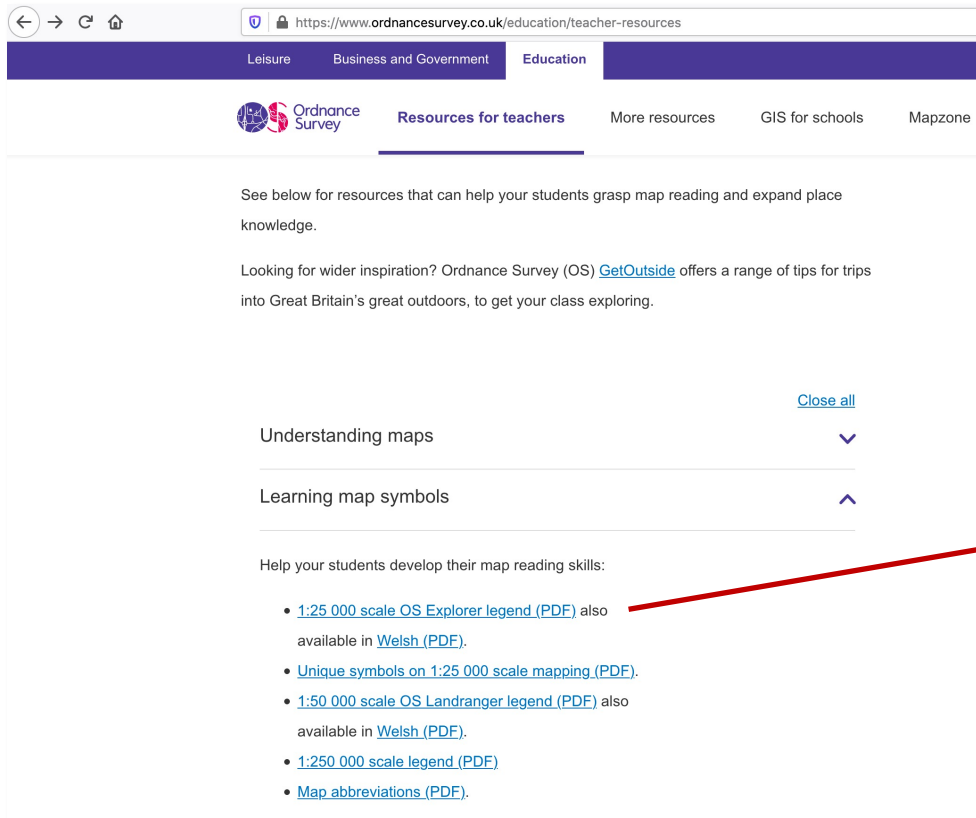


Theory for the Orienteering Honor

Ranger Class, Area8 Curriculum Camp 2021

Signs and symbols for topographic maps

<https://www.ordnancesurvey.co.uk/education/teacher-resources>



A screenshot of the Ordnance Survey website's 'Education' section. The page title is 'Resources for teachers'. It includes a navigation menu with 'Leisure', 'Business and Government', and 'Education'. Below the navigation, there are links for 'Resources for teachers', 'More resources', 'GIS for schools', and 'Mapzone'. The main content area contains introductory text about map reading resources and a list of links to PDF guides for different map scales: '1:25 000 scale OS Explorer legend (PDF)', 'Unique symbols on 1:25 000 scale mapping (PDF)', '1:50 000 scale OS Landranger legend (PDF)', '1:250 000 scale legend (PDF)', and 'Map abbreviations (PDF)'. A red arrow points from the first link to the legend image on the right.

Leisure Business and Government Education

Ordnance Survey Resources for teachers More resources GIS for schools Mapzone

See below for resources that can help your students grasp map reading and expand place knowledge.

Looking for wider inspiration? Ordnance Survey (OS) [GetOutside](#) offers a range of tips for trips into Great Britain's great outdoors, to get your class exploring.

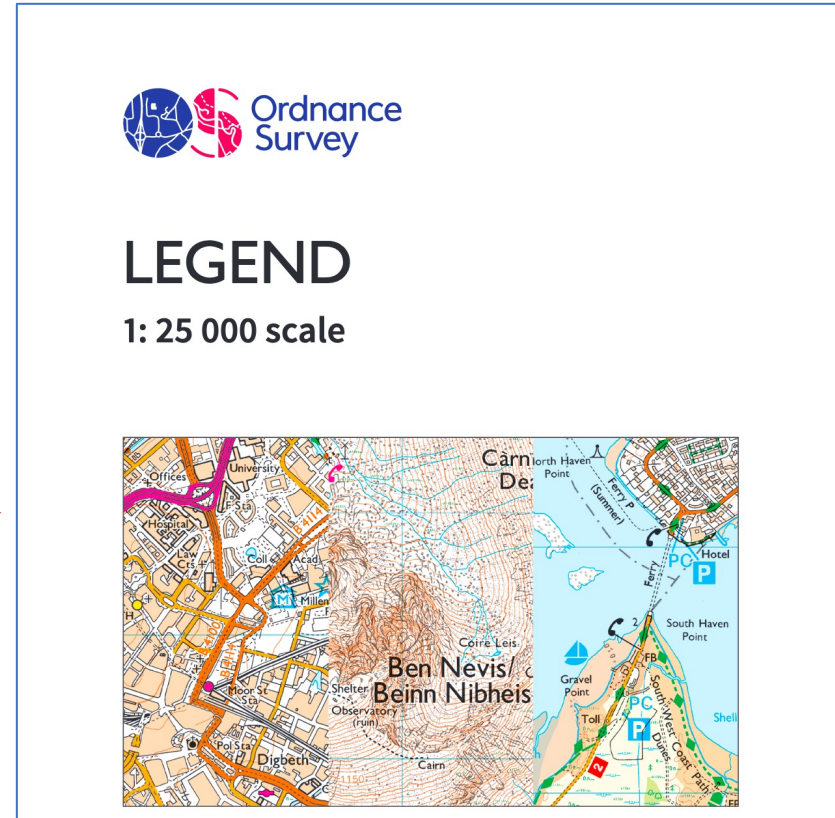
[Close all](#)

