

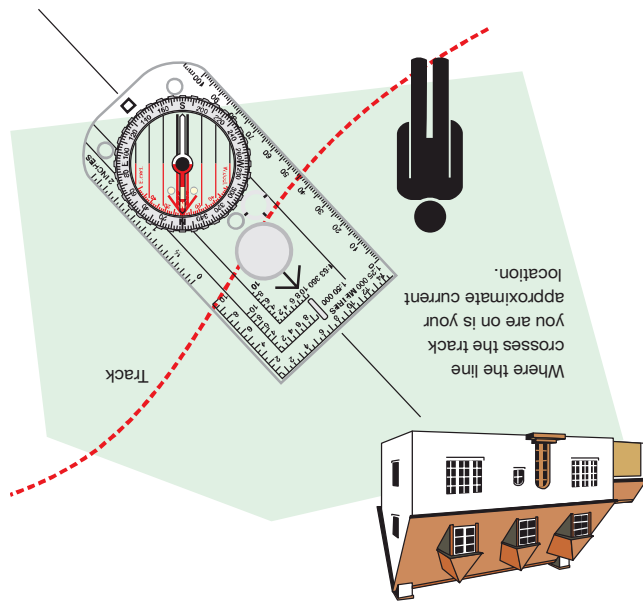
A resection is similar to a back bearing but can be used if you are in the middle of open countryside or on an unknown track.

You need to begin by taking the bearings of three features in sight, which are also on your map (if there are no man-made features use natural features such as the crests of hills).

The three features should be spread out, ideally with 120° between each (for example, one in front of you, one if you look over your right shoulder and the other over your left shoulder). It is possible to use two features, but this will severely affect the accuracy of your pinpointing.

Repeat the steps you took to obtain a single back bearing for all three features you can see. You should now have three lines drawn on your map, creating a small triangle where they cross one another. Inside the triangle is your approximate current location.

Pinpointing your location 3. Resection



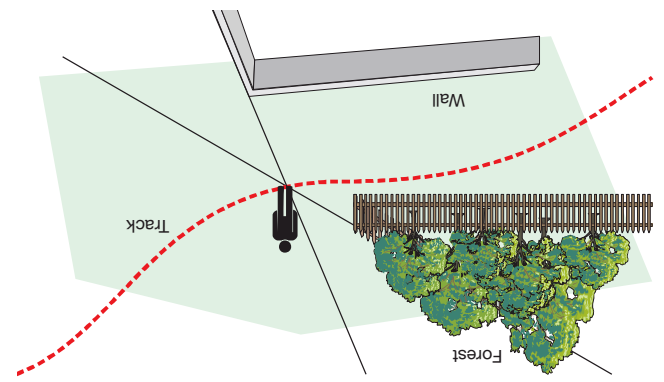
An alternative to using transit lines, and relying on sight, is to use a compass to locate your position.

If you are on a known track with an identifiable feature in sight (which also appears on your map) you can take a bearing in the direction of the feature and use it to calculate your location. Looking at your compass, detect the direction the feature is from your current location. With the direction of travel arrow pointing at the feature, turn the compass housing so the orienting line sits under the red half of the compass needle.

This bearing is a magnetic bearing rather than a grid bearing, which your map uses. You need to deduct magnetic variation from the compass reading to convert it. The magnetic variation is currently 2° to 6° throughout Great Britain (this amount changes annually, so check your Ordnance Survey map to work out the most current value). Revolve the compass housing 4° clockwise (for example) to deduct magnetic variation, and place the compass on your map.

Line the orienting lines up with the eastings (the grid lines running north-south) on your map. Now carefully slide the compass across the map so one of the edges of the base plate crosses the feature you spotted on the landscape on the map. If possible, draw a line along the base plate. Where the line crosses the track you are on is your approximate current location.

