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Score _____

CEEN 113 Engineering Measurements
 Closed Book, Closed Note, Calculator Required
3 Hour Time Limit

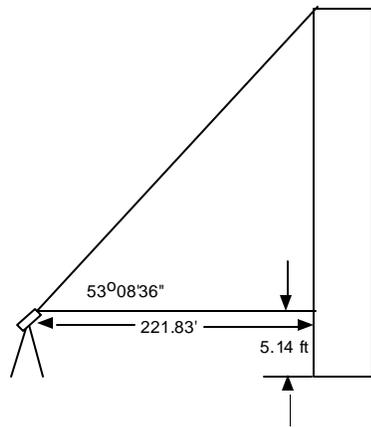
Final Exam

Fall 2002

- (5 pts) (7.4) Your boss has asked you to quickly estimate the area of a **rectangular** property by pacing. You pace the larger of the sides three times and count your paces to be 41, 43, and 48. You pace the smaller of the sides three times and count your paces to be 32, 33, and 32 (it is a rectangle so you only need to pace two of the sides). If your calibrated pace is 2.62 feet, what area for the property (sq ft) will you report to your boss?

9760 or 9770 ft

- (10 pts) (9.1.4) You are interested in determining the height of a building. You are unable to place a prism on top of the building and measure slope distance so instead you use a 100 foot steel tape to measure the distance (221.83 feet) from where you have set up a theodolite to the building (HI = 5.14'). You then turn a vertical angle ($53^{\circ}08'36''$) from this point to the top of building. a) What is the height of the building? b) If the tape measure you are using is actually 100.06 feet, what is the corrected horizontal distance measured? (You should use the uncorrected distance of 221.83 feet for the calculation in part a).



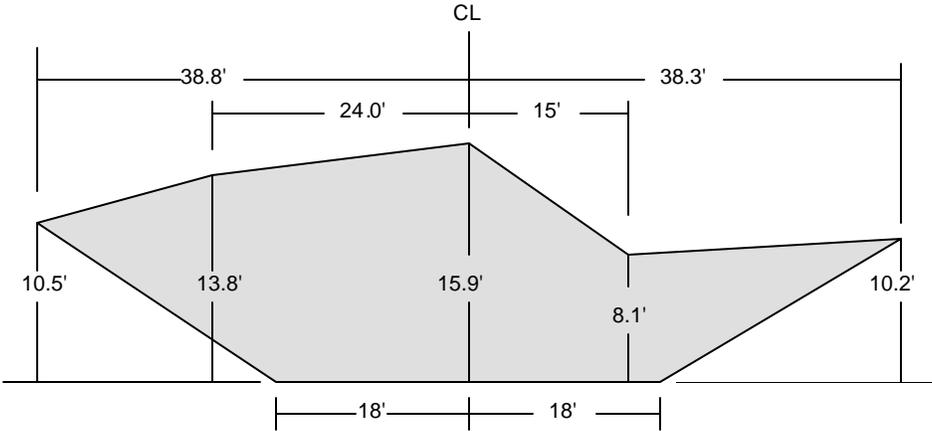
H = 301.06 ft
 Distance corrected = 221.96

- (5 pts) (2.1.2) What present magnetic bearing is needed to retrace a line for the conditions in 1875 given the following information?

1875 Magnetic Bearing	1875 Declination	Present Declination	Present Magnetic Bearing
N75°25'E	3°30'E	2°20'W	?

N 80°15' E

4. (5 pts) (9.1.4) Compute the area (sq. feet) of the cross-section shown below (HINT: Set it up to use the coordinate area method).



