Louis Hall

LS - 1

CALIFORNIA BOARD OF REGISTRATION FOR
CIVIL AND PROFESSIONAL ENGINEERS

August 26, 1964

PART I

1964 LAND SURVEYOR EXAMINATION

Closed Book

Time Allowed - Four Hours

INSTRUCTIONS TO EXAMINEE:

The first day of this examination consists of two parts of four hours each (morning and afternoon). Each part will be graded on the basis of 50 points. The total grading weight for the first day is 100 points.

Part I consists of 75 problems. Each problem has a grading weight of one point. You are required to answer 50 problems of your choice. Only the first 50 answers shown will be graded.

Detach the last sheet from this booklet. This is your answer sheet for this part of the examination. Show the one answer of your choice by entering the letter A, B, C, D, or E in the space provided on the Answer Sheet for the appropriate problem number. Only the answer will be graded. You may use any available space in this booklet for computations. The proctor will supply paper if you need it. Show your identification number on the Answer Sheet only. When you have completed Part I, return only the Answer Sheet to the proctor.

No texts, notes, or reference material is permitted in this part of the examination.

You may keep the examination questions.

SHOW YOUR ANSWERS ON THE ANSWER SHEET

NOTE: Select only one of the letters from each problem that corresponds to your choice as the most nearly correct answer to the statement given. Enter this letter into the appropriate space on the answer sheet.

1. The legal value set by the Congress of the United States for the number of inches in a meter is

   (A) 39.00
   (B) 39.3333---
   (C) 39.44
   (D) 39.30
   (E) 39.37 ✓

2. The weight of one cubic foot of water is usually taken as

   (A) 55 lbs
   (B) 16 "
   (C) 62.5 " ✓
   (D) 8.5 "
   (E) 33 "

3. An old deed description calls for one side of a parcel of land to be "217 chains and 4-1/2 rods" in length. This distance is

   (A) 500 yards
   (B) 14396.25 feet ✓
   (C) 2-3/4 miles
   (D) 2-1/4 miles
   (E) 7198.125 feet

4. The speed of light is approximately

   (A) 186,000 miles per second ✓
   (B) 186,000 feet per second
   (C) 1,860,000 feet per second
   (D) 18,600 feet per second
   (E) 18,600 miles per second

5. One radian is equal to

(A) $\frac{360^\circ}{\pi}$

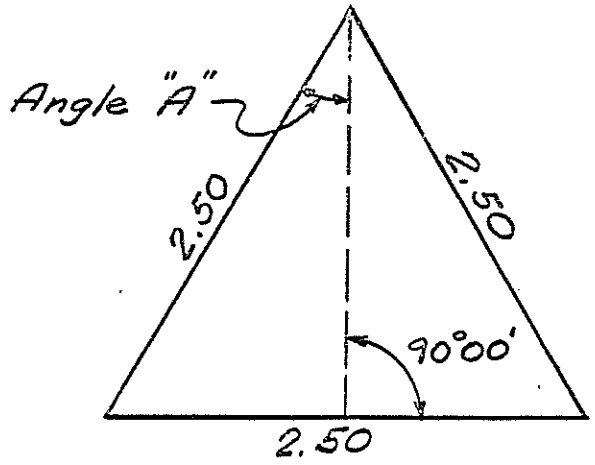
(B) $\frac{2\pi}{360^\circ}$

(C) $60^\circ$

(D) $\frac{\pi}{360^\circ}$

(E) $\frac{360^\circ}{2\pi}$ ✓

6. In the triangle pictured below, the sine of angle A is




(A) 0.707

(B) 0.871

(C) 0.500 ✓

(D) 1.000

(E) 0.070

7. Solve the following equations for X:

$$X + Y = 7$$
$$2X + 3Y = 18$$

$3X + 3Y = 21$
$-2X - 3Y = -18$
$X = 3$

(A) X = -1

✓ (B) X = 3

(C) X = 4

(D) X = 7

(E) X = -9

8. The usual standard temperature for a 100-foot steel tape is

(A) 65 deg F
(B) 78 deg F
(C) 68 deg F ✓
(D) 60 deg F
(E) 55 deg F

9. The wye level differs from the dumpy level because

(A) it is more accurate
✓(B) it has the telescope removable from its supports
(C) it has the telescope rigidly attached to its supports
(D) it is easier to operate
(E) it has a direct reading eyepiece

10. The sum of the following fractions is

+ 1/4"
+ 3/8"
+ 6/32"
+ 5/16"

(A) 1-1/4"
(B) 3/4"
(C) 5/8"
(D) 1-1/8" ✓
(E) 1"

11. The cosine of A = 0.90631
The versine of A = 0.09369

(A) 0.00001
(B) 9.0631
(C) 0.13609
(D) 0.013609
(E) 0.09369 ✓

12. Distance between two points in plane surveying means

(A) meander distance measured with a steel tape
✓(B) horizontal distance
(C) slope distance
(D) vertical distance
(E) distance measured by stadia hairs

13. The Beaman stadia arc is an attachment for the transit which

(A) is graduated in degrees, minutes, and seconds
✓(B) is graduated in per cent
(C) gives vertical distances directly
(D) gives horizontal distances directly
(E) is graduated in mils

14. The distance between Standard parallels in present day use is

(A) 18 miles
(B) 36 "
(C) 42 "
✓(D) 24 "
(E) 12 "

15. A dumpy level is usually tested by the

(A) Transit Rule
(B) Compass Rule
(C) Depression Rule
✓(D) Peg Method
(E) Glockenheimer Method

16. One-sixteenth corners of a section are

(A) set along the section lines at one-sixteenth mile intervals

✓(B) not normally set at the time of the original survey by the Bureau of Land Management

(C) set at the four corners of each one-sixteenth section

(D) restored by double proportionate measurement

(E) set by proportionate measurement between section corners

17. The scales of the slide rule are graduated

✓(A) logarithmically

(B) in the auto-point mode

(C) according to the binary scale

(D) into equal divisions

(E) on the sine curve

18. A steel tape will contract or expand about _____ times as much as a lovar tape.

(A) 10

(B) 20

✓(C) 3

(D) 100

(E) 30

coefficient of expansion
.0000065 steel
.00 00002 Inval
.0000022 Lorar

19. The standard railroad gauge in the United States is

(A) 4' 11"

(B) 4.65 feet

(C) 4' 8-1/2"

(D) 5.00 feet

(E) 4' 7-1/2"

20. You are compiling a manuscript on the Kelsh plotter at a horizontal scale of 1" = 50'. The horizontal scale of the diapositives in the projectors is

(A) 1" = 250'
(B) 1" = 500'
(C) 1" = 50'
(D) 1" = 10'
(E) 1" = 5000'

21. Latitude is

(A) any small circle on the sphere
(B) a great circle passing through the poles
(C) a distance measured East or West from the prime vertical
(D) determined by the angular distance from the zenith to the equator
(E) a plane coordinate

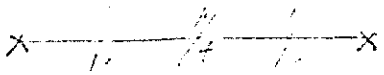
22. The contour interval is

(A) the horizontal distance between any two contour lines
(B) the height above the datum plane
(C) the slope distance between any two contour lines
(D) the vertical distance between any two contour lines
(E) the horizontal distance between two given points on the same contour line

23. A deflection angle is

(A) always turned in a clockwise direction from the backsight
(B) always turned with the telescope normal
(C) always turned with the telescope inverted
(D) the angle between the prolongation of a straight line and a line ahead
(E) the same as an interior angle

24. What is the distance between one-sixteenth corners along the section line?



(A) 10 chains
(B) 16 "
(C) 20 "
(D) 30 "
✓(E) 40 "

25. To read an angle by repetition, it is necessary to

(A) set plates at zero before backsighting for each turning of the angle
✓(B) keep plates set at the value of the angle already turned when backsighting for each turning
(C) turn angles with the telescope normal
(D) turn angles with the telescope inverted
(E) read only the last angle turned

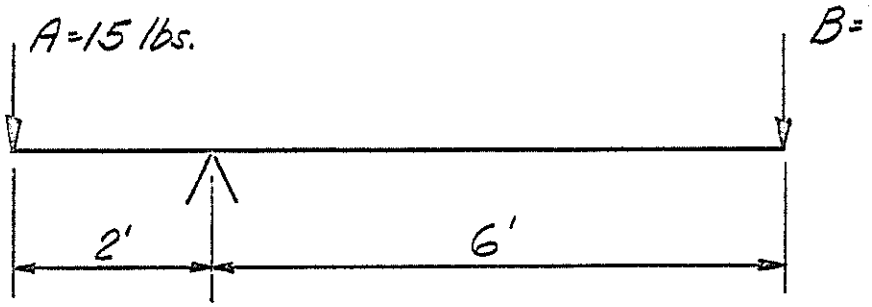
26. Alluvium is

(A) defined as the perceptible removal of a considerable quantity of soil from one portion of land and its deposit or annexation to another land body
✓(B) land which is gradually accumulated either by force of water or recession of the water
(C) the gradual wearing away of the earth by the force of water
(D) defined as the uncovering of land by the recession of water
(E) the property of the state

27. A term used to describe an apparent movement of the cross hairs over the image, due to a slight movement of the eye from side to side, is called

(A) hypertension
(B) refraction
✓(C) parallax
(D) fatigue
(E) astigmatism

28.




A weight of _____ pounds must be placed at B to balance beam A-B.

(A) 1 lb
(B) 10 lbs
(C) 2 lbs
(D) 12 lbs
✓ (E) 5 lbs

29. Isogonic charts are

(A) used to a great advantage when working on the gnomonic projection
(B) used to a great advantage in trilateration
(C) helpful mostly to navigators
✓ (D) an aid in the determination of magnetic variation
(E) of no value anymore

30. The establishing of precise horizontal and vertical control points for detailed surveys is one of the functions of the

(A) Bureau of Standards
(B) California Division of Highways
(C) Corps of Engineers
✓ (D) Coast and Geodetic Survey
(E) General Land Office

31. A single chain of triangles is adjusted in two steps by the

(A) "station adjustment" and the "figure adjustment"

(B) "geometric condition" and the "trigonometric condition"

(C) "geometric condition" and the law of sines

(D) law of sines and least squares

(E) "trigonometric condition" and the "side condition"

32. At 10:00 P.M., Pacific Daylight Saving Time, on July 21, 1963, you made a celestial observation. The time and date at Greenwich was

(A) 3:00 P.M., July 21, 1963

(B) 5:00 A.M., July 21, 1963

(C) 4:00 A.M., July 22, 1963

(D) 3:00 P.M., July 22, 1963

(E) 5:00 A.M., July 22, 1963

33. The standard meridian for determining Central Standard Time is 90° West longitude. When it is 11:15 P.M., Central Standard Time, in Keokuk, Iowa, on June 20, 1964, at Greenwich, England, it is

(A) 7:15 P.M., June 20, 1964

(B) 5:15 P.M., June 21, 1964

(C) 5:15 A.M., June 21, 1964

(D) 4:15 P.M., June 21, 1964

(E) 3:15 A.M., June 20, 1964

34. The center of Section 6 is established by the following procedure:

(A) 1/2 mile due North from the South 1/4 section corner

(B) at the geometrical center of the section

(C) 2640 feet proportionate measure between the East and West 1/4 section corners

(D) 2640 feet North from and on line between the North and South 1/4 section corners

(E) at the intersection of the 1/4 section lines running North-South and East-West through Section 6

35. In a regular township, the only section that has fractional lots along both its North and West sides is

(A) Section 6 ✓

(B) Section 1

(C) Section 30

(D) Section 2

(E) Section 36

36. The centerline of an existing road has been run and the external distances of the curves have been measured. In order to set each curve which would be used to determine the radius of the curves, if $\Delta$ is the deflection angle?

