basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

GEOGRAPHY

MAPWORK

NOTES

GRADES 10-12

Section 1
Mathematical Mapwork

- ACCURACY IS OF THE UTMOST IMPORTANCE !!!
- In order to write the mapwork examination you need the following equipment
  - Protractor
  - Pen
  - Pencil
  - 30 cm ruler
  - Chain or string
  - Calculator

1. Conventional Signs

This is a standard sign used on a map to indicate a particular feature. These must be learnt as they form the LANGUAGE of mapwork. See attached list

A conventional sign is a standard sign used on a map to indicate a particular feature. The conventional sign may be a letter of the alphabet or it may be a symbol. Many symbols look like the features that they depict. If you know your signs you will be able to interpret every map.

Learn the colours, they give the clues

REFERENCE:

Use a topographical map to complete the following table:

Name	Colour	Symbol
International Boundary and Beacon		
Provincial Boundary		
Game, Nature Reserve & State Forest Boundary		
Multiple Track Railway; Station		
Single Track Railway; Siding		
Electrified Railway		
Narrow Gauge Railway		
Service Railway		
Railway in a Cutting		
Embanked Railway		
Other Railway; Tunnel		
Arterial Route		
Main Road		
Secondary Road; Bench Mark		
Track; Footpath; Hiking Trail		
Other Road; Bridge		
Road Over Railway Bridge		
Power Line		
Post Office; Police Station; Store		
Place of Worship; School; Hotel		
Huts		
Lighthouse; Marine Light		
Marine Beacon; Trig. Beacon		
Magnetic Station; Ground Sign		
Monument; Battlefield		
Historical Site		
Cemetery; Grave		
Cattle Kraal; Dipping tank; Ruins		
Fence;		
Stone Wall		
Dam Wall		

Anti-Erosion Wall		
Excavation		
Mine Dump; Donga		
Perennial Water		
Non-Perennial Water		
Dry Pan		
Perennial River		
Non-Perennial River		
Dry Water Course		
Spring; Waterhole; Well (Water Point)		
Windpump; Water Tower; Reservoir		
Marsh and Vlei		
Pipeline (above ground)		
Photo Centre		
Coastal Rocks		
Prominent Rock Outcrop		
Terrace		
Cultivated Land		
Orchard or Vineyard		
Trees; Bush		
Avenue of Trees		
Row of Trees		
Forest; Plantation		
Golf Course; Park		
Recreation Ground		
Original Farm Boundary		

How to learn conventional signs

There are three ways of grouping conventional signs to make the learning easier. Why not try all three and then choose the one that suits you.

A. THREE TYPES OF SYMBOL

1.	Point symbols	-	buildings, dipping tanks, trigonometrical beacons
2.	Line symbols	-	railways, roads, power lines, telephone lines
3.	Area symbols	-	cultivation, orchards and vineyards, pans

B. SIX COLOUR GROUPS

1.	Brown:	land or earth features	-	contours, eroded areas, prominent rock outcrops, sand areas and dunes, secondary or gravel roads
2.	Blue:	water features	-	aqueducts, canals, furrows and siphons, coastlines, dams, lakes, marshes, swamps and vleis, pans, rivers, water-towers; national freeways are also shown in blue
3.	Green:	vegetation features	-	cultivated fields, golf courses, nature and game reserve boundaries, state forest boundaries, orchards and vineyards, recreation grounds, woodland
4.	Black:	construction features	-	roads, tracks, railways, buildings, bridges, cemeteries, communication towers, dam walls, excavations and mine dumps, telephone lines, power lines, windpumps, wrecks, ruins, trigonometrical beacons, boundaries
5.	Grey:	construction features	-	built-up areas, cadastral information
6.	Red:	construction features	-	national, arterial and main roads, lighthouses and marine lights; pink also shows international boundaries

C. FIVE ELEMENTS

1.	Relief	-	contours, spot heights, trigonometrical stations
2.	Water	-	lakes, rivers, waterholes, reservoirs
3.	Vegetation	-	cultivation, orchards and vineyards, forests, plantations, woodland
4.	Man-made	-	communication lines, settlements
5.	Political	-	boundaries

