MAP USING

TYPES OF MAPS

It is important to know the different map types and their uses in order to select the correct map for the task. Also, knowing how to fold and maintain these maps properly will keep them serviceable and in good condition.

PURPOSE OF A MAP

The purpose of a map is to pass on specific information. A map is a scale, or proportionately smaller, representation of the ground that uses internationally accepted symbols to represent both physical and manmade features found on the ground. They identify locations such as towns, lakes, and rivers by name. Map designs reflect the individual needs of the users (e.g. urban planners, travelers, education and cadets). The art and science of making maps is called cartography. The oldest known maps are preserved on Babylonian clay tablets from about 2300 B.C.

TOPOGRAPHICAL MAP

This type of map is commonly used by the military. The purpose of a topographical map is to present a picture of the ground as it really exists. Topographical maps show as much detail as the scale allows, generally 1:25 000, 1:50 000, or 1:250 000. Also;

- **Physical features** of the ground, (i.e. rivers, woods, and hills with the heights and shapes)
- **man-made features** (i.e. roads, railways, towns, villages and buildings etc.)
- **The names of specific features** such as towns, villages, rivers, and descriptive names of general features such as railways, fords and post offices are also found on topographical maps.

ORIENTEERING MAP

Through the International Orienteering Federation (IOF), specific rules and standards have been set for the production of orienteering maps, including colour, symbols, and scales. They are much more detailed than regular topographic maps, both with reference to vegetation and landforms.

STREET AND ROAD MAP

Street and road maps are designed to assist commuters and tourists to locate key site such as roads and highways, police stations, fire halls, hospitals, schools, parks and more.

RELIEF MAP

Relief maps are a three dimensional representation, usually of terrain. The terrain elevation is usually exaggerated by a factor between five and ten. This helps to visually recognise the terrain features.

DIGITAL MAP

Digital maps, such as those found on computer programs and when using a GPS, are useful as reference tools as they are updated regularly. This allows for a generally more accurate reference.

POLITICAL MAP

Political maps show countries, provinces or other political borders (e.g. globes and atlases).

STATISTICAL MAP

Statistical maps show statistical information such as the production levels of crops or minerals across a country.

OUTLINE MAP

Outline maps show only borders, rivers, coastlines, etc.

AIR PHOTO MAP

Air photomaps are actual pictures used in reconnaissance or to create many of the maps listed. Where local resources are available, the instructor may show actual copies of the above listed types of maps to cadets.

CARE OF THE MAP

Some maps being produced are already waterproof; however, most maps are printed on normal paper. Paper maps are expensive and easily damaged. You must take precautions to protect them from water, dirt and wind. Maps, when exposed to water, will become soggy, deteriorate and tear.

Waterproofing a Map.

Preparing a map for the elements is a vital step to prolong the life of the map. Ways to prepare a map for waterproofing include:

- **Zipper Bag Method.** This method requires a large heavy weight zipper bag and waterproof tape (duct or packing tape). Cut enough tape to completely adhere to one edge of the bag from corner to corner. Stick one half of the tape from corner to corner. Flip the bag over and fold the tape down on itself and the other side of the bag. Perform each step twice more to the other sides of the bag.
- **Contact Paper (Map Tac).** Covering the map with contact paper will waterproof the map; however, it will become very stiff. A permanent marker or grease pencil will be required to write on the map. Use rubbing alcohol to remove permanent marker from the contact paper.
- **Chemical Coatings.** Chemical coatings will be effective in waterproofing maps; however, they must be handled carefully in a well-ventilated area. They are applied with a brush, to a map on a flat surface, and must be allowed to fully dry before attempting to use them.

Drying a Map. If a map gets wet, let it dry completely on a flat clean surface.

Opening a Map. A map should never be fully opened in a strong wind. It should be opened to the area you are using, and refolded along the original fold lines.

Writing on a Map. Use only pencil to mark your maps and erase all markings gently. Maps that are protected by plastic can be marked using grease pencils or fine tipped markers.

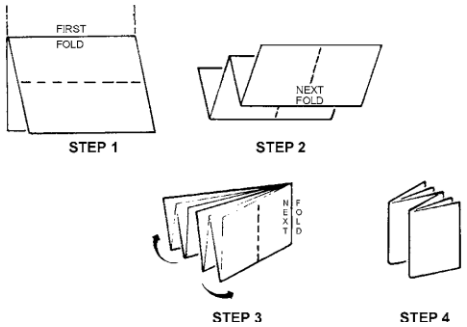
Storing a Map. Maps should be stored in a dry place, rolled, folded, or laid flat.
Instructors should demonstrate examples of waterproofed maps, as resources permit.

