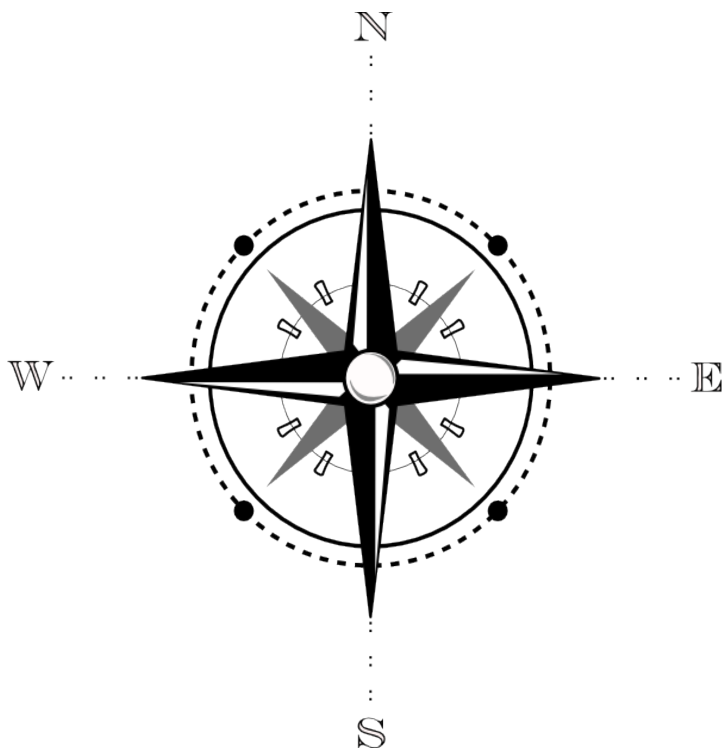
Orienteering Study Guide



Junior Varsity
Lake Shelbyville Eco-Meet 2025

US Army Corps of Engineers

U.S. Army Corps of Engineers
Lake Shelbyville 1989
State Rt. 16

Shelbyville, IL 62565

Eco-Meet
ORIENTEERING & GEOCACHING STUDY GUIDE

PART 1: ORIENTEERING

I. INTRODUCTION

Orienteering and geocaching are two separate entities that share a common outcome: navigating across a landscape to find a particular point. Both orienteering and geocaching require maps, though they are used in different forms. First, let's briefly discuss the differences between these terms.

The sport of **orienteering** is a challenging outdoor activity using a detailed topographic map and a compass to navigate through the terrain and find a series of terrain or man-made features indicated on a map. The sport of **geocaching** is a real-life treasure hunt where a person uses a GPS (geographical positioning system) as a navigation aid. Points or coordinates are programmed into a handheld unit and it is up to the geocacher to navigate to the points of interest.

II. WHAT IS ORIENTEERING?
Orienteering is the ability to find your way (navigate) using a compass and map. Competitive Orienteering is a cross-country running sport, demanding physical and mental fitness. The sport emphasizes map reading and the ability to make quick decisions under physically challenging conditions.
Instruction: Definition of Orienteering

A. **Orienteering** is a challenging outdoor activity using a detailed topographic map and a compass to navigate through the terrain and find a series of terrain or man-made features indicated on the map. Orienteering is a competitive sport that originated as a military exercise in Scandinavia in the early 1900's.

B. Orienteering is a motivating recreational activity, which increases love of the outdoors and promotes environmental awareness. It fits into academic goals of curriculum, develops critical thinking skills and increases physical fitness. All ability levels can compete in local, regional and national events.

Orienteering History
The following dates help to give a historical perspective of the development of Orienteering from military beginnings.

- 1886 – The term "orienteering" was being used by the military to mean crossing unknown territory with the aid of a map and compass.
- 1897 – The world's first public orienteering competition held in Norway.
- 1919 – Major Ernst Killander of Sweden devised a cross-country competition where runners not only ran a course but had to choose their own routes using a map and compass. He is considered the "Father of Orienteering"
- 1941-1943 – Orienteering events were held at Dartmouth College, organized by Finnish army officer Piltti Heiskanen.
- 1946 – Bjorn Kjellstrom of Sweden, the co-inventor of the protractor type, liquid-damped magnetic compass, moved to the U.S. and organized many competitions, the first of his events was held at Dunes State Park in Indiana.
- 1961 – The International Orienteering Federation was formed.

• Spring 1966 – U.S. Military Academy at West Point began intramural score orienteering in pairs.
• 1966 – The first World Orienteering Championships were held in Finland.
• Summer 1967 – The U.S. Marine Corps Physical Fitness Academy at Quantico, Virginia, began orienteering activities under assistant director Jim "Yoggi" Hardin.
• November 1967 – Harald Wibye of Norway organized an orienteering event at Valley Forge, Pennsylvania.
• October 1970 – The first U.S. Orienteering Championships was held at Southern Illinois University.
• August 1971 – The U.S. Orienteering Federation was formed in Virginia.
• Marines won the first six U.S. men's orienteering titles. In the early and mid-1980's, five-time U.S. elite champion Peter Gagarin of Massachusetts founded and coached the U.S. Team which has represented the United States at every World orienteering championship event since 1974. Among the women, not one has achieved the success of Sharon Crawford of Massachusetts, who was the top U.S. woman at seven straight World Championships and in 1989 at the age of 45 won her eleventh individual U.S. Orienteering Championship.
• 1988 – Orienteering was accepted as a U.S. Olympic Committee Class C sport, later known as an affiliated sport.
• Currently, there are approximately 60 orienteering clubs in the U.S.

III. MAP READING

The writing of maps is a special science called cartography. There has been a long tradition of producing maps and over the years there has evolved (developed) a standard method of making maps. A **map** is a two-dimensional representation of the three-dimensional world.

All maps will have some basic features in common and map reading is all about learning to understand their particular "language." You'll end up using a variety of maps to plan and run your trip but perhaps the most useful map is a topographic map. A topographic map uses markings such as contour lines to simulate the three-dimensional topography of the land on a two-dimensional map. In the U.S. these maps are usually U.S. Geological Survey (USGS) maps. Other maps that you'll find helpful are local trail maps which often have more accurate and up-to-date information on specific trails than USGS maps do. Here's a brief overview of the basic language of maps.

