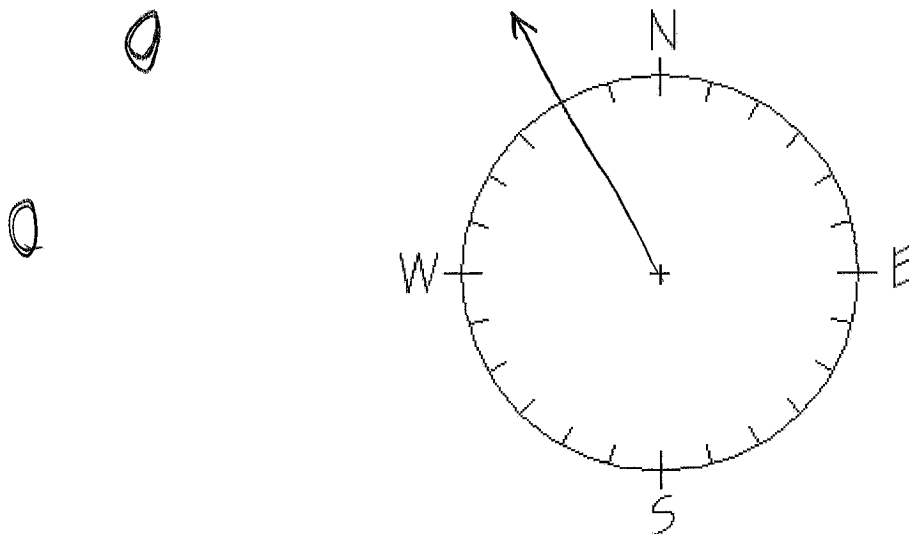


Name: Spencer Easton

Midterm #1
~~200 Points~~ — 400 points

1. Draw a bearing of $N30^{\circ}W$ on the compass below (20 points):



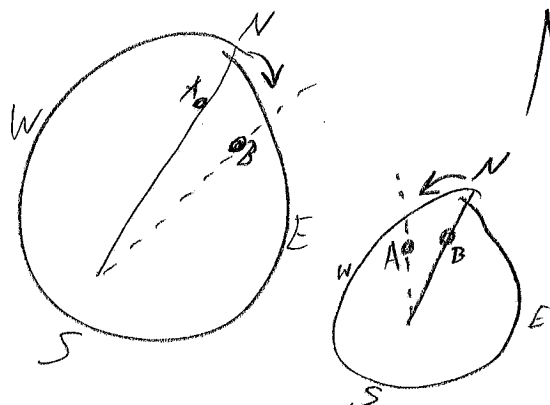
2. Convert a bearing of $N55^{\circ}22'20''W$ to an azimuth (20 points):

$$N55^{\circ}22'20''W = 304^{\circ}38'40''$$

3. Convert an azimuth of $102^{\circ}09'54''$ to a bearing. Express your answer in degrees, minutes, and seconds (20 points):

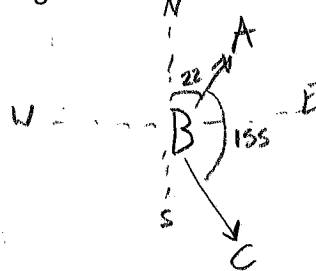
$$S77^{\circ}51'6''E$$

4. The bearing from Point A to Point B is $N88^{\circ}16'35''E$. What is the bearing from Point B to Point A (20 points)?



$$N88^{\circ}16'35''W$$

5. A surveying crew set up a theodolite over Point B and back sighted on Point A. The survey crew then used point C as the foresight. The horizontal angle measured clockwise from Point A to Point C was $155^\circ 28' 40''$. The bearing from Point B to Point A is $N22^\circ 41' 10''E$. What is the bearing from Point B to Point C (20 points)?