FOLDING A MAP

To properly fold a map, the following steps are to be followed:

1. Lay the map face up, then fold map in half by bringing the top (north) of the map sheet down to the bottom (south) of the map sheet. Crease where the bend in the map has occurred; this is the centre of the map

2. Fold the top half of the map sheet into half again, then turn the map over and fold the bottom half to match the top half
3. Fold the ends of the map into half from left to right
4. Fold each of the open ends back into half again so that the map name and index to adjacent map sheet appears on the outside



It is important to know the different map types and their uses, so that cadets can select the correct map for their needs. Also, knowing how to fold and maintain maps properly will keep them in good condition for a long time.

MARGINAL INFORMATION AND CONVENTIONAL SIGNS

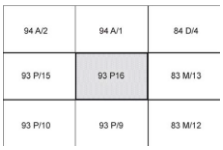
Cadets shall be able to identify features on the map as they relate to objects on the ground. The cadets will apply this knowledge during training where any type of map is to be used.

MARGINAL INFORMATION

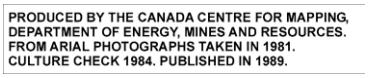
The margins provide information important to the full understanding and use of the map. Before using any unfamiliar map, it is important to have a good look at the information contained in its margins. The layout and contents of the marginal information should be in relatively the same area for all topographical maps. This information includes:

- **Name of Map Sheet.** For ease of reference the name of the map is usually a major community or district the map covers (you will find this at the bottom centre of the margin, as well as in the bottom right corner).

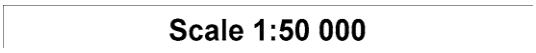
- **Number of the Map and Index of Adjoining Maps.** A diagram showing the position of the map sheet in relation to adjoining sheets is shown near the lower right hand margin. The diagram shows the sheet numbers of the adjoining sheets and accentuates the sheet in hand.



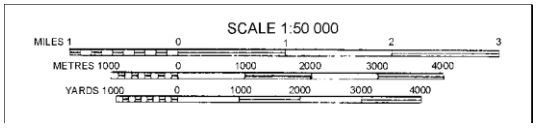
- **Date of Map Data.** Helps to indicate the amount of change that may have occurred since the map was printed (you will find it in the copyright information in the bottom left and right corners).



- **Map Scale.** The scale of the map, e.g. 1:50 000, is shown prominently in the bottom margin.



- **Scale Bars.** Used to help measure distance on the map (you will find them under the map scale, bottom centre). Notice how the left end of the scale bars is divided into tenths for measuring accurate distances.



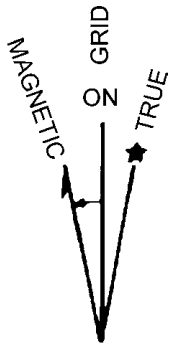
- **Contour Interval.** Used to indicate a set distance between the contour lines. The contour interval could be in feet or metres (you will find this in the bottom margin, just right of the scale bars).

CONTOUR INTERVAL 10 METRES
ELEVATIONS IN METRES ABOVE MEAN SEA LEVEL
NORTH AMERICAN DATUM 1927
TRANSVERSE MERCATOR PROJECTION

- **Military Index Number for Ordering This Map.** The index is found in the top right corner of the map sheet; used for ordering additional maps, and includes the following information:
  - Map series number, which identifies both the area and the scale of the map and the series number taken from the map catalogue.
  - Sheet numbers or name to identify the map (identity by sheet name is rare).
  - Edition designation (identifies the currency of the information shown on the map; the edition number will increase with each revision).

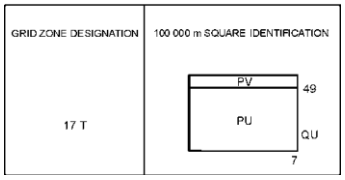
Military users, refer to this map as:	SERIES	A 751
	MAP	31 D/2
	EDITION	5 MCE

- **Declination Diagram.** Each map contains the information necessary to relate the true, grid, and magnetic bearing of any line within the area covered by the map sheet. This information is given in the form of a diagram with explanatory notes. The diagram is in the right side margin.



