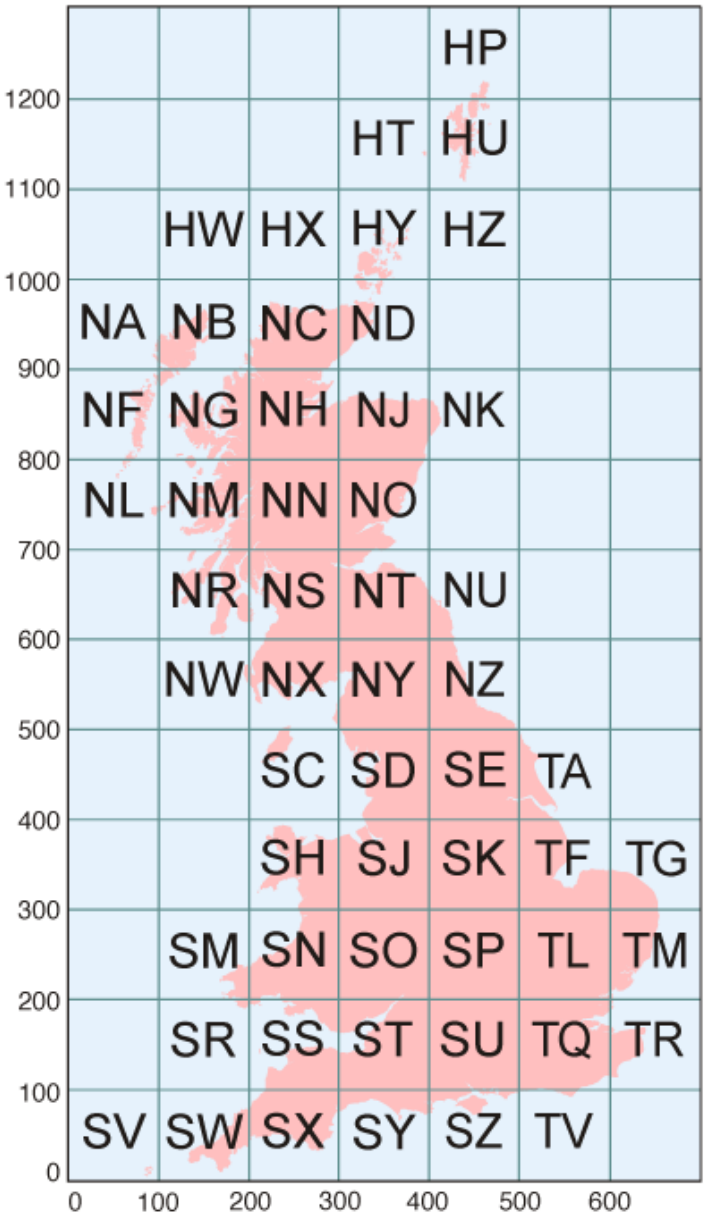
NAVIGATION

The map is simply a picture of a particular area shown from a bird's eye view keeping everything in proportion to its surroundings, using signs and symbols to represent actual features on the ground.

It shows us a set area that is identified by a reference number/letter similar to that of the postal code system. On Ordnance Survey (OS) maps it will also include a sheet number and in the UK there are 70 area reference codes. The diagram (fig 1) below shows how they are split and the unique area code for each. By combining the area code and the sheet number a specific area can be easily located.

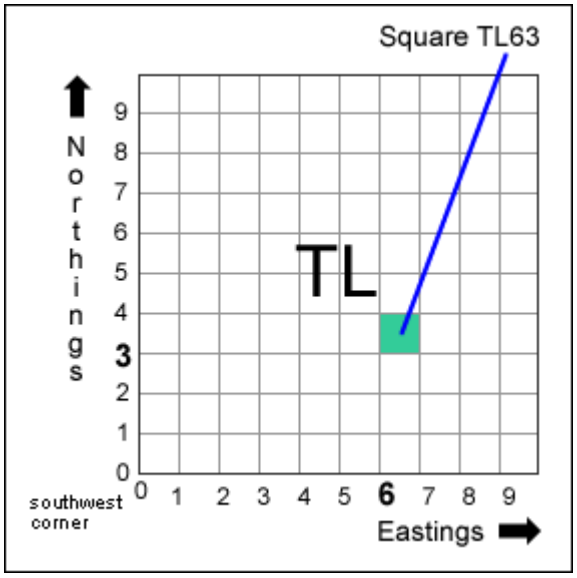


The map or sheet is also set to a specific scale or size. The most common sizes are 1:50 000, 1: 25 000 & 1:40 000 and are available in a variety of formats from regular paper copies, aqua maps (waterproof) or digital maps which can be downloaded from the computer and printed off to specific areas which you may wish to walk including your own personalised route plan.