Understanding maps ▼

Learning map symbols ▲

Help your students develop their map reading skills:

- [1:25 000 scale OS Explorer legend \(PDF\)](#) also available in [Welsh \(PDF\)](#).
- [Unique symbols on 1:25 000 scale mapping \(PDF\)](#).
- [1:50 000 scale OS Landranger legend \(PDF\)](#) also available in [Welsh \(PDF\)](#).
- [1:250 000 scale legend \(PDF\)](#)
- [Map abbreviations \(PDF\)](#).




The legend page features the Ordnance Survey logo at the top left. Below the logo, the word 'LEGEND' is written in large, bold, black capital letters, followed by '1: 25 000 scale' in a smaller font. At the bottom of the page is a sample topographic map section showing a coastal area with a large hill labeled 'Ben Nevis / Beinn Nibheis'. The map includes various symbols for roads, buildings, water, and terrain contours.

Ordnance Survey

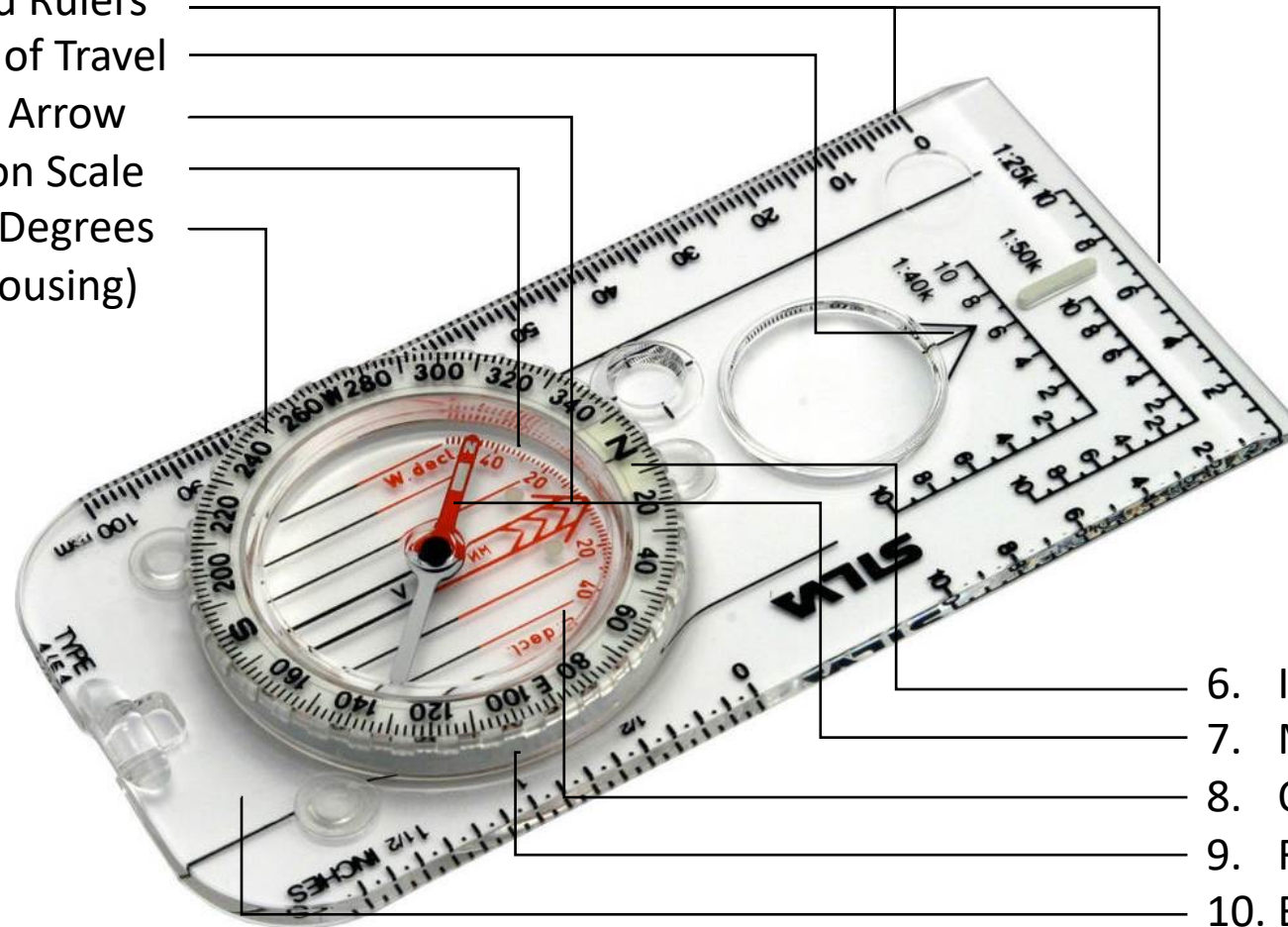
LEGEND

1: 25 000 scale



Parts of your compass

1. Scales and Rulers
2. Direction of Travel
3. Orienting Arrow
4. Declination Scale
5. Dial with Degrees
(part of housing)



NB! Red end of the compass needle points to North!

