Topo50 Map

Used by New Zealand Emergency Services

Map Reading Guide

How to use a Topographic map

1:50 000

Land Information New Zealand
Toitu te whenua

Topographic Services

New Zealand Government

THIS GUIDE PROVIDES INFORMATION ON:

- datums
- projections
- the New Zealand topographic map series Topo50 (and how to read them), and
- how to navigate using a map.

Further detailed information on datums and projections in New Zealand can be found in **'Where in the World are We: A Technical Guide to Datums and Projections in New Zealand'**, available on the Land Information New Zealand website www.linz.govt.nz/surveypublications.

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WHO MAKES TOPOGRAPHIC MAPS?

New Zealand Topo50 maps are produced and published by Land Information New Zealand (LINZ).

Topo50 maps are at a scale of **1:50 000** and show geographic features in detail. They are useful for a wide range of activities such as local navigation by vehicle or on foot, locality area planning and study of the environment.

LINZ also produces smaller scale maps at **1:250 000**, **1:500 000**, **1:1 million**, and **1:2 million** scales. These maps are useful for planning travel over large distances, or for giving an overview of New Zealand.

Maps are used by a wide variety of groups including the military, emergency services, and recreational users such as trampers.

WHAT IS A TOPOGRAPHIC MAP?

Topographic maps are detailed, accurate graphic representations of features that appear on the Earth's surface. These features include:

- **Cultural:** roads, buildings, urban development, railways, airports, names of places and geographic features
- **Hydrography:** lakes, rivers, streams, swamps, tidal flats
- **Relief:** mountains, valleys, slopes, depressions
- **Vegetation:** wooded and cleared areas, vineyards and orchards.

The level of detail shown on a map depends on the scale of the map; small scale maps are less detailed than larger scale maps.

CREATING A MAP

Portraying features on the curved surface of the earth onto a flat map requires the use of a geodetic datum and map projection.

Geodetic datums

Mapping and coordinate systems are based on a geodetic datum, which is a mathematical surface that best fits the shape of the Earth. New Zealand's previous datum - New Zealand Geodetic Datum 1949 (NZGD49) - was defined in 1949 and best fitted the shape of the Earth in the New Zealand region only.

In 2000, a new national geocentric datum was adopted in New Zealand - the New Zealand Geodetic Datum 2000 (NZGD2000). This datum is based on a mathematical surface that best fits the shape of the Earth as a whole. Its origin is at the Earth's centre of mass, hence the term 'geocentric'. The datum also incorporates a deformation model used to manage deformation across New Zealand as a result of plate tectonics. For most users these effects can be ignored.

The primary reason for the change from NZGD49 to NZGD2000 is the widespread use of Global Satellite Navigation Systems (GNSS) such as the Global Positioning System (GPS). This is based on a geocentric datum known as the World Geodetic System 1984 (WGS84). The Topo50 map series uses NZGD2000. For most practical purposes, WGS84 and NZGD2000 coordinates are the same.

On a map, datum coordinates are expressed in terms of latitude and longitude. These are often referred to as geographical coordinates.

A significant implication of the change from NZGD49 to NZGD2000 is that latitude and longitude values differ from their NZGD49 predecessors by approximately 190 mN and 10 mE. While features on the ground will not move, their coordinates will change by approximately 200m in a northerly direction when moving to the NZGD2000 datum.

HINT: Remember, if you're using a map that is in terms of NZGD49 your GPS may show your location as being approximately 200m different

Map projections

A map projection enables the curved mathematical surface approximating the Earth to be represented on a flat sheet of paper (i.e. a map). Many projections can be defined in terms of a particular geodetic datum.

The projection process results in the map's spatial representation being distorted. Imagine stretching and tearing a basketball to make its curved surface lie flat on the ground. The magnitude of the distortion can be calculated, allowing corrections to be made when necessary.

There are many different types of projection, each having its own advantages and disadvantages. No projection is perfect. The projection chosen for a map will have minimal, or acceptable, distortion relative to the map's scale and purpose.

Map projections generally use a rectangular grid coordinate system. These grid coordinates are described in terms of easting and northing, the distances east and north of an origin. The origin is assigned a set of coordinates and this is often termed the false origin. Grid coordinates are usually expressed in units of metres.

The Topo50 map series uses the New Zealand Transverse Mercator 2000 (NZTM2000) projection. The previous 1:50 000 NZMS 260 map series used a different projection called the New Zealand Map Grid (NZMG).

THE PARTS OF A TOPO50 MAP

The two main parts of a Topo50 map are:

- the map face, which shows the area mapped and includes information to help you visualise or recognise the area and locate features on the map; and
- the map margin information, which gives details to help you use the map, as well as explanations on when, where and how the information was compiled.

TOPO50 MAP OF CHRISTCHURCH (BX24)

Cover and back panel

On a Topo50 map a cover panel shows the map sheet name and indicates the area of the map and surrounding map sheets.

The back panel shows the general location of the map, the publication date of the map, where further information can be found, and important limitations with information shown on the map.

Maps are produced from information available on a certain date. Over time, that information may change. The Topo50 maps have a published date. There will be maps on the LINZ website at www.linz.govt.nz showing the date particular areas were last maintained so users can see the age of the data on any particular map.

FRONT AND BACK COVER PANELS OF TOPO50 MAP OF CHRISTCHURCH (BX24)

Datum and projection information panel

Information on the datum and projection used are shown on the information panel of a Topo50 map.

