SSIP APRIL – MAY 2020

MATHEMATICAL LITERACY

PARTICIPANTS' GUIDE

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A. FOREWORD

This document is the result of the Just in Time Secondary School Intervention Programme (JIT SSIP) which is an intervention programme for FET teachers in the Gauteng Department Education (GDE) in collaboration with Matthew Goniwe School of Leadership and Governance (MGSLG).

B. PURPOSE

The purpose of this programme is professional development of FET teachers who are currently teaching in the school FET phase of the education system. The programme is aligned to the strategic goals of the GDE which focuses on improving the teaching and learning practice in the most classrooms through capacitation of teachers on Content, Pedagogy, and Assessment and ICT integration.

C. SSIP AIMS/GOALS

The SSIP programme aims at professional development for Grade 10-12 teachers in the application of effective teaching and reflective practice to improve learner performance on the identified Grade 12 examinable topics. The overall goal for SSIP is to provide teachers with professional expertise, tools and skills to spot student learning difficulties and decide on the course of action.

SSIP came about as result of the diagnostic needs that are identified through the end of the year NSC examination student learning data. In response to this design and development of teaching resources are developed to train teachers on the learner needs.

The four interconnected outcomes that drive the professional development activities for SSIP are:

- Enhancing Teachers knowledge: deep understanding of subject matter knowledge and students ideas on the content
- Enhancing quality teaching and assessment for learning: effective instructional approaches that teachers may use to ensure improved understanding by most learners.
- Developing ICT integration skills :Use of ICT to improve teaching and learning
- Building professional learning communities: allow teachers to start collaborating and form professional networks in non-formal settings in context of their schools

D. SSIP OBJECTIVES

By the end of the workshop teachers should be able to:

- have mastered and understood all aspects related to Measurement, Maps and Scales within the FET Mathematical Curriculum
- utilise ICT integration and encourage interactive lessons in teaching and learning

E. LEARNING ASSUMED TO BE IN PLACE

Participants are qualified teachers with a qualification in teaching at NQF 4 or above and teaching Mathematical Literacy.

F. TARGET AUDIENCE

Teachers who were identified through the 2019 NSC results, diagnostics report, and needs analyses of the teacher in the Integrated Quality Management System (IQMS) who teaching Mathematical Literacy in target schools. The course is aimed at professional development to improve learner performance in Mathematics Literacy.

G. NOTIONAL HOURS:

The time required to successful completion has been allocated as follows:

Contact face to face session	17, 5 hours
Pre Test	1 hour
Day 2 : Content Practice and Demonstration	10,5 hours
Day 3: Content Practice and Demonstration	5 hours
Post Test	1 hour

H. COURSE DESIGN AND ASSESSMENT STRATEGY

- The envisaged course focuses on four modules with at least two units each viz.
  - ✓ Module 1: Maps Plans and Other Representations of the Physical World
  - ✓ Module 2: Measurement

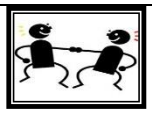
- Teachers will be subjected to the variety of content knowledge, formative activities to consolidate the content learnt, Pre-test at the beginning of each workshop session to further verify content gaps and post-test in the last session.
- Pre-Post Test data will be used to monitor what learning has taken place in the 3 days of the session and workshop activities will also be used to support participant on subject matter knowledge

I. COURSE OUTLINE/ MAP

Module 1 : Maps, Plans and Other Representations of the Physical World	
Objectives/Outcomes	**Units**
• Work with different types of scales on maps • Work with scales on maps • Calculate actual length and distance when map is known	Unit 1: Scale
• Calculate map measurements when actual lengths and distances are known using a given scale • Determine the scale in which a map has been drawn in the form 1: ----- and use the scale to determine other dimensions on the map • Interpret compass directions in the context of appropriate maps	Unit 2: Maps and Scale Unit 3: Floor and Elevation Plans

Module 2 : Measurement	
Objectives/Outcomes	**Units**
• Calculate/measure metric/imperial units, time, conversion factors/tables, solid to liquid and temperature. • Calculate/measure the perimeter, area, surface area and volume of objects. • Calculate/measure the Volume and surface areas of rectangular, triangular prism, cylindrical prism pyramids, cones and spheres. • Determine/calculate appropriate quantities of materials/components required to complete a task or project.	Unit 1: Conversions, measuring time, timetables and speed Unit 2: Two-Dimensional Measurement Unit 3: Three-Dimensional Measurement

J. TABLE OF ICONS TO BE USED IN THIS MANUAL

Discussion	
Group ACTIVITY	
Individual ACTIVITY	
Study Tips	
Notes	
Ice Breaker	
Time	
Tools	

K. TABLE OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ATP	Annual Teaching Plan
CAPS	Curriculum and Assessment Policy Statement
ICT	Information and Communication Technology
LP	Lesson Plan
FG	Facilitator's Guide
NPPPPR	National Policy Pertaining to Programme and Promotion requirements
PG	Participant's Guide
FS	Fact Sheet
PPT	PowerPoint Presentation
TPACK	Technological, Pedagogical, Content and Knowledge
TS	Training Session

L. TERM ANNUAL TEACHING PLAN

DATE	CONTENT	CONTEXT
14/04 – 17/04	**SCALE** • Scale (ratio, bar) • Determine actual lengths and distances from a given scale • Determine a scale for drawings and/or models • Determine a scale in which to draw diagram or construct a model	• Seating plan (classroom, offices, cinemas, sport stadiums, etc) • Layout maps (buildings in a school or sports field, stores in a shopping centre) • Street maps • National/provincial maps • Elevation maps • Strip charts
20/04 – 24/04	**MAPS** • Grid reference • compass directions • slope on map	
28/04 – 30/04	**SCALE and PLANS** • Diagrams (assembly instructions in manuals, etc.) • Plans (symbols and notation, terminology, determine actual dimensions using a given scale, determine a suitable scale to draw	
06/05 – 08/05	**MEASUREMENT (Calculating)** • Length, distance and time • Perimeter • Area	• House plans • Floor plans • Painting Tiling (laminating, ceramic, etc.)

11/05 – 15/05	**MEASUREMENT (Calculating)** • surface area • Volume • Rate (speed, costing, etc.)	• Assembling wooden furniture or any appliance • House floor plan

M. COURSE TIMETABLE

TIME	ACTIVITY
15:30 – 16:30	Arrival
16:00 – 17:00	Plenary Session: Opening and Welcome, Issuing of Training Materials and Other Logistics
17:00 – 18:00	TS 1: Pre Test
18:00 – 19:30	Supper

DAY 2

TIME	ACTIVITY
06:30 – 08:00	Breakfast
08:00 – 10:30	TS 2: Module 1 – Unit 1
10:30 – 10:45	Tea Break
10:45 – 13:00	TS 3: Module 1 – Unit 2
13:00 – 14:00	Lunch
14:00 – 15:30	TS 4: Module 1 – Unit 3
15:00 – 16:00	TS 5: Module 1 – Unit 4
16:00 – 16:15	Tea Break
16:15 – 18:00	TS 6: Module 2 – Unit 1
18:00 – 19:00	TS 7: Module 2 – Unit 2
19:00 – 20:30	Supper

DAY 3

TIME	ACTIVITY
06:30 – 08:00	Breakfast
08:00 – 09:00	TS 8: Module 2 – Unit 2
09:00 – 10:30	TS 9: Module 2 – Unit 3
10:30 – 11:00	Tea Break
11:00 – 12:00	TS 10: Module 2 – Unit 3
12:00 – 13:00	TS 11: Post Test
	Closing Session: Closing Remarks
13:00 – 14:00	Lunch

MODULE 1: MAPS, PLANS AND OTHER REPS. OF THE PHYSICAL WORLD

INTRODUCTION

In this module participants will look at the concept of

- Number scale and bar scale
- Map scale and calculating distance
- Compass directions and giving directions

OVERVIEW

In this topic, participants will work with maps of possible unfamiliar contexts and complex structures.

SPECIFIC OBJECTIVES

When participants complete this module, they should be able to:

- Work with different types of scale on the map/plan
- Work with scale on map/plan
- Calculate actual length and distance when map/plan is known
- Calculate map/plan measurement when actual length/distance is known using a given scale
- Determine the scale in which a map/plan has been drawn in the form 1: … and use the scale to determine other dimensions on the map/plan
- Interpret compass directions in the context of appropriate map/plan

GRADE PROGRESSION

GRADE 10	GRADE 11	GRADE 12
Maps and plans of familiar context e.g. school.	Maps and plans of less familiar context e.g. Office space	Maps and plans of possibly unfamiliar contexts or complex structures e.g. RDP houses.