6. Index Line
7. Magnetic Needle
8. Orienting Lines
9. Rotating Housing
10. Base Plate

How to orient yourself with a map

- Find your location on the map (point A)
- Find your destination on the map (point B)
- Place the compass on the map so that the Direction of Travel arrow faces the direction of point B (the destination) and the side of the compass Base Plate crosses both points (A and B)
- Hold the compass on the map so that the Direction of Travel arrow is facing away from you
- Turn your body (not the map with the compass), holding the compass on the map in front of you, until the compass needle is aligned within the Orienting Arrow inside the Dial Housing.
- Direction of Travel arrow is now pointing to your destination

How to orient yourself with a map - Example

Compasses Direction of Travel arrow is pointing away from the map holder, towards the destination (point B)

Compass magnetic needle points to a grid north (note that this is fine as long as there is no declination. See definition for declination on slide 16.)

The edge of the compass is aligned with the start (point A) and finish points (point B) of the journey



Azimuth

- Azimuth is an angle between north-south line and an imaginary line between you and an object you are heading for.

Example: The angle between blue grid north and red line connecting points A and B is the azimuth.



How to find azimuth (bearing) on a map

- Set the map on a flat surface
- Locate start and destination points on the map
- Put the compass on the map such that the back corner of the Base Plate is at the start location and the side of the base plate touches the point of destination
- Turn your compass dial until the Orienting Lines inside the Dial Housing are in line with the grid north of the map. Make sure the Orienting Arrow inside the compass Dial Housing is pointing to the top of the map.
- Read the angle next to the compass Index Line - this is your grid azimuth!
- If needed, correct for declination by converting grid azimuth to magnetic azimuth.

How to find azimuth (bearing) on a map - Example



Orienting Arrow points to grid north
Index line points to 43 degrees inside
the rim. This is your grid azimuth.

Edge of the compass is aligned
with points A and B

Orienting Lines are in line with grid
lines

Back Azimuth

Back Azimuth is a reverse of the azimuth, which is 180 degrees opposite of the azimuth.

When do you need it?

If you have to move back (opposite direction) on azimuth.

How to calculate?

If azimuth is <180 degrees, then add 180 degrees to get back azimuth

If azimuth is >180 degrees, then subtract 180 degrees to get back azimuth

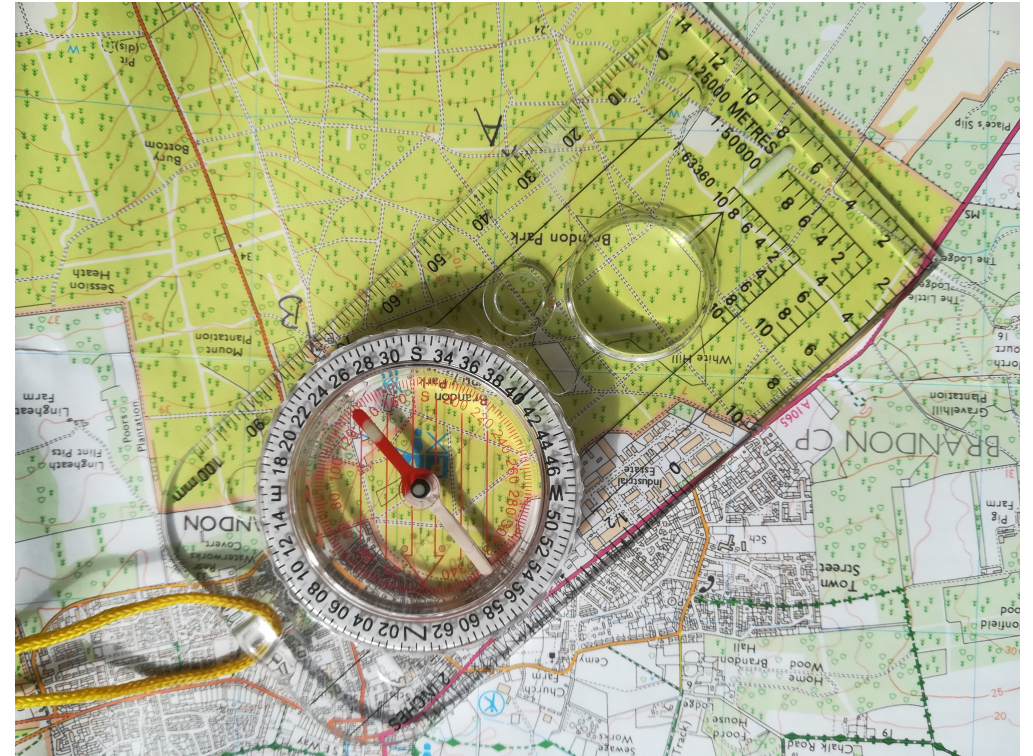
Back Azimuth - Example

Azimuth	Back Azimuth
43	$43+180=223$
125	$125+180=305$
264	$264-180=84$

Back Azimuth - Example



Azimuth: 43 degrees



Calculated back azimuth: $43 + 180 = 223$ degrees

Observed back azimuth: ~ 223 degrees

Shooting a magnetic azimuth

- Find a high ground where you can see the destination or object you need to travel to
- Place the compass flat in you hand pointing the compass Direction of Travel arrow to the object, away from your body
- Turn the compass dial until Orienting Arrow inside the Dial Housing aligns with the Magnetic Needle.
- Index Line is now pointing to your magnetic azimuth

