principal point of reference for horizontal positions in the North American Datum is located in

A California

B Nebraska

C Nevada

D Oklahoma

(E) Kansas

21 Where, from natural causes, land forms by imperceptible degrees upon the bank of a river, either by accumulation of material, or recession of the water, the process is called

A avulsion
B reliction
C accretion
D erosion
E revulsion

22 A boundary line 2635.54 feet long must be laid out on the ground. A 300-foot tape is to be used, and it is found by comparison with a standard to be 300.04 feet long. Neglecting other correction factors, what taped length must be measured to stake this boundary line? 2635.19

23 At the location of this examination on this morning, Greenwich Civil Time could be determined by

A adding 8 hours to the local civil time
B subtracting 7 hours from Pacific Daylight Saving Time
C subtracting 8 hours from Pacific Standard Time
D adding 8 hours to Pacific Standard Time
E adding 9 hours to Pacific Daylight Saving Time

24 The sides of a triangular parcel ABC are a = 55 feet, b = 35 feet, and c = 50 feet. The area of this parcel is _____ square feet. (Give answer to nearest 0.1 square foot) 1254.316

25 The right or power of government to take private property for public use upon a payment to the owner of a just compensation is called _____.

26 An aerial camera has a focal length of 89.16 mm. This focal length is 3.501 inches.

27 In a normal township, the center of Section 6 would be established

A at a point 40 chains proportionate measurement west along the E-W centerline from the E¼ corner
B at the midpoint of the N-S centerline
C by double proportionate measurement along the centerlines
D at the intersection of the centerlines running between opposite 1/4 corners
E at a point 40 chains north along the N-S centerline from the S¼ corner

28 In topographic mapping, interpolation consists of

A drawing contour lines through points of known elevation

B correctly spacing contour lines by proportionate distance measurements

C connecting points of equal elevation

D reducing or enlarging the scale of the map

E drawing in freehand smooth contour lines

29 Evidence which is not contained in a written description, but which is used to clarify the description is called _____ evidence.

30 In the California State Coordinate System

A the mapping angle is a function of longitude

B the scale factor is a function of longitude

C the cylinder is the geometric form used for the projection

D the projection used is the Mercator projection

E there are 6 zones

31 The degree of curve used in staking a circular highway curve is

A equal to the central angle divided by the length of the curve

B equal to the deflection angle between two successive stations on the curve

C an angle subtended by an arc of 100 feet

D an angle subtended by a chord of 100 feet

E equal to the deflection angle between the tangents

32 At station 21+00 the invert of a 6" diameter sewer pipe is located at elevation 112.12 feet. The pipe grade to station 35+00 is minus 0.15%. A house service will be connected at Station 35+00. If the floor elevation in the house is 95.21 feet, can the house sewer connection be properly served by gravity?

No

33 The particular location of this examination room can be located on the earth's surface by identifying the coordinates of latitude and longitude. What are the corresponding identifying coordinates that will identify the coordinates of a star on the celestial sphere?

34 The section corner common to sections 19, 24, 25 and 30 is lost. If no other pertinent corners are lost, you should reestablish the lost corner position

A by single proportionate measurement between the W¼ corner of section 19 and the W¼ corner of section 30

B by single proportionate measurement between the N¼ corner of section 30 and the N¼ corner of section 25

C by double proportionate measurement between the W¼ corner of section 19, the W¼ corner of section 30, the N¼ corner of section 30 and the N¼ corner of section 25

D by double proportionate measurement between the E¼ corner of section 19, the E¼ corner of section 30, the N¼ corner of section 25, and the N¼ corner of section 30

E halfway between the E¼ corner of section 25 and the E¼ corner of section 24

35 A certain block in a subdivision shows lots 1 to 9 inclusive with 50 foot frontages, and lot 10 with 53.62 feet. On retracement, you find the block corner and the two front corners of lot 5. Would you determine the correct frontage length of lot 8 by:

A placing all excess or deficiency between block corners in Lot 10

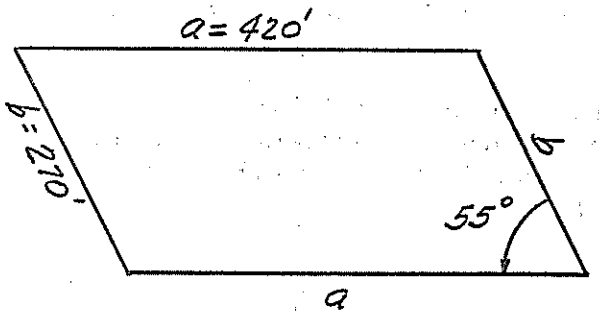
B placing all excess or deficiency in Lots 6 to 10 inclusive in Lot 10