GLOSSARY OF TERMS

Scale	Is used to indicate how much an object has either been reduced or enlarged from its actual size. Also applicable to distance between two places. $$Scale = \frac{Map\ distance}{Actual\ distance}$$
Number scale	A number scale such as 1 : 5 000 means that 1 unit on the map represent 5 000 units in real life
Bar scales	Presented as a picture, it means that if you placed a ruler next to this scale, you could determine how many centimeters next to this scale, you could determine how many centimeters represent the specified kilometers.
Distance	Length of a line joining any two points.

Distance as the Crow flies	Length of a straight line joining any two points.
Actual/Real/True distance	Real distance between any two points.
Map/Plan distance	Distance between any two points on a plan or map.
Elevation map	Information about the profile of a route as seen from the side.
Highway	A major road that links major cities.
National road map	Shows major roads linking major cities to each other.
Route map	Shows a specific route, for instance for an event, as seen from above.
	Determines how many times smaller an object shown on a plan or map is that its actual size
Scale drawing	A diagram of a real-life object drawn in proportion.
Street map	A map of a small area such as a town or city.
Strip map	A map of a section of a travelling route.

CONTENT

Participants will study this module through the following units

Unit 1	Scale
Unit 2	Maps and Scale
Unit 3	Floor and Elevation plans

UNIT 1: SCALE

INTRODUCTION

In this unit participants will look at the concept of Scale viz. **number scale and bar scales including large scale and small scale.**

SPECIFIC OBJECTIVES

At the end of this Unit, participants should be able to:

- Work with number and bar scale
- Discuss the disadvantages and advantages of bar scale and number scale
- Expressing number scale as a bar scale and vice versa
- **Determining the scale used to resize the image**
- Use the given scale to do calculations
- Calculating the actual length of the drawing or image of the object.

LESSON NOTES 

Scale can be expressed as a set of levels or numbers used in a systematic way to compare or measure things.

TYPES OF SCALE

- **Number scale**
  - Also called a ratio scale.
  - It is always expressed as a ratio like 1:200
  - This means 1 unit on the map represents 200 units on the ground. E.g. 1cm measured on the map will represent 200cm on the ground.
  - The units should always be in the simplest form.

    i.e. if 5: 900 is given, divide both sides by 5

    $\frac{5}{5}:\frac{900}{5}$ = 1: 180

  Using a number scale:
  - Multiply the given distance by the real part of the map.
  - If the distance was not given, use a ruler to measure the distance on the map.
  - Multiply the scale factor by the distance measured to get the real distance.
  - E.g. If you measured 800 mm, to get the real distance multiply 800 by 180.

- **Bar scale**
  - Also called a graphic scale or a linear scale.
  - Bar scale is represented in segments

    100m 200m
  - Each piece of the segment represents the given distance

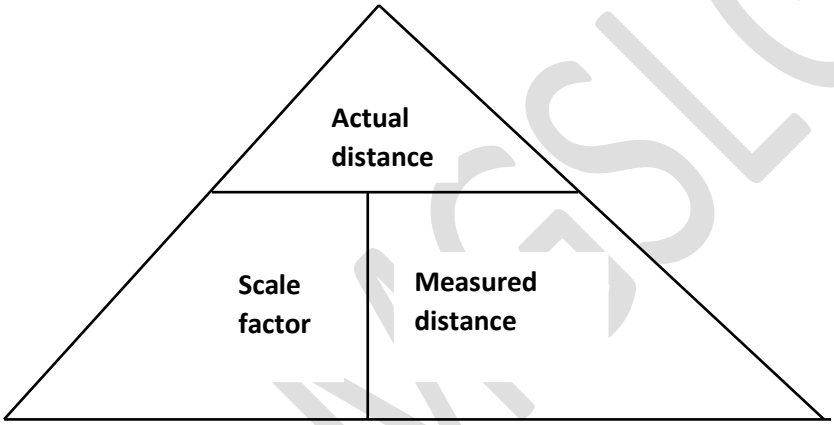
  - **Using a bar scale:**
    - Measure the size of one segment or the whole bar with a ruler in centimetres preferably.
    - If you measured the whole bar, simplify the scale before doing any calculations.
    - Measure the distance on the map in centimetres.
    - Calculate how many segments of the bar graph it works out to be; i.e. divide the total distance measured and divide it by the length of one segment or simplified size of the bar.
    - Multiply the distance by measurement indicated on one bar.

- **Converting from bar scale to number scale**

100m 200m

- Measure 1 segment of a bar.
- Write the ratio of a measured segment to the actual length
- Change units to be similar
- Simplify and write the scale in the form 1: …

This triangle may be used when calculating distance or scale factor



Take Note:

- The horizontal line(__) represents division
- The vertical line (|) represents multiplication.
- To calculate the Actual distance, multiply the measured distance by the scale factor.
- To calculate the measured distance, divide the actual distance by the scale factor.
- To calculate the scale factor, divide the actual distance by the measured distance.

Bar scale versus number scale

Type of scale	Advantages	Disadvantages
Bar scale	• Resizing the map does not affect the bar scale as it changes with the resized map. • Can be used to determine actual lengths and distances without doing many calculations. • Quick and relatively easy to use.	• One has to measure the length of one segment and measure the distance on the map before doing calculations. • Certain instruments are used to measure a bar scale, e.g. a ruler.
Number scale	• We only have to measure one distance • If the distance is given, we only have to multiply the given distance by the real part of the map. • Calculations are usually fairly simple. • Any unit e.g. cm or mm can be used when using a ratio scale, which can then be converted to another appropriate unit e.g. km.	• When plans/maps are resized i.e. made bigger or smaller, the ratio scale becomes inaccurate and cannot be used. • Calculations are required to determine the actual lengths and distances.

Example 1:

Explain the meaning of the following ratio scales:

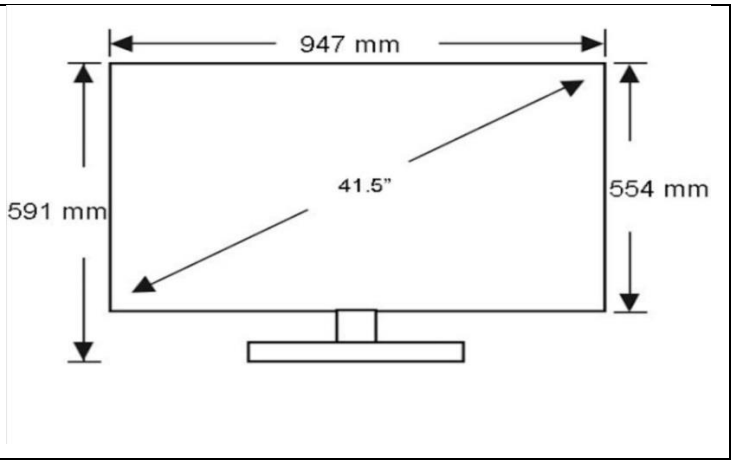
a) 1 : 500
b) 3000 : 1

Solution

a) 1 unit on the map, represents 500 units in reality.
b) 3000 units on the map, represents 1 unit in reality

Example 2

Lihle recently moved into a new home. She bought a flat screen TV with the dimensions as indicated below. Use the length distance of $947\ mm$ to determine the scale used on this drawing.