Map Etiquette

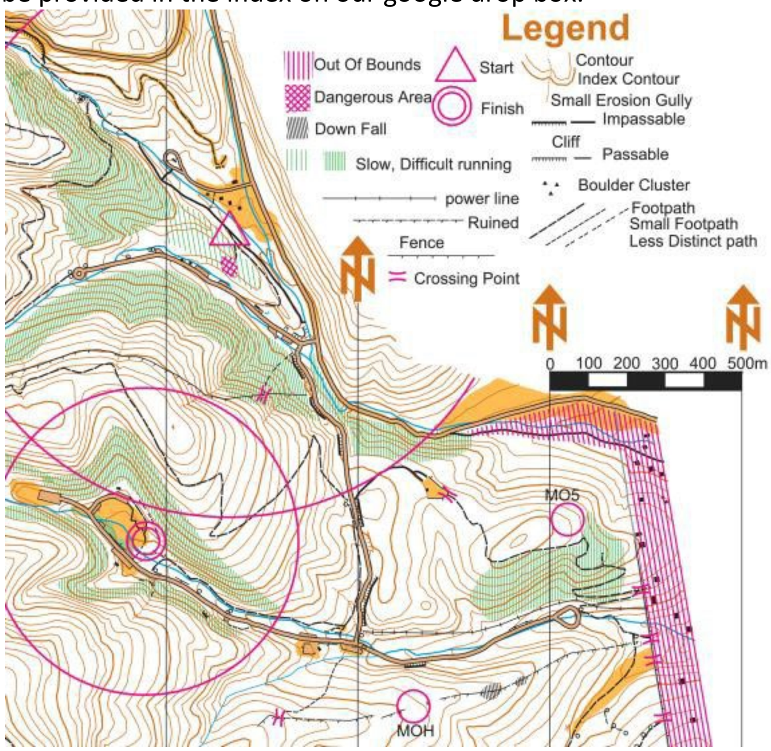
- **Always Print -** Printing makes it neat and easy to read
- **Title -** Specifically identifies map
- **Direction Indicator -** Points directly to one of the four main directions (usually North)
- **Print Horizontally -** Keep printing level - exception: rivers and mountains
- **Key or Legend -** Identifies as symbols and colors used on the map to identify various features
- **Border-** Include around entire map area & key or legend
- **Lettering Block-**

- **Use capital lettering for:** Title, oceans & seas, continents & countries, provinces & territories
- **Small lettering for:** cities, rivers & lakes bays & islands

- **Color-** only use colors to identify specific features; must be included in key or legend
- **Neatness-** avoid smudges, dirt, messy printing, & wrinkled paper
- **Name or Author-** include at the bottom right-hand corner
    - **Identification of your map**- full name, course, block, date
- **Scale**- must always be indicated on the map (i.e. 1:250,000 or 1 cm = .5km)

A. The Orienteering Map

1. A topographic map shows the shape of the terrain and detailed features that are not commonly found on other maps. A digital topographic map of Lake Shelbyville will be provided in the index on our google drop box.



2. **Scale** – Find the scale (1:XX,XXX) on the orienteering map. The scale shows the size relationship of map to earth.
    a. All maps will list their scales in the margin or legend. A scale of 1:250,000 (be it inches, feet, or meters) means that 1 unit on the map is the equivalent of 250,000 units in the real world. So 1 inch measured on the map would be the equivalent of 250,000 inches in the real world. Most USGS maps are either 1:24,000, also known as 7 ½ minute maps, or 1:62,500, known as 15-minute maps (the USGS is no longer issuing 15 minute maps although the maps will remain in print for some time).

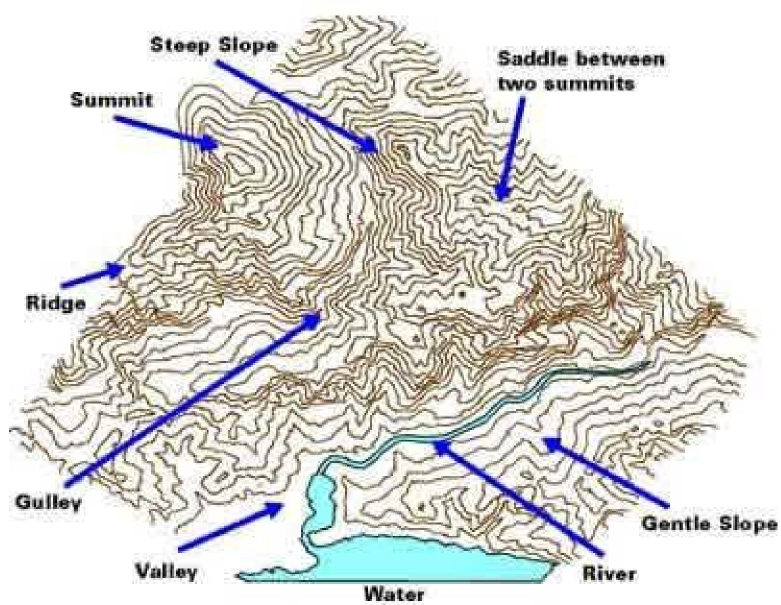
b. Standard topographic maps are usually published in 7.5-minute quadrangles. The map location is given by the latitude and longitude of the southeast (lower right) corner of the quadrangle. The date of the map is shown in the column following the map name; a second date indicates the latest revision. Photo-revised maps have not been field checked.

Map Size	Scale	Covers	Map to Landscape	Metric
7½ Minute	1:24,000	1/8 of a degree	1 inch = 2,000 feet (3/8 mile) 2.64 inches = 1 mile	(1 centimeter = 240 meters)
15 minute	1:62,500	¼ of a degree	1 inch = ~1 mile	(1 centimeter = 625 meters)

3. **Latitude and Longitude** - Maps are drawn based on latitude and longitude lines. Latitude lines run east and west and measure the distance in degrees north or south from the equator (0° latitude). Longitude lines run north and south intersecting at the geographic poles.
   a. Longitude lines measure the distance in degrees east and west from the prime meridian that runs through Greenwich, England. The grid created by latitude and longitude lines allows us to calculate an exact point using these lines as X axis and Y axis coordinates.
   b. Both latitude and longitude are measured in degrees (°).
      i. 1° = 60 minutes 1 minute = 60 seconds
      ii. Therefore: 7 ½ minutes = 1/8 of 60 minutes = 1/8 of a degree
      iii. 15 minutes = ¼ of 60 minutes = ¼ of a degree
4. **Contour lines and intervals** – Contour lines are a method of depicting the 3-dimensional character of the terrain on a 2-dimensional map. Just like isobars in the atmosphere depict lines of equal atmospheric pressure, contour lines drawn on the map represent equal points of height above sea level.
   a. Look at the three-dimensional drawing of the mountain below. Imagine that it is an island at low tide. Draw a line all around the island at the low tide level. Three hours later, as the tide has risen, draw another line at the water level and again three hours later. You will have created three contour lines each with a different height above sea level. As you see below, the three-dimensional shape of the mountain is mapped by calculating lines of equal elevation and then transferring the lines onto the map.
   b. On multi-colored maps, contour lines are generally represented in brown. The map legend will indicate the contour interval-the distance in feet

(meters, etc.) between each contour line. There will be heavier contour lines every 4th or 5th contour line that are labeled with the height above sea level. The images below illustrate how a variety of surface features can be identified from contour lines.

c. Find the contour interval on the orienteering map. A contour interval is the elevation change between contour lines. Elevation lines show the steepness and shape of the terrain. Visual models or drawings like the one below are helpful to illustrate the concepts.
    i. Steep slopes – contours are closely spaced
    ii. Gentle slopes – contours are less closely spaced
    iii. Valleys – contours form a V-shape pointing up the hill – these V's are always an indication of a drainage path which could also be a stream or river.
    iv. Ridges – contours form a V-shape pointing down the hill
    v. Summits – contours forming circles
    vi. Depressions – are indicated by circular contour with lines radiating to the center