DETAILS PROVIDED ON A TOPO50 MAP

HORIZONTAL DATUM: New Zealand Geodetic Datum 2000 (NZGD2000)
For practical purposes, NZGD2000 equates to WGS84

VERTICAL DATUM: Mean Sea Level

PROJECTION: New Zealand Transverse Mercator 2000 (NZTM2000)

PARAMETERS

Spheroid: GRS80; Scale Factor 0.9996
Origin Latitude: 0° South; Origin Longitude:173° East
False Northing: 10 000 000mN; False Easting: 1 600 000mE

HOW TO READ A TOPO50 MAP

The first step in reading a topographic map is to become familiar with the specific characteristics of the map or maps you're using.

Open up your map, check it covers the places of interest and then find the following characteristics:

HINT: Pay attention to how your map unfolds so you can fold it up again correctly

Map Scale

- **What is the map scale?** A map represents a given area on the ground. A map scale refers to the relationship (or ratio) between distance on a map and the corresponding distance on the ground. The map scale tells you about the comparative size of features and distances displayed on the map.
- **Which direction is north?** This is important because the north point orients the map to the real world.
- **What symbols are used on the map?** Have a look at the legend. To understand the map you need to understand the symbols used. Features that appear on maps with different scales may be depicted by different symbols.

What datum and projection is used? If you are going to use the coordinates from the map, you will need to determine which coordinate system (or datum) and projection is used on the map. Always include a reference to the datum or projection when quoting coordinates. Datums and projections are explained earlier in this booklet. This information will be contained in the text on the map footer (see previous section 'Datum and projection information panel').

If you're using a Global Navigation Satellite System (GNSS) such as the Global Positioning System (GPS), remember to set your GNSS receiver to the same coordinate system as your map, or a compatible one. Maps on New Zealand Geodetic Datum 2000 (NZGD2000) datum are compatible with WGS84 used in GNSS.

The Topo50 maps are at a scale of 1:50 000. Common scales for New Zealand topographic maps are:

Scale		Ground distance of 1cm on the map
Larger	1:50 000	500 m
	1:250 000	2.5 km
	1: 1 million	10 km
Smaller	1: 2 million	20 km

To explain scales graphically, look at a 1:50 000 scale Topo50 map. The first number of the scale (1) represents a core unit of distance on the map, while the second (50 000) represents that same distance on the ground.

In this case, one centimetre on the map represents 50 000 centimetres, or 500 metres, on the ground. The distance between Trigs A582 and MQZG on the following map is measured at 9 cm at the map scale, which equates to 4.5 km on the ground.

EXAMPLE OF SCALING DISTANCE OF A TOPO50 MAP (NOT TO SCALE)

The larger the scale of a map, the smaller the area that is covered and the more detailed the graphic representation of the ground. For example, small scale maps (such as 1:250 000) are good for long distance vehicle navigation, while large scale maps (1:50 000) are ideal for travel on foot.

Distance

In addition to the map scale, most maps also show a scale bar:

SCALE BAR FOR A TOPO50 MAP (NOT TO SCALE)

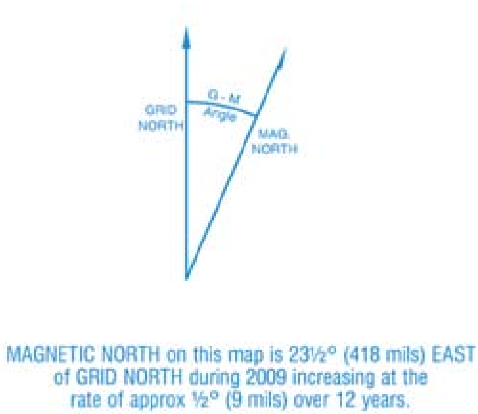
Using the scale bar on a map you can determine the distance between two points on the map.

HINT: Use a piece of string, ruler or strip of paper to measure the distance between two points on the map. Then hold the right hand end of the measurement on a whole number of kilometres on the scale so the other end of the measurement is to the left of the 0 marker and note the whole number of kilometres (right hand point measurement). Add to this the percentage of a kilometre read to the left of the zero marker

Directions

Maps usually include a north point diagram in the map margin information. This shows the direction of Grid North and Magnetic North at the centre of the map.

EXAMPLE OF A NORTH POINT DIAGRAM ON A TOPO50 MAP



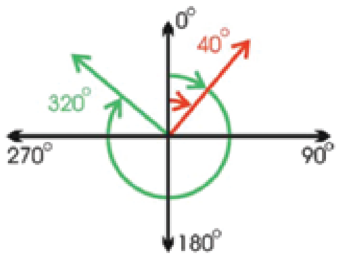
- **True North** (TN) is the direction to the Earth's geographic North Pole.
- **Grid North** (GN) is the direction of the blue vertical grid lines (eastings) on a Topo50 map. The angular difference between GN and TN is known as grid convergence.

- **Magnetic North** (MN) is the direction from any point on the surface of the Earth towards the Earth's North Magnetic Pole. The angular difference between TN and MN is known as Magnetic Declination. As GN is used in preference to TN for map reading purposes, it is more useful to know the difference between GN and MN. This is known as the Grid/Magnetic angle. This varies across New Zealand and because the position of the North Magnetic Pole moves slightly from year to year, the Grid/Magnetic angle and Magnetic Declination will vary by a small amount each year. In using a map for accurate navigation, magnetic variation can be important, particularly if the map is several years old.

