Using Map and Compass the Army Way

Tools (Materials needed for students to complete project):
Lensatic compass (one for each pair of students)
Protractor (one for each student)
Topographical map of location for Student Activity four
(one for each pair of students)
Paper for computing back azimuths
Sharp pencil (.05 lead) for plotting azimuths
Classroom with overhead projector
Outside area with 10 known points
(identifiable on a map and over 1000 meters from working area)

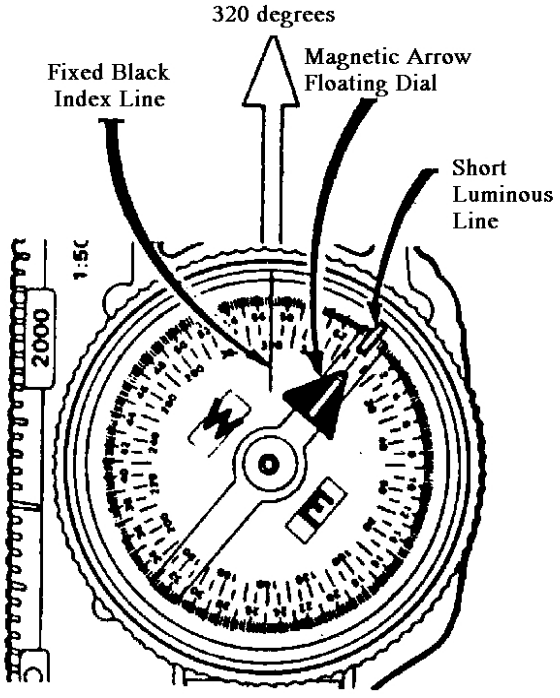
Lesson 1: Determining magnetic azimuths using a lensatic compass. The center hold technique is the fastest and easiest way to measure a magnetic azimuth.

1. Make sure the needle on the lensatic compass is floating freely.

2. Hold the compass between the forefingers and thumbs of both hands and pull your elbows down to your sides (Figure 1). This action will place the compass between your chin and waist.

3. To measure an azimuth, simply turn your entire body toward the object, pointing the zero or index mark directly at the distant known location.

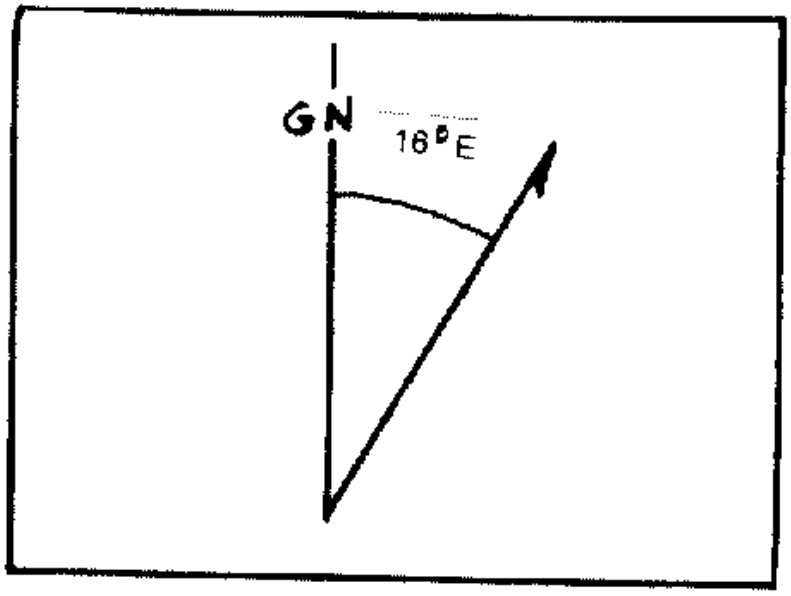
4. Once you are pointing at the object, look down and read the azimuth from beneath the fixed black index line. The second diagram at right (Figure 2) illustrates a magnetic azimuth of 320 degrees.



