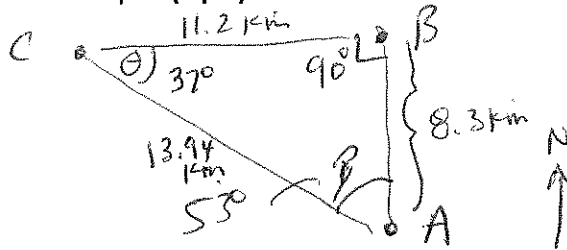1. You are located at point A, at a field site. Point B is located 8.3 km directly north of your position. Point C is located 11.2 km directly west of Point B.

   a. Draw a sketch map showing the relationships. **(2 pts)**

[handwritten work, upper left:]
$194.32 = 68.89 + 125.44$
$194.32 = 194.32$
Check

[sketch:]
C — 11.2 Km — B, θ 37°, 90°
13.94 Km, 55°, 8.3 km, A, N ↑

   b. Use a trigonometric solution to determine the compass Azimuth bearing from your position point A to point C. Show all of your math work and trigonometric relations. **(3 pts)**

$$TAN\,\theta = \frac{\overline{AB}}{\overline{BC}} = \frac{8.3\,Km}{11.2\,Km} = 0.741$$

$$INV\ TAN\ (0.741) = 37°\ (rounded)$$

$$AZIMUTH\ A \rightarrow B = 360 - 53 = \boxed{307°}$$
NORTHWEST

$$\angle B = 180 - (90 + 37)$$
$$\angle B = 53°$$

NOTE INTERIOR ∢ ∑ = 180°

   c. Using a trigonometric solution, determine the distance between point A and C in kilometers and feet; show of your math work, trigonometric relations, and unit algebra. **(3 pts)**

PYTHAGOREAN THEOREM $(\overline{AB})^2 + (\overline{BC})^2 = (\overline{Ac})^2$

$$(8.3\,Km)^2 + (11.2\,Km)^2 = (\overline{AC})^2$$
$$(68.89\,Km^2) + (125.44\,Km^2) = (\overline{AC})^2$$
$$194.33\,Km^2 = AC^2$$

$$\sqrt{194.33\,Km^2} = \sqrt{(AC)^2}$$
$$13.94\,Km = \overline{AC}$$
$$\boxed{DISTANCE = 13.94\,Km}$$
$$\overline{AC}$$

2. Given the following longitudes and latitudes of positions on the Earth's surface:

   a. convert to the following degrees-minutes-seconds formats, to decimal degrees **(Show all of your math work) (3 pts)**:

   Longitude: 77° 2' 24" W
   Latitude: 38° 54' 36" N

   Longitude   77.04° W   77 + 2'
   Latitude   38.91° N

   What is the name of your geographic location?   WASHINGTON, D.C.

[handwritten work left:]
$\frac{24"}{60"} = 0.4 + 2' = 2.4'/60' = 0.04° + 72° = 72.04°$
$\frac{36"}{60"} = 0.6 + 54' = 54.6'/60' = 0.91° + 38° = 38.91°$

   b. convert to the following decimal-degrees formats, to degrees-minutes-seconds **(Show all of your math work) (3 pts)**:

   Longitude: 123.035095° W
   Latitude: 44.942898° N

   Longitude   123° 2' 6" W
   Latitude   44° 56' 34" N

   What is the name of your geographic location?   SALEM, OREGON

[handwritten work bottom:]
LONG $0.035095° \left(\frac{60'}{1°}\right) = 2.1057'$ $0.1057'\frac{60"}{1'} = 6.3"$
123°   2'   6"

LATITUDE 44° $0.942898° \frac{60'}{1°} = 56.57388'$ $0.57388'\frac{60"}{1'} = 34.43"$
56'   34"

3. You have located three points on the Earth's surface, using a GPS, with the following UTM coordinates, Zone 10 North, in meters:

LOCATION	Easting	Northing
Point A	487000 m	4968000 m
Point B	481000 m	4968000 m
Point C	481000 m	4958000 m

a. Draw a sketch map showing UTM coordinates as tic marks on the neat line boundary of the map, and the locations of the labeled points **(2 pts)**.
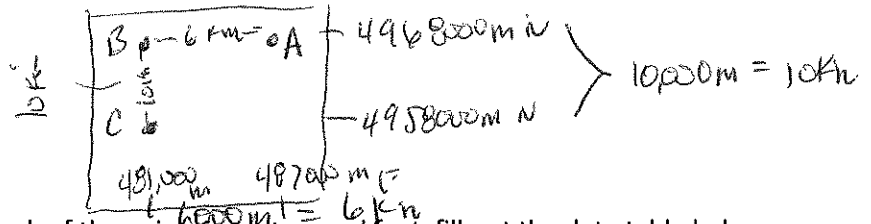
b. Calculate the straight line distance between each of the points in meters and feet, fill out the data table below (show all of your math work, trig solutions and unit algebra) **(4 pts)**:

Distance A-B ___6000___ meters $\frac{3.28 ft}{m}$ = ___10,680___ feet

Distance B-C ___10,000___ meters $\frac{3.28 ft}{m}$ ___32,800___ feet

Distance A-C ___11,661.9___ meters $\frac{3.28 ft}{m}$ ___38,251.0___ feet

PYTHAGOREAN THEOREM

$$(\overline{AB})^2 + (\overline{BC})^2 = (AC)^2$$
$$(6000 m)^2 + (10,000 m)^2 = (AC)^2$$
$$3.6 \times 10^7 m^2 + 10^8 m^2 = AC^2$$
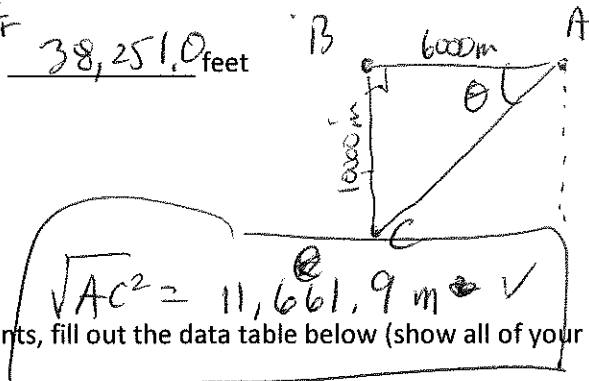
$$\sqrt{AC^2} = 11,661.9 \, m \checkmark$$

c. Calculate the azimuth bearings between each of the points, fill out the data table below (show all of your math work, trig solutions and unit algebra) **(4 pts)**:

Bearing from Point A to Point B: ___270°___

Bearing from Point B to Point C: ___180°___

Bearing from Point A to Point C: ___211°___

$$TAN\Theta = \frac{BC}{AB} = \left(\frac{10,000 m}{6000 m}\right)$$
$$TAN\Theta = 1.67$$
$$\Theta = 59°$$
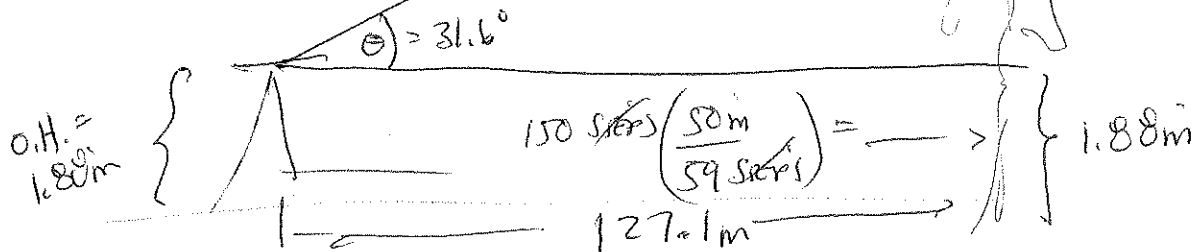
Azimuth
$$A \rightarrow C = 180 + (90-59)$$
$$A \rightarrow C = 180 + 31 = 211°$$

4. Your ocular height is measured at 1.88 meters and your average pace measurement is 59 steps over 50 meters. Your job is to measure the height of a Douglas fir tree in the field, using pace and compass techniques. You walk 150 steps due west of the fir tree in question. Using a compass clinometer, you sight an angle of 31.6 degrees through the view finder.

a. Draw and label a sketch of the relationships in the space below, label your diagram with West to the left and East to the right. Show all of your distances and elevations in meters **(2 pts)**.

$\theta) = 31.6°$

O.H. = 1.88m

$150 \text{ steps}\left(\dfrac{50m}{59 \text{ steps}}\right) = \underline{\quad} \rightarrow$

1.88m

$127.1m$

OPP

b. Using your ocular height, the clinometer measurements, and favorite trig function for calculating the height of an object, determine the total height of the fir tree in meters and feet. Show all of your math work and unit algebra **(4 pts)**.

$$TAN\ \theta = \frac{OPP}{ADJ}$$

$$TAN(31.6°) = \frac{OPP}{127.1m}$$

$$OPP = TAN(31.6)(127.1m) =$$

$$OPP = 78.2m$$

$$TOTAL\ HT = O.H. + OPP$$

$$= (1.88m + 127.1m) = \boxed{128.98m}$$

$\sim 129\ m$

TOTAL HT =

423 FT