Adventurer's MK

NAVIGATION

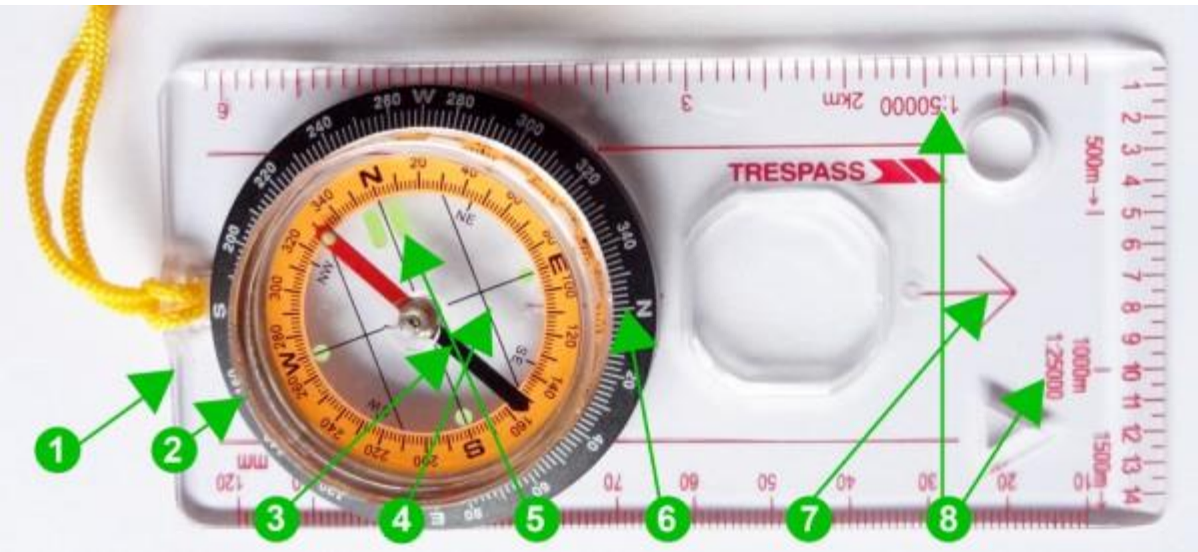
Choosing a compass
Choose your compass with care. The most appropriate type to use is probably the orienteering compass. A good one will have a well-balanced steel magnetic needle that settles into position quickly. The needle should be coloured differently at each end, usually red at the north end. If the tip glows in the dark then even better.

The base plate and dial are usually strong plastic. The dial will have increments of around 2° marked clearly. On the dial itself will be faint meridian lines (faint parallel blue lines pointing in the same direction as north on the dial). Some even have extra information such as magnetic variation or declination degrees marked on the dial. The dial also has an arrow marked on the bottom aligned with north on the dial.

The base plate should be transparent and have scales in both metric (cm and mm) and imperial (inches). A magnifying glass, clinometer, sighting mirror and adjustable declination screw are all welcome extras. Don't forget a strong strap attached to the base plate which should be securely held at the other end to your shirt pocket buttonhole or around your neck.

Why is it spinning like that?
Because a compass is based upon a magnet the needle can be affected by magnetic fields and materials such as iron. For instance your belt buckle, a zip, karibiner. Even mineral deposits in the ground can offset your compass. Don't just look down either. Look around and above you. Sitting under a power line or near an electric motor will not do you any favours.

Typical compass



All compasses include many common features.

1. Baseplate – the plastic rectangular transparent base.
2. Compass housing or wheel, degrees covering 360 degrees, and N-S-E-W or cardinal points for North, South, East and West.
3. Magnetic needle – red end for north, black end for south.
4. Compass lines or orienteering lines – on the bottom of the compass housing.
5. Orienting arrow (2 green lines on this compass) – fixed and aligned to north within the compass housing.
6. Index line – the beginning of the direction of travel arrow.
7. Direction of travel arrow – the arrow at the end of the baseplate.
8. Map scales 1:25 000, 1:50 000 and metric measurer or Romer scales.