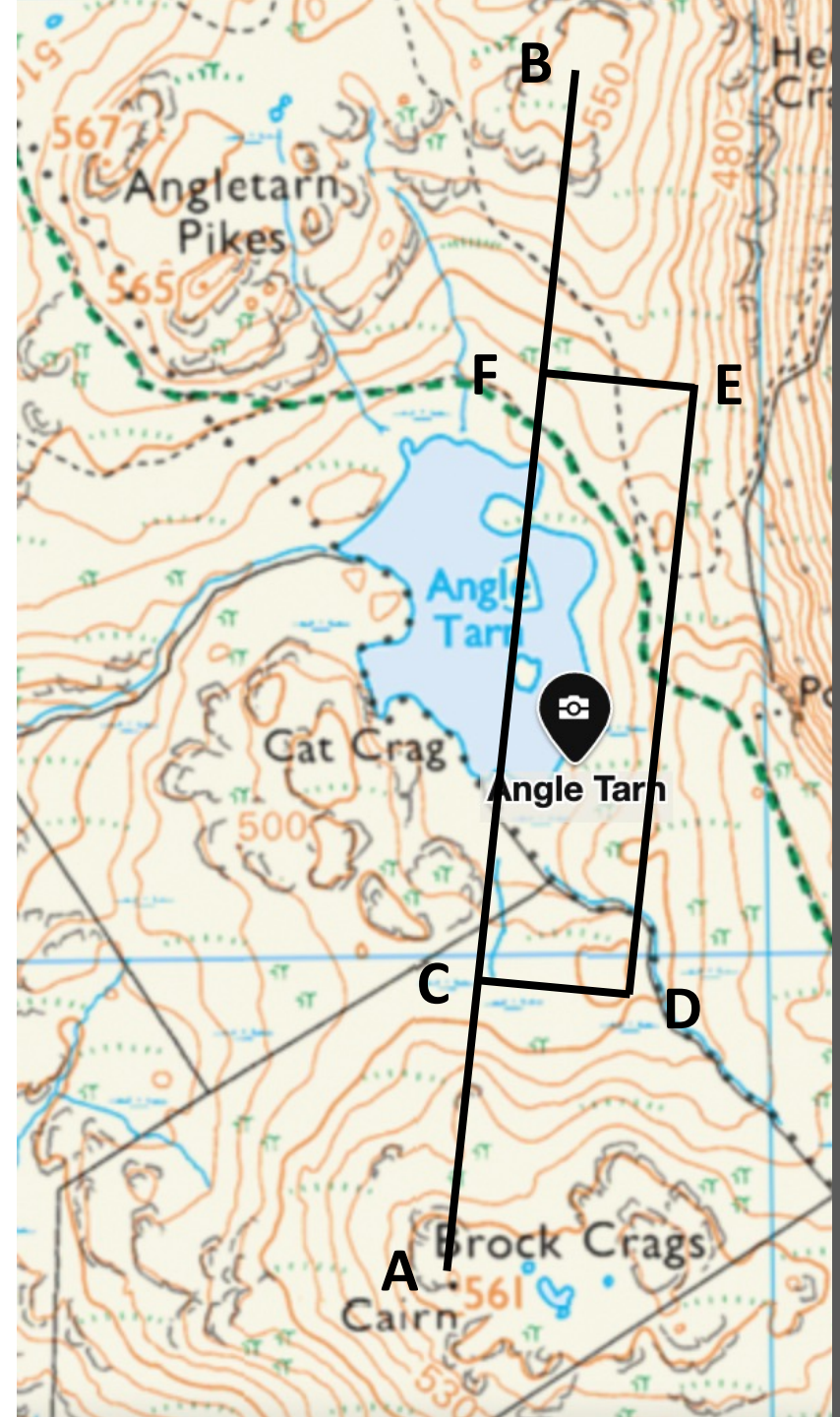


Marching/following a magnetic azimuth

1. Set the azimuth/bearing
2. Place the compass flat in you hand (and away from all metals) with the Direction of Travel arrow pointing ahead, away from you. Hold compass little bit away from your body so you can comfortably look both the compass and the landscape in front of you
3. Turn yourself (not the compass) until the magnetic needle is in line with the Orienting Arrow. The Direction of Travel arrow in front part of your compass is now pointing to your destination
4. Register an object on on horizon where the Direction of Travel arrow points to. Put your compass away and start walking towards that object.
5. Repeat steps two, three and four until you have reached the destination

Bypassing an obstacle while marching a magnetic azimuth

- Stay on your azimuth until you reach your obstacle
- Turn 90° (using your compass) and walk a set distance to go around the obstacle (point C)
- Turn 90° again towards your original azimuth (point D)
- Cover the length of the obstacle and turn 90° again (point E)
- Walk back the same distance you have covered previously to go around the obstacle until you are back on your original azimuth
- Take another 90° turn to resume your original DOT (point F)