$S 1^\circ 51' 10'' E$

155.5

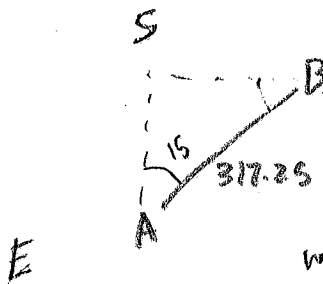
22.6

6. The horizontal distance to Point B from Point A is 317.25. The bearing from Point A to Point B is $S15^\circ 05' 30''W$. Calculate the latitudes and departures for Point B from Point A (20 points).

sin, cos, tan

$$\text{latitude} = \cos(15^\circ 05' 30'') \cdot 317.25 = \underline{306.31}$$

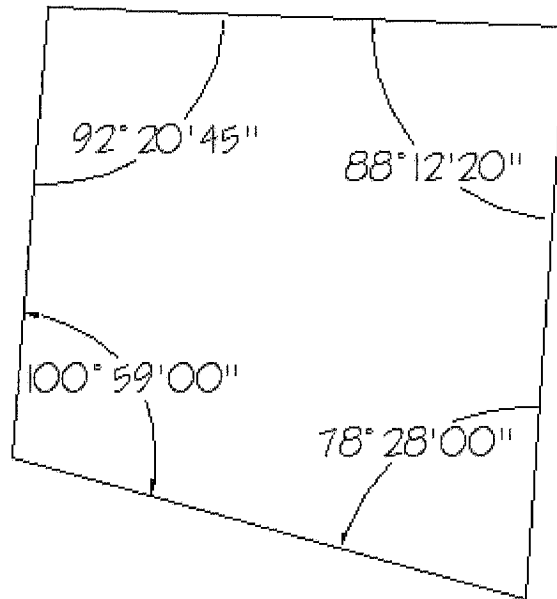
$$\text{departure} = \sin(15^\circ 05' 30'') \cdot 317.25 = \underline{82.6}$$



7. Point A is located at the coordinates 1000.00 North and 1000.00 East. What are the coordinates for Point B in Problem 6 (20 points)

$(693.69 \text{ North}, 917.4 \text{ East})$

8. A surveying crew surveyed a four-sided property shown in the figure below. Using K equal to 6 seconds, check the accuracy of the angles. Is the accuracy acceptable? Justify your answer.



$$\begin{array}{r} 92^{\circ} \quad 20' \quad 45'' \\ 88^{\circ} \quad 12' \quad 20'' \\ 100^{\circ} \quad 59' \quad 00'' \\ 78 \quad 28' \quad 00'' \\ \hline \end{array}$$

