NAME_____ Score_____

CEEN 113 Sections 1-6 Engineering Measurements Dr. Nelson Exam #1 Fall 2001
October 9-11 (Late fee on October 11th)

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 first 13 and last problems are worth 5 pts and problems 14-16 are worth 10. The numbers in parenthesis are the competencies being tested from the class list – you can ignore them.

1. (7.4) You want to be able to tape a distance of 2400 ft with a total error of no more than ±0.15 ft. How accurately must each 100 ft be taped so that the desired limit is not exceeded?

   0.03

2. (7.4) You wish to measure 234.84 meters with a 30-meter tape that has a calibrated length of 29.97 meters. What distance do you actually need to measure so that you will have the desired measurement?

   235.07 m

3. (9.1) Using a total station you sight on a rod and measure a zenith angle of 71°29'42" and a slope distance of 339.65 ft. If the elevation on the ground where your total station is set up is 2562.34 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).

   2670.14 ft

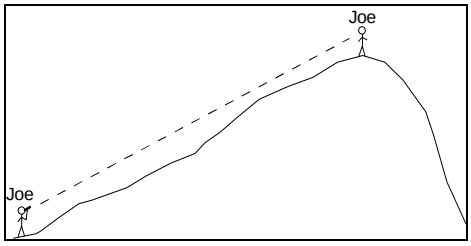
4. (7.4) If you are standing on a 12 ft tower (eye level is at 17.8 ft) watching a train move away from you across the flat plains, how far (in miles) from tower is the train when the top of its 20-foot caboose disappears from your view?

   11.5 miles

5. (9.1) In measuring an angle by repetition, the reading after the first turning in a direction positive was 63°15'22". The reading after the sixth turning is 19°31'54". Determine the angle measured.

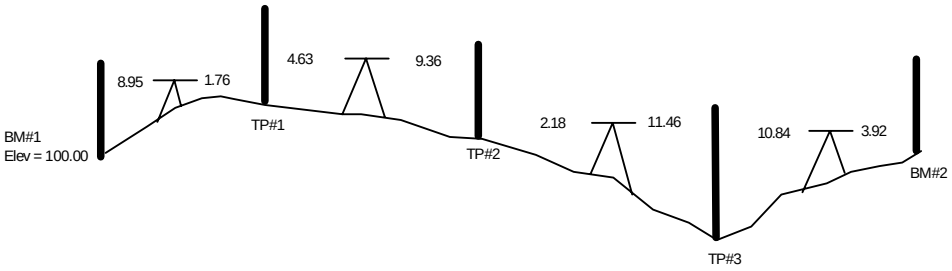
   63°15'19"

6. (7.4) Using a clinometer, Joe measures a 44^{o} vertical angle to Bill standing on top of a nearby hill. It took Bill 631 paces to get to the top of the hill and 619 paces coming back. If Bill's calibrated pace is 2.74 ft/pace, what is the approximate height of the hill Bill climbed from where Joe stands?



H = 1190 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.



BM 2 = 100.10 ft

8. (7.4) Compute the area (in acres) of the traverse defined by the coordinates given in the table below.

X (ft)	Y (ft)
207.4	559.3
666.7	738.5
688.3	541.7
839.0	379.8
604.0	296.0
323.9	218.3

4.24 acres

9. (7.4) A level circuit was run to set the elevations of several bench marks. The elevation values and distances (cumulative) obtained are shown in the table below. What precision (classification) of leveling was performed?

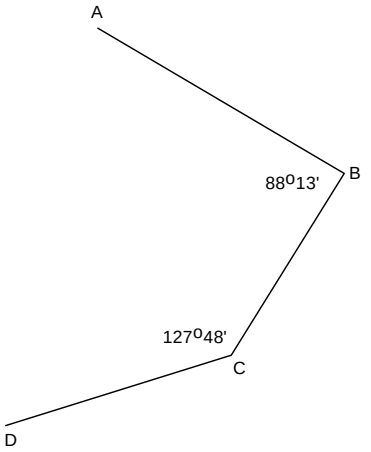
Point	**Distance from BM1 (miles)**	**Elevation**
BM1	0	909.13
BM2	3	898.84
BM3	7	892.16
BM4	10	901.37
BM1	14	908.57

Rough

10. (7.4) Adjust the elevations for level circuit shown in problem 8.

