Online Surveying FE 208
Lectures 10 and 11

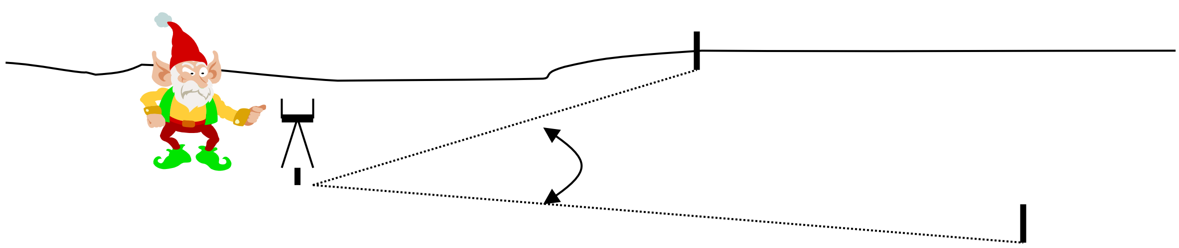
Angles, Bearings, and Azimuths

Learning Objectives for this Lecture

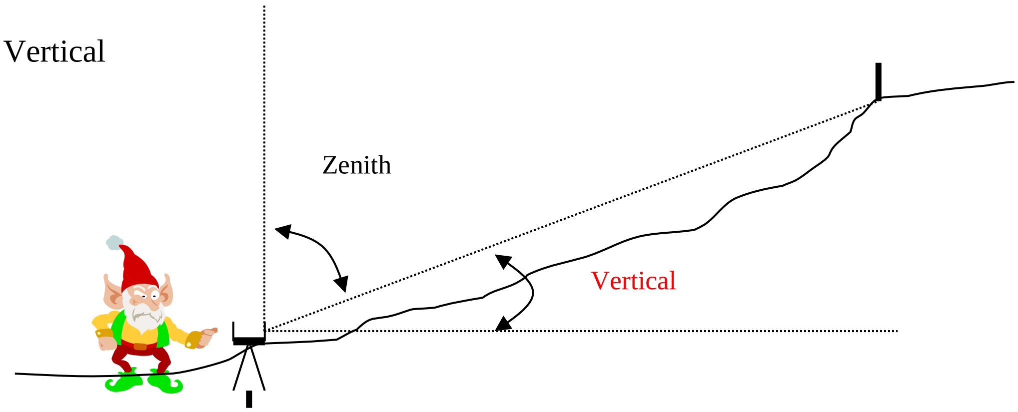
1. **Know the two types of angles**
2. **Know the three requirements for turning an angle**
3. **Know the different angle types**
4. **Know the different directions of lines**
5. **Be able to compute azimuths from bearings**
6. **Be able to compute bearings from azimuths**
7. **Be able to compute angles by the tangent method**
8. **Be able to compute interior angles from direction**
9. **Be able to compute direction from angles**

Introduction

- Location of a line is done with angles and direction
- Two types of angles
  - Horizontal



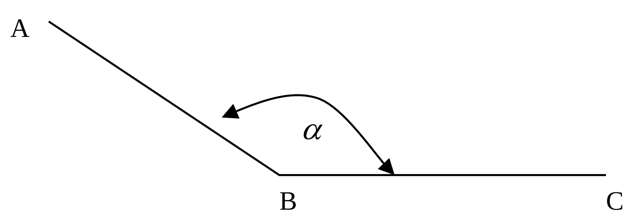
– Vertical



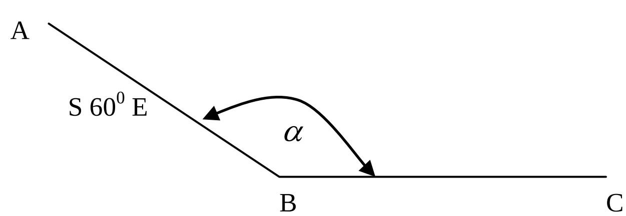
Three requirements for turning an angle:

- Reference line
- Turning direction
- Angle value

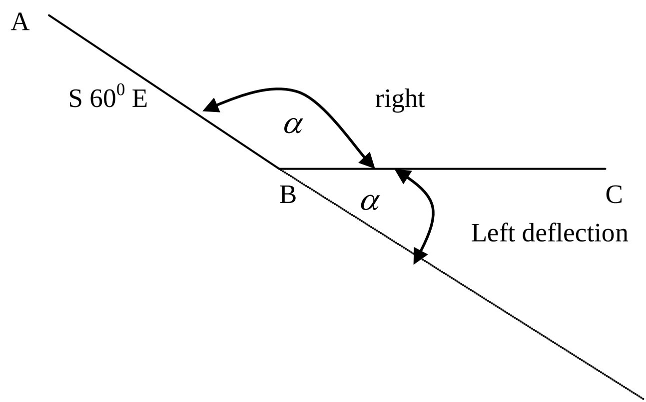
Example: We want to turn the angle ABC



1. Establish the reference line



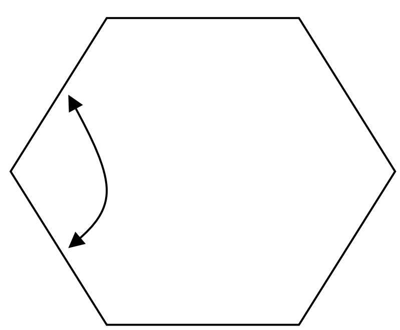
2. Establish the turning direction



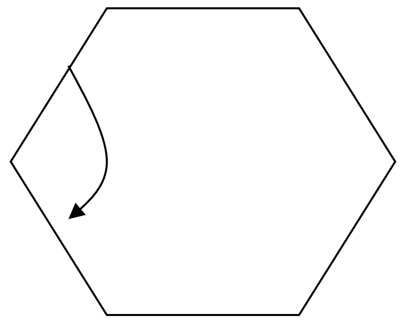
3. Compute the angle value

Angle Types

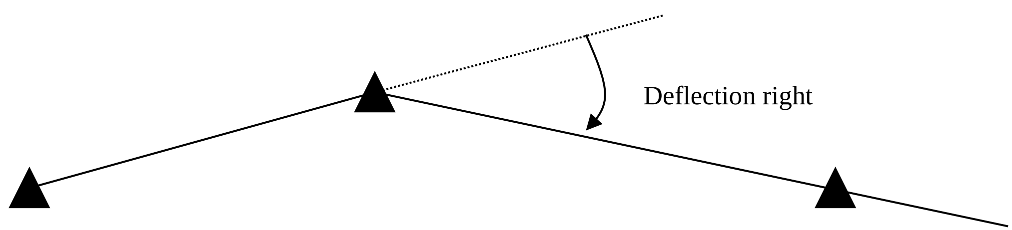
- Interior angles
  – Used in polygons or closed traverses
  – Exterior angle + interior angle = 360^0 = check



- Angles to the right
  – Turned clockwise normally
  – Turned from rear station to the forward station

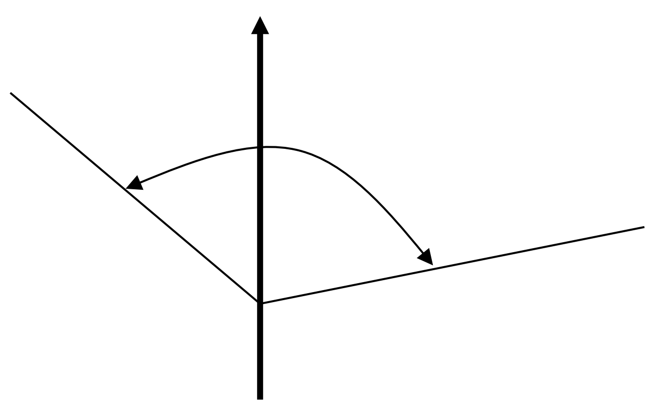


- Deflection Angles
  – Turned as an extension of the back line to the forward station
  – Normally used on open traverses or linear surveys
  – Important to note direction turned



Directions of lines

Angles are referenced to a control meridian line of some sort – generally north-south.



