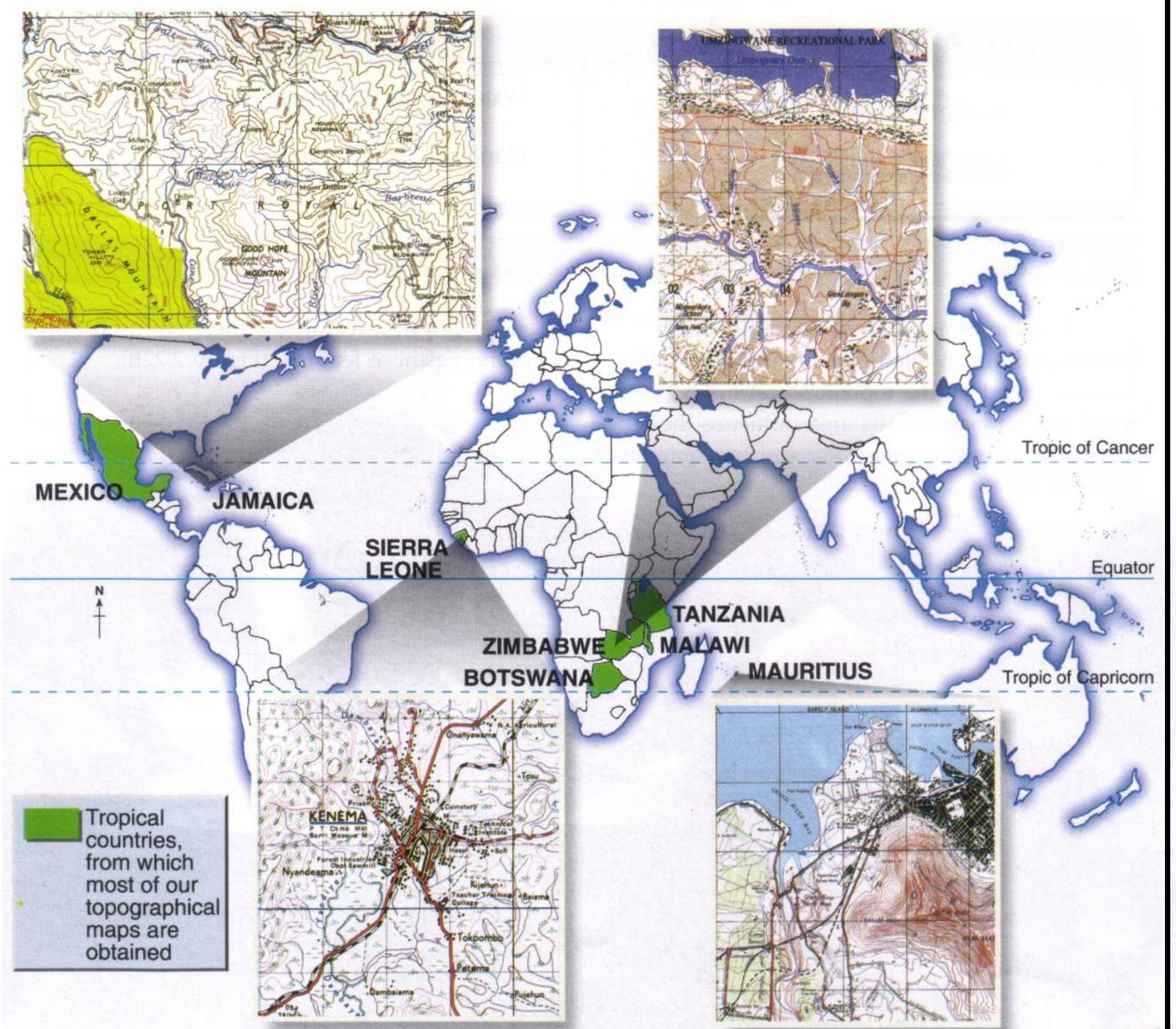
Map reading notes

Introduction

In the course of 2 or 3 years course, Candidates will be exposed to **topographical** maps from **tropical countries** such as Mauritius, Tanzania, Zimbabwe and Jamaica. Many of the topographical maps of these developing countries show landscapes which are basically ***rural*** with some urban settlements in the making.



Why use topographical maps for Geo Elective Map Reading?

- ✓ It is a large-scale map covering a specific area of land on the Earth's surface.
- ✓ It is a very useful kind of map that shows the **topography** of an area, i.e whether it is flat, undulating, rugged or mountainous
- ✓ on the map, variations in **contour** patterns, various shades of **colour**, use of different **symbols** and **abbreviations** help us interpret the landscape and land use fairly accurately.

The Singapore teachers do not know the map which the Cambridge setters will use for the setting of the 'N'/ 'O' level Geography Elective Map Reading questions. However, in the course of preparing you for exams, we will use the commonly used maps used by the Cambridge to expose you to different types of questions and different map reading skills.

By the end of 2 or 3 years, we will have completed the whole booklet. By then, you will be expected to be an expert for map reading.

Please refer to Annex 1 for the list of skills that you have to master at the end of 2 or 3 years.

Elective Geography paper is a very **skill-based paper**.

The map reading questions carry **10** marks and found in Section A. It is compulsory. There will be at most 5 parts to this compulsory structured question.

1. Basic map reading skills notes (Revision)

- The below basic map reading skills are essential in answering map reading questions.
- The hands-on will be covered during your map reading practice session.
- Mastering basic map reading skills will allow us to **extract relevant information from the map** (under the assessment objectives)

All topographical maps must bear the following essentials:

- a **title** to tell which area is mapped
- a **scale** which is given as a ratio, or in words or as a line scale
- a **legend** (reference) to show what the symbol represent and what the abbreviations are
- **grid lines** for finding locations on the map.
- **Compass directions** which shows the north point

Elements of a map

Title	Grid lines	Symbols	Legends	Scale	North arrow

Functions of each elements

Identifies the area mapped	For locating places	Represent human and physical features	Indicates what the symbols represent	For converting map distance into ground distance	For measurement of direction

All elements of a map are essential for reading and interpreting maps

(a) Using Legend

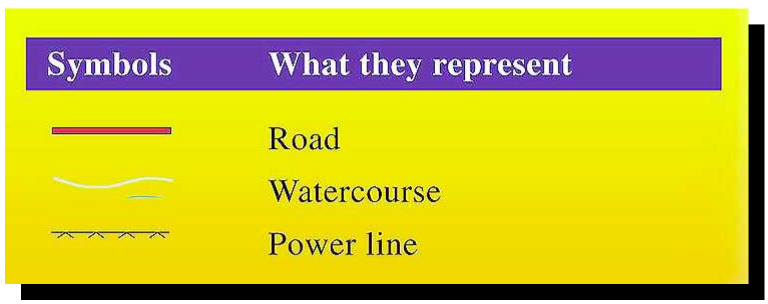
- ✓ The legend of a topographical map is also called the key or references.
- ✓ The legend of a topographical map is made up of **symbols**.
- ✓ Symbols are used on maps to represent all kinds of **human and natural features**.
- ✓ Symbols are drawn **small** and carry fairly similar **likeness** of what they represent.
- ✓ Most symbols cover a wide range of **geographical features** such as physical features, natural vegetation and transport lines.