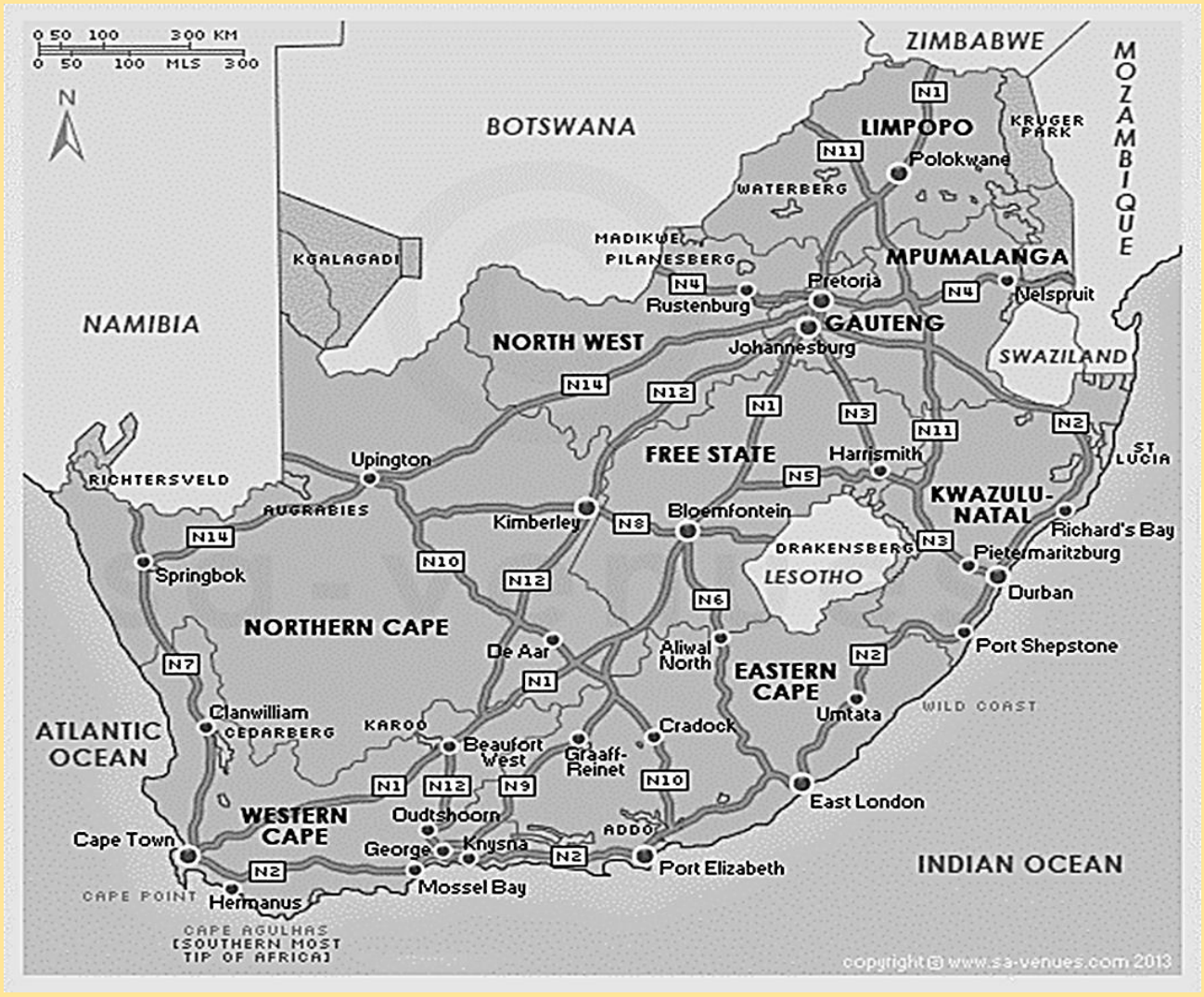
Solution:

Step 1: Use a ruler to measure the length distance = $85mm$	Step 2: Write the distances in ratio form $85mm$: $947mm$	Step 3: Simplify the ratio i.e. $\frac{85mm}{85mm} : \frac{947mm}{85mm}$	Step 4 : Write the scale in simplified for i.e. 1 : 11.141176 ….	Step 5: Write the scale in simplified form i.e. 1: 11

Example 3:

Working with a bar scale

Lizzy lives in Polokwane, Limpopo. She wants to go visit a friend in Bloemfontein, Free State. Use the Map and the bar scale below to calculate the straight line distance, in kilometres, from Polokwane to Bloemfontein.



Solution

Step 1: Use a ruler to accurately measure the length of the bar scale (either in cm or mm).
1cm: 100km

Step 2: Use a ruler to measure the straight line distance (as the crow flies) between Polokwane and Bloemfontein, as accurately as possible.
4,8 cm

Step 3 Use the numerical ratio in step 1 to calculate the actual distance.

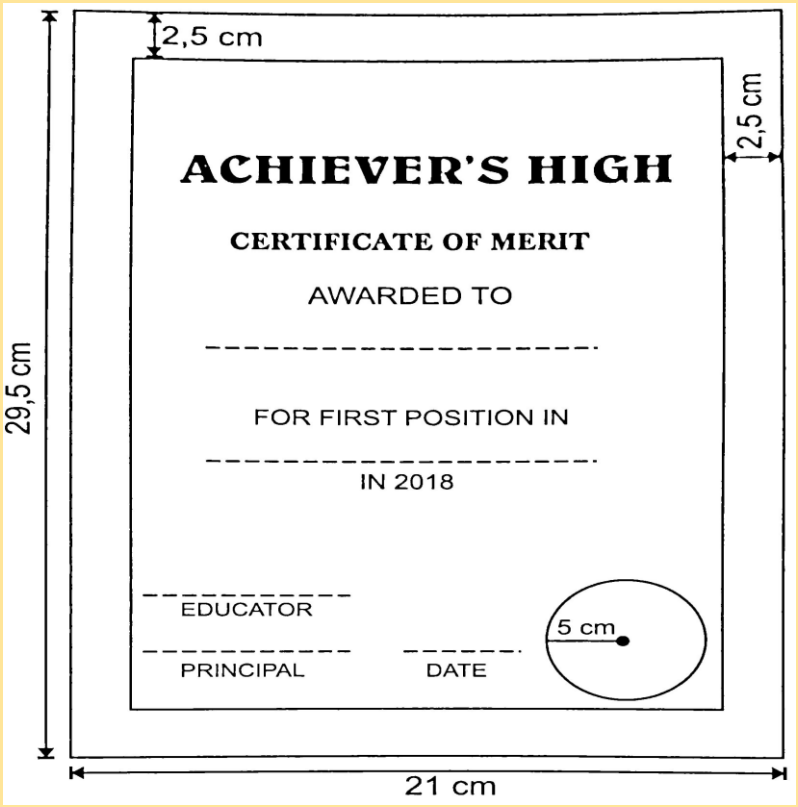
Actual distance $= \frac{4{,}8\ cm \times 100\ km}{1cm}$
Actual distance $= 480\ km$

Activity 1.1.1. Individual Work (15 Minutes)

Instructions

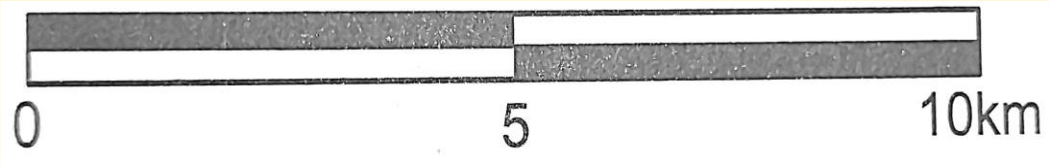
- Refer to the questions provided
- Task 1: Answer the questions and allocate marks or indicate were marks are allocated.
  Task 2: Identify the taxonomy levels for each question
- These questions are intended to prompt participants to consolidate the unit and possible ways in which this section can be taught
- Report Back and Discussion
- Resources: Training manual, Note pad, Pen and Calculator.

1. Ms Welcome an educator at Achievers High School, is responsible for preparing the prize giving certificates for the annual academic awards day. The certificate is rectangular in shape. The certificate has outside dimensions of $Length = 29{,}5\ cm$ and $Breadth\ = \ 21\ cm.$



a) Use the Breadth of the certificate to determine the scale used to draw this certificate.
b) Explain the meaning of the scale above.

2.



a) Measure the above scale in cm.
b) What does the Bar scale represent?
c) The Straight line distance on a map between points A and B is $85\ cm$.
Use the bar scale above to calculate the actual distance in $kilometres$.

Additional Notes:

End

UNIT 2: MAPS AND SCALE

INTRODUCTION

In this unit participants will look at the concept of

- Compass directions and giving directions
- Types of maps
- Map scales and calculating distance

LEARNING OUTCOME

At the end of this Unit, participants should be able to:

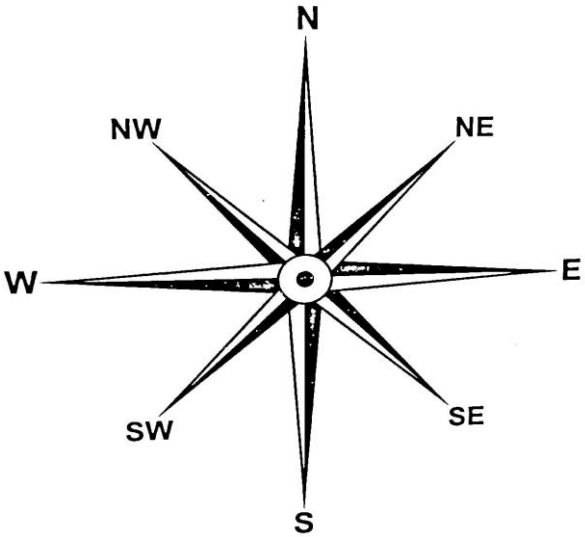
- Work with different types of maps
- Calculate actual length or distance on the map using bar scale or number scale
- Using given map to find the way to the destination
- Determine the scale in which a map has been drawn in the form 1: …. **and** use the scale to determine other dimensions on the map.

