

ITCM 310: Test 2, Part 1
October 28, 2010

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(3 Points Each)

A (1) What type of tapes are used in Survey 310 labs?

- (a) Add on metal tape in hundredths
- (b) Gunter's chain
- (c) Subtract tape
- (d) Engineers chain
- (e) None of the above
- (f) a and d

-3

90

show work

(2) The following distances were recorded on an old deed for a parcel of land that is to be resurveyed; convert the given distances to their equivalent distances in feet.

- (a) 5.32 chains
- (b) 8 chains, 57 links
- (c) 13 chains, 78 links

351.12' GC
565.102' GC
909.48' GC

(3) A steel tape with a standardized length of 99.990 ft. is used to lay out and mark a distance on level ground; the required horizontal distance is 300.00 ft. The average temperature at the time of measurement is 95° F. What distance should be laid out between the two points under those conditions so that the actual horizontal distance will be 300.00 ft? (Assume normal tension is used.)

0.00000645 (95-68) 300.00

$C_T = 0.052245$

300.00
- .052245
299.947755

299.947755

(4) List four methods of leveling and briefly describe.

- (1) differential leveling: used to determine differences in elevation between points by using a level & a Philadelphia rod
- (2) benchmark leveling: type of leveling employed when a system of BMs is to be established, extended or densified
- (3) reciprocal leveling: level is set up on one side of a river and then on the other side to get the final result
- (4) three wire leveling: take readings from each line and then average them to get the answer

(5) List five sources of random errors in leveling.

- (1) Natural
- (2) Personal
- (3) Systematic
- (4) Accidental
- (5) Instrumental

X 3

(6) List six possible instrumental errors that may occur during surveys with a transit or theodolite.

- (1) bubble not centered
- (2) collimation error
- (3) gradation errors
- (4) telescope not centered
- (5) loose tripod head
- (6) tripod not level

(7) Convert the following bearings to azimuths.

(a) N $25^{\circ} 10' 15''$ E

$25^{\circ} 10' 15''$

(b) S $67^{\circ} 32' 14''$ W

$247^{\circ} 32' 14''$

(c) N $22^{\circ} 15' 52''$ W

$337^{\circ} 44' 08''$

(d) S $72^{\circ} 15' 57''$ E

$107^{\circ} 44' 03''$



(8) Convert the following azimuths to bearings.

(a) $277^{\circ} 15' 35''$

N $82^{\circ} 44' 25''$ W

(b) $15^{\circ} 17' 22''$

N $15^{\circ} 17' 22''$ E

(c) $183^{\circ} 15' 52''$

S $03^{\circ} 15' 52''$ W

(d) $121^{\circ} 13' 20''$

S $58^{\circ} 46' 40''$ E

(9) The magnetic bearing of a boundary line was recorded as N $35^{\circ} 00'$ W in a deed dated 1903. At that time and place, the magnetic declination was known to be $3^{\circ} 15'$ W. Determine the true azimuth and bearing for the line.

$$\begin{array}{r} 35^{\circ} 00' \\ + 03^{\circ} 15' \\ \hline 38^{\circ} 15' \end{array}$$

$$\begin{array}{r} 359^{\circ} 60' \\ - 38^{\circ} 15' \\ \hline 321^{\circ} 45' \end{array}$$



N $38^{\circ} 15'$ W - BEARING

$321^{\circ} 45'$ - Azimuth

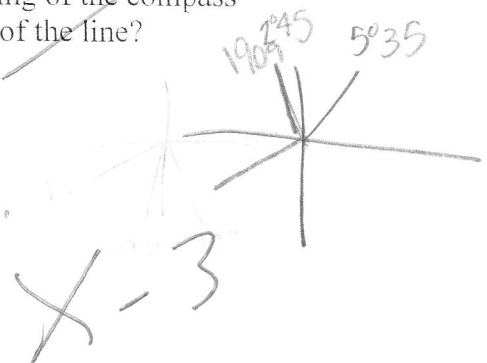
(10) The magnetic bearing of a boundary line was recorded as S $76^{\circ} 30'$ W in 1897, at which time the declination was $2^{\circ} 45'$ W. It is desired to retrace the line with a compass today, when the declination is $5^{\circ} 35'$ E. What reading of the compass should be used to retrace the line? What is the true azimuth of the line?

You should use $5^{\circ} 35'$ E to read the compass today.

The Azimuth:

$$\begin{array}{r} 179^{\circ} 60' \\ + 76^{\circ} 30' \\ - 05^{\circ} 35' \\ \hline \end{array}$$

$250^{\circ} 55' = \text{True Azimuth}$



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(7 Points Each)

1.