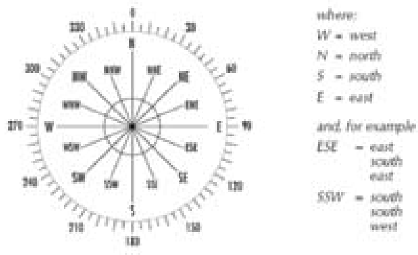
Bearings

Directions can also be expressed as bearings. A bearing is the clockwise horizontal angle measured from north to a chosen direction. Bearings are usually shown in degrees and range from 0° (north) to 360° (also north). South is 180°, east is 90°, west is 270°. Bearings are often used for navigating between points.

ILLUSTRATION DEPICTING BEARINGS OF 40° AND 320°



A COMPASS ROSE AND BEARING GUIDE



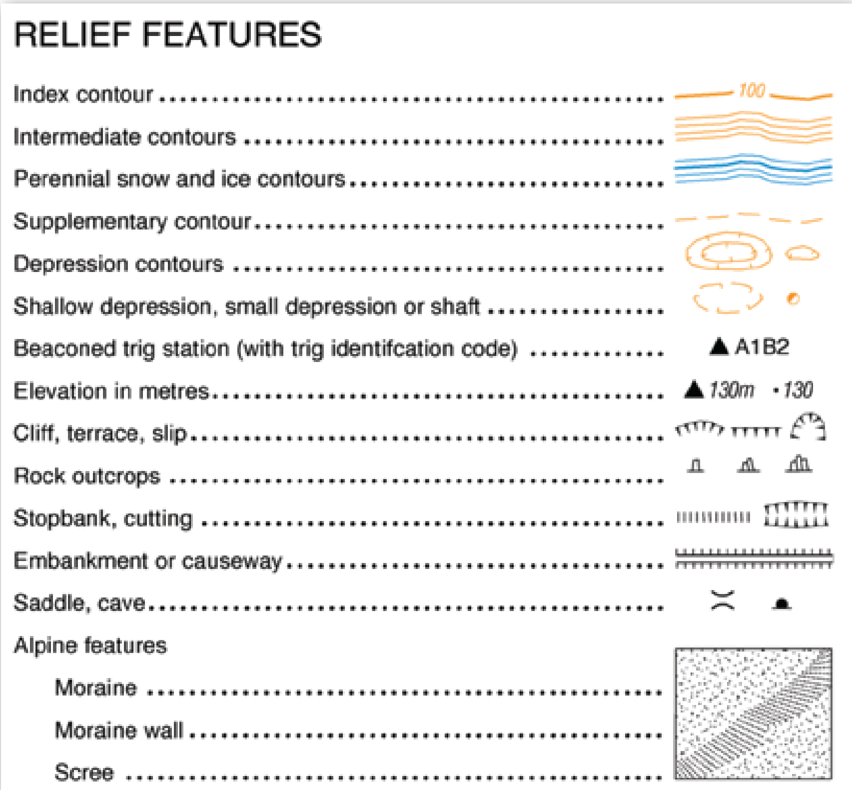
Map symbols (the legend)

Maps use symbols to represent features on the ground. These features include roads, tracks, rivers, lakes, vegetation, fences, buildings, power lines etc. Given the size of a map, it is not possible to show all features on the ground. Large scale maps show more detail and a larger number of features. Depending on the scale of the maps, features may have to be offset so they can be clearly shown on the map, e.g. a roadway and a railway line may have to be separated horizontally so they don't overlay each other.

Colour plays an important part in symbols and some international conventions apply to the use of colour. For example, blue for water features, black for culture and green for vegetation.

Symbols are grouped in themes on the legend. While most symbols are easily recognised as the features they represent, you can always refer to the map's legend.

PART OF A LEGEND FROM A TOPO50 MAP



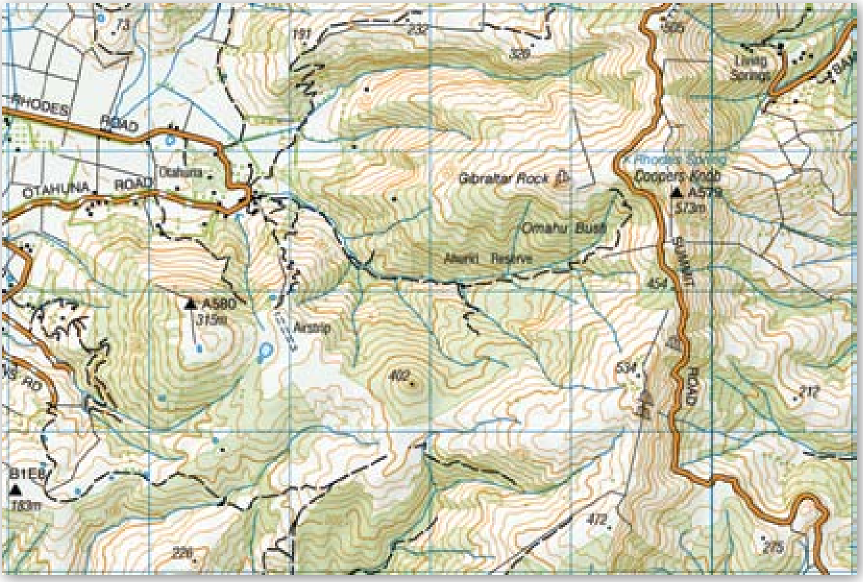
Contour lines

Topo50 maps show 20m contour lines. These lines, which join points of equal height, represent the relief in the terrain depicted. For example, if there are many contour lines close together, the terrain is steep. Contour lines that are far apart indicate land with gentle slopes. The accuracy of a contour line is usually taken to be about half the contour interval, i.e. 10m on a Topo50 map.