A typical (Silva type) compass consists of a magnetic strip of metal, suspended or pivoted (so it can swing freely) within a moveable dial. The dial is usually liquid filled (this dampens the oscillation of the needle allowing it to settle into position much more quickly) and has several parallel lines marked on the dial itself. The compass should have a clear plastic base plate with straight edges. Along the edges should be scales in both metric (cm and mm) and imperial (inches). Some may have additional features such as a magnifying area and degrees of declination/magnetic variation (usually marked on the compass dial). A wrist strap is another important feature if you want to keep the compass.

There are usually 3 different types of arrow marked on the compass. As indicated in the diagram, the vertical arrow marked on the plastic background is your direction of travel arrow. This is the only arrow you ever follow.

The arrow that spins in the middle of the compass (usually coloured red and white) always turns to point north (the red end is the end that points north). NEVER follow this arrow (because you will always be walking north then, no matter where you actually wanted to go!) When using a compass try not to hold it near any metal or any magnets else this arrow will be attracted to them and you will end up going in the wrong direction. Depending on where you are simply placing the compass near the floor may give you an inaccurate reading due to iron and mineral deposits in the ground. Always check you have the same reading at ground level and when standing up.

The third arrow is the one that will be marked upon the dial. (you can't actually see this on the picture). It is usually a red arrow marked on the bottom of the dial. This is the one that will match up with the red and white pointer that spins. When you want to read a number off the dial, look at the point where it touches the line at the top (the one marked by 'read bearing here'), this is the number you want.

NOTE: There are 360 degrees in a circle. Be careful about how many degrees each line on the compass represents. Normally on compasses of this type each line is 'worth' 2 degrees. This is important as a difference of 5 degrees over a walk of 6 miles will mean you will be about half a mile from where you should be!

All you have to remember are the four main points of the compass. All the other points are made by combining these four. (for instance halfway between north and east is northeast).
Some silly ways to remember the order of the points are to recall the following phrases. The points start at the top and go around clockwise.

- ❖ Never Eat Shredded Wheat
- ❖ Naughty Elephants Squirt Water

If you wish to quote a more accurate direction you can either opt for a more complicated compass point;

North by Northeast is a position halfway between north and northeast. Note that the convention for naming points of this type is to quote the 'more important' compass point first. For example, halfway between southwest and west would be called West by Southwest (and not Southwest - West).

Or you can resort to quoting an angle measured clockwise from North (in degrees);
Recall there are 360° in a circle. So North would be 0°. East would be 90°. South - 180° and West 270°. As another example, Northeast would be 45° (halfway between north and east).
The advantage of quoting in degrees is speed and accuracy (a direction of 208° is not an obvious compass point!). This is related to bearings.

USING THE SUN AND SHADOWS

The earth's relationship to the sun can help you to determine direction on earth. The sun always rises in the east and sets in the west, but not exactly due east or due west. There is also some seasonal variation. In the northern hemisphere, the sun will be due south when at its highest point in the sky, or when an object casts no appreciable shadow. In the southern hemisphere, this same noonday sun will mark due north. In the northern hemisphere, shadows will move clockwise. Shadows will move counter-clockwise in the southern hemisphere. With practice, you can use shadows to determine both direction and time of day. The shadow methods used for direction finding are the shadow-tip and watch methods.

Shadow-Tip Methods

In the first shadow-tip method, find a straight stick 1 meter long, and a level spot free of brush on which the stick will cast a definite shadow. This method is simple and accurate and consists of four steps:

1. Place the stick or branch into the ground at a level spot where it will cast a distinctive shadow. Mark the shadow's tip with a stone, twig, or other means. This first shadow mark is always west--everywhere on earth.
2. Wait 10 to 15 minutes until the shadow tip moves a few centimetres. Mark the shadow tip's new position in the same way as the first.
3. Draw a straight line through the two marks to obtain an approximate east west line.
4. Stand with the first mark (west) to your left and the second mark to your right--you are now facing north. This fact is true everywhere on earth.