- 1: 50 000 = 1 cm on the map is equal to 500m on the ground
- 1: 25 000 = 1 cm on the map is equal to 250 m on the ground
- 1 : 40 000 = 1 cm on the map is equal to 400 m on the ground

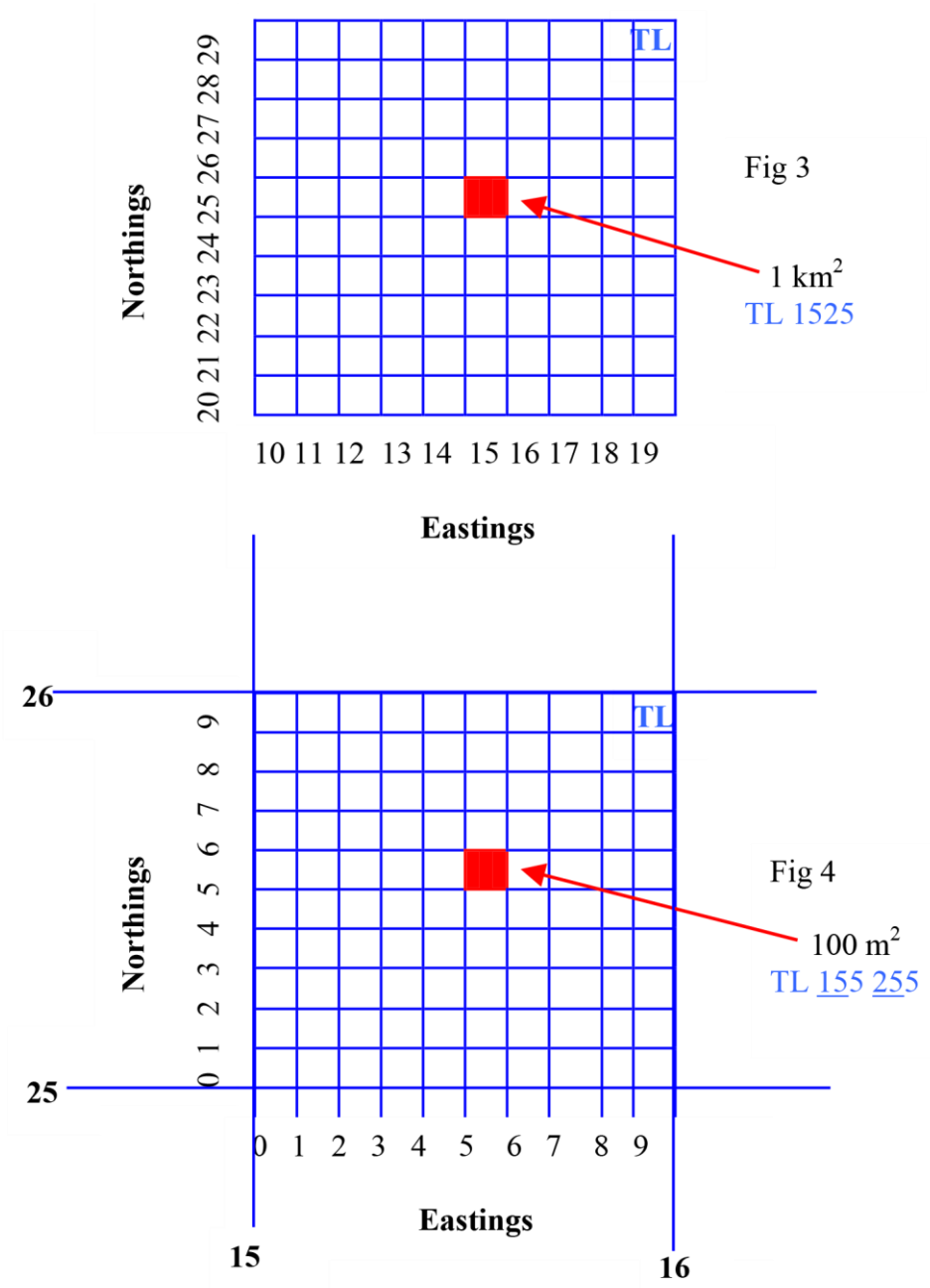
The scaling of maps allows us to measure accurately distances between points. The smaller the scale the more detail can be offered on the map. Maps of a smaller scale cover a smaller land area geographically.