$$358^{\circ} \quad 120' \quad 5''$$

$$360^{\circ} \quad 00' \quad 5''$$

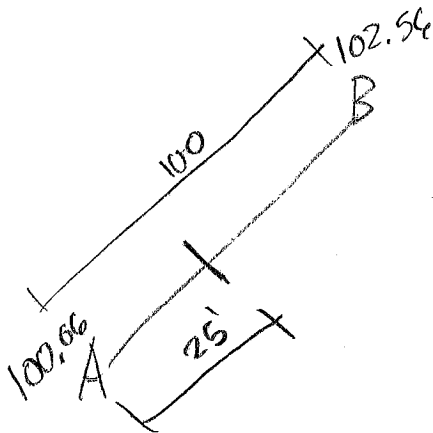
$$-360^{\circ} \quad 0' \quad 0''$$

$$= 0^{\circ} \quad 0'' \quad 5''$$

it is acceptable because you are smaller than K

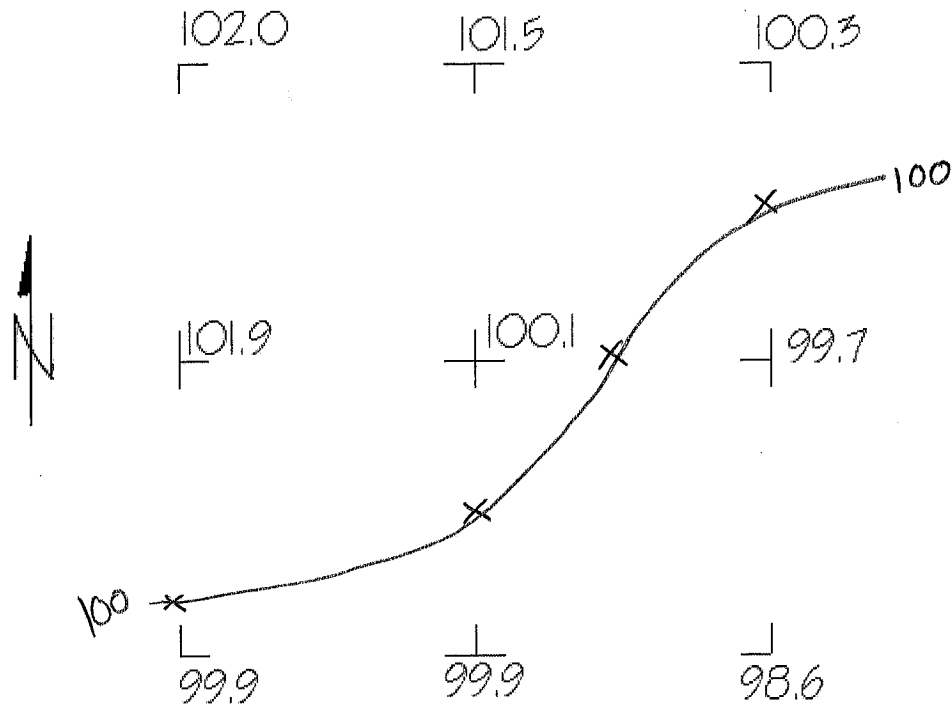
9. Point A and Point B are 100 feet apart. The elevation of Point A is 100.06 feet. The elevation of Point B is 102.56 feet. How far from Point A, along the line from Point A to Point B, would you draw the 101-foot contour line when preparing a topographic map? Use linear interpolation. (20 points)

$$100 - \sqrt{101 + 100.06} + \sqrt{101 + 102.56} = 25'$$

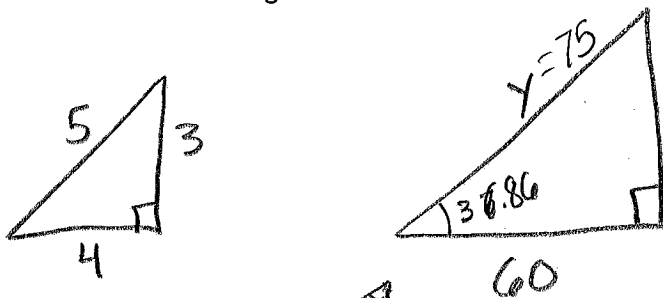


$$25'$$

10. Sketch the 100.0 contour line on the following topographic map. (20 points)



11. You are laying out a building using a 3-4-5 triangle. The base of the triangle is 60 feet. What are the lengths of the other two sides of the triangle? (20 points)



$$x = 45 \quad \gamma \quad \cos 36.86 = \frac{60}{\gamma} \left(\frac{\gamma}{\gamma} \right)$$

$$\frac{60}{\cos 36.86}$$

$$\frac{60}{\frac{4}{5}} = \frac{4}{3}$$

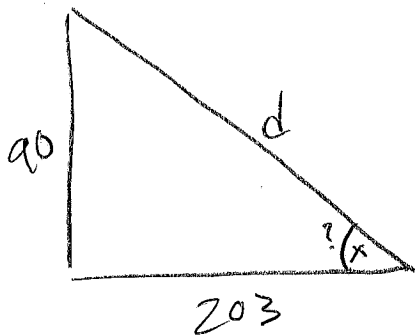
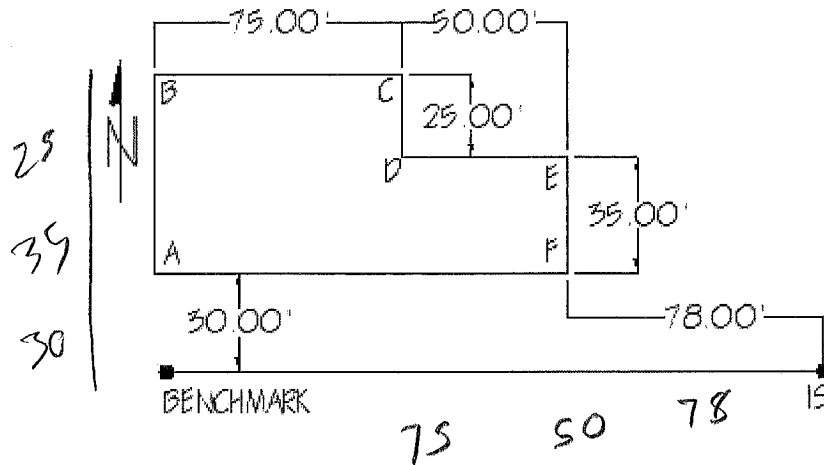
$$75^2 = 60^2 + x^2$$