An alternate method is more accurate but requires more time. Set up your shadow stick and mark the first shadow in the morning. Use a piece of string to draw a clean arc through this mark and around the stick. At midday, the shadow will shrink and disappear. In the afternoon, it will lengthen again and at the point where it touches the arc, make a second mark. Draw a line through the two marks to get an accurate east-west line

The Watch Method

You can also determine direction using a common or analogue watch--one that has hands. The direction will be accurate if you are using true local time, without any changes for daylight savings time. Remember, the further you are from the equator, the more accurate this method will be. If you only have a digital watch, you can overcome this obstacle. Quickly draw a watch on a circle of paper with the correct time on it and use it to determine your direction at that time.

In the northern hemisphere, hold the watch horizontal and point the hour hand at the sun. Bisect the angle between the hour hand and the 12 o'clock mark to get the north-south line.If there is any doubt as to which end of the line is north, remember that the sun rises in the east, sets in the west, and is due south at noon. The sun is in the east before noon and in the west after noon.

Note: If your watch is set on daylight savings time, use the midway point between the hour hand and 1 o'clock to determine the north-south line.

In the southern hemisphere, point the watch's 12 o'clock mark toward the sun and a midpoint halfway between 12 and the hour hand will give you the north-south line

USING THE MOON

Because the moon has no light of its own, we can only see it when it reflects the sun's light. As it orbits the earth on its 28-day circuit, the shape of the reflected light varies according to its position. We say there is a new moon or no moon when it is on the opposite side of the earth from the sun. Then, as it moves away from the earth's shadow, it begins to reflect light from its right side and waxes to become a full moon before waning, or losing shape, to appear as a sliver on the left side. You can use this information to identify direction. If the moon rises before the sun has set, the illuminated side will be the west. If the moon rises after midnight, the illuminated side will be the east. This obvious discovery provides us with a rough east-west reference during the night.

USING THE STARS

Your location in the Northern or Southern Hemisphere determines which constellation you use to determine your north or south direction.

The Northern Sky

The main constellations to learn are the Ursa Major, also known as the Big Dipper or the Plow, and Cassiopeia. Neither of these constellations ever sets. They are always visible on a clear night. Use them to locate Polaris, also known as the polestar or the North Star. The North Star forms part of the Little Dipper handle and can be confused with the Big Dipper. Prevent confusion by using both the Big Dipper and Cassiopeia together.

The Big Dipper and Cassiopeia are always directly opposite each. other and rotate counter-clockwise around Polaris, with Polaris in the centre. The Big Dipper is a seven star constellation in the shape of a dipper. The two stars forming the outer lip of this dipper are the "pointer stars" because they point to the North Star. Mentally draw a line from the outer bottom star to the outer top star of the Big Dipper's bucket. Extend this line about five times the distance between the pointer stars. You will find the North Star along this line

Cassiopeia has five stars that form a shape like a "W" on its side. The North Star is straight out from Cassiopeia's centre star. After locating the North Star, locate the North Pole or true north by drawing an imaginary line directly to the earth.

Working with Maps

Bearings

Taking bearings from a compass and using them on a map is fairly straightforward.

Setting the map to North

To set your map to north, find a flat area to place your map (away from metallic objects). You will need to know what the local Grid Magnetic Angle is first. This is found at the foot of OS Landranger Maps. Align the GMA value (6° for example) with the direction arrow on the compass.

Turn the map and compass together until the red needle points to N on the compass. Your map will now be aligned with Grid North and hopefully you will be able to identify features - unless you're in fog or clouds!

Setting a Compass bearing to a Map
If you are ever unsure as to whether your map is aligned correctly, you can double check by taking a bearing from a visible reference point and convert it to a map bearing.

Point the compass' direction arrow toward your reference point and while keeping the compass still, turn the compass capsule until the orienting arrow is aligned with the N on the compass. Now deduct the GMA which will give you the grid bearing.