The National grid is further downsized to individual sheets. This is done by Grid Lines drawn in blue criss-crossing the map. These lines form boxes that are numbered around the border and at intervals through the map and are called grid squares.



The grid lines are then numbered further still. To give a unique reference point that is called a Grid Reference we use the National grid letters for example TL then the grid numbers taken from the map. In Fig 2 the grid reference for one individual grid square is shown as TL63. The Eastings are always given first and then the Northings

It is unusual for a map to have only single numbers for the Eastings & Northings on the sides of the map they are normally double figures. This leads us to a 4 Fig grid reference which gives us an area of 1Km2. Fig 3 shows a 4 Fig Grid Reference, the highlighted square is now TL 1525.



From a kilometre grid square that individual square is subdivided into 10 equal squares, starting with zero and counting up to nine. Taking the Eastings first and then the Northings our new 6 Fig Grid Reference is now TL 155 255. This means we can accurately give a position fix of 100m2. (Fig4)

Remember when taking a grid reference always remember Eastings then Northings or 'Along the corridor & up the stairs'

There is much confusion about what North is used and the differences between them. Fig 5 illustrates the variations between the 3 different North's used in Navigation.

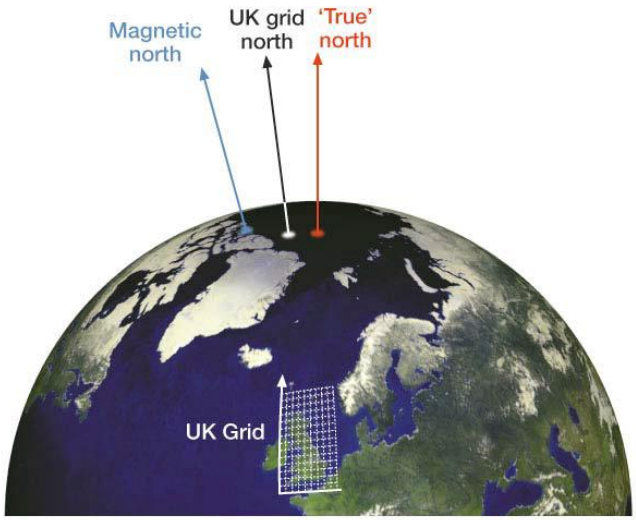


Fig 5

Illustration from 'Hill Walking' © MLTUK/ VG 2003

Magnetic North is where our compasses point to, Grid North is the location of the UK National Grid (top of the map and grid lines) and True North is the actual location of the North Pole. For us as navigator's True North is not used but when taking measurements from a map (grid) using a compass then walking on that bearing (magnetic) then a combination of the two is used taking into account the differences between them which is also known as the magnetic variation.

THE COMPASS

A compass is an instrument that measures angles (protractor) and then can allow the user to follow a bearing (shown in degrees from North) in a particular direction. There are many different types of compass but the type most commonly used is shown below in Fig 6