(A) $R = \frac{E}{\cos \Delta}$

(B) $R = E \times \text{exsecant } \Delta$

✓(C) $R = \frac{E}{\text{exsecant } \Delta/2}$

(D) $R = E \times (\text{exsecant}-1)\ \Delta$

(E) $R = E\left(\frac{1}{\cos \Delta} + 1\right)$

37. In direct leveling, which of the following is not true?

(A) a foresight is a rod reading taken on a point the elevation of which is to be determined ✓

(B) the height of instrument is the elevation of the line of sight

(C) a backsight relates to the direction in which the sight was taken

(D) to determine the height of instrument involves the backsight

(E) a backsight is a rod reading taken on a point the elevation of which is known

38. Prolonging a straight line with a transit by double centering eliminates the error caused by the

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

(B) line of sight not being parallel to the axis of the telescope bubble

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

(D) plate bubbles out of adjustment

(E) vertical cross hair not being truly vertical

39. A formula employed for the determination of the long chord of a circular curve is

(A) $\sin A = \frac{LC}{R}$

(B) $\sin A \times 2R = LC$

(C) $\tan \frac{1}{2} A = \frac{\frac{1}{2} LC}{R}$

(D) $\sin \frac{1}{2} A \times 2R = \frac{1}{2} LC$

(E) $\sin \frac{1}{2} A \times 2R = LC$

Assume:

A = central angle

R = radius

LC = long chord

40. The necessary parts of a spherical triangle to determine the azimuth of the sun are

(A) latitude, longitude, and altitude

(B) hour angle, longitude, altitude, and horizontal angle

(C) equation of time, altitude, and declination

(D) longitude, time, and altitude

(E) latitude, altitude, and declination

41. California is divided into _____ Grid Zones.

(A) 2

(B) 6

(C) 8

(D) 7

(E) ?

42. In retracing a government survey, the surveyor finds an original section postmarked as follows:

One notch on the South and one notch on the East.

The surveyor knows he is at the corner common to

(A) Sections 1, 2, 11, and 12 ✓

(B) Sections 14, 22, 15, and 23

(C) Sections 25, 26, 35, and 36

(D) Sections 5, 6, 7, and 8

(E) Northeast corner of Section 36

43. In ordinary leveling, if you keep your foresight and backsight distances nearly equal, what source of error do you eliminate?

(A) horizontal cross hair not truly horizontal

(B) parallax

(C) rod not standard length

(D) earth's curvature and refraction ✓

(E) bubble not exactly centered at instant of sighting

44. When the coordinates of two points, A and C, are known, which of the following formulae would you employ to determine the bearing of the line connecting these two points? Let B equal bearing of line, d equal departure, and l equal latitude.

(A) $\sin B = \frac{d}{l}$

(B) $\tan B = \frac{l}{d}$

(C) $\cos B = \frac{l}{d}$

(D) $\tan B = \frac{d}{l}$ ✓

(E) $\sin B = \frac{l}{d}$

45. A Spanish Grant line intersects a township 2-1/4 miles West of the East boundary of the township for the full length of the township. What is the first number of the section of the township adjacent to the grant line?

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

46. A client desires to patent the "Lucky Strike" Placer Mining Claim, and requests you to survey his claim.

As a licensed land surveyor, you will

(A) charge him no more than the statutory fee of $500
(B) refer him to a Deputy United States Mineral Surveyor
(C) perform the survey and write him a legal description of the claim, which will contain a tie to a recognized section corner
(D) file a Record of Survey with the County Surveyor
(E) refer the lines of the survey to the true meridian and tie one corner to a recognized section corner

47. The station of the B.C. of a curve = 32 + 69.07
The central angle of the curve = 37° 30'
The degree of curve, based on arc definition = 02° 00'
The station of the E.C. =

(A) 42 + 06.07
(B) 69 + 99.07
(C) 72 + 06.09
(D) 51 + 44.07
(E) 37 + 32.00

48. You are required to set a point 300 feet distant at a right azimuth angle of 137° 16' 10" from the backsight. You have a transit graduated only to single minutes. You turn an angle of 137° 16', measure 300 feet, and mark a point. You then invert the telescope, double the angle, and mark the split. How much do you measure from the split toward the right, to complete your task?

(A) 3/8 inch

(B) 0.015 feet

(C) 1/2 inch

(D) 0.03 feet

(E) 0.0003 feet

49. In California, the owner of a building that encroaches into a public street

(A) may acquire title by adverse possession after 10 years

(B) will never acquire title by adverse possession √

(C) may acquire title by adverse possession after 20 years

(D) may acquire title by "de teum facto"

(E) may acquire title if the street was in existence prior to 1900

50. During the course of an extensive second order leveling program, it becomes necessary to cross a large body of water. Which of the following programs would you be most likely to employ?

(A) set up two levels, one on each side of the body of water to be crossed, and at the same instant take readings on water surface level

(B) estimate distance across the body of water and apply curvature corrections to rod reading

(C) cross by use of trigonometric leveling

(D) cross by reciprocal leveling

(E) none of the above would be satisfactory

51. A practical method for the determination of the latitude of a place, if no maps or tables are available, is

(A) by observation of the sun at noon

(B) by observation of the sun at sunrise and sunset

(C) by observation of Polaris at eastern elongation

(D) with a dip needle

(E) by observing the meridian altitude of Polaris at succeeding upper and lower culmination and averaging the two recorded readings

52. The closing corners found along a township line

(A) are generally established by double proportionate measurement

(B) control the direction of the North-South section line in an East-West position

(C) may be relied on as the true location of the section corners

(D) were established by recent surveys to control the subdivision of the township

(E) must be used exclusively to determine the true location of the interior section corners

53. A course in your transit and chain traverse is intercepted by a deep precipitous canyon about 400.00 feet in width. You must maintain an accuracy in your work of 1 part in 10,000 parts. To cross this canyon in the most economical manner and maintain the required accuracy you would

(A) make stadia measurements from both sides of the canyon, reading all three wires

(B) obtain the services of a geodimeter

(C) traverse down across the canyon

(D) triangulate

(E) do (A) above, and place whatever error, disclosed by later calculations, in this course

54. You are set up at point B. You read a magnetic bearing of N 40-1/2° W to point A, and a magnetic bearing of N 22-1/4° E to point C. You point your transit at point A and set 0° 00' on the plate. You turn angle ABC by repetition (3 times direct and 3 times reversed). Your final reading is 15° 43' 40". The mean angle is

(A) 02° 37' 15"
(B) 62° 37' 15"
(C) 12° 37' 15"
(D) 365° 43' 30"
(E) 92° 37' 15"

55. The Land Surveyors' Act

(A) permits a licensed land surveyor to prepare improvement plans for minor subdivision streets
(B) permits a licensed land surveyor to prepare improvement plans for any road, but forbids him from designing any other fixed works
(C) does not permit a licensed land surveyor to design any fixed works
(D) permits a licensed land surveyor to design drainage systems for subdivisions only
(E) permits a licensed land surveyor to prepare improvement plans for streets not exceeding 52 feet in width

56. Except where the grant under which the land is held indicates a different intent, the owner of the upland, when it borders on tidewater, takes to the

(A) ordinary low water mark
(B) limits of reliction
(C) lower low water mark
(D) ordinary high water mark
(E) higher high water mark

57. When using a subtense bar, it is necessary to obtain vertical angle readings

(A) to reduce measured distance to horizontal distance
(B) except that reading of vertical angles has no value
(C) at both ends of subtense bar
(D) if you desire to know difference in elevation
(E) to compensate for curvature and refraction

58. Brown grants to Black as follows: The East 20 feet of Lot 17, New Era Tract, to be used for road purposes.

(A) Brown has conveyed fee title to Black

(B) Brown has granted an easement to Black

(C) Brown has granted a revocable permit

(D) Brown has reserved a road easement

(E) Brown has, in effect, dedicated a road to public use

59. In the course of a survey of a lot within a recorded subdivision, an excess of distance is disclosed by field measurement. You would

(A) place all the excess in the public streets

(B) prorate the excess regarding streets the same as lots

(C) prorate the excess in the lots only

(D) place all the excess in the last lot

(E) place all the excess in the lot you are surveying ✓

60. To file a record of survey, based on and showing coordinates based on the California Coordinate System, it is necessary to do one of the following in addition to normal requirements:

(A) show computations

(B) file field notes with County Surveyor

(C) show on the map the traverse or triangulation scheme, and the monuments of origin, of your control surveys ✓

(D) show on the map that brass plate monuments set in concrete were placed at all points where you have indicated coordinate values

(E) none of the above are required

61. One of the following deeds, even though it is properly executed, would not necessarily convey title:

(A) grant deed

(B) gift deed

(C) trust deed ✓

(D) joint tenancy deed

(E) quit claim deed

62. You are required to lay out a building from an architect's plans. The dimensions on these plans are in feet and inches. Using a surveyor's tape, graduated in feet and hundreths of a foot, what measurement would you use to lay off the distance of 30 feet 2 inches? For this problem, disregard temperature and tension corrections.