REMEMBER: **Symbols are the easiest to read because all you have to do is to look at the legend given.**

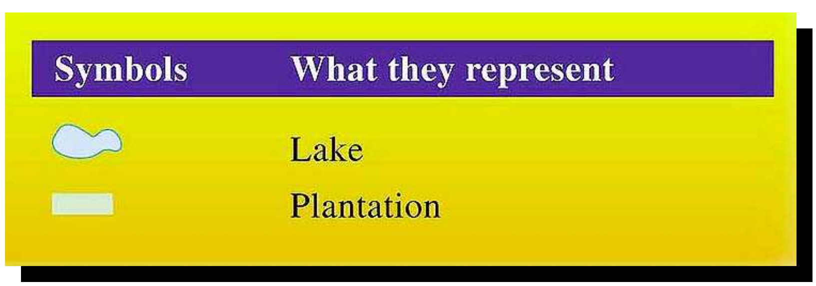
There are five types of map symbols:

- **Point symbols.** These represent point-like features such as houses, dams and mountain peaks.

- **Line symbols.** These represent features that occur in lines such as roads, railways and rivers. Different colours are often used to distinguish between them.



- **Area symbols.** These represent features that cover large areas and are identified with shading or colouring. Examples are forests, orchards and built-up areas of towns and cities. Often a solid colour is used, such as green to show national parks. In other cases a combination of colours and symbols may be used, such as blue dots with a solid blue outline to show a seasonal lake.



- **Abbreviations.** This may appear beside other symbols to explain what they are or on their own. They are employed to indicate types of buildings based on their **functions**.

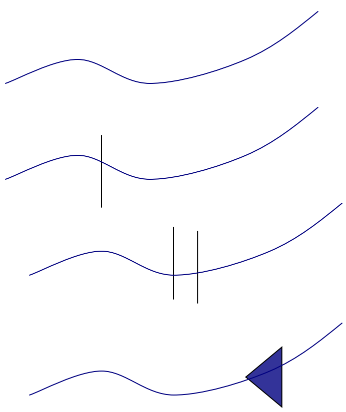
Symbols	What they represent
Resr	Reservoir
Mos	Mosque
H	Hotel

- **Colour.** This brings out the relief and features even more vividly. Common colours are blue for water features (rivers, lakes and seas), brown for landscape features, green for vegetation, and black for railways and buildings or red for main roads.

<u>Common mistakes of locating features from the legend</u>

✓ Candidates choose the wrong feature(s) because there are more than 1 feature attached in one symbol.

✓ **From this symbol, Candidates are supposed to deduce that,**



Watercourse

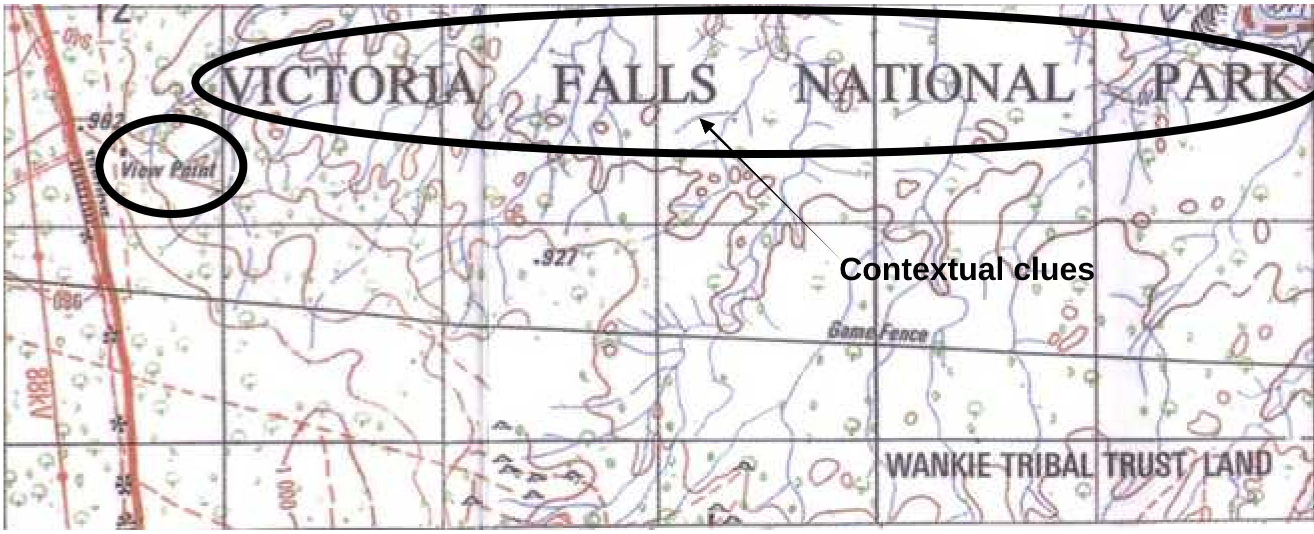
Waterfall

Rapids

Dam

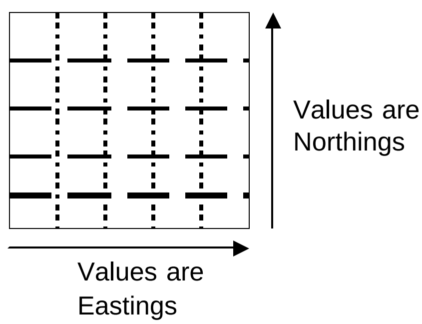
✓ Candidates often stumbled when asked to locate features that are not found on the legend.
✓ E.g. Refer to map 8 question 1,

State the six-figure grid reference of the **view point** **<u>overlooking the Victoria Falls National Park</u>** in the southwest portion of the map. [1]



- o For such feature (e.g. viewpoint), Candidates should pay close attention to the contextual clues from the question.
- o In this case, the contextual clue is overlooking Victoria Falls National Park.
  - ▪ This will mean that the feature is located near Victoria Falls National Park.

