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Score _____

CEEN 113 Sections 1-6 Engineering Measurements Dr. Nelson Exam #2 Fall 2000
November 13-14 (Late fee on November 15th)

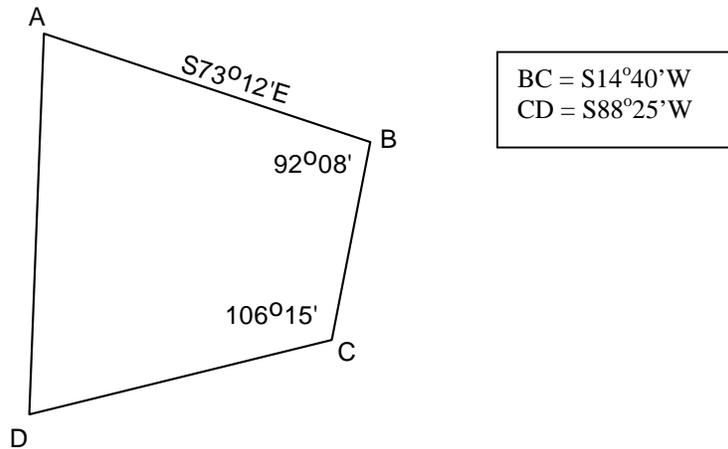
OPEN BOOK & LAB MANUAL (not notes and homework) - CALCULATORS REQUIRED

Show your work in the space provided, but for the most part I am grading your **answers**.

2 hour 30 minute time limit (1 point for each two minutes over will be deducted). Pace yourself, if you are stuck on a problem move on to the ones you are more confident in and then come back if you have time.

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

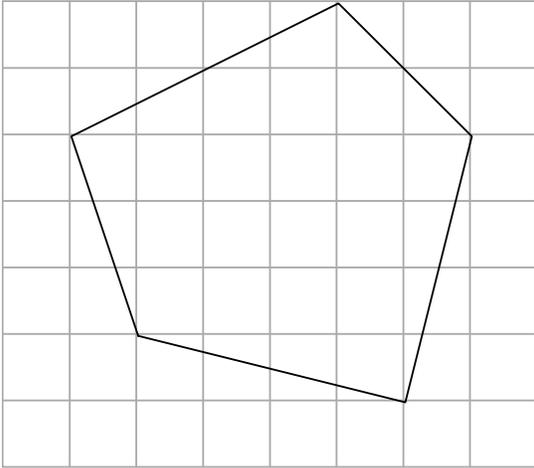
1. Calculate the bearings for BC and CD from the following diagram (8 pts).



2. The PVI of a vertical curve is 31+25 at elevation of 4625.32 feet. $g_1=3.2\%$ and $g_2=-4.6\%$. If the curve length is 1200 feet, determine the station and elevations of the PVC and PVT as well as the elevation of the **vertical curve** at its midpoint ($L/2$) (7 pts).

PVC = 25+25
Elev = 4606.12
PVT = 37+25
Elev = 4597.72
Mid chord elev = 4601.92
Elev at midpoint = 4613.62

3. If the grid squares are 50 feet apart determine the area (sq. feet) of the five-sided polygon (Hint: Use the coordinate area method). (8 pts).



Area = 58,750 sq ft

4. A grade of +4.3% passes through station 10+50 at elevation 1567.3. A grade of -2.4% passes through station 17+85 at elevation 1569.7. Determine the station and elevation of the location where the two grade lines intersect (This is not complete vertical curve information, I just want you to intersect the two lines). (6 pts)

Station = 13+49
Elevation = 1580.16

5. For a horizontal circular curve, the PI is at station 29+64.20, I is 32°30', and the degree of curve D is 3°10' (arc definition). Compute the following curve information: (15 pts)

a) R .

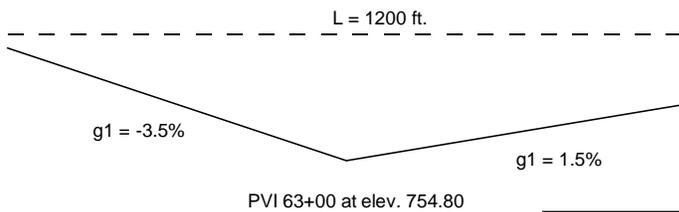
b) PC .

c) PT .

d) Deflection angles for the first even 100-foot station after the PC and the last even 100-foot station before the PT.

At 25+00 deflection = 1°
At 34+00 deflection = 15°15'1"

6. For the vertical curve shown below determine the required elevation and or station information listed on the answer sheet. $g_1 = -3.5\%$, $g_2 = 1.5\%$, the PVI is at station 63+00 at an elevation of 853.48, and the length of the curve is 1200 feet (18 pts).



a) Station and elevation of the BVC = .

b) Station and elevation of the EVC = .

c) The elevation at station 64+75 = .

d) Station and Elevation of the low point on the curve .

7. Two street curb lines intersect with $I = 48^\circ 43'$. A curb radius must be selected so that an existing catch basin will abut the future curb. The curbside of the catch basin centerline is located from the PV at a distance of 12.384 m. and at an angle of $18^\circ 41'$ from the right of the forward tangent. Compute the radius that will permit the curb to abut the existing catch basin (12 pts).

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| $R = 81.3\text{m}$ |
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8. Bearings, lengths, departures and latitudes are given in the table below for a five-sided traverse. Calculate the linear error of closure and the precision (+ for departure is East and + for latitude is North). (6 pts)

| Station | Bearing | Length (ft) | Departure (ft) | Latitude (ft) |
|---------|-------------|-------------|----------------|---------------|
| A-B | N26°10'0"E | 285.10 | +125.72 | +255.88 |
| B-C | S75°24'48"E | 610.45 | +590.77 | -153.74 |
| C-D | S15°30'6"W | 720.48 | -192.56 | -694.27 |
| D-E | N01°41'30"W | 203.00 | -5.99 | +202.91 |
| E-A | N53°05'54"W | 647.02 | -517.40 | +388.50 |

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|-----------------------------------------------|
| $E_L = 0.9 \text{ ft.}$ Precision = 1/2700 |
|-----------------------------------------------|

9. The following information with respect to the diagram shown below is known:

Angle x is $22^{\circ}30'14.6''$, and angle y is $29^{\circ}48'50.6''$

$X_A=38,762.5$, $Y_A=98,202.66$, $X_B=61252.84$, $Y_B=110,002.65$, $X_C=78,565.12$, $Y_C=89,102.32$
 (all coordinates are in feet)

Using the 3-point resection method compute the coordinates at point P (20 pts).

Some important equations that will be helpful include:

$$J = g + h = 360 - x - y - R$$

$$\tan(h) = \frac{\sin(J)}{K + \cos(J)}$$

$$\text{where: } K = \frac{\sin(x) \overline{BC}}{\sin(y) \overline{AB}}$$

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| $X_p = 33,773.46$ $Y_p = 63842.54$ |
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