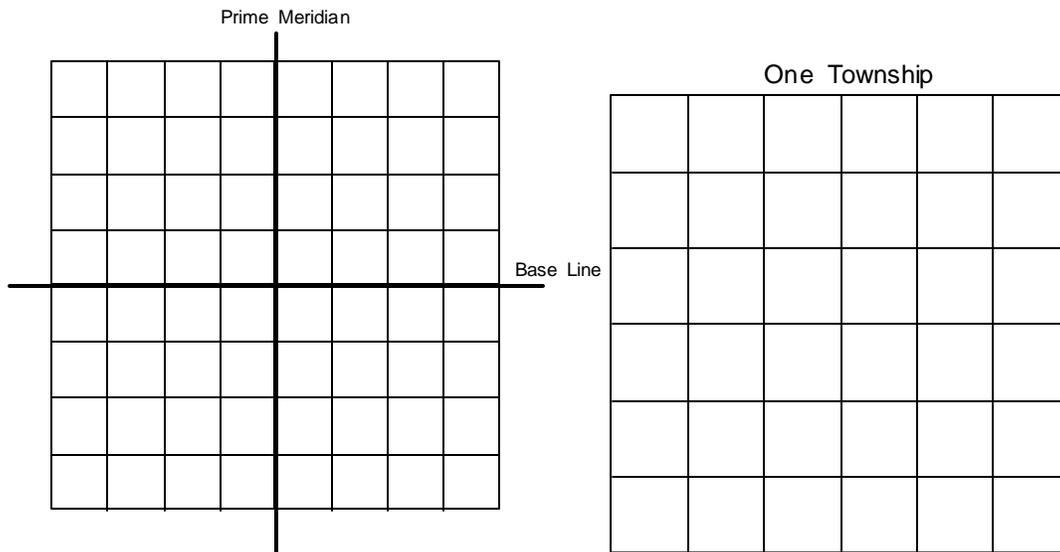
Area = 716.7 ft²

5. (10 pts) (9.1.4) The following table shows cross sectional areas at several stations along a proposed highway. Compute the total volume of cut and the total volume of fill in **cubic yards**.

Fill 2410 yd³ Cut 2733 or 2721 yd³

Station	Cut (ft ²)	Fill (ft ²)
8+00	0	776
9+00	0	354
9+33	0	82
9+57	40	20
9+81	197	0
10+00	548	0
11+00	723	0

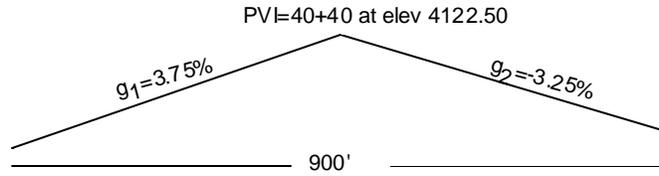
6. (5 pts) (9.1.3) Using the two maps below indicate (with one x on each map) where the SW1/4, NE1/4, Section 19, T4S, R2W would be.



7. (5 pts) (5.9) The PI of a horizontal curve is at station 28+32.41. The degree of the curve, $D=6^{\circ}30'$, and the angle of intersection $I=54^{\circ}14'$. Determine the PC, and PT of the curve?

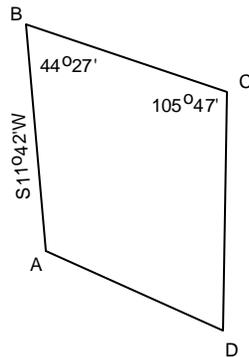
PC = 23+81.01
PT = 32+15.37

8. (10 pts) (5.9) For a vertical curve $g_1=3.75\%$ meets $g_2=-3.25\%$ at station 40+40 and elevation 4122.5 ft. If the equal-tangent curve is 900 ft. long, find the station and elevation of the high point.



Station = 40+72 Elevation = 4114.67
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9. (5 pts) (9.1.3) Given the two interior angles shown, and the bearing of line AB as $S11^{\circ}42'W$, compute the bearing and Azimuth of line CD.

