

Name: _____.

CIE 272
Exam 1
14 October 2003

Directions. This is a 2-hour, open-book examination. There are **eight pages**. You are expected to do your own work. Answer the questions on the exam sheets. Partial credit will be given only if I can understand how you arrived at your answers, so please *show your work*.

DON'T PANIC!

If you can't solve a problem, chances are good that many other students are in the same predicament. Also, if a question is unclear, don't hesitate to ask for clarification.

0. Write your name on the exam **NOW!**

1. (10 Points) A surveyor is measuring the angles in a closed-loop traverse survey.

a. (5) While set up at point **A**, the surveyor uses the double-angle technique to measure the interior angle. After completing the procedure, the theodolite reads a horizontal angle of $131^{\circ} 43'$. What value should the surveyor record as the measured value of the angle?

b. (5) What is the expected value of the deflection angle measured at point **A**?

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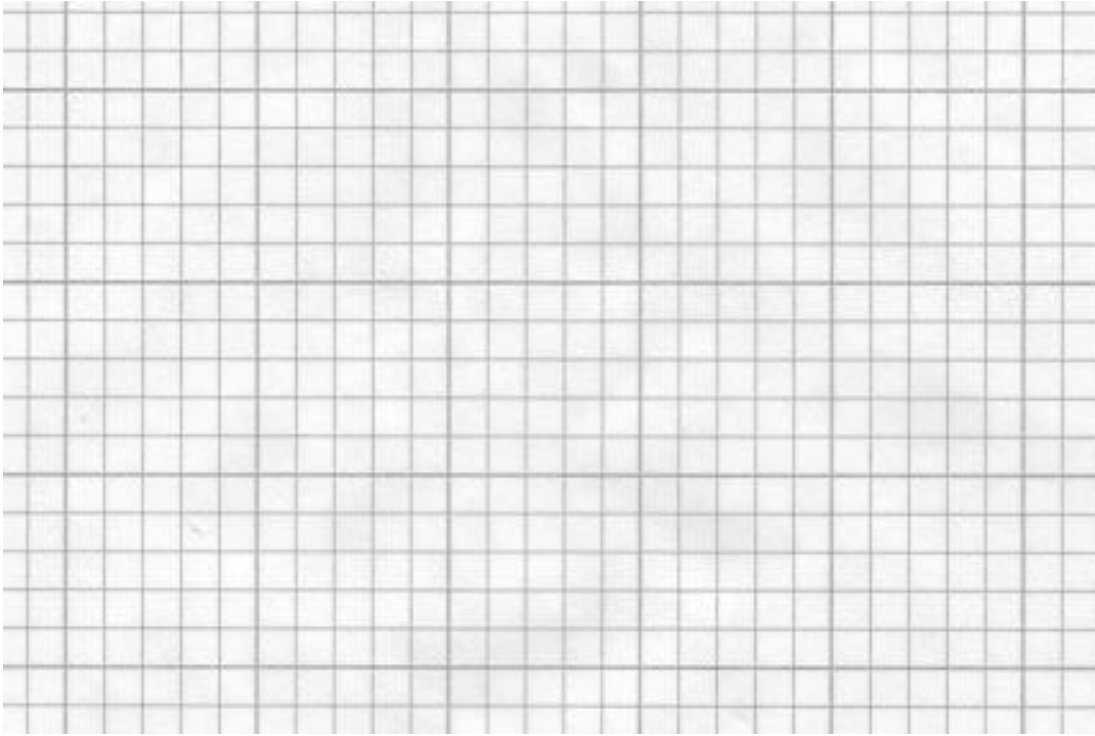
2. (25 Points) A total station was set up in an open area to make measurements of the centerline of a road that is under construction. Like the total stations you used, the vertical distance, VD, is positive if the prism is above the scope. A backsight was made to BM13, which has elevation 306.539 m. Four foresight measurements were then made to points along the centerline of the road. All measurements were made with a prism height of 2.000 m. The results of the survey are shown in the table below:

| STA | Distance Along Centerline (m) | Backsight (m) | HI (m) | Foresight (m) | Elevation (m) |
|---------------|-------------------------------|---------------|--------|---------------|---------------|
| BM13 | | | | | 306.539 |
| <i>set-up</i> | | -7.859 | | | |
| 0+00 | 0 | | | -1.255 | |
| 0+50 | 50 | | | -0.318 | |
| 1+00 | 100 | | | +0.282 | |
| 1+50 | 150 | | | +0.578 | |

- a. (10) Determine the elevations of the four stations (0+00, 0+50, 1+00, 1+50).

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- b. (10) Sketch the profile of the road.



- c. (5) The slope of the road bed is supposed to constant, connecting the existing elevations of stations 0+00 and 1+50. Use your sketch to determine if stations 0+50 and 1+00 require **cutting** or **filling**.

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3. (35 Points) A survey is conducted to establish the boundaries of a five-sided property.
- a. (10) The surveyor determines the interior angle at point **B** to be $210^{\circ} 12'$. This angle measurement was made "to the right." Determine the magnitude and direction of turning for the deflection angle.
- b. (10) The measured interior angles for the five corners of the traverse are given in the table below. Determine the angular misclosure, and adjust the angles as necessary.

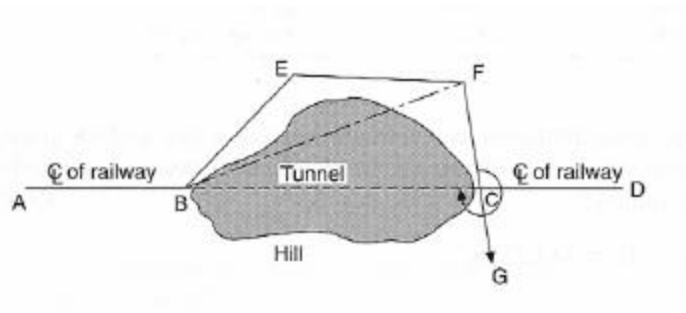
| Angle at Point: | Interior Angle |
|-----------------|-------------------|
| A | $62^{\circ} 46'$ |
| B | $210^{\circ} 12'$ |
| C | $88^{\circ} 04'$ |
| D | $99^{\circ} 38'$ |
| E | $79^{\circ} 12'$ |

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- c. (15) Side **BC** proceeds due West, and the points are laid out in a clockwise fashion. Determine the bearing and azimuth of side **DE** and **EA**.

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4. (30 Points) A railroad is to be constructed from **A** to **D** in a straight line, tunneling through a hill (see figure). In order to speed the work, the tunnel will be driven from both sides.



The centerline of the railroad has been established from **A** to the foot of the hill at **B**. Now, the position **C** on the other side of the hill must be determined. A traverse around the hill yielded the following measurements:

| Traverse Leg | Azimuth | Horizontal Distance (m) | Remarks |
|--------------|----------|-------------------------|-------------------------|
| AB | 88° 00' | -- | Center line of railroad |
| BE | 46° 30' | 495.8 | |
| EF | 90° 00' | 350.0 | |
| FG | 174° 12' | -- | Long sight past hill |

Determine:

- The horizontal distance **FC** required to establish point **C**
- The clockwise angle from **CF** that must be turned to begin the tunnel
- The horizontal distance of the finished tunnel.

[**Hint:** Apply the Law of Sines to triangle BFC.]

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