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Foreword

In order to improve learning outcomes the Department of Basic Education conducted research to determine the specific areas that learners struggle with in Grade 12 examinations. The research included a trend analysis by subject experts of learner performance over a period of five years as well as learner examination scripts in order to diagnose deficiencies or misconceptions in particular content areas. In addition, expert teachers were interviewed to determine the best practices to ensure mastery of the topic by learners and improve outcomes in terms of quality and quantity.

The results of the research formed the foundation and guiding principles for the development of the booklets. In each identified subject, key content areas were identified for the development of material that will significantly improve learner’s conceptual understanding whilst leading to improved performance in the subject.

The booklets are developed as part of a series of booklets, with each booklet focusing only on one specific challenging topic. The selected content is explained in detail and include relevant concepts from Grades 10 - 12 to ensure conceptual understanding.

The main purpose of these booklets is to assist learners to master the content starting from a basic conceptual level of understanding to the more advanced level. The content in each booklet is presented in an easy to understand manner including the use of mind maps, summaries and exercises to support understanding and conceptual progression. These booklets should ideally be used as part of a focussed revision or enrichment program by learners after the topics have been taught in class. The booklets encourage learners to take ownership of their own learning and focus on developing and mastery critical content and skills such as reading and higher order thinking skills.

Teachers are also encouraged to infuse the content into existing lesson preparation to ensure in-depth curriculum coverage of a particular topic. Due to the nature of the booklets covering only one topic, teachers are encouraged to ensure learners access to the booklets in either print or digital form if a particular topic is taught.
2. **How to use this Study Guide**

- The guide provides basic mapwork skills that cut across Grades 10-12.
- It should be used in conjunction with a relevant textbook and CAPS and exam guidelines specific for a particular grade.
- It explains important terms and key concepts.
- It develops key skills in reading, analysing and interpreting topographical and orthophoto maps.
- Theory and mapwork are integrated.
- Application of GIS concepts.
3. Study and Examination Tips

Some tips to approach the examinations.

3.1 PAPER 2 (MAPWORK)

This is a 1½-hour question paper. It will be written second on the day of the Geography examination.

- The question paper consists of **four questions** that are **compulsory**, as follows:

  **QUESTION 1**: Multiple-choice questions - **15** (single marks) (Cut across the syllabus.)

  **QUESTION 2**: Geographical techniques and calculations (includes cross-sections and application) - **20** (single marks)

  **QUESTION 3**: Application of theory/map and photo interpretation - **25** (Single marks for definitions and identification of features such as landforms, slopes, drainage patterns, settlement patterns, street patterns, etc. Double marks for providing reasons, application, interpretation, analysis and evaluation.)

  **QUESTION 4**: Geographical Information Systems (GIS) - **15** (Single marks for definitions. Double marks for providing reasons, application, analysis and evaluation.)

- The cognitive level rating of both question papers is as follows:
3.2  Topic specific

3.2.1 Topographic maps (1:50 000)

All the geographical skills and knowledge studied in Grades 10 and 11 are relevant to Grade 12.

Mapwork techniques

These concepts should be taught in an integrated fashion.

- Contour lines, contour interval, height and conventional signs.
- Compass direction.
- True/geographic bearing.
- Magnetic declination and bearing.
- Map scale - types of scales and comparing the scales of topographic maps, orthophoto maps and aerial photographs.
- Calculating straight-line distance in reality.
- Calculating area of regular features.
- Map reference numbers/ map index.
- Map coordinates/ fixing position - stating the coordinates.
- Calculation and interpretation of gradient.
- Cross-sections - drawing cross-sections, indicating the position of features on cross-sections and identifying features represented by cross-sections.
- Intervisibility.
- Calculating vertical exaggeration.

Topographic map application

- Interpretation of 1:50 000 topographic maps: Interpreting physical features, e.g. relief, drainage, climate and vegetation.
- Interpreting cultural features, e.g. settlement, land-use and transport networks.
- Application of all aspects of the syllabus covered in the theoretical section of Geography.
- Interpreting temperature, rainfall, climate zones and biomes, graphs and tables that are related to the 1:50 000 topographic map and the 1:10 000 orthophoto map being assessed.