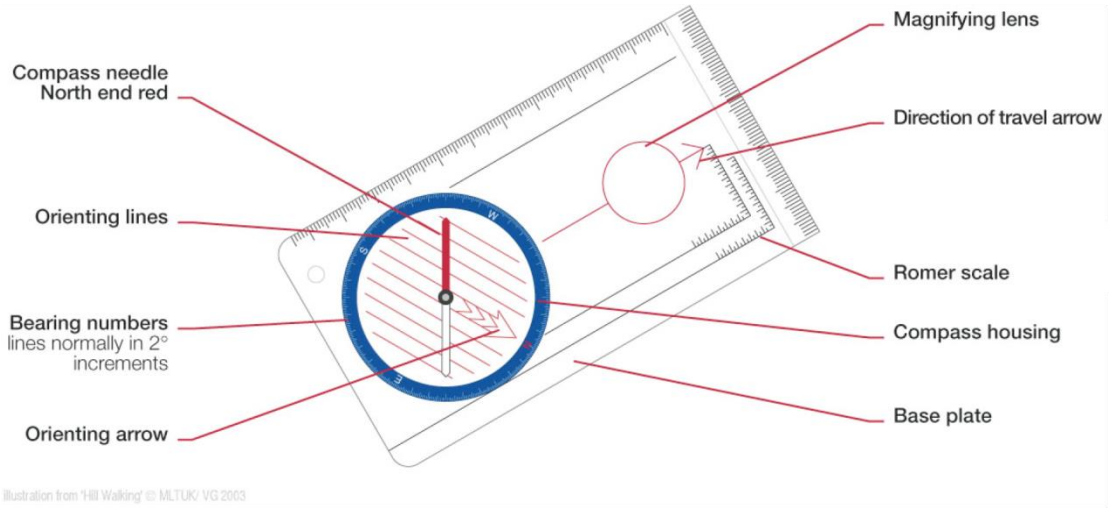
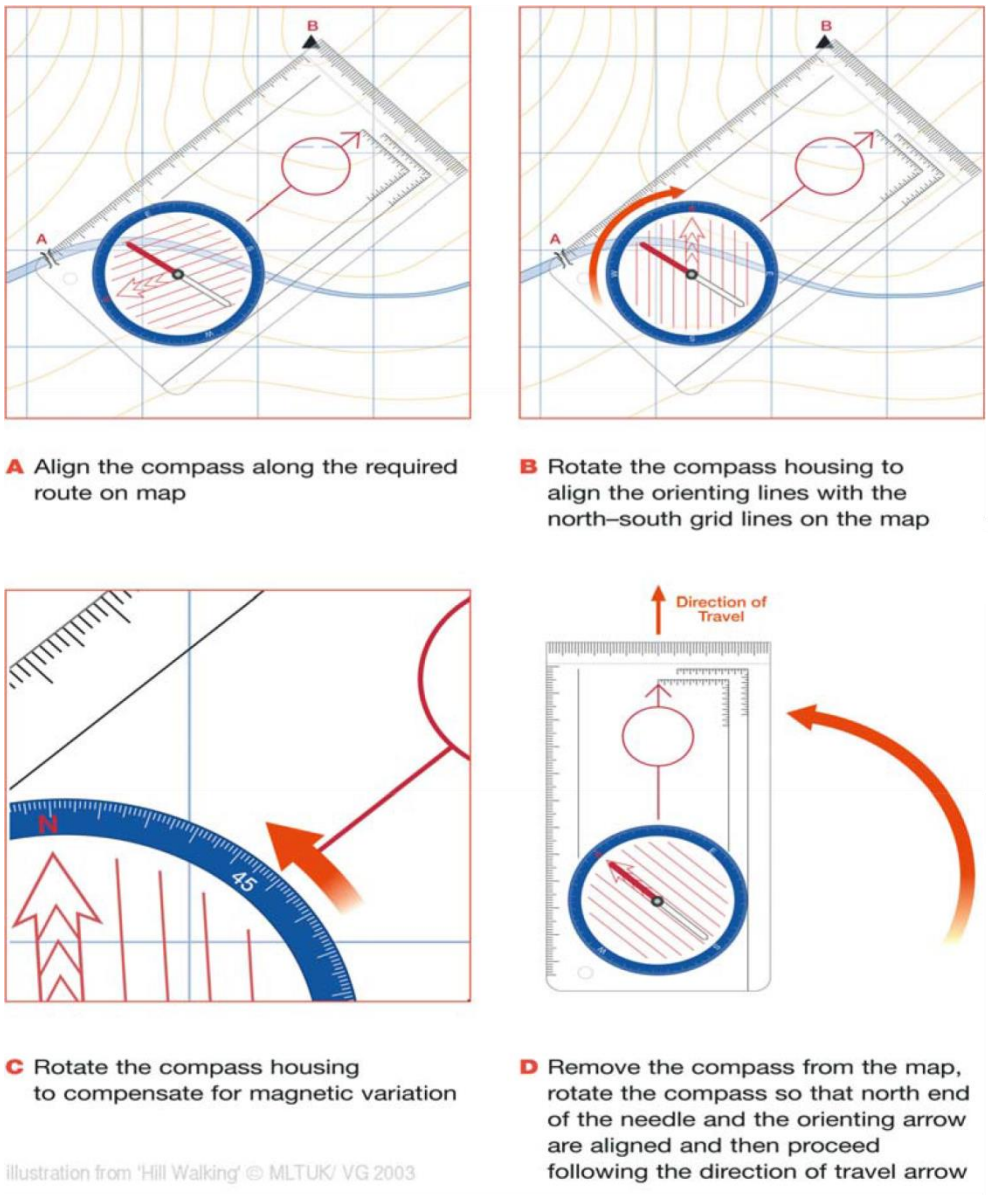


Fig 6

Illustration from 'Hill Walking' © MLTUK/ VG 2003

To take a bearing follow the stages illustrated below in Fig 7



A Align the compass along the required route on map

B Rotate the compass housing to align the orienting lines with the north–south grid lines on the map

C Rotate the compass housing to compensate for magnetic variation

D Remove the compass from the map, rotate the compass so that north end of the needle and the orienting arrow are aligned and then proceed following the direction of travel arrow

illustration from 'Hill Walking' © MLTUK/ VG 2003

Fig 7

Magnetic variation at present is 3 degrees.

