Assignment 2
Setting Out

1- Question 1 :

Setting out: is the process of finding the physical location of a point with known Coordinates.

2- Question 2.

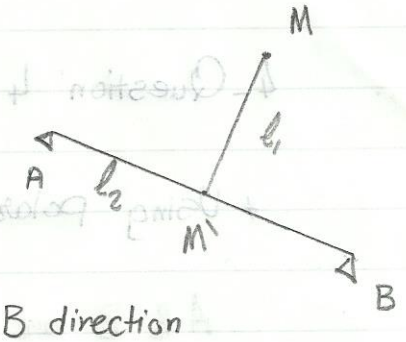
Surveying: measuring quantities in order to calculate Coordinates of a point in field for mapping

Setting out: measuring quantities to locate a point from map with known coordinates, and finding it's physical location in field (magnification of maps to field)

3- Question 3 :

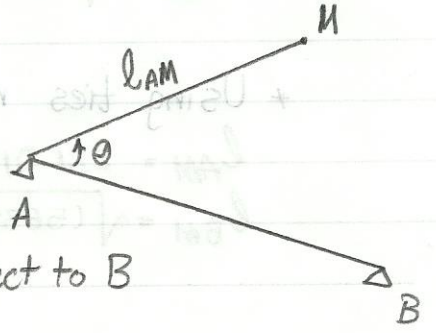
1- Offset method:

* Main idea:
* Required Instrumets: tapes
* Required quantities: l_1 , l_2
* Field procedure: Measure distance l_2 from A to B direction
  Set M` point
  Set perpindicular to AB
  Measure l_1 and set M point.



2- Polar method:

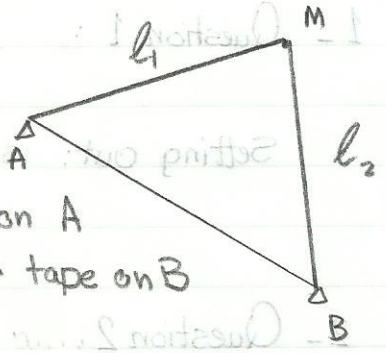
* Required Instruments: theodolite + EDM
* Required quantities: θ , l
* Field procedure: Setup theodolite at A direct to B



- Measure angle θ
- Using EDM at A and using l_{AB} get point M.

3- Ties method:

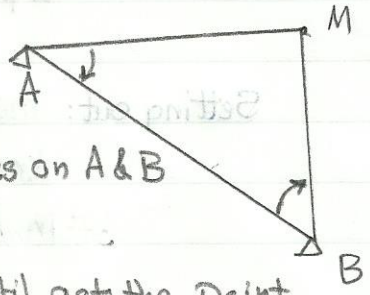
* Required instruments: tapes
* Required quantities: l_1, l_2
* Field procedure:



Set the ring of tape on A
& the ring of the other tape on B
and get the l_1 & l_2
Intersect them to get M point

4- Intersection method:

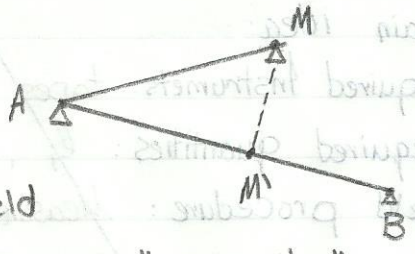
* Required instruments: theodolite
* Required quantities: θ_1 & θ_2
* Field procedure: set up 2 theodolites on A & B



measure θ_1 & θ_2
Moving the staff until get the point
that achieve the 2 angles.

4- Question 4:

* Using polar method:



A & B are known points in the field

get $\angle MAB = \alpha_{AB} - \alpha_{AM} = 127° 32' 32'' - 45° 19' 5''$

$= 82° 12' 42''$

$$l_{AM} = \sqrt{(5632.054 - 5432.201)^2 + (6785.214 - 6587.654)^2} = 281.0188\ m$$

* Using ties method:

$l_{AM} = 281.018\ m$

$$l_{BM} = \sqrt{(5632.054 - 5865.654)^2 + (6785.214 - 6254.547)^2} = 579.807\ m$$

* Using offsets method:

$\ell_{AM'} = \ell_{AM} \cos \hat{MAB} = 281.618 \cos(82°12'42") = 38.0818\ m$

$\ell_{MM'} = \ell_{AM} \sin \hat{MAB} = 278.4257\ m$

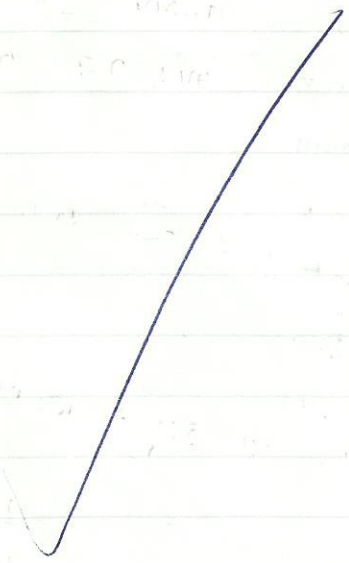
* Using Intersection method:

$< MAB = 82°12'42"$

$< ABM = \alpha_{BM} - \alpha_{BA} = 336°14'27" - 307°32'32"$

$= 28°41'55"$

* The prefered method is Polar method
As it's more accurate and ~~the~~ ~~Fo~~ takes less time.