(A) 30.17 feet
(B) 30.27 "
(C) 30.06 "
(D) 30.16 "
(E) 30.60 "

63. In the retracement of a government survey, you find a considerable discrepancy with the government field notes, both in direction and distance, between two original found monuments. The monuments were verified by you from witness trees called for in the notes. You must

(A) prove which of the monuments is in error, correct the position of the erroneous monument and file a record of survey
(B) remove the erroneous monument, obliterate the corner accessories, place the monument in its correct location, and place like corner accessories, if possible
(C) request the Bureau of Land Management to rectify the error
(D) accept the monuments as found to be true and correct, prorate the error throughout this portion of the line, and file a record of survey ✓
(E) use corners found in adjacent sections to relocate the erroneous corner

64. All quarter-quarter section corners not established by government surveys should be placed on a straight line connecting the section and quarter section corners and placed midway between them, except in

(A) Section 1
(B) Section 6
(C) the North and West tiers of the township ✓
(D) Section 31
(E) any fractional section, the 1/16 corner should be placed at proportionate distance, according to the government field notes

65. To determine the true altitude of the sun, one must

(A) subtract the parallax angle from the measured altitude

(B) add refraction to the measured altitude

(C) subtract refraction from and add parallax to the measured altitude

(D) add both refraction and parallax to the measured altitude

(E) subtract both refraction and parallax from the measured altitude

66. The Porro-Koppe principle in photogrammetry

(A) is a method of mechanical projection

(B) is utilized in the design of the direct projection plotters, such as the Kelsh

(C) is fundamental to the design of printers for making Balplex diapositives

(D) is fundamental to radial triangulation

(E) applies to a method used in some instruments for eliminating the effect of camera lens distortion

67. The radial line method of extending photo control

(A) depends upon slotted stereo-templates

(B) is an approximate method for determination of elevations

(C) is a reliable way to determine horizontal control for Kelsh plotter operation

(D) is a necessary step in the making of an uncontrolled mosaic

(E) is fundamentally based on the assumption that the photographs are truly vertical

68. If three horizontal control points are available in a stereo model and one of the three fails to hit the plotted position on the manuscript, it means that the

(A) point was misidentified on the photographs

(B) point is mathematically in error

(C) point incorrectly plotted on the manuscript

(D) point is misinterpreted by the operator

(E) error is caused by any one of the above, singly or in combination

69. A contact positive photograph

(A) is geometrically identical with its negative

(B) is geometrically reversed from its negative

(C) is simply a reversal of light and dark areas by chemical process

(D) is always a paper print

(E) exhibits more detail than its negative

70. The Scheimpflug principle in photogrammetry

(A) applies to projection system of the multiplex

(B) explains the application of projective geometry to photogrammetric instrumentation

(C) describes the optical conditions upon which first order instruments are designed

(D) involves both geometric and optical considerations of projection

(E) is a method of compensating for lens distortion

71. A base-height ratio of 1.2 is characteristic of

(A) 12" f.l. vertical photos, 60% overlap

(B) 8-1/4" f.l. vertical photos, 60% overlap

(C) 6" f.l. vertical photos, 60% overlap

(D) 8-1/4" f.l. convergent photos, 100% overlap

(E) 6" f.l. convergent photos, 100% overlap

72. Examination of diapositives for use in a Kelsh plotter indicates film shrinkage. The operator should

(A) determine the percentage of film shrinkage and change the focal length accordingly

(B) determine the amount of film shrinkage and change the focal length by the same amount

(C) change the principal distance by the percentage of film shrinkage

(D) ignore the shrinkage since it will not affect the model

(E) adjust the scale of the model empirically to obtain the best fit to vertical control

73. The one-projector method of relative orientation of a stereoscopic model

(A) is in the sequence of swing, swing, y-tilt, y-tilt, x-tilt

(B) applies only to instruments fitted with a z-motion

(C) is not as reliable as the two-projector method

(D) is in the sequence of swing, swing, x-tilt, x-tilt, y-tilt

(E) is used to fit the model to the control points

74. The nadir point on a 6" f.l. photograph tilted 30° is _____ inches radial from the principal point

(A) 3.00

(B) 5.20

(C) 3.45

(D) 0.52

(E) 3.20

30° Angle Functions

| Sin | Cos | Tan | Cot | Sec | Csc |
|---|---|---|---|---|---|
| .5000 | .86603 | .57735 | 1.7321 | 1.1547 | 2.0000 |

60° Angle Functions

| Sin | Cos | Tan | Cot | Sec | Csc |
|---|---|---|---|---|---|
| .86603 | .50000 | 1.7321 | .57735 | 2.00000 | 1.1547 |

75. If a stereo model is leveled to four vertical control points, each of which is located near the corner of the model, and one of the points fails to read within accepted tolerance, it is apparent that

(A) the point is misidentified on the photographs

(B) the point has an incorrect field elevation

(C) the model is warped because of some undetermined cause

(D) any one of the four points could be in error

(E) the diapositives are not properly centered on the plate holder

Problem 8 - Wt. 2

Public land surveys were first divided into rectangular tracts, with sides that were approximately 24 miles long. These tracts were later subdivided into townships, and the exterior boundaries and section lines were located.

On the sketch, identify lines A, B, C, D, E, and F.

Show your answers in the workbook, and identify each answer clearly.

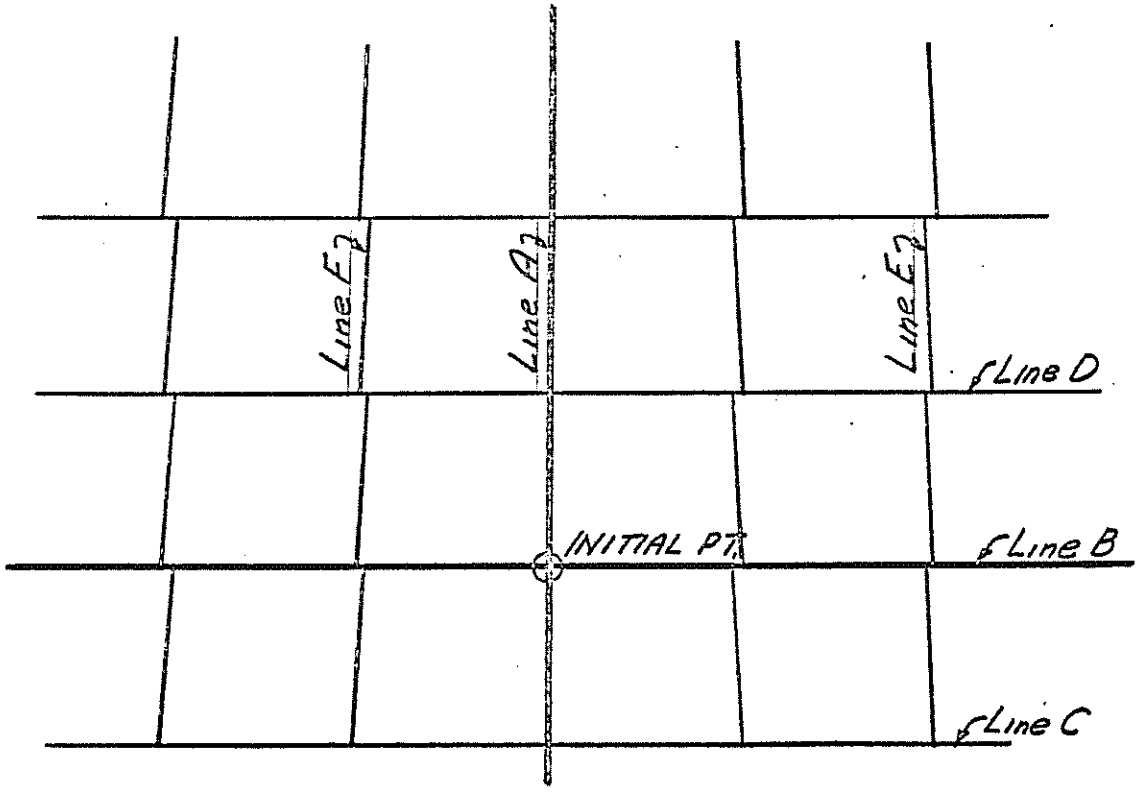



FIG. II-8

Problem 9 - Wt. 3

Compute the arc length of a circular curve from the following information:

Central angle $\Delta = 33°$

Radius R = 100 feet

Problem 10 - Wt. 3

Compute the declination of the sun at the time of observation.

Given:

Date: Saturday, August 15, 1964

Time: $4^h:00^m$ P.M. Pacific Standard Time

Declination: $0^h$ G.C.T. (midnight) = + 14° 07' 04"

Difference per hour: — 0° 00' 47"

Problem 11 - Wt. 3

Give four acceptable methods for the identification of a tract of land in a legal description. (Do not include example.)

Example: Lot and block of a recorded subdivision.

Show your answers in the workbook, and identify each one clearly.

Problem 12 - Wt. 3

A storage pile of crushed rock is 60 feet square at its base, 30 feet square at its top, and 29 feet high.

Compute the volume by

(a) the average end areas method

(b) the prismoidal method

Problem 13 - Wt. 3

The diagram shown below represents a part of a circle of R = 1 and a central angle of Δ. Draw the figure in your workbook, add any construction that you think is necessary, and identify each of the following:

(a) cosine

(b) tangent

(c) secant

(d) versin

(e) exsecant

(f) cotangent

Example: Sine $\Delta = \frac{a}{C} = \frac{a}{R} = \frac{a}{1} = a$

Note: Each function shall be shown by a specific lineation as shown by the example.

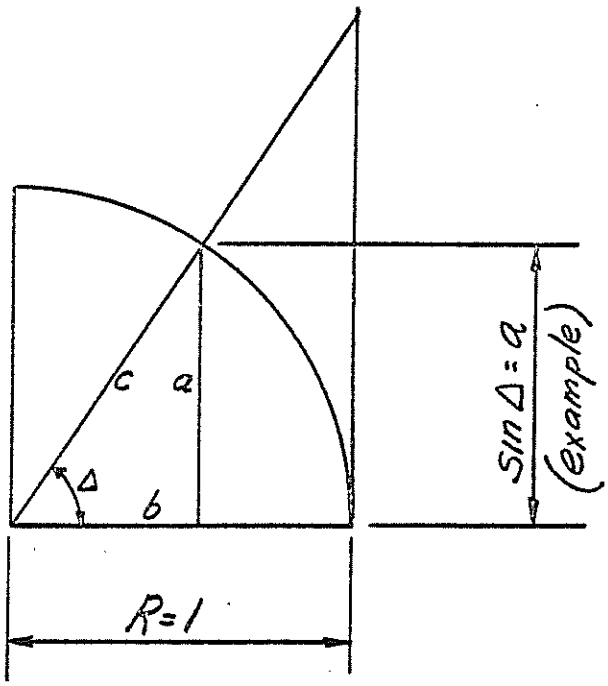



FIG. II-13

Problem 14 - Wt. 3

Identify each of the following by its full proper name:

| | |
|---|---|
| ACSM | NBS |
| CCCELS | ASP |
| ASCE | USGS |

Problem 15 - Wt. 4

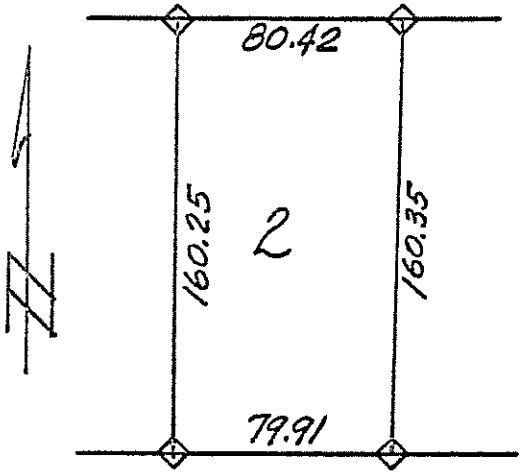
Distinquish between each of the following:

(a) existing corner
(b) obliterated corner
(c) lost corner
(d) witness corner

Problem 16 - Wt. 4

(a) What are the dimensions of the parcel conveyed on April 4, 1930, to Smith as "The East half of Lot 2"?