C prorating all excess or deficiency between block corners in all the lots and the streets at the ends of the block

D prorating all excess or deficiency in Lots 6 to 10 inclusive in these lots only

E prorating all excess in Lots 6 to 10 inclusive in these lots and the street bordering Lot 10.

36 The area of the trapezoid shown below is _____ acres. (Give answer to nearest 0.01 acre)



sin 55° = .819
cos 55° = .574
tan 55° = 1.428
cot 55° = .839

37 An observation to determine the latitude of the place of observation is best made on

A The sun at 12:00 noon Standard Time

B polaris at any time

C polaris at either elongation

D polaris at either culmination

E the sun at any time

38 Some telescope objectives and eyepieces use lenses which consist of crown and flint glasses sealed together, and which tend to refocus monochromatic images into a single sharp image. These are called _____ lenses.

39 A topographic map is drawn to a scale of 1:50,000. A straight line is drawn on this map in an area where the contours are equally spaced. The line cuts across the contour labeled 2500 at Point B, and across the contour labeled 2100 at Point A. The scaled distance from A to B is 2 1/8 inches. The ground slope from A to B is 4 1/2 percent.

40 If you knew the date of conveyance, and the name of the buyer, you could determine the book and page of the record of the conveyance in the recorder's office by referring to the _____ index.

41 The value of y in the following pair of equations is equal to _____.

$3x + 7y = 50$

$2x + 3y = 20$

42 In subdividing a township just south of a standard parallel, the government surveyors set a monument to mark the NW corner of section 2. Assuming that all monuments are found, you should determine the correct position of the NW corner of section 2 by

A double proportionate measurement between the nearest corners N, S, E, and W

B moving along the line, or its extension, between the monuments set to mark the NW corner and the W¼ corner of section 2, to the point of intersection with the correct line of the standard parallel

C using record distances from the W¼ corner of section 2 and the nearest corner on the standard parallel

D accepting the position of the monument set to mark the NW corner of section 2

E single proportionate measurement along the standard parallel

43 In a triangulation net the use of small angles is usually deemed undesirable because

A they increase the strength of figure

B they decrease the strength of figure

C they increase the cost because more angle turns are required

D they make the calculations more difficult

E the insections of the angle sides are poor thus permitting an increase in errors

44 On a mass diagram as used on a highway project, the rising part of the curve indicates

A overhaul is required

B freehaul

C excavation

D embankment

E a change in the profile grade for this particular section of the project

45 From point A at longitude 122°40' and latitude 38°05' and where the mapping angle is minus 1°19'35.41", point B bears N27°32'15"E. To the nearest second, the grid bearing of the line from B to A is _____.

46 The azimuth, from the south, from station A to station B is 306°22'18.543". If the convergence of meridians through A and B is 14.223", the azimuth from station B to station A is _____.

47 On a topographic map, the contour interval is

A the scaled distance between adjacent contour lines

B the difference in elevation between adjacent contour lines

C the slope distance between adjacent contour lines

D the elevation above mean sea level

E the change in elevation per unit of horizontal distance between adjacent contour lines.

48 When coordinates in the California Coordinate System are shown for points on a record of survey map the map may not be recorded unless

A the County Surveyor certifies that the computations are correct

B the County Surveyor certifies that the surveyor who prepared the map has filed field notes showing ties to a control point

C the surveyor who prepared the map certifies that he has tied to acceptable control points of known coordinates

D the map shows, or is accompanied by a map showing, the control scheme through which the coordinates were determined from points of known coordinates

E the surveyor who prepared the map certifies that adequate monuments were placed at all points where coordinates are indicated on the map.

49 The government field notes show a call at 40 chains for a quarter corner and the next call at 79 chains 15 links for a section corner, the distance between these two corners is exactly _____ feet.