2. Orientating the map

Study the lines of latitude and longitude around South Africa. Learn the position of the following lines:
23 ½ ^{0} S – Halfway through Limpopo;
29 ^{0} S – North of Lesotho and cuts KZN in half;
34 ^{0} S – Cape Town at top of Peninsula;
18 ^{0} E – West of Cape Town;
20 ^{0} E – Border of Namibia;
25 ^{0} E – Northern Border of Eastern Cape;
30 ^{0} E – Southern border of KZN;
32 ^{0} E – Eastern border of Mpumalanga and Swaziland

3. Distance and Scale

Scale on South African topographical maps is always a Representative Fraction – 1:50 000

1:50 000 means 1cm repr 0,5 kms
1 cm repr 500 meters

Therefore - ON TOPOGRAPHICAL MAPS

TO FIND AN ANSWER IN KMS, MEASURE IN CMS AND DIVIDE BY 2

TO FIND AN ANSWER IN METRES, MEASURE IN CMS AND MULTIPLY BY 500

Scale on the Orthophoto map is always a Representative Fraction - 1 : 10 000

1: 10 000 means 1cm repr 0,1 kms
1 cm repr 100 meters

Therefore - ON ORTHOPHOTO MAPS

TO FIND AN ANSWER IN KMS, MEASURE IN CMS AND DIVIDE BY 10

TO FIND AN ANSWER IN METRES, MEASURE IN CMS AND MULTIPLY BY 100

If the distance is not a straight line, use a chain, a piece of string or a compass to measure.

4. Direction and Bearing and Magnetic Bearing

Direction is a generalized method of showing the position of one place from another
i.e. points of a compass

Bearing is the measurement of direction in degrees.
True North is ALWAYS at the top of the topographical map, but not always at the top of the photos.
0° is True North, Bearing is measure CLOCKWISE from True North.

Magnetic Bearing is the distance in degrees from Magnetic North (i.e. from where the compass points to North) to the position of the place.

Follow the following formula for ALL Magnetic Bearing sums.

Formula: Magnetic Bearing = True Bearing + Magnetic Declination 2008

True Bearing – you MEASURE on the map from one point to another.
(e.g. 284°) This is the angle between True North and the line joining the two places

Magnetic Declination 2008 – do the CALCULATIONS. This is the angle between True North and Magnetic North.

Magnetic Declination (given on map at side) (All magnetic declination in SA is to the WEST) This is the angle between True North and Magnetic North
e.g. 24° 15' west of TN with an annual change of 2' east for 1999

Difference in years 2008 – 1999 = 9 years x 2' = 18' EAST of True North

WEST YOU ADD: EAST YOU SUBTRACT

Magnetic Declination minus your answer
24° 15' - 18' = 23° 57' WEST of TN

Therefore Mag Bg = 284 + 23° 57' = 307° 57'

5. Map Referencing / Co-ordinates

This is the method of finding any point on the map

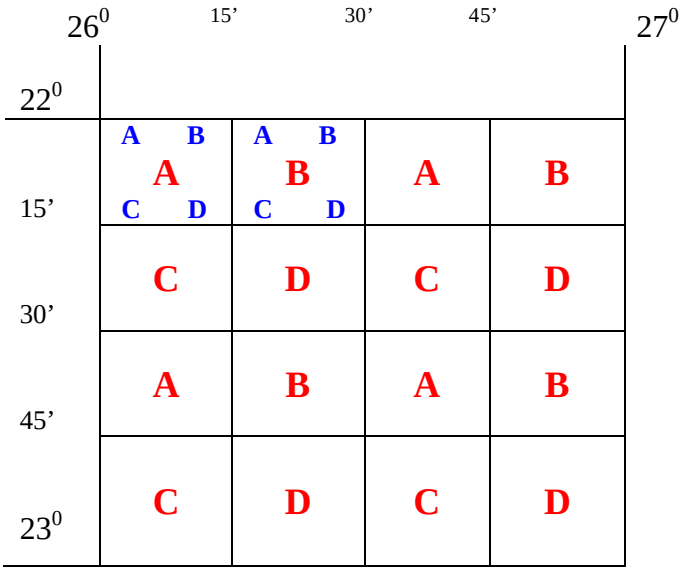
5.1 LATITUDE AND LONGITUDE

This is the method of finding the co-ordinates of a place.

SOUTH AFRICA IS ALWAYS ONLY SOUTH AND EAST
Remember, Latitude and Longitude is measured in degrees, minutes and tenths of a minute (or seconds).

