Benha University

Shoubra Faculty of Engineering

Surveying Engineering
Lecture 3: Bearings

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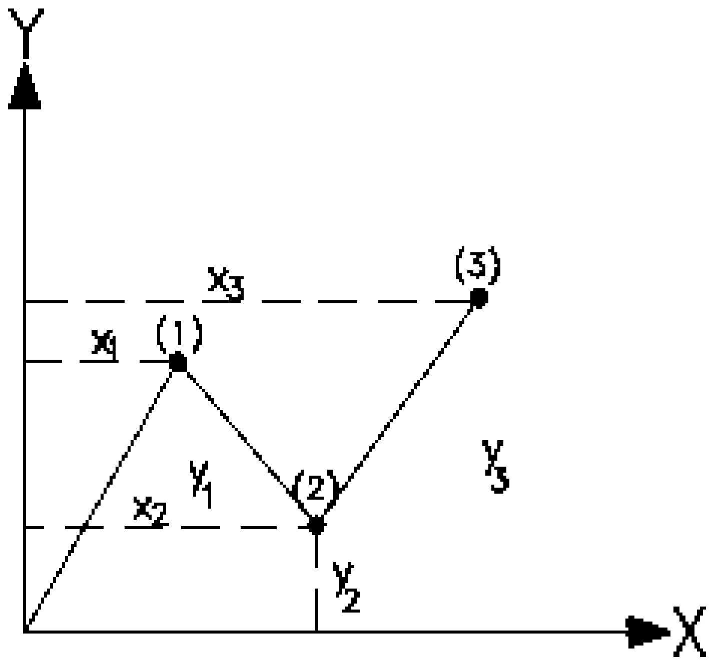
Geomatics Department

Contents

Coordinate Systems

1- Geographic or geodetic coordinate systems (Φ,Ω,h) or (X, Y ,Z)

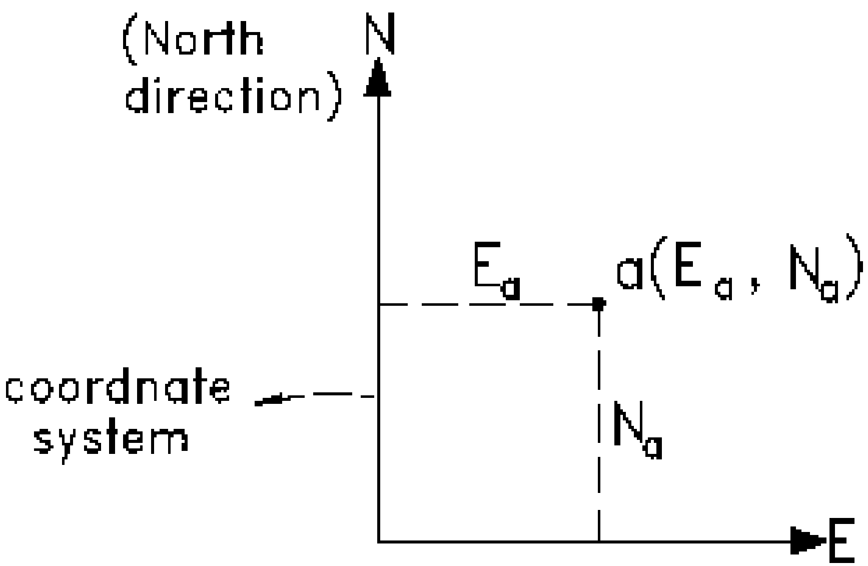
2- Plane coordinates: Cartesian (X,Y) or (E,N)



