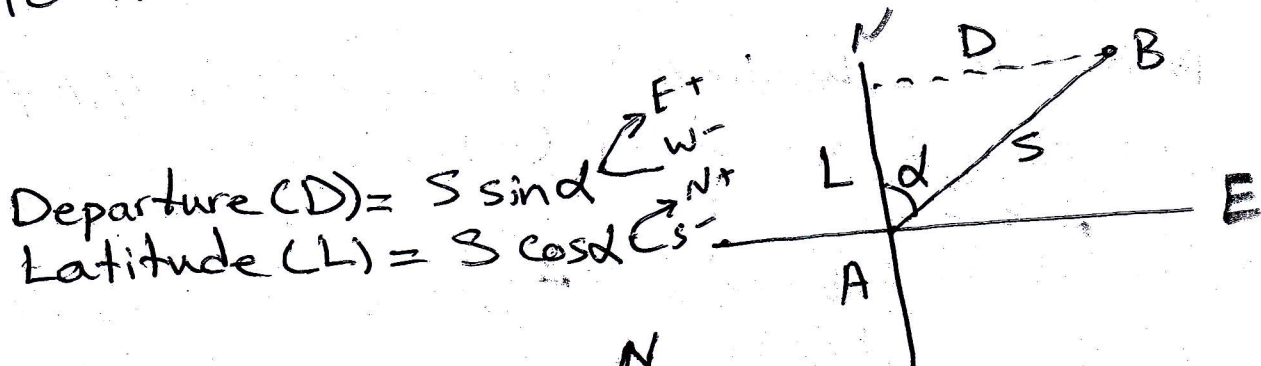


# Coordinates (Departure and Latitude)

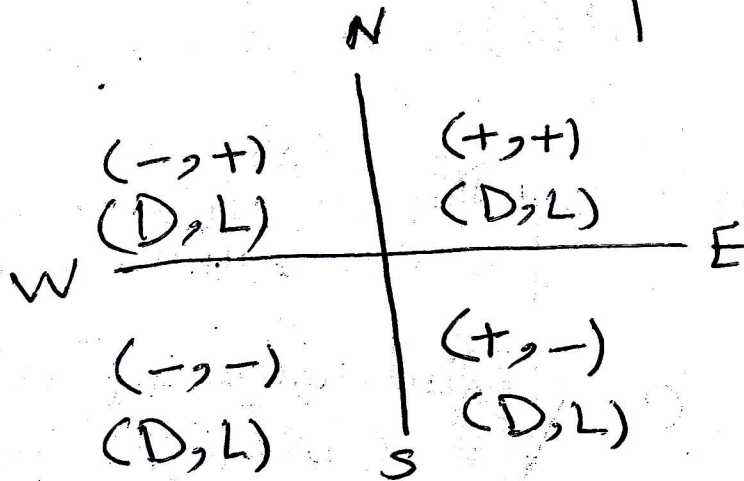
Departure (easting or westing) of a survey line is defined as its coordinate measured at a right angles to the assumed meridian (D).

Latitude (northing or southing) of a survey line is defined as its coordinate measured parallel to the assumed meridian (L).



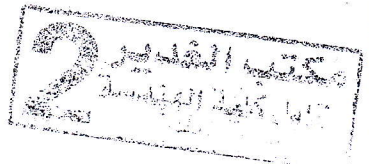
$$\text{Departure (D)} = S \sin \alpha$$

$$\text{Latitude (L)} = S \cos \alpha$$



Latitude  $\begin{cases} \rightarrow + \text{North} \\ \rightarrow - \text{South} \end{cases}$

Departure  $\begin{cases} \rightarrow + \text{East} \\ \rightarrow - \text{West} \end{cases}$



Example/ Compute the coordinates of all stations of closed traverse (Loop), if the station A is the origin. The information of W.C.B and length for each side in traverse are shown below:

line	AB	BC	CD	DE	EA
W.C.B	29° 30'	100° 45'	146° 30'	242°	278° 45'
length (m)	83.5	59.4	62	50.3	90.4

sol. line	W.C.B	length (m)	Departure		Latitude		Coordinate
			E (+)	W (-)	N (+)	S (-)	
AB	29° 30'	83.5	* 41.117		** 72.675		A(0,0)
BC	100° 45'	59.4	58.359			11.080	* B(41.117, 72.675)
CD	146° 30'	62	34.22			51.701	** C(99.475, 61.595)
DE	242°	50.3		44.412		23.614	D(133.695, 9.894)
EA	278° 45'	90.4		89.348	13.752		E(99.283, -13.72)
		$\Sigma = 345.6$	$\Sigma = 133.695$	$\Sigma = 133.76$	$\Sigma = 86.427$	$\Sigma = 86.395$	F(-0.065, 0.632)

\* Departure =  $L \sin \alpha = 83.5 \sin 29^\circ 30' = 41.117$   
 if the result (+) is in (E), while the result (-) is in (W).

