

NAME _____

Score _____

CEEN 113-1 Engineering Measurements
Open Book, Closed Note, Calculator Required
3 Hour Time Limit

Final Exam

Fall 2000

1. (12 pts) Using the following set of field notes (the top values represent rod readings with the given HI, and the bottom values are distances left/right of the center line) determine the slope intercepts on both the left and right side of the roadway centerline. The **roadway** for this cross section is a 30-ft wide level roadbed with fill slopes of 2:1 at an elevation of 300.5 ft. (5.10)

HI = 298.3		6.9	6.2	2.2	2.6	1.8	0.7	
	Left	50	31	6	CL	12	50	Right

Left: X = 31.9 ft, Elev. = 292.1
Right X = 22.4 ft., Elev. = 296.8

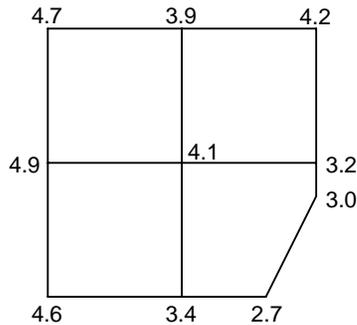
2. (2 pts) You wish to measure a distance of 782.34' with a 100' tape that has a calibrated length of 99.98'. What distance should you measure? (7.4)

782.50

3. (3 pts) After zeroing your vernier scales while sighting at point A you turn an angle of $63^{\circ}12'36''$ to point B. You then repeat this measurement five additional times and the final reading is $19^{\circ}15'24''$. What is the most correct measurement of the angle from A to B? (7.4)

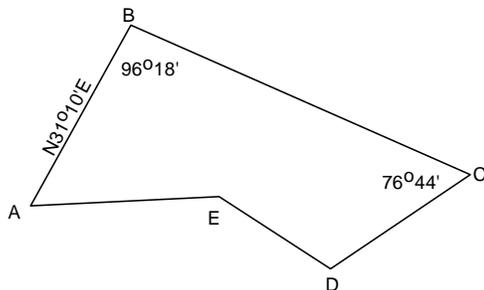
$63^{\circ}12'34''$

4. (5 pts) The following diagram represents a small portion of a borrow pit. The squares are 10 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 10 foot corners are located as follows: the 3.0 cut is 3.0 feet down from its nearest corner (the 3.2 cut) and the 2.7 cut is 6.0 feet over from its nearest corner (the 3.4 cut). Estimate the volume (ft^3) that has been removed from the borrow pit. (7.4)



Approx. 1532 cu. feet

5. (5 pts) With the bearing of line AB and the interior angles at B and C given in the diagram below, compute the bearing of line BC and the azimuth of line CD. With the bearing of line AB and the interior angles at B and C given in the diagram below, compute the bearing of line BC and the azimuth of line CD. (2.1.2)



Bearing BC = S65°08'E
Azimuth CD = 218°08'

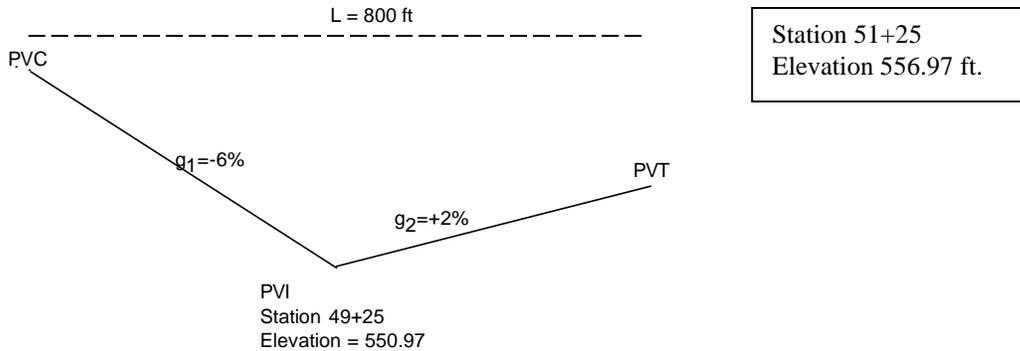
6. (10 pts) You are using stadia to make measurements. The upper stadia hair has a reading of 8.37 feet and the lower stadia hair has a reading of 5.11 feet on the distant rod. The zenith angle to the center cross hair measures $87^{\circ}12'29''$ and the center cross hair is on 6.74 feet. (a) What is the horizontal distance between instrument and rod? (b) What is the difference in elevation between the ground directly under the instrument and the ground at the base of the rod if the instrument height is 5.81 ft.? (7.4)

$H = 325.23 \text{ ft.}$ $V = 15.86 \text{ ft.}$ $\Delta\text{Elev} = 14.93 \text{ ft.}$
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7. (5 pts) A sanitary sewer is to be constructed from an existing MH #1 (invert elevation = 142.380 ft.) @ .72 percent slope (falling, i.e. MH #1 is higher than MH #2) for a distance of 343 ft. to proposed MH #2. The elevations of the offset grade stakes are as follows: 0+00=153.214, 0+50=154.025, 1+00=152.786, 1+50=152.143, 2+00=151.540, 2+50=153.638, 3+00=155.273, 3+43=154.985. Prepare a grade sheet showing the cuts at each station. (5.10)

Station	Cut
0+00	10.834
0+50	12.005
1+00	11.126
1+50	10.843
2+00	10.600
2+50	13.058
3+00	15.053
3+43	15.075

8. (10 pts) For the vertical curve shown below determine the required elevation and or station information listed on the answer sheet. $g_1 = -6\%$, $g_2 = +2\%$, the PVI is at station 49+25 at an elevation of 550.97, and the length of the curve is 800 feet. Find the station and elevation of the low point. (5.10)



9. (10 pts) Given: PI @ 3+962.79, $I = 16^\circ 13'$, and $R = 400$ m, compute the following: (5.10)

- a) The stations of the of the PC, and PT

PC = 3+905.80
PT = 4+019.01

- b) Deflection angle and chord distance from the PC to a catch basin located at station 3+993.28

Deflection = $60^\circ 15' 55''$
Chord = 87.31 m

10. (5 pts) Complete and check the level notes shown. All units are in meters. (7.4)

Point	B.S.	H.I.	F.S.	Elev.
BM #1	7.432			864.384
TP #1	7.121		1.862	
TP #2	6.946		6.733	
TP #3	5.397		6.491	
TP #4	4.312		4.682	
BM #2			5.111	

Elev BM #2 = 870.713 m

11. (10 pts) The following cross-sections represent cut-sections for a roadway base at consecutive stations 200 feet apart (the cross section at 21+00 was derived from the “average” geometry of the other two). You should calculate the volume of material that will need to be excavated using both the average end area method and the prismoidal method between stations 20+00 and 22+00. **Be sure to clearly indicate the area of each cross-section as part of your answer.** The scale on the plots shown is 1 inch equals 20 feet horizontal and 1 inch = 5 feet vertical (each small square is 4 feet horizontal by 1 foot vertical). **Hint:** Use the coordinate area method to calculate areas. (5.10)

No answer because the photo copy of cross sections did not come through.

12. (13 pts) Given the information shown in the figure below with the XY coordinates of A = (2250.29, 3624.86), B = (1750.24, 499.51), and D = (4500.58, 2874.79). Determine the coordinates of C and the horizontal angle you would turn while set up over C from A to locate D. (2.1.2)