Assignment 3

* Question 1:

- Components of the total station.

Theodolite → Measure angles (HCR)
EDM → Measure distances (slopes)
Memory → To save data
Processor → To calculate equations & Applications

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* Question 2.

- Output files of the total station:

1- Coordinates file: (.xyz):
East & North Coordinates, height, Code & description

2- Raw file : (.raw)
Details of each point

3- DXF file:
AutoCad file with the lines

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* Question 3:

Kinds of memory:

Internal memory: use cable to transfer data
External memory: Can be extracted and connected by reader

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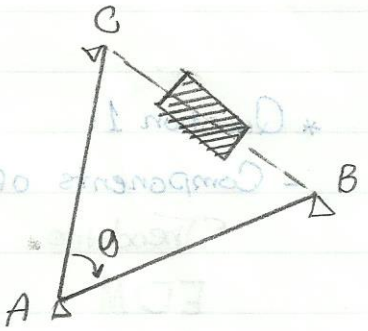
* Question 4:

The main idea of positioning using total station:

1- Insert the coordinates of occupied station (E & N)
2- Target to backsight point & insert it's data (E & N)
3- Set orientation
4- Target to the unknown point & get it's coordinates.

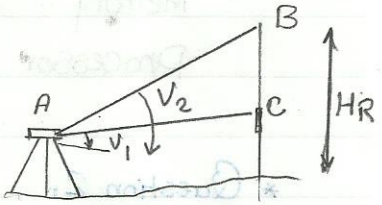
* Question 5:



- MLM: Missing line measurment

$$l_{BC} = \sqrt{l_{AB}^2 + l_{AC}^2 - 2\, l_{AB}\, l_{AC} \cos\theta}$$

- REM: Remote elevation measurment



$$H_{building} = H_R + SD_{AC} \cos V_1 \,(\tan V_2 - \tan V_1)$$

* Question 6:

$$\alpha_{AB} = \tan^{-1}\frac{5100-5000}{8100-8000} = 45^\circ = HCR_{AB}$$

* yes, the engineer had set the orientation.

$$\alpha_{AM} = 213^\circ\ 31'\ 40''$$
$$l_{AM} = 215.021 * \cos(90^\circ - 88^\circ\ 30'\ 30'') = 214.948\ m$$
$$E_M = E_A + l_{AM} * \sin\alpha_{AM} = 4881.275364\ m$$
$$N_M = N_A + l_{AM} * \cos\alpha_{AM} = 7820.815449\ m$$

$$M = (4881.275, 7820.8154)\ m$$

* Question 7:

$$\alpha_{AB} = \tan^{-1}\frac{E_B - E_A}{N_B - N_A} = 135^\circ$$

* No, the engineer didn't set the orientation.

$$\alpha_{AM} = 135^\circ + 45^\circ = 180^\circ$$
$$l_{AM} = 264.054 * \cos(90^\circ - 88^\circ) = 263.893\ m$$
$$E_M = 4500 + l_{AM} \sin\alpha_{AM} = 6500\ m$$
$$N_M = 6400 + l_{AM} \cos\alpha_{AM} = 6136.107\ m$$
$$M = (6500, 6136.107)\ m$$

* Question 8:

$l_{AB} = 233.981 * \cos(90 - 97^\circ\ 19'\ 53'') = 232.0681\ m$

$l_{AC} = 211.034 * \cos(90 - 113^\circ\ 31'\ 40'') = 193.49\ m$

$\angle BAC = 113^\circ\ 31'\ 40'' - 45^\circ = 68^\circ\ 31'\ 40''$

$l_{BC} = \sqrt{l_{AB}^2 + l_{AC}^2 - 2\, l_{AB}\, l_{AC} \cos \hat{BAC}} = 241.7\ m$

$\Delta H = H_i + 232.0681 * \tan(-7^\circ\ 19'\ 53'') - H_i - 193.49 * \tan(-23^\circ 31'\ 40'')$

$= 54.38557\ m$

the slope of the line BC:

$BC = \sqrt{\Delta H^2 + l_{BC}^2} = 247.743\ m$

* Question 9:

* $l_{hz} = 123.321 * \cos 3^\circ = 123.152\ m$
* $H_{building} = H_R + SD * \cos\nu * (\tan\nu_1 - \tan\nu_2)$