The coastline on a map represents the line of mean high water level (MHW). However, contours represent the heights above mean sea level (MSL).

HINT: Contour values read uphill. As you read the contour numbers, you will be looking up hill

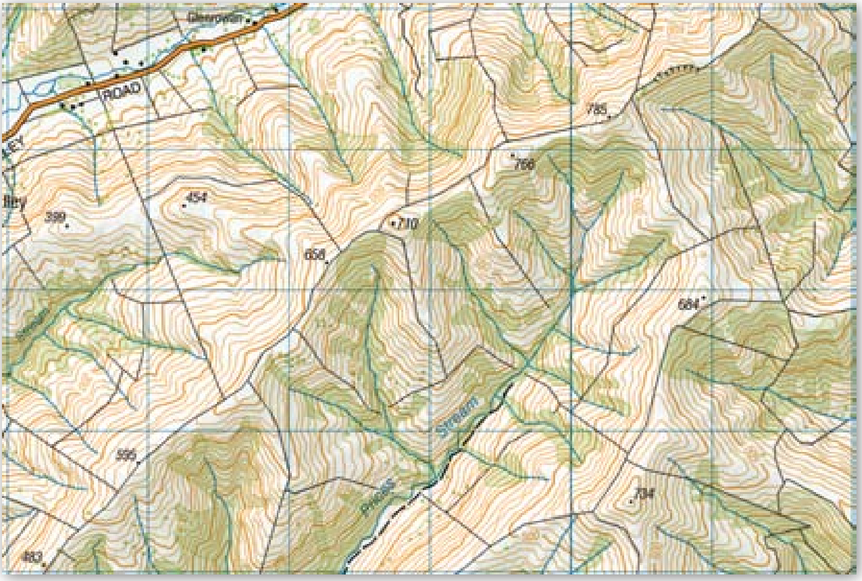
EXAMPLE OF CONTOUR SHAPES (NOT TO SCALE)



Relief shading

In addition to contour lines, relief shading helps you visualise the terrain. Hills and valleys are shaded as if they were illuminated from the north-west.

EXAMPLE OF RELIEF SHADING (NOT TO SCALE)



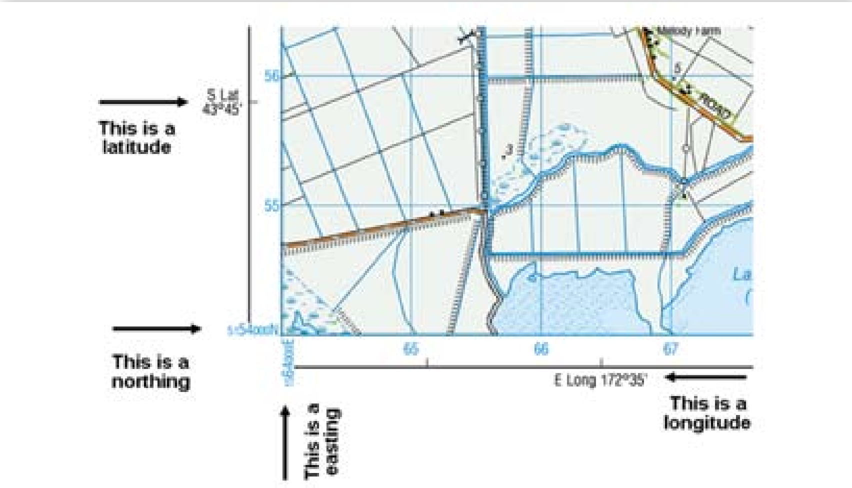
Map coordinates

Map coordinates are usually shown in one of two ways:

- **geographical coordinates**, given as latitude and longitude values in degrees, minutes and seconds, e.g. New Zealand Geodetic Datum 2000 geographical coordinates; or
- **grid coordinates**, given as easting and northing values, in metres, e.g. New Zealand Transverse Mercator 2000 projection grid coordinates.

Topo50 maps show a geographic graticule (latitude and longitude, in degrees, minutes and seconds) and a coordinate grid (eastings and northings, in metres), so you can determine relative and absolute positions of mapped features.

EXAMPLE OF MAP COORDINATES USED ON A TOPO50 MAP (NOT TO SCALE)



Geographical coordinates - latitude and longitude

You can find or express a location using the geographic coordinates of latitude (north or south – horizontal lines) and longitude (east or west – vertical lines).

Latitude is the angular expression of the distance north or south from the equator (0° latitude). The South Pole is at 90°S; the North Pole at 90°N.

