NAVIGATOR

Ordnance Survey Maps
Compass Use

The Navigator Staged Activity Badge

One of the core skills in Scouting is **navigation** – that is, being able to find your way using a variety of techniques and tools, without getting lost. The badge teaches an understanding of:

- Maps and how to find your location (Stage 1)
- Cardinal points of a compass (Stages 1-2) and bearings (3+)
- Grid references (Stages 2+)
- Ordnance Survey maps (Stage 3+)
- Map scales (Stage 3+)
- Equipment for walking – how to dress and other gear

This presentation concentrates on maps, grid references, and the use of a compass. It briefly discusses GPS – another form of navigation that uses a device that can receive signals from satellites. It is aimed at Stage 3.

scouts
be prepared . . .

NAVIGATOR STAGED ACTIVITY BADGE

ORDNANCE SURVEY

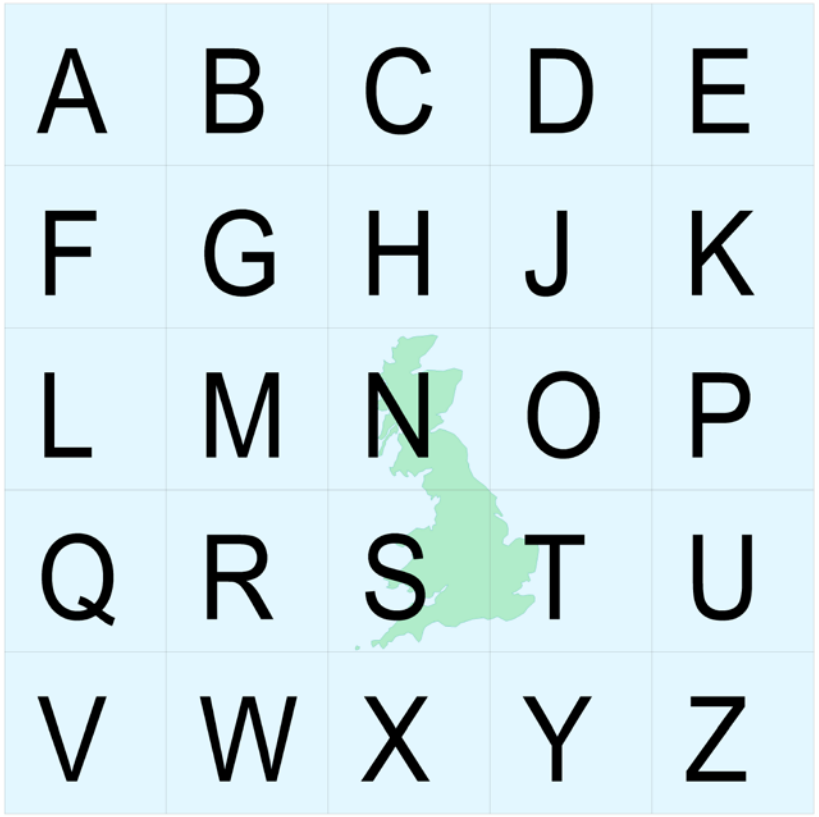
After the Battle of Culloden, the British military decided that good maps were very important, and so the Board of Ordnance began a grand survey in 1783, which led to the formation of Ordnance Survey in 1791.

ORDNANCE SURVEY

Since that time, Ordnance Survey has become one of the largest publishers of quality maps and map data in the world. It is a public-owned company run by the government of the United Kingdom. This is why all Ordnance Survey maps are “Crown Copyright”.

The National Grid

Ordnance Survey maps use a grid system called The National Grid. It starts by dividing the area of the UK and surrounds into squares that are 500km by 500km, each identified by a letter.



scouts
be prepared . . .