3.2.2 Photographs

- Types of photographs.
- Advantages and disadvantages of different types of photographs.
- Orthophoto maps.
- Interpreting size, shape, tone, texture, shadow and patterns of vertical aerial photographs to identify features, landforms and activities on photographs and orthophoto maps.
- Orientation of orthophoto map to topographic map.
- Compare orthophoto maps to topographic maps.
- All techniques mentioned under mapwork techniques are applicable to orthophoto maps.
Orthophoto map application

- Interpretation of 1:10 000 orthophoto maps: Interpreting physical features, e.g. relief, drainage, climate and vegetation.
- Interpreting cultural features, e.g. settlement, land-use and transport networks.
- Application of all aspects of syllabus covered in the theoretical section of Geography.

3.2.3 Types of maps

- Reference maps.
- Thematic maps - defining, identifying and interpreting different types of thematic maps with the aid of an atlas.

3.2.4 Geographical Information Systems (GIS)

- Concepts of:
  - GIS
  - Remote sensing
- Resolution
- Pixels
  - Spatial resolution
  - Spatial and attribute data
  - Vector and raster data
  - Spatial objects
- Points/Nodes
- Lines
- Area/Polygons
- Concept of layering information
- Components of GIS
- Sources of information for GIS
- Data manipulation and analysis:
  - Concept of data manipulation
  - Data integration
  - Buffering
  - Querying
  - Statistical analysis
- Data standardisation
- Data sharing
- Data security
- Application of GIS by:
  - Government
  - The private sector
- Developing a 'paper GIS' from existing maps, photographs and other sources of information on layers of tracing paper.
- Identifying and interpreting concepts using given data, such as satellite images, topographic maps, orthophoto maps, aerial photographs, pictures and statistics indicated on graphs and tables.
The Greenwich meridian divides Earth into a western and an eastern hemisphere.

- The 0° line of longitude runs parallel with the Greenwich meridian.
- The 90° east and west longitudes are called the eastern and western hemispheres.

Lines of latitude are imaginary lines that wrap around the globe. Each defines the latitude of a place. Lines of latitude are measured from the equator. Lines of longitude are measured from the prime meridian. The prime meridian runs through Greenwich, London.

**Lines of Latitude and Longitude**

To determine a geographic location on the Earth’s surface, we make use of what is termed the coordinate system. As a geographic coordinate is important to determine the exact location of phenomena on the Earth’s surface.

**Location**

4.1 Mapwork skills and techniques
The 4 blocks are further subdivided into smaller blocks, also labeled A through D. The area between the latitude and longitude lines is divided into 16 sub-areas between two latitude and longitude lines.

Block A is indicated in the shaded area in the diagram above. Blocks B, C, and D, therefore, 3224AP is in the bigger block B and the smaller block D. Blocks E through H are divided into 4 equal blocks each. A to D are divided into 16 sub-areas between two latitude and longitude lines.

32S and 24E stand for the diagram's map reference 3224AP, which stands for the latitude and longitude values in the diagram. The latitude values increase southwards and the longitude values increase eastwards. The latitude, which is represented with the letter E, is always written first using the letter S if it’s south of the equator, and the letter N if it’s north of the equator. South Africa is located south of the equator and east of the Indian Ocean.
The numbers represent longitude.
- The letters represent latitude.
- Vertical row along the top of the map indicates the row.
- Locate the corresponding number (numeric) on the map indicated by the horizontal row.
- Locate the letter (alpha) along the side.

Refer to the map on this page and:
- Concept of location
- The first step in understanding the
- Alpha-numeric grid
- Numeric (numbers)
The place that you want the direction of.

- The place from which the direction is calculated.

- The place where you are calculMilitary.

- The place where you are calculating.

Note: There are always two points involved.

- South, east, and west.

- Cardinal points: the four main ones being: north, south, east, and west.