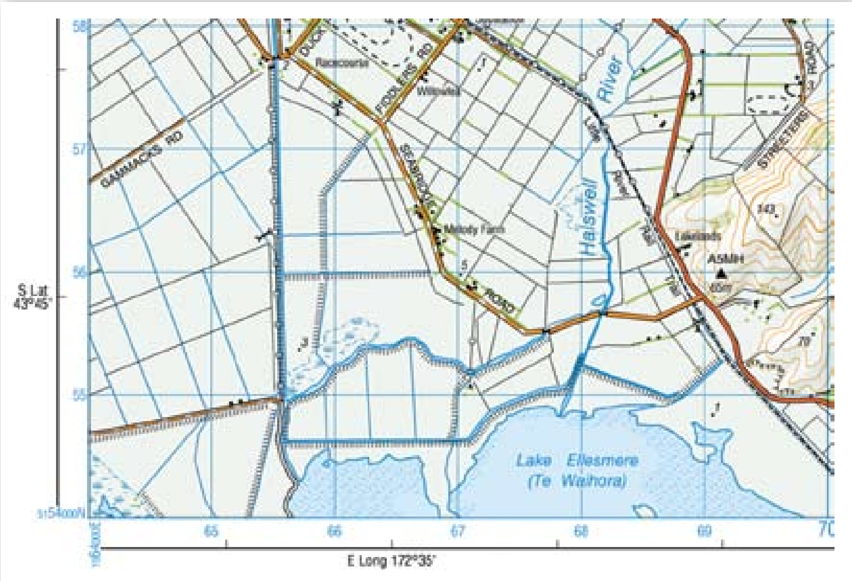
Longitude is the angular expression of the distance east or west from the imaginary line known as the Prime Meridian at 0° longitude.

Geographical coordinates are measured in degrees (°), minutes (‘) and seconds (“). Each degree is divided into 60 minutes; each minute is divided into 60 seconds. When expressing coordinates, latitude is given first. For example, the geographical coordinates for Trig A5MH on the map following would be stated as: 43° 44′ 55″ S   172° 37′ 00″ E.

On the Topo50 maps the latitude and longitude coordinates are shown along the edges of the map face as black lines with short black markers that indicate the minutes of latitude and longitude.

WARNING: The lines of latitude and longitude which join the black tick marks on Topo50 maps are not parallel to the grid because of the effects of the Earth's curvature and projection used

EXAMPLE OF LATITUDE AND LONGITUDE LINES ALONG THE EDGE OF A TOPO50 MAP (NOT TO SCALE)



Grid coordinates - eastings and northings

Grid lines can also be used to find or express a location. Grid lines are the equally spaced vertical and horizontal intersecting lines superimposed over the entire map face. Each line is numbered at the edge of the map face. On 1:50 000 Topo50 maps, the distance between adjacent lines is 2cm which represents 1000 metres.

Official LINZ maps are printed so grid north points to the top of the sheet. One set of grid lines runs north-south, while the other runs west-east. The position of a point on the map is described as its distance east from a north-south line and its distance north of an east-west line.

For this reason, grid lines are also called:

- **eastings** – these are the vertical lines running from top to bottom (north to south). They divide the map from west to east. Their values increase towards the east; and
- **northings** – these are the horizontal lines running from left to right (west to east). They divide the map from north to south. Their values increase towards the north.

The squares formed by intersecting eastings and northings are called grid squares. On Top50 maps each square represents an area of 100 hectares or one square kilometre.

How to quote a grid reference for a particular point

A grid reference is used to describe a unique position on the face of the map. The degree of accuracy required will determine the method used to generate a grid reference. All methods follow a similar approach. The two tables below describe how to give a simplified six figure grid reference and a full northing and easting grid coordinate for Mt Cavendish shown on Topo50 map BX24.

The simplified way of expressing the full grid coordinate is to specify the sheet number and a six figure grid reference. Remember to quote the sheet number as the six figure grid reference is not unique to a single sheet.

HOW TO READ A SIX FIGURE GRID REFERENCE ON A TOPO50 MAP FOR MT CAVENDISH

TO GIVE A GRID REFERENCE ON THIS MAP (To nearest 100 metres)			
Sample Point: · *Mt Cavendish (1577107E 5173728N)*			
East		North	
1. Locate the first VERTICAL grid line to the LEFT of the point.		4. Locate the first HORIZONTAL grid line BELOW the point.	
2. Read the grid values labelling the line in either the top or bottom margin or across the middle of the map.	77	5. Read the grid values labelling the line in either the left or right margin of the map.	73
3. Estimate tenths of a grid square eastwards from the grid line to the point.	1	6. Estimate tenths of a grid square northwards from the grid line to the point.	7
	771		737
Grid Reference (Quote sheet number first): **BX24 771737**			

HINT: If a grid reference starts with a zero, remember to include it

A full grid coordinate to the nearest 100m is given by a seven figure easting and northing for the example above.

HOW TO READ A FULL GRID REFERENCE ON A TOPO50 MAP FOR MT CAVENDISH

TO GIVE AN EASTING AND NORTHING GRID COORDINATE ON THIS MAP

(Note that this example gives the coordinate to the nearest 100 metres)

SAMPLE POINT   Mt Cavendish

East Coordinate		**North Coordinate**	
1. Record the first two digits of the full easting (E) given in the bottom left corner of the map margin. These are the first and second numbers of the easting grid coordinate.	15	1. Record the first two digits of the full northing (N) given in the bottom left corner of the map margin. These are the first and second numbers of the northing grid coordinate.	51
2. Locate the first VERTICAL grid line to the LEFT of the sample point.		2. Locate the first HORIZONZTAL grid line BELOW the sample point.	
3. Read the grid values labelling the line in either the top or bottom margin or across the middle of the map. These are the third and fourth numbers of the easting grid coordinate.	77	3. Read the grid values labelling the line in either the left or right margin of the map. These are the third and fourth numbers of the northing grid coordinate.	73
WARNING If these numbers are less than the third and fourth numbers in the bottom left corner values of the map, add 1 to the first two digits.		**WARNING** If these numbers are less than the third and fourth numbers in the bottom left corner values of the map, add 1 to the first two digits.	
4. Estimate tenths of a grid square **eastward** from the grid line to the point. This is the fifth number of the full easting grid coordinate.	1	4. Estimate tenths of a grid square **northward** from the grid line to the point. This is the fifth number of the full northing grid coordinate.	7
5. The final two numbers of the full easting grid coordinate are 00 as we can only estimate the reference to the nearest 100 metres.	00	5. The final two numbers of the full northing grid coordinate are 00 as we can only estimate the reference to the nearest 100 metres.	00
	1577100		5173700