THE NATIONAL GRID

The National Grid

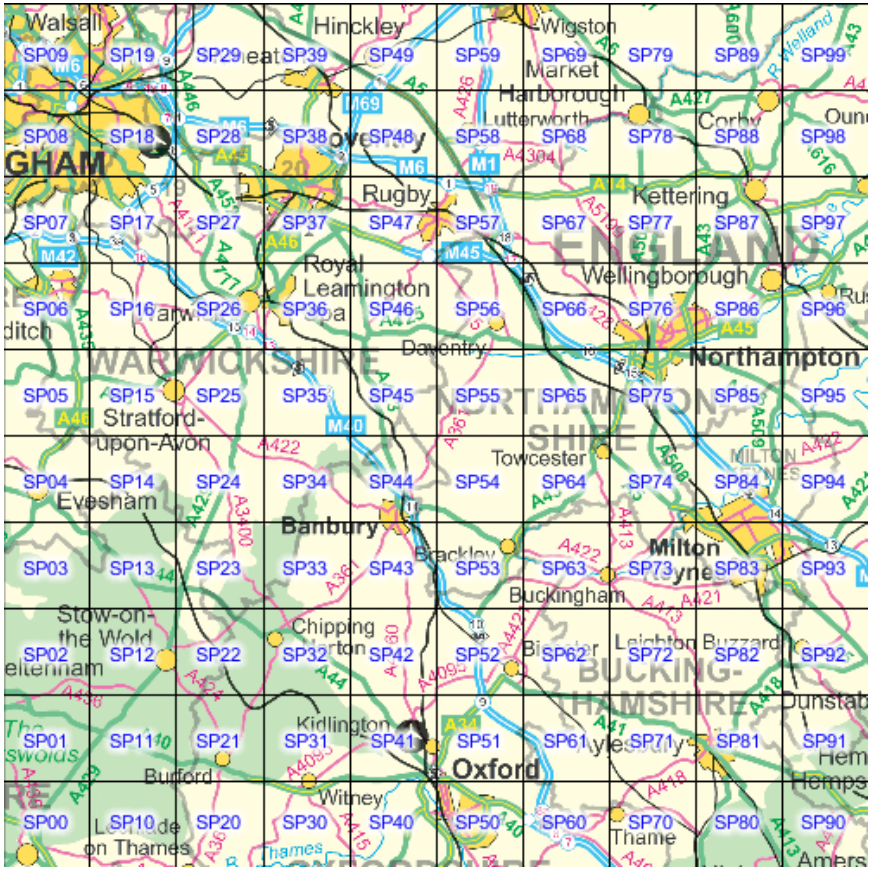
Each of the 500km squares is divided into twenty five 100km squares, again given a letter. Note the letter “I” is not used for either grid – it can be mistaken for other letters and numbers too easily.

We will look at the red numbers in a bit!

THE NATIONAL GRID

The National Grid

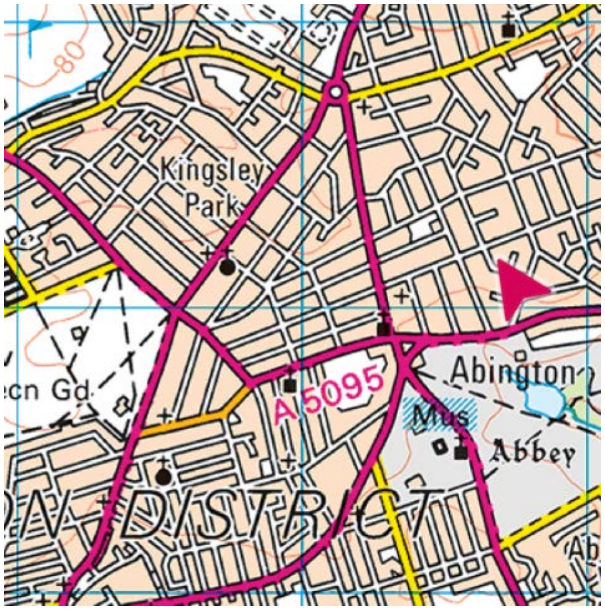
Each of the 100km squares is divided into a 10km by 10km grid. This grid uses numbers horizontally and vertically, always noting the bottom left corner of a square. SP76 is “100km square SP, seven 10km squares along, six 10km squares up”.

