

Navigation 101 - Topographic Maps

Legend

- Date, compass rose, scale, distance, height b/w contours, magnetic declination (this map is adjusted; use the blue n/s lines)

Basic Features

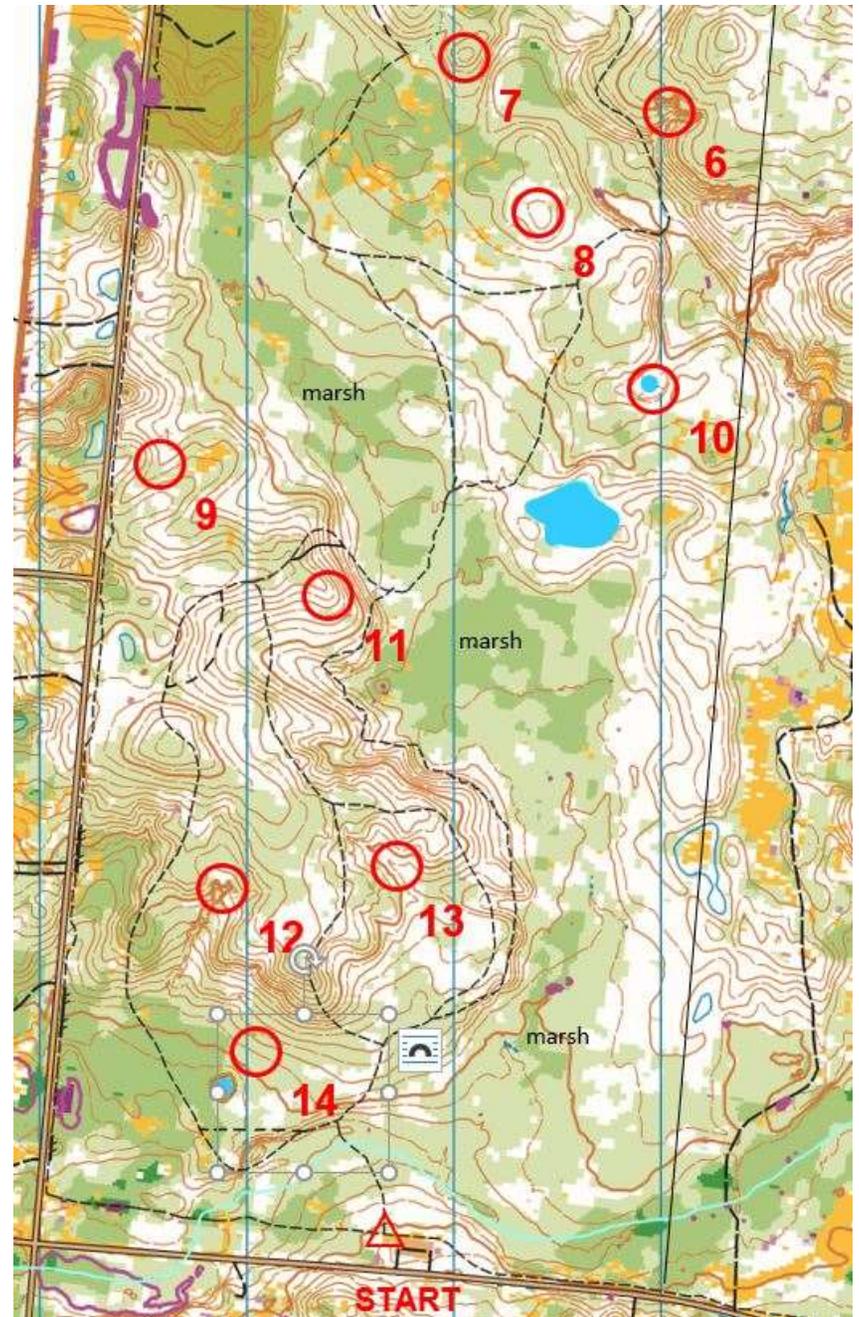
- **Slope/ridge:** parallel lines on side of hill. If contours are closely spaced, it's a steep slope. Otherwise, gentle slope. See CP 14. To determine if it goes up or downhill, look for water nearby.
- **Valley:** wide low area between 2-3 slopes. See CP 6 and 12.
- **Swale:** similar to valley but with much smaller with gentle, shallow slopes on its sides. See CP 9 and 13.
- **Gully/reentrant:** V-shaped series of lines off high ground formed by water draining. Similar to valley but with very narrow low ground between slopes. See tops of valleys at CP 6 and 12.
- **Hilltop:** concentric circles w/ lines radiating to center. See CP 7 & 8.
- **Depression:** bowl-shaped low area. Sometimes filled with water. Concentric circles with lines radiating to the center with small lines pointing toward center to distinguish it from a hilltop. See CP 10.
- **Spur:** U-shaped series of lines coming off high ground. Has slopes on three of its sides (if surrounded by water, peninsula). See CP 11.
- **Saddle:** area between hilltops. No examples on this map but the area between CP7 and 8 would be one if they were closer.
- **Water features:** blue lines = creeks/rivers, blue areas = ponds/lakes
- **Man-made features:**
 - buildings = black squares, private property = olive boxes
 - trails and roads = black dotted lines (except main roads = orange)
 - power lines = black dotted lines with squares between (for towers)