Latitude is ALWAYS stated first and Longitude second.
If you do not say South and East, you get NO marks.

3.2 ALPHA –NUMERIC MAP CODE



To work out which map it is, the rule is
LATITUDE, LONGITUDE, BIG LETTER (Block), LITTLE LETTER (Block)
Eg. 22 26 A B

6. Height

Height on all maps and photos is shown in metres above sea level

On the topographical map, the CONTOUR INTERVAL i.e. the VERTICAL distance between 2 contour lines is 20 METRES.

On the orthophoto map, the CONTOUR INTERVAL, is 5 METRES

Height is used to show the following:

- Relief
- Intervisibility
- Gradient
- Cross-sections
- Vertical Exaggeration

Height is shown on maps in various ways – always in metres above sea level i.e. as altitude

- Contour lines
- Spot heights
- Trigonometrical beacons
- Bench marks

7. Gradient

This is the STEEPNESS of a slope, and is represented as a ratio eg 1 : 50, 1 : 500
Remember: THE SMALLER THE NUMBER, THE STEEPER THE SLOPE.

To work out Gradient, use the following formula:

Gradient = $\frac{\text{VI}}{\text{HE}}$ $\frac{\text{Vertical Height}}{\text{Horizontal Equivalent}}$

VI = Highest height - Lowest height - always in metres

HE = Measure the distance between the 2 points in cms, multiply by 500 (TO GET METRES)
ONLY EVER MEASURE IN CMS

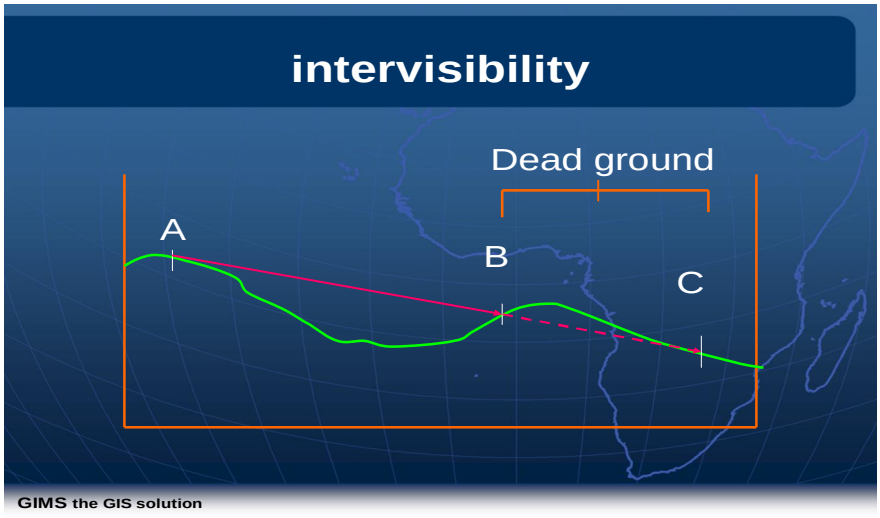
Divide the top answer by ITSELF, divide the bottom answer by the TOP.
The answer is a RATIO i.e. NO units must be given.

8. Intervisibility

This is the concept of whether one place on a map can be seen from another.
It is decided upon by studying the heights between the 2 places. Any ground which cannot be seen behind a higher height is known as DEAD GROUND.

If a convex slope is between the 2 places, the second cannot be seen.

A rough cross-section sketch shows this more easily.



9. Cross-Sections

A cross-section is a profile of the area under discussion. It is a diagram showing change in height along a line drawn between 2 points on a map.

IN AN EXAM, THE VERTICAL SCALE WILL ALWAYS BE INDICATED – YOU MUST NOT CHANGE IT. e.g. 1 cm repr 50 metres on the Y axis (vertical axis)

You will usually be given a partially completed cross-section to complete.

Remember: the Horizontal Scale remains 1:50 000 (this will be the scale along the base line on X axis)

Procedure for drawing cross-sections

BEFORE starting, study the area of the cross-section to the general shape or lie of the land, i.e. always have an idea of the shape BEFORE you begin plotting heights or drawing the section.

1. Join the 2 points, making sure the FROM point is on the left.

2. On a "magic" piece of paper, delimit the cross-section on the map and match it to the "given" graph. Mark off the right hand extreme on the graph and draw a vertical line to delimit it.