(b) Where would you place the East line of "The West 40 feet of Lot 2", which was conveyed to Aldrich on April 6, 1930?




◇ Denotes found original corner.

The record dimensions of Lot 2 are 80'x160'.

The lengths that you measure are as shown on the sketch.

All of Lot 2 is owned by Jones on April 3, 1930.

FIG. II-16

Problem 17 - Wt. 4

The government field notes for Section 6 show the distance between the East one-quarter corner and the Northeast corner of the section as 39.95 chains. You measure between the same two corners and find the distance to be 40.05 chains.

At what distance, North from the East one-quarter corner, do you set the one-sixteenth corner? Give distance in feet.

Problem 18 - Wt. 4

You are staking the center line of the road shown below. You set up at point "B" and backsight on point "A". What is the right azimuth angle that you turn at point "B" to establish point "C"?

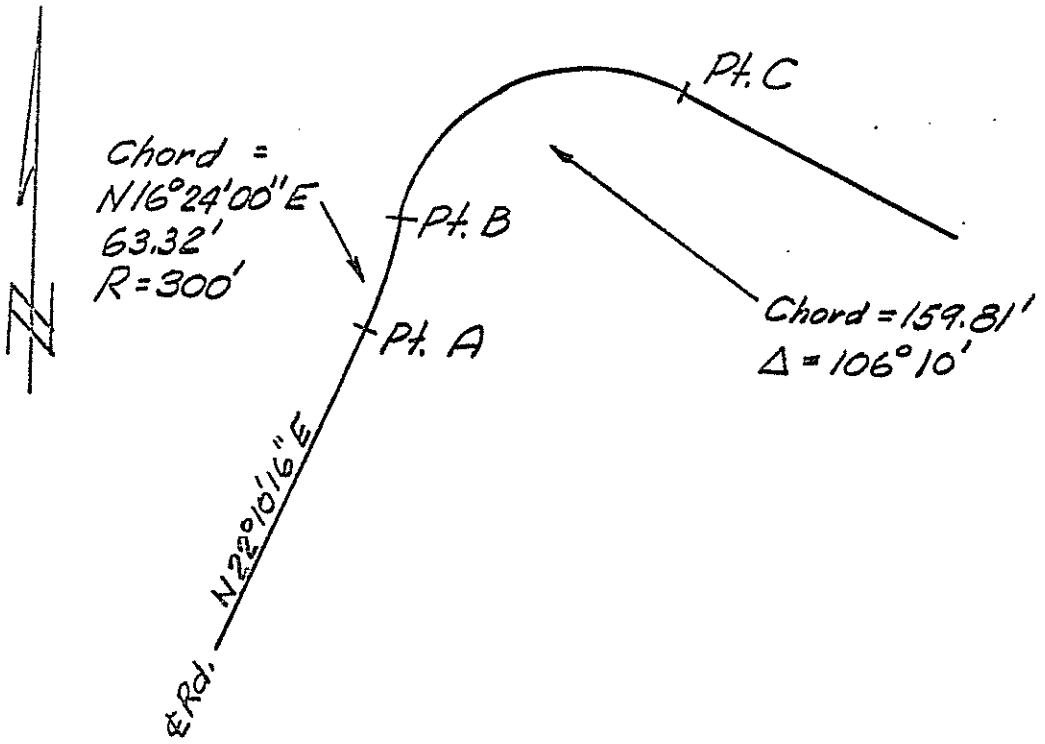



FIG. II-18

Problem 19 - Wt. 6

Define each of the following terms as they apply to land surveying practice:

(a) prima facie evidence

(b) oral evidence

(c) real evidence

(d) hearsay evidence

(e) reputation evidence

(f) extrinsic evidence

Problem 20 - Wt. 5

Level lines were run by three different routes into B.M. No. 1. The length of each route and the elevation differences obtained are as shown in the sketch.

Compute the several elevations obtained on B.M. No. 1. Weight these elevations proportionally to the lengths of the three level runs. Assign a value of 1 to the shortest route. Assign weights inversely proportional to their distances for the other two routes.

What is the most probable value of B.M. No. 1?

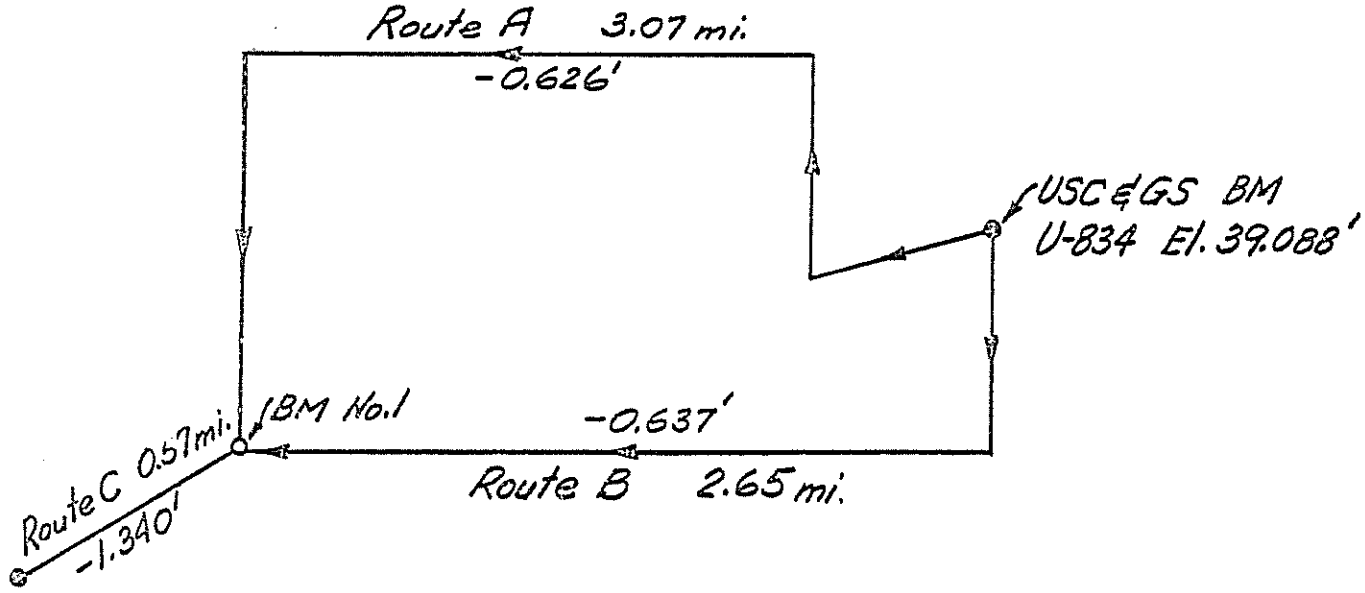



FIG. II-20

Problem 21 - Wt. 6

Define each of the terms listed below as they relate to the field of land surveying.

(a) reliction
(b) riparian owner
(c) adverse possession
(d) meander line
(e) avulsion
(f) accretion

Problem 22 - Wt. 5

Below is a sketch of some elevations plotted from a set of field notes.

Show this plat in your workbook, and draw the topography with a 2-foot contour interval on the grid shown. Interpolate by eye. Do not scale the distances.

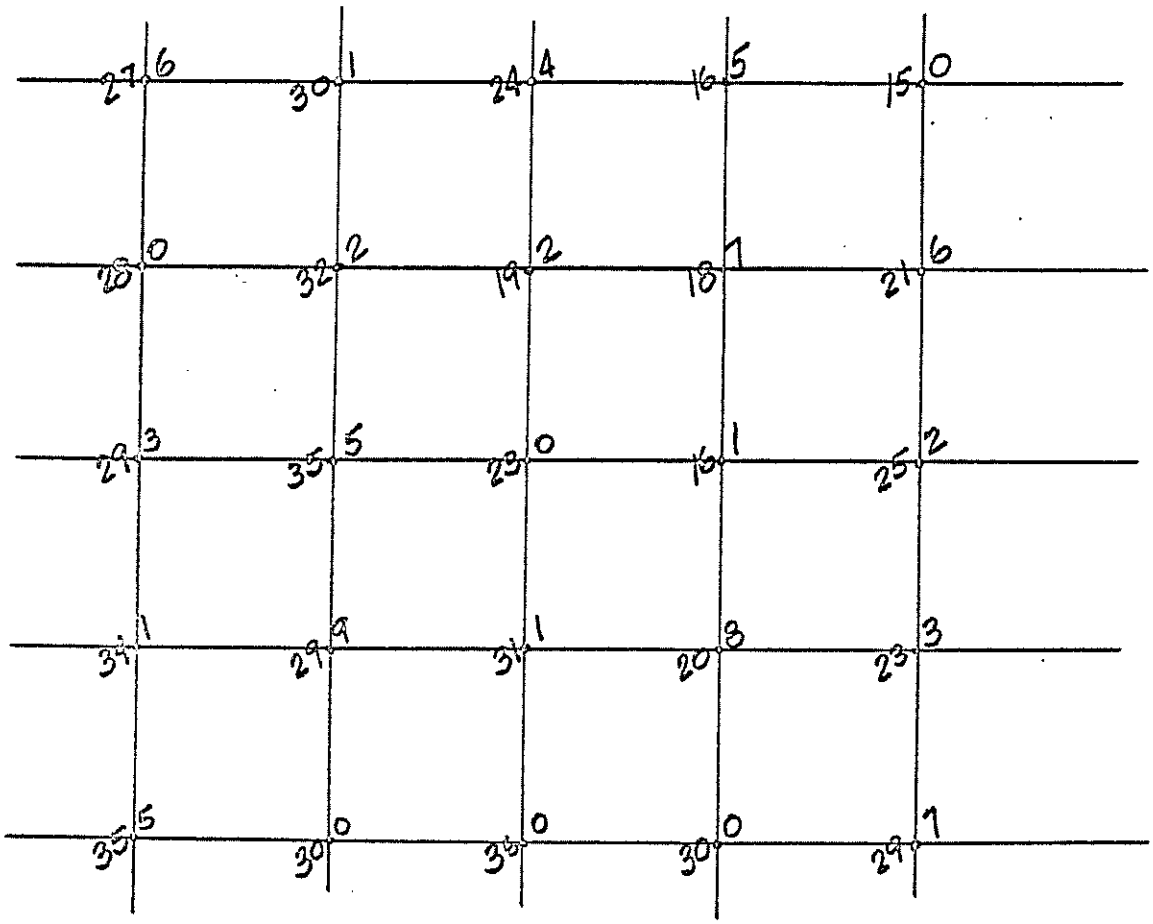
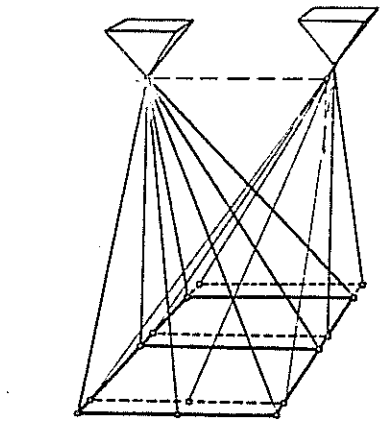