Colors

- Green: woods, brush (marsh land usually has cattail symbol)
- Blue: water
- White: light vegetation
- Brown: contour lines
- Red/gray: urban areas
- Purple: area needs to be "vetted"/scouted



MICHIGAN
ADVENTURE RACE



Compass Elements, How to Use

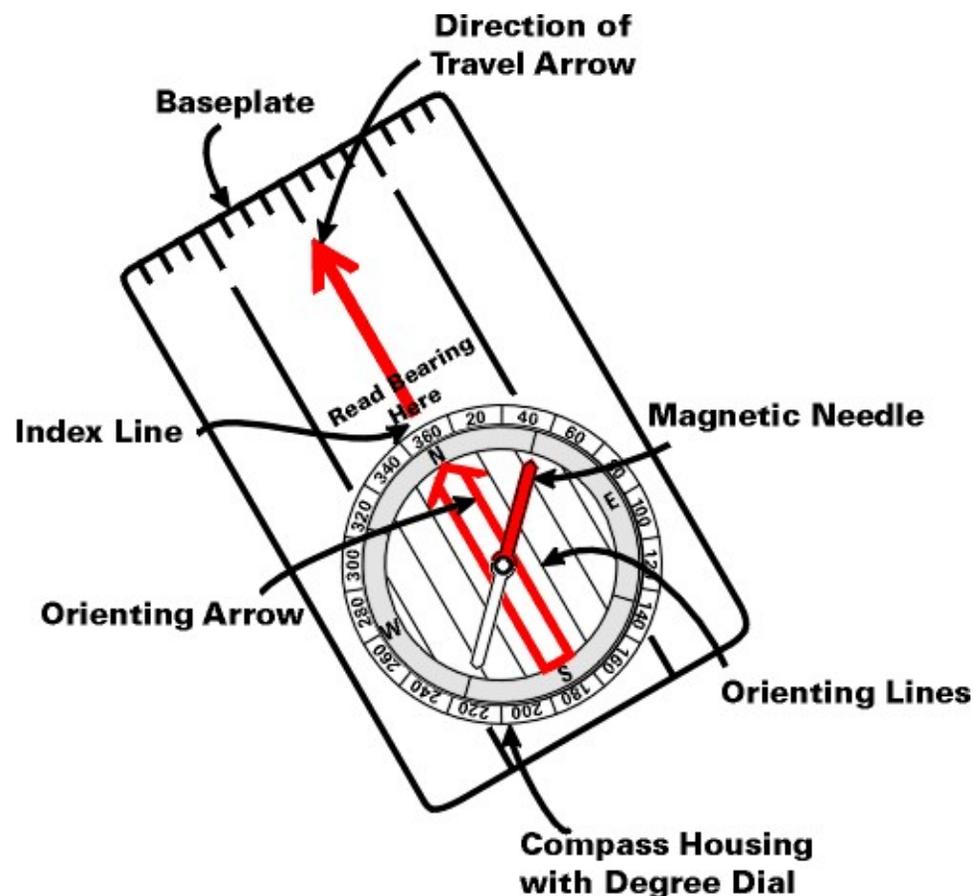
1. To go in a desired direction, rotate compass housing to align with that direction (set your “bearing”, e.g., west or 270 degrees).

Hold compass parallel to the earth and rotate your body so that the magnetic needle, which always points north, is aligned with the orienting arrow on the housing (red in the shed).

Follow the direction of the travel arrow on the compass (keeping “red in shed”).

2. To determine what direction you are facing, point the direction of travel arrow and rotate the compass housing until the needle is aligned with the orienting arrow.

Tip: Avoid wearing a metal belt.