SAMPLE COORDINATE   1577100 mE   5173700 mN

PLANNING A TRIP

Planning a successful route through rough country usually requires a topographic map, a compass, perhaps a Global Navigation Satellite System (GNSS) receiver such as a Global Positioning System (GPS) receiver, and observation of various land forms. Streams and vegetation can help with navigation but may hinder your progress.

Make sure you have the right scale map for the trip you are planning. Obviously, journeys on foot should be supported by a larger scale map, or set of maps.

Often, route finding does not require great accuracy, but it does require planning. Before setting out, study the map. Find your start and finish points. The terrain depicted on the map will help you select a suitable route, and anticipate and make best use of the features you will encounter.

For example, you may discover a leading spur or main ridge that will help you avoid a river valley with cliffs or steep terrain. You will also be able to measure the route's distance and any heights to climb, allowing you to estimate how long each stage of the trip will take.

USING GPS

The GPS is one of a number of GNSS and has been developed by the USA's Department of Defense. It is widely used for civilian navigation and positioning, surveying and scientific applications, and although an excellent tool, it is best used with a map.

GPS receivers have many useful features for navigation, such as the ability to store positions and determine speed and direction of travel (which are beyond the scope of this guide). Provided it is used correctly, a comparatively inexpensive, hand-held GPS receiver can provide positions with accuracy better than 15m and often at the 5m level.

NOTE: a GPS is no substitute for a map and compass

EXAMPLES OF GPS RECEIVERS

Using GPS with a map

A GPS receiver calculates position by measuring distances to four or more GPS satellites. GPS is accessible 24 hours a day, anywhere in the world, in all weather.

GPS is based on the WGS84 datum (see explanation of datums on page 3).

For practical purposes NZGD2000 can be regarded as the same as WGS84. It is important to check which datum your map is based upon.

HINT: Set your GPS datum to match your map datum

This datum information will be shown in the map margin. For the best match between your map coordinates and GPS receiver, configure the GPS receiver to display coordinates (geographical or grid) on the same datum as the map being used.

Most GPS receivers have the ability to display either geographic or grid coordinates on a number of national and regional datums. It is important to know how to set the correct datum in your receiver. Please consult your GPS receiver's user guide for details. If the datum you need is not offered in your receiver, consult your GPS dealer for assistance.

It is recommended practice to check your GPS receiver against well-defined map features every time you use it. Visit a feature such as a road intersection, determine its position by GPS and compare this with coordinates calculated from a map. The larger the scale of the map the better. The coordinates of survey control marks or trig points, may be obtained from the LINZ geodetic database at www.linz.govt.nz/gdb

THE MAGNETIC COMPASS

A magnetic compass is an important aid to route-finding and anyone who ventures into the outdoors should carry one.

A compass works on the principle that the pivoting magnetised needle (or the north point of the swinging dial) always points to the north magnetic pole.

As a result, you can use a compass with graduations (degrees) marked on it to measure the bearing of a chosen direction from magnetic north.

HINT: Metal objects such as cars, fence posts and wires, steel power poles and transmission lines, can affect the accuracy of a compass reading. Stand clear of such items when using a compass – at least 1m from metal fence posts and wires and up to 20m from a car

Compass errors

Geological features such as iron ore deposits and dolerite rock that has been struck by lightning can affect a compass. It is even possible for the needle to become reverse-polarised if it is stored for a long time near a strongly magnetised object.

It is therefore advisable to treat magnetic bearings with caution and to check the accuracy of your compass. Determine magnetic bearings between objects at least one kilometre apart, using information available from a map and compare them with your compass bearing. This should be repeated in different directions.

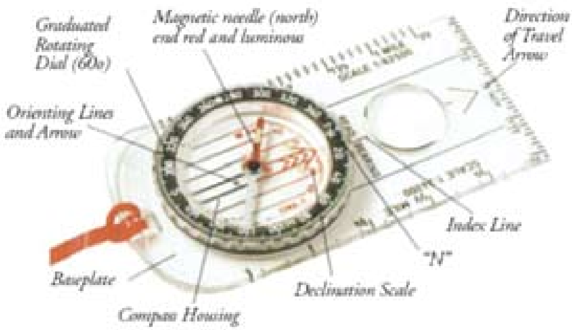
Check for local anomalies by reading bearings between objects about 100 metres apart in opposite directions – the bearings should differ by 180 degrees.

Features of a compass

There are many types of compasses. The pivoted needle, adjustable dial compass is the most useful type. See example – Silva compass below.

As well as a north-pointing Needle, it will often have a transparent base with a Direction of Travel Arrow and Orienting Lines marked on the Rotating Dial housing, so it can be used as a protractor for measuring grid bearings on a map.