Station	B.S.	H.I.	F.S.	Elevation, ft.	Distance, ft.
BM1	6.680			761.191	
		767.871'			39'
TP1	8.781		1.275	766.596'	40'
		775.377'			60'
BM2	2.882		2.204	773.173'	67'
		776.055'			41'
TP2	2.243		8.755	767.300'	48'
		769.543'			52'
BM1			8.331	761.212'	56'
$\Sigma =$	20.586		20.565'		403'

The above table contains notes from a closed, "positive backsight" differential leveling circuit. Complete the table and answer questions 1 - 3 about the circuit. **Important: Show your work.**

(a) Elevation of BM2 =

773.173'

Elevation of Instrument between TP1 and BM2 =

775.377'

(b) Error of Closure =

0.021'

Using backsights and foresights, perform an arithmetic check of this error of closure.

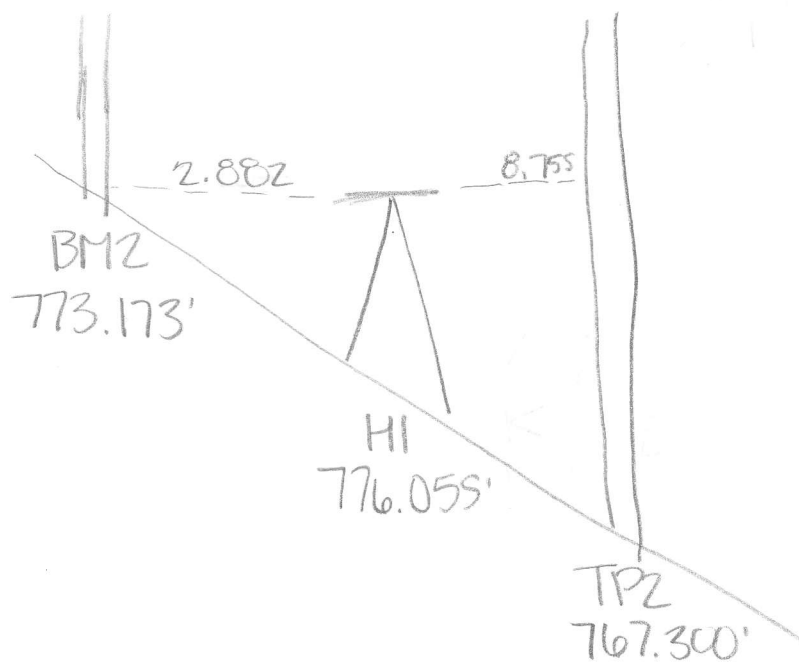
$$20.586 - 20.565 = 0.021$$

(c) What is the relative accuracy of the level circuit? 1 in