LESSON NOTES

DEFINITION

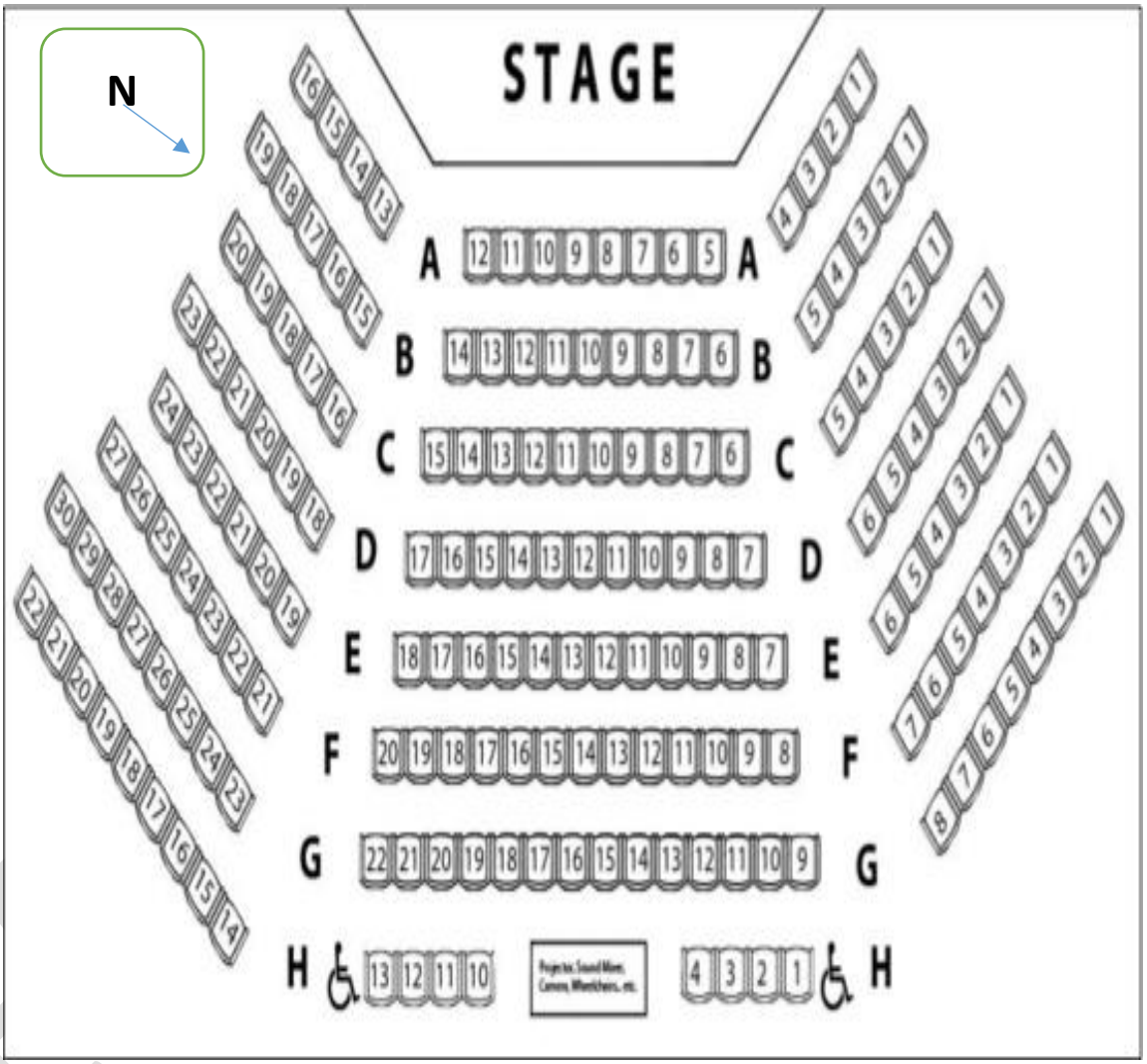
- A map is a diagrammatic representation of an area of land or sea showing physical features, cities viz. National/Provincial map, Strip chart, Elevation map, Street map etc.
- A map can be expressed as a plan or a chart.

COMPASS DIRECTIONS AND GIVING DIRECTIONS

• Compass directions are important when describing one's position. • Relative position is used to describe a person's position or direction in relation to a particular landmark. • The following words can be used to describe relative positions: Left, right, opposite, next to, straight, up, past, between and behind.	

TYPES OF MAPS

1. **Maps of Smaller areas**
   - Includes seating plans in a cinema, stores in a shopping centre, seating plan in a bus or aeroplane.
   - A numbering system and a grid reference is often used to locate places in such maps.
   - A grid reference consists of a letter and a number e.g. B6.



Possible Questions:

John takes his wife to a concert of her favourite artist.
Study the seating plan of the Vereeniging Theatre above and answer the questions that follow:

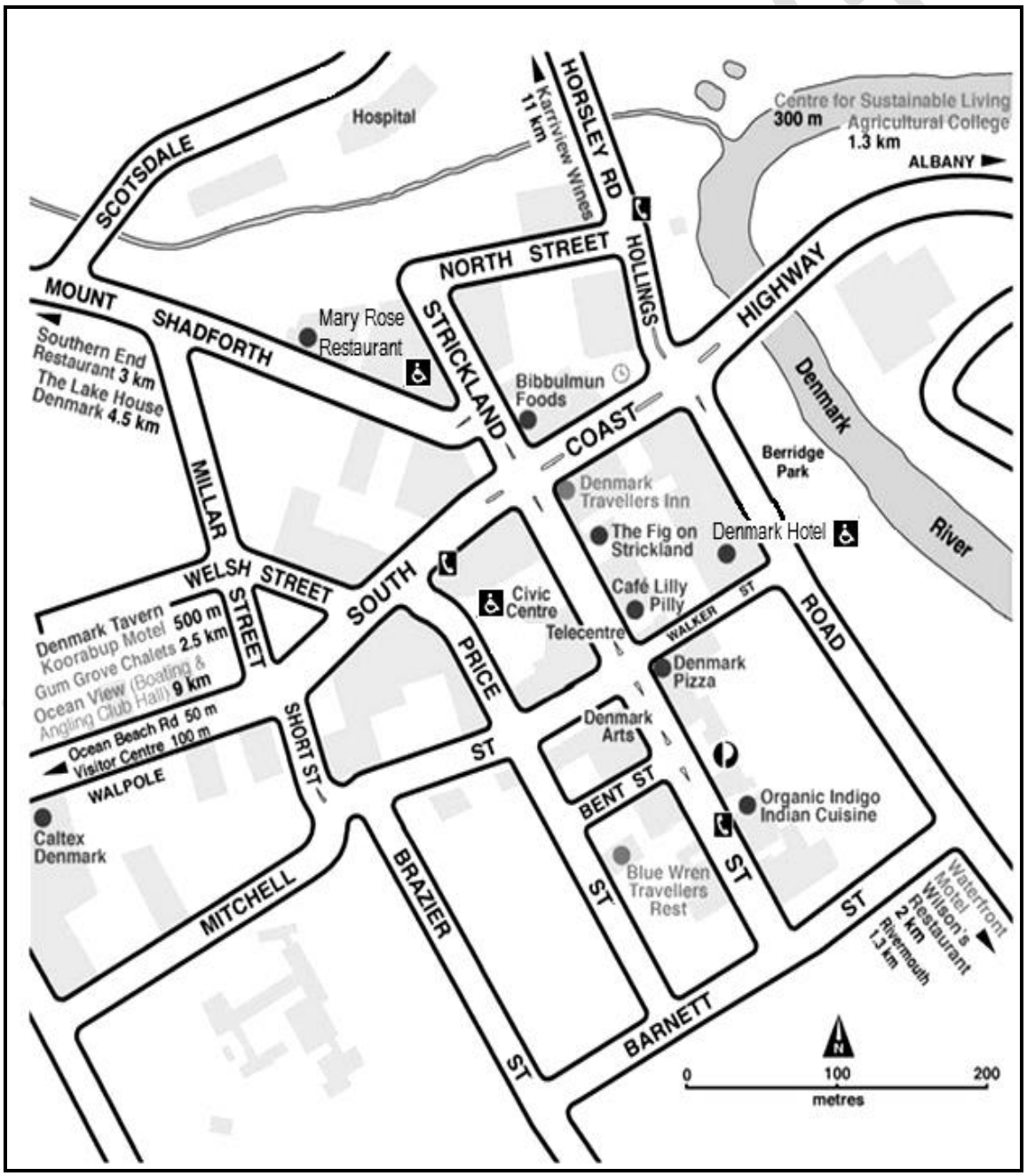
a) How many seats are available in the theatre?
b) Determine how many spaces are reserved for wheelchairs in this theatre.
c) Give the compass direction of seat H22 from the stage.
d) John is seated in the middle block, in the third row from the back. His seat is exactly in the middle of the row. Name the row and seat number where he is seated.