- Compass direction uses 16 place in relation to another. Direction uses 16

- This is used to describe the position of one

Direction
Examples:

- South Southwest:
The sewage disposal works (at D)
- The direction from spot height 52.4 (at C) to
  - To spot height 48.7 (at B) is North East
  - The direction from spot height 53.4 (at A)
Examples:

Geographic coordinates

- 26°46'5.29"N, 29°01'E
- 26°45'12.70"N, 29°04.17'E

On the sketch, the coordinates of point A are...
Scale

- Linear scale is a straight line.
- The ground.
- The map represents 50.000 cm on the ground.
- All South African topographic maps have a
- 1 cm represents 0.5 km.

Types of scales

- Ratio Scale or Representative Fraction
  - 1 cm represents 0.5 km.
  - 1:250,000 or 1
  - 50,000

Line scale
The following are standardized conventional signs on South African topographic maps. These are internationally-accepted letters or symbols that indicate a real-life feature.
Converting mm to km

1 km = 1,000,000
Convert to km: 1,200 mm
= 1.2 km

To get the actual distance in reality:
• Multiply the map distance by the map scale.

Measuring and calculating distance in km

0 0 0 0 0 0 km

Convert to km: 0.4 cm
= 0.04 km

To get the actual distance in reality:
• Multiply the map distance by the map scale.
• The distance is 2.4 cm.
• The two points in centimeters. In this case:
• You can measure the distance between.
### Converting mm to m

<table>
<thead>
<tr>
<th>km</th>
<th>dm</th>
<th>cm</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Convert mm to m: $1 \text{ mm} = \frac{1}{1000} \text{ m}$

Convert 1200 mm to m: $\frac{1200}{1000} = 1.2$ m

**Note:** Multiply the map distance by the map scale. To get the actual distance in reality.

- Multiply the map distance by the map scale.
- To get the actual distance in reality.
- The distance is 2 cm. In this case, the distance is 2 m.
- You can measure the distance between the two points in mm.

### Converting cm to m

<table>
<thead>
<tr>
<th>km</th>
<th>dm</th>
<th>cm</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Convert cm to m: $1 \text{ cm} = \frac{1}{100} \text{ m}$

Convert 12000 cm to m: $\frac{12000}{100} = 120$ m

**Note:** Multiply the map distance by the map scale.

- Multiply the map distance by the map scale.
- To get the actual distance in reality.
- The distance is 2.4 cm. In this case, the distance is 2.4 m.
- You can measure the distance between the two points in mm.

### Measuring and calculating distance in km

- You can measure the distance between the two points in mm.
- Multiply the map distance by the map scale.
- To get the actual distance in reality.
- The distance is 2.4 cm. In this case, the distance is 2.4 m.
- You can measure the distance between the two points in mm.

- You can measure the distance between the two points in mm.
- Multiply the map distance by the map scale.
- To get the actual distance in reality.
- The distance is 2.4 cm. In this case, the distance is 2.4 m.
- You can measure the distance between the two points in mm.
**Example of the calculation of area A on the topographic map - in m²**

\[
\text{Area} = \text{Length} \times \text{Breadth} = 1.850 \times 3.200 = 6.000 \text{ m²}
\]

**Example of the calculation of area A on the topographic map - in km²**

\[
\text{Area} = \text{Length} \times \text{Breadth} = 1.85 \times 3.2 = 6.00 \text{ km²}
\]

---

**Method of calculating area**

1. Multiply the length and breadth (remember your final answer when converting to km²).
2. Measure the length and breadth on the scale of the map.
3. Convert to kilometres/square kilometres.
4. Measure the length and multiply this by the scale of the map. Then...
Step 2 - Horizontal Equivalent

Horizontal Equivalent: Measure the actual distance between the two points (A and C).

Vertical Interval: Measure the difference in height between the two points (A and B).

How to Calculate Average Gradient

\[
\text{Gradient} = \left(\frac{\text{Vertical Interval}}{\text{Horizontal Equivalent}}\right)
\]

The formula for Gradient is:

Average Gradient
The gradient of Illustration 2 is steeper than the horizontal equivalent of Illustration 2; therefore, the horizontal equivalent of Illustration 1 is more.

Illustration 2 - The gradient is 1 : 15.
Illustration 1 - The gradient is 1 : 66.