Pinpointing your location 2. Back bearings



When you know two or more features on a map will line up with one another along your journey you can form a transit line. As you walk along a track (which appears on the map) there will only be a single point where two features appear in a direct line with each other.

Draw a line on the map that crosses through both features and continues across the track you're walking on. When you see the two features on the landscape line up as you walk along the track you'll be at the point where the line on your map crosses the track (as shown here).

It's also possible to create transit lines using linear features such as walls, fences or straight streams, even if the features won't line up as they did above. By drawing lines on a map, extending the existing lines of linear features, you can create several transit lines that will help you pinpoint your location (as shown below).

Pinpointing your location 1. Transit lines

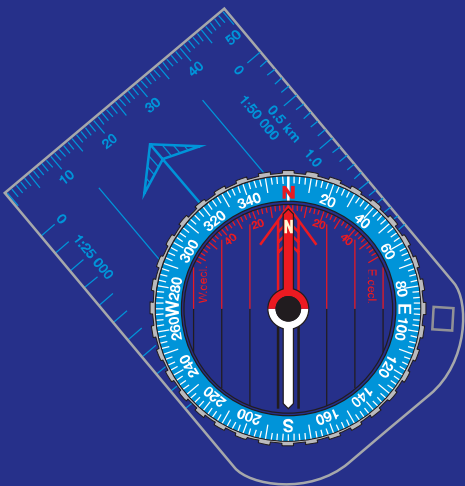
Introduction to advanced map reading

The aim of this leaflet is to introduce you to some advanced map reading techniques that can be useful when navigating. These techniques are largely used when you are off the beaten track in mountainous or difficult terrain, where excellent navigation skills are essential.

Before reading this leaflet you should have a good understanding of how to use a compass and map to navigate. Reading the Ordnance Survey leaflets *Introduction to maps* and *Map reading made easy* will give you a good understanding of basic techniques.

Techniques to pinpoint your location

There are several techniques to help pinpoint your location on a map. Pinpointing your location is useful to make sure you're moving in the right direction or can help you to relocate if you are lost. These techniques can be used very effectively once you've learned to interpret the features of a map. Some methods will rely on your eyesight while others use your compass.



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3. For people who love extremes
4. For touring and local route planning
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Other titles in the series



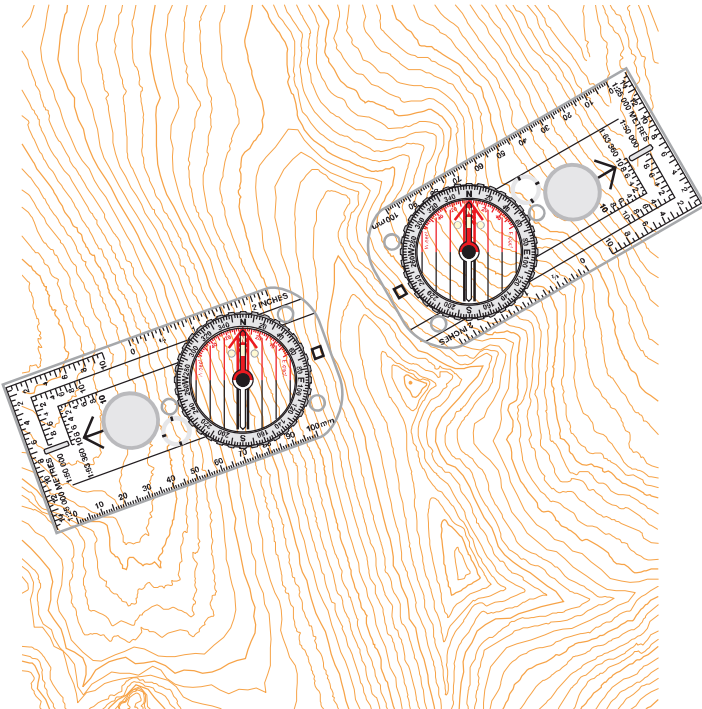
Advanced map reading



Pinpointing your location 4. Aspect of slope

If you are lost, slopes can often provide vital clues to help pinpoint your location. You will need to know which km square on the map's grid you are in. Stand facing directly down a slope, imagining you are at 90° to the contour lines of the slope. Using your compass, take a reading of the direction the hill is sloping in and make a note of the reading. This reading is known as the 'slope aspect'.

