NAME_____ Score_____

CEEN 113 Sections 1-6 Engineering Measurements Dr. Nelson Exam #1 Fall 2002
October 8-10 (Late fee on October 10th)

CLOSED BOOK - CALCULATORS REQUIRED – EQUATION SHEET PROVIDED AT END

Any answer requiring an angle should be given in ***Degrees-Minutes-Seconds*** format.

For the most part these problems are all or nothing so be careful. Clearly identify your answer, but I still suggest you show your work.

The numbers in parenthesis at the beginning of the problems are the competencies being tested from the class list. You don't need them, I just use them when grading to see how well you are learning (or I am teaching) the core competencies for the class.

1. (7.4) You want to be able to tape a distance of 660 meters with a total error of no more than ±5 cm. How accurately must each 30 meters be taped so that the desired limit is not exceeded? (5 pts)

   E = 1.07 cm

2. (7.4) You wish to measure 896.78 feet with a 100-foot tape that has a calibrated length of 100.04 feet. What distance do you actually need to measure so that you will have the desired measurement? (5 pts)

   896.42 ft.

3. (9.1) Using a total station you sight on a rod and measure a zenith angle of 76°32'18" and a slope distance of 243.21 ft. If the elevation on the ground where your total station is set up is 4611.68 ft, then what is the elevation on the ground where the prism is being held? (Assume that the prism height is the same as the height of the instrument). (5 pts)

   4668.30 ft.

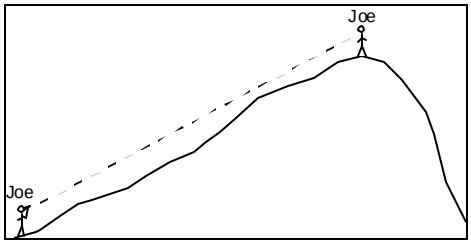
4. (7.4) If you are standing on a lifeguard station that is 8 ft high (eye level is at 13.9 ft) watching a sailboat move out to sea (it is a calm sea and there are no waves). How far (in miles) from your station is the boat when the top of its 30-foot mast disappears from your view (assuming you can actually see this far!)? (5 pts)

   12.15 miles

5. (9.1) In measuring an angle by repetition, the reading after the first turning in a direction positive was 88°36'47". The reading after the eighth turning (you make the measurement eight times total) is 348°54'48". Determine the angle measured. (5 pts)

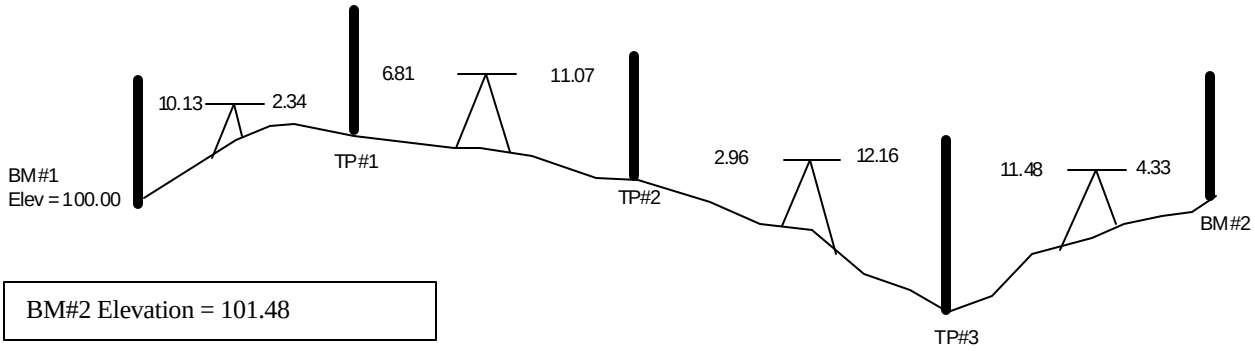
   88°36'51"

6. (7.4) Using a clinometer, Joe measures a 38° vertical angle to Bill standing on top of a nearby hill. It took Bill 712 paces to get to the top of the hill and 704 paces coming back. If Bill's calibrated pace is 2.66 ft/pace, what is the height of the hill Bill climbed from where Joe stands? (5 pts)



1160 ft.