In the example provided:

Diagrams to illustrate the concept of gradient.
1. True bearing is the angle between true north and true north.
2. Magnetic bearing is the angle between magnetic north and a given point, measured in a clockwise direction.
3. Magnetic declination is the angle between magnetic north and true north.

Definition of bearing
Magnetic declination is always west of true north.

Find the local annual change to the magnetic declination.

Calculate the magnetic declination for the current year:

\[ 16 \text{ years } \times 10\,^\circ = 160\,^\circ \text{W} \]

Total change: Multiply the difference in years by the mean annual change to find the total annual change in minutes.

- Mean annual change: Given in minutes - 10.0

2018 - 2002 = 16 years

Calculate the difference in years:

Current year minus the year the last MD was calculated.

How to calculate magnetic declination (MD):

\[ A.D = 283^\circ \]

\[ A.C = 37^\circ \]

\[ A.B = 143^\circ \]

(Use the outside numbers on the protractor.)

- Measure the angle from the true north line clockwise.
- Place the protractor along the true-north line with
  the zero on the north.
- Draw a line between the two proclines (A-B-A-C-A-D).

How to calculate true bearing:

Draw a north-south line across the piece from which the measurement is to be taken.

Determine the bearing.
\[ \frac{\pi}{2} = 60^\circ, \quad 1\text{hr} = 2^\circ 40' \]

If the minutes are 60 or more, they should be converted into hours:

\[ = 22^\circ 13' \text{ W} \]

If East, we subtract. If West, the mean annual change is to the West.

The mean annual change can either be eastwards or westwards.
143° + 22.1°W = 165.1°W

Formula: Magnetic bearing = True bearing + magnetic declination
   Add the true bearing to the current magnetic declination.

How to calculate magnetic bearing (MB)
Step 1

Method to draw a cross section

(Points A and B in the example)

Which you will be drawing the cross section.

Find the two points on the map between

Cross section and vertical exaggeration (VE)
Step 2

On the strip of paper, work out the height of the contour lines and mark this between the two points in the cross section onto the piece of paper. Use a piece of paper and mark off all the contours.
Step 3

**NOTE:** The lowest contour line value that you have recorded is example 1cm=20°.

Place the strip of paper on the horizontal line. Make a mark 0.000 m using 6.9°.
The horizontal scale is labeled as the scale of the map you should be the first point on the vertical scale.

Draw the vertical and horizontal axis of the cross section by drawing two lines at 90° to each other on an A4 sheet of paper.
Step 4

Vertical scale = 1:2000
20 x 100 = 2000
Example: 1 cm = 20m (100cm = 1m)

Therefore, if the vertical scale is 1 cm = 20m, the vertical scale must be a ratio.

NB: Both the vertical scale and horizontal scale must be a ratio.

Calculating the vertical exaggeration:

- The vertical and horizontal scale is required to calculate.
- The ratio between these two scales is also required.
- A vertical exaggeration of 25 is reasonable. If it is bigger,
  the result may be too large.

If the vertical scale is not exaggeration, then it will
not be possible to see the detail on the map.

A cross section is made bigger compared to the map scale.

What is vertical exaggeration?

Remember to label your cross section accordingly.

- Locate two points on your graph.
- Draw a line between these two points.
- Join the points on your graph Free-hand line.
Determining Visibility

Step 2

\[
\frac{1}{5000} \times \left( \frac{50}{1} \times \frac{2000}{1} \right) = \frac{1}{2}
\]
The prevailing wind in this area comes from the north-east.

On the map, several trees have been planted on the north-eastern part of the settlement (Clewer). It is therefore deduced that the prevailing wind direction is not aligned with the trees. However, it is possible to interpret the general wind direction on topographic maps. The following is an interpretation of wind direction when direction is not marked (marked) on a map.
Likely lake off in an east-southeast direction. Take off against the wind. In this map extract, the aircraft will most likely fly off. Generally, aircraft landing is where the wind is land and take off. The way the landing strip is constructed...
Radiation misting on the valley bottom.
A frost pocket on the valley bottom due to inversion.

Precipitation:
- It is a cold and heavy wind.
- It blows down-slope.
- It blows during the night.