\*\* Latitude =  $L \cos \alpha = 83.5 \cos 29^\circ 30' = 72.675$   
 if the result (+) is (N), and if the result (-) is (S)

\* Coordinate B  $\rightarrow X_B = X_A + \text{Departure AB}$   
 $= 0 + 41.117 = 41.117$

$Y_B = Y_A + \text{latitude AB}$   
 $= 0 + 72.675 = 72.675$

★ ★

$$X_c = X_B \mp \text{Departure BC} \quad \left\{ \begin{array}{l} + E \\ - W \end{array} \right. \quad (11)$$

$$= 41.117 + 58.358 = 99.475$$

$$Y_c = Y_B \pm \text{Latitude BC} \quad \left\{ \begin{array}{l} + N \\ - S \end{array} \right.$$

$$= 72.675 - 11.080 = 61.595$$

We notice the final coordinate in A is  $(-0.065, 0.032)$  and must be  $(0, 0)$  so that some error occurred in the measurements of the field. To correct these we must be used one of two ways:

- 1) Compass Rule
- 2) Transit Rule

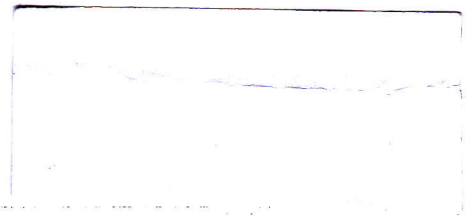
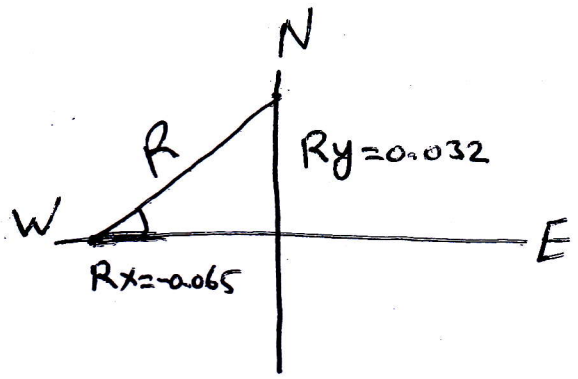
### Compass rule

$$R_x = \sum E - \sum W = -0.065$$

$$R_y = \sum N - \sum S = +0.032$$

$$R = \sqrt{R_x^2 + R_y^2}$$

$$= \sqrt{(-0.065)^2 + (0.032)^2} = 0.072 \text{ m} \quad \text{or} \quad 345.6 \text{ m}$$





(12)

$$\frac{CD_i}{S_i} = \frac{R_x}{\sum S} \Rightarrow CD_i = \frac{R_x}{\sum S} * S_i = k * S_i$$

$$\frac{CL_i}{S_i} = \frac{R_y}{\sum S} \Rightarrow CL_i = \frac{R_y}{\sum S} * S_i = k * S_y$$

$CD_i$  = Correction to the departure of the side

$CL_i$  = Correction to the latitude of the side

$R_x$  = total error in departure.

$R_y$  = total error in Latitude

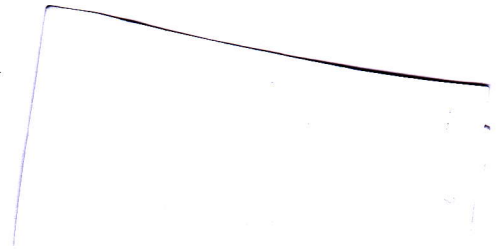
$\sum S$  = total length of the traverse

$S_i$  = length of any side

∴  $R_x = -0.065 \rightarrow$  therefore the correction Departure  
=  $+0.065$

∴  $R_y = +0.032 \rightarrow$  therefore the correction Latitude  
=  $-0.032$

$$\sum S = 345.6$$



## Correction of departure

$$C_{DAB} = \frac{R_x}{\sum S} * S_i = k * S_i = \frac{0.065}{345.6} * 83.5 = 0.016^m$$

$$C_{DBC} = 1.881 * 10^{-4} * 59.4 = 0.011^m$$

$$C_{DCD} = 1.881 * 10^{-4} * 62 = 0.012^m$$

$$C_{PDE} = 1.881 * 10^{-4} * 50.3 = 0.009^m$$

$$C_{PEA} = 1.881 * 10^{-4} * 90.4 = 0.017^m$$

$$\underline{\Sigma = 0.065}$$

## Correction of latitude

$$-9.26 * 10^{-5}$$

$$C_{LAB} = \frac{R_y}{\sum S} * S_i = k * S_i = \frac{-0.032}{345.6} * 83.5 = -0.008^m$$

$$C_{LBC} = -9.26 * 10^{-5} * 59.4 = -0.0055 \approx -0.006$$

$$C_{LCD} = -9.26 * 10^{-5} * 62 = -0.006$$

$$C_{LDE} = -9.26 * 10^{-5} * 50.3 = -0.0047 \approx -0.004$$

$$C_{LEA} = -9.26 * 10^{-5} * 90.4 = -0.008$$

$$\underline{\Sigma = -0.032}$$