Two types of directions:

- Bearings
- Azimuths

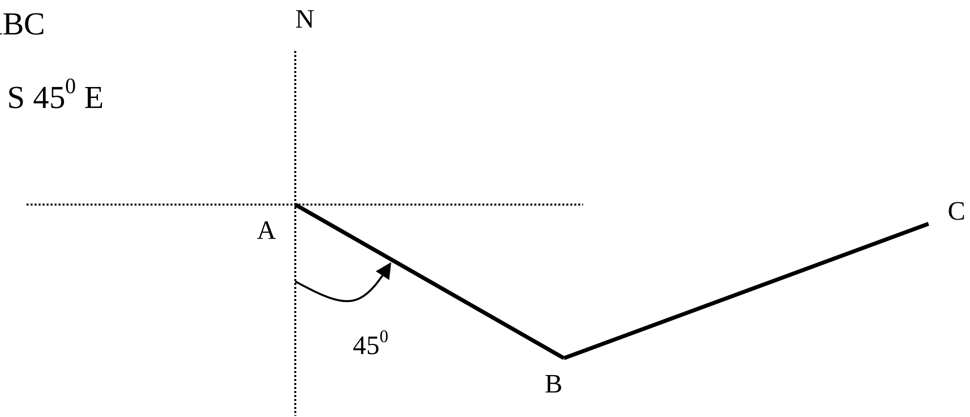
Bearings

Bearings are expressed by quadrant with respect to the reference line.

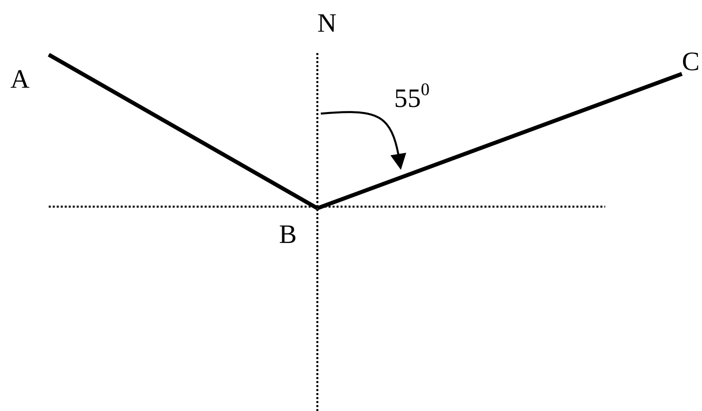
- Measured as the acute angle between the reference line and the line itself
- Measured either north or south
- Referenced additionally to the east or west
- Referenced to the direction of the survey

Example: Traverse ABC

Line AB – Bearing = S 45^0 E



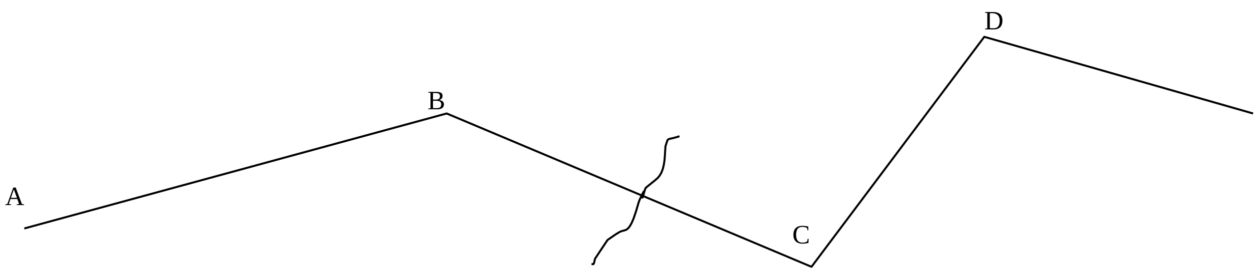
Line BC – Bearing = N 55^0 E



Field process

Bearings are measured ***ahead*** or ***forward*** and then checked ***back***.