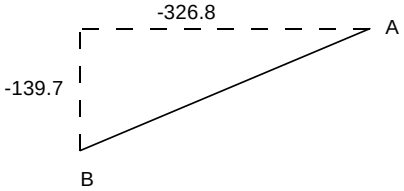
BM	Elevation
BM1	909.13
BM2	898.96
BM3	892.44
BM4	901.77
BM1	909.13

11. (2.1.2) Given the Azimuth of AB is 132°34', and the interior angles shown at B and C. Determine the Azimuth of CD.



276°33'

12. (2.1.2) Find the bearing (to the nearest second) of AB, given the departure and latitude shown in the figure below.



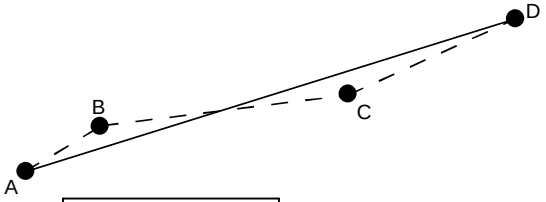
S 66°51'16" W

13. (2.1.2) In 1900 a magnetic bearing was measured to be S87°15'W when the magnetic declination at that location was 5°E. What is the astronomic or true bearing? Also, if the magnetic declination today is 5°W find the magnetic bearing today.

N 87°45' W
N 82°45' W

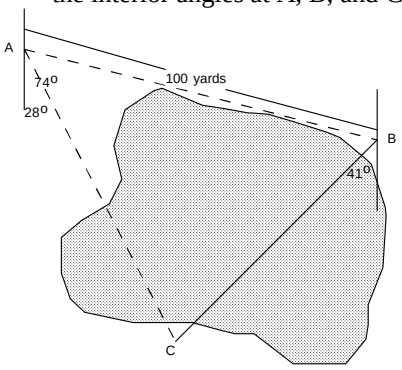
14. (2.1.2) The two frontage corners (A and D) of a large tract of land are joined by the open traverse ABCD with the given distances and bearings. Determine the distance and bearing of the property frontage AD.

Course	Distance (ft)	Bearing
AB	80.32	N70°10'07"E
BC	953.83	N74°29'00"E
CD	818.49	N70°22'45"E



1851.44 ft
N 72°28'58" E

15. (2.1.2) A bridge is to be built across a small lake from B to C. The bearing from B to C is S41°W. From a point A, 100 yards from B, the bearings to B and C are S74°E and S28°E, respectively. Find the interior angles at A, B, and C and the distance from B to C.



77.1 yds

16. (2.1.2) Given latitudes and departures in the table below, compute the linear error of closure and precision, then compute the corrected latitudes and departures.

Course	Distance (ft)	Bearing	Latitude	Departure	Corrected Lat.	Corrected Dep.
AB	164.95	N71°11'E	+53.20	+156.13	***53.16***	***156.16***
BC	88.41	S31°00'E	-75.78	+45.53	***-75.80***	***45.55***
CD	121.69	S44°18'W	-87.09	-84.99	***-87.12***	***-84.97***
DE	115.89	N68°47'W	+41.94	-108.03	***41.91***	***-108.01***
EA	68.42	N7°21'W	+67.86	-8.75	***67.84***	***-8.74***

$E_L = 0.17$
$P = 3290$

Answers

17. (2.1.2) Using the **uncorrected** latitudes and departures from problem 16, determine the meridian distances for each line segment. **Note:** We are using the uncorrected values so that I'm sure everyone is using the same answers. However, because there is some error in closure for departures, do not be worried if when computing the meridian distances they do not exactly close as you work your away around from the "westerly" most point. Be sure to sketch, at least roughly, the traverse in order to help you determine the meridian distances.

Segment	MD
AB	78.07
BC	178.90
CD	159.17
DE	62.66
EA	4.27

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 $\dfrac{Correctionin\ in\ LatitudeAB}{Total\ Error\ in\ Latitude} = \dfrac{LatitudeAB}{Perimeter}$

Conversions:

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