3. On the map, place the piece of paper, and (holding it steady) mark off EVERY contour that cuts it, ACCURATELY numbering each mark vertically.
   Eg.

2	2	2	2
0	2	4	6
0	0	0	0

4. Now place the "magic" piece of paper along the base line of the graph – ensure that the 2 extremes are accurately lined up. Matching the vertical scale to the marked contour height, mark a small "x" to show the position of each contour on the graph.

5. YOUR EDGES OF THE GRAPH MUST COINCIDE WITH THE LIMITS OF THE GRAPH – nowhere on earth does a piece of land end in mid air!!!

6. Join these points free hand, taking care to show valleys or hills where 2 or 3 adjacent points are at the same height.

7. Write a FULL heading on your cross-section
   eg. Cross section from • 96 to r 281 on 3326 BC Grahamstown map extract
   1 : 50 000 Topographical Series

8. Mark in the horizontal scale
   Mark in the vertical scale showing the units of measurement
   Label the edges of the cross-section using the designated points (NOT just A and B)

10 Vertical Exaggeration

This is used as the vertical scale must be exaggerated because, if the horizontal scale were used for the vertical, the relief would show as an almost flat line on a cross-section.

Formula: Vertical Exaggeration = Vertical Scale (Given on the cross-section) / Horizontal Scale (1cm repr 50 metres)

Eg Vertical Scale = 1 cm repr 20 metres
Convert to cms (an RF) by multiplying by 100
i.e. 1 : 2 000

$$VE = \frac{1}{20} \qquad \frac{1}{500}$$

$$VE = \frac{1}{20} \times \frac{500}{1}$$

VE = 25 times

ALWAYS WORK IN METRES, IT IS MUCH EASIER

READING, ANALYZING and INTERPRETING

Maps give us information about the earth's surface through pictures. The section that is represented is so full of complicated details that a description using only words or numbers would be very confusing. However, it is difficult to recognize the real landscape from the map's lines and symbols. There are three stages in the understanding of a map and they are:

- reading - identifying and recognizing features and then describing the information;
- analyzing - reading and processing the information by selecting and classifying and measuring (quantifying)
- interpreting - including deducting, evaluating and making inferences about map and photograph information; recognizing interrelationships by comparing and contrasting patterns.

LANDSCAPE FEATURES	**READING (Recognition and position of features**	**ANALYSIS (Reading process plus classification)**	**INTERPRETATION The process of reading and analysis plus the deductive and inductive evaluation of the map and photo**
RELIEF	Identify the real features on the map and or photograph, e.g. mountains, valleys, plateaux, plains, escarpments, etc. What is the position of each feature?	What is the area covered by each feature? How steep are the mountain sides? How wide is the valley floor? etc.	A study of the relief will provide some clues about the underlying ecology.
DRAINAGE	What are the names of the rivers? How many rivers are there? What is the position of the river relative to other features?	What is the drainage pattern? In what direction do the rivers flow? Are the rivers perennial or non-perennial? How wide are the rivers? What area do they drain? Where are the watersheds?	The study of the drainage pattern will provide facts from which you can infer the rock type, e.g. underground drainage, sinkholes may point to dolomite or limestone. Non-perennial rivers may indicate a dry climate.

NATURAL VEGETATION	What type of vegetation is shown on the map and/or photograph? Forest, grassland, desert, scrub, etc.	What is the area covered by each vegetation type? Is the forest deciduous, rain forest or coniferous?	The vegetation type will enable you to deduce the climate and the soil type of the area.
COMMUNICATION SYSTEMS	Identification and position of road, rail and water transport systems, telegraph, telephone and power lines on the map and/or photograph.	What types of roads are found? Tarred, untarred, main or secondary? Are the railway lines single or double track electrified or unelectrified? What is the length of electrified railway lines? etc.	The communications systems may be indicative of the economic importance of the area.
LAND USE	Identification and placement of man's impact on the landscape. Placement and recognition of fenced-off areas, fields, quarries, orchards, etc.	What is the area covered by fields? What is the size of individual fields? Are the fields ploughed or unploughed? Are there crops on the fields? etc.	From the state of the fields, the season may be inferred and from the type of crop, the climate.
INDUSTRY	Identification and position of factory buildings, mines, mine dumps, packing sheds, etc.	What types of factories are found,e.g.large manufacturing, iron and steel works, chemical factories, such as Sacs Oil Refineries? etc.	From the knowledge gained above the type of factory may be deduced. e.g. a canning factory in a fruit growing area. A mine shows that there are minerals present in the area. The layout of the mine may identify the mineral as gold or coal, etc.
SETTLEMENT	Identification and siting of towns, dorps, houses, simplex complexes, t ownshipsetc.	The settlement pattern may be classified as dispersed, nucleated, ribbon, etc. The buildings may be grouped according to their function. What area is covered by settlement?	From the settlement pattern something of the history, the economy and man's impact on the area may be gained. Economic satus of residential areas.