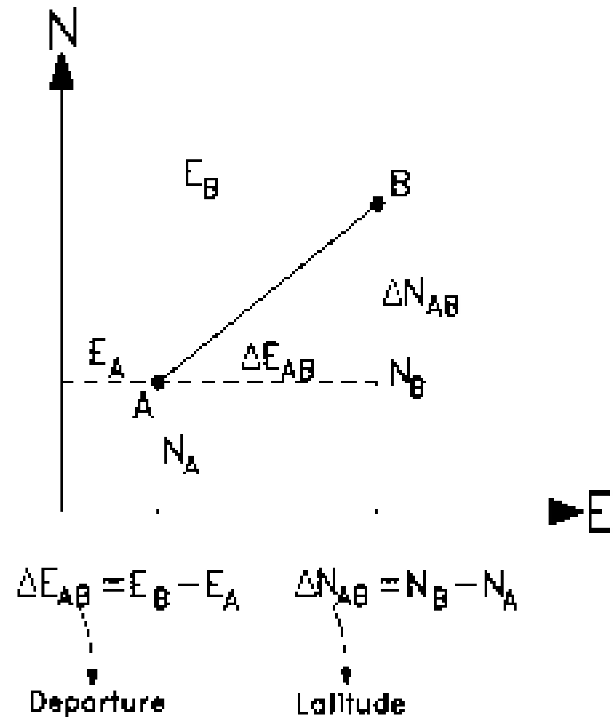
Plane Coordinate System

1- Cartesian (X,Y) or (E,N)

Coordinates of point

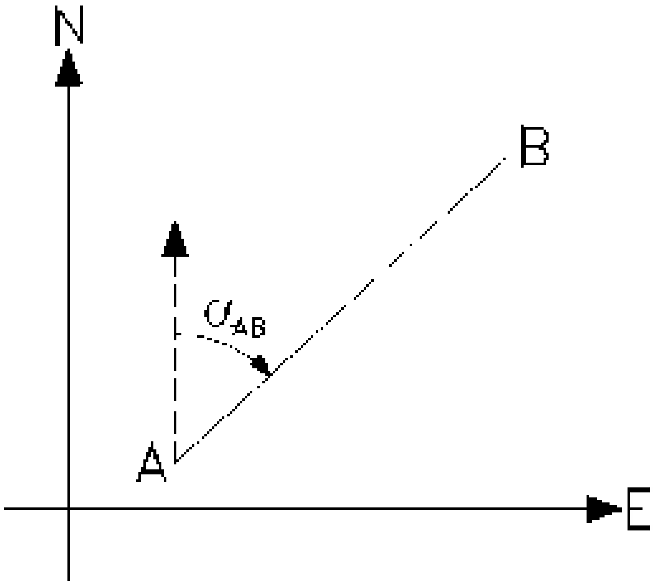


Components of a line

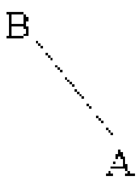


Whole Circle Bearing (WCB)

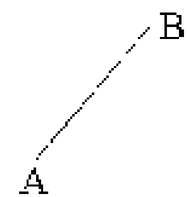
1- Azimuth of the line (WCB): It's the angle measured from the North direction to the line in the clockwise direction.



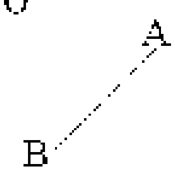
$$\alpha = 270 \rightarrow 360$$
$$\Delta E = -ve$$
$$\Delta N = -ve$$



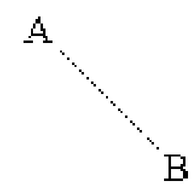
$$\alpha = o \rightarrow 90$$
$$\Delta E = -ve$$
$$\Delta N = -ve$$



$$\alpha = 180 \rightarrow 270$$
$$\Delta E = -ve$$
$$\Delta N = -ve$$



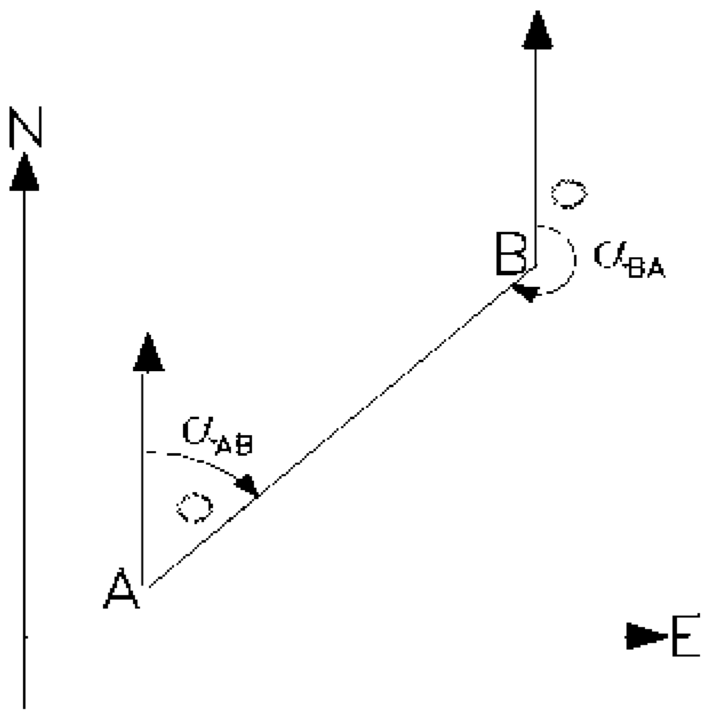
$$\alpha = 90 \rightarrow 180$$
$$\Delta E = +ve$$
$$\Delta N = -ve$$



If α negative then add 360˚ if α > 360˚ then subtract 360˚.