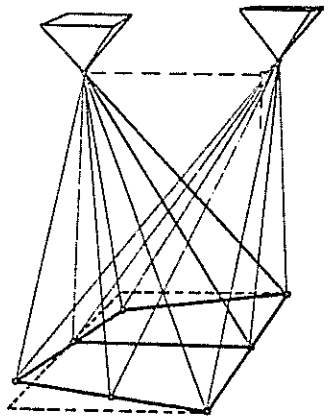

FIG. II-22

Problem 23 - Wt. 3

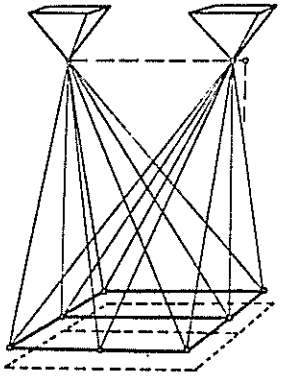
Identify the sources of relative orientation errors according to the illustrated photogrammetric effects. Show your answers in the workbook, and identify each answer clearly.



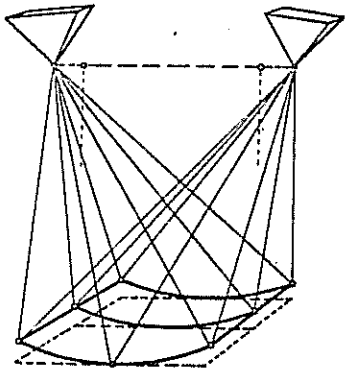
A _____



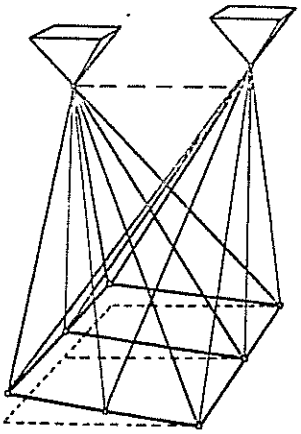
B _____



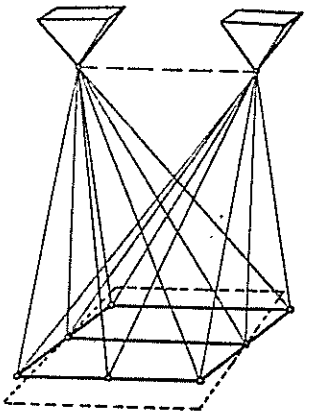
C _____



D _____



E _____



F _____

FIG. II-23

Problem 24 - Wt. 5

Two overlapping vertical aerial photographs were taken with a camera having a 6" focal length lens. The average scale was 1" = 1020'. The photographs were oriented for parallax bar readings, and it was found that the air base on the left photograph measured 3.614", and on the right photograph it measured 3.586". The parallax bar readings of two points were:

Point #1, 15.34 mm

Point #2, 14.65 mm

(a) Determine the approximate difference in elevation of the two points.

(b) If the parallax bar readings increase with an increase in separation of the two marks, which point is higher? Why?

Problem 25 - Wt. 5

Define the following photogrammetric terms:

(a) focal length

(b) principal point

(c) nadir point

(d) swing

(e) principal distance

(f) tilt

(g) fiducial mark

(h) principal line

(i) isocenter

(j) axis of tilt

Problem 6 - Wt. 2

Solve for the elevations at B, C, and D in the vertical curve shown below.

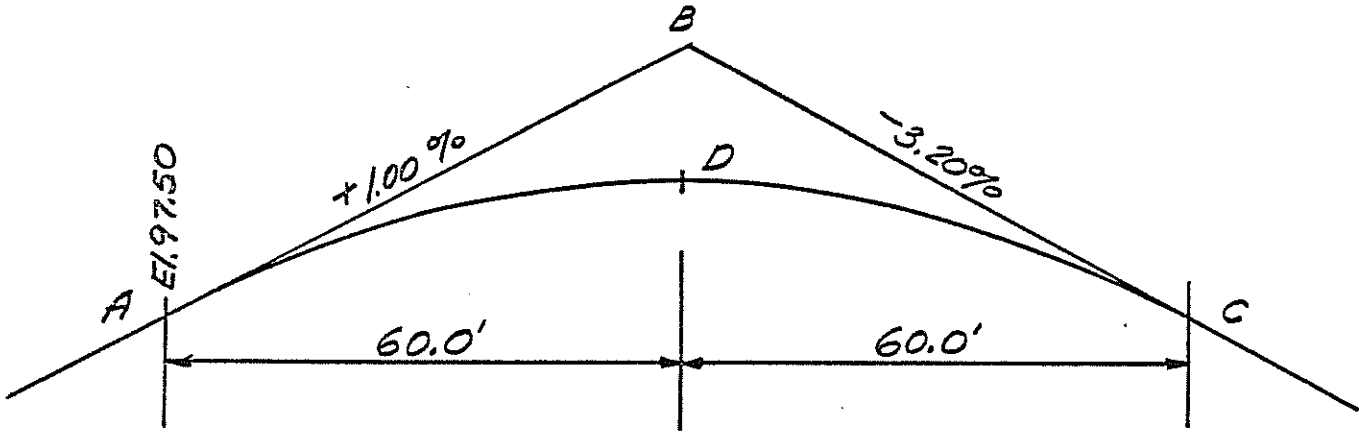



FIG. II-6

Problem 7 - Wt. 2

Determine the coordinates for the missing section corner.

Note: All original corners were set at 40-chain intervals.

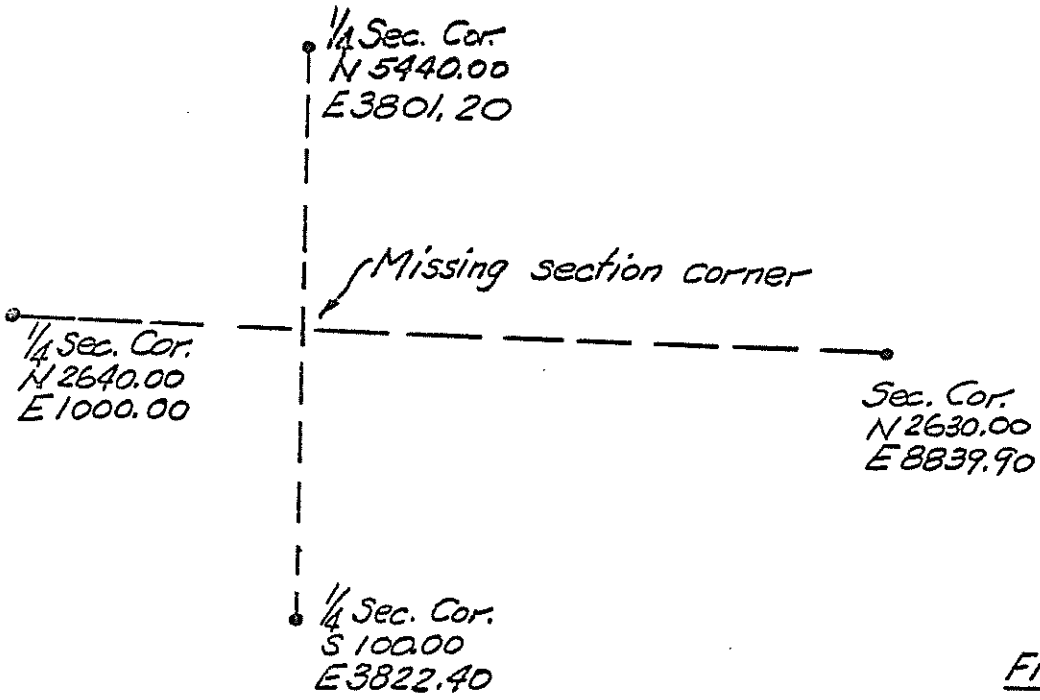



FIG. II-7

Problem 1 - Wt. 2

A distance measured between two points was recorded as 300.53 feet. The temperature at the time of measurement was 78°F. If the tape is standard at 68°F, what is the true length of the line?

Problem 2 - Wt. 2

In place of the radius, degree of curvature is often used to designate the sharpness of a curve. It has two definitions which give slightly different results. Name these two definitions.

Problem 3 - Wt. 2

Sewer manhole "A" has an invert of 122.35 feet. S = +0.20% toward manhole "B". A house service is to be connected to the 6" pipe between these manholes at a point 275 feet from manhole "A". The builder plans to establish the floor of the house at elevation 122.75. Will he be able to sewer this house by gravity? Show your computations.

Problem 4 - Wt. 2

In the traverse pictured below, the sum of the interior angles totals 2159° 59' 32".

How much would you adjust each angle?