Applying Theory

Look at the contour lines to get the shapes for features like spurs, river valley, mesas, buttes, conical hills, homoclinal ridges. This tells you the climate of the region and gives clues to vegetation and agriculture.

Settlement theories are clearly displayed on 1:50 000 maps. Look for shapes of settlement, circular, linear, stellar. South Africa's apartheid urban development can be interpreted from the street patterns and the size of urban plots on a map.

Climate on Topographical Maps

A 1:50 000 map does not display climatic data directly but there is a lot of indirect information from which inferences can be made:

Temperature - relates to latitude, altitude, distance from the sea and aspect of slope, valley climates have inversions.

Rainfall - rivers indicate seasonal or perennial flow, farming activities relate to rainfall. In a dry region, look for evidence of irrigation, i.e. storage dams and reservoirs, windmills and livestock (cattle and sheep) are found in drier areas, lack of vegetation cover shows dry or arid areas.

Wind - lines of trees forming windbreaks often indicate wind direction.

ADDITIONAL FACTS

What markers look for when testing mapwork

A number of testing styles are used to evaluate Mapwork. One method is to arrange questions in an order of increasing difficulty. This tests your:

- knowledge - specific facts, names and direct information;
- comprehension - to select and organize knowledge;
- application - to apply knowledge and to solve problems;
- analysis - to break down information into parts or to see relationships;
- synthesis - to put parts together so as to form a whole;
- evaluation - to judge the value and accuracy of something according to the evidence given.

* *

LEARN SOME KEY WORDS USED BY EXAMINERS IN MAPWORK PAPERS

1. Knowledge

describe - give a clear meaning, a diagram should be used whenever possible
list - itemize
outline - give main details in order
other words: name, identify, label, select

2. Comprehension

compare - look for things that resemble each other, emphasize similarities
contrast - look for things that are not the same, differences
distinguish - separate of differentiate
explain - describe clearly and give reasons while trying to analyze the causes
interpret - translate, give your judgement
relate - show how things are related or connected to each other, or are like each other
other words: arrange, estimate

3. Application

apply - interpret what you see in terms of a model, or a law
demonstrate - point out, show or display, or prove
other words: construct, discuss critically, differentiate, explain giving examples, modify, propose, predict, relate, solve.

4. Analysis

outline - organize a description under main points
relate - show how things are related or connected to each other
other words: differentiate, distinguish, illustrate, point out, select, subdivide

5. Synthesis

summarize - give the main points in a reduced form
other words: categorize, combine, compile

6. Evaluation

justify - prove or give reasons for conclusions
other words: evaluate, interpret, support, verify

A. READING MAPS (identifying, recognizing and describing)

Map reading involves identifying points, patches and lines on a map.

The following guide will help you build up a general description of an area:

1. Position

Latitude and longitude, proximity to noticeable features either physical or human, especially a nearby urban area.

2. Area

The approximate size of the area being described.

Natural landscape feature:

3. Relief

Look for regions – uplands and lowlands, the proportions, the highest point and the lowest point, give the relief range, the general altitude landforms, trends (direction) of relief, move from general observations to specific features.
Look for identifiable slopes – convex, concave, regular and irregular, steepness, any recognizable surfaces.

4. Drainage

Look for a system, some idea of direction, identify drainage basins, density of river network, stage of river courses (upper, middle or lower), the pattern (trellis, dendritic, radial, etc.), recognizable features (waterfalls, rapids, braiding, etc.), if the rivers are perennial or not, modifications by man.

5. Vegetation

Some interpretation is needed now that 1 : 50 000 maps shade areas of natural vegetation in a green wash (earlier maps indicate trees and bush) – how much of the area is covered, the relationship with the relief (i.e. in valleys – riverine, or one side of relief), areas with no vegetation.