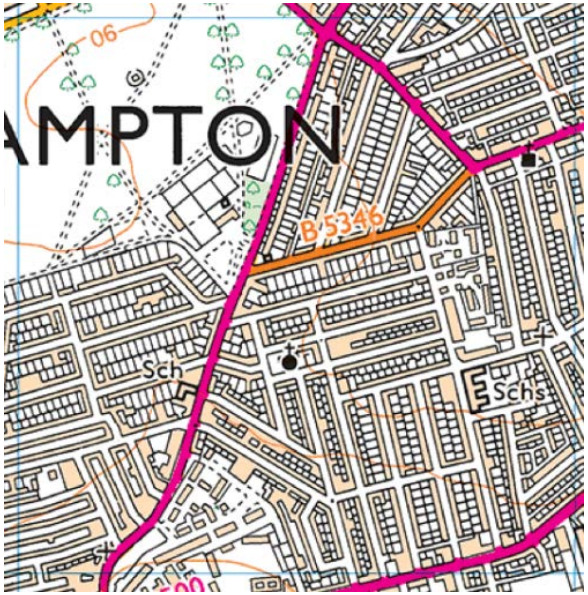


THE NATIONAL GRID

The National Grid

The 10km grids are finally split into 1km squares, again numbered 0 to 9 vertically and horizontally from the bottom left corner of a 10km square. These 1km squares are marked on Landranger and Explorer maps with blue lines.

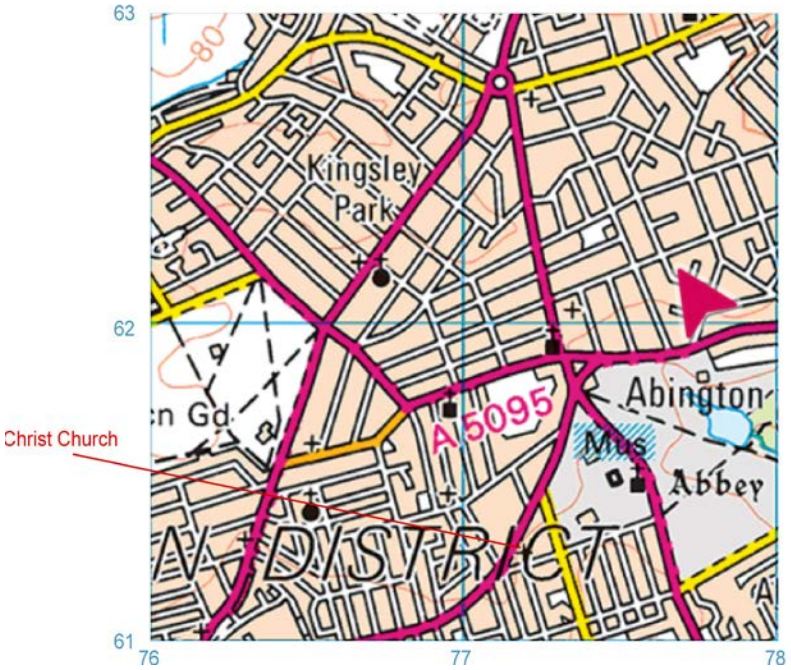




THE NATIONAL GRID

GRID REFERENCES

A grid reference points to a location within the National Grid. Basic grid references use four numbers, that locate the bottom left corner of a 1km square on an Ordnance Survey map. The numbers are specific to each 100km square, marking out each 1km square inside it – from 00 to 99, horizontally and vertically.