Sta	HD	Brg AHD	Brg BCK	Notes
A		N 62 E		
	121.85			
B		S 70 E	S 61 W	
	89.63			Creek
C		N 27 E	N 70 W	
	82.61			
D			S 28 W	



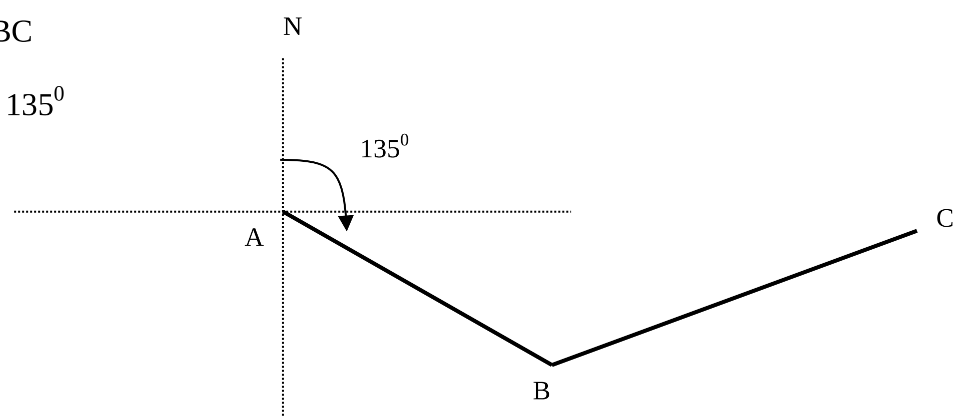
Azimuths

Azimuths are expressed clockwise with reference to the reference line.

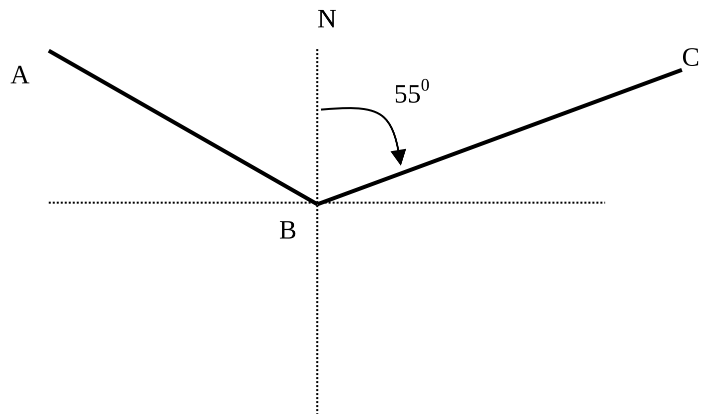
- Measured as the total angle between the reference line and the line itself clockwise
- Generally measured from north
- No referencing from the east or west

Example: Traverse ABC

Line AB – Azimuth = 135^0



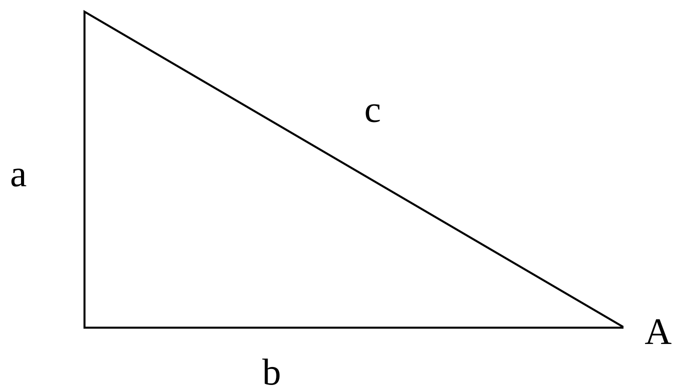
Line BC – Azimuth = 55^0

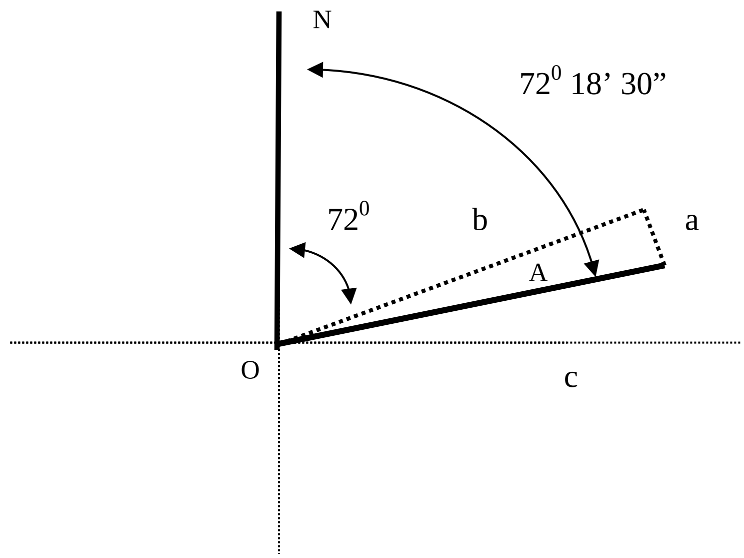


Computing angles by the Tangent Method also called a Tangent Offset

Used on very long lines that have little room for angular error or for layout off of an existing line.