- **Universal Transverse Merecator (UTM) Grid System.** The UTM grid is divided into "zones", each covering six degrees of longitude and eight degrees of latitude. The 60 longitude bands are numbered and the 20 latitude bands are lettered. Each grid zone is one rectangle of the grid pattern, established by the bands and designated by the figures of the longitude band followed by the letter of latitude band (e.g. 17T).

ONE THOUSAND METRE
UNIVERSAL TRANSVERSE MERCATOR GRID
ZONE17



- **Conventional Signs.** A table showing the conventional signs used on the sheet in their correct colours with their descriptions is shown in the bottom or side margin, plus in a more complete list on the back of the map.

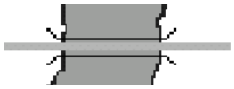
Conventional Signs

The information in this teaching point is presented to provide the instructor with background knowledge of conventional signs. The instructor may choose to review the information with the cadets prior to the commencement of the activity outlined below.
A number of symbols are used to indicate an object or item of detail that cannot be shown either by outline or by a line symbol. Most have been established through long usage and standardization agreements. The meaning of most symbols is obvious. If there is doubt however, consult the table of conventional symbols located on every map. Located on the back of most maps you will find many additional conventional signs.

Map reading not only involves the ability to interpret the symbols shown on the map and to understand the information given in pictorial or written form, but it also involves a true understanding of the ground portrayed and an appreciation of the reliability and value of the particular map being used. Where the symbol may have more than one meaning, the sign or symbol will be accompanied by a descriptive word (e.g. tank or tower). The use of different colours is a major means of showing and distinguishing detail of any or all types of detail.

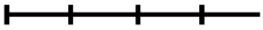
Man-made Features by Colour

- **Red** is used to identify paved roads and highway numbers. Red is also used to shade in areas of urban development.
- **Orange** is used to represent unpaved roads.
- **Black** is used for cultural features, toponyms (place names), some symbols and precise elevations.

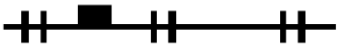


Tunnel

Road/Track



Railway (single track)



Railway (multiple track) with station

School

Fire Department

Police Station

Church

Buildings

Natural Features by Colour

- **Brown** is used for contour lines, contour elevations, spot elevations, sand, cliffs, and other geological features. Contours (dark) Cliff (dark) Sand (brown)
- **Blue** is used for water or permanent ice features (i.e., rivers, lakes, swamps and ice fields), names of water features and the grid lines.
- **Green,** which is used for vegetation features (i.e., woods, orchards and vineyards). Orchard (green)

Additional Features by Colour

- **Grey** is used for the legend of conventional signs on the back of the map.
- **Purple** is used for updates that are made over top of the original map information.

The information presented in this lesson will enable the cadet to identify features on the map as they relate to objects on the ground. The cadets will apply this knowledge during any training where any type of map is to be used.

CONTOUR LINES

This information allows the cadet to be able to identify features on the map as they relate to the shape and elevation of the ground. Cadets will apply this knowledge during training where any type of map is to be used. Knowing the shape of the ground will allow cadets to identify major landforms that may be nearby, thereby helping to identify their position on the map.

DEFINITION OF RELIEF ON A MAP

"Relief," or elevation, is the shape of the ground in a vertical plane. Relief on a map is the showing of the heights and shapes of the ground, above mean sea level, in feet or metres. There are two distinct elements in the representation of relief. These are:

- **Representation of Height.** This is a fact-based representation of the height of the land and of landforms. Differences in appearance on the map will arise from the type, density and accuracy of the information provided.
- **Representation of Shape.** This may be largely artistic, and the methods used will vary between maps.

CONTOUR LINES AND INTERVALS

A contour is a line on the map joining points of equal elevation in relationship to sea level, and is the standard method of showing relief on topographical maps. Contours are shown at a regular vertical interval (difference in height between contours lines) that is called the contour interval. The contour interval is always stated in the margin of the map, normally near the graphic scales. Contours are normally drawn as continuous brown lines. Every fourth or fifth contour is called an "Index Contour" and is shown by a thicker brown line; this helps in reading and counting the contours to determine a height.