Human landscape features (infrastructure of developments):

6. Land use

A useful method is to consider economic activities:

a) Primary - farming (describe the type of farming: cultivation, orchards, vineyards, stock farming with kraals, watering-places, windmills, dipping tanks, irrigation furrows, canals and pipes, farm dams, plantations);

- mining (describe mine sites and proximity to communications);
- forestry (describe how this relates to relief);
- fishing (coastal maps, especially of the southern and western coasts of South Africa, show the fishing areas).

(b) Secondary - industry (look for industrial location factors, market, raw material, power and water, labour, flat land and transport).

(c) Tertiary - services (education, recreation, health, shops, etc.)

7. Settlement

(a) Rural - nature, size, situation, pattern is dispersed or nucleated, function.
(b) Urban - patterns, of streets, functional zones, the CBD.

8. Communications

Types (road, rail, air, water) directions, patterns, look for influence of relief (watersheds, valleys).

Economic activities on 1 : 50 000

It is useful to follow a classification of economic activities when reading mapwork information relating to human activities. All the economic activities provide the **infrastructure** (signs of economic development) of a mapped area:

1. Primary production

An activity concerned with using nature's resources directly. It involves farm workers:

§ farming - subsistence farming which is cultivation with little other infrastructure
§ fishing - coastal settlement, quays and harbours
§ forestry - plantations, forests
§ mining - dumps, diggings, excavations and service railways
§ game farms - nature reserves

2. Secondary production

An activity that increases the value of primary products. It involves blue collar workers:

§ manufacturing - industrial areas, factories
§ commercial farming - where modern technology is used: large orchards, vineyards and plantations where a noticeable infrastructure, e.g. roads, power are clearly evident.

3. Tertiary activity

These are service activities that are in specialist buildings and offices and involve white collar workers:

§ transport - road, rail, air, water, with their termini
§ communications - telephone, communication towers, post offices
§ tourism and recreation - caravan parks, golf courses, hiking trails, resorts, sports fields, recreation areas, stadiums, hotels

§ energy - power lines
§ shops - and supermarkets
§ education - schools, universities
§ health - hospitals
§ entertainment - drive-in theatres
§ worship - churches
§ social services - polices

Photograph Interpretation

A vertical photograph taken from an altitude of several thousand metres can be quite confusing, particularly if you have not experienced such a view from an aircraft. You will have to practise in order to develop interpretation and recognition skills.

Orthophoto maps have contours and other information on them as well as which, features are closer and so easier to identify:

The following ideas will help you:

Shape

Geometric shapes indicate man-made objects. Railway lines appear as thin lines with gentle curves and gradual junctions. Roads are wider and have right-angle junctions. Cultural features are regular and have a definite pattern. Railway yards and cloverleaf flyovers on motorways are easily identifiable. Natural features are irregular, such as rivers which have winding confluences.

Size

Buildings can look the same in shape but their size indicates the difference between a small hut, a house and a factory. Road width is usually clear.

Shadow

Tall, thin objects, such as church steeples, telegraph poles, lighthouses and factory chimneys, may be too small to be seen from directly above. Their shadows show their positions and shapes.

However, long shadows obscure certain features, so photographs are not taken too early or too late in the day. The best time is two hours before and two hours after noon.

Shadows also indicate **direction** and this helps the reader to orientate a photograph. In the southern hemisphere shadows generally point **southwards as the sun lies to the north.**.

Problem: The sun rises in the east and sets in the west. Vertical aerial photographs are taken two hours before and two hours after noon. Which way would the shadows point at those times?
(Answer: In the morning the shadows will point slightly south-west and in the afternoon they will point slightly south-east.)

Do not automatically expect the top of an aerial photograph to be north. North at the top is a mapping convention and a photograph is not a map.

In the case of the Orthophoto map, north is at the top.

If the aircraft flies east-west and then west-east, work out why the printing on the photographs is sometimes the right way up and sometimes upside down.

