30084100

RED

Name _____

CEEn 113 Engineering Measurements
Fall Semester 2008
Final Exam
Dr. Mitchell

INSTRUCTIONS: Closed Book. Closed Notes. Calculator Allowed. No Laptop.

(a) Numbered problems 1 through 14. Answer each multiple choice problem on the machine graded answer sheet. You do not need to show your work. You will get credit for these problems only if you give the correct answer. There is no penalty for a wrong answer so it is to your advantage to answer each question (even if you guess).

(b) Lettered problems A through C. Answer each problem on the sheets provided (use the back of the sheets if you need more space). Show all your work. You may receive partial credit if you give an incorrect answer but demonstrate you know how to solve a problem. Please do your work clearly and neatly so I can follow what you've done. If I can't read it or can't follow your work, you won't get partial credit. Draw a box around your final answers to problem C so I can find them.

(c) This exam has a time limit of three hours. Time will be checked by the testing center in and out stamp. I will not score the exam if you have it in your possession longer than 3 hours 10 minutes.

SECTION I. (8.113.6) Your client intends to purchase a parcel of land. The deed for the parcel describes it as follows:

> Beginning at a point North 88°33'19" East 353.16 feet along the section line and North 385.50 feet from the Southeast corner of Section 32, Township 7 South, Range 3 East, Salt Lake Base & Meridian; thence North 00°07'53" East 228.50 feet along a fence line to a fence corner on the south line of 400 South Street; thence South 89°45'37" East 288.00 feet along the south line of 400 South Street to the west line of Anderson Avenue; thence South 00°58'03" West 228.52 feet along the west line of Anderson Avenue; thence North 89°45'37" West 284.66 feet to the point of beginning.

Assume that all calls (measurements of bearing and distance) in the description are correct.

Problem A (10 points). On page 8, sketch (neatly, but need not be to scale) the parcel of land, including (i) north arrow, (ii) location of streets, (iii) location of fences, (iv) label the section corner and section line, (v) label the bearing and distance of the tie legs from

the section corner to the point of beginning, and (vi) label the bearing and distance of boundary legs of the parcel.

PROBLEM 1 (10 points). The area of the parcel to the nearest 0.01 acre is:

A. 1.45 acres
B. 2.45 acres
C. 1.50 acres
D. 1.65 acres
E. none of the above

SECTION II. (8.113.6) A parcel of land is described as:

> South ½ of the Southeast ¼ of the Northwest ¼ and the Northeast ¼ of the Southwest ¼ of Section 17, Township 4 North, Range 2 West, Uintah Special Meridian.

Another way of writing the description is:

> S½SE¼NW¼,NE¼SW¼, Sec 17, T4N, R2W, USM.

Assume that Section 17 is a regular section (i.e. 1 mile square).

Problem B (6 points). On page 9, the top drawing represents the initial point, meridian and base line of Uintah Special Meridian PLSS area. Each square on the drawing is 6 mi X 6 mi. Place an "X" in the proper square where the parcel of land is located.

On page 9, the bottom drawing represents one township. Each square on the drawing is one section. Place an "X" in the proper square where the parcel of land is located.

PROBLEM 2 (6 points). What is the area of the parcel?

A. 60 acres
B. 80 acres
C. 160 acres
D. 40 acres
E. none of the above

SECTION III: (8.113.7) Given a parabolic vertical curve connecting two highway grades with L=400 ft, PVI Sta = $28+71^{\underline{00}}$, PVI Elev = 1465.84 ft, g_1 = -3.2% and g_2 = +1.8%.

PROBLEM 3 (2 points). To the nearest 0.01 foot, what is the station of PVC?

A. $28+67^{\underline{00}}$
B. $28+31^{\underline{00}}$
C. $29+40^{\underline{44}}$
D. $26+71^{\underline{00}}$
E. none of the above

PROBLEM 4 (2 points). To the nearest 0.01 foot, what is the elevation of PVC?

A. 1469.44
B. 1337.84
C. 1472.24
D. 1478.64
E. none of the above

PROBLEM 5 (2 points). To the nearest 0.01 foot, what is the station of PVT?

A. $29+40^{\underline{00}}$
B. $30+71^{\underline{00}}$
C. $29+11^{\underline{00}}$
D. $28+75^{\underline{44}}$
E. none of the above

PROBLEM 6 (2 points). To the nearest 0.01 foot, what is the elevation of PVT?