How to Navigate with Compass & Map

To find the Bearing from point X to Y

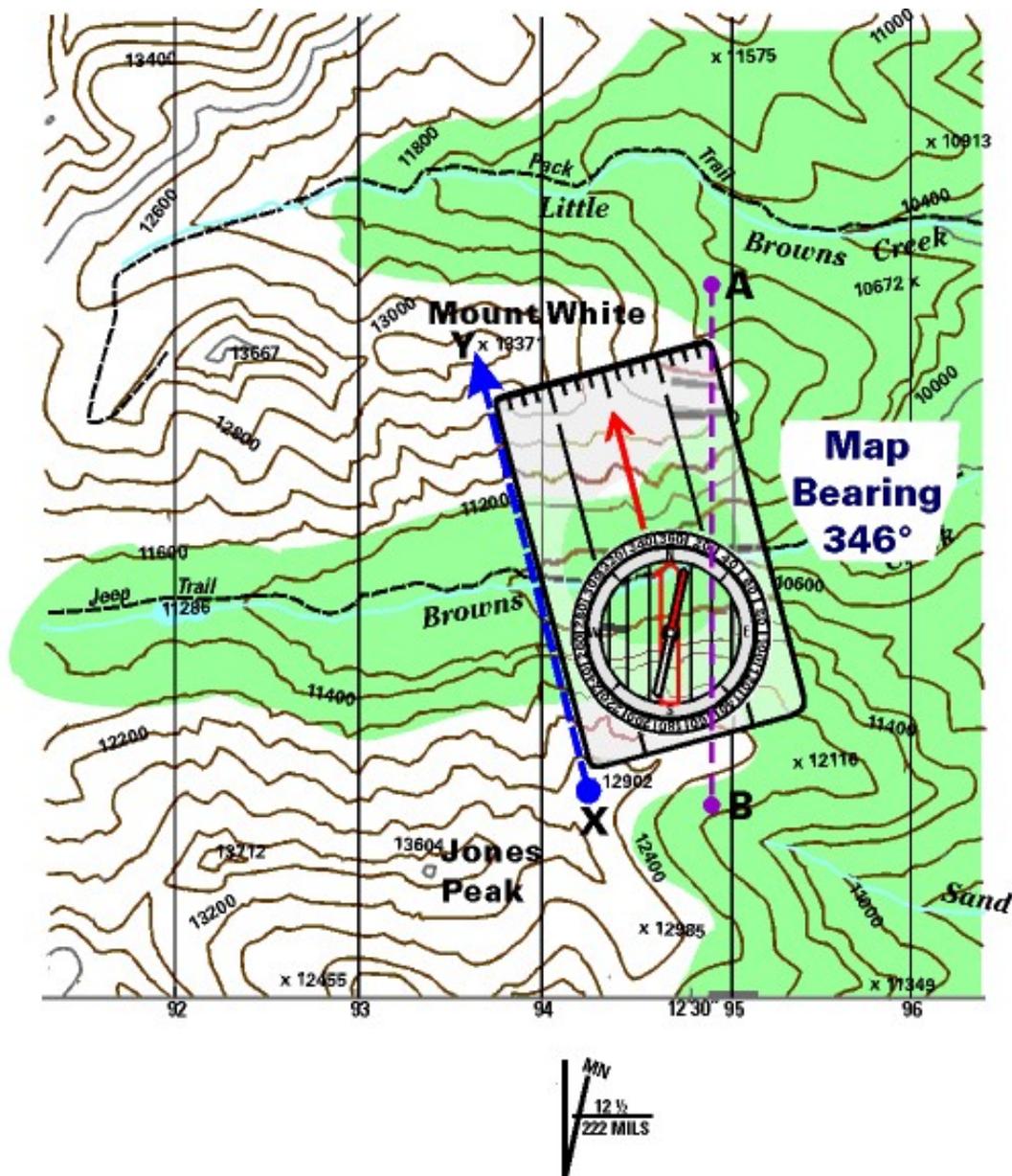
- Align the edge of the compass with starting (X) and finishing (Y) points
- Rotate the compass housing until the orienting lines on the compass line up with the N/S orientation lines on the map. North on the compass degree dial should match North on the map. Read bearing.

To “orient the map”

- Rotate the map and compass together until the red end of the compass needle points north (red in the shed).

To go from X-> Y

- Follow the direction of the **travel arrow** on the compass (the arrow on the baseplate, not the red end of the compass needle), keeping the needle aligned with the orienting arrow on the housing. Use objects such as trees in the distance to follow rather than always looking down at compass.



Common Mistakes

- Orienteering only works if you know where you are (X).
- Ensure that you are lining up the compass with direction of travel arrow pointing from X (where you are) to Y (destination), not Y to X.
- When you rotate compass housing to line up north/south lines on compass with those on the map, make sure that north on the compass matches north on the map.
- Make sure you know how far you have to go (distance)
 - On a 1:24,000 scale map, every 1 cm = 240 meters
 - On a 1:10,000 scale map, every 1 cm = 100 meters
- Try counting your steps or paces (every other step) in the woods to get a good idea of how far you are going. And measure how long it takes you on average to travel 100, 400, 800 meters in various types of terrain.