Tan A = a/b





Example:

We need to run a line at 72^0 18’ 30” but our instrument is only good to 1^0

We can run a line 500’ along b from our starting point O
Compute the 900 offset distance a

Tan A = a/b

Tan 0^0 18’ 30” = a/500’

(Tan 0^0 18’ 30”) * 500’ = a

a = 2.69’

Computing Bearings

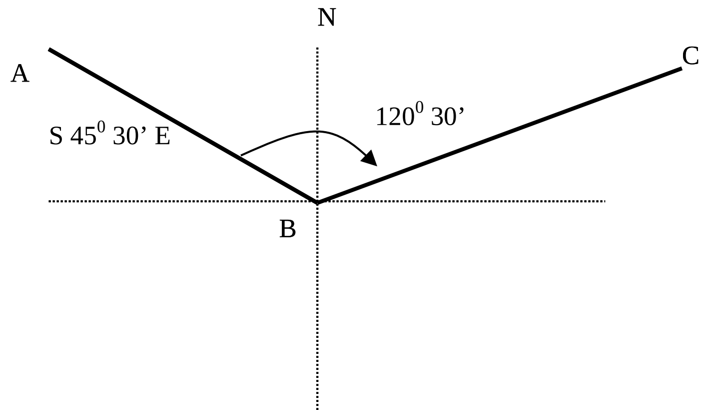
DRAW A SKETCH!!!

It is quite often necessary to compute bearings from angles

Again, the three requirements for turning an angle:

- Reference line
- Turning direction
- Angle value

Example problem: Line AB has been set at S 45^0 30’ E. Angle B was turned at 120^0 30’. What is the bearing of BC?



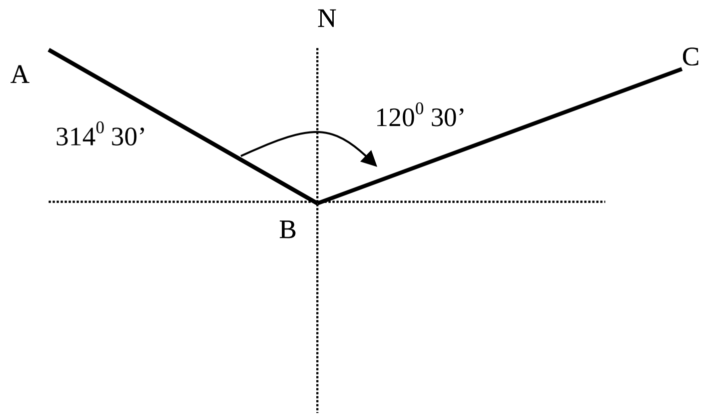
Line AB = line BA = N 45^0 30’ W

Bearing BC then = 120^0 30’ - 45^0 30’ = 75^0 00’ = N 75^0 00’ E

Computing Azimuths

DRAW A SKETCH!!!

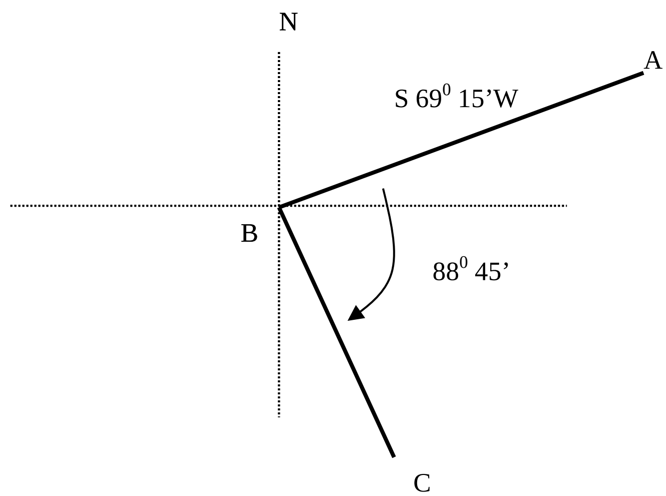
Example problem: Line AB has been set at 134^0 30' . Angle B was turned at 120^0 30'. What is the azimuth of BC?