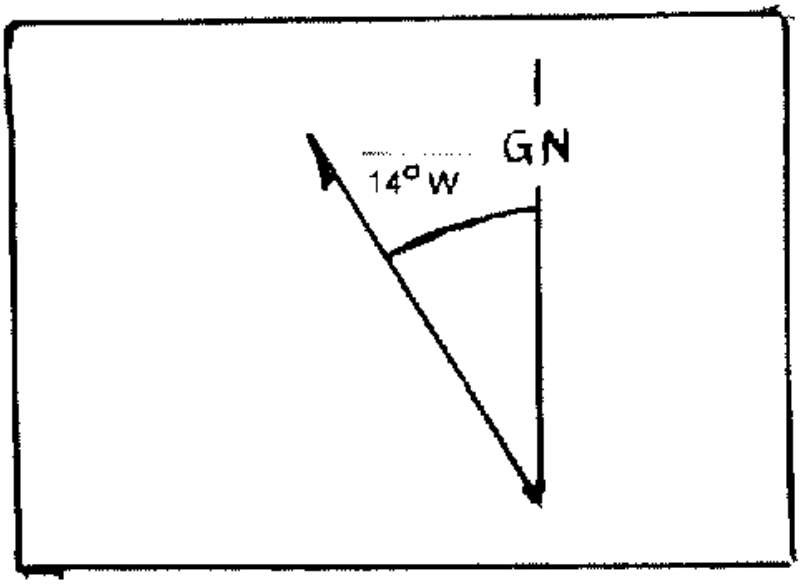
You must measure at least two well defined distant locations that can be pinpointed on the map. Two is what we will cover in this lesson but three would be more accurate. To determine the second azimuth repeat steps 2 to 4 on another well defined distant location.

Be sure you are away from power lines, vehicles or other metal objects when using a compass, these objects will affect its performance!

diagram is the right of the grid North line (marked with an E in the G-M angle) add the G-M angle to the magnetic azimuth. If the result of this addition is larger than 360 degrees you must subtract 360 degrees to determine the grid azimuth.



If the magnetic North arrow is to the left of the grid North line (marked with a W in the G-M angle) subtract the G-M angle to determine the magnetic azimuth. If the result of this subtraction is a negative number you must add 360 degrees to determine the grid azimuth.



The angular difference between grid and magnetic North is caused by the attraction of the Earth's magnetic field. This field is found in Northern Canada.

Lesson 3: Convert grid azimuths to back azimuths

You have done the first two of the four steps in locating yourself on a topographical map. You have located two distant known points. You have converted their magnetic direction to a grid (or map) direction. You know the direction to them but not to your location. To determine your location you must compute the back direction. The back azimuth is determined by adding or subtracting 180 degrees to the grid azimuth. This lesson will assist you in learning how to convert the grid azimuth to a back azimuth. In the fourth (last lesson) you will be able to plot the two back azimuths and determine your location. First you learn to convert grid azimuths to back azimuths.

To determine back azimuths that are less than 180 degrees
add 180 degrees.
To determine back azimuths that are more than 180 degrees
subtract 180 degrees.

Examples:
Grid azimuth = 107 degrees (add 180) 107 + 180 = 287 degrees
Grid azimuth = 243 degrees (subtract 180) 243 - 180 = 063 degrees

Lesson 4: Convert grid azimuths to back azimuths Plot back azimuths. Determine location on a topographical map

You have done the first three of the four steps in locating yourself on a topographical map. You have located two distant known points. You have converted their magnetic direction to a grid (or map) direction. You know the direction to them but not to your location. Now that you have learned to convert the grid azimuths to back azimuths you are ready to finish up. This lesson helps you understand how to plot the back azimuths. The two or three back azimuths will intersect at a location on the map. Where they intersect is your location (X marks the spot).

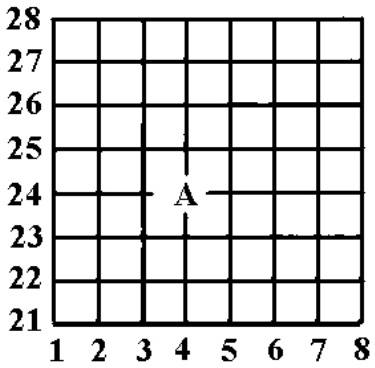
Orient the map toward the North using the compass.
Identify two or three known distant locations on the ground and mark them on the map.
Measure the magnetic azimuth to the first of the two or three known positions from your location using a compass (lesson 1).
Convert the magnetic azimuth to a grid azimuth (lesson 2).
Convert the grid azimuth to a back azimuth (lesson 3).
Using a protractor, draw the back azimuth on the map from the known distant position back toward your unknown position.
Repeat the steps in blue for a second and optional third known distant position.
The intersection of the lines is your location.

K. DEFINITIONS Grid Lines

1. ***AZIMUTH*** (bearing, direction) - A horizontal angle in respect to North (degrees, 6400 mils). It is read on the dial of the lensatic compass in either degrees or mils, by the number directly under the black index line.

Example: Azimuth of 90 degrees or 1600 mils (Read 16) is due East.

2. ***COORDINATES*** The North / South and East / West lines on a Map (grid lines). Positions are determined on a map by intersecting coordinates. The lower left is the origin and coordinates are read to the right and then up.