(b) Using Grid References



- ✓ Grid lines are used to locate features on a topographical map.
- ✓ The vertical and horizontal grid lines are numbered from the origin found at the south-west of the map.

- ✓ The vertical grid lines as represented by the dotted lines are known as ***eastings***.

<u>Properties of eastings</u>

- ✓ Their values increase eastwards.
- ✓ Their **values** are shown on the top and bottom edges on the map.

- ✓ The horizontal grid lines as represented by the long dashes are known as ***northings***.

<u>Properties of northings</u>

- ✓ Their values increase northwards.
- ✓ Their values are shown on the left and right edges on the map.

Note:

- ✓ There is a tendency to confuse eastings with northings.
  - o Reason: Visually, the eastings, being vertical lines tend to create the impression of pointing northwards. Hence, they are often mistaken for northings.

- ✓ The intersection of an easting and a northing gives the grid reference.

- ✓ There are 4 figure grid reference and 6 figure grid reference.

- ✓ To obtain the grid reference, the easting is read first followed by the northing.

- ✓ A ***4*** figure grid reference gives a **grid square**.

Finding 4 figure grid references

- ✓ It is used for general purpose.
- ✓ Always begin from the eastings, followed by the northings.

Steps:

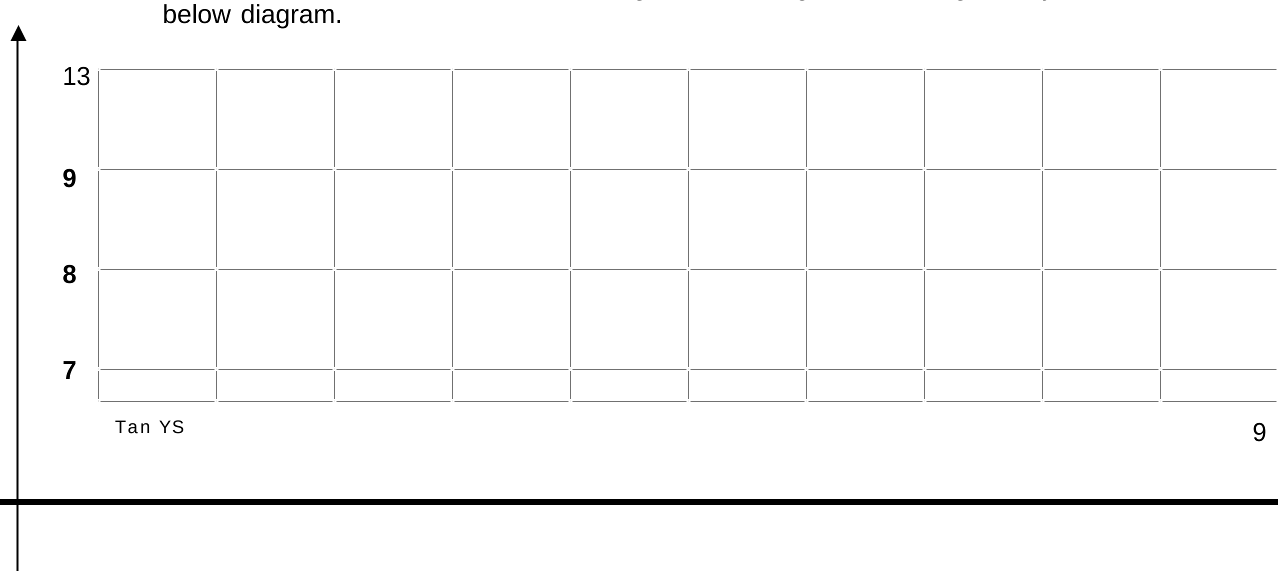
1. Locate the grid square of the particular feature to be found.
2. Read the easting for the south-west of the grid square.
3. Read the northing for the south-west of the grid square.
4. Simply write the two numbers together, with the easting first.

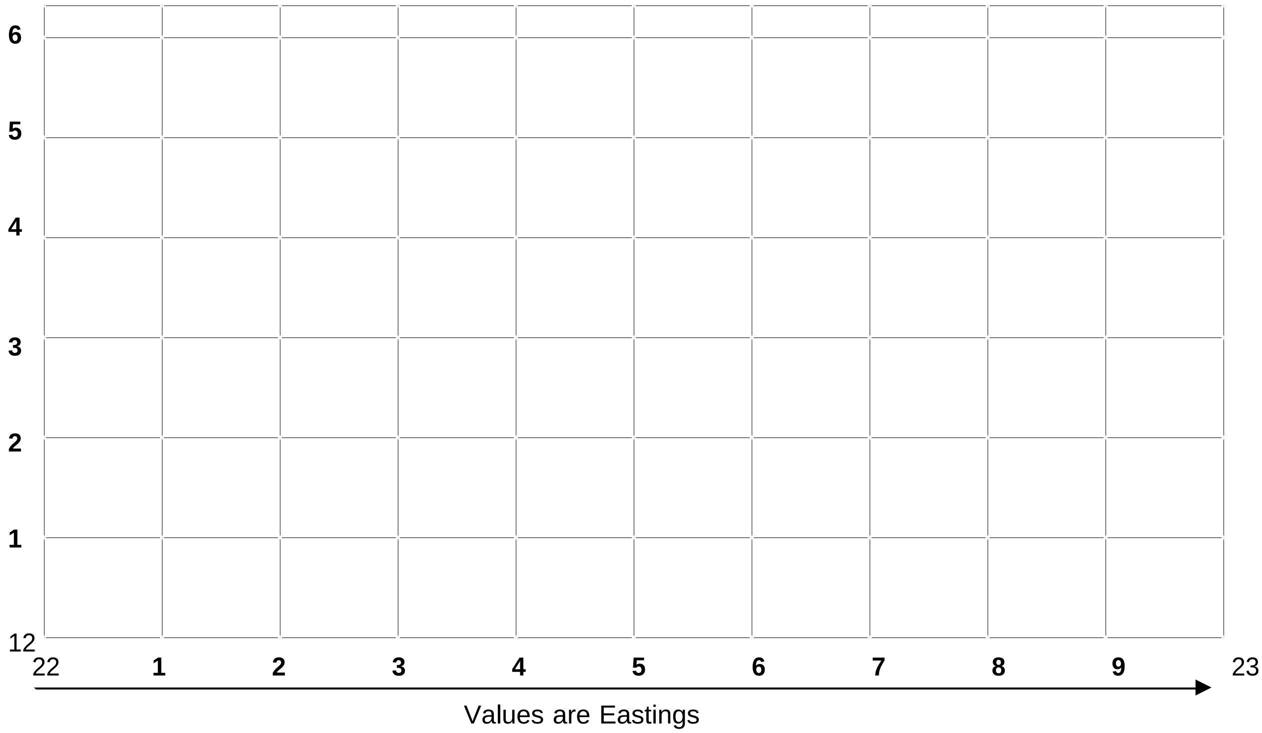
Finding 6 figure grid references

- ✓ It is used for precise locations
- ✓ It pinpoints actual location by involving the **subdivision** of the eastings and northings reference into **10** imaginary lines.
- ✓ Each tiny square represents 1/100 of the original big (grid) square.