$$-3600 = 45^2$$

$$y = 75$$

$$x = 45$$

12. A survey crew has been assigned to layout the building shown in the figure below. The survey crew plans on setting up a theodolite over Point IS and using the benchmark as a backsight. Calculate the angle and distance to Point B from Point IS. The distance should be measured from Point IS. The angle should be measured clockwise from the line IS-Benchmark with the instrument located at Point IS. (20 points)



$$90^2 + 203^2 = C^2$$

$$C = 222.06$$

$$\tan X = \frac{90}{203}$$

$$\tan^{-1} \frac{90}{203} = X$$

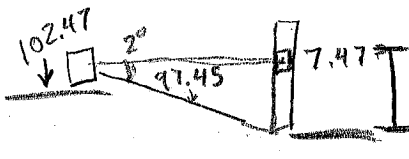
Angle $X = 23.91^\circ$ or $23^\circ 54' 36''$
distance $d = 222.06'$

13. A survey crew used a theodolite to stake the corners of a building. For one corner of the building the survey crew took the following readings for the existing ground elevation:

Instrument Height = 102.47 feet
Slope Distance = 97.45 feet
Vertical Angle = $2^{\circ} 11' 50''$
Rod Reading = 7.47 feet

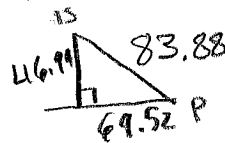
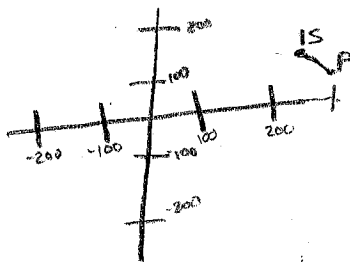
The bottom of the building foundation is to be constructed at an elevation of 96.00 feet. Determine the cut or fill for the building corner. Be sure to identify if it is a cut or a fill. (20 points)

$$102.47 - 7.47 = 95$$



You would need to Fill 1' for this corner

14. The instrument station (Point IS) has the coordinates of 144.17 N, 222.47 E. You are laying out a point (Point P) with coordinates of 97.23 N, 291.99 E. What is the distance between Point IS and Point P? (20 points)

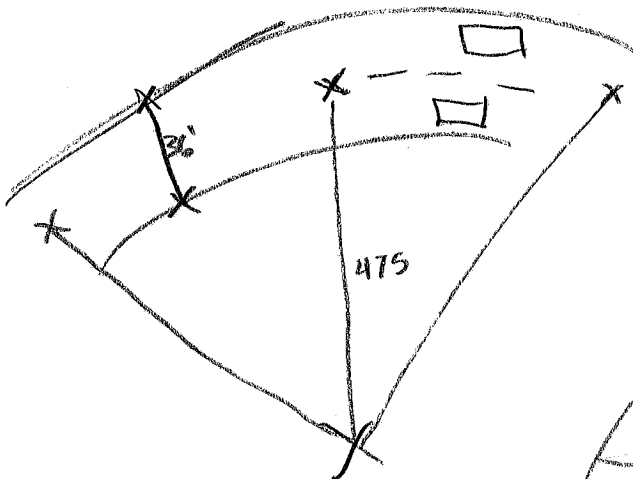


$$46.94^2 + 69.52^2 = C^2 = 83.88$$

$$\sqrt{203.36 + 7000} = C^2 = 83.88$$

$$d = 83.88$$

15. A 36-foot wide road is to be constructed with a curve that has a 475-foot radius. The radius is measured to the center-line of the road. Determine the radius for the inside edge of asphalt and outside edge of asphalt. (20 points)



