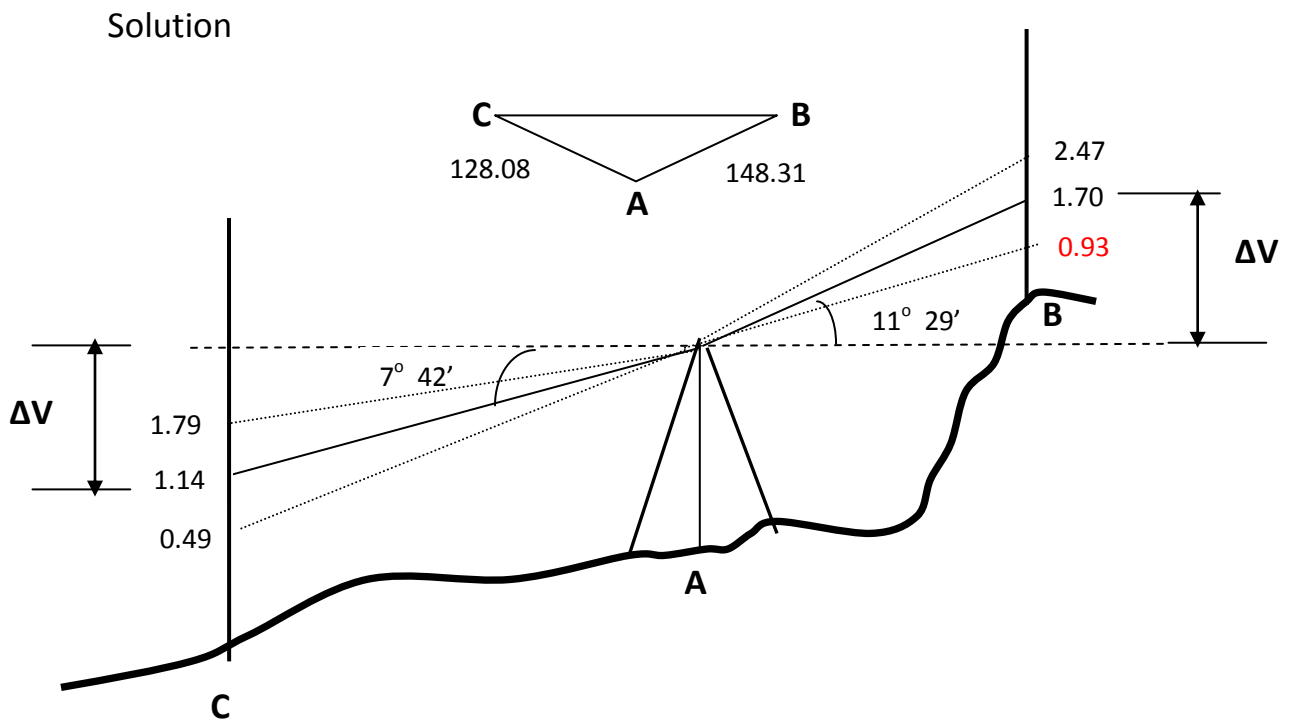


Sheet #2b

Model Answer for Problem 4

4. A, B and C are three points, the following observations were taken from point A to B and C for the purpose of determining the two constants of the tacheometric instrument (K and e). From A the vertical rod at point (B) reads 2.47, 1.70, 0.93 and rise angle equals $11^{\circ} 29'$. Also from point (A) the vertical rod at point (C) was observed and the readings were: 1.79, 1.14, 0.49 and down angle of $7^{\circ} 42'$. If the distances H_{AB} and H_{AC} were 148.31m and 128.08m respectively. Find the tachometric constant (K) and the additional constant (e). Calculate also the difference in elevations between (B) and (C).



Assume that the tacheometric constant is **K** and the additional constant is **e**

Horizontal distance $H_{AB} = K R \cos^2 (a) + e. \cos (a)$

Observing to point B

$R = u - l$

$R = 2.47 - 0.93 = 1.54 \text{ m}$

Observing to point C

$R = u - l$

$R = 1.79 - 0.49 = 1.30 \text{ m}$

$\cos (a1) = \cos 11^\circ 29' = 0.980$

$\cos (a2) = \cos 07^\circ 42' = 0.991$

Horizontal distance $H_{AB} = K R \cos^2 (a1) + e. \cos (a1)$

$148.31 = 1.54 \times (0.980)^2 K + 0.980 e \dots\dots\dots(1)$

Horizontal distance $H_{AC} = K R \cos^2 (a2) + e. \cos (a2)$

$128.08 = 1.30 \times (0.991)^2 K + 0.991 e \dots\dots\dots(2)$

$151.34 = 1.51 K + e \dots\dots\dots(3)$

$129.24 = 1.29 K + e \dots\dots\dots(4)$

$151.34 - 1.51 K = 129.24 - 1.29 K$

$0.22 K = 22.1$

$K = 100.154 = 100 \text{ approx.}$

Substitute with K in equation (3) $e = 0.34$

Substitute with K in equation (4) $e = 0.24$

Thus $e = (0.24 + 0.34) / 2 = 0.29$

$\Delta V = H \tan (a)$

$$\Delta V_B = H_{AB} \tan (\alpha_1)$$

$$\Delta V_B = 148.31 \tan (11^\circ 29') = 30.10 \text{ m}$$

$$\Delta V_C = 128.08 \tan (07^\circ 42') = 17.26 \text{ m}$$

$$\text{Elev}_B \text{ from the instrument level} = 30.10 - 1.70 = 28.40 \text{ m}$$

$$\text{Elev}_C \text{ from the instrument level} = 17.26 + 1.14 = 18.40 \text{ m}$$

$$\text{Difference in elevation between B and C} = \text{Elev}_B - \text{Elev}_C$$

$$\text{Difference in elevation between B and C} = 28.40 + 18.40 = 40.80 \text{ m}$$