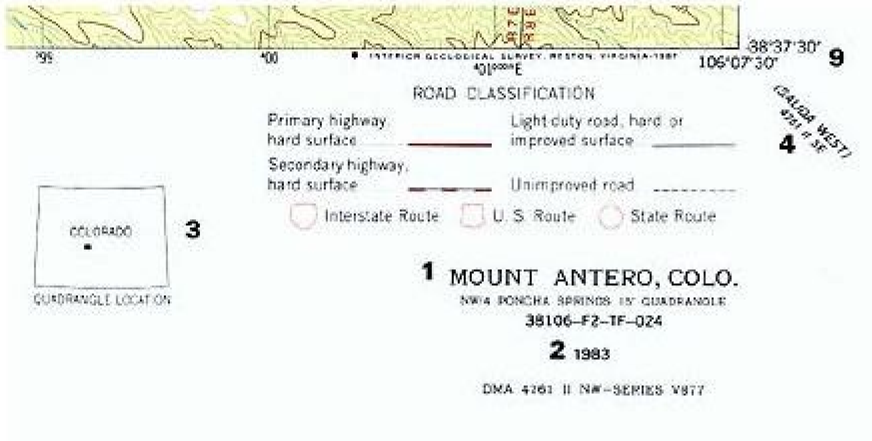

Steep Slope
Saddle between two summits
Summit
Ridge
Gulley
Gentle Slope
Valley
River
Water

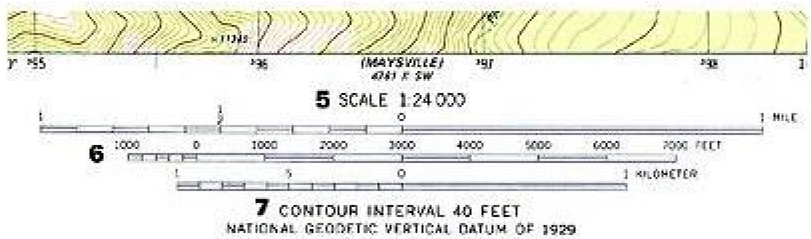
5. **Legend** – The orienteering map legend shows which symbols are used on the map.

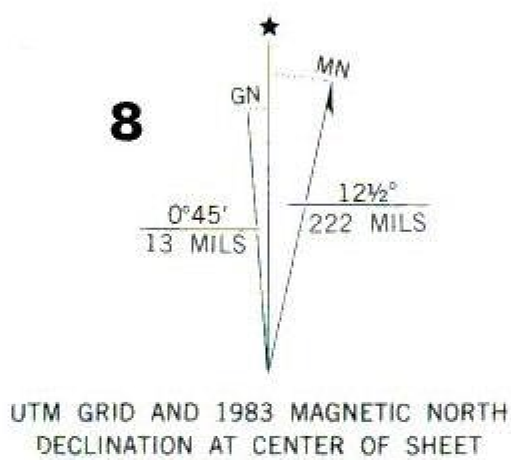
6. **Magnetic north lines** – Parallel lines with small arrows pointing toward magnetic North on the map. These lines are spaced on the map every 500 meters (on a 1:15,000 map). Read more about this later in the study guide.
7. **Colors** – Note the colors on the orienteering map: USGS topographic maps use the following symbols and colors to designate different features
   a. Black – man-made features such as roads, buildings, etc.
   b. Blue – water, lakes, rivers, streams, etc.
   c. Brown – contour lines
   d. Green – areas with substantial vegetation (could be forest, scrub, etc.)
   e. White – areas with little or no vegetation; white is also used to depict permanent snowfields and glaciers

f. Red – major highways; boundaries of public land areas
g. Purple – features added to the map since the original survey. These features are based on aerial photographs but have not been checked on land.

8. **Other map features:** A USGS map includes latitude and longitude as well as the names of the adjacent maps (depicted on the top, bottom, left side, right side and the four corners of the map). The major features on the map legend are show below.
    a. Map Name
    b. Year of Production and Revision
    c. General Location in State
    d. Next Adjacent Quadrangle Map
    e. Map Scale
    f. Distance Scale
    g. Contour Interval
    h. Magnetic Declination
    i. Latitude and Longitude







Data source: http://troop172newpaltz.com/adventure-skills/

B. Supplemental information – Please pay special attention to the links below. They will prove very helpful for successfully completing the Orienteering portion of Eco-Meet.
   a. **Watch YouTube video: https://www.youtube.com/watch?v=Y8ckrHq00aI**
      i. Title: How to Use a Compass & Map [Compass Navigation Tutorial]
      ii. Author: Black Owl Outdoors
   b. Want to practice your orienteering skills? **Visit this webpage:** http://www.scoutorama.com/orienteer_game/

IV. ORIENTEERING TERMS AND TECHNIQUES

A. To improve your orienteering skills, learn and use these terms and techniques:
Dead reckoning is moving a set distance along a set line. Generally, it involves moving so many yards or meters in a specific direction, usually a compass reading in degrees. (i.e. “Move 350 meters due north” or “Move 1,500 meters on an azimuth [or reading] of 220 degrees.”) As you move along your set line, you may want to identify **steering marks** to guide you. Find a point in the distance—a building, a hilltop, a large tree—on your line and move toward that point. Dead reckoning has two advantages: It is easy to teach and learn, and it is an accurate way of moving from one point to another over short distances.

B. ***Handrails*.** Find existing linear features—trails, fences, roads, streams, power lines—that parallel your route. Use these “handrails” as a check between control points. On the GWU map, the streets are your handrails.

C. ***Pacing*.** You need to know how to measure distance on the ground. Measure out a (or use an established) 100-meter pace course. Walk the course. Count the number of paces it takes for you to walk the 100 meters. This number is your pace count. Some people use a double-pace count: they step off on their left foot and count every time their left foot hits the ground. It is easier to use a double-pace count because you are counting half the number of steps. Everyone’s pace count is different, so never rely on a friend’s pace count. The longer your legs, the shorter your pace count, and vice versa. Your pace count (double pace count) may be 73; that is you reach 100 meters on the 73rd alternate footstep. Your friend, who may be just a few inches taller, may have a much longer stride and may be able to cover the same 100 meters in just 67 paces. It is also important for you to know your pace count for the fractions of 100 meters, such as 25 meters and 33 meters. Knowing paces for these distances will allow you to easily figure out fractions of 100 meters such as 25, 33, 50, 66, and 75 meters without a lot of mental computing.

D. **Terrain association** is movement by landmarks. You compare what you see on the ground with what you see on your map as you move. When navigating by terrain association, you must constantly orient your map as you change directions. Moving by terrain association is more forgiving than dead reckoning. If you make a mistake by dead reckoning, many times you must move back to your last known position and begin the dead reckoning over again. With terrain association, you can always quickly find your location by comparing what you see around you with what you see on the map. In most cases, you can identify your location without ever having to backtrack at all. Because of this, terrain association is often less time-consuming than dead reckoning. The example in this section used terrain association to travel across campus using the GWU map.