INTERPRETING CONTOUR LINES

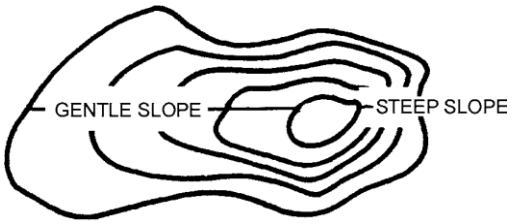
Interpreting contour lines provides a visualization of the shape of the ground, which is shown on the map by contour lines and contour intervals. Correct interpretation of the shape of the ground from contour lines requires practice and practical experience on the ground. It is essential to study various features, comparing the map to the ground in each case.

SLOPES

The distance between contour lines on the map will indicate to you the type of slope on the ground.

Steep Slope. When the contour lines are spaced closely together there is less distance to travel to gain or lose elevation

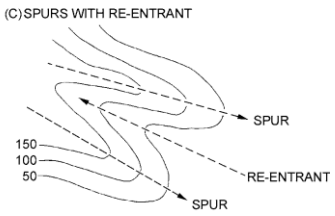
Gentle Slope. When the contour lines are further apart there is a greater distance to travel to gain or lose elevation



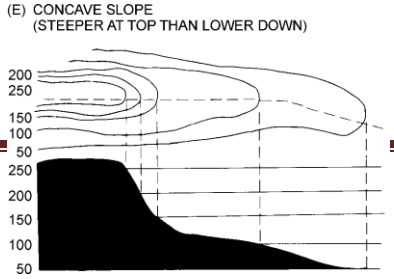
Uniform Slope. When the contours are an equal distance apart. The slope remains constant in its decline, whether steep or gentle

Spurs. A contour feature that extends out from a slope

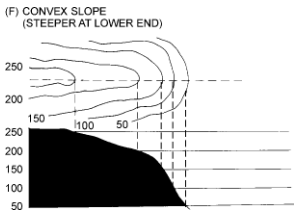
Re-entrants. A contour feature that cuts back into a slope



Concave Slope. When the spacing of the contours gets further apart at the bottom. The middle of the slope seems to depress inward – appearing concave



Convex Slope. When the spacing of contours down a slope gets close together at the bottom. The middle of the slope seems to bulge outward – appearing convex



ORIENTING A MAP

Orienting a map by inspection makes it easy to relate information on the map to features on the ground. It is important to have the map oriented when moving over a complex route in order to reach your destination.

ORIENT A MAP BY INSPECTION

Orienting a map by inspection means to turn the map so that, visually, the map directions and map detail correspond with that which is on the ground. This is the simplest and quickest way of orienting a map, provided you have a general idea of your own position. Orienting the map does a number of things:

- it makes it easy to relate the map to the ground when direction and distance on the map corresponds to the ground;
- it helps you find your location or direction if you are in doubt; and
- when moving over a complex route, or when traveling over long distances, orienting the map will keep you on the right track.

ORIENT A MAP

In order to orient your map by inspection the following steps should be followed:

1. identify your approximate location on the map;
2. identify two or three prominent objects or landmarks on the ground and find them on the map. Try to use landmarks in different directions;
3. rotate your map until all identified objects on the map line-up with the direction in which objects are located on the ground; and
4. check visually to ensure that all features to your front are in front of your position on the map.

GRID REFERENCE

As an army cadet it is important to know how to use the grid system. Since the grid system is the basis of map reading, the concept of a four-figure and six-figure GR will be a stepping stone to becoming a strong map-reader. A GR details the location of a grid square on a map, and prevents confusion about location. Communication about exact locations over the radio is made possible with an understanding of a GR.

USE OF GRID SYSTEM

The grid system is a rectangular network of intersecting vertical and horizontal blue lines superimposed on a topographical map. Maps are normally printed so that north is at the top of the sheet when the writing is the right way up. The lines of the grid system are drawn evenly spaced so that one set of lines run north to south (vertically) and the second set of

lines run east to west (horizontally). These lines are assigned a sequential number starting in the bottom left corner. The intersecting grid lines at the lower left corner designate a grid square.

EASTINGS

Because the vertical lines are numbered from east to west, they are called **eastings**. Eastings are a series of parallel lines plotted as an overlay to the map sheet, with a two-digit number at the top and bottom end of each line in the margins.