Forward Bearing (FB) and Back Bearing (BB)

1- The relation between the Forward Bearing (FB) and Back Bearing (BB).



$$\alpha_{BA} = \alpha_{AB} \pm 180^\circ$$

$$if \quad \alpha_{AB} > 180^\circ \rightarrow -$$

$$if \quad \alpha_{AB} < 180^\circ \rightarrow +$$

Ex:

$$\alpha_{AB} = 227^\circ \rightarrow \alpha_{BA} = 227 - 180 = 47^\circ$$

$$\alpha_{AB} = 118^\circ \rightarrow \alpha_{BA} = 118 - 180 = 298^\circ$$

Quadrant Bearing (QB)

It is the angle between the line and North-South direction whichever closer in clockwise or anticlockwise direction.

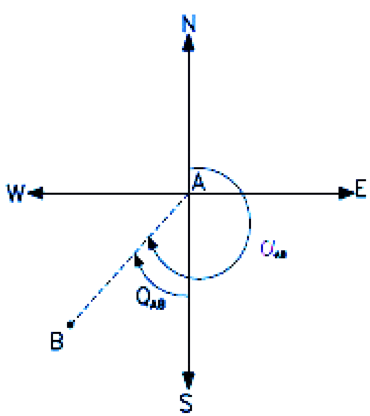
$$Q = 0 \to 90^{\circ}$$

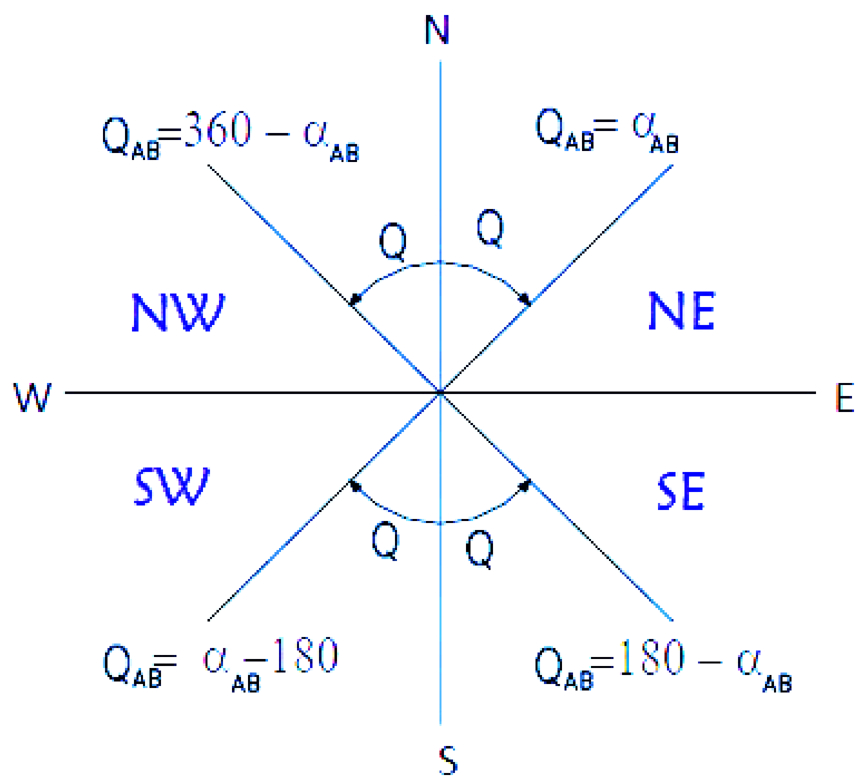
Ex:

$$If \propto = 240^{\circ}$$

$$Q = 240^{\circ} - 180^{\circ} = 60^{\circ}$$

$$= S60^{\circ}W$$



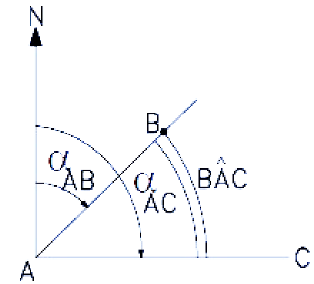


Coordinates main concept

1- Calculation of an angle between 2 bearings:

$$\alpha_{AC} - \alpha_{AB} = B\hat{A}C$$

Angle always in clockwise direction



2- Calculation of components of a line from length and bearing

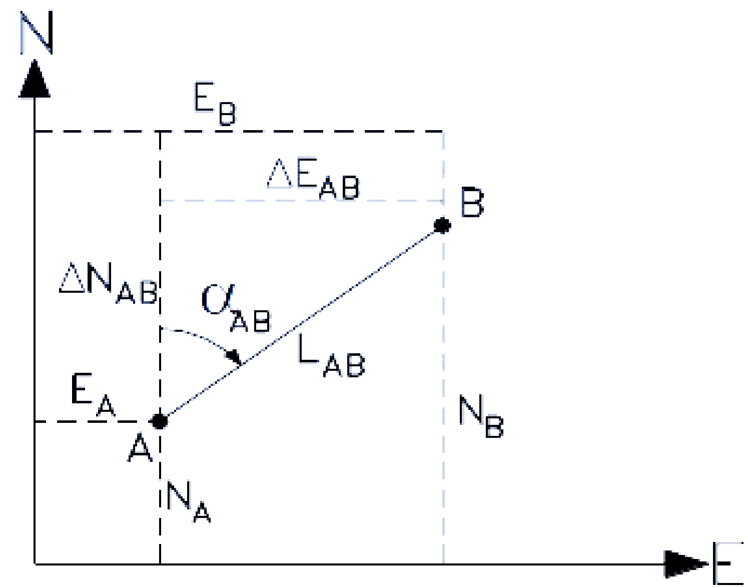
$$\Delta E_{AB} = L_{AB} \sin \alpha_{AB}$$

$$\Delta N_{AB} = L_{AB} \cos \alpha_{AB}$$

If coordinates of A are given, then:

$$\boxed{E_B = E_A + L_{AB} \sin \alpha_{AB}}$$

$$\boxed{N_B = N_A + L_{AB} \cos \alpha_{AB}}$$



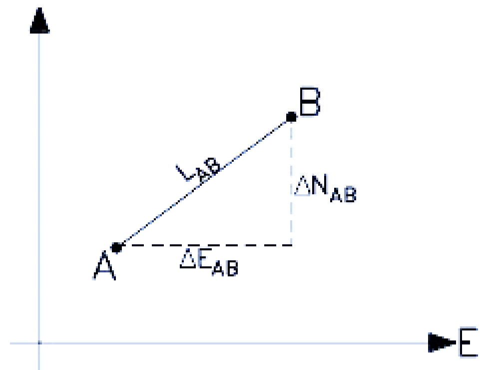
Calculation of length and bearing from coord.

1- Calculation of length of a line from coordinates:

$$\Delta E_{AB} = E_B - E_A$$

$$\Delta N_{AB} = N_B - N_A$$

$$L_{AB} = \sqrt{\Delta E_{AB}^2 + \Delta N_{AB}^2}$$



2- Calculation of bearing of a line from coordinates:

$$Q_{AB} = \tan^{-1} \frac{|\Delta E_{AB}|}{|\Delta N_{AB}|}$$

$\Delta E = -ve$ $\Delta N = +ve$ $\alpha_{AB} = 360 - Q_{AB}$	$\Delta E = +ve$ $\Delta N = +ve$ $\alpha_{AB} = Q_{AB}$
$\Delta E = -ve$ $\Delta N = -ve$ $\alpha_{AB} = 180 + Q_{AB}$	$\Delta E = -ve$ $\Delta N = -ve$ $\alpha_{AB} = 180 - Q_{AB}$

First without signs, then take sign into consideration.

Supplementary files:

- https://www.youtube.com/watch?v=L_HqYnLx3sI
- https://www.youtube.com/watch?v=vB8bhi5vbg4
- https://www.youtube.com/watch?v=lM6kWrgsGYw

Thanks

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