Looking at the km square on your map, try to find a slope that faces in the same direction as the reading you've just taken. This will help you to establish an approximate location. Taking back bearings will also help. To improve accuracy, walk to another nearby slope, take another reading and then look for this on your map. If you come across a distinguishing feature, such as a spur or valley, measure its slope aspect and look for it on the map. This will help you narrow down or even pinpoint your location. Measuring the aspect of slope is particularly useful if you are lost and find yourself in a bowl or on the end of a spur or ridge.



Measuring the distance travelled 1. On the ground

You now know the direction you need to be heading in, but it would be expecting too much from both your equipment and yourself to be able to reach your target spot on. So you must be able to tell when you have missed your target location and have gone too far. As much as possible you need to track your position on the ground while you are walking. This can be done using features both on the map and on the ground.

The first step is to use your map to measure the distance to your next checkpoint. If you haven't got a ruler, use the millimetre scale on your compass. On a map with a scale of 1:25 000 each millimetre is worth 25 metres, or on a 1:50 000 scale map each is worth 50 metres, and so on.

You then need to measure your distance on the ground. There are two ways of doing this:

Pacing – To pace successfully you need to know in advance how many double paces you can take for every 100 metres. Double pacing is better than single as it reduces the level of counting. It is estimated that a person of average height will take 65 double paces every 100 metres, but it is vital you work it out to your own pace count. Please do this by walking normally. Remember slopes or poor conditions underfoot will require an adjustment and steep slopes will shorten your stride dramatically.

Timing – If you know, or can at least guess, how fast you are walking you can work out how long it is going to take you to walk from your starting point to your next target location. At 4 km/hr, which is an 'average' speed, it will take you 1.5 minutes to cover each 100 metres, so a leg of 700 metres should take you 10.5 minutes to walk. Again, as with pacing, this will be affected by slopes, poor underfoot conditions and other factors, so you will have to adjust your time accordingly.

Measuring the distance travelled 2. Naismith's rule

As previously mentioned, measuring the time you take to travel a certain distance is all well and good if you are travelling on a flat landscape. However, in reality this won't be the case. With this in mind, a Scottish climber called Naismith created a simple but effective formula that took into account the changes in height while calculating speed over the ground – 5 km/hr plus ½ hour for every 300 metres of ascent.

For convenience, this formula is often expressed in terms of extra time required to climb a given number of contour lines – for example, it takes an additional minute to climb one 10-metre contour line or an additional 5 minutes for each thick contour line. On a descending slope it is assumed that you will be walking faster on shallow slopes but possibly a lot slower on steep descents – it is therefore taken that this will even out over the course of a day's walk.

Feature interpretation

In remote and difficult terrain man-made features can often be rare. It's also possible a man-made feature, such as a log cabin, can be added or removed from the landscape. Since natural features don't change as quickly or easily as their man-made counterparts, being able to use them to navigate is essential.

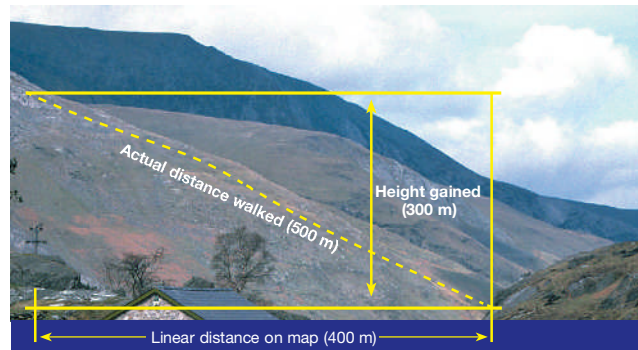
Interpreting the shape of the land on a map using contour lines is an extremely useful navigational tool. Looking at the lines and creating a mental picture of the landscape will allow you to plan a journey effectively. Orange or brown contour lines on maps join points of equal height above sea level together, and are usually measured in 5- or 10-metre height intervals.