NORTHINGS

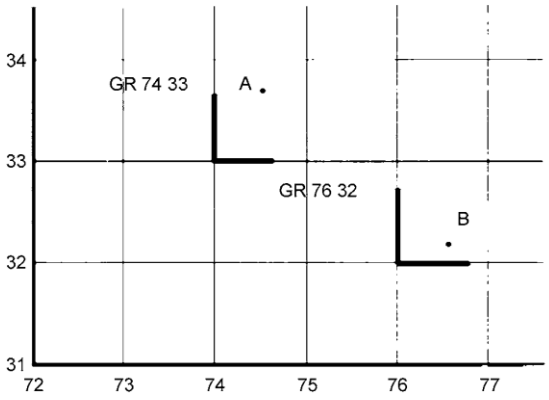
Because the horizontal lines are numbered from the equator toward the north, they are called **northings**. Northings are a series of parallel lines plotted as an overlay to the map sheet, with a two-digit number at the left and right end of each line in the margins. The most southerly point of Canada is Middle Island in Lake Erie, approximately 4 620 000 metres from the equator at latitude 41° 41’ north.

GRID REFERENCE

The military traditionally identify grid lines by stating the two-digit number of each grid line. When a location is identified using the grid system it is call a “Grid Reference” (GR). When giving a GR to a square, the reference is always to the southwest (bottom left) corner of the square. GRs are always given with the easting value first, followed by the northing value.

FOUR-FIGURE GR

A four-figure GR is used to identify a specific 1000 metre by 1000 metres grid square. It will have four numerical digits derived from the numbers assigned to the eastings on the X-axis, and the northings on the Y-axis, where the grid lines intersect at the bottom left corner of the grid square.

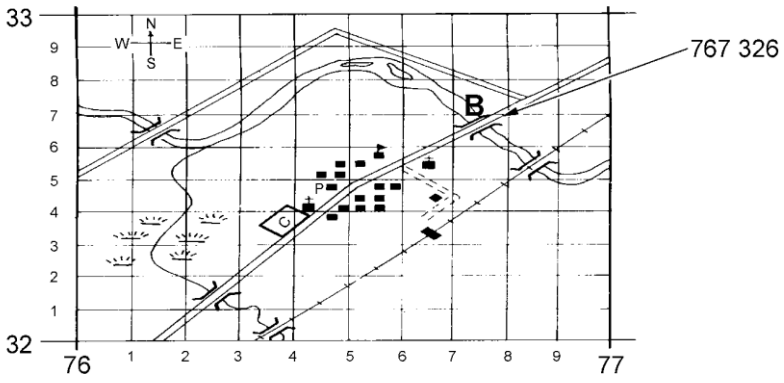


ACCURACY OF A GRID REFERENCE

The accuracy of a four-figure GR on a map sheet with a 1:50 000 scale is 1000 metres. When a more precise location is required, a six-figure GR is used which is accurate to 100 metres.

SIX-FIGURE GR

A six-figure GR is used to determine a more accurate location within a specific grid square. It is necessary to break up the grid square shown on the map into 100 subdivisions (10 in each direction). By creating an imaginary grid inside a grid square, we can use the same principles of the four-figure grid reference to make a more accurate



statement of location. The diagram shows the detail within the square 7632, which contains Point “B”, a bridge. The centre point of this bridge is in the small square whose southwest corner is 7/10 east of easting 76, and also 6/10 north of northing 32. Its easting is thus 76.7 and its northing 32.6 units. Omitting the decimal points, the GR is thus written as 767326.

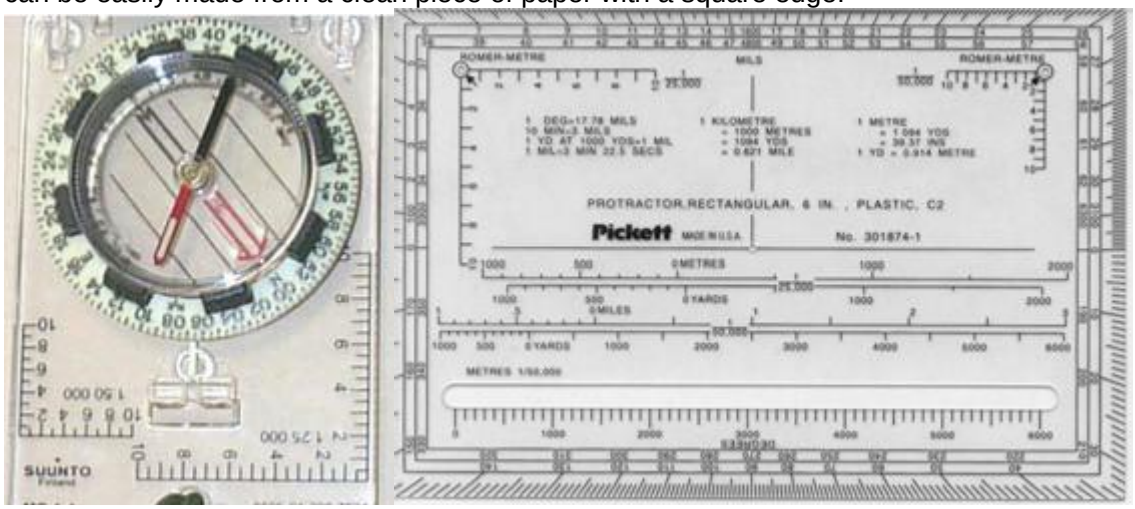
Each small easting and northing is numbered 1 to 9, from west to east and from south to north respectively. This imaginary grid inside a square can be estimated, or you can measure accurately using a tool called a “romer”.