50 The vernal equinox occurs in

A January
B March
C June
D September
E December

51 A map showing the elevation on a grid superimposed on a borrow pit excavation. The process of interpolation would involve

A connecting the points of known equal elevation

B drawing smooth freehand contours

C tracing the contours

D spacing the contours by proportion between known points

E locating the ridge and valley control lines

52 The USGS standard quadrangle maps are often drawn to a scale which is indicated as 1/24000. This means that

A one map width equals 24000 feet

B one foot on the map equals 24000 inches

C one foot on the map equals 24000 feet

D one inch on the map equals 24000 feet

E one unit of any measure is equal to 24000 units on the ground divided by twelve

53 The expansion of a triangulation net which is done by the older convention of turning angles from points of determined location will depend primarily upon the

A effects of the topography

B total number of repetitions that angles are turned

C reduction to center precision

D strength of figure

E accuracy of the measurements for base line

54 When a pavement or roadway is superelevated in order to compensate for the centrifugal force on a curve, the superelevation rate in feet per foot will vary inversely as the curve radius and the

A momentum of the vehicle

B velocity of the vehicle

C square root of the velocity of the vehicle

D square of the velocity of the vehicle

E velocity of the vehicle and the side friction factor

55 Two separate highway cross sections were taken at stations that are 100 feet apart. One section is in cut and the other section is determined to be a straight line. The volume of earth work between these two sections is most accurately determined by the

A prismoidal method

B coordinate method

C average end area method

D DMD method

E use of the grade and the ground rod

56 The standard type subtense bar has sighting marks that are set exactly at 2 m apart. When a sighting is made, the

A vertical angle from the transit to the bar is not measured, as it is not necessary to reduce the slope distance to the horizontal distance

B horizontal angle measured is dependent of the inclination of the line of sight

C accuracy obtained in the horizontal measurement will be 0.1 feet in 1000 feet

D bar can be sighted in any position so long as it is leveled accurately

E error in a single measurement will increase in proportion to the square of the distance measured

57 The mapping angle θ as used in the California State Plane Coordinate System is affected directly by changes in

A latitude

B longitude

C atmospheric conditions

D the convergence of meridians

E the offsets from the line of reference

58 When a township is surveyed and the measurements do not fit exactly to the theoretical dimensions, the proration of the excess and/or deficiency is usually assigned to

A the North and East tier of sections

B the North and West tier of sections

C the South and West tier of sections

D the West tier of sections

E the North tier of sections

59 The procedure known as reduction to center must be applied in triangulation in order to

A compensate for the convergence of meridians

B calculate the spherical excess

C prorate the standard error

D determine if the instrument is directly over the point

E correct for an instrument that may be located over an eccentric station

60 The position of a given star is usually identified on the celestial sphere by

A the equation of time and the hour angle

B the hour circle and the prime meridian

C the right ascension and the declination

D the declination and the true bearing

E the sidereal hour angle and the right ascension

61 Time can be measured either according to the true sun, or according to what is known as the "mean" sun. At different periods of the year, the time factor between these two suns is identified as the

A sidereal hour angle

B difference between sun time and sidereal time

C universal hour angle

D equation of time

E standard hour angle

62 The perimeter tract of land which contains a new subdivision was surveyed with a traverse that was made up of seven courses. The angles that were measured were on the side of the traverse toward the tract. In this case, the summation of the measured angles would total

A 1260°

B 1170°

C 1080°

D 900°

E 720°

63 The center of a section of land as defined in legal terms is

A the point of intersection of a straight line run from the NW corner to the SE corner, and a straight line run from the NE corner to the SW corner

B a point which measured 40 chains West from the right-hand meridian line, and 40 chains North from the near base line

C the midpoint of the section based on an equal distribution of the total acreage

D the point identified at the intersection of two straight lines drawn between the N-S and the E-W one-quarter section corners

E a point which is 40 chains South of the base line at the North side of the section, and is 40 chains West of the meridian line

64 It is sometimes necessary to assign a weighted value to the calls of a deed for the purpose of determining the intention. Which of the following would have the least weight in such a determination?