One of the easiest ways to convert contour lines into a mental picture is to imagine the lines as high tide marks left by the sea. As the water level drops it leaves a line every 5 or 10 metres on the landscape, forming the contour lines.

It's worth bearing in mind that smaller features may be missed by contour lines. If a feature is 9 metres high on the land it may not appear on a map with contour lines at 10 metre intervals. This can be surprising when you see the actual landscape and it contains features you haven't imagined since they don't appear on your map.

When interpreting contour lines you can use symbols and features around them to get a better understanding of how the landscape will appear in reality. In particular, you should look for the symbols for cliffs, outcrops, scree and streams, as they will give you a valuable insight into the formation of a landscape.

When calculating the distance of your journey on a map you need to remember the actual distance you are going to travel along the ground will be further than the map implies. The two dimensions of a map don't show you the actual distances of slopes you will be travelling up and down, adding to the overall distance you walk.



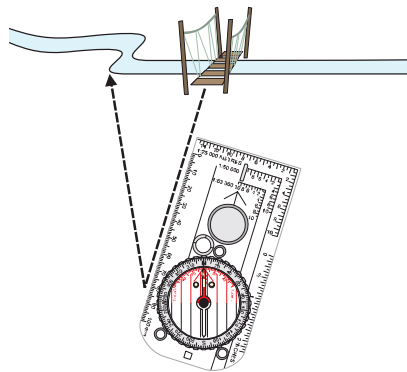
Can't find your next location? Walking on a bearing

As you walk on a bearing, errors will undoubtedly creep into the actual direction you are travelling in and the distance you have measured. For example, when walking across a slope on a compass bearing you will tend to stray off slightly downhill. Also, your pacing may become inaccurate as a result of difficult terrain.

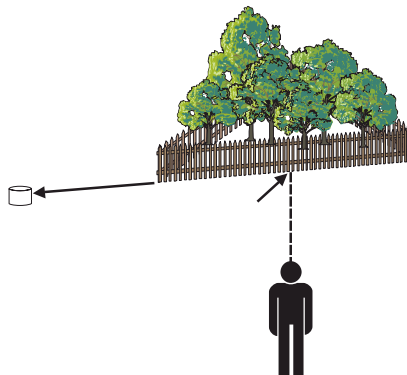
To help counteract this, choose closer checkpoints, preferably between 1 000 m and 500 m – but this will ultimately depend on the terrain you are crossing. Also, try lining up a distant object on your bearing and walk towards it with your eyes constantly on the object and not on your map and compass – this will help to prevent veering off course.

There are a couple of methods you can use when walking on a bearing to help guarantee you reach your chosen checkpoint.

Aiming off – If your checkpoint is on a linear feature such as a stream or a track, by simply aiming off slightly to one side of the checkpoint, you can guarantee which direction you need to head to reach your checkpoint upon hitting the linear feature.



Attack points – To locate difficult features simply find another definite, prominent feature nearby and make your way to the centre of it. Once there use pacing to find the original feature you are looking for – as shown in the diagram.

