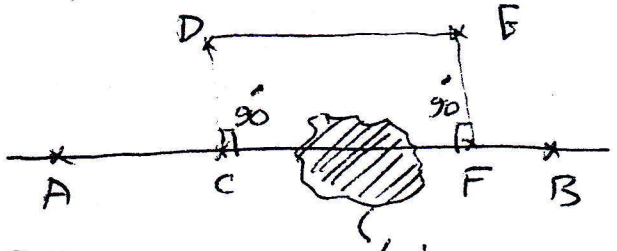
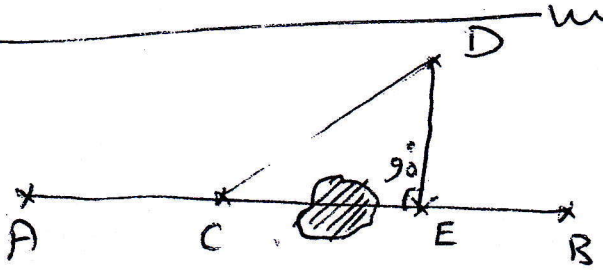
Obstacles during the measurement

The obstacles are generally large water bodies, i
lakes, rivers, ... etc.



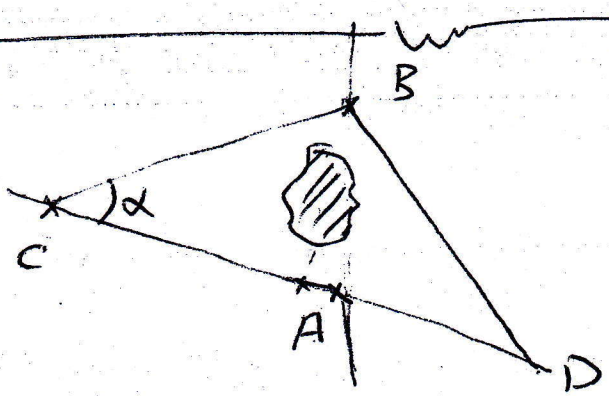
$AB = AC + CF + FB$

where $CF = DE$



$$CE = \sqrt{(CD)^2 - CDE)^2}$$

$$AB = AC + CE + EB$$

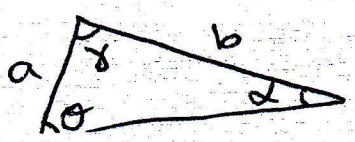


Δ BCD

$$BD^2 = BC^2 + CD^2 - 2CB.CD \cos\alpha \quad \text{---cos}$$

$$\cos\alpha = \frac{BC^2 + CD^2 - BD^2}{2BC.CD}$$

Δ ACB $\quad AB^2 = BC^2 + AC^2 - 2BC\,AC\cos\alpha$

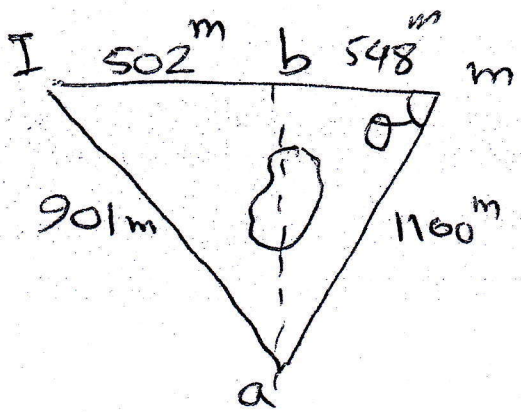


$$\frac{a}{\sin\alpha} = \frac{b}{\sin\theta} = \frac{c}{\sin\gamma}$$

example:

A big pond obstructs the chain line (ab). A line (aI) was measured on the left of line (ab) for circumventing the obstract. The length (aI) was 901 m. Similary, and the line am was measured on the right of line (ab) whose length was 1100 m. Points m, b, and I are on the same straight line. Lengths of lines (bI) and (bm) are 502 m and 548 m, respectively. Find the distance (ab).

Sol.