Now placing your compass on the map with the long edge passing through your current location (hopefully you know this bit!) then rotate the compass around your position until the orienting lines inside the capsule align with the grid lines with the orienting arrow pointing to the north of the map.

If you follow along the edge of the compass which is on your position, it should pass through, or at least point towards, your chosen reference point.

A Compass can be used for the following
A compass can assist you to locate where you are and how to get to another point. While many believe a Sat Nav or Smart Phone app will do this job for them, it must be borne in mind that electronic instruments can fail, break or run out of power.

1. Aligning the map with the compass so that your location matches what you see on the ground, and that you're heading in the right direction.
2. Taking a bearing (direction) from the map and walking.
3. Using a bearing to identify features coincident on the ground and map.
4. Use 'back bearings' to identify where you are from two or more distant known objects.

Magnetic North and True North
Magnetic north is different to map grid north because magnetic north (where the compass needle points) changes in different places of the world and changes over time. The longer your trip the greater the variance between the two.

You have to adjust the bearing on the compass to take account of the difference between map grid north and magnetic north. The difference in degrees is marked on printed Ordnance Survey Ireland maps but as a rule of thumb, adjust by 5 degrees by turning the compass housing anticlockwise.

Which way do I go?
To figure out which way you need to go to reach your destination, you will need to know where you are and where that is on the map. Then identify on the map your destination. Following that…

1. Place the edge of the compass base plate along the line connecting A. where you are and B. your destination.
2. Rotate the compass housing so that the parallel lines contained within, line up with south/north grid lines on the map.
3. Take the compass and place close to your body and rotate yourself where you stand until the north end of the compass needle aligns with N in the compass housing.
4. Follow the directional arrow which will be pointing away from you and identify a point in the distance

5. Travel to the point identified and repeat the process when you get there.

A basic paper map is the simplest, most reliable and most effective way to find your location and navigate somewhere else. Paper maps don't break when you drop them. Most are printed on waterproof or resistant paper, so they'll survive getting wet. A piece of paper can't run out of battery. And, to top all that off, paper maps are incredibly cheap or, if you're willing to put in a few minutes' work, even free.

With a moving part in it, a compass adds a slight degree of that-might-break-iness. But it'll still be far more rugged than a battery-powered gadget and, often, far more accurate too; a compass works even with cloud cover or foliage between you and space. The two combined are something no person doing anything in the outdoors or even just traveling through a remote area should ever be without. Of course, they're not much good if you don't know how to use them. But the good news is that knowledge will survive a fall.

Any map is going to be a basic, two-dimensional, top-down representation of a real-world, three-dimensional area. It's the data on it and how that's displayed that separates them.

Where a basic trail or road map will just have lines indicating the position of trails or roads — often with an oversimplified representation of their shapes and scale,— a topographic map will give you a detailed and accurate representation of the three-dimensional shapes of the terrain around you.

This is the most effective type of map and the one you should seek out. On a topo map, contour lines do what they sound like and trace the contours of the landscapes features. Each line will be a constant height apart (depending on the scale), giving you an idea of the height of, say, a mountain, its shape and the steepness of its individual sections.

The simplest way of using a map to figure out where you are is simply to look at these contour lines to create a 3D image in your head, then compare that to what you see. "That cliff face over there is here on the map, so I must be standing… right here, between it and the river." That probably sounds complicated, but we'll go into detail and with a little bit of practice you'll have it down in no time.

A Brief Map Glossary

Latitude: Latitude lines go east/west and measure how far north or south you are from the equator. "Ladder" and "Latitude" kinda sound the same, and the rungs on a ladder are like latitude lines, so that's how I remember which one it is.

Longitude: Longitude lines run north/south and measure how far east or west you are of Greenwich, England.

A map's position is defined by the position of its southeast (bottom right) corner and is oriented so north is up and south is down.