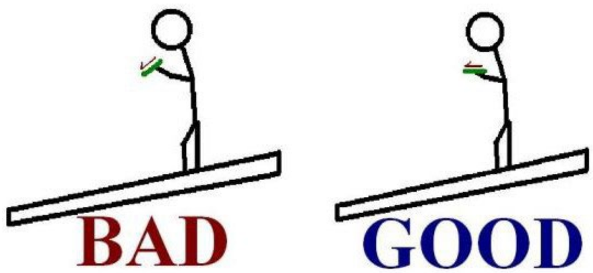
E. **Thumbing.** Thumbing is a technique used in terrain association in which you fold your map small enough to put your thumb next to your start point. Do not move your thumb from your start point. To find your new location, look at your map and use your thumb as a reference for your start point. That way, you don’t have to keep looking over the entire map.

F. **Measuring Distances:** There are a number of ways to measure distance accurately on a map. One is to use a piece of string or flexible wire to trace the intended route. After tracing out your route, pull the string straight and measure it against the scale line in the map legend. Another method is to use a compass (the mathematical kind) set to a narrow distance on the map scale like ½ mile and then “walk off” your route. It is a good idea to be conservative and add 5-10% of the total distance to take into account things like switchbacks that don't appear on the map. It's better to anticipate a longer route than a shorter one.

V. COMPASS BASICS- A. The compass is used to take a bearing, give direction, show where North is, measure distance and transfer direction from a map to the ground.

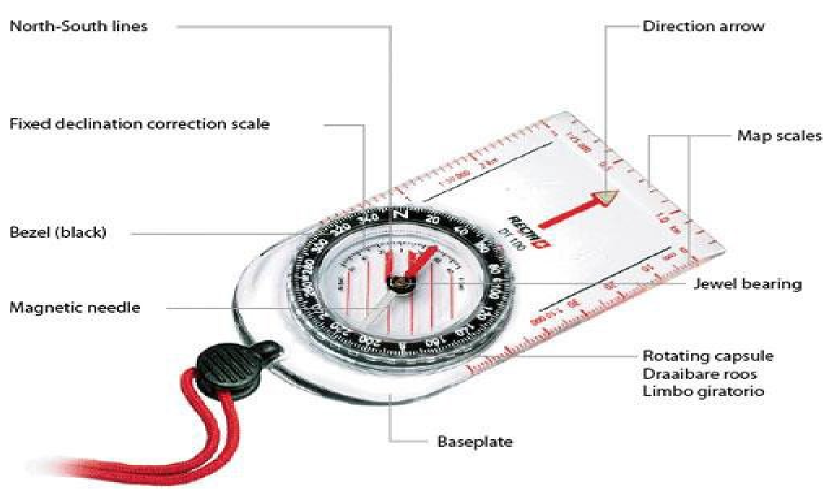
A. Important facts about the compass:

1. The protractor compass is the most familiar and used by hikers.
2. Never drop or shake (spin) your compass.
3. Each mark on the dial is 2 or 5 degrees.



B. Important parts of the compass:

1. **Base plate** - The base plate acts as a protractor in order to line up the compass with the desired route on the map. It usually includes a direction of travel arrow and measurement ruler.
2. **Bearing ring** or **dial** - 360 degrees total
3. **Direction of travel arrow** - (blue or black)
4. **Orienting arrow** - (red) permanently points to north
5. **Orienting lines** - (red and black) used to line up with map
6. **Magnetic north arrow** or **needle** - (red/white) the red side always points towards the north
7. **Distance measuring scale** - (inch/metric) for use with a map to measure distance
8. **Housing** - The liquid-filled housing, which may includes a 360-degrees bezel, turns in order to line up north on the compass with the magnetic declination lines on the map.



VI. DIRECTIONS/DEGREES

A. The **Cardinal** points of directions and degrees

1. North = 0 or 360
2. South = 180
3. East = 90
4. West = 270

B. The **Intercardinal** points of directions and degrees

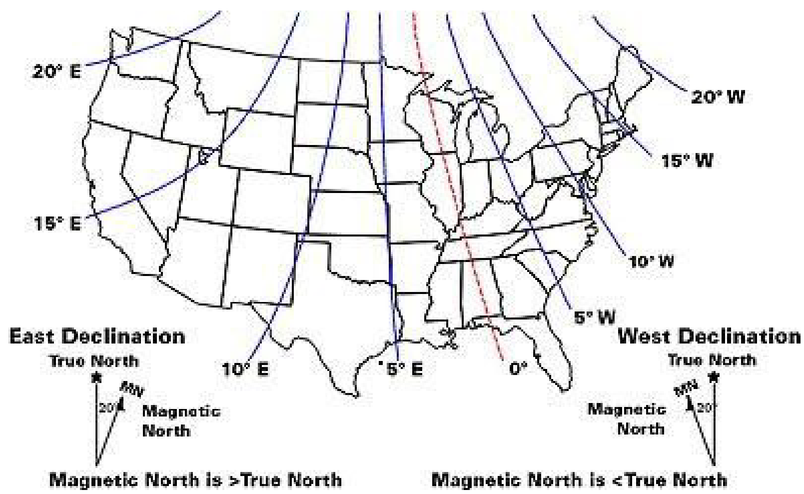
1. Northeast = 45
2. Southeast = 135
3. Southwest = 225
4. Northwest = 315

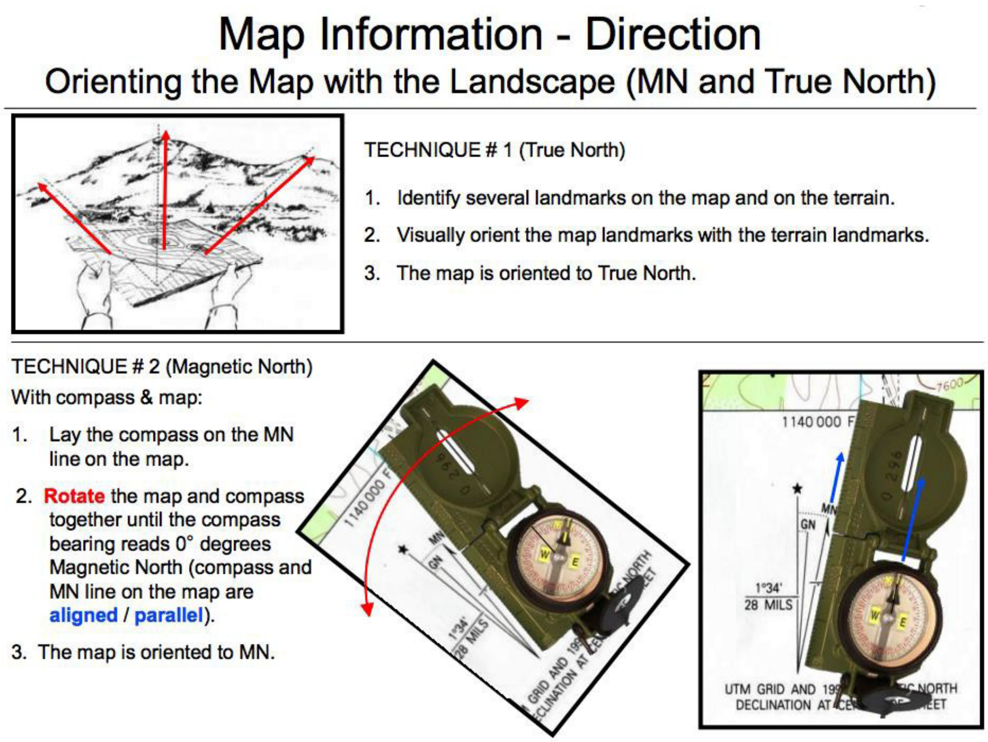
VII. WHAT IS NORTH?