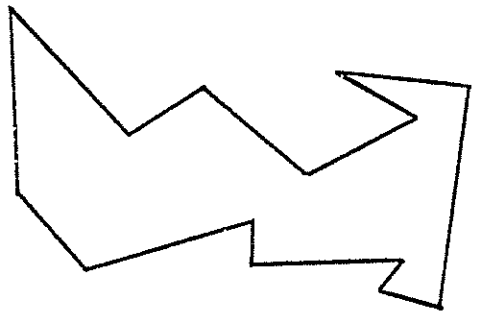


FIG. II-4

Problem 5 - Wt. 2

The sum of the angles of a triangle, as extracted from the field book, is 180° 00' 02.3". If the spherical excess of the triangle is known to be 00.6", what is the error of closure of the triangle?

Louis Hall

CALIFORNIA BOARD OF REGISTRATION FOR CIVIL AND PROFESSIONAL ENGINEERS

1964 LAND SURVEYOR EXAMINATION

August 26, 1964

LS PART II 2

Closed Book

Time Allowed - Four Hours

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

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

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

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

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

You may keep this set of examination questions.

Machine-type calculators are not permitted for this part of the examination.

Lewis Hall

CALIFORNIA BOARD OF REGISTRATION FOR CIVIL AND PROFESSIONAL ENGINEERS

1964 LAND SURVEYOR EXAMINATION

August 27, 1964

LS

PART III

3

Open Book

Time Allowed - Four Hours

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

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

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

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

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

You may keep this set of examination questions.

Machine-type calculators may be used in this part of the examination.

Problem 1 - Wt. 10 Required

Solve for the length of curve (L = ?) and for delta (Δ = ?) as shown in the figure below.

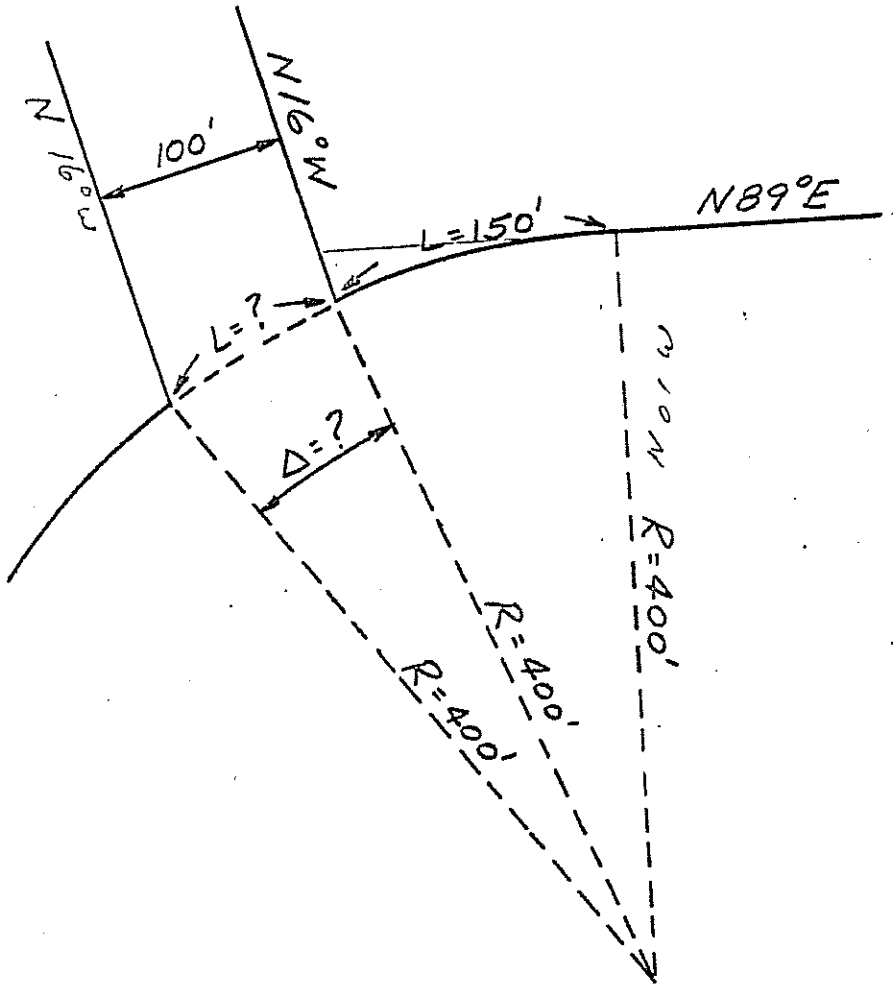



FIG. III-1

Problem 2 - Wt. 10 Required

In checking the performance of your head chainman, you test to see how close to 19# he can estimate his pull (using a 3# tape unsupported). The results were (in pounds): 21.5, 19.8, 21.1, 22.5, 23.0, 21.0, 22.0, 21.4, 20.3, 21.4.

Wt.

6 (a) Assuming that your tape was exactly 100.000 feet long at 19# pull unsupported, and assuming that the above was the average performance of the fieldmen, what is the error per 100 feet as determined by the means of the above pulls? Your result must be obtained by computations (not from tables).

2 (b) If you individually computed each error for each pull as given above, would you expect the average of your results to be greater, the same, or less than that obtained by the method used in (a)? Why?

1 (c) In what general class (or classes) of error (or errors) would the above errors of pull be placed?

1 (d) If you are taping down a slope of 20° and you are using a 19# pull with the above tape (all other conditions are the same as at standardization), will you be measuring 100.000 feet on the slope? Explain why.

Problem 3 - Wt. 10 Required

In the afternoon, you set up at the point of beginning of your description, sight on the sun, and turn an angle of 52° 27' 20" to the right to your first line. If the sun were 10° 03' 00" below the plane of the equator, your latitude was 34° 27' 00", and the hour angle of the sun at the instant of observation was 36° 27' 00", what is the bearing of the line?

Problem 4 - Wt. 10 Optional

Shown below is a set of angles as separately measured in the field with an instrument reading to the nearest second. The land is located in Section 10, and point G is the correctly set position for the center of the section.

REQUIRED:

Wt.

5 (a) Balance the angles.

1 (b) Give the working equations for any other adjustment conditions necessary to make the computations the same for any path.

4 (c) The westerly line of the southwest quarter has a probable error of 0.26 feet. Assume the following: (1) For the purpose of computation of this part of the problem, assume that all of the angles were measured as being 45° or 90°. (2) The probable error of any measured angle is 5" plus or minus. (Sin 45° is .70710678 and 45° 00' 05" is .70712392) (3) For a triangle wherein all angles are measured, the error of computation is reduced from 1.00 to 0.75. (4) When computing through a quadrilateral wherein all angles are measured, the error is reduced from 1.00 to 0.60. (5) The error is reduced by $\sqrt{n}$, where "n" is the number of triangles in which the computations are carried through. What is the probable error in line DE?

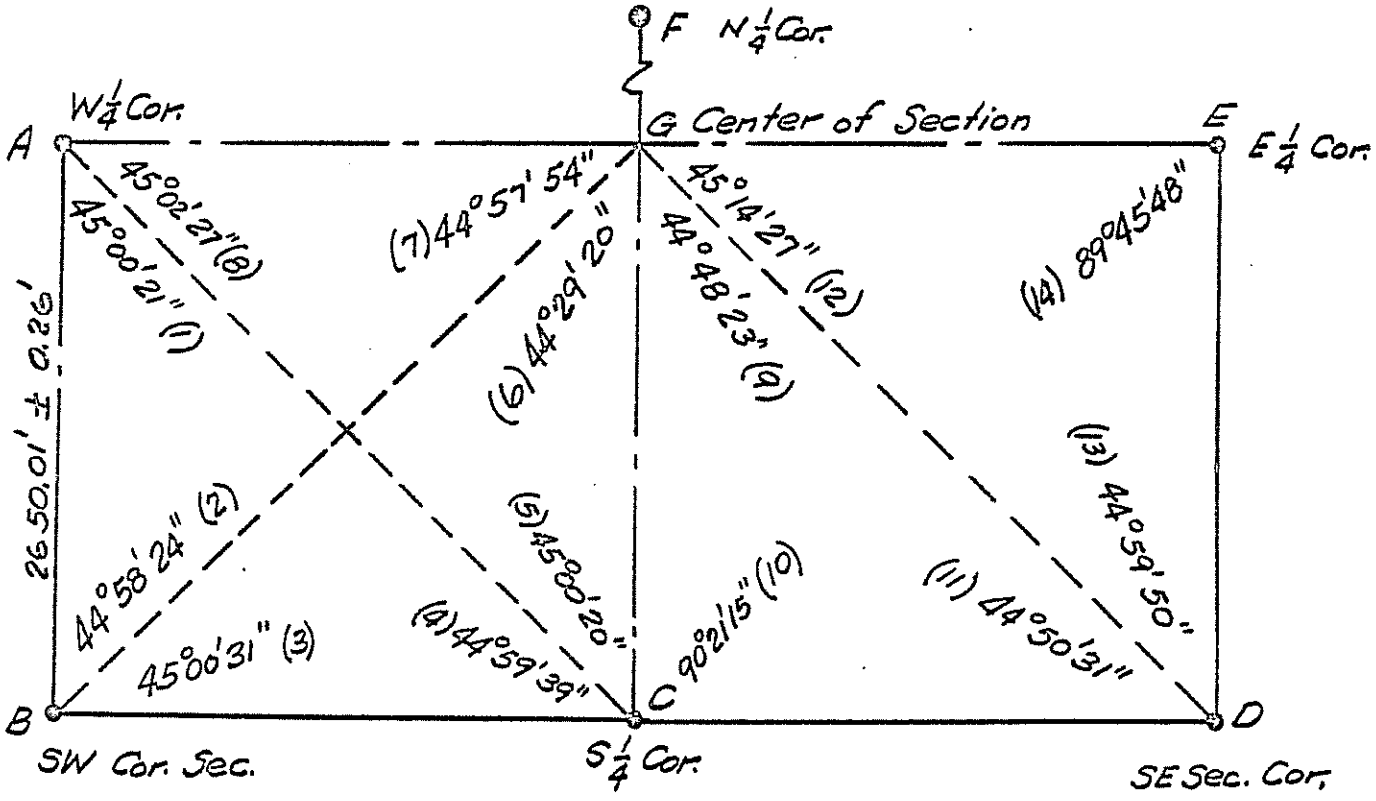



FIG. III-4

Problem 5 - Wt. 10 Optional

When locating land boundaries, under what circumstances would the surveyor use possession to determine title lines and corners? When discussing the question, illustrate your answer with situations wherein you would, and wherein you would not use possession in subdivisions, sectionalized lands, and metes and bounds descriptions.