A. 1469.44
B. 1462.24
C. 1473.04
D. 1472.24
E. none of the above

PROBLEM 7 (2 points). To the nearest 0.01 foot, what is the station of the low point on the curve?

A. $29+27^{\underline{00}}$
B. $28+15^{\underline{00}}$
C. $29+47^{\underline{35}}$
D. $29+37^{\underline{44}}$
E. none of the above

PROBLEM 8 (2 points). To the nearest 0.01 foot, what is the elevation of the low point on the curve?

A. 1496.34
B. 1473.54
C. 1474.54
D. 1468.14
E. none of the above

SECTION IV: (8.113.2) The following table shows cross-sectional areas at several stations along a proposed highway.

Station	Cut (ft^2)	Fill (ft^2)
8+00	0	854
9+00	0	376
9+35	0	92
10+10	60	23
11+00	208	0
12+00	523	0
13+00	748	0

PROBLEM 9 (12 points). The earth work volumes between stations 8+00 and 13+00 are

A. Cut: 4237 yd^3; Fill: 2779 yd^3
B. Cut: 4209 yd^3; Fill: 2766 yd^3
C. Cut: 12712 yd^3; Fill: 8337 yd^3
D. Cut: 2779 yd^3; Fill: 4237 yd^3
E. none of the above

SECTION V: (8.113.7) A simple circular curve to the right is used to connect two horizontal tangents on a highway centerline. The known curve data is: PI @ Sta $255+81^{\underline{03}}$, degree of curvature (arc definition) is 5.5°, $\Delta = 27°22'00"$.

PROBLEM 10 (3 points) What is the station of PC?

A. $250+83^{\underline{46}}$
B. $258+34^{\underline{66}}$
C. $253+27^{\underline{40}}$
D. $260+78^{60}$
E. none of the above

PROBLEM 11 (3 points). What is the station of PT?

A. $260+78^{60}$
B. $263+32^{23}$
C. $258+34^{66}$
D. $258+24^{97}$
E. none of the above

PROBLEM 12 (3 points). With a theodolite (total station) set up over PC and back sighting PI, what angle (to the nearest second) must you turn to sight PT?

A. 27°22'00"
B. 14°31'00"
C. 22°22'00"
D. 18°41'00"
E. none of the above

SECTION VI: (8.113.5) One leg of a property survey made in 1890 is described as having a magnetic bearing of North 13°30' West. At the location of the property magnetic declination in 1890 was 3°30' East. Present magnetic declination is 2°20'West.

PROBLEM 13 (5 points). What is the true (polar) bearing of the line?

A. North 17°00' West
B. North 10°00' West
C. North 12°20' West
D. North 15°50' West
E. none of the above

PROBLEM 14 (5 points). What is the present magnetic bearing of the line?

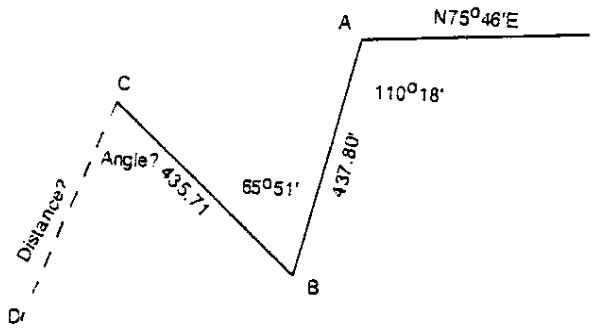
A. North 17°00' West
B. North 7°40' West
C. North 7°40' East
D. North 11°10' West
E. none of the above

SECTION VII: (8.113.3) Using a 100-ft steel tape, you record a distance of 416.55 feet between Point A and Point B. The tape is known to have an actual length of 100.02 feet at standard temperature. It's a chilly day (like the last week of lab that you endured) with an outside temperature of 32°F.

PROBLEM 15 (5 points). To the nearest 0.01 foot, what is the actual length between Point A and Point B?

A. 416.53 ft
B. 416.45 ft
C. 416.73 ft
D. 416.58 ft
E. none of the above

SECTION VIII: (8.113.2, 8.113.6)You must perform an open traverse from a section corner at A to locate the point of beginning of a land description at D. The deed description of the land calls for a point of beginning South 518 feet and West 590 feet from the section corner. Because of obstructions (like the library), you can't sight directly from the section corner to the point of beginning. You set up temporary points at B and C. The bearing of your back sight (reference line easterly from A), interior angles at A and B, and distances A to B and B to C are given in the diagram below.