The Position of A is read 4 -24

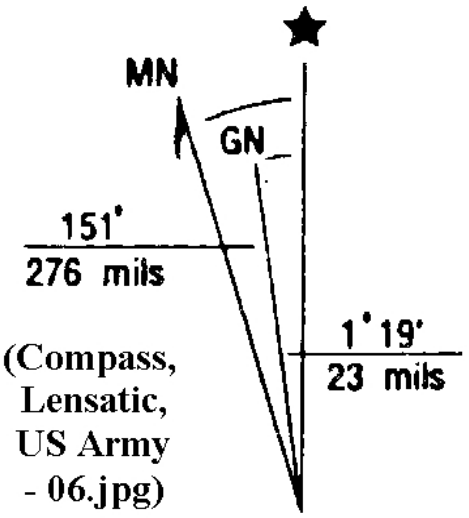
Read the number along the right first and then the number the from bottom to the top.

(Compass, Lensatic, US Army - 05.jpg)

3. ***NORTH*** Generally a topographical map (a map using contour lines to show elevation and make possible the identification of canyons, peaks, ridges and other terrain features) shows three North's in the declination diagram.

a. TRUE NORTH The actual position of the North Pole of the Earth's surface. It is the Northerly Point toward which the Meridians (North, South or longitudinal lines) between the Poles are drawn. Maps generally are oriented to true North. (Shown at left by a ray or line tipped with a star ★).

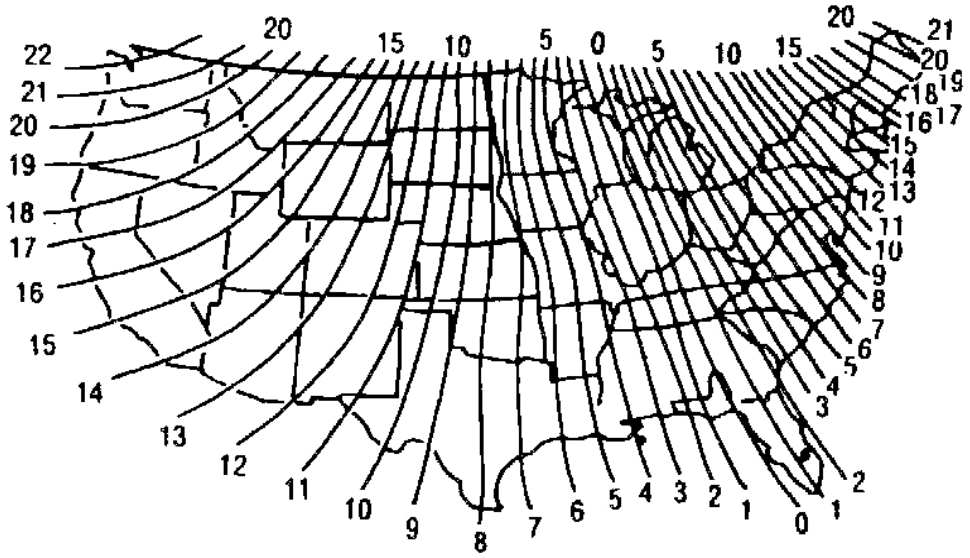
b. MAGNETIC NORTH An irregular and wavering magnetic force which tends to run generally Northward and Southward, causing a compass to point variously, depending on location. These magnetic 'Polar Areas' are more man 1000 miles away from the North and South Poles and it is in these directions that the compass magnet points.
(Shown by a ray tipped with **MN** and / or a single barbed spear.)



(Compass, Lensatic, US Army - 06.jpg)

c. ***GRID NORTH*** The North indicated by the Map Meridians running longitudinally. Because of the Earth's curvature, these lines are often pulled a little away from the true Meridian in order to provide a straight line, rectangular layout of coordinates. (Shown above by a ray tipped with **GN**.)

4. ***MAGNETIC DECLINATION*** The horizontal angle (difference in degrees) between Magnetic North and True North. The Magnetic Declination Angle varies from area to area and from time to time; generally about 1' (one minute) per year. (There are 60 minutes to one degree). The picture below shows an Isogonic Chart for the U.S. This chart is helpful to understand how Magnetic North readings will vary from True North for different parts of the country. This declination (variation, angular difference) will be shown in the Declination Diagram or stated in the marginal information on your Map.



(Compass, Lensatic, US Army - 07.jpg)

A. Lines to the left of the Zero Declination Line on the Isogonic Chart are called Easterly Variation. The **N** Arrow of the lensatic compass will point East of True North.

B. Lines to the right of the Zero Declination Line on the Isogonic Chart are called Westerly Variation. The **N** Arrow of the lensatic compass will point West of True North.

C. When the lensatic compass is used with a map or in conjunction with a map bearing, an adjustment should be made to allow for the variation. This is not necessary for rough compass work. In areas where the variation is slight, or for maps that use Magnetic North to locate the longitudinal grid lines (such as some orienteering maps).