FEATURES OF A TYPICAL COMPASS



Using your compass to reach a destination

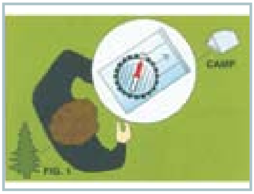
To follow compass bearings to your chosen destination, you will either need to determine magnetic bearings to visible features along the route, or will already have these bearings.

TO DETERMINE MAGNETIC BEARINGS:

1 Select a visible feature along the route you want to travel. Holding the compass level, point the Direction of Travel Arrow at the visible feature.

2 Find your bearing to the visible feature by turning the Compass Dial until the "N" aligns with the red end of the Needle. Read your bearing in degrees at the Index Line.

3 Keeping the Needle aligned with the "N", proceed in the direction indicated by the bearing at the Index Line. The bearing will help you keep on track when the feature is not visible. Repeat this procedure until you reach your destination.



WHEN MAGNETIC BEARINGS ARE KNOWN:

1 If you've been given a bearing in degrees to travel, turn the dial so that the bearing is set at the Index Line. Hold the compass level in front of you, with the Direction of Travel Arrow pointing straight ahead.

2 Turn your body until the red end of the Needle is aligned with the "N" on the dial. You are now facing your direction of travel.

3 Pick out a visible feature in line with your bearing and walk to it. Repeat the procedure until you reach your destination.

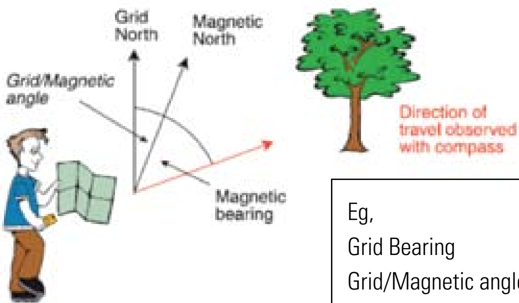
Conversion of bearings

Magnetic bearings measured with a compass must be converted to grid bearings for plotting on a map. Similarly, grid bearings measured on a map must be converted to magnetic bearings for compass navigation on the ground.

The grid/magnetic angle is the difference between grid north and magnetic north and is a positive value if magnetic north it is east of grid north and a negative value if it is west of true north.

To convert from a magnetic bearing to a grid bearing, add the grid/magnetic angle to the magnetic bearing. To convert a grid bearing to a magnetic bearing, subtract the grid/magnetic angle (see page 10).

HINT: G M S rule is: Grid to Magnetic Subtract (Good Morning Sunshine)



Eg,

Grid Bearing	620
Grid/Magnetic angle	- 200
Magnetic Bearing	= 420

SIMPLE USES OF A MAP

Orienting a map

It is a good habit to orient your map before reading it. To do this, hold your map horizontally and rotate it until its direction and features correspond to what you see before you on the ground.

If you are unable to identify the surrounding features, you can use the compass to orient the map. To do this:

- Hold the map flat. Place the compass on the map so that the long edge of the base plate, or a line in the adjustable dial, sits over or is parallel to a north-south grid line. Ensure that the ‘N’ on the dial points to north on the map.

- Turn the map with the compass on it until the magnetic needle points to the magnetic variation (which is approximately 20° currently).

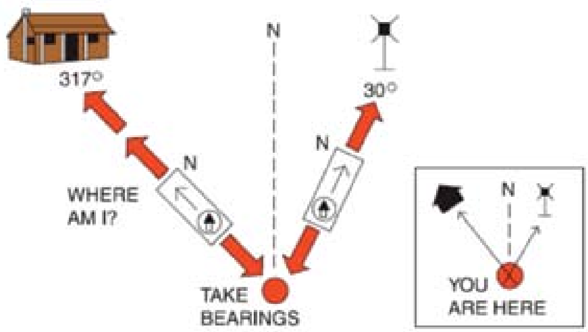
Once the map is oriented, you should be able to identify prominent features in the landscape.

Finding your present position

If you have a GPS receiver, you can use it to determine your coordinates, remembering to set it to a datum corresponding to the datum on your map. Or, once you can identify surrounding features on the ground and on the map, you can use the following procedure to find your current position.

HINT: Pack your map and compass in an easy-to-reach place. In wet weather, put the map, with the appropriate area displayed, in a clear plastic bag

1. Choose two visible features and find these on your map. Now point the Direction of Travel Arrow towards one feature and rotate the Compass Dial until the red end of the Needle points to the "N" on the dial.
2. Add the grid/magnetic angle to the bearing shown at the Index Line and turn the dial to the new bearing.



3. Place the compass on your map with the side edge of the baseplate touching the feature and pivot it until the Orienting Arrow or lines align with the grid north lines. Draw a line from the feature along the side of the baseplate across the map.
4. Repeat this process with the second feature. Your location is where the two lines intersect.

Setting a course

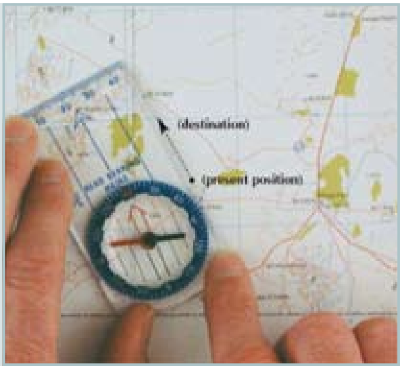
Once you have oriented your map and identified your position, you can set a course. Do this by sighting or by laying a straight line (using the edge of the map card or a piece of string) across the map. It is also good practice to identify a distant visible feature on the line, such as a rocky outcrop, and proceed. Then identify another feature on the line and so on until you reach your destination.