Steps:

1. Locate the grid square of the particular feature to be found.
2. Divide the grid square into 10 equal parts along both the northings and eastings.
3. Number these divisions from 0 to 9 along both northings and eastings. They are bold in the below diagram.





4. Mark the **southwest corner** of the feature that you are locating.
5. **Estimate** how far the feature is from the easting first using the scale in tenths.
6. **Estimate** how far the feature is from the northing using the scale in tenths.
7. Write the value for the easting followed by the northing.

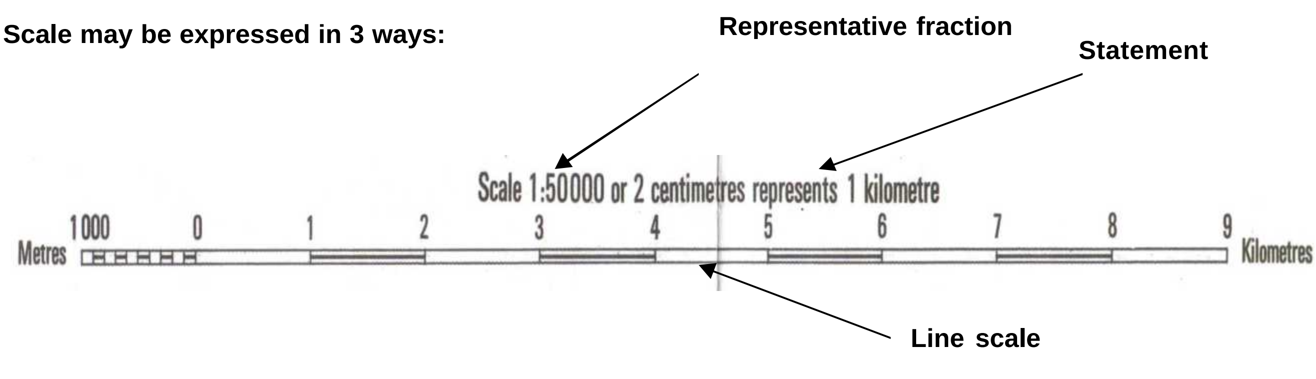
Note:

- ✓ The third number is part of the easting and the sixth number is part of the northing. These numbers refer to the small squares in tenths.
- ✓ Accuracy of 6 figure grid reference depends on subdiving the parts equally and ensuring that the (dotted) lines are parallel to the grid lines.

(c) Scales

- ✓ The scale is **ratio** of a given distance on a map to the corresponding distance on the ground
- ✓ Scales allow you to work out distances between places; how large towns, lakes and forests are; and what the size of the map area is.

Scale may be expressed in 3 ways:



- ✓ As a **statement**.

  E.g. One centimetre on a map represents 100 000 centimetres on the actual ground *or* One centimetre on a map represents one kilometre on the actual ground.

- ✓ As a **ratio or representative fraction**. For example: 1:100 000.
- ✓ As a **line scale**.

Reading a line scale

- ✓ A line scale is shown as a graduated line.
- ✓ From the right of the zero mark, the line is divided into whole units (km).
- ✓ From the left of the zero mark, 1 whole unit (km) is subdivided into 5 sections, with each representing 200 m. The section nearest to the zero mark is 200 m while the furthest is 1,000 m.

Pointer to note about line scale

- ✓ Candidates have to realise that the line scale does vary from different topographical maps.

Zvishavane's topographical map line scale

Victoria Falls's topographical map line scale

From the above line scales,

Candidates should observe that the subdivision of the line scale found on the extreme left side of the line scale is different from the 2 maps.

However, the subunits with each representing 200 m are the same.

Conversion Table:

1 m = 100 cm 1km = 1000 m

E.g. 2 cm on the map represents 1 km on the actual ground.

Steps:

2 cm: 1 km

2 cm: 100,000 cm (convert to the same unit)

1 cm : 50,000 cm (Divide both sides by 2)

1: 50,000 (Eliminate the units)

Common mistake involving statement scale

- ✓ Candidates often represent scale in a statement by writing 1 cm represents 1 km or 1000m or 100, 000 cm. **This is mathematically incorrect!!!!**

Additional points to note

- ✓ A scale of 1:50,000 means that 1 cm on the map represents 50,000 cm or (0.5 km) on the ground.
    - 1:25 000 means 1 cm represents 0.25 km or 250 m
    - 1:100 000 means 1 cm represents 1 km or 1000 m
- ✓ When asked to redraw a given map extract to a different scale, you need to determine what the new scale is. [Refer to O level Nov 2003 Geography Elective paper Q1(a)]
- ✓ E.g. For a scale of 1cm representing 0.5 km (1: 50,000) ,
    - ***Half*** the scale is 1 cm representing 1 km (1: 100,000)
    - ***Twice*** the scale is 1cm representing 0.25 km (1: 25,000)
- ✓ The terms 'large scale' and 'small scale' often confuse people. It is wrong to think that a large-scale map covers a large area and a small-scale map covers a small area.
    - In fact, a map scale of 1:100 000 is smaller than a map scale of 1:50 000.
    - This is because scale is the ratio of the size of the feature as it appears on a map compared with its actual size.
    - A topographical map with a large scale will show far **more** details than a topographical map with a **small** scale.

After acquiring the knowledge of scales, we can measure **distances** from the map.

Straight line distances

- Straight-line distances are measured using a ruler.
- The distance measured on the map is then read off the given line scale or Representative Fraction.

Steps:

To measure the straight-line distance between two points on a map,

- ✓ Place a ruler against the two points
- ✓ Mark the distance of the two points on the ruler
- ✓ Place the ruler against the line scale to check the actual distance on the earth's surface (ground)

Curved-line distances

- ✓ Curved distances can be measured using a piece of thread / string.
- ✓ The distance measured is then placed along the given line scale or Representative Fraction to obtain the correct actual distance.

Steps:

To measure a curved distance between two points on a map,

- ✓ Place one end of the string on the start point.
- ✓ Use it to follow the curved distance closely.
- ✓ Mark a mark on the string at the end of the curved distance.
- ✓ Straighten the string and place it against the line scale.