7. (9.1) Set up and complete the differential level notes for the information shown in the accompanying illustration. All back sights are shown to the left of the instrument diagrams and fore sights are shown to the right. All units are feet. Be sure to show your arithmetic check. (5 pts)



BM#2 Elevation = 101.48

8. During a level circuit you cover a distance of 15732.44 feet and have a vertical error of .252 feet. What classification is your level circuit survey? (5 pts)

Rough

9. (2.1.2) An open traverse is performed between points A and B with three intermediate points. Given the distances and Azimuths in the table below determine the azimuth and distance from point A to B. **Hint:** It will help you if you sketch the open traverse. (10 pts)

Line	Distance (m)	Azimuth
A-1	128.88	86°37’
1-2	208.56	165°18’
2-3	96.54	223°15’
3-B	145.05	145°05’

Distance = 431.70 m
Azimuth = 152°37’55”

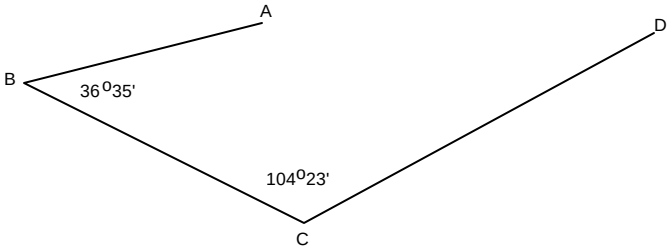
10. (2.1.2) Given the coordinates in the table below compute the bearings and distances from a) point J to point K, and b) from point K to point L. (10 pts)

Point	Y (feet)	X (feet)
J	66.07 North	909.13 East
K	158.72 South	315.47 East
L	89.55 North	1008.25 West

Distance JK = 634.79 ft
Bearing JK = S 69°15’39” W

Distance KL = 1346.80 ft
Bearing KL = N 79°22’38” W

11. (2.1.2) Given the Bearing of AB is S62°52’W, and the interior angles shown at B and C. Determine the Bearing of CD. (8 pts)

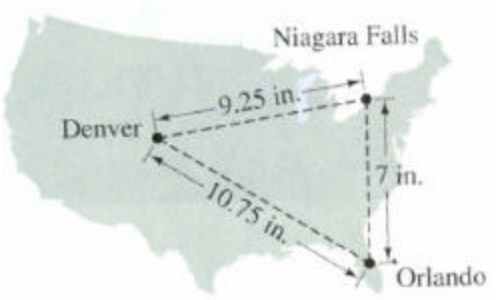


At B = S 80°33’ E
At C = N 23°50’ E

12. (2.1.2) In 1900 a magnetic bearing was measured to be N88°15’E when the magnetic declination at that location was 3°E. What is the astronomic or true bearing? If the magnetic declination today is 8°E find the magnetic bearing today. (6 pts)

True Bearing = S 88°45’E
Mag Bearing = N 83°15’E

13. (2.1.2) On a given map Orlando is 7inches due south of Niagara Falls, Denver is 10.75 inches from Orlando and 9.25 inches from Niagara Falls. Find a) the Bearing from Orlando to Denver and b) the bearing from Niagara Falls to Denver. (10 pts)



Orlando to Denver = N 58°20'14" W
Niagara Falls to Denver = S 81°33'48" W

14. (2.1.2) The following data were given for a closed traverse ABCDEFA. Determine a) the linear error of closure, b) the precision of the survey, and c) using the Compass Rule correct the latitudes and departures. Hint: Remember that +latitude is North and +departure is East. (10 pts)

Course	Distance (ft)	Latitude	Departure	Corrected Lat.	Corrected Dep.
AB	183.79	0	+183.79		
BC	160.02	+128.72	+98.05		
CD	226.77	+177.76	-140.85		
DE	172.52	-76.66	-154.44		
EF	177.09	-177.09	0		
FA	53.95	-52.43	+13.08		

EL = .476 ft
Precision = 1/2050
Corrected lat/dep not shown

15. (2.1.2) Using the **uncorrected** latitudes and departures from problem 14 determine the Bearing of BC and the Azimuth of DE. (6 pts)

BC = N 37°17'52" E
DE = 243°36'05"

Equations:

Etotal = $\pm\ E\sqrt{n}$

Etotal = $\pm\sqrt{E_1^2 + E_2^2 + ... + E_n^2}$

C = $0.574M^2$

C = $0.0675k^2$

Rough Leveling $\pm\ 0.4\sqrt{M}$

Average Leveling $\pm\ 0.1\sqrt{M}$

Excellent Leveling $\pm\ 0.05\sqrt{M}$

Law of Sines $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Law of Cosines $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Compass Rule $\dfrac{Correction\ in\ Latitude AB}{Total\ Error\ in\ Latitude} = \dfrac{Length AB}{Perimeter}$

Conversions:

1mile = 5280 feet
1 acre = 43,560 sq. feet
1 ft = 12 inches
1 chain = 66 feet