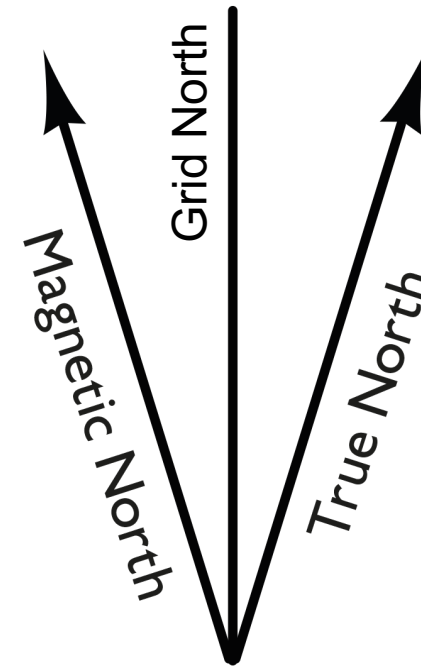


Difference between True North, Magnetic North and Grid North

True North – The geographical north, i.e. the north pole

Grid North – Top of the map where the grid of your map is pointing

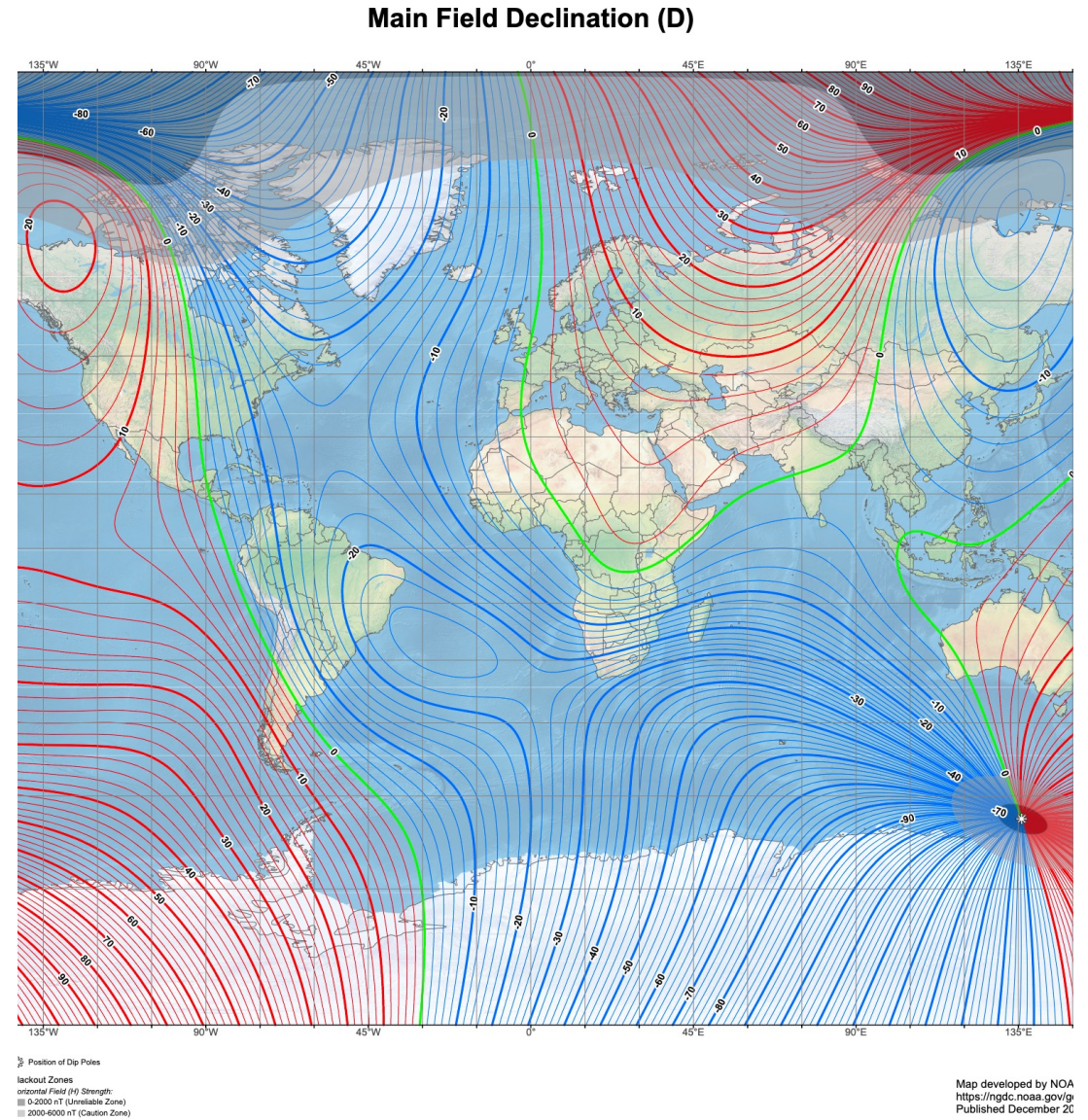
Magnetic North – The (magnetic) north where your compass needle is pointing



Declination

Declination (magnetic declination) is the angle between Magnetic North and True North

Declination varies across the Earth surface and changes over time. For example, declination at London, UK was 1 degree west in 2014 but reduced to 0 degrees in 2020.¹