Alternatively, to measure actual distance on the ground is to use Representative Fraction, be it curved or straight line distance.

E.g. If the distance measured on the map is 4 centimetres and the map has a scale of 1:50,000, then the actual distance on the ground is 4 x 50,000 = 200,000 cm or 2 km.

<u>How to read the distance using line scale?</u>

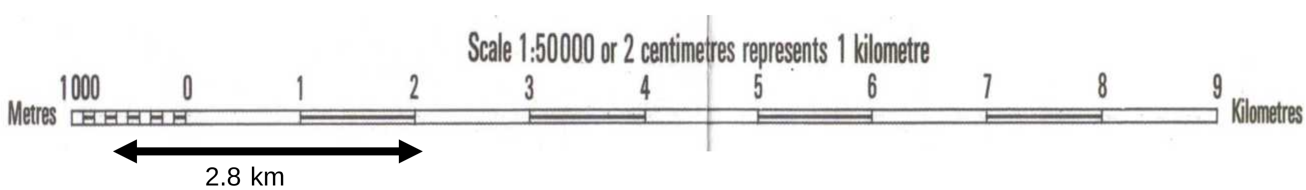
Steps:

To read a curved/ straight distance between two points [AB] on a line scale,

- ✓ Place the measured distance AB against the line scale.
- ✓ Do not place AB starting from the zero mark.
  - o Instead, place the end of point B on a whole number scale.
  - o Then, place the remaining end that must be less than **<u>1cm on the map</u>** on point 0 (zero) to read the subdivision of the whole unit.

For instance, the distance of AB is measured by a string as shown below.

- ✓ Then, straighten the string. 



(d) Directions and Bearings

Directions

- ✓ Directions can be indicated in terms of compass points.
- ✓ On a topographical map, the key compass direction, North, is always given.
- ✓ From there, we can **estimate** all the other 3 cardinal points are South (S), east (E) and West (W).
- ✓ Between each of these 4 main cardinal points is a sub cardinal point – North East **(NE)**, South East (**SE**), North West (**NW)** and South West (**SW**)
  - o These sub cardinal points **begin** with **<u>North</u>** or **<u>South</u>** and **end** with **<u>East</u>** or **<u>West</u>**.

- ✓ Between these 4 sub cardinal points are 8 other subsidiary points – North North East (NNE), East North East (ENE), East South East (ESE), South South East (SSE), South South West (SSW), West South West (WSW), West North West (WNW) and North North West (NNW).
  - o The subsidiary points **begin** with **4 basic cardinal points** and **end** with **4 sub cardinal points**.

Summary of directions

Directions

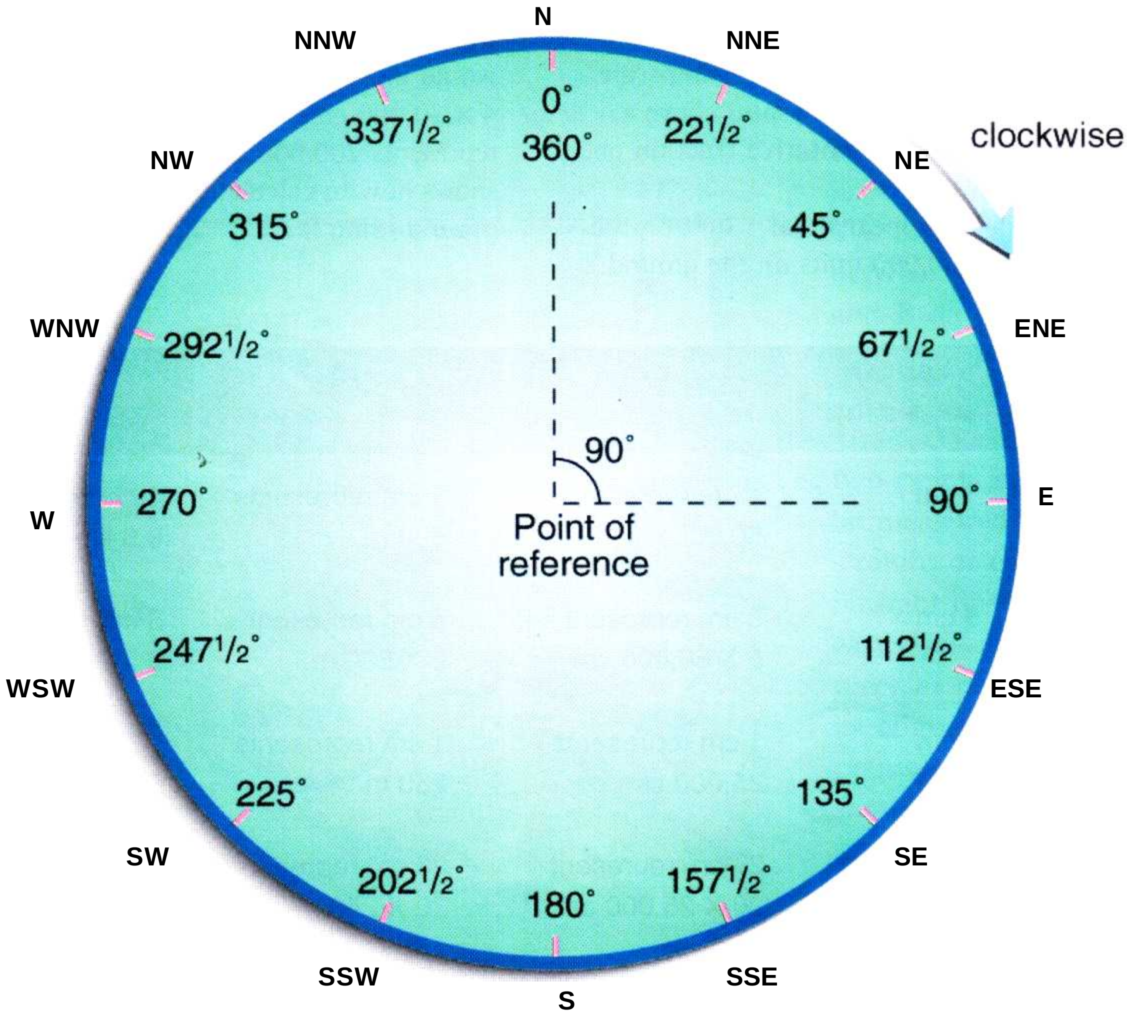
4 Cardinal points
(N, S, E, W)

4 sub- Cardinal points
(NE, NW, SE, SW)

8 subsidiary points
- **Begin with 4 cardinal points**
- **End with 4 sub-cardinal points**

(NNE, ENE, ESE, SSE, SSW, WSW, WNW, NNW)

- ✓ Cardinal points are shown by the directional indicator.
- ✓ In many cases, directions are only **approximation.**
- ✓ Each of these compass directions has an equivalent compass bearing.
  - o E.g. North East is 45°, North North East is 22½ °.
- ✓ On a topographical map, a required location is always given from the **observer's point of view**.
  - o This is indicated by the word **'from/ of '** used in the map reading question



Measuring Directions

Steps:

To measure the direction of one feature or place [A] ***from*** another [B],

- ✓ Draw a straight-line connecting them [A and B].
- ✓ At [B], draw a vertical line that is parallel to the eastings of the map. This line indicates north.
- ✓ Look at [B] and use the 16 point compass to describe the position of [B] from [A].