Scale: How zoomed in you are. You can find a map's scale in its margin or legend. The scale is listed as "1:XXXXX," meaning that one unit of measure on the map represents "XXXXX" times that number in the real world. Most USGS topo maps, which is the standard we'll using for most examples in this article are: 1:24,0000. So, one inch on one of these maps represents 24,000 inches in the real world. Or a little over 1/3 a mile.

Legend: Explains what the various symbols and colors on the map mean.

Map Name: The colloquial name for the region a map covers. "Yosemite National Park," for instance. Always check a map or maps covers your entire route; it's easy to be off one edge even if a map is titled for the loose area you'll be traveling through.

Year of Production: The year in which the data for the map you're looking at was collated. If there's a single date on the map, this is it.

Year of Revision: The date on which the map may have been updated to reflect changing conditions. If there's a second date on the map, this is it.

Photo Revised: When or if the map was last checked against the real world.

Distance Scale: A to-scale representation of a standard distance, typically a mile or kilometer or both. Helps you work out distances between points.

The black lines represent a hill, in the real world, viewed sideways. The red lines represent contour lines a set height apart. Look at the point at which the two colors intersect, imagine looking at this terrain from the top down, and you'll see why the lines on steep slopes appear closer together. Also, I'm crazy sweet at art.

Contour Lines: On coloured maps, these are typically brown lines that trace the contours of geographic features, by elevation. They're spaced a set distance apart.

Contour Interval: Important! The elevation between contour lines. You can then count the lines to see how much elevation you might need to gain or lose on a given route or to determine the relative height of geographical features around you.

Magnetic Declination: The difference in angle between magnetic north (where your compass points) and the place where Santa Claus lives.

Creating A Mental Image From A Map: Ok, with all that in your head, how do you translate a two-dimensional image into a mental image of the terrain you're looking at?

First, let's make sure we all understand those pesky contour lines. Look at the room around you and its furniture, now imagine it filled with one foot of water. "Draw" an imaginary line at that one-foot water level, then add another foot and "draw" a line there; so on and so forth. That's what contour lines are doing in the real world, displaying an absolute height apart.

The closer the lines are together in this top-down view, the steeper the terrain. The further apart they are, the more gradually sloped. The idea is to paint a picture of what geographic features like mountains and hills and valley and peaks and whatnot look like.

Let's look at some typical features you'll find out in the world and see how they're represented by contours:
(1) Steep Slopes: The closer contour lines are together, the steeper the slope is.
(2) Gentle Slopes: The further apart the lines are, the more gradual the slope.
(3) Valleys: The contour lines form a "V" with the point facing uphill. This is naturally how water runs off the terrain.
(4) Ridges: The contour lines form a "V," this time pointing downhill.
(5) Peaks: Contour lines forming circles.

Ok, the positions on these images don't quite line up — I'm on a plane headed to Iceland — but hopefully you get the idea. Circles are peaks, when the lines go close together then the terrain is steeper; when the lines spread out, it gets less steep. Ridges are Vs that point down, Vs that point up are valleys.

How To Measure Distance: Grab a little piece of string and trace your intended route on the map. Now, pull it straight and compare it to the map's Distance Scale. Easy, right?

You'll frequently find interval distances listed for hiking trails. A little number tells you the distance between two points on the trail. I'm not sure who calculates these, but assume it varies between maps created by different entities and have encountered some significant differences between these distance and those in the real world. Last summer, I was looking at a map of the Sespe Wilderness — an area I know very well — and noticed something was very off. A hike that was shown to be only 5.7 miles long on the map was actually more like 12 to 14 in real life. I'd hiked it before. The moral of this story is to measure distances yourself, or at least apply some critical thought to them.

Your map is oriented true north, but your compass points at magnetic north. Fun! And, this can lead to some fairly big navigation errors. Goof just five degrees on your intended direction and you'll be nearly a mile off after just 10 miles of hiking.

That's why there's a Magnetic Declination key.

There's a couple different things you can do with your compass, but to just get an idea of what's in which direction, just stick your compass on the magnetic declination key and turn the map a little so it's oriented towards magnetic north.