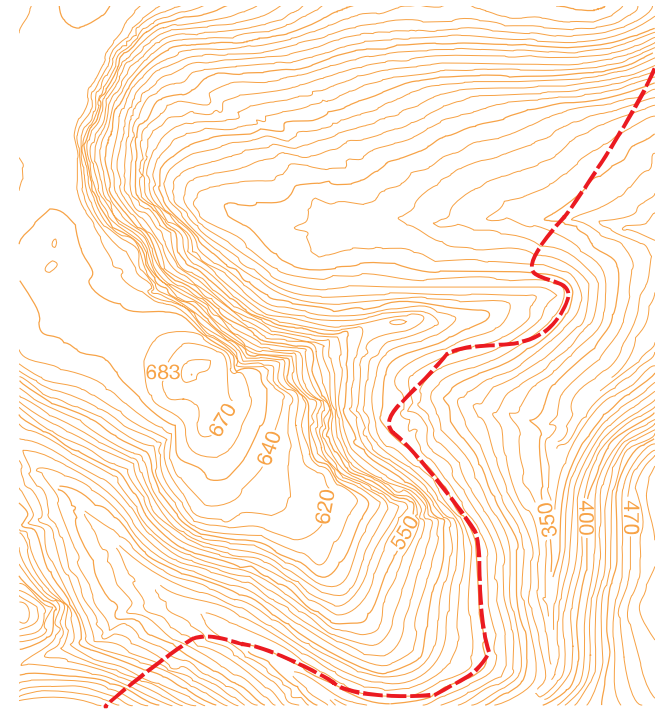


Contouring

When planning your route on a map it pays to remember that the straightest line between your starting point and destination may not be the easiest, quickest or safest. Examine the map of the area you are walking in very carefully before planning a route. If you are going to be walking in mountainous or rough terrain it is often a good idea to plan a route following contour lines. This is called 'contouring'.

Contouring can allow you to avoid walking over the top of large hills and mountains, potentially saving you time and energy. When planning the route you should consider the distance of the journey, the weather conditions, the amount of equipment being carried and the fitness levels of the walkers before deciding whether to tackle the slopes or to contour around them.

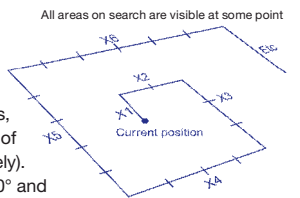
Many leisure walkers will avoid contouring in favour of climbing slopes for a great view or sense of achievement. In harsh conditions, where speed and efficiency are essential, contouring is often the best option.



Still can't find your next location?

If, after following one of the previous measuring methods, you arrive at an area but cannot see your next chosen checkpoint – often due to poor visibility – refer back to your map and look for any distinguishing features or clues. If you cannot see what you are looking for you will have to do a systematic search of the area to locate your next point. There are two types of search you can undertake:

Spiral search – This is a good method to use if you are alone and have limited visibility. From your current position, use your compass and walk north to the limit of your visibility. Stop and use your compass, turn 90° to the right and walk twice the limit of your visibility (you will have to pace accurately). Stop again and turn right through another 90° and walk three times the limit of your visibility. Keep repeating this process with longer and longer legs until you find your checkpoint or object.



Sweep search – A drawback of the sweep search is that it is difficult to carry out alone, but can be easily undertaken by a party of walkers. Using the sweep method is relatively simple. Space everyone out so that you are all still within visible contact and sweep backwards and forwards across the area to be searched until your checkpoint or object is located.

Note: To work out the limit of visibility distance, ask someone to pace away from you. Stop them when it becomes difficult to see them – this is your distance. If you are unable to do this guess the distance, making sure you underestimate rather than overestimate it.

Navigating at night or in bad weather

Navigating in fair conditions should present no great problems to an advanced walker. Poor conditions don't require new techniques, just a more skilful and determined use of those you already possess. Nevertheless, it is important to draw attention to certain aspects that require special consideration that would prepare you for such conditions:

- Your route plan should note possible escape paths along your route, have a record of compass bearings, distances and estimated times.
- Check through your equipment before you set off to make sure everything is in working order.
- Make sure you have easy access to essential equipment when you pack your rucksack.
- Use a map case to protect your map from bad weather or use an OS Explorer Map – Active.

Remember, advanced planning can help ease stress if you find yourself in a difficult situation.