¹ https://en.wikipedia.org/wiki/Magnetic_declination

How to work between declination and grid declination

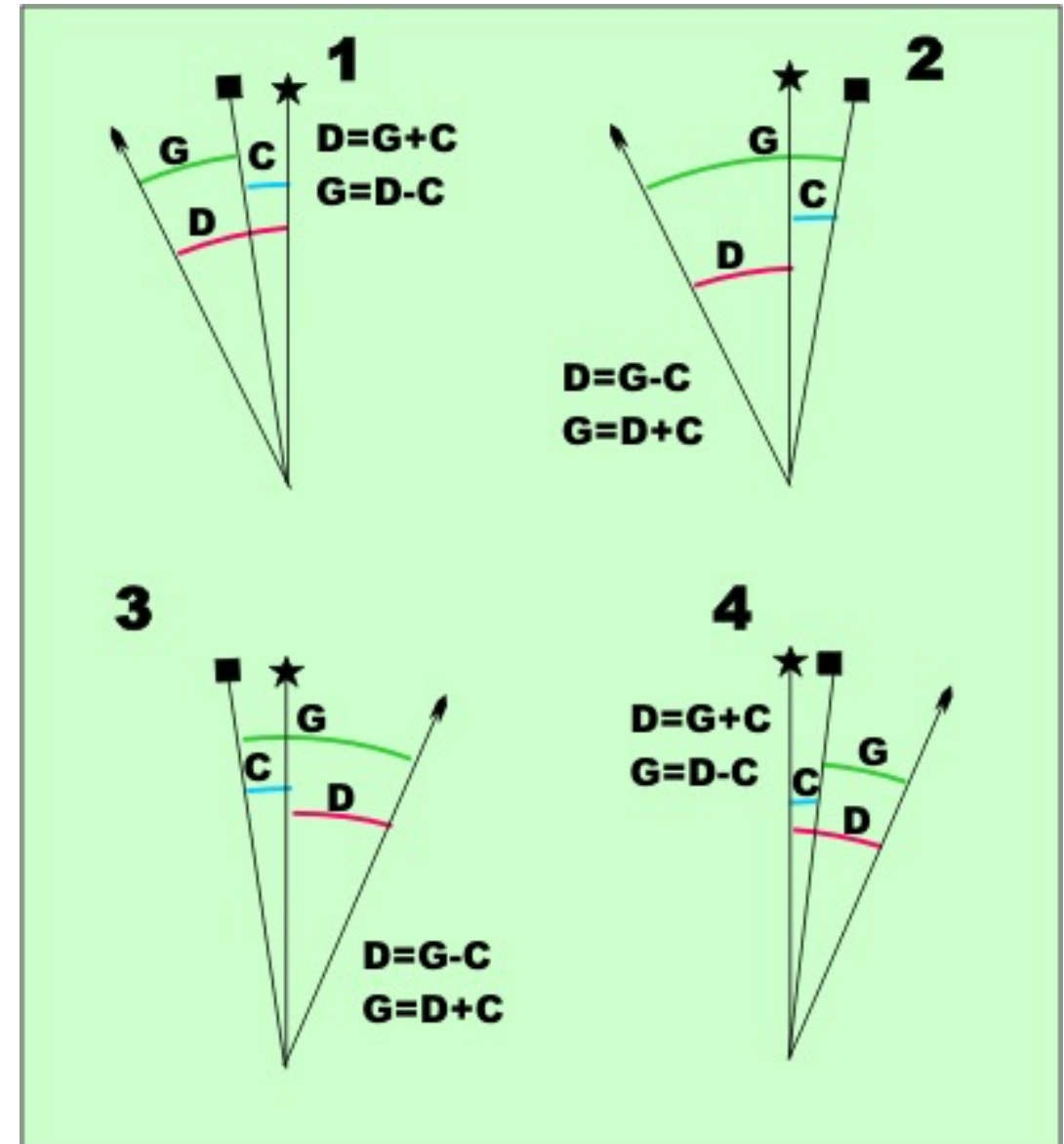
In the diagram,

- the **star** indicates **true** north;
- the **square** indicates **grid** north;
- the **arrow** indicates **magnetic** north;

G refers to grid declination;

C is the convergence angle;

D refers to the declination.



How to correct for declination

You can correct for declination by adjusting magnetic azimuth on compass dial; or by adjusting the declination scale of the compass. Note that not all compasses have declination scale.

- For Westerly Declination, add the declination to the true azimuth to obtain the magnetic azimuth reading. $\text{Magnetic} = \text{true} + \text{westerly declination}$
- For Easterly Declination, subtract the declination from the true azimuth reading to obtain the magnetic azimuth reading. $\text{Magnetic} = \text{true} - \text{easterly declination}$

How to correct for declination - Example

Exercise

1. Grid azimuth for marching from point A to B is 205° .
2. Declination instruction on the map say "At the centre of this sheet true north is $2^\circ 10'$ west of grid north for July 2016. Annual change is approximately $10'$ west"
3. Your compass does not have declination adjustment feature (no declination scale in Dial Housing)

Solution

1. Calculate declination in 2021 as follows:
 $5 \times 10' \text{ west} = 50' \text{ west}$
 $2^\circ 10' \text{ west} + 50' \text{ west} = 3^\circ \text{ west}$
The declination in 2021 is 3° west
2. Correct your azimuth for declination as follows:
Remember that for westerly declination, Magnetic = true + westerly declination
Set your azimuth to $205^\circ + 3^\circ = 208^\circ$

Resection

Resection is a method for determining an unknown position by measuring angles with respect to known positions.