Katabatic wind has the following characteristics:
- This air movement is called Katabatic wind.
- Movement during the night.
- The arrows pointing towards each other illustrate air by the insect.
- According to contour line arrangement as illustrated.

Line A-B represents a valley.

How to read Katabatic flow:
Ambient wind has the following characteristics:

- This air movement is called ambient wind.
- Air movement during the day.
- The arrows pointing away from each other illustrate the line arrangement as illustrated by the inset.
- Line A-B represents a valley (according to the contour line).

On the diagram:

- This wind is relatively warmer and lighter.
- It blows down the valley.
- It blows during the day.
(Facing away from the direct insolation).

- A is the south-facing slope. It will generally be cooler when the sun is direct insolation.
- B is the north-facing slope. It will generally be warmer.

Notes:

- A and B are situated on different valley slopes.
- By reading the contour lines on the adjacent diagram, the north-facing slopes in the Southern Hemisphere (SH) are generally warmer than the south-facing slopes.

Identifying aspect slope direction

Aspect slope direction
### Reasons

The temperature at Y is higher than the temperature at X.

- Y is situated in the urban build-up area.
- X is situated in the rural-urban fringe.

#### On the diagram:

Identifying and interpreting urban vs rural temperatures.
Determining stream order:

1. When streams of different orders meet, there is no increase in the order.
2. The order of the stream will continue to increase if a third order stream flows from a second order stream.
3. When two second order streams meet, they form a third order stream.
4. The smallest streams are classified as first order streams.
How to determine the direction in which the river flows:

- Tributaries join at an acute angle.
- A dam wall shows the downstream direction.
- Contours bend upstream.
- Rivers flow from higher to lower areas.
- Rivers flow towards the sea.

Direction of flow of the river.
Types of drainage patterns

Radial
- High point, such as a dome.
- The river flows away from the central point.
- Right angle.
- Right angle to the channel with larger streams at the margins.
- Radial drainage system.

Rectangular
- Right angles.
- Right angle to the channel with larger streams at the margins.

Trellis
- Looks like the branches of a tree.
- Trellis drainage appears as a dendritic system.
- Trellis drainage is characteristic of folded mountainous terrain.

Dendritic
- Trellis drainage patterns.
- Trellis drainage patterns.
Il is a temporary baseline of erosion.

* The course of a river.

This Landform is mostly found in the upper Waterfalls.

Identification of Fluvial Landforms

Temporary basis of erosion

Fluvial Landforms - Waterfalls
The upper course

Identifying the different stages of a river

Spruce can be found:
- Waterfalls, rapids and meandering
- Flow is smoother
- Downward vertical erosion
- Estuary forming non-perennial rivers
- The area is steep with V-shaped valleys.
Middle course

- Meandering rivers and spurs can be found.
- Lateral erosion opens the area.
- Slots in meander.
- The river flows more slowly as it.
- The slope in the area is gradual.
Lower course

Identification of fluvial landforms and features

Flat and smooth - very few or no contour lines

Flood plains

Flooded streams

Meadows

Sandbanks

Mouth

Other fishweir lakes
Other Shapes

and between physical features such as mountains.

Linear shape - along transport routes, rivers.

T-shaped - at the junction of roads.

Types of shapes and how they are identified.

Settlements viewed from above.

Shape is the external appearance of rural

Shelter and defence

Climate - aspect

Building material

Other Factors

Fresh water supply - near springs.

By rivers, streams and cultivated land.

Quality of soil - arable land is included.

Flat land - very few or no contour lines.

Factors influencing the diagram.

The site of a settlement indicates the physical

nature of the area where it is located.
REMOTE SENSING

<table>
<thead>
<tr>
<th>Methods</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS design according to users' needs.</td>
<td>Data capture, data users, GIS analysis.</td>
</tr>
<tr>
<td>Data</td>
<td>Maps, aerial photos, satellite imagery, administrative records, etc.</td>
</tr>
<tr>
<td>Application programs such as ArcView.</td>
<td>Software</td>
</tr>
<tr>
<td>Hardware</td>
<td>CPU, screen, keyboard, mouse, scanner, printer, digitizing tablet.</td>
</tr>
</tbody>
</table>

COMPONENTS OF GIS

WHAT IS GIS?