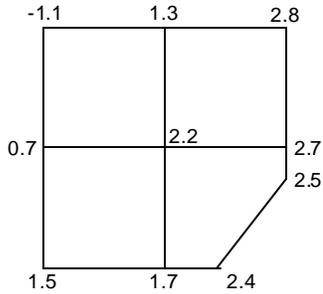


Azimuth 198°04' Bearing S 18°04' W

10. (5 pts) (9.1.3) If the coordinates of point A in the same figure as is used in problem 9 are (832.29, 176.54), and the distance AB is 456.79 ft., find the X,Y coordinates at B?

$B_x = 739.66$ $B_y = 623.84$

11. (5 pts) (9.1.4) The following diagram represents a small portion of a borrow pit. The squares are 25 feet on a side and the numbers represent the differences (cuts) in feet at the various points from one survey to the next. The two points not on 25 foot corners are located as follows: the 2.5 cut is 7.0 feet down from its nearest corner (the 2.7 cut) and the 2.4 cut is 12.0 feet over from its nearest corner (the 1.7 cut). Estimate the volume (yd^3) that has been removed from the borrow pit. Treat the one non-square section as a trapezoid and not several triangles. (7.4)



Volume = 150 yd³

12. (5 pts) (5.9) A sanitary sewer is to be constructed from an existing MH #1 (invert elevation = 139.28 ft.) @ .5% (that is .5ft/100feet uphill) for a distance of 340 ft. to proposed MH #2 which is **higher** in elevation than MH #1. The ground elevations at 100 foot intervals are as follows: 0+00=148.21, 1+00=147.78, 2+00=146.54, 3+00=150.27, 3+40=149.98. Prepare a grade sheet showing sewer invert elevations and cut distances in feet at each station.

Cuts
8.93
8.00
6.26
9.49
9.00

13. (5 pts) (9.1.3) For segment BC of the polygon defined in the table below determine the meridian distance from the “western-most” point and the parallel distance from the “southern-most” point?

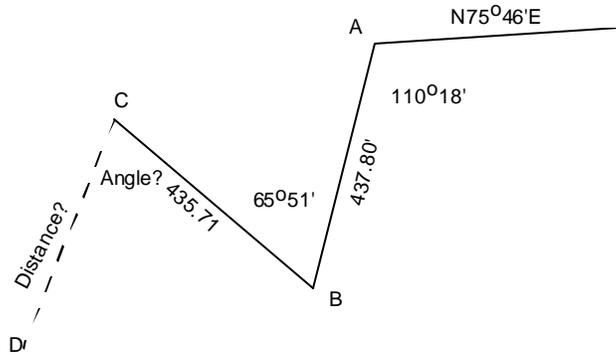
Point	X (ft)	Y (ft)
A	0	0
B	300	1000
C	1000	500
D	600	-300

Meridian BC = 650
Parallel BC = 1050

14. (5 pts) (2.1.2) A grade g_1 of -3.00% passes station $16+00.00$ at an elevation of 361.27 ft., and a grade g_2 of $+1.35\%$ passes station $40+00.00$ at an elevation of 348.41 ft. Compute the station and elevation of the point of intersection of these two grades. **Hint:** The 24 stations between the two given elevations do not define the length of a vertical curve. You are only asked to find the PVI in this case from which an appropriate equal-length vertical curve could be defined.

Station = $26+40.06$ Elevation = 330.06
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15. (15 pts) (9.1.3) You must perform an open traverse from a section corner at A to the point of beginning of your property at D. You know from the legal description that your property corner is 512.36 feet south and 558.17 feet west of section corner A. You can't move on a direct line from A to D so you set up at temporary points B and C. The bearing of your reference line at A, the interior angles at B and C, and the distances from A to B and B to C are given in the diagram. What angle must you turn at C (from B to D) and what distance from C to D do you need to measure to accurately locate your property corner at D. Hint: This is what you had to do in lab 10. The diagram below is not exactly to scale. (2.1.2)



Distance = 325.77
 Bearing = $84^{\circ}21'$