Maps of larger areas

- Street maps
- National road and rail maps
- Provincial road maps
- Strip route maps
- Distance maps
- Elevation maps

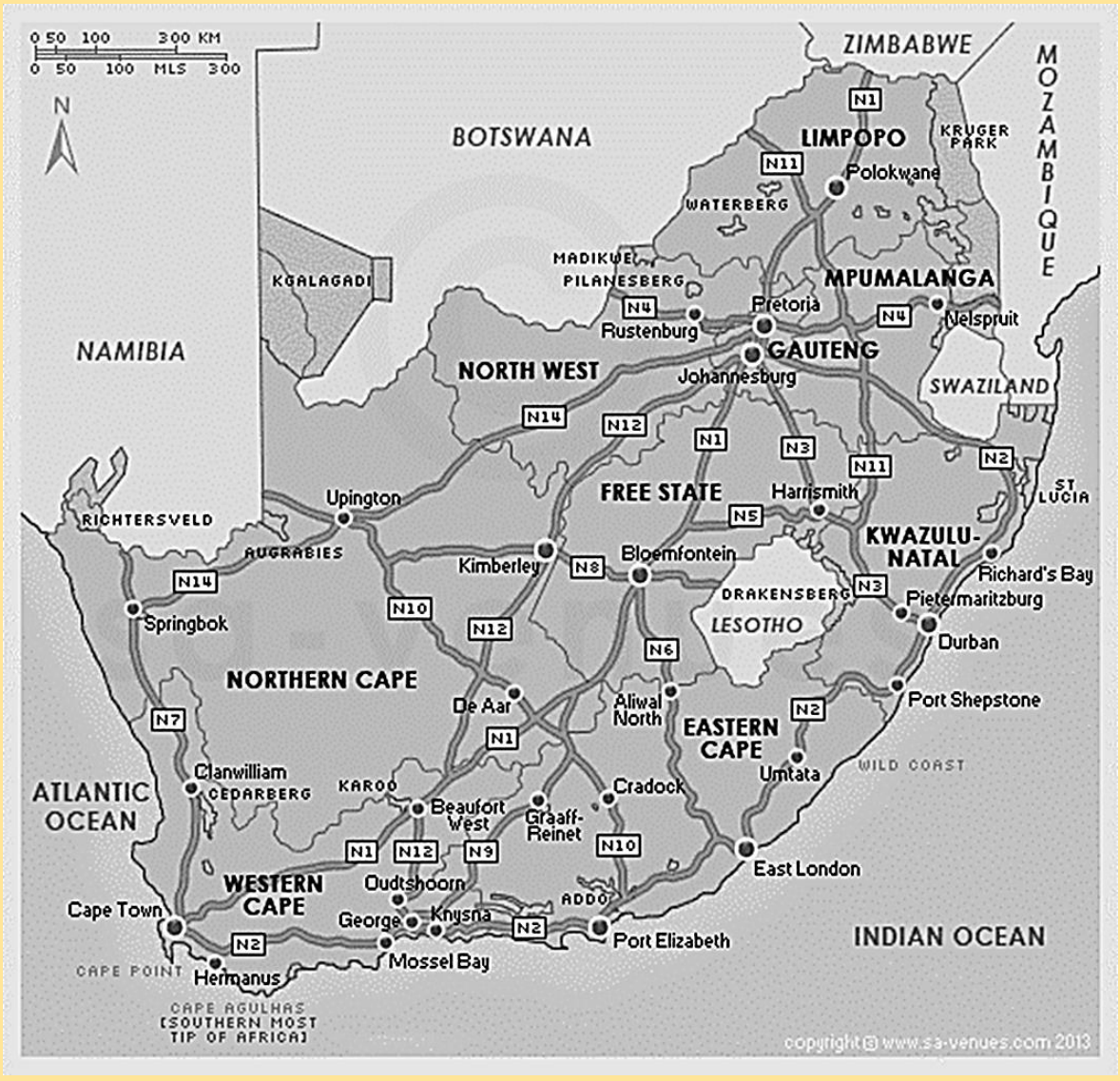
1. Street Maps

This map usually gives an in-depth view of the city, showing streets, the scale and sometimes with grid references.



2. National road and rail map

National roads in South Africa are a class of roads and freeways which connect major cities. They are made up of route numbers beginning 'N' from N1 to N18.
National roads are indicated by the letter N and a number inside a rectangle.



Example

The Ndlovu family lives in Umtata, eastern Cape. They travelled by car to Johannesburg in Gauteng to see a sick relative.

1. In which general direction is Johannesburg from Umtata?
2. Identify the national road that passes through only one province.
3. The family travelled along the N2 to Durban, from Durban they joined the N3 to Harrismith. When they reached Harrismith they took a wrong turn and found themselves travelling on the N5 towards Bloemfontein.
   a) Describe a possible route, except the N1 and without turning back to Harrismith that the family could follow to travel from Bloemfontein to Johannesburg.
   b) Name the National roads and any relevant towns in the description of the route.
   c) Use the bar scale to calculate the actual distance from Johannesburg to Umtata in kilometres.

3. Provincial Map

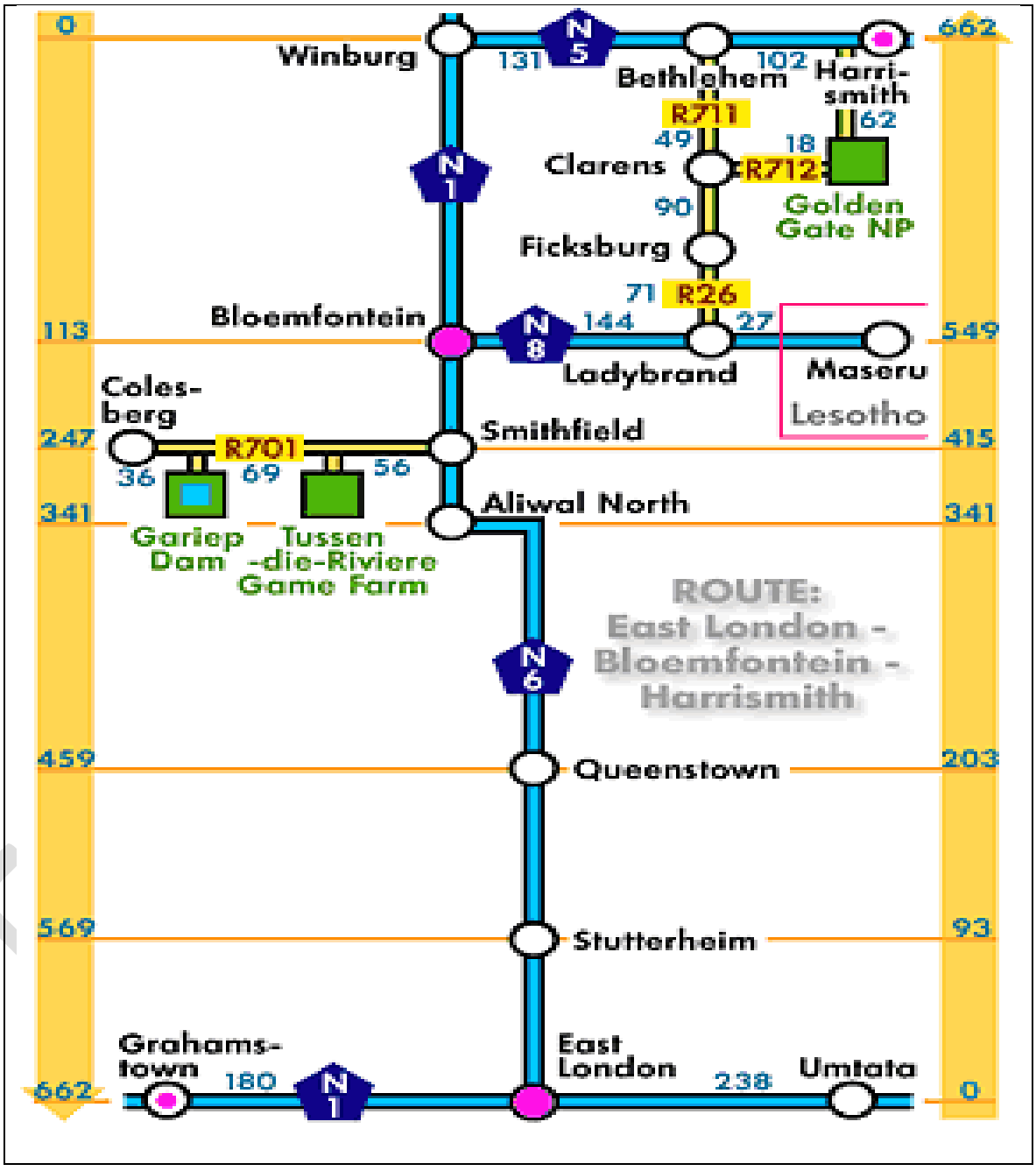
Indicates roads and towns that are found within a province.
Major provincial roads are indicated by a diamond shape.
Minor provincial roads are indicated by a rectangle or the letter R.

