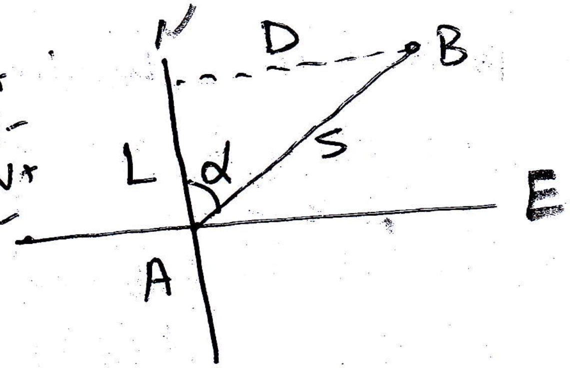
Coordinates (Departure and Latitude)

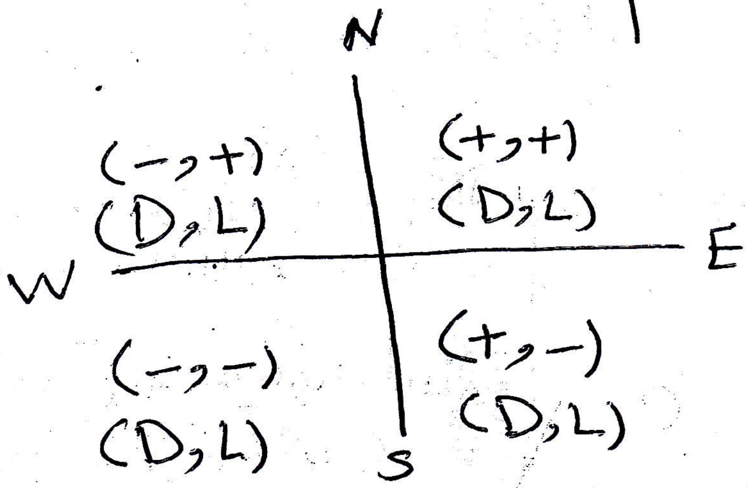
Departure (easting or westing) of a survey line is defined as its coordinate measured at a right angles to the assumed meridian (D).

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



Departure (D) = $S \sin\alpha$ E+ W−

Latitude (L) = $S \cos\alpha$ N+ S−



Latitude → + North, → − South

Departure → + east, → − West

(10)

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	$29^\circ 30'$	$100^\circ 45'$	$146^\circ 30'$	242°	$278^\circ 45'$
Length (m)	83.5	59.4	62	50.3	90.4

sol.

Line	W.C.B	length (m)	Departure $E^{(+)}$	Departure $W^{(-)}$	Latitude $N^{(+)}$	Latitude $S^{(-)}$	Coordinate
							A (0,0)
AB	$29^\circ 30'$	83.5	* 41.117		** 72.675		* B(41.117, 72.675)
BC	$100^\circ 45'$	59.4	58.35[illegible]			11.080	** C(99.475, 61.595)
CD	$146^\circ 30'$	62	34.22			51.701	D(133.695, 9.894)
DE	242°	50.3		44.412		23.614	E(89.283, -13.72)
EA	$278^\circ 45'$	90.4		89.348	13.752		A(-0.065, 0.632)
		$\Sigma=345.6$	$\Sigma=133.695$	$\Sigma\,133.76$	$\Sigma=86.427$	$\Sigma=86.395$	

* 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 $\longrightarrow$ $X_B = X_A \mp \text{Departure}_{AB}$

$= 0 \overset{E}{\mp} 41.117 = 41.117$

$Y_B = Y_A \mp \text{latitude}_{AB}$

$= 0 + 72.675 = 72.675$

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$X_C = X_B \mp \text{Departure } BC$ +E / −W

$= 41.117 + 58.358 = 99.475$

$Y_C = Y_B \pm \text{Latitude } BC$ +N / −S

$= 72.675 - 11.080 = 61.595$

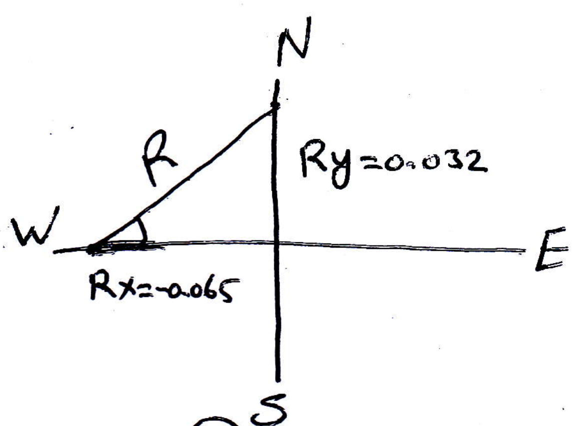
We notice the final coordinate in A is $(-0.065, 0.032)$ and must be $(0, 0)$ so that some error occured in the measurements of the field. To correct these we must be used one of two ways:

1) Compass Rule 2) Transit Rule

Compass rule

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

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



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

$= \sqrt{(-0.065)^2 + (0.032)^2} = 0.072\,m \;@\; 345.6\,m$

$$\frac{CDi}{Si} = \frac{Rx}{\Sigma S} \Rightarrow CDi = \frac{Rx}{\Sigma S} * Si = K * Si$$

$$\frac{CLi}{Si} = \frac{Ry}{\Sigma S} \Rightarrow CLi = \frac{Ry}{\Sigma S} * Si = K * Sy$$

CDi = correction to the departure of the side
CLi = correction to the latitude of the side
Rx = total error in departure.
Ry = total error in Latitude
ΣS = total length of the traverse
Si = length of any side

∴ $Rx = -0.065$ ⇝ therefore the correction Departure $= +0.065$

∴ $Ry = +0.032$ ⇝ therefore the correction latitude $= -0.032$

$\Sigma S = 345.6$

Correction of departure

$1.881 * 10^{-4}$

$$C_D AB = \frac{Rx}{\Sigma S} * Si = K * Si = \frac{0.065}{345.6} * 835 = 0.016 \text{ m}$$

$$C_D BC = 1.881 * 10^{-4} * 59.4 = 0.011 \text{ m}$$

$$C_D CD = 1.881 * 10^{-4} * 62 = 0.012 \text{ m}$$

$$C_D DE = 1.881 * 10^{-4} * 50.3 = 0.009 \text{ m}$$

$$C_D EA = 1.881 * 10^{-4} * 90.4 = 0.017 \text{ m}$$

$$\Sigma = 0.065$$

Correction of latitude

-9.26×10^{-5}

$$C_L AB = \frac{Ry}{\Sigma S} * Si = K * Si = \frac{-0.032}{345.6} * 83.5 = -0.008 \text{ m}$$

$$C_L BC = -9.26 * 10^{-5} * 59.4 = -0.0055 \simeq -0.006$$

$$C_L CD = -9.26 * 10^{-5} * 62 = -0.006$$

$$C_L DE = -9.26 * 10^{-5} * 50.3 = -0.0047 \simeq -0.004$$

$$C_L EA = -9.26 * 10^{-5} * 90.4 = -0.008$$

$$\Sigma = -0.032$$