Bearings

- ✓ It is measured in **angular** directions marked on a magnetic compass
- ✓ It is measured **clockwise** from 0° to 360°, i.e. a complete circle
- ✓ It is expressed in **degrees**.
- ✓ It is always measured from **grid north** – referred to as grid bearings
- ✓ Bearings are compass directions and they have the advantage of being able to give an exact direction of one place or feature from another.

Measuring Bearings

- ✓ It is always taken from one point to another- from the **observer** to the **object**.

- ✓ A **protractor** is used to calculate the actual angle or bearing observed

Steps:

To measure the bearing of one feature or place [A] ***from*** another [B],

For bearings less than 180^o,

- ✓ Draw a straight-line connecting them [A and B].
- ✓ Place the centre of a protractor over the first point [B]. The 0^o on the protractor must point to the north.
- ✓ Read the bearing off the protractor where the line you have drawn cuts its outer edge.

For bearings more than 180^o,

- ✓ Draw a straight-line connecting them [A and B].
- ✓ Place the centre of a protractor over the first point [B]. The 180^o of the protractor must be pointing to the north.
- ✓ Read the bearing off the protractor where the line you have drawn cuts its outer edge.
- ✓ Remember to add 180^o to the get the bearing of [A] from [B].

Common mistakes:

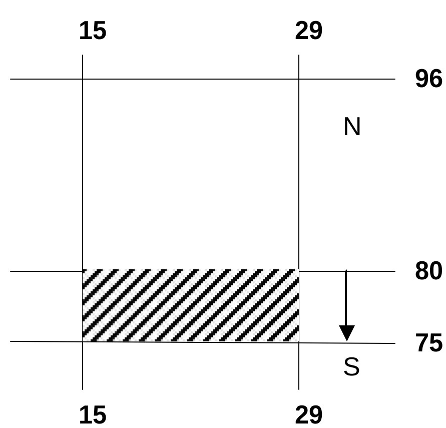
- ✓ Students often stumbled on which **direction** to decide especially to make decisions between North East and North North East, etc when it is asked in map reading questions.
  - One possible solution is to find the **bearing** instead of the direction first.
- ✓ Students should avoid using short forms in direction like NE to represent North East.

E.g. In order to make a rationale choice, do note that

- ✓ For answer that involves North North East, the bearing is less than $22½^o$.
- ✓ For answer that involves North East, the bearing is more than $22½^o$ but less than 45^o.

NB: Directions are used to locate the **boundary** where a feature is found.

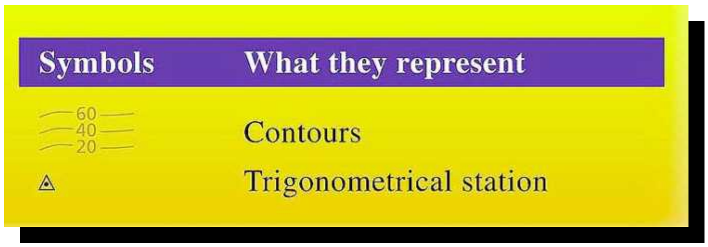
E.g. Explain the distribution of the agricultural activities **south** of northing 80.



Given that a topographical map has a range of northings between 75 and 96 and a range of eastings between 15 and 29, candidates should explain the distribution of the agricultural activities bounded between northings 75 and 80 and eastings 15 and 29. This is represented by the shaded region.

(e) Heights

- ✓ Heights of relief features are shown on a map through:
  - o Contours
  - o Spot heights, trigonometrical station and benchmarks.



- ✓ The unit of measurement given in the legend of the map is usually in **<u>metres</u>**.

Contours

<u>Basic concepts on contours</u>

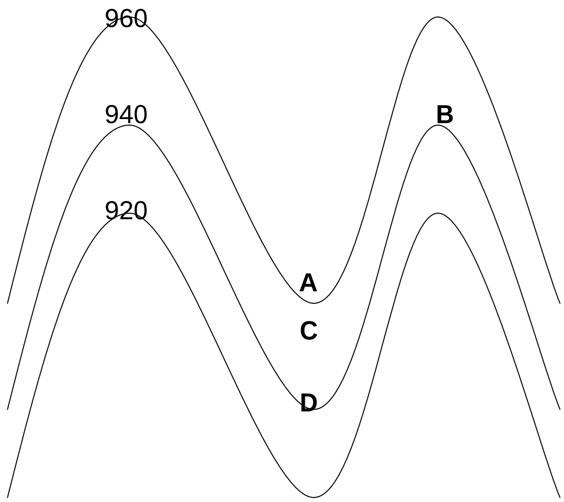
- ✓ A contour is a line that joins places of the same height above sea level.
- ✓ It is represented in **brown** lines on the topographical maps.
- ✓ The **<u>height</u>** of the contour is indicated on each contour line.
- ✓ The difference between one contour line and the next is called contour interval.
- ✓ If only certain contours are numbered, you have to find how many contours lie between the numbered contours and work out the contour interval.
- ✓ A contour interval is given on the legend on the topographical maps.
- ✓ From the below legend, it can be deduced that the contour interval is 20m.

- ✓ Note: It is possible for two sets of contour intervals to be used, one for contours below a certain height and one of those above a certain height.
- ✓ The height of a point can be given accurately only if it lies on a contour line. If not, we will have to use approximation.
- ✓ The height of a feature between two neighbouring contours is estimation. If it is halfway between one contour numbered 50 m and another numbered 100 m, its height is 75m.

<u>Some pointers to note:</u>

- ✓ Contour lines can be confusing to the untrained eye. Thus, trace the contours carefully.

Example:



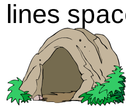
From the above contours, Candidates should deduce that point

- A is 960 m.
- B and D are 940 m.
- C is approximately 950 m.
    - Reason: It is in between point A and D.