$= 1.43 + 123.152 * (\tan 12^\circ - \tan 3^\circ) = 21.15264\ m$

Assignment 4

* Question 1:
  - Types of structural deformation:
    - Vertical deformation (Settlement)
    - Horizontal deformation (Inclination)

* Question 2:
  Check settlement of a certain bridge:
  - Check the level of bridge before loading
  - Check the level of bridge after loading
  - Check the level of bridge just after loading removal.
  - If there's no deformation after load removal, the bridge is safe.
  - If not, the bridge is unsafe and a company should be asked for repairing

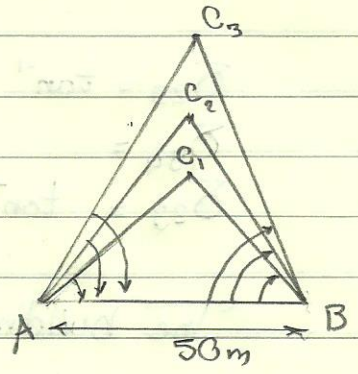
* Question 3:
  - Check the inclination of a certain structure using:
    - The optical plummeter
    - Theodolite & horizontal scale
    - Total station
    - Intersection method.

* Question 4:

$\theta_1 = 65^\circ 7' 27''$

$\theta_2 = 65^\circ 6' 44''$

$\theta_3 = 65^\circ 5' 27''$



$$\frac{AC_1}{\sin 47^\circ 04' 23} = \frac{50}{\sin 65^\circ 7' 27''} \rightarrow AC_1 = 40.356\,m$$

$AC_2 = 40.360\,m$

$AC_3 = 40.366\,m$

Assume coordinates of $A = (0,0)$ & $\alpha_{AB} = 68°\,0'\,0''$

$\alpha_{AC_1} = \alpha_{AB} - \angle CAB = 68°\,0'\,0'' - 67°\,48'\,05'' = 11'\,55''$

$\alpha_{AC_2} = 11'\,16''$

$\alpha_{AC_3} = 10'\,33''$

$E_{C_1} = E_A + l_{AC_1} \sin\alpha_{AC_1} = 0.139\,m$ $\quad N_{C_1} = N_A + l_{AC} \cos\alpha_{AC_1} = 40.355\,m$

$E_{C_2} = 0.132\,m$ $\quad N_{C_2} = 40.359\,m$

$E_{C_3} = 0.125\,m$ $\quad N_{C_3} = 40.365\,m$

$\delta_{12} = \tan^{-1}\left[\frac{\sqrt{\Delta E^2 + \Delta N^2}}{H}\right] = 0°\,6'\,56''$

$\delta_{23} = 0°\,9'\,18''$

$\delta_{13} = 0°\,16'\,13''$ (H = 8)

} $\delta \neq 0$

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* Question 5:

Assume $A = (0,0)$

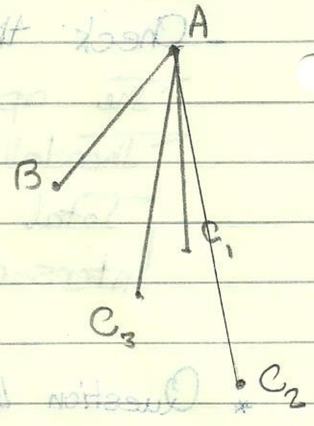
$E_{C_1} = E_A + l_{AC_1} \sin\alpha_{AC_1} = 48.3262\,m$

$N_{C_1} = N_A + l_{AC_1} \cos\alpha_{AC_1} = 8.1222\,m$

$C_1 = (48.3262, 8.1222)$

$C_2 = (48.3333, 8.1282)$

$C_3 = (48.332, 8.117875)$



$\delta_{23} = \tan^{-1} \frac{\sqrt{\Delta E^2 + \Delta N^2}}{3.5} = 0.15217$

$\delta_{34} = 0.17035$

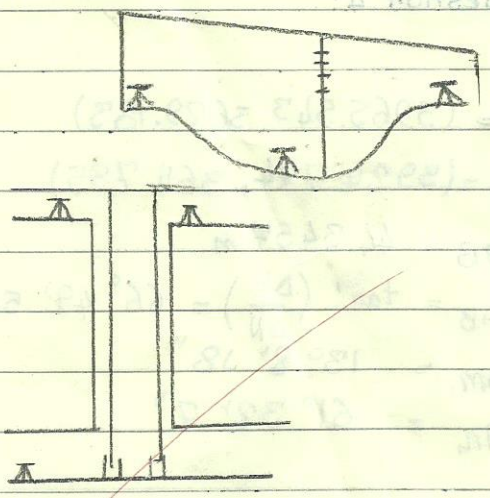
$\delta_{23} = \tan^{-1} \frac{\sqrt{\Delta E^2 + \Delta N^2}}{7} = 0.0592$