$$\frac{0.021}{403} = \frac{403}{0.021}$$

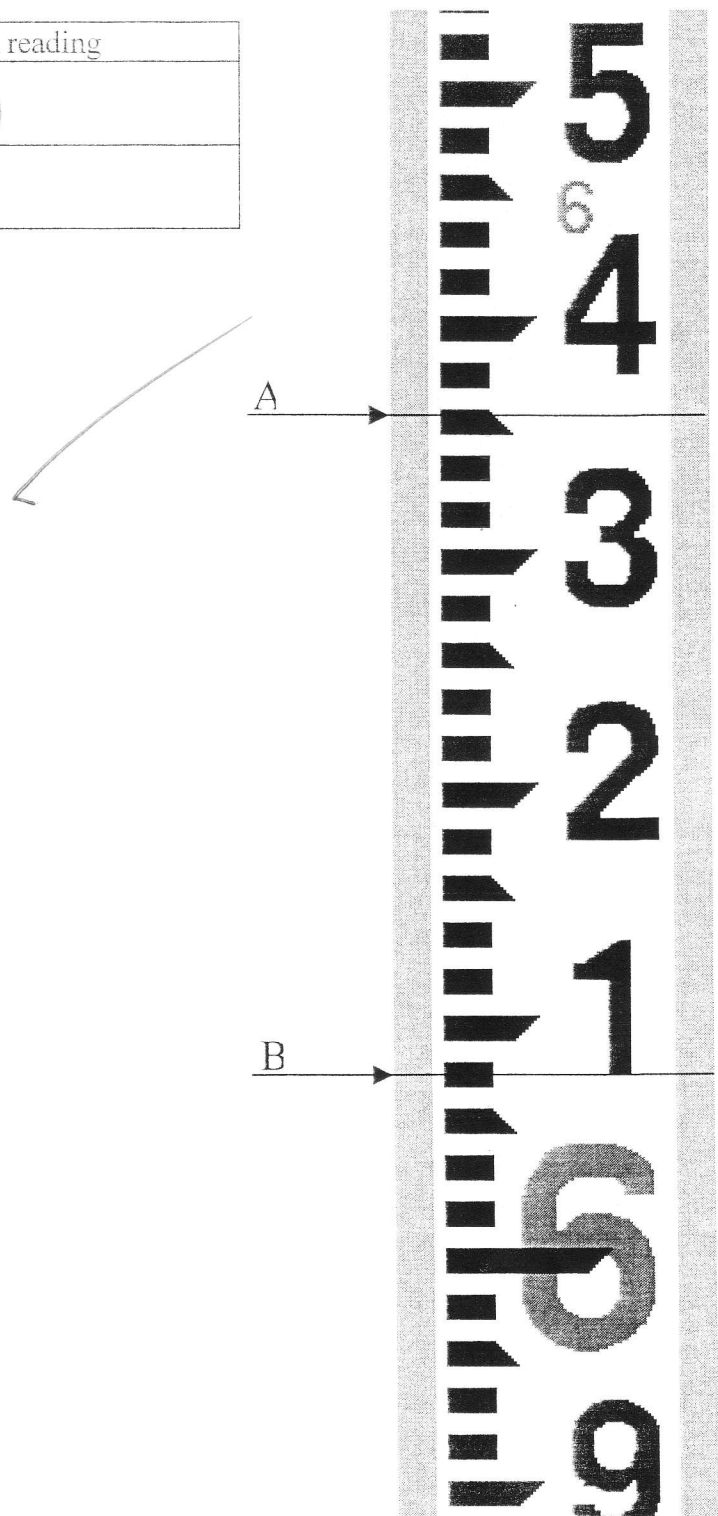
1: 230,286 inches

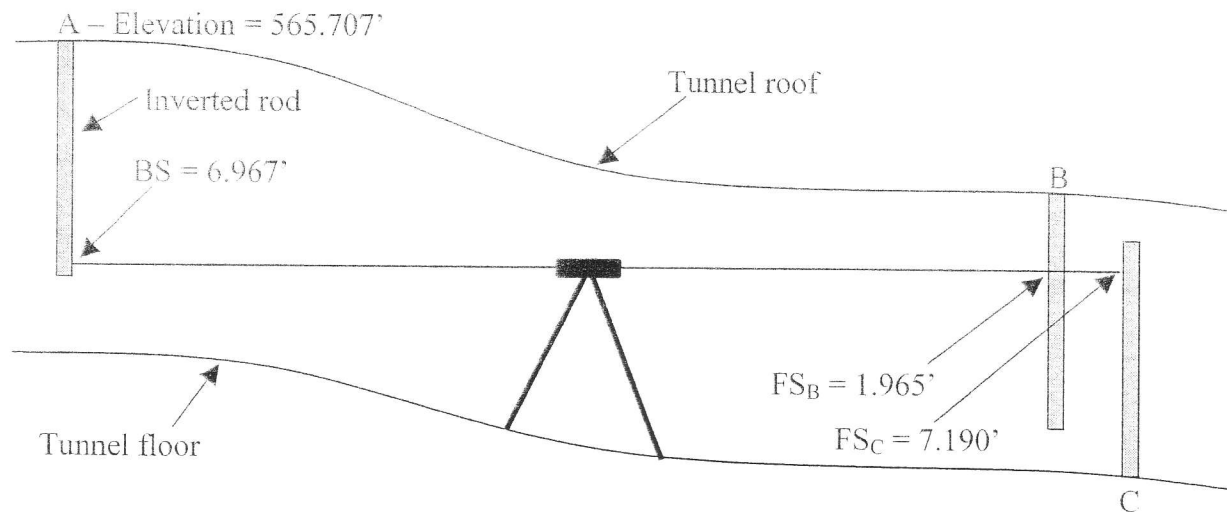
2. From the "Field Data" table in Problem #1, accurately sketch in the area below an elevation (side) view of the instrument setup and land layout for the two points between and including points BM2 and TP2 (only). Include instruments (level and rods), backsight and foresight shots, land grade, approximate elevation changes in topography from the field data, height of instrument, and any other details to accurately represent the shot. Do not attempt to draw exactly to scale.



3. A Philadelphia rod is shown below (not shown to scale). Two arrows (labeled "A" and "B") indicate horizontal lines across the rod. What are the rod readings at those two arrows to 0.001' accuracy?