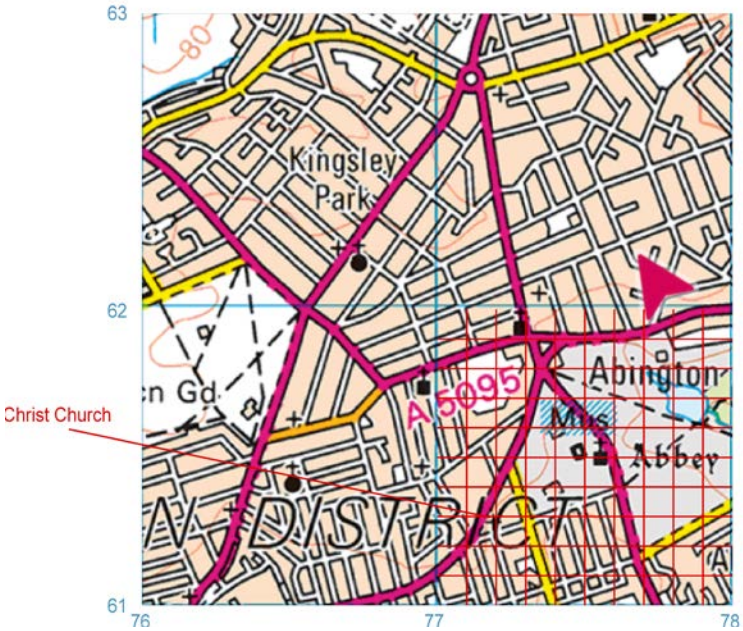


From this map, we can see that Christ Church is in square 77 61. The full four-figure grid reference would be **SP7761**, which means "100km square SP, 77km along, 61km up".

Six Figure Grid References

A four-figure reference only tells us what 1km square something is in. A six-figure reference is more accurate.

To work out a six-figure reference, imagine the 1km square on the map is itself divided into a 10-by-10 grid. To be more accurate, you can measure this with a ruler or use a Romer scale from a compass. Remember that 0 is always bottom-left.



From this map, we can see that Christ Church is 2 along and 3 up. Our grid reference becomes “77km along, plus 200m, and 61km up, plus 300m” – 772613. The total grid reference is **SP772613**.

GRID REFERENCES

More on Grid References

In the real world, no-one really uses the “SP” and other lettered grids. Well, they do – but not so much when using a map. But you do need some way of noting where in the UK your 4 or 6 figure reference is pointing.

Of course, you can do this by identifying the 100km grid. You can also do it with numbers. You remember the red numbers we said we’d come back to? Well, grid SP can be found there – 4 along and 2 up, from a zero point at the bottom left of grid SV. Why SV? Because that’s the first 100km square used when fitting the UK into the National Grid.

So, we can use an 8-figure reference: **47722613**.

We can also use a specific map. The Landranger map that covers Northampton is sheet 152 – so we could say “**772613 on Landranger 152**”.

Only use one method, though!

scouts be prepared . . .

GRID REFERENCES

ON YOUR MAPS:

1. Which wood is at reference **726422**?
2. What historical site is at **756446**?
3. What type of building is at **763446**?
4. What crosses what at **738447**?
5. What watery geography is at **767423**?
6. What is the grid reference for the petrol station outside Potterspury?
7. What is the grid reference of the phone box in Paulerspury that is closest to the A5?
8. What is the grid reference of Cherry Tree Lodge?
9. What is the grid reference of the footbridge east of Pury End?
10. What is the grid reference of Grafton Cottage Farm?

scouts
be prepared . . .

GRID REFERENCES

ON YOUR MAPS - ANSWERS:

1. Briary Wood
2. Castle remains
3. A school
4. The Grafton Way crosses the A5
5. A spring
6. 752434
7. 724456
8. 749422
9. 713454
10. 743456

scouts
be prepared . . .

GRID REFERENCES

MAP SCALES

We've discussed all of this 500km, 100km, 10km, 1km, grid reference stuff – but how does a map relate to the real world?

All maps show a zoomed-out view of the area they cover. Just how far a given map is zoomed out is determined by *scale*.