To remember the direction to turn the bezel on the compass use the handy rhyme.

'Grid to Mag ADD, Mag to Grid GET RID'

The compass can also be used to Orientate or Set the map. Setting the map means to align the map with your surroundings. Using a compass is a quick and effective way of doing this but setting the map by the land and feature recognition takes more skill and makes you more aware of your immediate surroundings. Once you have the map set and you have your location then a direction of travel can be identified.

CONTOURS

These are the brown lines and numbers that are drawn on a map to represent the relief of the land on a 2-dimensional picture. Contour lines show the height, shape and steepness or gradient of the ground by joining points of equal height above sea level. Fig 8 demonstrates the way landform is interpreted by the use of contours. Using an island the water line denotes Sea Level or Zero metres.

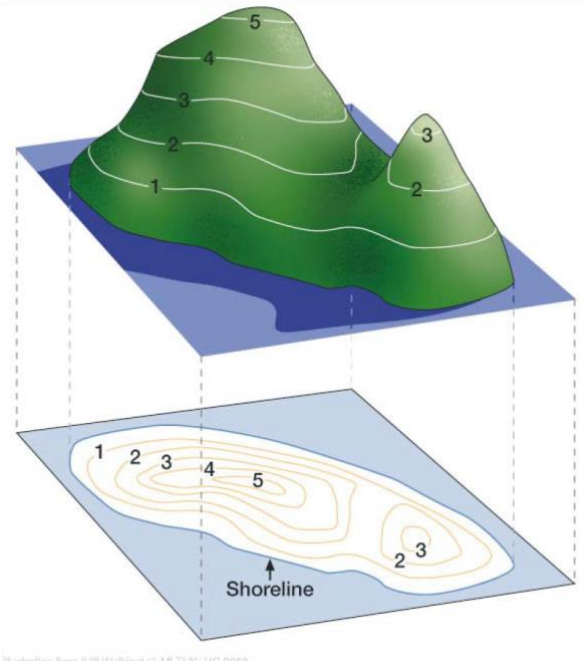


Fig 8

The spacing between the lines is known as the contour interval and a map will denote the vertical spacing of the lines. On Ordnance Survey maps the contour interval is 10m but this can change from map to map. This means we can simply calculate the vertical distance that we need to travel by counting the lines.

This picture is a useful guide to the gradient of a slope and its corresponding contour lines that you would normally associate with that slope. (Fig 9)