When features are sparse, you could use a GPS receiver. First, determine the coordinates of the destination point from the map and enter them into the receiver, then walk in the approximate direction of your destination, letting the receiver point you in the right direction as you go.

HINT: Check your map to determine if there are land features that may prevent you from following your GPS bearing

OR YOU CAN USE YOUR MAP AND COMPASS IN THIS WAY:

1 Before you start on your way, place the compass on the map so that the side edge of the baseplate connects your present position to your destination and the Direction of Travel Arrow is also pointing that way.



2 Turn the compass dial until the Orienting Lines are parallel with the grid north lines on the map and the Orienting Arrow is also pointing to grid north.

3

The dial's reading at the Index Line shows the grid bearing. Subtract the *Grid/Magnetic angle* from this bearing and turn the dial to show the new magnetic bearing at the Index Line.

4

Put the map aside. Hold the compass steady and level in front of you with the Direction of Travel Arrow pointing straight ahead. Turn your body until the red end of the Needle is directly over the Orienting Arrow, pointing to the "N" on the dial. The Direction of Travel Arrow now points to your destination. Look up, align the Direction of Travel Arrow with a feature and walk to it. Repeat this procedure until you reach your destination.

GLOSSARY

Bearing – geographic orientation of a line given as an angle measurement in degrees clockwise from true north.

Cartography – the art and science of producing maps, charts and other representations of spatial relationships.

Contour – a line drawn on a map joining all the points on the Earth that are the same height above mean sea level.

Coordinates – angular or linear values that designate the position of a point in a given datum or projection system.

Coordinates, geographic – a system of spherical coordinates commonly known as latitude and longitude.

Coordinates, grid – a plane-rectangular coordinate system expressed as eastings and northings.

Datum – a mathematical surface on which a mapping and coordinate system is based.

Elevation – the height above mean sea level.

Geocentric Datum – a datum which has its origin at the Earth's centre of mass. The advantage of the geocentric datum is its direct compatibility with satellite-based navigation systems.

Geographical coordinates – a position given in terms of latitude and longitude.

GPS – Global Positioning System – is a satellite based navigation system developed by the United States Department of Defense and widely used for civilian navigation and positioning.

GNSS – Global Navigation Satellite System

Graticule – a network of lines on a map or chart representing the parallels of latitude and meridians of longitude of the Earth.

Grid – two sets of parallel lines intersecting at right angles to form squares.

Grid convergence – the angular difference between Grid North and True North.

Grid coordinates – the equally spaced vertical and horizontal intersecting lines superimposed over the face of a map. One set of grid lines runs north-south, while the other runs west-east. The position of a point on the map is described as its distance east from a north-south line and its distance north of an east-west line.

Grid/magnetic (G-M) angle – the difference between grid north and magnetic north and is a positive value if magnetic north it is east of grid north and a negative value if it is west of true north.

Latitude – the latitude of a feature is its angular distance on a meridian, measured northwards or southwards from the Equator.

Longitude – an angular distance measured east or west along the equator from a reference meridian (Greenwich).

Magnetic north – the direction as indicated by a compass to the earth magnetic pole.

Map – a representation of the Earth's surface. A cadastral map is one showing the land subdivided into units of ownership; a topographic map is one showing the physical and superficial features as they appear on the ground; a thematic map displays a particular theme, such as vegetation or population density.

Map projection – any systematic way of representing the meridians and parallels of the Earth upon a plane surface.

Mercator projection – the conformal cylindrical projection tangential to the Equator, possessing the additional valuable property that all rhumb lines are represented by straight lines. Used extensively for hydrographic and aeronautical charts.

Meridian – an imaginary line from the North Pole to the South Pole connecting points of equal longitude.

NZGD49 – New Zealand Geodetic Datum 1949 - a local datum that was a best fit to the shape of the Earth in the New Zealand region. It has now been superseded by NZGD2000.

NZGD2000 – New Zealand Geodetic Datum 2000 – a geocentric datum based on a mathematical surface that best fits the shape of the Earth as a whole, with its origin at the Earth's centre of mass.

NZMG – New Zealand Map Grid – a conformal mapping projection adopted for New Zealand in 1973 with minimal scale error. Based on NZGD49.

NZTM2000 – New Zealand Transverse Mercator projection 2000 - a Transverse Mercator projection based on NZGD2000. The unit of measure is the metre.

Relief – the deviation of an area of the Earth's surface from a plane. It refers to the physical shape of the surface of the Earth.

Rhumb line – a curve on the surface of a sphere that cuts all meridians at the same angle; the path that maintains a constant true bearing.

Topography – description or representation on a map of the physical and cultural surface features.

Transverse Mercator (TM) projection – a conformal cylindrical map projection, originally devised by Gauss, also known as the Gauss-Kruger projection. As its name implies, its construction is on the same principle as the Mercator projection, the only difference being that the great circle of tangency is now any nominated meridian. Meridians and parallels are curved lines, except for the central meridian for a specified zone (meridian of tangency), which remains a straight line. The amount of scale distortion may become unacceptable at distances greater than about 1.5 degrees in longitude from the central meridian.

WGS84 – World Geodetic System 1984 – a geocentric geodetic datum developed by the United States Department of Defense for use with GPS. For most practical purposes, NZGD2000 is equivalent to WGS84.

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