4. Strip chart/Route map

Drawn vertically on a page and shows distances on a national road between cities in South Africa.

It is a map that primarily displays roads and transport links rather than natural geographical information.

It is a type of navigational map that commonly includes political boundaries and labels, making it also a type of political map.



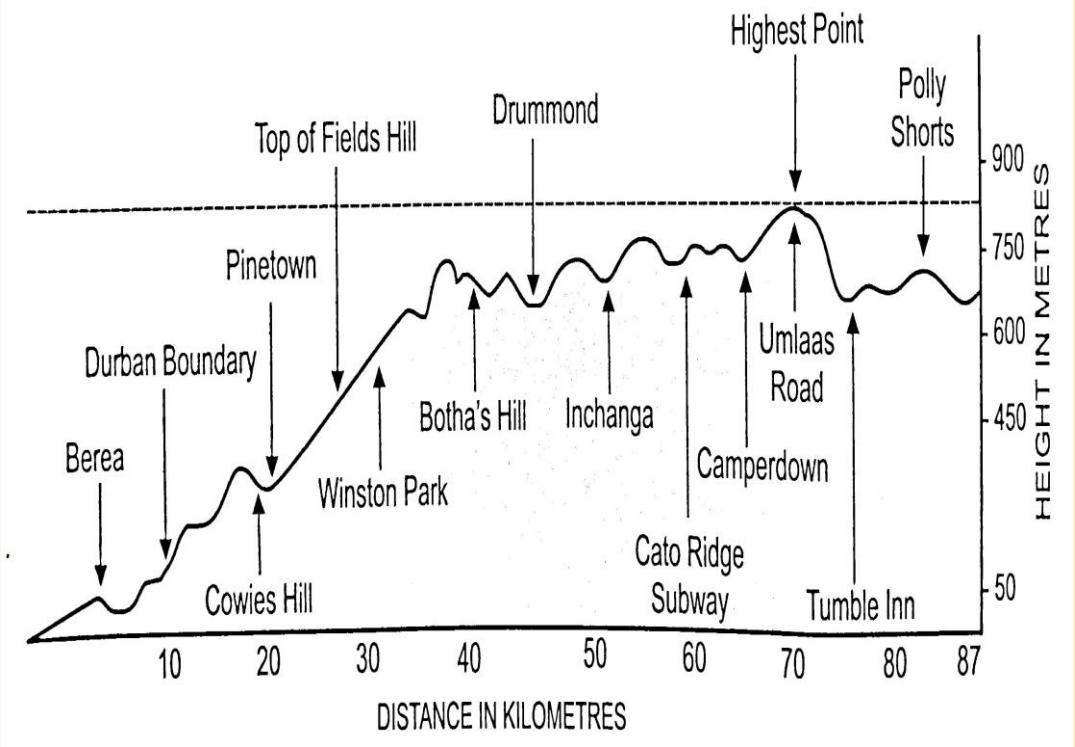
5. Elevation Maps

- Also known as Profile maps, represents the height above the sea level or altitude at different locations.
- Inclines (up-hills), declines (down-hills) and distances may also be shown.
- This type of map is very useful for marathon runners and athletes.

- **Steep slope:**
  - Contour lines are closer to each other
  - Soil erosion occurred
  - Building on it may be expensive

- **Gentle slope:**
  - Contour lines are apart from each other
  - You can build on it as the slope is not steep
  - Building infrastructure will be cheaper. (e.g. drawing water), farming

Comrades Marathon Profile Map



6. Distance Table

- Provides distances between main towns, cities, countries, etc.
- The table is made up of rows and columns.

Distances in km	Bloem-fontein	Cape Town	Durban	East London	Johannes-burg	Mthatha	Port Elisabeth	Pretoria
Bloem-Fontein		1004	634	584	398	570	681	455
Cape Town	1004		1753	1079	1402	1314	769	1460
Durban	634	1753		647	557	439	984	636
East London	584	1079	647		982	235	310	1040
Johannes-burg	398	1402	557	982		869	1075	58
Mthatha	570	1314	439	235	869		545	928
Port Elisabeth	681	769	984	310	1075	545		1133
Pretoria	455	1460	636	1040	58	928	1133	
George	773	438	1319	645	1171	880	335	1229

Examples

Jo-Anne and her friends are going on a vacation. They are planning to tour three different cities in the country. Use the Distance table above to help you answer the following questions:

a) Determine the distance from Cape Town to East London.
b) Determine the distance from East London to Pretoria.
c) Calculate the distance from George to Port Elizabeth via Johannesburg.

Solution:

a) $1079\ km$
b) $1040\ km$
c) Step 1 :
The distance from George to Johannesburg $= 1171\ km$
Step 2: Distance from Johannesburg to Port Elizabeth $= 1075\ km$
Step 3: Total distance
$= 1171\ km + 1075\ km$
$= 2\ 246km$
$\therefore distance\ from\ George\ to\ Johannesbur$
$= 2\ 246km$

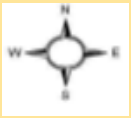
Activity 1.2.1. Group Discussion (15 Minutes)

Instructions

- Participants should form groups of 4 – 5
- Refer to the questions provided
- Task 1: Answer the questions and allocate marks or indicate where marks are allocated.
  Task 2: Identify the taxonomy levels for each question
- These questions are intended to prompt participants to consolidate the unit and possible ways in which this section can be taught
- Report Back and Discussion
- Resources: Training manual, Note pad, Pen and Calculator

1.1. The Matric learners of Sunset High School sat for their NSC exams in November 2019. Below is a seating plan of the matric learners in the school hall.

	1	2	3	4	5	6	7	8	9
A									
B									
C									
D									
E									
F									
G									
H				**Invigilators' Table**					
I									



Scale: 1: 300

a) Determine the general direction if travelling from C5 to F8.
b) Explain the meaning of the given scale.
c) Use the given scale to determine the actual area of the following in cm^2.:
   (i) Candidate's table E7
   (ii) Invigilator's table

1.2. Kruger National Park, in Mpumalanga South Africa, is one of Africa's largest game reserves. Satara Rest camp is one of many camps in Kruger National Park.
(Adapted from KZN, 2019, P2)
Below is the travelling time to Satara rest camp from Crocodile Bridge and Gate.

Distance from Gates to Camps		
	Satara Rest Camp	
	Distance	Time
Crocodile bridge and gate	$127\ km$	$5\ hours\ 5\ minutes$

- Important information:
  Recommended speed 25km/hour for game viewing

Use the information provided in the travelling timetable and on the Kruger National Park Map to answer the questions that follow.

a) Give the general direction if travelling from Crocodile Bridge and gate to Satara rest camp.
---

b) A tourist wants to travel from Malelane gate to Phabeni gate. Direct the tourist to Phabeni gate.
---

c) The time taken to travel from Crocodile Bridge and gate to Satara Rest Camp is 5 hours and 5 minutes. Show how this time was calculated. Round off your answer to the nearest minute.
---

d) Convert the bar scale of this map to a number scale in the form 1: ..... Show your workings.
NB: Round off your number scale to the nearest whole number.
---

e) Use your answer from QUESTION d) above to calculate the straight-line distance from Crocodile Bridge to Satara rest camp.
Explain why your answer from QUESTION e) does not match 127 km given above.
---

f) Explain why your answer from QUESTION e) does not match 127 km given above.