A. No, this is not a silly question; there are two types of north.

1. **True North:** (also known as Geographic North or Map North – marked as H on a topographic map) is the geographic North Pole where all longitude lines meet. All maps are laid out with true north directly at the top. Unfortunately for the wilderness traveler, true north is not at the same point on the earth as the magnetic north Pole which is where your compass points.

2. **Magnetic North:** Think of the earth as a giant magnet (it is actually). The shape of the earth's magnetic field is roughly the same shape as the field of a bar magnet. However, the earth's magnetic field is inclined at about 11° from the axis of rotation of the earth, so this means that the earth's magnetic pole doesn't correspond to the Geographic North Pole and because the earth's core is molten, the magnetic field is always shifting slightly. The red end of your compass needle is magnetized and wherever you are, the earth's magnetic field causes the needle to rotate until it lies in the same direction as the earth's magnetic field. This is magnetic north (marked as MN on a topographic map). If you locate yourself at any point in the U.S., your compass will orient itself parallel to the lines of magnetic force in that area.





VIII. DECLINATION

A. You can see that location makes a great deal of difference in where the compass points. The angular difference between true north and magnetic north is known as the declination and is marked in degrees on your map. Depending on where you are, the angle between true north and magnetic north is different. In the U.S., the angle of declination varies from about 20° west in Maine to about 21° east in Washington. The magnetic field lines of the earth are constantly changing, moving slowly westward (½ to 1° every five years). This is why it is important to have a recent map. An old map will show a declination that is no longer accurate, and all your calculations using that declination angle will be incorrect. As you will see, understanding this distinction becomes important when navigating with a map and a compass.

B. Buy Your Compass for the Right Area: As well as the magnetic deviation east or west, compasses also show a vertical "dip" up and down. This dip varies in different parts of the world and compasses are specially calibrated for that dip. So you can't take a compass made for North America and use it in South America and get accurate readings.

C. Which North to Use **-** So we have two types of north to contend with. When you look at your map, it is drawn in relation to true north; when you look at your compass, it points to magnetic north. To make the map and compass work together you must decide on one North as your point of reference and base all your calculations on that. As you can see the following chart, failure to take declination into account can put you way off target.

Declination or Degrees Off Course	Error Off Target after Walking 10 Miles
1°	920 feet (280 meters)
5°	4,600 feet (1,402 meters)
10°	9,170 feet (2,795 meters)

D. Using Map and Compass

1. Even after years of using a map and compass I could never remember how to correct for declination. Do I add declination or subtract it? What if I'm out west versus in the east? While navigating through dense fog on a sea kayaking trip, I finally came up with an easy way to remember. As long as you remember the basic principles, you can easily work it out in your head.

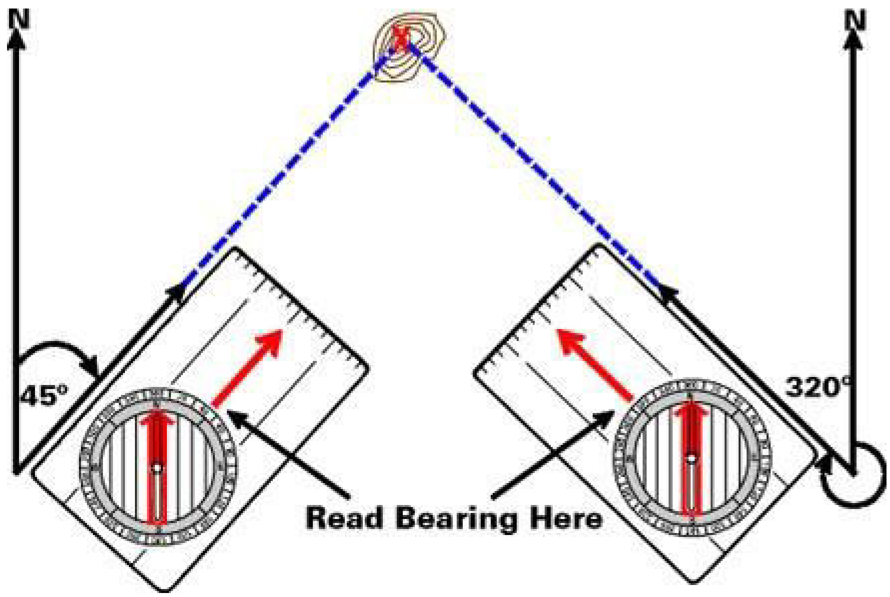
E. What's your Map Declination?

1. The first thing you need to know is where you are in relation to magnetic north. You can find this information by looking on your map legend.

a. If you look at the map of North America in below you will see the line roughly marking 0° declination. If you are on the line where the declination is 0°, then you don't have to worry about any of this, since magnetic north and map north are equivalent. (Wouldn't it be nice if all your trips were on the 0° of declination line?) If you are to the right of that line, your compass will point toward the line (to the left) and hence the declination is to the west. If you are to the left of the line, your compass will point toward the line (to the right) and hence the declination is to the east.

IX. BEARINGS

A. The compass is used primarily to take bearings. A bearing is a horizontal angle measured clockwise from north (either magnetic north or true north) to some point (either a point on a map or a point in the real world). Bearings are used to accurately travel to a destination or to locate your position. If you are working from your map, it is called a map bearing and the angle you are measuring is the angle measured clockwise from true north on your map to this other point on the map. If you are taking a bearing off a real point on the landscape with a compass, you are using your compass to measure the angle clockwise from magnetic north to this point on the landscape. This is called a magnetic bearing. Remember that the bearing is measured clockwise. If you think of true north as 12 o'clock then a bearing to the right of that (1 o'clock) is greater than true north and a bearing to the left of True north (11 o'clock) is less than true north.



B. Map Bearings & Magnetic Bearings:

1. If, you think about your map as an artist's rendition of the world. It displays true north, but it doesn't include magnetic fields as the real world does, so you need to make accommodations when going from your map to the real world. The real world doesn't have a true north-it's merely a construct of the map-so you have to make accommodations when going from the real world to your map. The basic principle is this: to correct for declination, you want the map bearing and the magnetic bearing to be equivalent. If you are lucky enough to be on the line where the declination is 0°, both are already equivalent, or if you orient your map with your compass then you have made the two equivalent. Otherwise, you will need to make your own bearing corrections by adding or subtracting the declination amount. That gives us 4 possible permutations to work with:

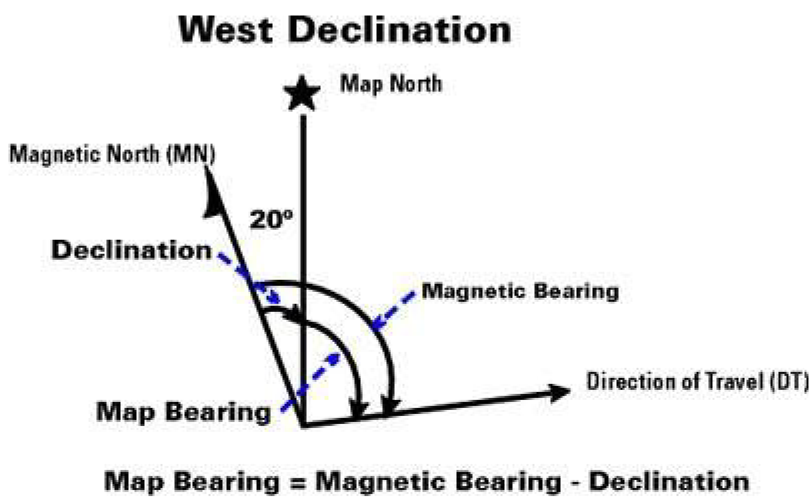
a. West Declination – Going from a Map Bearing to a Magnetic Bearing
b. West Declination – Going from a Magnetic Bearing to a Map Bearing
c. East Declination – Going from a Map Bearing to a Magnetic Bearing
d. East Declination – Going from a Magnetic Bearing to a Map Bearing

C. West Declination:

1. If your declination is west, then magnetic north is less than true north and the map bearing is less than (<) the magnetic bearing. You need to make the two bearings equivalent by adding or subtracting the declination.

2. Map Bearing to Magnetic Bearing: If you are taking a bearing from one point on your map to another point on the map with respect to true north, then you are working with the map bearing. Now you want to figure out where your position is in the magnetic bearing. In order to transfer this information back to your magnetic bearing you need to add the declination to your map bearing to create the proper magnetic bearing. Map bearing + Declination = Magnetic Bearing.

3. Magnetic Bearing to Map Bearing: If you use your compass to take a bearing from your current position to a point on the landscape, then you are working with the magnetic bearing. Now you want to figure out where your position is on the map. In order to transfer this information back to your map you need to subtract the declination from your magnetic bearing compass bearing to create the proper map bearing. Magnetic Bearing – Declination = Map Bearing

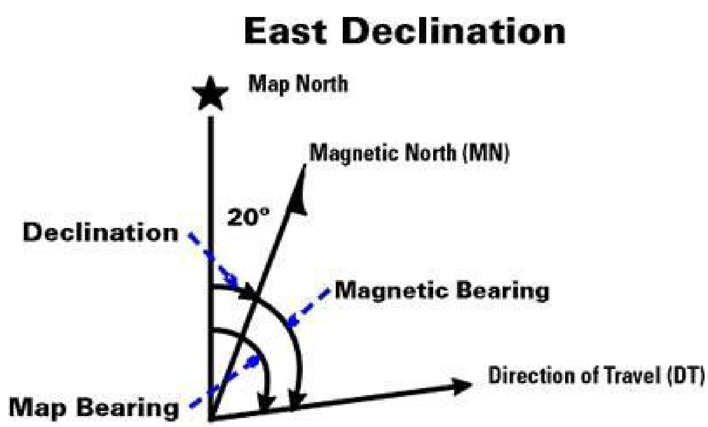


D. East Declination:

1. If your declination is east then magnetic north is greater than true north the map bearing is greater than the magnetic bearing. You need to make the two worlds equivalent by adding or subtracting the declination.

2. Map Bearing to Magnetic Bearing: If you are taking a bearing from one point on your map to another point on the map with respect to true north, then you are working with the map bearing. Now you want to figure out where your position is in the magnetic bearing. In order to transfer this information back to your magnetic bearing you need to subtract the declination from your map bearing compass bearing to create the proper magnetic bearing. Map bearing – Declination = Magnetic Bearing.

3. Magnetic Bearing to Map Bearing: If you use your compass to take a bearing from your current position to a point on the landscape, then you are working with the magnetic bearing. Now you want to figure out where your position is on the map. In order to transfer this information back to your map you need to add the declination from your magnetic bearing compass bearing to create the proper map bearing. Magnetic bearing + Declination = Map Bearing.



Map Bearing = Magnetic Bearing + Declination

If the declination is...	Then...	Map Bearing to Magnetic Bearing	Magnetic Bearing to Map Bearing
West	Magnetic North < True North Map Bearing is < the Magnetic Bearing	Map Bearing + Declination = Magnetic Bearing	Magnetic Bearing - Declination = Map Bearing
East	Magnetic North > True North Map Bearing is > the Magnetic Bearing	Map Bearing - Declination = Magnetic Bearing	Magnetic Bearing + Declination = Map Bearing

X. USING A MAP AND COMPASS TOGETHER

A. Adjusting Your Compass for the Local Declination:

1. Another way to deal with declination is to adjust your compass. Some compasses have an outer degree ring that can be unlocked either with a setscrew or a latch. This allows you to reset the compass to account for declination. For example, if the declination were 14° East, you could rotate the degree dial to the right so that the

magnetic needle was pointing to 14° instead of 360°. Once you do this, you will no longer have to add or subtract for declination because your compass is aligned to true north. Now when the compass needle is inside the orienting needle, the compass bearing that you read off your compass will be in relation to true north instead of magnetic north. If you have a fixed-ring compass, you can mark the declination angle on the compass ring with a piece of tape.

B. Check Your Position Regularly - Make it a habit of keeping your map and compass handy and refer to them every hour or so to locate your position (more often in low visibility). Keep track of your starting time, rest breaks and lunch stops, and general hiking pace. This will also give you an idea of how far you have traveled and whether your Time Control Plan is accurate.

C. Orienting the Map: It is easiest to read a map if the map is oriented to the surrounding landscape. If you see a valley on your left, then the valley shows on the left on the map. You can do this by eye or with your compass.

1. Using Land Features: Lay the map on the ground or hold it horizontally. Rotate the map until recognized features on the ground roughly align with those on the map.

D. Using a Compass:

1. Identify your declination from your map. If your declination is West of true north, subtract the declination from 360°. If your declination is East of true north.
2. Set the compass at the correct declination bearing so that you compensate for declination.
3. Place your compass on the map so that the edge of the base plate lies is parallel to the east or west edge of the map with the direction of travel arrow toward the north edge of the map.
4. Holding the compass on the map, rotate the map with the compass until the north end of the magnetic needle points to the N on the compass housing (i.e. the red north end of the magnetic needle and the orienting arrow align). This is often referred to as "boxing the needle" since the magnetic needle is inside the "box" formed by the orienting arrow. The map is now oriented with respect to magnetic north. This means that the compass needle direction north is the same as true north on the map. You can also place the compass on the map so that the edge of the base plate lies along the magnetic north indicator line on the map legend at the bottom and rotate the map as described above. This may give you a more accurate orientation for your map.

E. Identify Terrain Features: With the map oriented, look around for prominent features landscape features such as mountains, valleys, lakes, rivers, etc. Make a mental note of the geographical features you will be traveling along and seeing during the day. If you keep the terrain in your mind, you will usually have a general idea of where you are just by looking around.