Alternatively, you can adjust a quality compass for the declination in your area of travel. They all differ a little, but should include instructions on doing so.

We're dealing with magnetic fields here, so magnetic declination appears a bit complicated. You just need to correct for it in your area of travel and the key on your map helpfully gives you all the information you need to do so with a simple graphic you can use to align the map to magnetic north so that plays nice with your compass.

How To Take A Compass Bearing: So you've got a destination or waypoint picked out either on the map or in real life. Now you want to be able to head towards it, regardless of vision (imagine a thick fog or nighttime or dense woodland or whatever).

Using one of the nice compasses describe above, you'll be able to navigate in a specific direction, rather than simply going loosely north east or similar.

Look at the bezel ring surrounding the needle. On it, a 360-degree circle is broken down into two or five-degree increments. These measure the distance towards a point in relation to its clockwise angle from magnetic north. Take particular care to set a bearing precisely and you'll avoid spending time and effort by being tracked off-course over distance.

If you're headed towards, say, a peak you can see in the distance, simply hold the compass flat, with the direction of travel arrow pointed towards said destination and twist the bezel so the big red arrow inside it aligns with magnetic north. Take note of where your intended direction of travel lies

— say 40 degrees — and consult the compass regularly to ensure that you're walking in that direction. So long as the big red arrow inside the bezel lines up with the compass needle when the compass is pointed ahead, you're headed in the right direction.

Taking a bearing from a map is basically the same idea. Align the map with magnetic north. Look a the map and figure out where you are and where you want to be. Sit the compass on the map so the direction of travel arrow or long edge lies along the imaginary line between your location and destination (or way point). Twist the bezel so the big red arrow inside it aligns with the needle. Note the degree of your bearing. Now, pick up the compass and hold it level. Keep the needle in the big red arrow and you're headed in the right direction.

How To Use A Map And Compass To Determine Your Exact Position: If you're ever really lost and need to reestablish confidence with either yourself or a group, do this. Knowing exactly where you are on a map is a huge confidence booster and is equivalent to pushing the reset button on any previously erroneous navigation. Don't worry though, your dog always thinks you know exactly what you're doing.

This is just like using GPS, it shows you exactly where you are.

First, find two prominent visual objects you can identify on your map, the further apart the better. The peaks of big mountains or similar, can't-mistake-them features work best. Hold your compass level and point its direction of travel arrow directly at the first object. Twist the bezel so the big red arrow inside it aligns with the needle. Locate that object on the map and place a long edge of your compass on it. Keeping that edge on top of the object, rotate the map until its orienting lines align with the orienting lines inside the compass bezel. Trace the line created by the edge of your compass on the map, you are somewhere on it. Repeat the process with the second object. Where the two lines cross, that's you're exact position. Congratulations, you're no longer lost.

Where To Find And Build Maps: A map gives you knowledge and knowledge gives you the ability to make informed decisions, to change plans, to respond to unexpected circumstances or to figure out where the hell you are if you get lost. So, you want a map with the most data possible.

But, you may have unique needs, in which case you should create your own map. This allows you to print a chosen route on top of the best topo map for a given region in a scale that best suits your individual situation. We've got a detailed article on doing that for free right here. It's not just for Android phones, there's substantial guidance for everyone creating any map.

If you go that route, try to get yourself an end result that encompasses the total area in which you'll be traveling and which gives you the most possible data on trail locations, water sources and the like. Carrying one, large scale map that encompasses your total area of operation, plus smaller scale maps that cover your individual needs is the best idea. You can buy waterproof printer paper, put the maps you create in plastic baggies, laminate them etc. It's worth putting in the effort; a damaged map is a worthless map.

Navigating The Real World: Use that mental image of the terrain around you to keep constant tabs on your position. Build a picture of the area you'll be passing through and make sure things feel right as you do. Periodically, stop and check your position; how often you do this will be a a factor of the kind of terrain and weather conditions you're dealing with.