Tone

The tone of the photograph depends on the altitude of the sun and the amount of light reflected by the object. Some useful examples for you to observe are:

Darker	Lighter	Reason
irregular surfaces	smooth surfaces	smooth surfaces reflect light and irregular surfaces absorb light
clear water	muddy water	light penetrates clear water and reflects off muddy water
still water	wind-swept water	waves scatter reflection of light
wet ground	dry ground	wet ground absorbs more light
vegetation cover	bare ground	cover absorbs light (sand appears white)
ploughed fields	bare fields (fallow)	ploughing breaks the reflecting surface
mature crops	new crops	taller crops absorb more light
rivers	roads	tar roads appear white because they reflect light (even though they look dark to us on the ground)
summer vegetation	winter vegetation	trees lose leaves in winter

Texture

This shows patterns of land use or cover. A citrus orchard has a coarse texture when compared with maize which has a finer texture. Sand appears smooth while scrubland appears woolly.

The following are pointers that are useful for identification:

Land use	Characteristics	
cultivation	-	crops give a speckled appearance
	-	cut wheat or hay fields are light and smooth
	-	tractors leave noticeable streaky lines
	-	ploughed fields often look striped and are darker
orchards and vineyards	-	have a regular chequer-board texture
	-	fruit orchards have a coarse texture
	-	vineyards have a finer texture and sometimes look striped
forests or plantations	-	appear dappled or mottled
	-	have an easily recognizable striped pattern
pastures	-	are finely patched or speckled
	-	animal paths show as thin white lines usually converging at a watering-place

Identifiable features

A school usually has sports fields.
A golf course has fairways and greens.
Urban settlements clearly indicate residential differences:

- small buildings close to one another near the city centre indicate lower income housing;
- buildings with spacious grounds away form the city centre indicate higher income housing.

An airport has easily identifiable runways – planes take off into the wind for uplift ad land into the wind to slow them down.
Mining areas have noticeable dumps and excavations.
Telephone and power lines can be identified by the regularity of their shadows.

Mapwork is easy marks, but practice is required!!!!

GIS CONCEPTS

GIS: a system of hardware, data, people, organisations and institutional arrangements for storing, analysing and disseminating spatially-linked information.

System:
Any organised assembly of resources and procedures united and regulated by interaction or interdependence to complete a set of specific functions.

Information System:
A system, whether automated or manual, that comprises of people, machines, and /or methods organised to collect, process, transmit, and disseminate data that represent user information.

Geographical Database:
A collection of information about spatial locations and shapes of geographical features recorded, stored and organised in such a way that a computer program can quickly select desired pieces of data. A database can be thought of as an electronic filing system.

Spatial Data:
Data that shows location, which is mainly in the form of a map. The specific location can be geo-referenced according to longitude and latitude. Spatial data contain the coordinates and identifying information for various map features. Three types of features can be represented in the map: points, lines, and areas. The various physical aspects of the map such as political boundaries, roads, railroads, waterways, and so forth are organised into layers according to their common features.

A layer can be either static or thematic. Static layers use the same graphical attributes (colour, line, width, and so forth) for all features in a layer. Thematic layers can use different graphical attributes to classify the features in a layer. For example, a thematic area layer representing sales regions could use different colours to show the quarterly sales performances of each region. A thematic line layer representing highway could use different line widths to show the classes of roads.

Attribute data:
It refers to data set information describing geographical characteristics of features or information that can be linked to spatial data.

Two of the ways in which you can use attribute data in GIS include:

- using variables from the attribute data as themes for layers. For example, an attribute data set containing population data could provide a theme for a map of census tracts.
- creating actions that display or manipulate the attribute data when features are selected in the map.

Primary data:
Data obtained for the first time and used specifically for the particular problem or issue being studied. First hand information collected from fieldwork, observations, questionnaires, surveys, etc., or collected directly from source.

Secondary Data:

Data that was collected by someone else (probably for a different purpose). This second-hand or published information. Can be obtained from census data, reports, newspapers, internet, maps, statistics, etc.

Advantages of using Secondary Data

- As secondary data is usually available more cheaply. The collection of secondary data is generally significantly quicker and easier (and hence less costly) than collecting the same data 'from scratch'
- Existing data are likely to be available in more convenient form, digital format example internet.
- Using secondary data can give us access to otherwise-unavailable organisations, individuals or locations.
- Secondary data allows the researcher to compare data on 'time base' i.e. origin of data to current data.
- Secondary data is likely to be pre-processed thus eliminating the time-consuming (and hence costly) analysis stage.