A geographic information system (GIS) is a computer-based set of procedures for assembling, storing, manipulating, analyzing and displaying geographically referenced information.
There are two types of geographical information: locational (spatial) data. Non-locational (attribute) data.

<table>
<thead>
<tr>
<th>Low Resolution</th>
<th>High Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>More pixels: small pixels.</td>
<td>Fewer pixels: larger pixels.</td>
</tr>
<tr>
<td>The ability of a remote sensing sensor to create a sharp and clear image.</td>
<td>With raster data, objects on the surface of the Earth are represented by rows and columns of evenly sized blocks, called pixels. Pixels are the smallest unit of data storage.</td>
</tr>
</tbody>
</table>
DATA INTEGRATION

Software and linked to specific spatial features. Errors in the database can be eliminated during manipulation.

Spatial information must be manipulated into this file format so that it can be used in the GIS.

When all the data layers are in similar data files, the data can be integrated (put together).

Explain why data manipulation is important in a GIS.

DATA MANIPULATION

Data manipulation involves pulling the different data sources into a format that can be integrated.

What is data manipulation?

Gis Layers

- Each layer represents a single entity/ theme.
- Raster data are shown in layers.

Al spatial data, whether it is vector data or...
The text is not legible due to the image quality. It appears to be a page discussing geographical problems and solutions, but the content is not clear enough to transcribe accurately.
Some examples of industries that use GIS in their planning, operation and decision-making are indicated in the table below.

<table>
<thead>
<tr>
<th>Industry</th>
<th>How the Industry uses GIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Planning and managing existing and new crops</td>
</tr>
<tr>
<td>Mining</td>
<td>Planning and managing movements of field study</td>
</tr>
<tr>
<td>Military</td>
<td>Planning services</td>
</tr>
<tr>
<td>Police services</td>
<td>Planning the quickest route to a crime scene</td>
</tr>
</tbody>
</table>

**Buffering**

A line used to demarcate an area around a special feature. It is sometimes necessary to identify some at different distances from certain geographic features.

**Examples:**
- Buffering infrastructure, roads, etc.
- Buffering water bodies, forests, etc.
- Buffering zones of human habitation, etc.

The advantage of the modern GIS that uses computers is that it is faster, more efficient and can manage large volumes of data over large study areas.

GIS can be used manually using transparent overlays (paper GIS). This method is tedious and does not allow for changes in scale.
Heads down on the map. The world is exciting as most of the answers are found on the map itself. Learners should use map symbols to unlock on the map itself.

Geography is one of the most interesting subjects as it empowers learners with important skills needed in the 21st Century World.

**Modals:**

The ups and downs of life. But what is unique about them is that they keep on believing in themselves. So keep the faith.

*Human beings are interesting creatures: they find it hard to learn the most when they do not get their own way.*

**Jerome Meyer**

With Geography, you will always know where you are going - just keep on pushing on.

Do not give up. Keep on believing in yourself and know that there is something in you that is greater than any challenge.

Remember that you are not alone. Many have walked the same road before you and succeeded.

**Heille Belayimi**

You should seize an inspiration and assurance that you can definitely win.

This has been the story of my life: falling and trying, but most importantly, rising again. Your triumph over the challenges is not found in hard work and sacrifices that you will one day look back with pride and satisfaction and say to yourself:

**Portia January**

Going to keep on moving forward and will complete the race.

Every challenging and difficult time that you have gone through in your life has shaped you into the winner you are today.

Message to Grade 12 learners from the writers:

Be dedicated and work smarter, then you will succeed. Learners should interpret the key to unlock information questions when working with maps.
Thank you and Acknowledgements.

The Geography guide was developed by Ms. Pemla January, Mr. Helihe Benjamini, Mr. Mosapeli Mokoena and Mr. Jerome Meyer, who are

Administrative and logistical support was provided by Mr. Richard Maboyi, Mr. Noxolo Malore and Ms. Jemile Mphili.

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