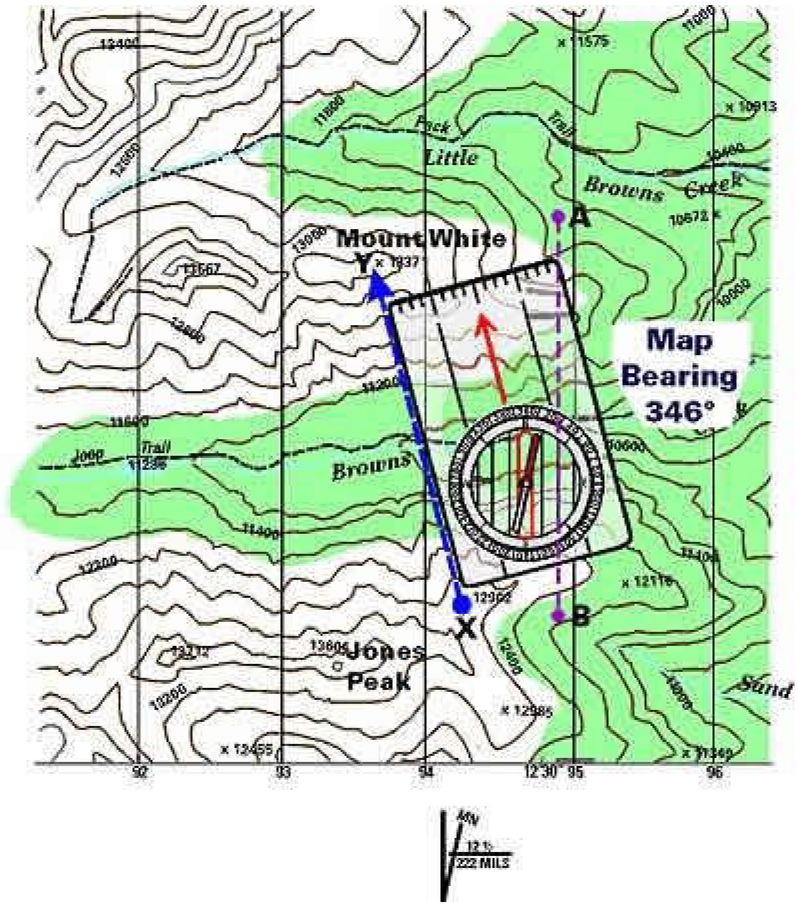
F. Tricks of the Trail - Orient Your Map: You can eliminate the need to correct for declination if you use your compass to orient the map each time. As long as the map is oriented with respect to magnetic north, any bearings you take from map to compass or compass to map will be the same. For this reason, it's a good idea to always take the time to orient your map. It will make your life much easier. It also means that each time you use your map, your will need to re-orient it with your compass.

G. Real Life Scenarios: Using Your Map and Compass to Navigate.

> **Scenario #1** – Lost in the Fog: Okay, you hike in along the trail and then bushwhack off trail to a nearby alpine lake to camp. When you wake up the next morning, you are fogged in. You know where you are on the map, but you can't see to find your way out. What you need to do is take a bearing on your map from your known campsite back to a known point on the trail that you can identify on the map. Then follow your bearing through the fog. Here's your procedure:

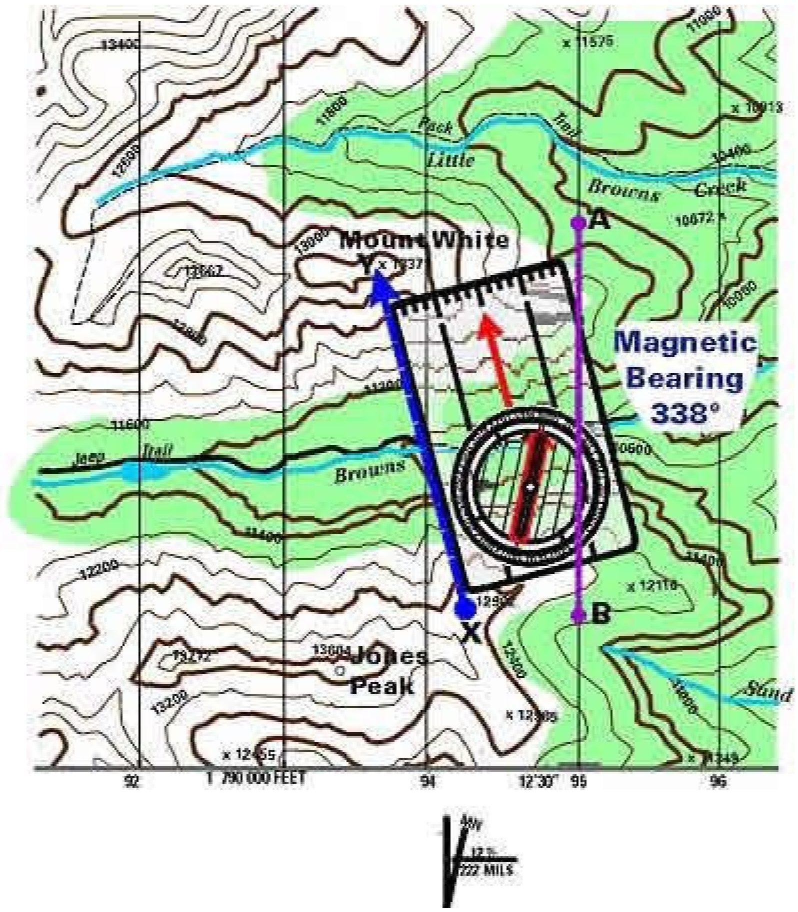
H. Taking a Bearing From the Map
(Map *Not* Oriented):

1. Lay the long edge of the compass base plate on the map, making a line from the starting point to the destination (from point X to point Y). Since the base plate is parallel to the direction of travel arrow, the base plate can be used to set the direction to the destination.
2. Holding the base plate steady, rotate the compass housing until the compass orienting lines and orienting arrow are pointing to true north. Here you see the orienting lines and arrow are parallel to the line from A to B as well as to the map gridlines. 3. Read the bearing (in degrees) from the degree dial at the point on the compass base plate marked "Read bearing here." In this case the bearing is 346°.



I. Taking a Bearing from the Map
(Map Oriented to Magnetic North):

1. Orient the map with the compass.
2. Lay the long edge of the compass base plate on the map, making a line from the starting point to the destination (from X to Y). Since the base plate is parallel to the direction of travel arrow, the base plate can be used to set the direction to the destination.
3. Holding the base plate steady, rotate the compass housing until the orienting arrow coincides with the North end of the magnetic needle (known as "boxing the arrow").
4. Read the bearing (in degrees) from the degree dial at the point on the compass base plate marked "Read bearing here." In this case the bearing is 338°.



Scenario #2 – Heading to the Summit: You have been hiking along the trail and found a good campsite that is marked on the map. You see a summit ridge above tree line that looks like a great place for photographs, but there's a valley thick with Douglas fir between you and the summit. What you need to do is take a bearing from your current position to the summit and use that to travel through the forest. Here's your procedure:

J. Taking a Bearing from the Land:

1. Point the compass direction of travel arrow to the destination on the land.
2. Rotate the compass housing until the north orienting arrow of the compass housing lines up with the red magnetic needle. This is referred to as "boxing the needle," since you want the needle to be inside the box defined by the orienting arrow. The north-orienting arrow must be pointing in the same direction as the red (north) magnetic needle. Your compass will look like the figure above with the needle boxed.
3. Read the bearing (in degrees) from the degree dial at the point on the compass base plate "Read bearing here."