ΔamI

$$\cos\theta = \frac{am^2 + mI^2 - aI^2}{2am \cdot mI}$$

$$\cos\theta = \frac{(1100)^2 + (1050)^2 - (901)^2}{2 \cdot 1100 \cdot 1050}$$

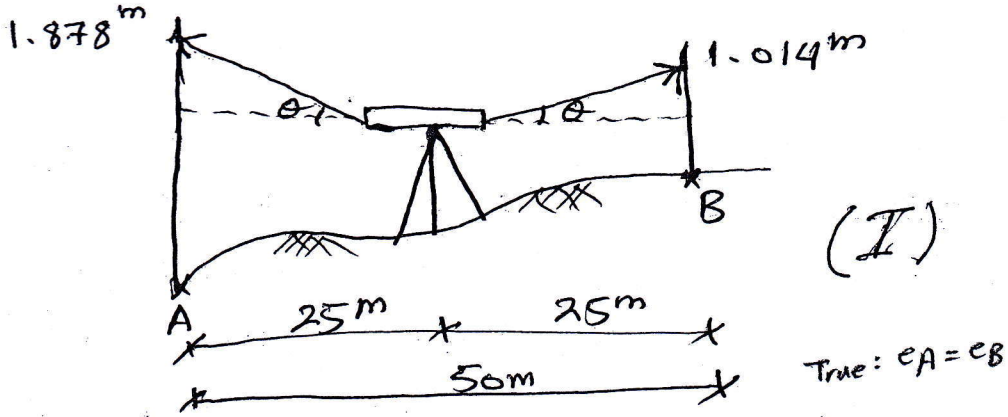
$$= 0.6496532$$

$$ab^2 = am^2 + bm^2 - 2am \cdot bm \cdot \cos\theta$$

$$= 1100^2 + 548^2 - 2 \cdot 1100 \cdot 548 \cdot 0.6496532$$

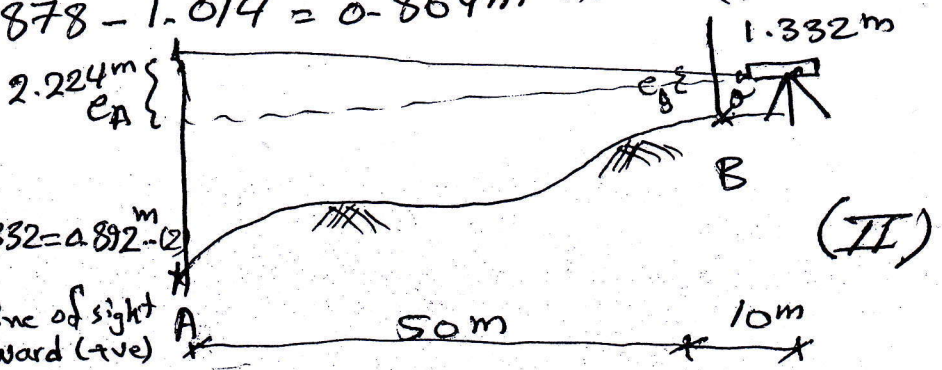
$$ab = \sqrt{727146.24} = 852.69 \text{ m}.$$

Permanent adjustment of Level device readings
(Two Pegs method)



(I)

I) $\Delta H)_{AB}$ True $= 1.878 - 1.014 = 0.864$m ..... (1)



(II)

II) $\Delta H)_{AB} = 2.224 - 1.332 = 0.892$ m ..... (2)

$\Delta H)_{II} > \Delta H)_{I}$ ⇒ The line of sight upward (+ve)

Correct reading at A $= 2.224 - e_A$

Correct reading at B $= 1.332 - e_B$.

where: $e_A = 60 \tan\theta$ and $e_B = 10 \tan\theta$

$$\Delta H)_{AB}^{True} = (\text{Correct reading at A}) - (\text{Correct reading at B})$$

$$0.864 = (2.224 - 60\tan\theta) - (1.332 - 10\tan\theta) \quad \text{.....(3)}$$

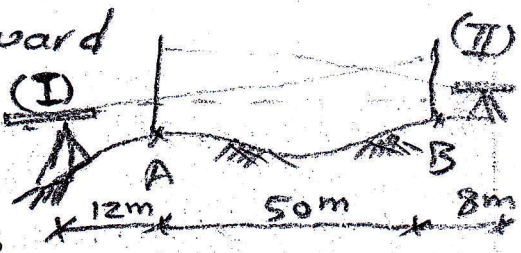
↑ may be (+ve) when the line of sight downward

Solved Eq.(3) to find $(\tan\theta)$ and e_A, e_B to find correct reading at A and B.

----- H.W

Example/ After the temporary adjusting the leveling device, the readings of staffs at position A and B were 2.481 m and 1.693 m, respectively, where the leveling device puts at 12m behind the position A and the distance between A and B was 50m. After transferring the leveling device behind B with distance 8m and the temporary adjusting on the leveling device was established again, the readings of staff at A and B were 2.051 m and 1.281 m, respectively. Find the correct readings at A and B if there is an error in the leveling readings.

Sol. assume the line of sight upward



I) { Correct reading)$_A$ = 2.481 − 12 tanθ ---- (A)
Correct reading)$_B$ = 1.693 − 62 tanθ ---- (B)
$\Delta H)_{AB}$ = Correct reading)$_A$ − Correct reading)$_B$
$\Delta H)_{AB}$ = 0.788 + 50 tanθ ---------- (1)

II) { Correct reading)$_A$ = 2.051 − 58 tanθ ---- (C)
Correct reading)$_B$ = 1.281 − 8 tanθ ---- (D)
$\Delta H)_{AB}$ = Correct reading)$_A$ − Correct reading)$_B$
$\Delta H)^{II}_{II}{}_{AB}$ = 0.77 − 50 tanθ ---------- (2)

By combination between Eq.(1) and Eq.(2)

$\Delta H)_{AB}$ = 0.779 ---------- (3)

Substituting Eq.(3) in Eq.(1) OR substituting Eq.(3) in Eq.(2)

tanθ = −0.00018

Then Correct reading)$_A$ = 2.483 m, Correct reading)$_B$ = 1.704 m } I

Correct reading)$_A$ = 2.061 m ? II