$$36/2 = 18$$

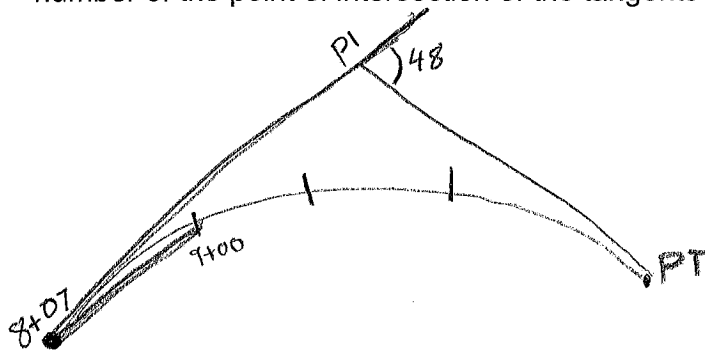
$$475 - 18 = 457$$

$$475 + 18 =$$

$$R^i = 457'$$

$$R^{out} = 493'$$

16. A survey crew is to layout a 540-foot radius curve. The beginning of the curve (PC) is located at Station 8 + 07.00. The included angle (I or Delta) is 48° . Determine the station number of the point of intersection of the tangents (PI). (20 points)



$$T = 540 \tan \frac{1}{2}(48) = 240.42$$

$$\begin{array}{r} 807.00 \\ + 240.42 \\ \hline 1047.42 \end{array}$$

PI station # would be 10 + 47.42

17. 1. Determine the station number for the end of curve (PT) in Problem 16. (20 points)

$$Lc = 2(540 \sin \frac{1}{2}(48)) = 439.28$$

$$\begin{array}{r} 807.00 \\ 439.28 \\ \hline 1246.28 \end{array}$$

The station # for the end curve PT would be
12 + 46.28

18. Determine the deflection angle and sub-cord length between Station 8 + 07.00 and Station 9 + 00 in Problem 6. Express the angle in degrees, minutes, and seconds. (20 points)

$$d = \frac{90}{\pi 540} = 0.05307$$

$$807 - 900 = 93$$

$$0.05307(93) = 4.93551 = 4^{\circ} 56' 8''$$

$$\text{Short cord} = 2(540) \sin(4^{\circ} 56' 8'') = 92.92'$$

$$\begin{array}{l} \text{Sub cord length} = 92.92' \\ \text{deflection angle} = 4^{\circ} 56' 8'' \end{array}$$

19. 1. Determine the cord length from Station 9 + 00 to Station 10 + 00 for the curve in Problem 6. (20 points)

$$900 - 1000 = 100$$

$$0.05307(100) = 5.307$$

$$2(540) \sin(5.307) = 99.89$$

$$\text{Cord length for } 9+00 \text{ to } 10+00 = 99.89'$$

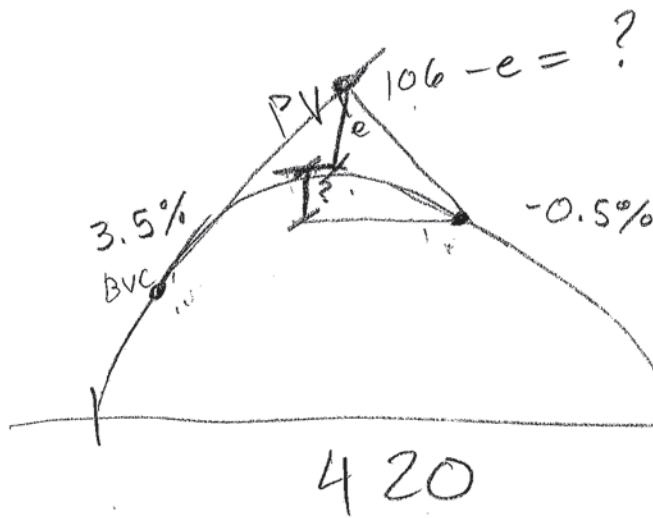
20. 1. A survey crew is laying out a vertical curve with the following properties:

$$L = 420 \text{ feet}$$

$$g^1 = 3.5\%$$

$$g^2 = -0.5\%$$

The elevation at the intersection of the tangents (PVI) is 106.00 feet. What is the elevation of the road at Point PVI? (20 points)



$$e = \frac{0.035 - (-0.005) 420}{8} = 2.10$$

$$2.10'$$

$$106$$

$$- 2.10$$

$$103.90'$$