WHAT IS SCALE?

Scale is simply a measure of how much smaller (or larger) one thing is in relation to another. You may have noticed models that have “1:72” on the box or similar. All that means is that the model is 72 times smaller than the real thing it is a model of.

The same applies to map scales, except they are usually a lot bigger than that. The two most common scales you will come across are 1:50,000 (the scale used by Landranger maps), and 1:25,000 (the scale used by Explorer maps).

Whenever you measure one unit of distance (any you like – centimetres, millimetres, inches...) on a map, that will represent a number of units *of the same type* in the real world equal to the large number. On a 1:50,000 scale map: One centimetre measured on the map is equal to 50,000 centimetres in real life, for example.

Making It Practical

Obviously, it's not very practical to measure a hike route in terms of thousands of centimetres, so it is better to work out units that are easily measured on the map to what they mean in the real world once scaled up. Let's use centimetres for the map, and kilometres in real life.

One centimetre map = 50,000 centimetres real life. Now for the maths bit... There are 100 centimetres in 1 metre, so we can divide by 100 to get 50,000 in metres = 500. One kilometre is equal to 1,000 metres, so we now know that every centimetre we measure on the map is equal to half a kilometre. Or, for every two centimetres we measure, we have a real world distance of one kilometre.

You remember Ordnance Survey maps have a 1 km grid printed on them? Guess how big they are when measured on a 1:50,000 scale map...

Choosing Scale

1:50,000 scale maps (the Landranger series) are OK if you are travelling long distances using prominent features such as roads. They aren't very good for hiking, however, as they do not show every feature that might get in the way or otherwise cause problems when hiking.

1:25,000 scale is good for hiking. It zooms in, having 4cm map per 1km real life, and shows details that you would need to see when hiking.

Other scales are available, in various forms. Maps more zoomed out than 1:50,000 are useful for road atlases, when all you are really interested in are roads and petrol stations.

1:10,000 and larger scales are used for more detailed surveying and navigation – particularly in sports such as orienteering.

THE COMPASS

The compass is an essential navigation tool. At its most basic, a compass is a magnetised needle that is free to turn, that will always align itself pointing North.

THE BASEPLATE COMPASS

One of the best compasses to use for navigation is the **baseplate compass**. These compasses have a rotating compass housing mounted on a plate. The compass housing is marked off in degrees, and has orientating lines marked on its base. The base plate has a direction of travel arrow, and usually has some other useful features too.

This is a Silva Expedition baseplate compass. The baseplate has Romer scales for calculating grid references, scales for measuring distances, and a magnifying lens.

Do not worry about the black and red numbers inside the compass – you may learn what these are for when you master the basics of navigation!

scouts
be prepared . . .

BASEPLATE COMPASS

Taking Bearings

The numbers around the edge of the compass housing are marked in **bearing degrees**. Just like a circle has 360 degrees, so does the circular compass. Due North is 0 degrees. If you travel around the main cardinal points from there, East is 90 degrees, South is 180 degrees, and West is 270 degrees.

To take a bearing, point the **direction of travel arrow** on the baseplate towards whatever you wish to know the bearing towards, then rotate the **compass housing** so that the **orientating arrow** lines up with the red “North” end of the **compass needle**. On the bearing scale, in line with the direction of travel arrow, you will see a line – the bearing indicated by this line is the bearing towards the object you are pointing at.

scouts
be prepared . . .

COMPASS BEARINGS

Taking Bearings on a Map

Ordnance Survey maps always line up so that North is towards the top of the map. The blue grid lines line up North-South and East-West.

We can use a compass to measure a bearing between two points on a map.

Put the long edge of the baseplate so that it forms a line connecting the point you are taking the bearing *from*, to the point you are taking the bearing *to*. Now turn the compass housing (ignore the needle – we don't need it for this) so that the orientating lines line up with the North/South grid lines of the map, and the orientating arrow is pointing to the map's North.