A adjoiner calls

B quantity calls

C artificial monuments

D natural monuments

E course and distance calls

65 In the metes and bounds method of property description, the point of beginning is one that

A is more controlling than the other designated points

B always is located on a highway center line or R/W line for easy reference

C is never a corner of the described property

D is selected primarily for certainty of identity

E is referenced to a section corner, or a one-quarter section corner

66 The base-height of a 6" focal length photograph on a 9" x 9" format with 70 percent overlap is

A 2.22 to 1

B 1.05 to 1

C 0.95 to 1

D 0.60 to 1

E 0.45 to 1

67 The nadir point on a 6" focal length photograph tilted 15° is _____ inches from the principal point.

15° Angle Functions

sin	cos	tan	cotan	vers	exsec
.25882	.96593	.26795	3.73205	.03407	.03528

A 1.55

B 1.61

C 5.80

D 22.39

E 0.20

68 Ground relief as identified by a small hill will show on an aerial photograph as

A no different than surrounding features

B a high spot

C a low spot

D unimportant and not measurable

E displacement of images.

69 An aerial camera which has a focal length of 8" and which is operated at an altitude of 15000 feet over terrain which is 1200 feet above sea level will deliver an aerial photograph to a scale of

A 1/20700
B 1/15000
C 1/12000
D 1/25000
E 1/27000

70 When working through procedures for relative orientation - which of the following would be the point around which rotational motions would normally be made

A isocenter
B nadir point
C principal point
D nodal point
E focal point

71 A camera which contains a glass plate on which is etched an accurately ruled grid is also known as a

A hiran
B shoran
— C reseau
D halation
E goniometer

72 When a double convex lens is used as a magnifier the image will be

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

73 Identify the statement which holds the only correct relationship

A 100 grads = 360 degrees

B 1 grad = 1/100 radians

C 1 degree = 9/10 grads

D 1 grad = 9/10 degrees

E 200 grads = 2000 mils.

74 An area was photographed from an altitude of 21000 feet with a wide angle camera which had a 4" focal length. The area covered by the photograph was

A 79.9 sq. miles

B 97.5 sq. miles

C 43.7 sq. miles

D 87.5 sq. miles

E 63.0 sq. miles.

75 Two separate geometric figures are represented by the equations

$$2x - 3y = -6 \quad \text{and}$$

$$4x^2 + 9y^2 = 36$$

The intersection points of these two elements are identified by which of the following combinations?

A (0, + 3) (0, + 2)

B (0, 0) (+3, + 2)

C (-3, - 1) (+2, 0)

D (-3 + 1) (+2, - 2)

E (-3, 0) (0, +2)

END OF PART A

L S

LAND SURVEYOR - 1968

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. 5

A base line was measured in the field a total of 10 times with the following results

622.121	622.128	622.096	622.091	622.107	622.119
622.131	622.115	622.103	622.123		

a What is the most probable length of the line?

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

c What is the probable error of any one of these measurements?

d What is the probable error of the mean?

e What is the 90 percent error?

Problem B2 - Wt. 5

Define in your own words each of the following terms

a nadir point	f focal length
b principal point	g Porro-Koppe principle
c swing	h Scheimpflug principle
d tilt	i relief displacement
e isocenter	j principal line

Problem B3 - Wt. 5

Sketch in your workbook a circular highway curve layout connecting two tangents. Place the proper symbols for all elements that are used in calculations or staking, in their correct locations on the sketch.

Write the common equations used to determine the six principle elements of the curve.

Problem B4 - Wt. 5

Write the respective stadia equations for H and V with an inclined line of sight. Define all terms used, and explain how any constants in the equations can be determined in the field.