120^0 30' - (360^0 00' - 314^0 30') =

120^0 30' - 45^0 30' = 75^0 00'

Additional problems

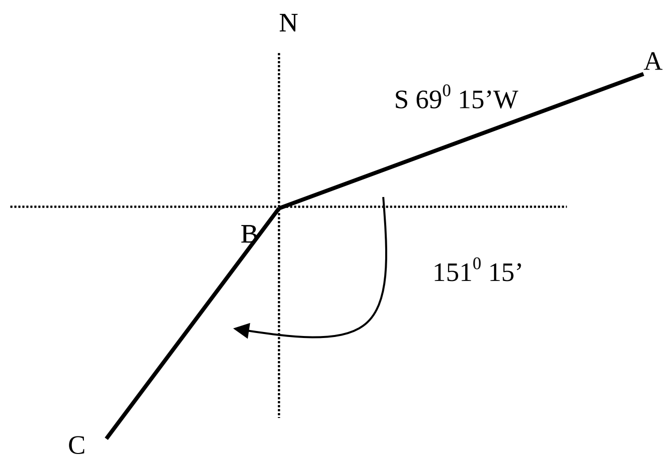


(90 - 69^0 15') = 20^0 45'

88^0 45' - 20^0 45' = 68^0 00'

90 - 68^0 00' = 22^0 00'

S22^0 00' E



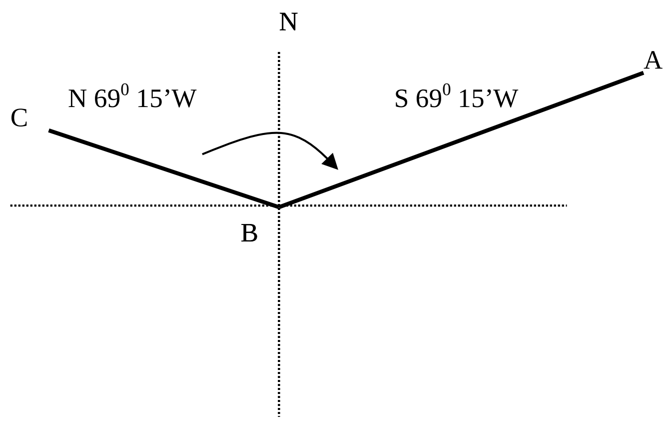
(90 - 69^0 15') = 20^0 45'

(90 - 20^0 45') = 110^0 45'

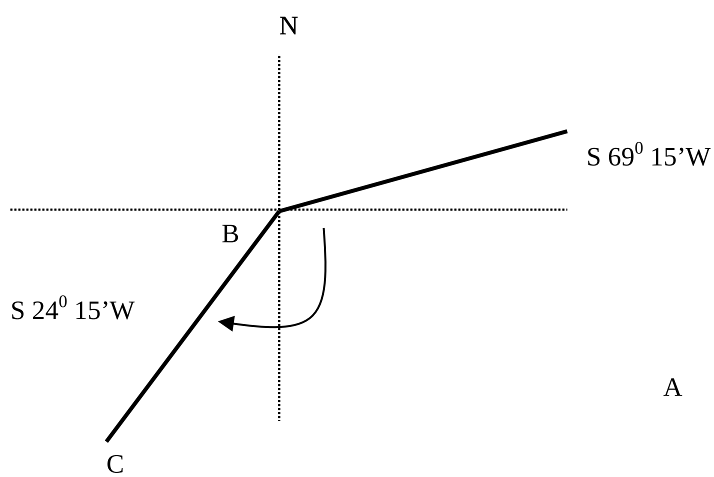
(151^0 15' - 110^0 45') = 40^0 30'

S40^0 30'W

Additional problems



(69^0 15’ + 69^0 15’) = 138^0 30’



(90 - 69^0 15’) = 20^0 45’

(90 + 20^0 45’ + 24^0 15’) = 135^0 00’