Arrow	Rod reading
A	6.350
B	6.075





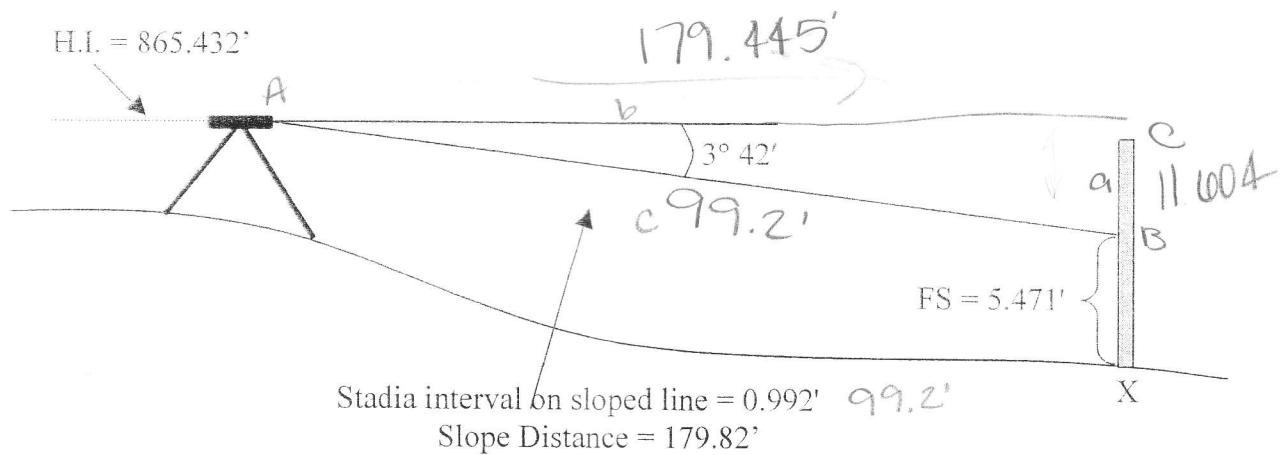
In the above figure, an elevation “shot” in an underground tunnel is shown. The backsight is taken off the tunnel roof (at point A), foresight B is taken off the tunnel roof (FS_B), and foresight C is taken off the tunnel floor (FS_C). Use the figure as a guide to answer the following questions. *Hint: The positive backsight computation method typically used in differential leveling will not work in this problem. Important: Show your work.*

4. (a) Elevation of Point B = 560.705'

(b) Elevation of Point C = 551.55'

5. Clearance between Points B and C = 9.155'

6. Elevation of Instrument = 588.740'



From the above figure, answer the following questions. **Important: Show your work.**

7. Elevation of Point X = 848.357'

8. Horizontal distance between leveling instrument and point X = 179.445'

$\cos \theta$ (slope dist)