Disadvantages of using Secondary Data:

- The method used to collect secondary data is often unknown to the user of the data (apart from major sources like Census).
- The user has little or no knowledge of the processing methods used.
- The user rarely has access to the primary data to check against.

Geo Referencing:
The process of linking phenomena such as points, lines and areas to their location on the earth's surface. It involves converting a place to X and Y coordinates so that it can accurately be plotted on the map.

Remote Sensing:
The process of capturing data using modern technology to obtain spatial information about the earth's surface where there is no physical contact between sensor and subject. For example, the use of satellites and the viewing of the earth's surface from an aircraft (as an aerial photo).

GPS:
Global Position Systems. They allow people to locate their positions by satellite. There is a series of 31 satellites at 20200 km above the earth used for positioning and triangulation.

Vector Data:
- Shows features as points, lines, nodes and areas (polygons).
- Layered and separated into themes
- Each point has a set of X and Y coordinates that specify its location in terms of latitude and longitude.

Points:
- Are zero dimensional (flat).
- have locations and attributes.
  (e.g. schools)

Lines:

- One dimensional.
- start and end at a point.
- Made up of a sequence of points that have been connected.
  (e.g. rivers and roads)

Nodes:

- Points that are found at the start and end a line or where two or more lines meet; in which case they represent junctions or intersections.

Vertex (pl. Vertices):

- Vertices are points found along a line.

Polygons:

- Two dimensional.
- Made up of series of connected lines.
- The starting point is the same as the ending point.
- Are closed.
  (e.g. cultivated land)

Rasta data:

- Data used is represented and stored by grid cells (rows & columns) or pixels.
- Used to represent continuous data, not individual features.
- Represents the dominant phenomenon in the area covered by a cell. A geographical feature becomes a collection of cells with the same attribute value.

Pixel:

- The smallest unit of spatial and spectral information represented in a digital image.
- Pixels are the “building blocks” of digital images because they are the little blocks you see when you zoom into a digital image.
- Pixel is a short form of “picture element”

Resolution:
Amount of detail with which a map depicts the location and shape of geographical features. The larger the map scale, the higher the possible spatial resolution. The area shown is smaller; hence more detail will be shown.

Pixel resolution:
An area represented by each cell or grid in a raster. The detail of the raster data depends on the size of the grid cells. A high pixel resolution means that a smaller area is depicted and more detail is shown. A low pixel resolution: A larger area shown and less detail.

Spectral Resolution:
The ability of a sensing system such as a satellite to differentiate between electromagnetic radiation of different wavelengths. It also refers to the range of wavelengths seen by a particular sensor.

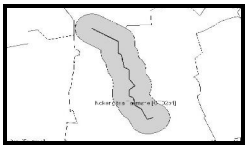
Functional Elements of GIS (What we expect to do with GIS/ processes required for a GIS to work)

Data Acquisition:
Is a process of identifying and collecting specific information (data) to solve a particular problem.

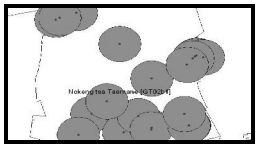
Spatial Query:
A query is a question about a place. Issuing a query means asking a GIS database a question, e.g. by clicking on a point to get attribute data about a town or any feature.

Spatial Analysis:
- It is the process of extracting or creating new information about a set of geographic features and examining the relationships between them.
- It is the process by which we turn raw data into useful information.

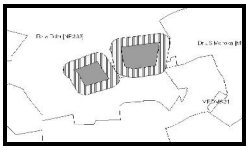
Buffering:
- Creating zones within pre-determined distance.
- Buffering builds new objects by identifying all areas that are within a certain specified distance of the original objects (whether be it a point, line or area)



line buffering



point buffering



polygon buffering

Data manipulation:
The process used to organise data for your specific needs. Changes that one makes to the data during analysis. It involves converting, re-arranging and analysing data to get answers

Pre-processing:
The process of correcting errors in the data and removing irrelevant information. It also involves ensuring that all data is projected the same way and is in the format required by the software being used.

Data-management:
Systematic and logical organisation of data so that it is usable. Data is stored in **folders** and **files** on a computer. It makes it possible to protect data (data security), allows for data sharing and for the maintenance of data quality (keeping data in a reliable and usable condition) as well as having a backup system.

Data quality:

The degree to which spatial information which has been captured satisfies the stated needs.