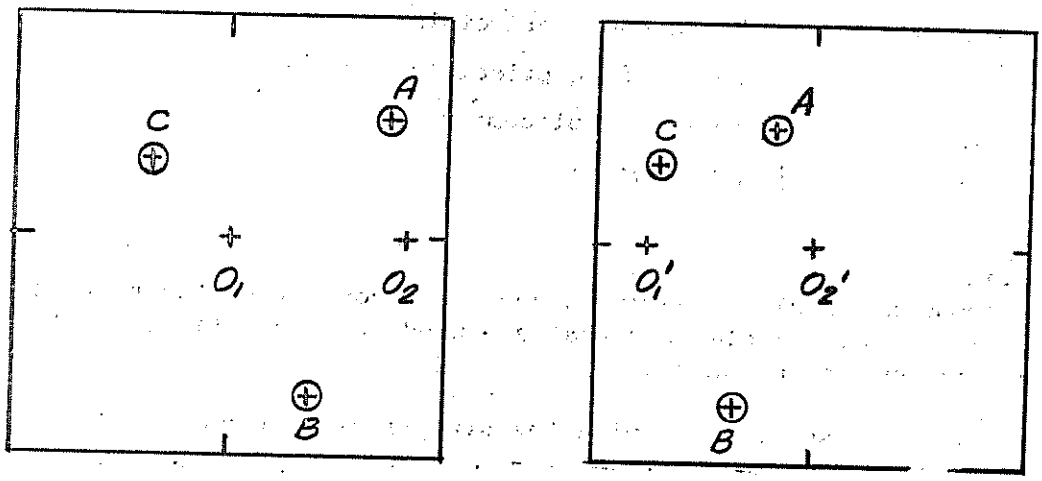
Problem B5 - Wt. 5

Define each of the following astronomical terms

a culmination
b elongation
c declination
d hour angle
e right ascension
f polar distance
g ecliptic
h vernal equinox
i zenith distance
j nadir

Problem B6 - Wt. 5

The following sketch shows a pair of overlapping vertical photographs. These were taken with a lens of 6" focal length, and they are shown ½ size in the stereogram. The average scale was 1:18,000. The principal points and conjugate principal points of each photograph, and the photographic images of ground points A, B, and C are shown. If the elevation of point A is 500 feet, what are the elevations of points B and C?



Problem B7 - Wt. 4

You are to determine the horizontal length of a line which lies on a 20° slope with a theodolite and a subtense bar. Explain the step by step procedure necessary to accomplish this assignment.

Problem B8 - Wt. 4

The following field notes are given for a road cross section

Station	Cross Sections				
4 + 48	F6.8 / 20.2	F2.3 / 6.0	F2.7	F3.0 / 4.0	F7.0 / 20.5
4 + 00	F3.2 / 14.8	F6.8 / 9.0	F5.6	F3.0 / 9.0	F4.8 / 17.2

Width of road base is 20 feet, and side slopes are 1½:1

a Compute the cross sectional area at each station in square feet

b Compute the volume by average end area method in cubic yards

c Compute the volume by the prismoidal method in cubic yards

Problem B9 - Wt. 4

According to the Subdivision Map Act, a Parcel Map must comply with certain provisions. Describe in your own words each of the following provisions

a What shall the parcel map show?

b Is the parcel map intended to show only divisions of land which are not included in the definition of a subdivision?

c What certificates appear on the parcel map?

d What are the requirements regarding materials, size and margins?

Problem B10 - Wt. 4

Three-wire levels were run with a Yard Rod from BM 1 at 206.481 feet elevation to BM2 with two setups. The three wires were read in proper sequence with the following results:

1	3.897,	3.825,	3.751
2	0.734,	0.658,	0.581
3	2.694,	2.631,	2.569
4	1.248,	1.186,	1.125

Set up the field notes in proper form and determine the elevation of BM2.

Problem B11 - Wt. 4

A +6 percent grade meets a -2 percent grade at Station 49+00 whose elevation is 866.20 feet. The length of the proposed vertical curve is 8 stations.

a What is the rate of change of grade?

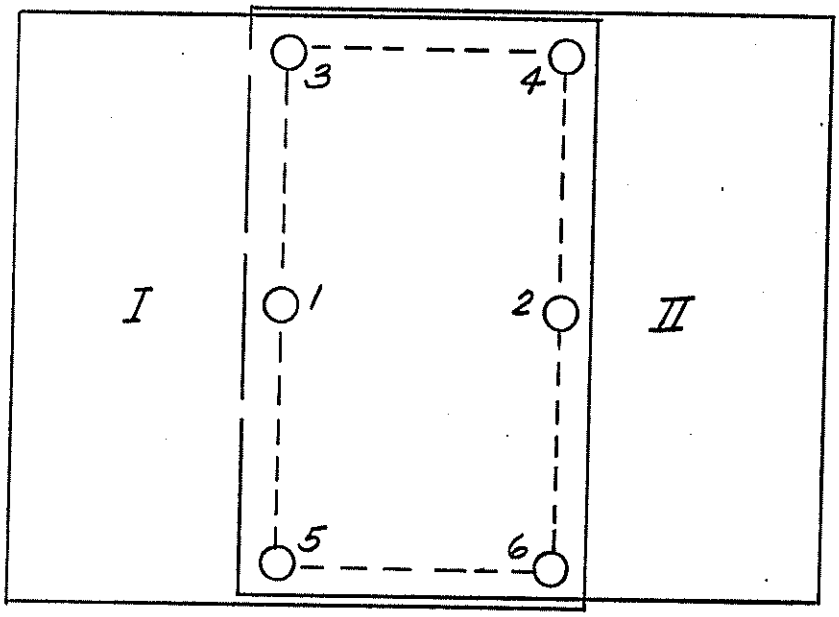
b What is the offset from the P.I. to the cruve?

c What is the elevation at station 52+00 on the curve?

d What is the station at the highest point on the curve?