ROMER

A romer is used to accurately measure a six-figure GR. Using a romer provides a more accurate GR, and can be used in place of estimating.

TYPES OF ROMERS

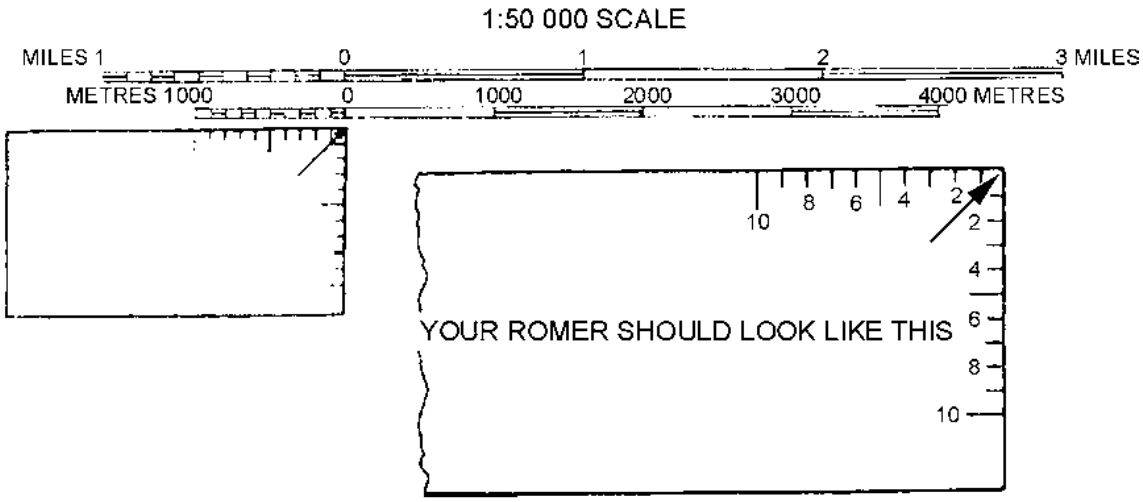
Romers for 1:25 000 and 1:50 000 scales in metres are included on the base plate of the compass and are also found on the Protractor C2. If these romers are not available, one can be easily made from a clean piece of paper with a square edge.



CONSTRUCT A ROMER

A romer can be easily constructed for determining a six-figure GR:

- select a clean piece of paper with a square edge;
- starting at the corner of the GR, place the paper along the 100 m map scale;
- mark off 10 equal sub-divisions, starting at the corner and working outward;
- number the markings from zero (at the corner of the paper) to 10; and
- repeat the first four steps on the adjacent edge of the corner of paper.



DETERMINE A SIX-FIGURE GR

A six-figure grid reference can be determined using a constructed romer by following these steps:

1. place the corner of the constructed romer on the grid square;
2. move the constructed romer IN the number of tenths required to align the romer directly below the conventional sign, or the location for which the GR is being determined;
3. move the constructed romer UP the number of tenths required for the corner of the romer to be positioned on the conventional sign, or location for which the GR is being determined;
4. read the value along the X-axis of the romer where it crosses the easting of the grid square (the value at this intersection becomes the third digit of the six-figure GR); and
5. read the value along the Y-axis of the romer where it crosses the northing of the grid square (the value at this intersection become the sixth digit if the six-figure GR).

When completing Point d and e above, ensure cadets are aware that they will always round down to the closest third digit. Grid references should be written in the format GR XXX/ XXX to help illustrate how the first half of the GR relates to the Easting and the second half relates to the Northing.