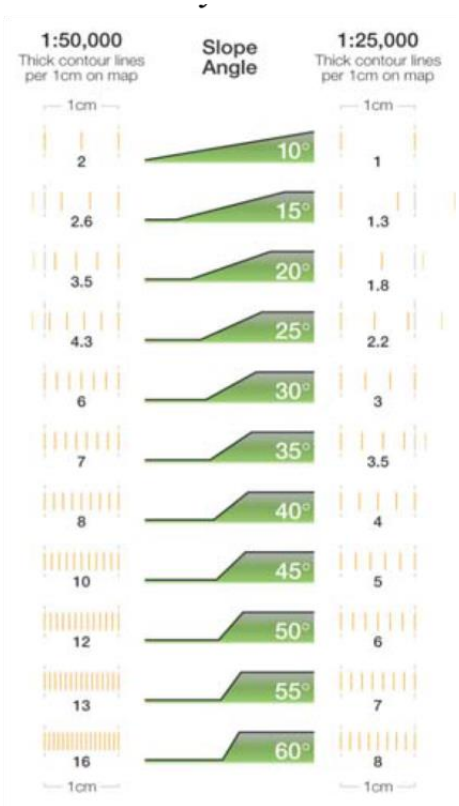


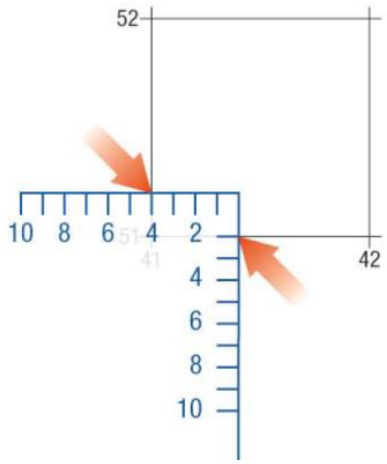
Fig 9

DISTANCE, SPEED & TIMING

This can be calculated on a map by understanding the scale and measuring using a ruler. This will be a very accurate method but sometimes time consuming to make measuring distance whilst on the move faster; use of a Romer scale like those found on the side of most compasses is a handy tool. The Romer is a ruler that is set to 100m increments so that it can be placed on the map and the distance in metres read off, without having to do any mental calculations and convert the scale of the map into metres. Fig 10 shows that a Romer scale can also be used to take a 6 Figure Grid Reference.

To use a Romer to measure the grid reference, place the corner of the relevant Romer on the point as shown below. Then read off the figures as indicated by the arrows – in this case the reading is 414 512.

Fig 10



An average person tends to walk at 4 kph but changes in terrain; tiredness throughout the day, load carried and a host of other variables will mean that your pace will fluctuate whilst out walking. It is acceptable to assume that we can travel anywhere between 2-6 kph with an idea of our speed and the distance that we need to travel we can then see how long it will take us to cover a set distance. Use of a timing card like the one shown in Fig 11 will allow us to calculate the whole days venture prior to departure.

Fig 11

Distance travelled metres	Speed kilometres per hour 5	4	3	2
1000m	12 min	15 min	20 min	30 min
800m	10 min	12 min	16 min	24 min
700m	9 min	11 min	14 min	21 min
500m	6 min	7½ min	10 min	15 min
400m	5 min	6 min	8 min	12 min
200m	2½ min*	3 min	4 min	6 min
100m	1¼ min*	1½ min	2 min	3 min

* These fractions have been rounded up to simplify timing – they should be multiples of 1.2

To accurately work out the time taken to cover a set distance, allowances must be made for the change of terrain and height gain and lost. To take into account the vertical distances covered time must be added for every 10m height gained.

This rule states that

'For every 10m gained in height then 1 minute should be added to the total time'.

NO extra time is allocated for loss of height.

The example below puts speed, height gain and distance into a total time.

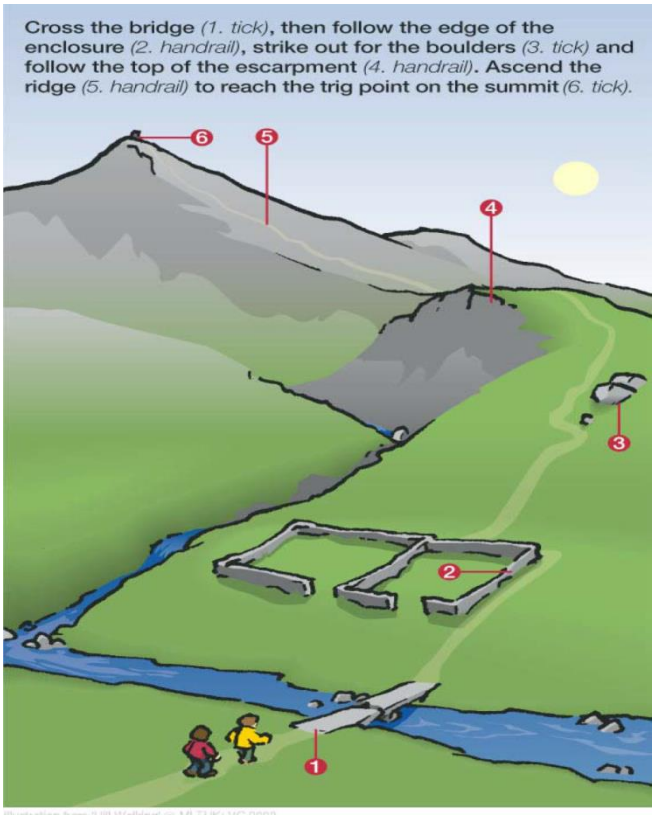
4 kph, 1.5 km, 13 contours (130m height increase)