Problem B12 - Wt. 3

Shown below is a sketch showing the overlap area of the projection of two diapositives. List briefly, in the order of their performance, the motions to be given to each of the two projectors to remove Y-parallax from the six points.



Problem B13 - Wt. 3

Line AB bears N16°33'E a distance of 400.00 feet.

a What is the latitude of AB?

b What is the departure of AB?

c What is the azimuth from the south of line AB?

d If the magnetic declination is 17°28'E, what is the magnetic bearing of BA?

16°33' Angle Functions

sin	cos	tan	cotan
.28485	.95857	.29716	3.36516

Problem B14 - Wt. 3

Define each of the following terms

a agreement deed

b easement

c common report

d color of title

e escrow

f presumption

Problem B15 - Wt. 2

Equivalents of measurement are as follows:

a 360 degrees = _____ grads

b one circular mil = _____ degrees

c one meter = _____ inches

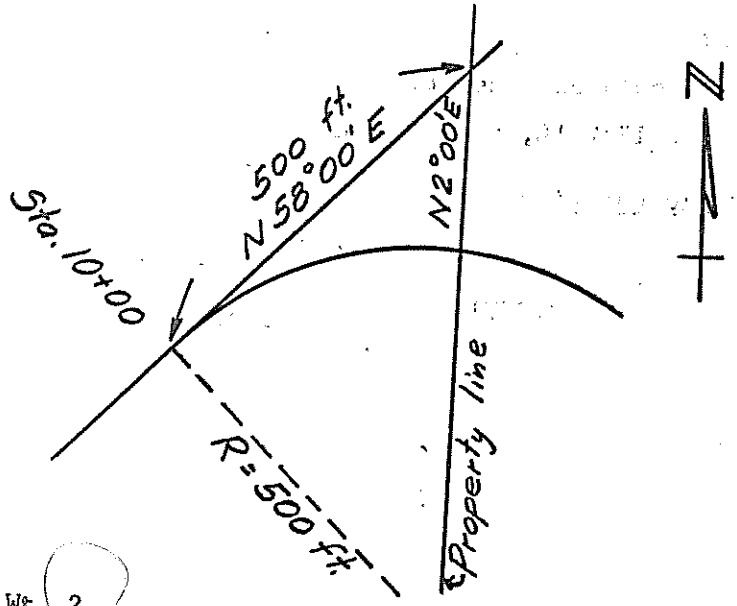
d one rod = _____ feet

e one chain = _____ feet

f 360° = _____ radians

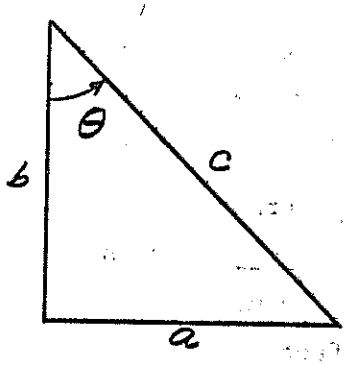
Problem B16 - Wt. 4

Referring to the sketch below, at what station does the highway curve cross the property line? (Slide Rule Accuracy.)



Problem B17 - Wt. 2

In the right triangle shown below, a is 90 feet and b is 120 feet. What is the decimal value of each of the following functions of Θ?



a sine
b cosine
c tangent
d secant
e versine
f exsecant

Problem B18 - Wt. 3

Define each of the following terms:

a extrinsic evidence
b parole evidence
c adverse possession
d accretion
e reliction
f thread of stream

Problem B19 - Wt. 2

An open traverse ABCDEF was run with line AB bearing S88°23'E, and the following angles were turned

a 35°10' left deflection at B

b 125°16' right deflection at C

c 139°37' left deflection at D

d 116°43' angle to the right (traverse angle) at E

What is the bearing of line EF? Show your computations.