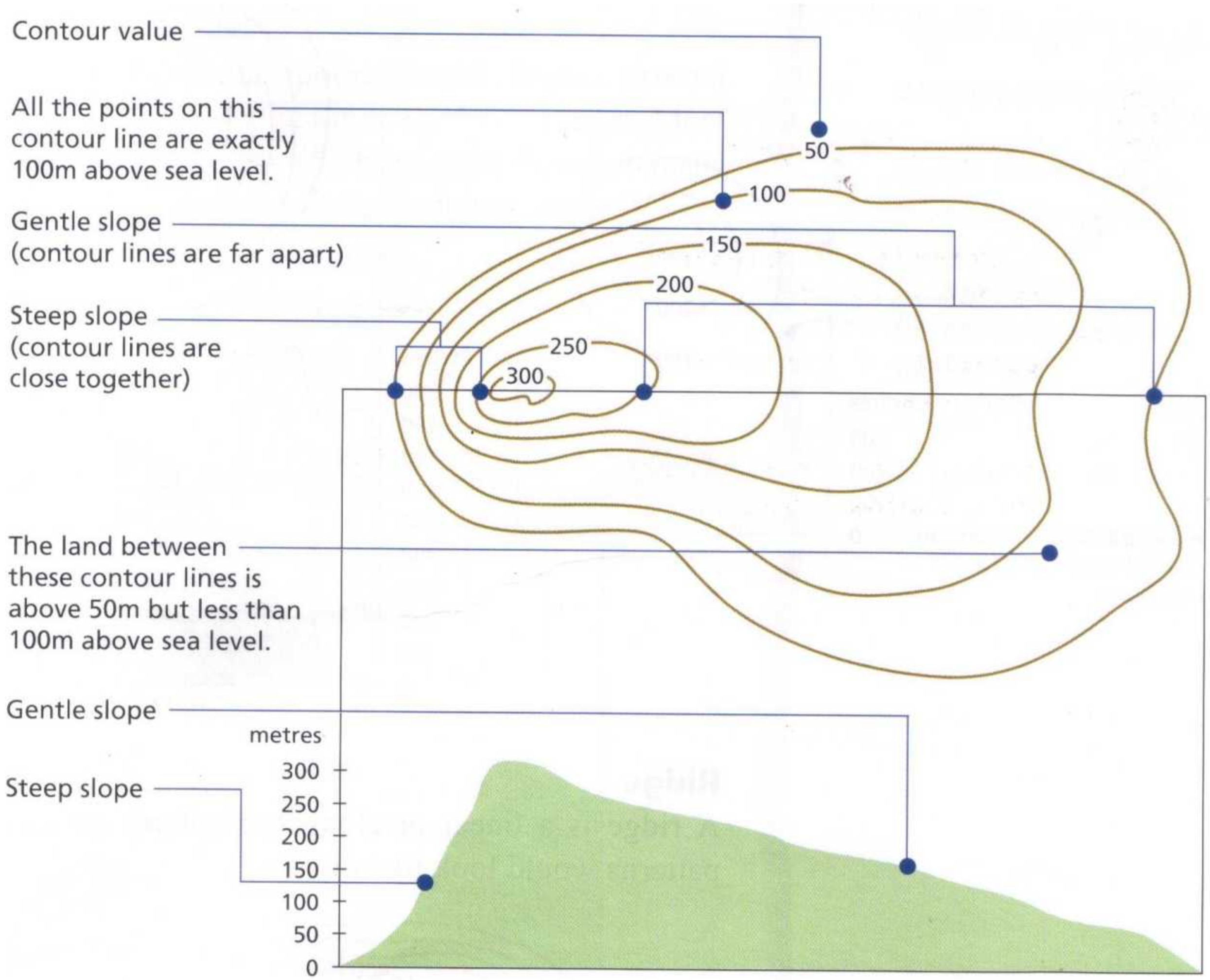
✓ Contour lines do not cross one another, but they may be so close together that they almost merge into one.

<u>Uses of contours</u>

1.1 The **<u>spacing</u>** (density) of the contours indicates the **slope (gradient)** of the land.

- Contour lines that are close together denote steep slopes.
- Contour lines that are far apart denote gentle slopes.
- When there are no contour lines, it means the land is almost flat.
- When the contour lines spaced <u>further apart</u> as the height of the slope <u>increases</u>, the slope is *convex*.
    - From low altitude to high altitude : Steep → Gentle
- When the contour lines spaced <u>closer together</u> as the height of the slope <u>increases</u>, the slope is *con**<u>cave</u>***.  (broad spacing → narrow spacing)
    - From low altitude to high altitude : Gentle→ Steep

1.2 Each feature or **landform** is represented by a specific **<u>pattern</u>** of contour lines.



Trigonometrical station △ **630**

- ✓ It is represented on a map by a triangle with a dot inside and the height printed beside it.
- ✓ This shows the **peak** of **landforms** such as mountains or hills.

Spot height . 1000

- ✓ It represents the height of a specific point on a map.
- ✓ It is taken at random heights by surveyors.
- ✓ It is symbolised by a dot with the height printed next to it.
- ✓ A spot height is not marked on the actual ground.

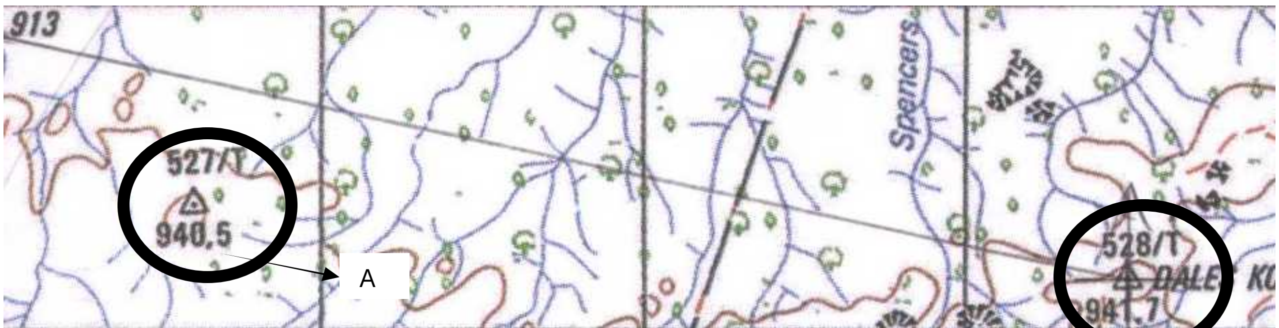
Benchmark .← 970

- ✓ It represents the height of the place above sea level on a map.
- ✓ It is measured heights indicated along roads.
- ✓ It is represented by a dot with an arrow pointing towards it.
- ✓ The height is printed beside this symbol.