22½ min + 13 min = 35½ minutes total time

TOOL KIT OF TECHNIQUES

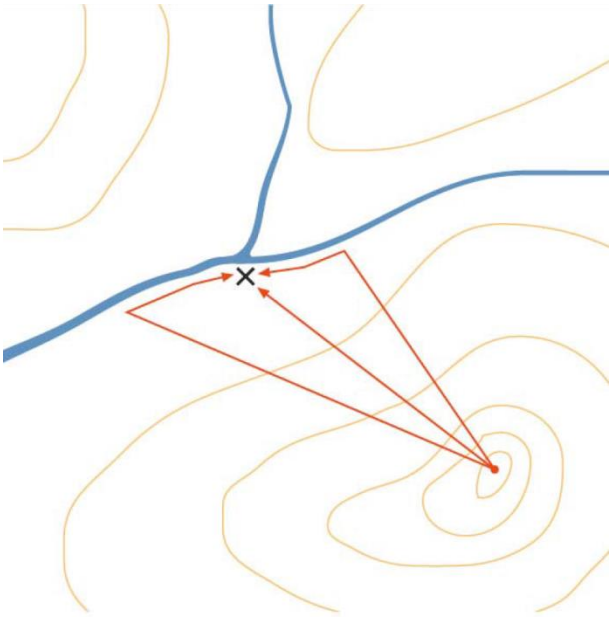
One of the techniques that prove to be useful whilst navigating is Handrailing, which is when you follow a linear feature such as a wall, fence or stream to another point. Fig 13 below shows the technique in use. Along with tick off features, which are objects/features, which we pass on the way it allows us, build up a plan or strategy for a leg of our route.

Fig 13



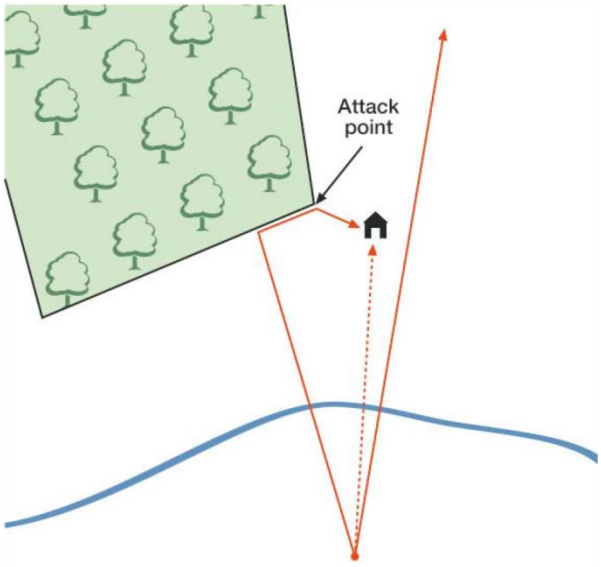
AIMING OFF is the deliberate error that enables us to miss our intended target by a set margin then turn left or right and walk onto it. Fig 14 shows how it can be effective.

Fig 14



ATTACK POINTS are just as they sound. A point on the map that is close to and easy to Navigate to our intended location. After reaching our attack point we can then micro navigate to our destination. See Fig 15 below.

Fig 15



Pacing is based on our own gait (stride length) and the principle that it remains the same from step to step. By knowing the number of double paces (the number of times your left foot touches then ground) that it takes to cover 100m we can then, with a fair degree of accuracy work out the distance we are covering. Using simple calculations and your own pacing chart as a guide it becomes a quick and reliable method of measuring distance for example my pacing chart is shown below. Fig 16

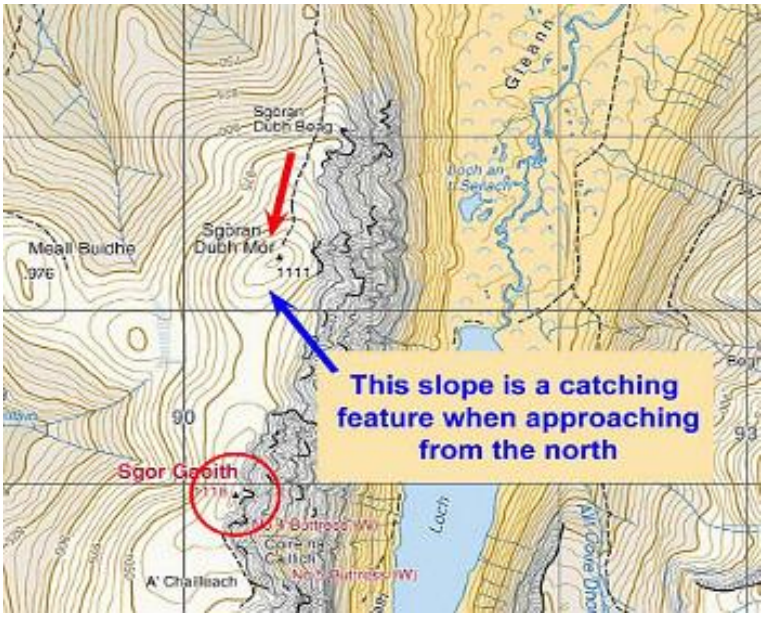
100m	60 paces
50m	30 paces
25m	15 paces
10m	6 paces
5m	3 paces

There are exceptions to this rule such as changes in terrain, uphill/downhill will all affect pacing. Using pacing is normally quite an anti-social navigational technique that requires you to count the number of steps and loses count leads to in-accuracy.