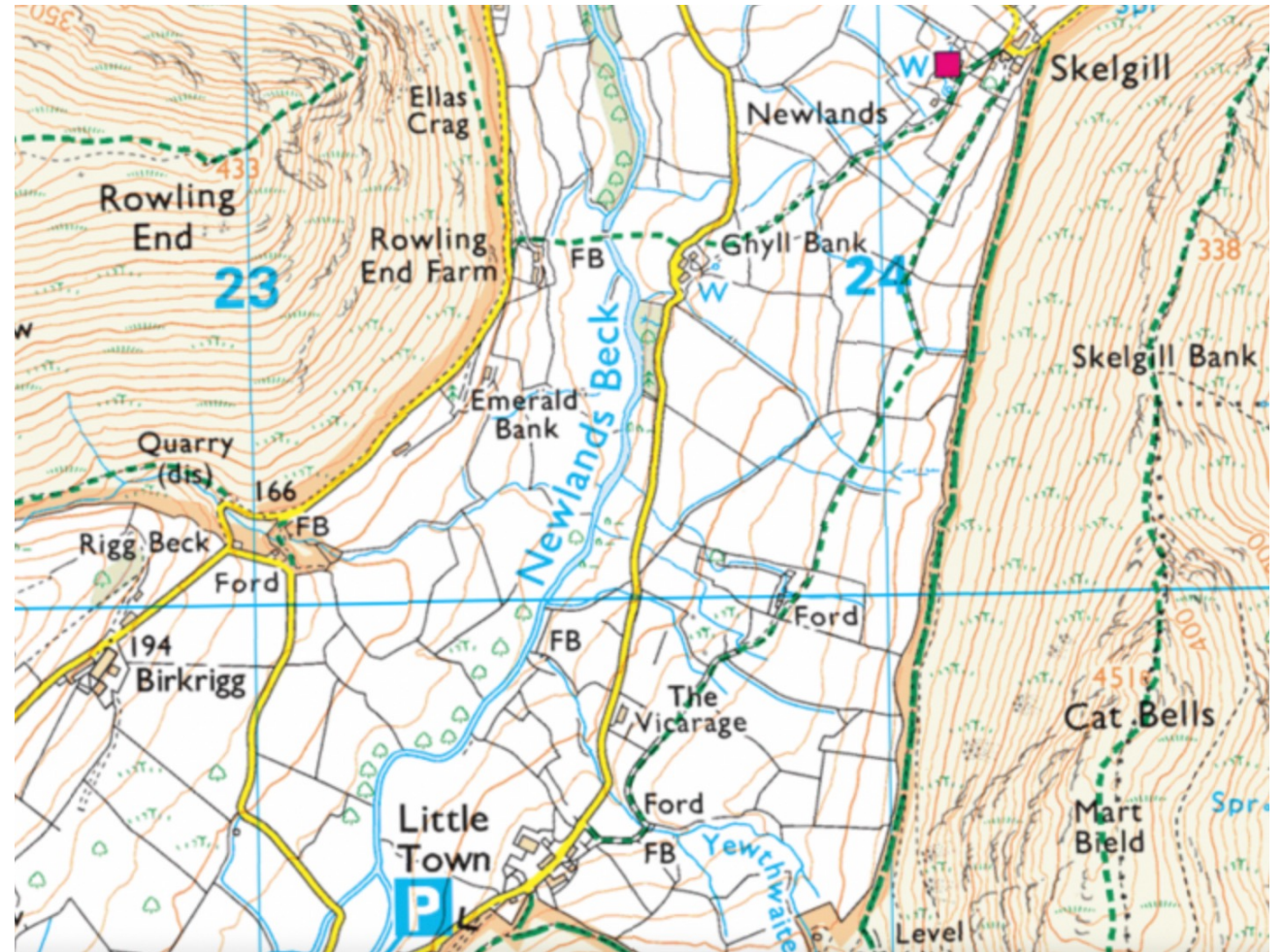
Resection is used for determining one's position on a map by shooting magnetic azimuths to at least two known objects and by transferring azimuth angles to a map as lines crossing the known objects. The location where the lines intersect is your position on the map.

Resection - Example

Exercise

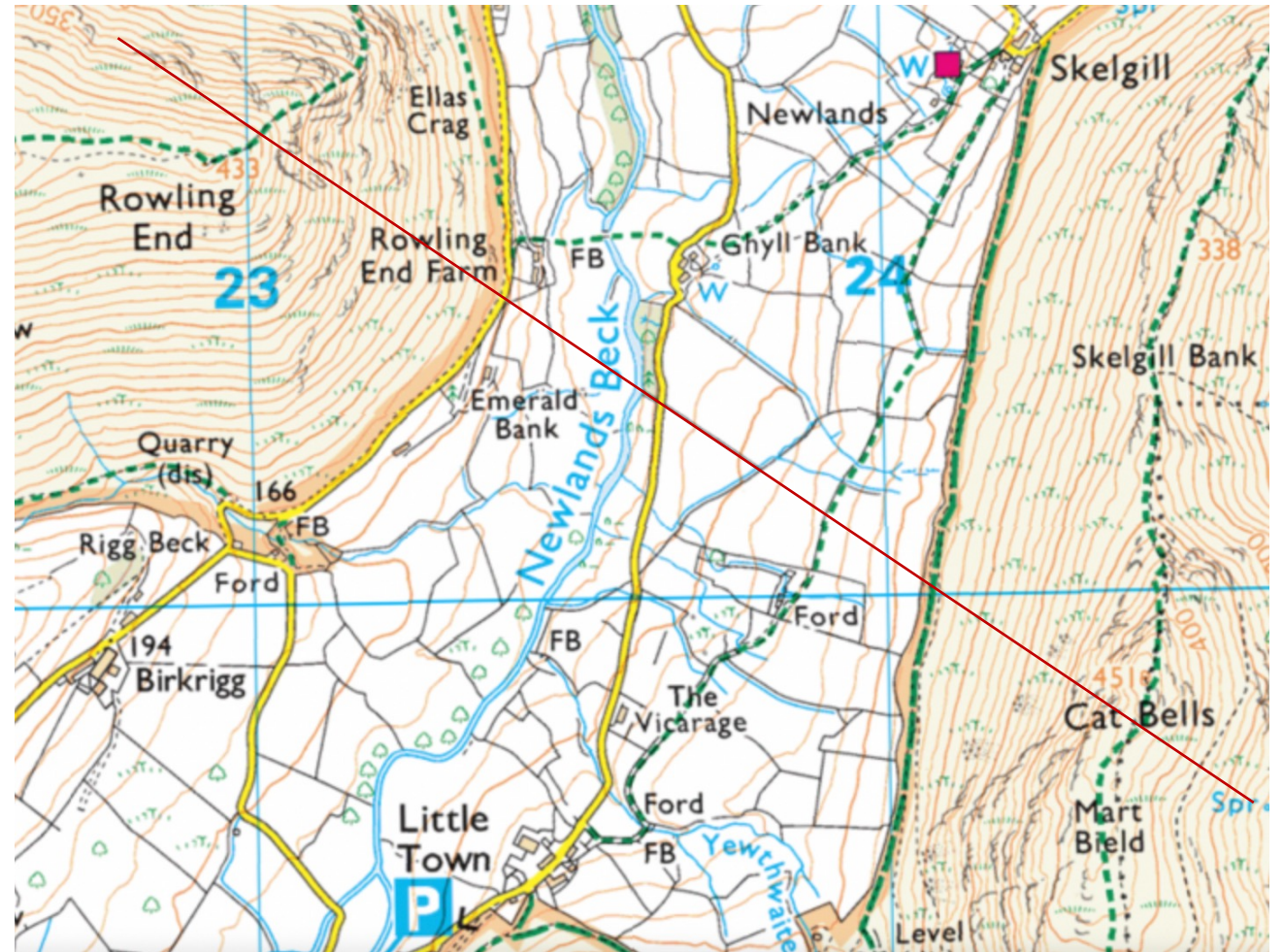
You are somewhere on the field between two hills. You recognize the peak of 'Cat Bells' and know that the houses far ahead on the hill side are in Brikrigg.