K. Walking a Bearing Taken from the Land:

1. After taking the bearing, as described above, hold the compass level and in front of you, so that the direction of travel arrow points to the destination.
2. Rotate your whole body until the magnetic needle lies directly over the orienting arrow. Make sure the north end of the magnetic needle points to N on the compass housing. The direction of travel arrow points to the destination.
3. Site a prominent feature to which your direction of travel arrow points. Walk to that feature.
4. Continue to sight on other features along the bearing and walk to them, until you reach your destination.

L. Walking a Bearing Taken from the Map: To walk a bearing taken from the map, you may need to correct for declination if you did not orient the map to magnetic north before you took your bearing. Once you have corrected for declination, follow the same procedure as indicated above for walking a bearing taken from the land.

M. Techniques for Walking a Bearing: Sometimes the terrain isn't always so cooperative to let you just follow your bearing in a straight line so there are a number of techniques to use when traveling on a bearing.

N. Line of Sight – Walk to an obvious landmark-a tree or boulder that is directly on the bearing. Then take another bearing on the next obvious landmark and walk to that. Keep it up until you reach your destination. By going to intermediate landmarks, you minimize the chances of veering off your bearing.

Scenario #3 – Retracing Your Steps to Camp: You got to the summit and got some great photos, even one of a baby mountain goat. Now it's time to get back to your campsite. You could just follow your back bearing (see below) back to your location, but there is bound to be some error, when you hit the trail where will you be in relation to your campsite? The best bet is to intentionally aim off. Here's your procedure:

O. Back Bearings: To check your position while walking a bearing, you can take a back bearing. Before you start to walk on your bearing, turn around take a bearing 180° off of the bearing you are going to walk. For example, if you are going to walk a bearing of 45°, shoot a bearing directly opposite your course of 225°. Locate some landmark along this bearing. Once you have moved a short distance along your bearing, turn around and shoot a bearing back to that landmark. If you are on course, that bearing will still read 180° off your bearing of travel (in this case 225°). If it doesn't, it means that you are off course. Sailors and sea kayakers use back bearings all the time to check for lateral drift from wind or currents. Back bearings are also useful if you are heading out to someplace and then returning along the same line of travel. There are two basic formulas for calculating a back bearing.

PART 2: GEOCACHING

I. INTRODUCTION (from geocaching.com)

As stated previously, geocaching and orienteering are two different sports that share common elements. Geocaching involves using a handheld GPS (Global Positioning System) or a cell phone with GPS capabilities. Geocaching is a real-world, outdoor treasure hunting game using GPS-enabled devices. Participants navigate to a specific set of GPS coordinates and then attempt to find the geocache (container) hidden at that location.

Geocaches can be found all over the world. It is common for geocachers to hide caches in locations that are important to them, reflecting a special interest or skill of the cache owner. These locations can be quite diverse. They may be at your local park, at the end of a long hike, underwater or on the side of a city street. There are currently over a dozen "cache types" in geocaching, with each cache type being a different variation of the game.

A. Rules of Geocaching

1. If you take something from the geocache (or "cache"), leave something of equal or greater value.

2. Write about your find in the cache logbook.

3. Log your experience at www.geocaching.com.

B. Getting Started- At its simplest level, geocaching requires these 8 steps:

1. Register for a free Basic Membership.

2. Visit the "Hide & Seek a Cache" page.

3. Enter your postal code and click "search."

4. Choose any geocache from the list and click on its name.

5. Enter the coordinates of the geocache into your GPS Device.

6. Use your GPS device to assist you in finding the hidden geocache.

7. Sign the logbook and return the geocache to its original location.

8. Share your geocaching stories and photos online.

Data Source: www.geocaching.com /guide/default.aspx

C. How Does GPS Work?

1. Global Positioning System (GPS) receivers tap into a satellite network from anywhere in the world to accurately pinpoint specific geographic locations. A location is identified by measuring its distance from at least three satellites by a process called trilateration. A geocacher can place a cache anywhere in the world, pinpoint its location using GPS technology and then alert others to the cache's existence and location via the Internet. Anyone with a GPS receiver can then hunt for the cache.

Types of Caches

Traditional:
The original cache type consisting, at minimum, of a container and a logbook. The coordinates listed on a traditional cache page describe the exact location for the cache.

Multi-Cache:
A multi-cache involves two or more locations. Hints are found in the initial cache(s) and then the final location is typically a physical cache container.

Puzzle Cache:
A cache that involves a puzzle or puzzles, sometimes complicated, that you must solve to determine the coordinates of the cache.

Event Cache:
Geocaching events organized by local geocachers and geocaching organizations. Listings contain coordinates, a date and time to meet.

D. Simple Rules of Geocaching

- If you take something from the cache, leave something of equal or greater value.
- Write about your find in the cache logbook.
- Log your find at www.geocaching.com.

E. Keep In Mind

- Caches should never be buried.
- Don't put yourself or others in harm's way.
- Don't place items such as food, explosives, knives, drugs or alcohol in a cache.
- Caches are intended to be enjoyed by people of all ages.
- Respect local laws and seek permission where needed.
- Review our cache listing requirements and guidelines before hiding a cache

F. Before You Go

- Find a cache that will meet your immediate goals. Are you looking for a difficult hike or an easy adventure?
- Print cache information (don't forget the hints) and make sure to bring both a map and compass.
- Remember that distances can be deceiving. A cache can take longer to find depending on trails, rivers and other obstacles.
- Pack any needed supplies such as water, food and extra clothing. Check cache terrain and difficulty ratings.
- Let someone know where you are going.

• Don't forget your GPS receiver and extra batteries.

G. Finding a Cache

• Mark your car as a waypoint to ensure your safe return.

• Be mindful of the environment, practice

H. Cache In Trash Out.

• Bring friends and family with you; sharing the experience can be very rewarding. Pets are usually welcome, too!

I. After the Find

• Sign the cache logbook.

• Leave the cache as you found it (hidden, of course).

• Log your find at www.geocaching.com. Found it! Didn't find it

Data source: https://www.geocaching.com/articles/guide_to_geocaching.pdf

II. NAVIGATING A GPS DEVICE

A. Basic GPS Terms

1. Waypoints – locations you store in a GPS device

2. Waypoint Manager – where the waypoints are stored in the GPS device

3. Route – a sequence of waypoints that leads you to your final destination

4. Tracks – a recording of your path. The track log contains information about points along the recorded path, including time, location, and elevation for each point.

5. Navigation – you can navigate a route, a track, to a waypoint, to a geocache, or to any saved location in the device.

i. You can use the digital map (stored on the device) or compass to navigate to your destination. It is up to the user to decide which way works best for them.

B. Tips and Tricks for GPS Navigation

1. When navigating using the map, check the scale to make sure you are zoomed in to the proper level.

2. Remember that GPS units are not 100% precise. You might have to look around within a 30 foot area to find what you are looking for.