<u>Common mistakes:</u>

- ✓ Candidates choose the wrong height from the trigonometrical station/ spot height / benchmark.

E.g. **<u>In Victoria Falls topographical map</u>**



B

- ✓ At region A, the height of the trigonometrical station is 940.5 m and not 527 m. This is because ‘527/F’ has an alphabet attached to the trigonometrical station.
- ✓ At region B, the height of the trigonometrical station is 941.7 m and not 528 m. This is because ‘528/T’ has an alphabet attached to the trigonometrical station.

(f) Gradients

- ✓ It refers to the angle of a slope and it is used to gauge how steep or gentle the slope is.
- ✓ The gradient between two places is often expressed as a ratio.
- ✓ It is a ratio of a vertical distance to a horizontal distance covered between two points of reference.

Steps:

To calculate the gradient between A and B,

- ✓ Calculate the vertical distance by finding the difference in height between the two points [AB]
  - o The vertical distance will be in **<u>metres</u>** as heights are given in metres.
  - o The difference in height between two points [AB] is measured from the following:
    - ▪ Trigonometrical stations
    - ▪ Benchmarks
    - ▪ Spotheights
    - ▪ Transport network by ***<u>contours, trigonometrical stations, spot heights, benchmarks</u>***
      - (e.g. railway, wide tarred, narrow tarred, gravel road)
    - ▪ Any features by ***<u>contours, trigonometrical stations, spot heights, benchmarks</u>***
- ✓ Calculate the horizontal distance by finding the **<u>straight-line distance</u>** between two points [AB] unless the two points [AB] are along the same track, railway or river.
  - o The horizontal distance is the actual ground distance on ground and not measurement on map.
  - o It must be measured in **<u>metres.</u>**
- ✓ Use the following formula to calculate the gradient.

$$\frac{\text{Difference in height between two points [AB] (Vertical distance)}}{\text{Difference between two points [AB] (Horizontal distance)}}$$

OR simply,

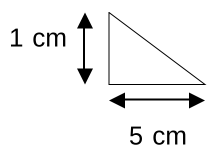
$$\frac{\text{Height}}{\text{Distance}}$$

✓ Since gradient is usually expressed in ratio as 1: x, we divide the horizontal distance by vertical distance to find the value of x. The value of x should be expressed in whole numbers.

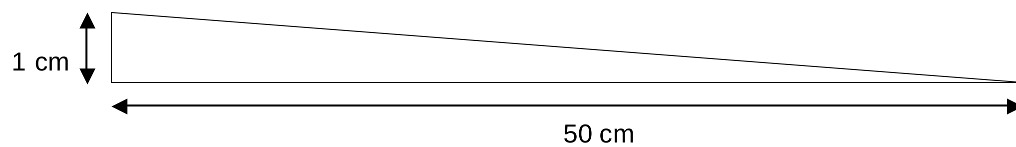
Comparing gradient

E.g. 1: 5 and 1: 50

1: 5 (not drawn to scale)



1: 50 (not drawn to scale)



✓ A gradient of 1: 5 is steeper than the gradient of 1:50.

Reason: A gradient of 1:5 has to cover less distance on the actual ground for 1 unit increase in height. Thus, it is steeper.

✓ A gradient of 1: 50 is gentler than the gradient of 1:5.

Reason: A gradient of 1:50 has to cover more distance on the actual ground for 1 unit increase in height. Thus, it is gentler.

NB: Gradient is **not the same** as scale even though they are expressed in the same unit.

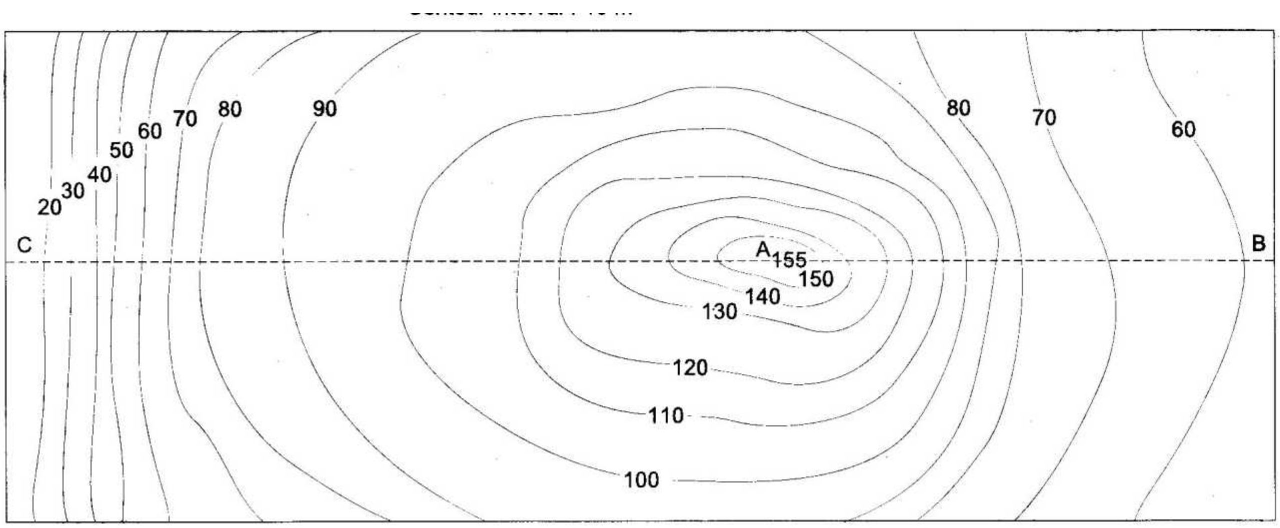
*** Intervisibility**

*This topic is not covered in your syllabus. However, the concepts involved in Intervisibility can be asked in map reading questions.

✓ Intervisibility between two points on a map refers to whether or not an observer at point A can see another person at point B, assuming that there are no tall trees, poor weather conditions or other obstructions in the way.
✓ Intervisibility is a theoretical concept.
  o We are interested in determining whether there is any higher ground between them that may cut off their view of each other.
✓ The best way of testing intervisibility on a topographical map is to see if

(i) there is any higher ground between two points **OR**
(ii) the slopes are concave or convex.

✓ From the contour map below,



- o Point A and B are intervisible as the slope is **concave**.
- o Point A and C are not intervisible as the slope is ***convex***.
- o Point B and C are not intervisible as they are **blocked** by a **hill peak** at A .

In general,

✓ There is no intervisibility between a spot at the bottom and a spot at the summit in a ***convex*** slope.

- Reason: The line of sight is blocked.

✓ There is intervisibility between the lowest and highest points of the ***concave*** slope.