Problem 6 - Wt. 10 Optional

You have slope staked "Beech Street" every 50 feet from Station 25 + 50 to 27 + 50 as follows:

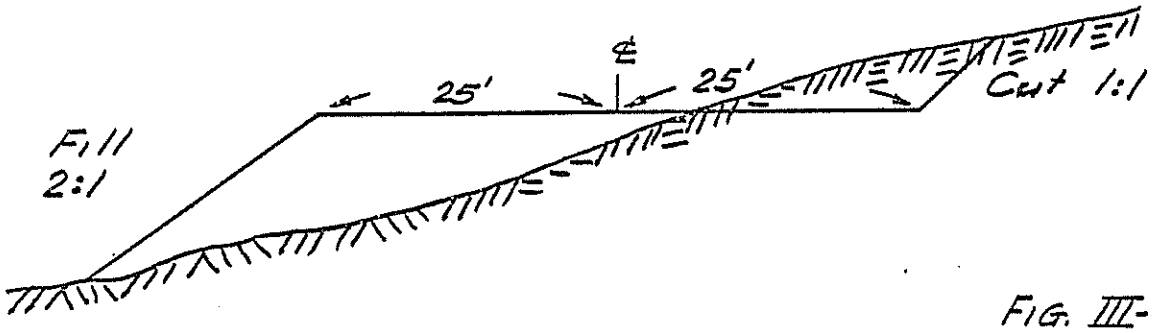



FIG. III-6

The cuts or fills at the toe of slope or at the top of cut as determined by you were as follows: 25 + 50: Rt. 5.5' cut, Lt. 3.2' fill. 26 + 00: Rt. 0.5' fill, Lt. 1.0' fill. 26 + 50: Rt. 2.2' cut, Lt. 1.0' fill. 27 + 00: Rt. 1.3' fill, Lt. 5.3' fill. 27 + 50: Rt. 12.3' fill, Lt. 1.0' cut. The designed centerline elevation at Station 25 + 50 was 101.75' with a plus 2% grade to Station 27 + 50. The existing centerline ground elevations from Station 25 + 50 to Station 27 + 50 were: 102.3, 103.8, 102.1, 103.1, and 101.0.

REQUIRED:

Wt.

Turn your test sheet sideways and draw a vertical line through the center. The left-hand side is the left-hand page of your field notebook, and the right-hand side is the right-hand page of your field notebook.

9 (a) Prepare a complete set of field notes showing how the above data would have been recorded. Any data that cannot be computed from the above may be assumed.

1 (b) Draw a picture of the slope stakes at Station 25 + 50 and show how they would be marked in the field.

Problem 7 - Wt. 10 Optional

Wt.

5 (a) A vertical angle of +3° 54' 06" was measured with a theodolite (H.I. = 4.5') to a distant signal (height = 7.1'). The theodolite and signal positions were both identified on 6" aerial photographs (nominal scale 1:12,000) for use in a standard Kelsh plotter. The distance between the two positions in the model measured 35.67". What is the difference in elevation of the two positions?

5 (b) In running a level line for a photo-control survey, it was necessary to jump a canyon to continue the line. A signal was placed 7.6' above the ground on the south side and the instrument was leveled into it from the north side. The instrument was removed and replaced with another signal at the same H.I. of 4.8'. The instrument was then set up on the south side of the canyon adjacent to the first signal and leveled into the second signal on the north side. By measurement, it was found that the adjacent signal was 2.8' higher than the instrument. If the ground elevation at the signal on the north side is 993.4', what is the ground elevation of the instrument (H.I. = 4.3') on the south side? Also, what is the distance across the canyon?

Louis Hall

CALIFORNIA BOARD OF REGISTRATION FOR CIVIL AND PROFESSIONAL ENGINEERS

1964 LAND SURVEYOR EXAMINATION

August 27, 1964

LS

PART IV

4

Open Book

Time Allowed - Four Hours

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

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

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

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

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

You may keep this set of examination questions.

Machine-type calculators are permitted in this part of the examination.

Problem 1 - Wt. 15 Required

You are asked to locate the westerly boundary of Section 10. The township plat (and the field notes) show a meander line adjoining the Pacific Ocean. State, in detail, the exact method you would use to precisely determine the correct boundary line along the Pacific Ocean. The job must be finished within a month, and the nearest U. S. Coast and Geodetic Survey standard station is 10 miles away.

NOTE: SELECT EITHER PROBLEM 2 OR PROBLEM 3 FOR 10 POINTS.

Problem 2 - Wt. 10 Optional

Determine the lengths of BC, AC, DE, DF, and EF, as shown in the figure below. (Graphical solution not acceptable.)

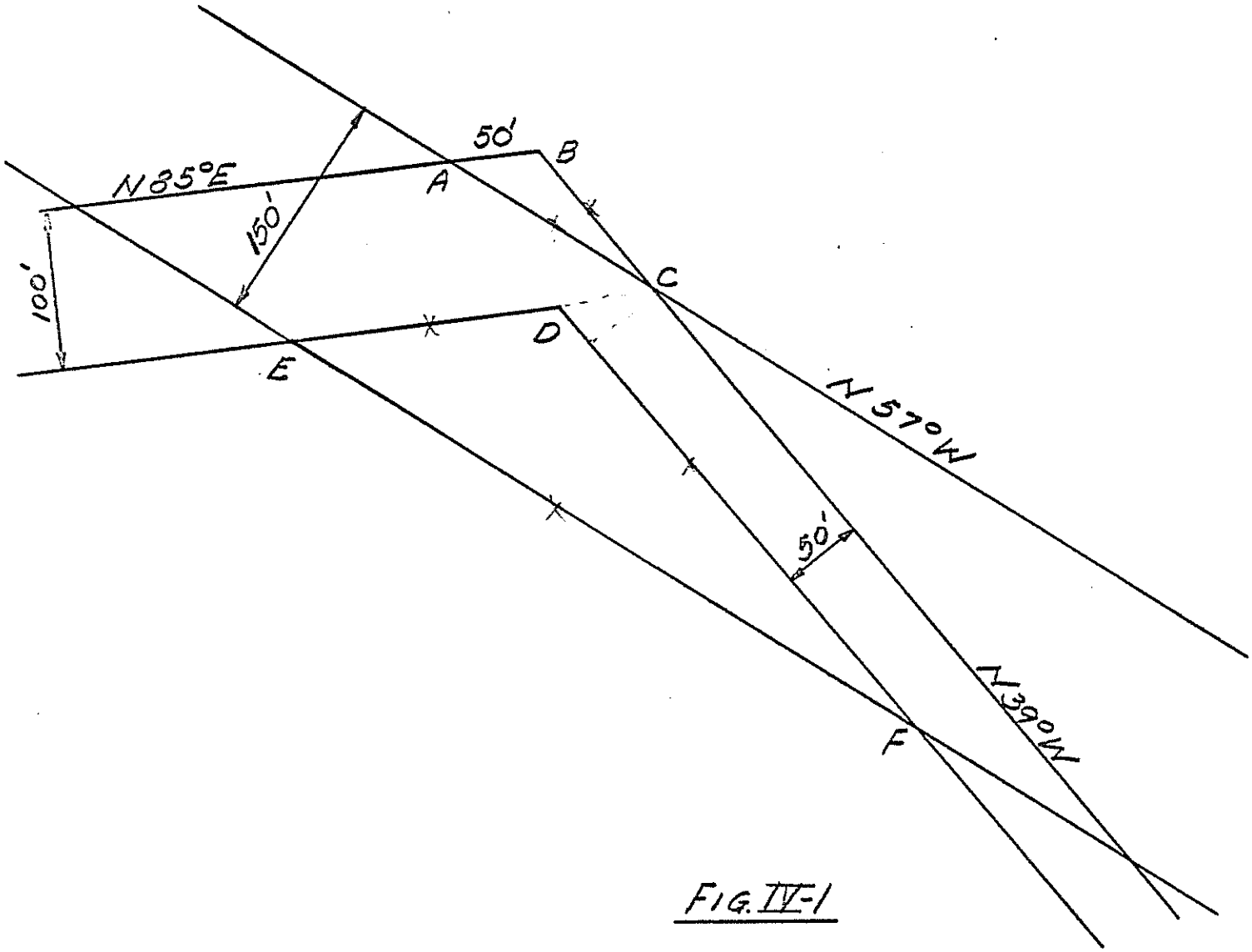



FIG. IV-1

NOTE: SELECT EITHER PROBLEM 2 OR PROBLEM 3 FOR 10 POINTS.

Problem 3 - Wt. 10 Optional

Calculate the lengths of CP and AP, as shown in the figure below. The drawing is not to scale.

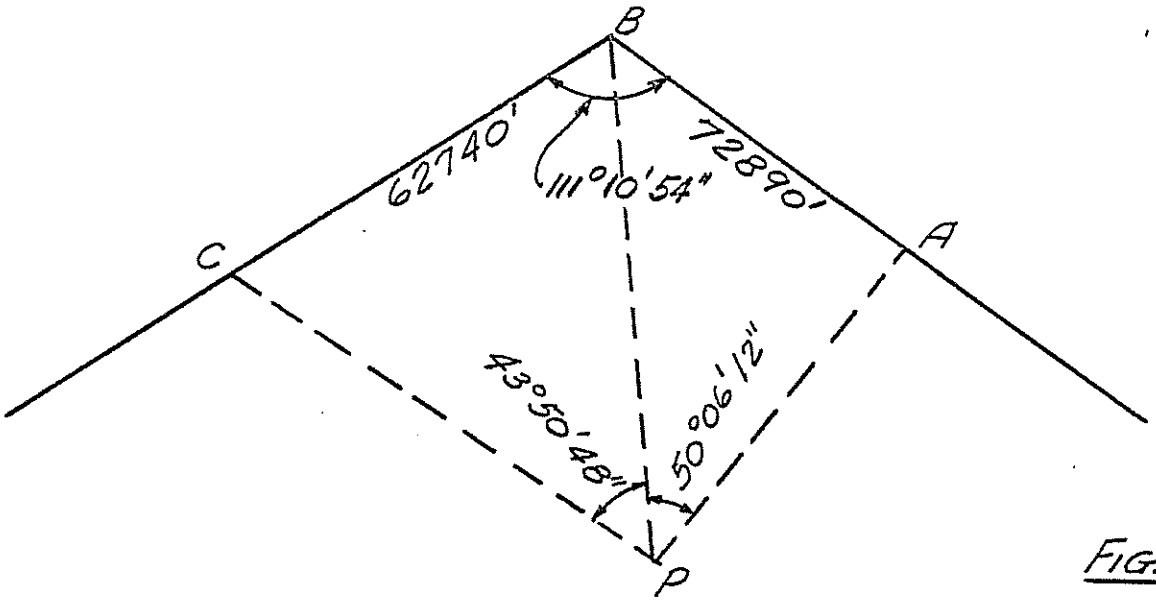



FIG. IV-3

NOTE: SELECT ONE PROBLEM FROM PROBLEMS 4, 5, OR 6 FOR 25 POINTS.