LAYOUT MAP FOR ENTRANCE KRUGER NATIONAL PARK GATES AND REST CAMPS IS ALSO PROVIDED BELOW:

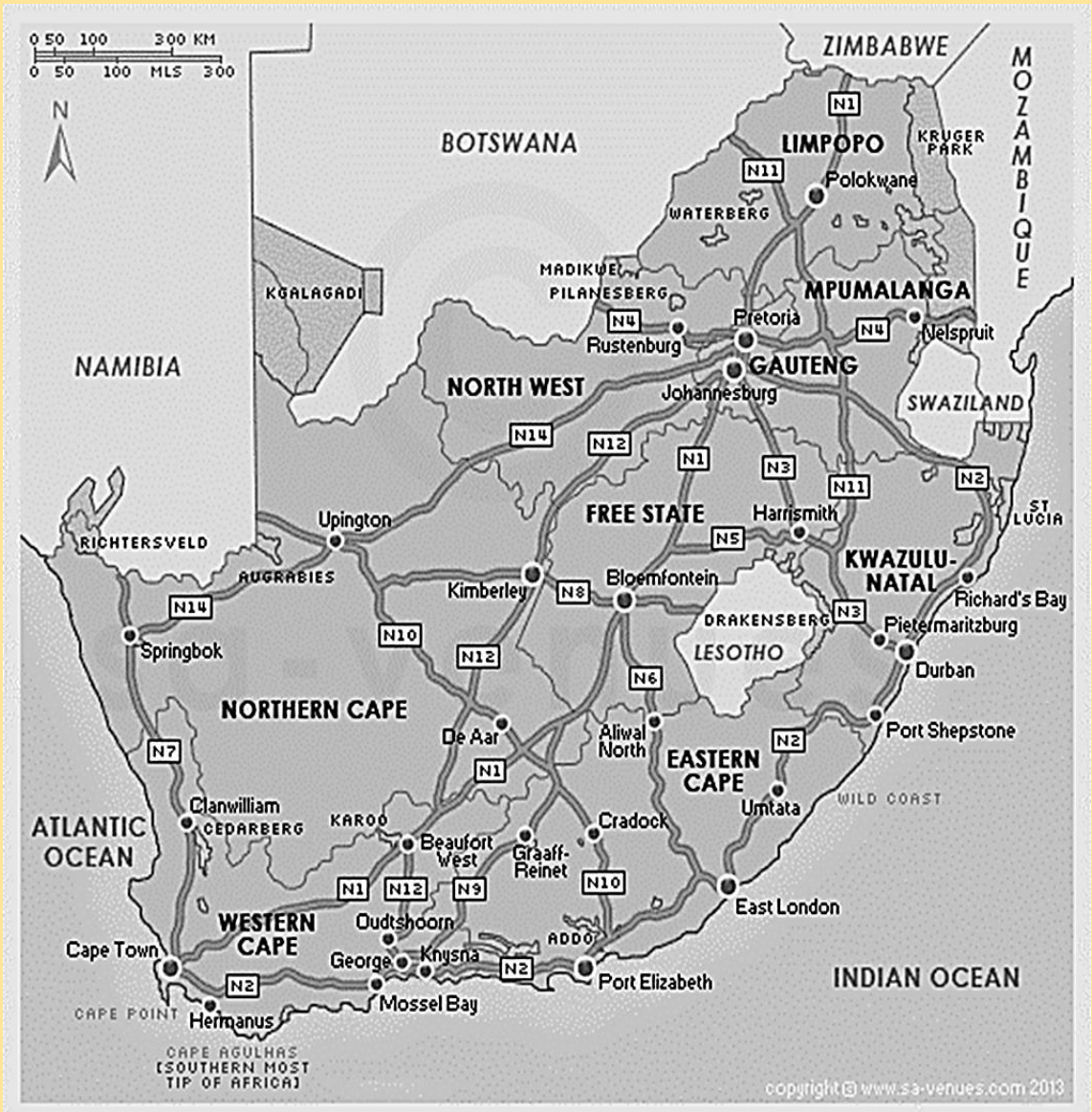

N
W
E
S
Pafuri gate
Pafuri
Border Post
Njalaland Trails
Punda Maria
& gate
Shingwedzi
Mopani
Giriuondo
Border Post
Letaba
Phalaborwa
gate
Olifants
Olifants Trails
Satara
Orpen & gate
Sweni Trails
Metsimetsi Trails
Paul Kruger gate
Phabeni gate
Skukuza
Lower Sabie
Numbi gate
Napi Trails
Pretoriuskop
Wolhuter Trails
Berg en dal
Crocodile
Bridge & gate
Boesman Trails
Malelane
& gate
30
0
30
60 Kilometers
PROUDLY
SOUTH AFRICAN
10 YEARS OF FREEDOM

Activity 1.2.2. Individual Work (15 minutes)

Instructions

- Refer to the questions provided
- Task 1: Answer the questions and allocate marks or indicate were marks are allocated.
  Task 2: Identify the taxonomy levels for each question
- These questions are intended to prompt participants to consolidate the unit and possible ways in which this section can be taught
- Report Back and Discussion
- Resources: Training manual, Note pad, Pen and Calculator

The Moodley family lives in Pietermaritzburg. A map of South Africa showing the National roads is given below: Study the map and answer the questions that follow:



1. The family travelled from Pietermaritzburg to Johannesburg by car, using the N3.
   a) Measure the distance, in centimetres, between these two cities.
   b) Hence use the scale given on the map to calculate the actual distance, in kilometres, between these two cities.

2. The car travelled at an average speed of 120km/hr. They departed at 08:15 and planned to arrive in Johannesburg at 14:10. Determine whether they arrived at the predicted time.
3. The family left Pietermaritzburg with a full tank of petrol. Along the way they stopped at a petrol station to refuel at a cost of R455,40.

   The capacity of the tank is 60 litres and the cost of fuel is R16,35 per litre.
   a) Before refuelling, the fuel gauge indicated that the tank was half full.

      Verify, showing ALL calculations, whether the fuel gauge was working properly.
   b) If the car's fuel consumption was 9 litres per 100 km, determine how far they were from Johannesburg when they refuelled.
4. Describe, in detail, the shortest possible route, using national roads, to travel from Port Shepstone to Upington.
5. Mr Moodley gave the following directions to his friend using his cellphone:
   - From George, travel north along the N12.
   - When you reach Beaufort West, take the N1 and travel through Bloemfontein to Pretoria.
   - Then travel along the N4 in a Westerly direction.
   - The next town will be your destination.

     What is his friend's destination?

Additional Notes:

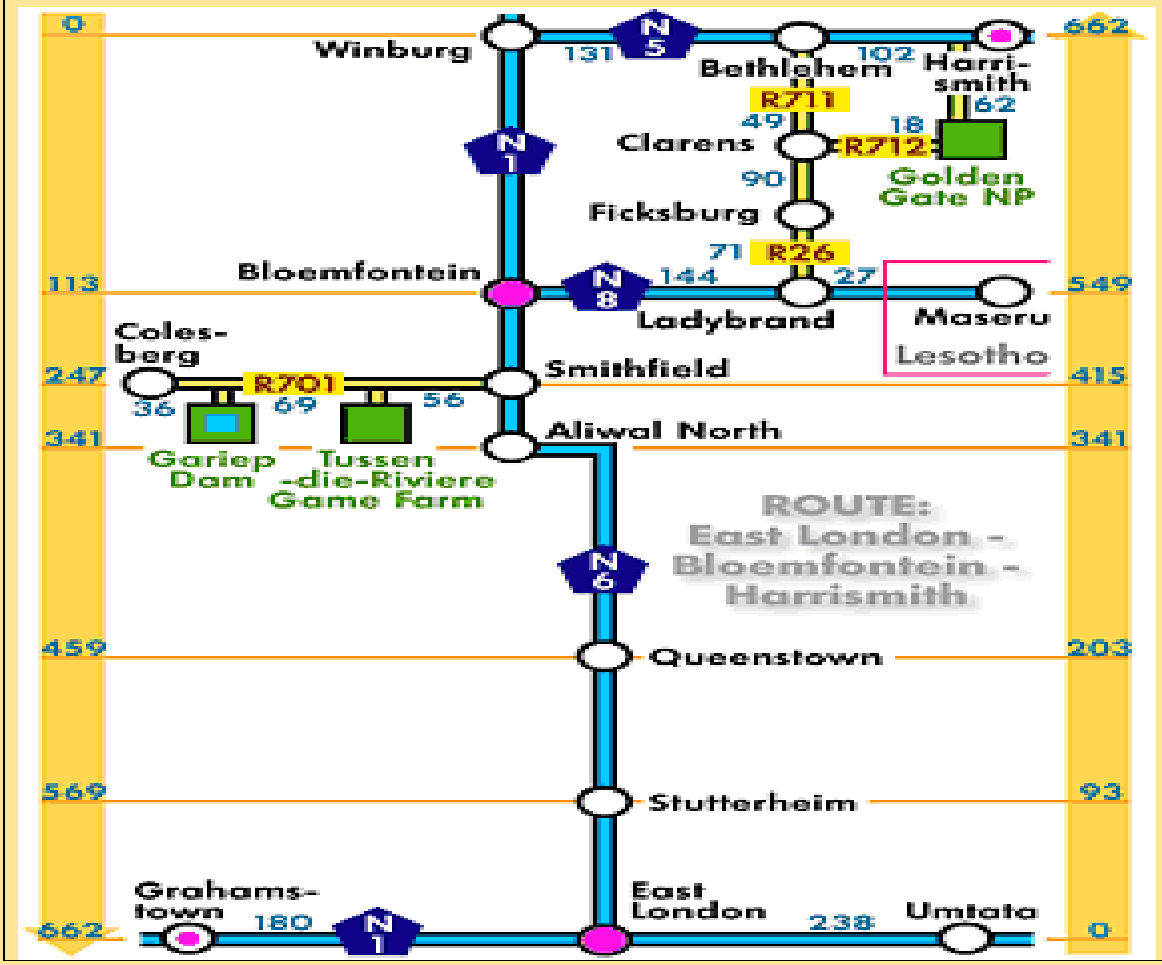
Activity 1.2.3. Individual Work (10 Minutes)