Problem B20 - Wt. 2

Name and describe two types of vernier that are in general use. If the horizontal circle of a transit is divided to 20 minutes and the vernier has 40 spaces equal to 39 spaces on the circle, what type of vernier was used and what is the least count of this vernier?

Problem B21 - Wt. 2

Convert each of the following into feet and hundredths of a foot.

a 7' - 9 3/4"

b 7 yds, 2 ft. and 11 in.

c 2 1/7 miles

d 12.0 meters

e 1 chain and 22 links

f 9 rods

Problem B22 - Wt. 2

Indicate whether the following is an accidental error, a systematic error or a blunder

a Level rod short at bottom

b Sighting at the wrong point

c Mistake in copying field notes

d Failure of eyepiece to focus exactly on target

e Transit not level

f Using tape at above the temperature it was corrected for

g Taking too long a sight with instrument

Problem B23 - Wt. 2

Using the "Logarithms of Numbers" extract shown below find the following:

a The log of 975.62 =

b The antilog of 9.980285 - 10 =

c 97.23 x 990.37 =

d 9.91^5 =

e $\sqrt{96.32}$ =

All work to be done by logarithms.

LOGARITHMS OF NUMBERS

No. 950—Log. 977 No. 999—Log. 999

N.	0	1	2	3	4	5	6	7	8	9	Dif.
950	977724	7700	7815	7801	7008	7052	7008	8043	8089	8135	46
951	8181	8220	8272	8317	8363	8409	8454	8500	8546	8591	46
952	8637	8683	8728	8774	8819	8865	8911	8956	9002	9047	46
953	9093	9138	9184	9230	9275	9321	9366	9412	9457	9503	46
954	9548	9594	9639	9685	9730	9776	9821	9867	9912	9958	46
955	980003	0049	0094	0140	0185	0231	0276	0322	0367	0412	45
956	0458	0503	0549	0594	0640	0685	0730	0776	0821	0867	45
957	0912	0957	1003	1048	1093	1139	1184	1229	1275	1320	45
958	1366	1411	1456	1501	1547	1592	1637	1683	1728	1773	45
959	1819	1864	1909	1954	2000	2045	2090	2135	2181	2226	45
960	982271	2316	2362	2407	2452	2497	2543	2588	2633	2678	45
961	2723	2769	2814	2859	2904	2949	2994	3040	3085	3130	45
962	3175	3220	3265	3310	3356	3401	3446	3491	3536	3581	45
963	3626	3671	3716	3762	3807	3852	3897	3942	3987	4032	45
964	4077	4122	4167	4212	4257	4302	4347	4392	4437	4483	45
965	984527	4572	4617	4662	4707	4752	4797	4842	4887	4932	45
966	4977	5022	5067	5112	5157	5202	5247	5292	5337	5382	45
967	5426	5471	5516	5561	5606	5651	5696	5741	5786	5830	45
968	5875	5920	5965	6010	6055	6100	6144	6189	6234	6279	45
969	6324	6369	6413	6458	6503	6548	6593	6637	6682	6727	45
970	986772	6817	6861	6906	6951	6996	7040	7085	7130	7175	45
971	7219	7264	7309	7353	7398	7443	7488	7532	7577	7622	45
972	7666	7711	7756	7800	7845	7890	7934	7979	8024	8068	45
973	8113	8157	8202	8247	8291	8336	8381	8425	8470	8514	45
974	8559	8604	8648	8693	8737	8782	8826	8871	8916	8960	45
975	989005	9049	9094	9138	9183	9227	9272	9316	9361	9405	45
976	9450	9494	9539	9583	9628	9672	9717	9761	9806	9850	44
977	9895	9939	9983	*0028	*0072	*0117	*0161	*0206	*0250	*0294	44
978	990339	0383	0428	0472	0516	0561	0605	0650	0694	0738	44
979	0783	0827	0871	0916	0960	1004	1049	1093	1137	1182	44
980	991226	1270	1315	1359	1403	1448	1492	1536	1580	1625	44
981	1669	1713	1758	1802	1846	1890	1935	1979	2023	2067	44
982	2111	2156	2200	2244	2288	2333	2377	2421	2465	2509	44
983	2554	2598	2642	2686	2730	2774	2819	2863	2907	2951	44
984	2995	3039	3083	3127	3172	3216	3260	3304	3348	3392	44
985	993436	3480	3524	3568	3613	3657	3701	3745	3789	3833	44
986	3877	3921	3965	4009	4053	4097	4141	4185	4229	4273	44
987	4317	4361	4405	4449	4493	4537	4581	4625	4669	4713	44
988	4757	4801	4845	4889	4933	4977	5021	5065	5108	5152	44
989	5196	5240	5284	5328	5372	5416	5460	5504	5547	5591	44
990	995635	5679	5723	5767	5811	5854	5898	5942	5986	6030	44
991	6074	6117	6161	6205	6249	6293	6337	6380	6424	6468	44
992	6512	6555	6599	6643	6687	6731	6774	6818	6862	6906	44
993	6949	6993	7037	7080	7124	7168	7212	7255	7299	7343	44
994	7386	7430	7474	7517	7561	7605	7648	7692	7736	7779	44
995	997823	7867	7910	7954	7998	8041	8085	8129	8172	8216	44
996	8259	8303	8347	8390	8434	8477	8521	8564	8608	8652	44
997	8695	8739	8782	8826	8869	8913	8956	9000	9043	9087	44
998	9131	9174	9218	9261	9305	9348	9392	9435	9479	9522	44
999	9565	9609	9652	9696	9739	9783	9826	9870	9913	9957	43