Problem 4 - Wt. 25 Optional

Describe how you would locate the land in Section 3 that lies westerly of the center line as shown below. This is a 25-point question and it will require a discussion of what you will do from the time you receive the description until you have completed the job. Also include a discussion of what you would do in the event a corner is lost (assume that the next nearest essential corner can be found when discussing a lost corner position).

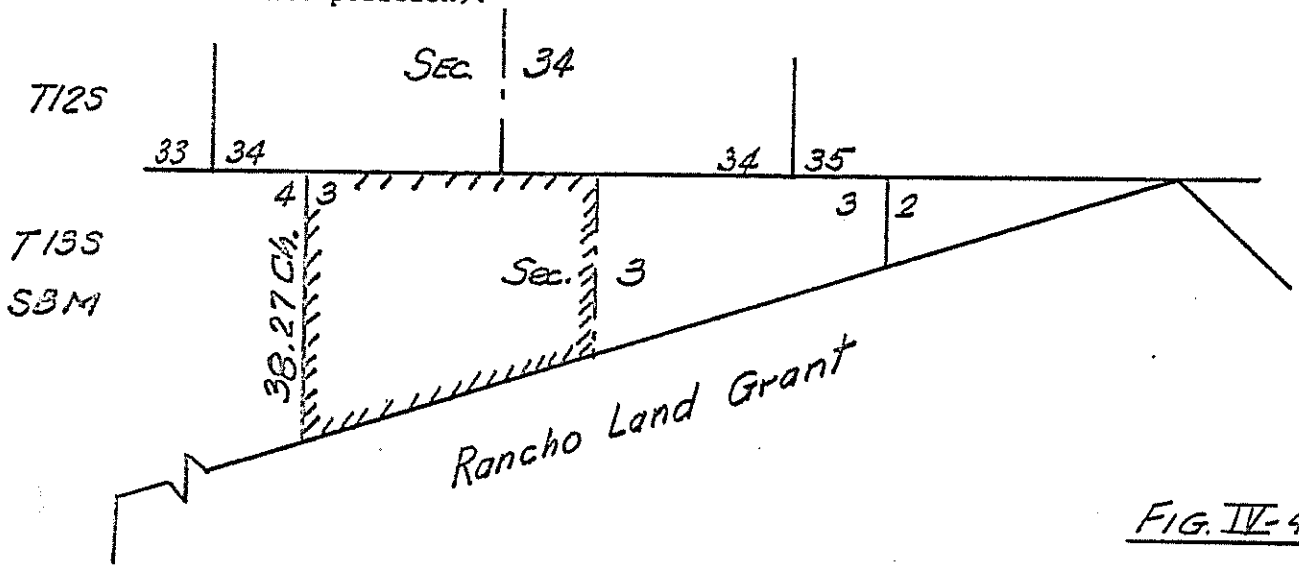



FIG. IV-4

NOTE: SELECT ONE PROBLEM FROM PROBLEMS 4, 5, OR 6 FOR 25 POINTS.

Problem 5 - Wt. 25 Optional

At 35°N and 25°E the geoid is 8 meters above the ellipsoid, and at 36°N and 25°E it is 20.5 meters above the ellipsoid.

Wt.

8 (a) What is the average component of the deflection of the vertical (deviation of the plumb line) in north-south direction?

8 (b) What would be the average astronomical latitude difference between these two points?

5 (c) What is the linear distance between points of $\phi$ geodetic 36°N and $\phi$ astronomic 36°N?

4 (d) What is the approximate relative error (expressed as $\frac{1}{?}$) between the two points (35°N and 36°N) as caused by the deflection of gravity?

NOTE: SELECT ONE PROBLEM FROM PROBLEMS 4, 5, OR 6 FOR 25 POINTS.

Problem 6 - Wt. 25 Optional

Photogrammetric mapping is required for engineering studies, as shown on the portion of a 7½-minute quadrangle map. The manuscripts are to be compiled with a 5-diameter direct projection plotter at a scale of 1" = 500' with a contour interval of 5'.

Wt.

10 (a) Prepare a flight plan which will ultimately result in a minimum number of models and photo-control points. Show all calculations. On the map, include the following:

(1) flight lines
(2) flight altitudes
(3) flight tolerances
(4) camera type
(5) any special instruction to flight crew

12 (b) Vertical accuracies specified for the maps are:

(1) 10% of all checked elevations shall not exceed 1/2 C.I.

(2) Standard error of all checked elevations shall not exceed ± 1.2'.

(3) Plus and minus errors shall balance within a mean of ± 0.4'.

Prob. 6 contd on next page

Problem 6 (contd)

According to the following values, determine if the maps meet these specifications:

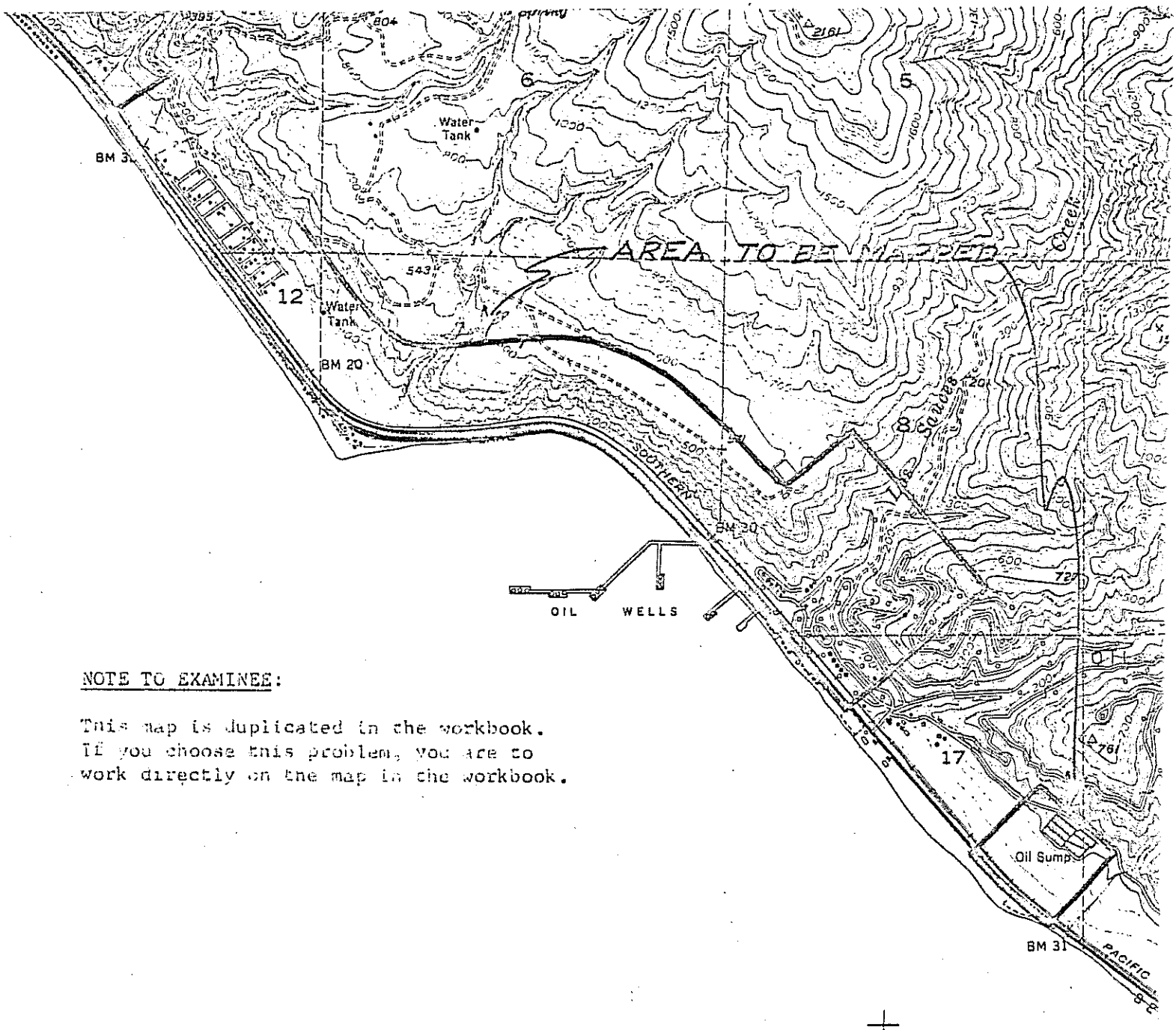
| Field Elev. | Map Elev. | Field Elev. | Map Elev. |
|---|---|---|---|
| 40.8 | 40.0 | 461.3 | 461.5 |
| 55.6 | 56.1 | 449.2 | 445.7 |
| 60.3 | 60.3 | 431.8 | 431.6 |
| 79.7 | 79.8 | 422.3 | 417.8 |
| 88.4 | 89.3 | 405.9 | 403.9 |
| 101.3 | 101.2 | 382.7 | 383.9 |
| 95.9 | 95.9 | 366.5 | 366.5 |
| 120.6 | 120.8 | 351.6 | 351.5 |
| 123.7 | 123.7 | 337.9 | 337.5 |
| 156.4 | 156.2 | 324.7 | 324.4 |
| 171.2 | 171.2 | 311.2 | 307.2 |
| 186.8 | 186.5 | 295.6 | 295.5 |
| 198.3 | 197.3 | 282.3 | 282.1 |
| 209.9 | 210.2 | 270.1 | 269.5 |
| 217.8 | 216.0 | 258.0 | 258.2 |
| 231.5 | 233.0 | 240.8 | 240.3 |
| 245.6 | 245.7 | 231.2 | 231.2 |
| 258.1 | 257.6 | 219.7 | 219.5 |
| 272.0 | 273.7 | 208.8 | 209.5 |
| 283.2 | 284.1 | 199.9 | 202.5 |

Wt.

3 (c) The small isolated area was controlled horizontally by two intervisible points #47-A and #47-B. After the map was compiled, it was discovered that both points were incorrect in their positions and that the azimuth 47-A to 47-B was also in error, but the distance between them was correct. What recommendations would you make to rectify this situation?

Prob. 6 contd on next page

Problem 6 (contd)




NOTE TO EXAMINEE:

This map is duplicated in the workbook. If you choose this problem, you are to work directly on the map in the workbook.