Read the bearing off the compass housing's dial as we did before.

Combining Bearings

If you know where you are on a map, and know where you want to go, you can measure the bearing on the map and then use the compass to keep you on track. There is one small problem, however.

Cartographers use known, fixed points to draw maps from. This means maps have known, fixed grids and assumptions of what is “North” – **Grid North**. The real world has no such thing.

Compass needles point to **Magnetic North** (they are, after all, magnets). Magnetic North can and does change.

This means, if you measure a bearing on a map you will be using Grid North, and if you then use that measurement to follow your compass – you will get lost.

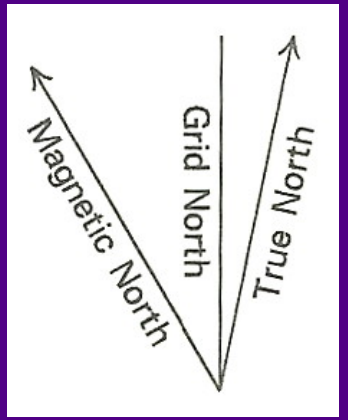
Combining Bearings

Fortunately, every Ordnance Survey map comes with the handy diagram shown to the right.
(Not necessarily exactly like that – it will differ for different maps, especially between maps of different ages).

This indicates the difference, for the map at its time of publishing, between Grid North and Magnetic North (True North is just the direction towards the North Pole). When working between map and real world compass bearings, you need to take this into account. With Magnetic North to the left, you add the angular difference when going from map to real world, and subtract the difference when going from real world to map. Do this by simply turning the compass housing the right number of degrees in the right direction.

scouts
be prepared . . .

COMPASS BEARINGS



ON YOUR MAPS:

1. What would you find yourself in if you travelled on a bearing of 90° for 1km from grid reference 724443?
2. What bearing does the A5 follow towards Potterspury from grid reference 721462?
3. If you travelled on a bearing of 40° for 2.3km from the boundary post at reference 724420, where would you find yourself?

scouts
be prepared . . .

COMPASS BEARINGS

ON YOUR MAPS:

1. Bradlem Pond
2. 132°
3. Lady Copse

scouts
be prepared . . .

COMPASS BEARINGS

GLOBAL POSITIONING (GPS)

Modern navigation techniques often involve space-age technology, as satellites beam information down to mobile phones, vehicle SatNav, and any other device capable of receiving GPS signals...

WHAT IS GPS?

The Global Positioning System (GPS) comprises a number of satellites that orbit the Earth transmitting geolocation and time information. Any device with a GPS receiver can pick these transmissions up and, if it picks up the transmissions from more than 3 satellites, use the data to calculate where it is. The more satellites that can be “seen” by the receiver, the more accurately the device can pinpoint its position.

Where did it come from?

It's older than you think.

The United States military developed the concept of navigating by satellite using radio navigation techniques used by the Royal Navy during World War 2. By 1978, an experimental version was ready for launch.

Throughout the 1980s, the US military continued to develop and experiment the system. It eventually proved itself in the Gulf War of 1990-1991, being used for navigation and to direct artillery and bombing missions to targets.

It remained a military asset until 1996, when President Bill Clinton opened it for use by civilians.

Since then, more satellites and improvements have been made, and GPS receivers have been built into all sorts of now-common devices. Other GPS satellite networks have been launched, too – notably by Russia, China, and the European Union.

GPS Devices

GPS receivers are found in:

- Smartphones
- SatNav
- Hand-held GPS navigation devices
- Vehicle tracking devices
- People tracking devices
- Emergency vehicles
- Pet collars
- and many more!

Geocaching

Geocaching is a game that has developed from GPS. It is like a huge hide-and-seek treasure hunt, played across the whole world.

Basically, you hide a geocache, record its coordinates on a central database of geocaches over the internet, and hunt down geocaches that other people have likewise hidden.

The game has become so popular, that there's even a Scout badge for it!

scouts
be prepared . . .

GPS