Problem C (20 points). On page 10, calculate the angle you must turn at C (angle from B to D) and the distance you need to measure (from C to D) to accurately locate the point of beginning at D. Distance should be rounded to the nearest 0.01 foot. Angle should be rounded to the nearest second.

SECTION IX: Extra Credit (answer on this page)

Problem X (3 points – extra credit – you are not required to answer this question). A grid factor is used when relating state coordinate (also known as plane coordinate) distances to ground distances. Why is a grid factor necessary and how is it used?

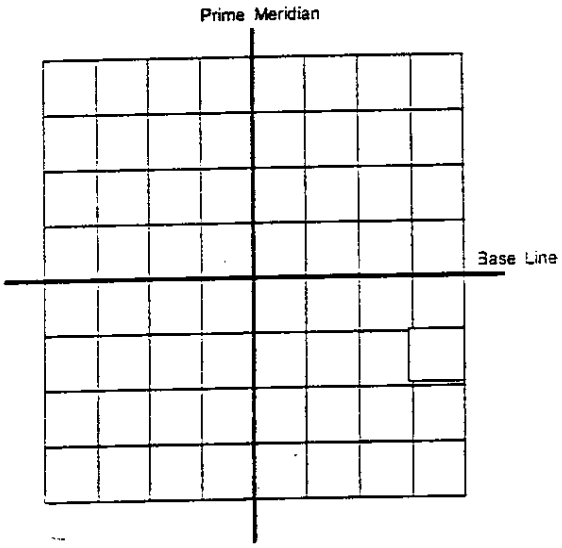
Problem Y (3 points – extra credit – you are not required to answer this question). A parcel of land is described as

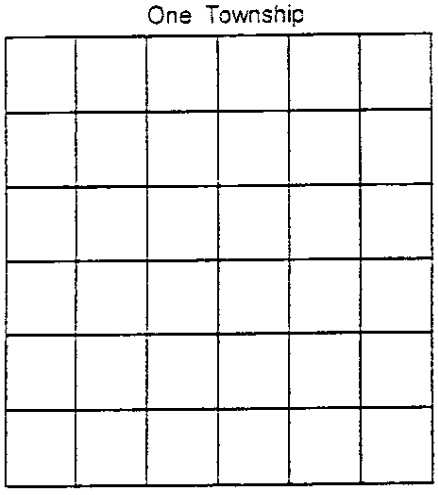
> Lot 2, Section 7, Township 35 South, Range 9 West, Salt Lake Base & Meridian.

Assume that Section 7 is a regular section (i.e. approximately 1 mi X 1 mi). Draw a sketch of Section 7, subdivide it into aliquot parts, and indicate which subdivision of the section is described.

SKETCH FOR PROBLEM A

DIAGRAMS FOR PROBLEM B





Formula Sheet

Law of sines

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Law of cosines

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc} \qquad \text{or} \qquad a^2 = b^2 + c^2 - 2bc(\cos A)$$

Quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Area of circular segment

$$A = \frac{\Delta}{360}\pi R^2 - R^2 \frac{\sin \Delta}{2}$$

Steel tape temperature correction (common units)

$$C_T = .00000645(T - 68)L$$

Horizontal curves

$$D_a = \frac{5729.58}{R}$$

$$T = R \tan \frac{\Delta}{2}$$

$$L = \pi R \frac{\Delta}{180} = 100 \frac{\Delta}{D_a}$$

$$LC = 2R \sin \frac{\Delta}{2}$$

$$M = R(1 - \cos \frac{\Delta}{2})$$

[next page]

$$E = R(\frac{1}{\cos\frac{\Delta}{2}} - 1) = R(\sec\frac{\Delta}{2} - 1) = T\tan\frac{\Delta}{4}$$

$$deflection/\,ft\_of\_arc = \frac{\Delta/2}{L} = \frac{90}{\pi R}$$

Vertical curves

$$L = K(g_2 - g_1)$$

$$y = \frac{r}{2}x^2 + g_1 x + PVC_{elev} \qquad r = \frac{g_2 - g_1}{L}$$

$$x' = \frac{g_1 L}{g_1 - g_2}$$