Strategy

Trails

- Is the trail on the map? How confident am I about this?
- Will it take me where I need to go; could it suck me into where I don't want to go?
- How fast can I travel on trail vs. off-trail? How much farther is it to take the trail? How certain is it I will know where I am along the way and at the end?
- Does it have attack points (“kinks” or intersections, elevation changes, natural features) that tell me where I am?
- If it's winter, are the trails likely to have been used prior to the race? Can I tell where they are? What trails are groomed? (Pre-run trails when possible)

Terrain

- The sure (slow) thing vs. the (fast) unknown (e.g., going over a hill on bearing vs. wrapping around)
- Where is the terrain usually brutal? Near creeks, reentrants (fall lines), low areas around wetlands
- Where does the terrain help guide you (“handrails”)? Creeks, reentrants, ridge lines.
- Stay within sight of creeks and reentrants but above them... e.g. on ridge lines or “spines”
- Pay careful attention to contour lines
- Climbing vs. descending. Climb early while fresh?

Measurement

- Pre-race: compass ruler, map wheel
- During race: compass, pace counting, stopwatch, counting features (e.g., reentrants)



Strategy

Attack Point

- A location that you are confident that you can identify and take a compass bearing from.
- Best strategy if the control isn't on or near a handrail or other large, distinct, easily identifiable feature, choose an
- Your accuracy in following the bearing decreases as the distance you travel increases.
- Note: using an attack point is also useful in less challenging situations, where you don't have to use a compass.

Handrail

- Features that you can follow easily (like a handrail on a staircase).
- Trails, roads, fences, streams, ditches, edges of fields, and other long, narrow features just as easily.
- Takes much less concentration than following a compass bearing.

Aiming Off

- Deliberately aiming to one side of a feature on or near to confidently predict which side it will appear on.
- For example, if you aim right at a bend on a stream, but don't see it when you hit the stream, you won't know whether to go upstream or downstream to look for it.

Visualization/Collecting Features

- Constantly visualize features in your mind before you get to them, then identify the features as you pass them, and locate or "collect" them on the map. "There should be a reentrant (gully) coming up on my right, and then there'll be a marshy area off to my left"
- If necessary, break a long leg up into several shorter sections between identifiable features, even if it means following a zig-zag course.



Strategy

Catching Features

- Lets you know if you've gone too far.
- Look on the map a short distance beyond the CP you are heading for, and pick out a big, distinct feature that you can't fail to recognize. If you arrive at this catching feature, you will know you have overshot the control, and can turn around and go back. "Catches" you.

Recovery/Relocation

1. When you feel you have lost contact with the map, stop. Stop sooner rather than later.
2. Orient the map with the compass.
3. Re-establish your location by looking at the oriented map and the features around you.
4. If you can't relocate right away, then reconstruct with teammate(s) where you think you went since the last place you knew you were.
5. If you still can't figure out where you are, go to a feature that you know is on the map (e.g., hilltop, trailhead, water feature) or return to the last place of known position.
6. Once you have relocated, don't rush to make up lost time except when you know where you are (e.g., a trail, road, on a river).

End Game

- Exiting an orienteering course
- Managing time (e.g., measure distance from furthest point)
- Design with the end in mind: finish near the finish, create loop that maximizes CPs and gets you back closer to the finish, plan for short on time and long on time



Strategy

Online Practice

- Review past races, attend clinics, get tips online
 - ✓ [United States Adventure Racing Association Racer Resources](#)
 - ✓ [MI Backyard \(now Michigan Adventure Club\) race analysis](#). Racers explain their logic for route selection from Michigan Adventure Races and other events. My #1 source for navigation tips.
 - ✓ [Mark Lattanzi's Navigation Tips site](#). Great resource from an expert navigator.

Real World Practice

- Search for navigation clinics in your area or ask an experienced racer to consider putting one on
- Join your local orienteering club if one exists near you
- [Yankee Springs Permanent Orienteering Course](#) (south of Grand Rapids, MI)
- [Seidman Park Permanent Orienteering Course](#) (Grand Rapids/Ada)
- Maps for other courses can be purchased from [Southern Michigan Orienteering Club](#)
- Do it yourself
 - ✓ Use online topo maps or free phone gps app (e.g., Terrain Navigator Pro); hike off-trail
 - ✓ Draw a line from one point to another, find every feature as you pass by it
 - ✓ Create “streamer” courses for each other (or create online and then find features)

Races

- See our race calendar at [Michigan Adventure Race](#). See also [Lost Arrow Sports](#) and [Southern Michigan Orienteering Club](#) sites for clinics and races.