How do you find your location using resection?



Resection – Example

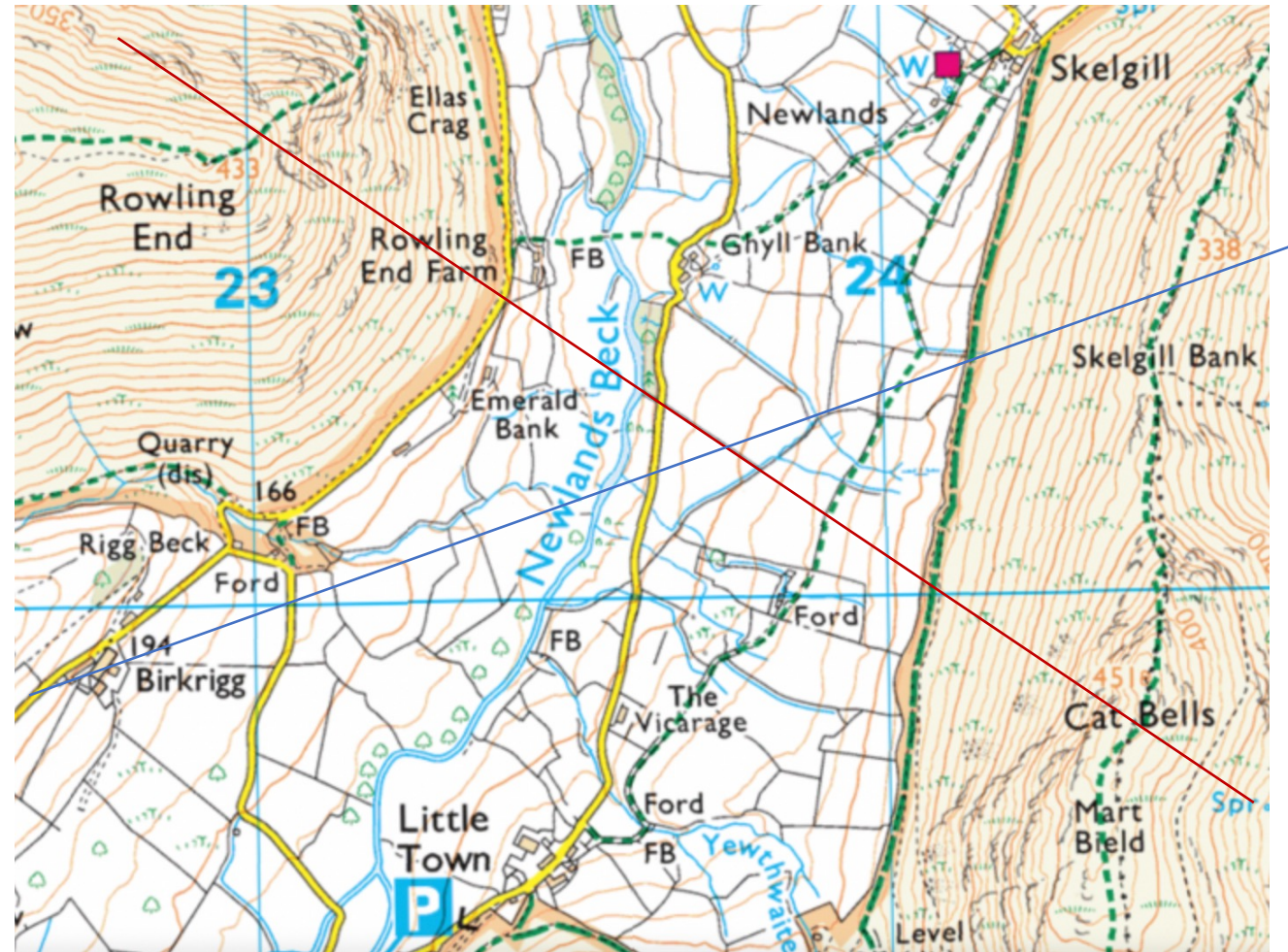
1. Shoot magnetic azimuth on the peak of 'Cat Bells'.
2. The magnetic azimuth observed is 126° .
3. Place the edge of the compass across the peak of 'Cat Bells' on the map and rotate the base of the compass until the Orienting Arrow inside the Dial Housing lines up with the grid north.
4. Draw a line (red on the map) across the peak of 'Cat Bells' following the edge of the compass. Extend the line across the valley.
5. Your location is somewhere on that line.



Note that the example assumes no declination

Resection – Example

1. Shoot magnetic azimuth on the houses of Birkrigg.
2. The magnetic azimuth observed is 250° .
3. Place the edge of the compass across the houses in Birkrigg on the map and turn the compass until the Orienting Arrow inside the Dial Housing lines up with the grid north.
4. Draw a line (blue on the map) across the houses of Birkrigg following the edge of the compass. Extend the line across the valley.
5. Your location is where the red and blue lines intersect.



Note that the example assumes no declination