∴ The building is inclined as $\delta \neq 0$

Assignment 5

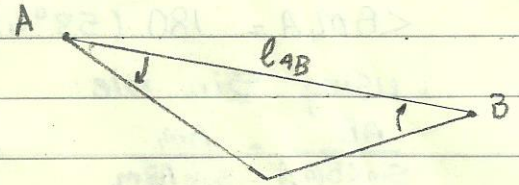
1- Types of tunnels:

- Surface (Shallow) tunnel
- Deep tunnel



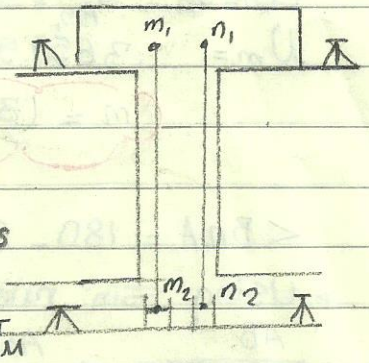
2- Shallow tunnels:

- Get the distance AB
- Get $\angle RBA$
- Get $\angle BAR$
- using Sin rule, get AR or BR → bearing → E, N of (R)



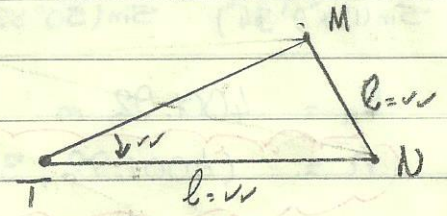
* Deep tunnels:

- get m_1 & n_1 Coordinates
- from m_1 & n_1 → m_2 & n_2
- Using weisbach triangle get the underground points

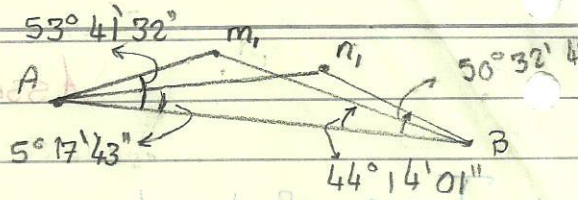


3- Weisbach triangle:

- Get l_{MN} & l_{TN}
- Get $\angle MTN$
- Using sin rule
- Get the Coordinates of T



* Question 4:



$A = (3965.543, 3629.183)$

$B = (3924.774, 3611.735)$

l_{AB} 44.3457 m

$\alpha_{AB} = \tan^{-1}\left(\frac{\Delta E}{\Delta N}\right) = 66° 49' 50"$ 246°49' 44"

$\alpha_{Am_1} = 13° 8' 18"$

$\alpha_{An_1} = 61° 32' 7"$

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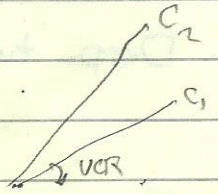


$\angle BM_1A = 180 - (53°41' 32" + 44° 14' 01") = 82° 4' 27"$

* using Sin rule:

$$\frac{AB}{\sin \angle Bm_1A} = \frac{Am_1}{\sin ABm_1} \Rightarrow Am_1 = 31.233278\ m$$

$E_m = E_A + l_{Am_1} * \sin \alpha_{Am} = 3965.543 + 31.233278 * \sin(13° 8' 18") = 3972.6424\ m$

$N_m = 3659.5987\ m$

$m = (3972.6424, 3659.5987)\ m$

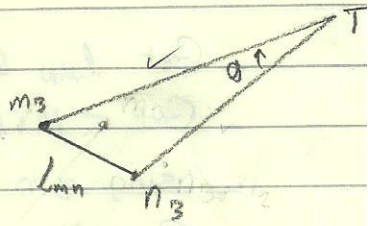
$\angle Bn_1A = 180 - (50° 32' 43 + 5° 17' 43") = 124° 9' 34"$

* Using Sin rule:

$$\frac{AB}{\sin(124°9'34")} = \frac{An_1}{\sin(50°32'43")} \Rightarrow An_1 = 41.3794\ m$$

$E_n = 4001.92\ m$ $N_n = 3648.905\ m$

$n = (4001.92, 3648.905)\ m$



* weisbech triangle:

$\theta = 161° 45' 41 - 156° 10' 10" = 5° 35' 31"$

$l_{mn} = \sqrt{\Delta E^2 + \Delta N^2} = 31.1694\ m$

$\angle V_t = 90 - 89° 15' 22" = 0° 44' 38"$

$l_{Tn_3} = 41.089 * \cos(0° 44' 38") = 41.0855\ m$

$\alpha_{mn_3} = 110° 3' 52"$ $\alpha_{mT} = 110° 3' 52" - 7° 22' 47" = 102° 41' 5"$

$T = (4012.72513, 3650.5769)\ m$