$$\cos(3^\circ 42') (179.82') = 179.445'$$

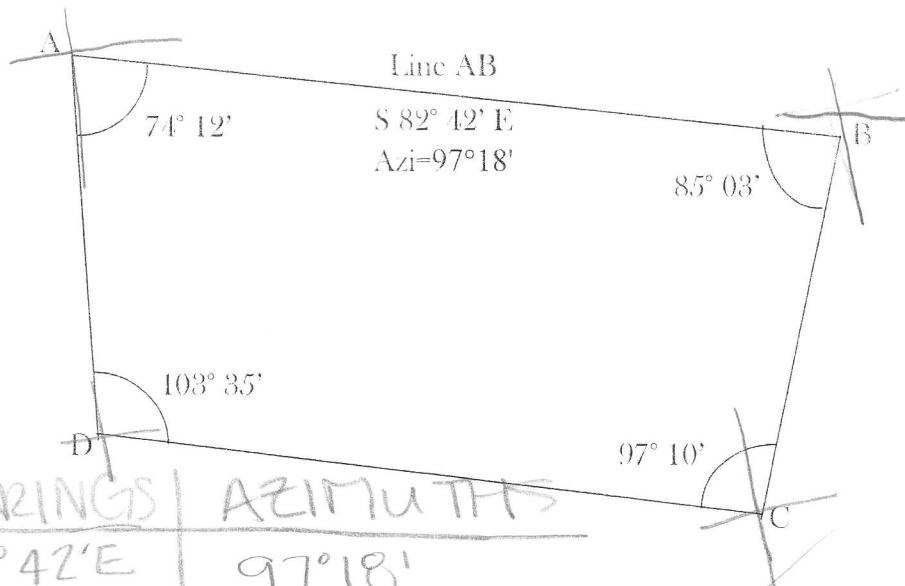
$$a^2 = b^2 + c^2 - 2bc(\cos A)$$

$$179.445^2 + 179.82^2 - 2(179.445)(179.82)(\cos(3^\circ 42'))$$

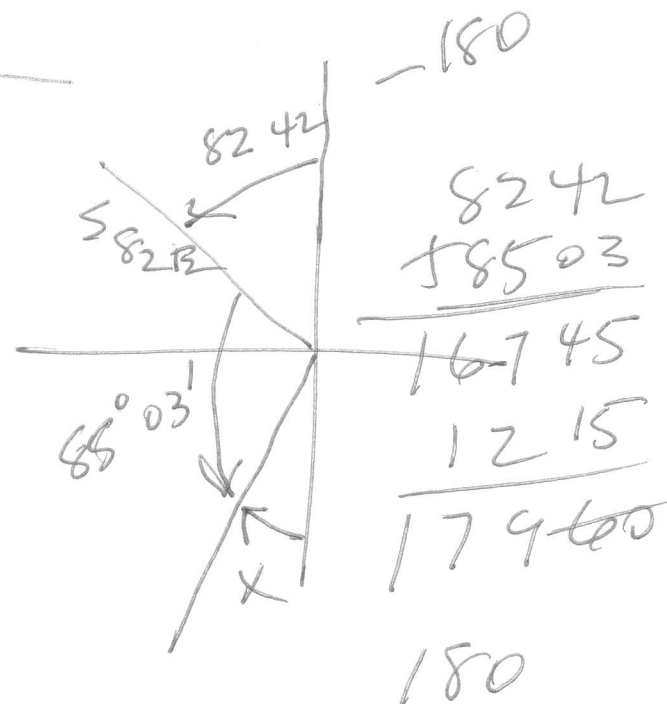
$$64535.74043 - 64401.08297$$

$$134.66'$$

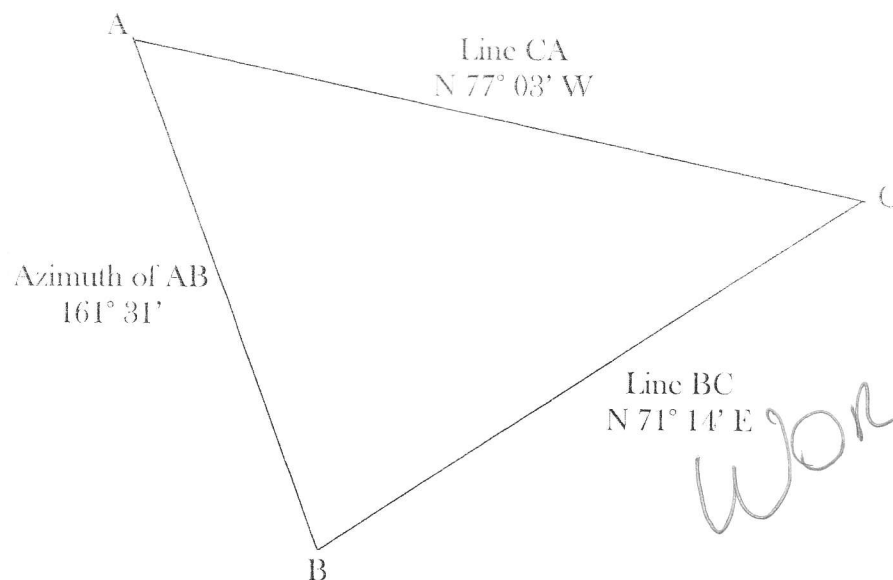
9. From the figure below, compute the **clockwise OR counter-clockwise azimuths and bearings of each course** (line) of the traverse with the given interior angles using either the azimuth clockwise **OR** counter-clockwise computational method. Assume line A-B has a bearing of S $82^{\circ}42'$ E (and azimuth of $97^{\circ}18'$) for computations. **Show your computations** column in the area below the figure. Provide a clear table of the azimuths and bearings of each line in the clockwise **OR** counter-clockwise direction.



	BEARINGS	AZIMUTHS
AB	S $82^{\circ}42'E$	$97^{\circ}18'$
BC	S $12^{\circ}15'W$	$192^{\circ}15'$
CD	N $84^{\circ}55'W$	$275^{\circ}05'$
DA	N $08^{\circ}30'W$	$351^{\circ}30'$



10. For the figure shown below, compute the interior angles at points A, B, and C. Show your work. Perform the appropriate mathematical check for your solution.



Point	Interior Angle
A	71° 43'
B	89° 43'
C	58° 34'