PROPORTIONAL PARTS

Dif.	1	2	3	4	5	6	7	8	9	Dif.
46	5	9	14	18	23	28	32	37	41	46
45	5	9	14	18	23	27	32	36	41	45
44	4	9	13	18	22	26	31	35	40	44
43	4	9	13	17	22	26	30	34	39	43

Problem B24 - Wt. 2

The stationing of the P.C. on a highway curve is 307 + 52.51, the central angle is 23°-30' and the radius is 1,050.00 ft. What is the stationing of the P.T.?

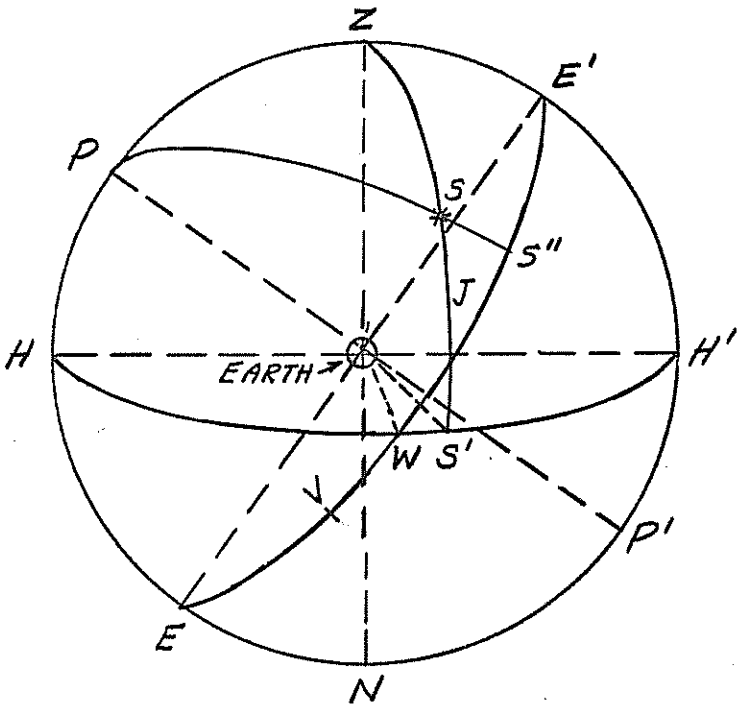
Problem B25 - Wt. 4

A highway embankment is 25 ft. wide at top with side slopes of 2 to 1. The height of the embankment along the center line at Sta. 8+00 is 5' -0" and at Sta. 9+00 is 3' -0". Assume the ground is level perpendicular to the center line. Find the volume of the embankment between Sta. 8+00 and Sta. 9+00 first by the average end area method and then by the prismoidal method.

Problem B26 - Wt. 5

Which letters in the following diagram define the following astronomical terms?

a Spherical triangle
b Celestial poles
c Zenith
d Altitude
e Co-altitude
f Latitude
g Co-latitude
h Declination
i Co-declination
j Nadir



Celestial Sphere

End of Part B