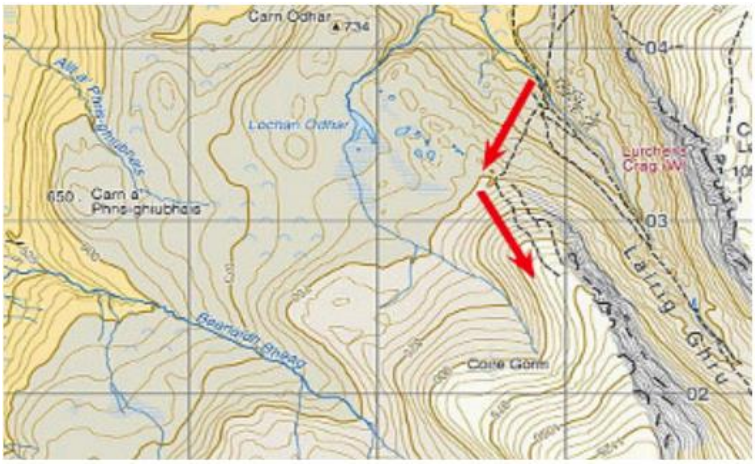
CATCHING FEATURES are features in the landscape that will tell you if you have overshot your target.

In the example shown here the route goes over Sgoran Dubh Mor on route to Sgor Gaoith.

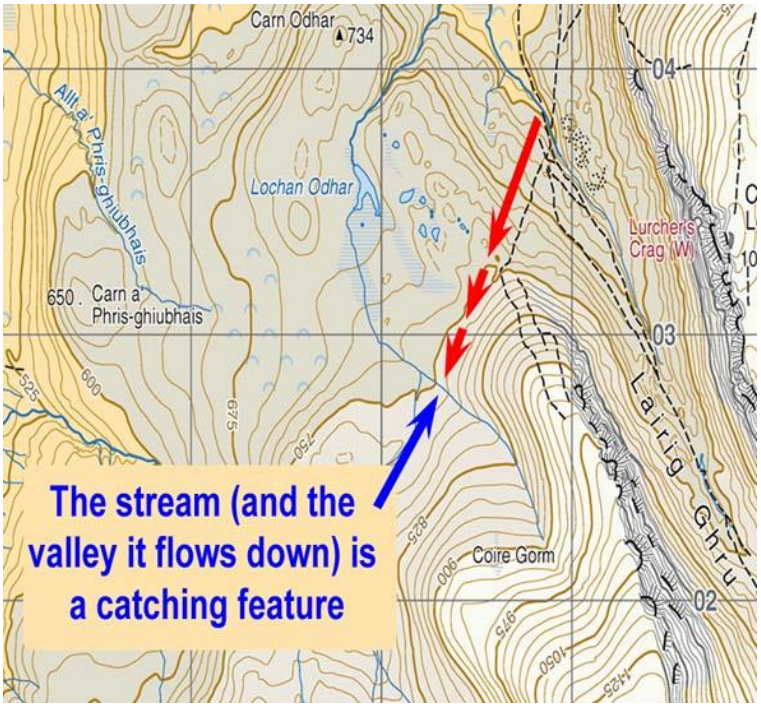
Sgoran Dubh Mor is an important feature to aim for along the way. If you find yourself going downhill before you have identified the summit you know you have gone too far. The downhill slope is the catching feature in this example.



In this second example the route heads up to the foot of a ridge and then turns to climb the ridge...



If you miss the foot of the ridge and the turning you will reach the stream and the valley it flows down. This will tell you that you have overshot the turning. Remember that streams are not always reliable features because there might not be any water running in them. It is often the contour feature which a stream flows down which is most significant. Some streams flow down significant features but many of them don't. So always check the contours. The stream and the valley it flows down are the catching feature in this example.



Catching Features should be identified before you set off for your target.

Timing and pacing can also be used as mental catching features.