Instructions 

Refer to the context provided

- These questions are intended to advance skills that can be used in the classroom and possible ways in which this section can be taught
- Task 1: Answer the questions and allocate marks or indicate were marks are allocated.
- Task 2: Identify the taxonomy levels for each questions
- Report Back and Discussion
- Resources Training manual and Note pad

1. Siyabonga used the strip map of the route from East London to Harrismith below while planning his trips around the Free State, Eastern Cape and Lesotho. The strip chart below shows the route that Siyabonga could take for his trip.
   Use the Information in the strip chart to answer the questions that follow:

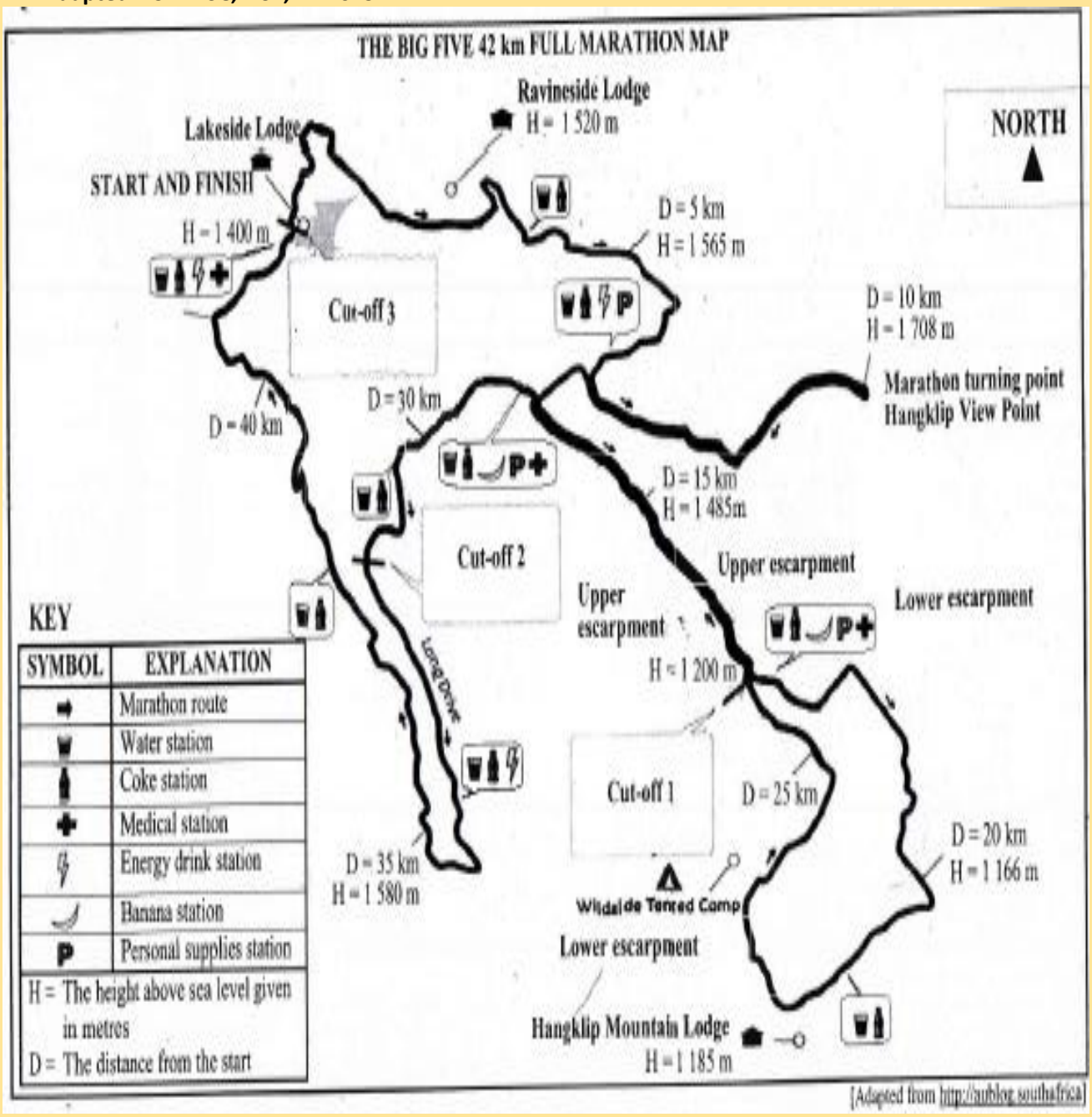


a) How many National roads are indicated on the strip chart?
b) Give the name of the road connecting Bethlehem and Ficksburg.
c) Give the General direction of Maseru from Queenstown.
d) Calculate the distance travelled from Bethlehem to Tussen-die-Riviere Game Farm passing Winburg.

2. The Big five Marathon is an annual event in South Africa. It can be run as a full 42km marathon or as a half-marathon of 21km. The race has specific cut-off times (Certain compulsory distances to be covered within specific times). Runners who do not meet the cut-off times are forced to withdraw from the race. Below are the cut-off times for the full Marathon.

Full Marathon			
	Cut-off 1	Cut-off 2	Cut-off 3
Distance from the start	25,5 km	31,5 km	Finish line
Time from start	4hours 15min	5hours 15min	7 hours

Adapted from NSC, Nov, P2 2019



Use the information above and the map provided to answer the questions that follow:

1. Give the general direction in which a marathon runner is heading when passing the 20km mark.
2. Consider the heights above the sea level for this race.
   a) Explain why a runner is correct when he stated that he was running uphill from the start to the 10km mark.
   b) Express in the form: 1: … , the lowest possible height above sea level to the highest height above sea level.
3. Explain why there are cut-off times for a marathon.
4. For the half marathon, a runner must cover a distance of 16,5 km in a time of 5 hours from the start of the race to beat the cut-off 2 time for the half-marathon.

   A runner of a full marathon compared his speed with the speed of the half-marathon runner and stated that he had to run 2,7km/h faster in order to beat the cut-off 2 time of the full marathon.

   Verify, showing ALL calculations whether he is correct. **You may use the formula**

$$\boldsymbol{Distance = Speed \times time}$$

Additional Notes:

UNIT 3: FLOOR AND ELEVATION PLANS

INTRODUCTION

In this unit, Participants will look at the concept of **floor plan of a house, elevation plans and questions regarding scale and plans.**

SPECIFIC OBJECTIVES

At the end of this Unit, participants should be able to:

- Work with different types of scales on plans and in the construction of models
- Determine the most appropriate scale in which to draw/construct a plan and/or model, and use this scale to complete the task
- Determine the scale in which a plan has been drawn in the form 1: --- and use the scale to determine other dimensions on the plan
- Analyse the layout of the structure shown on the plan and suggest alternative layout options
- Determine actual lengths of objects shown on plans using measurement and a given scale viz. number or bar scale.
- Determine quantities of materials needed by using the plans and perimeter, area and volume calculations
- Connect the features shown on elevation plans with features and perspectives shown on a floor plan of the same structure

GLOSSARY OF TERMS

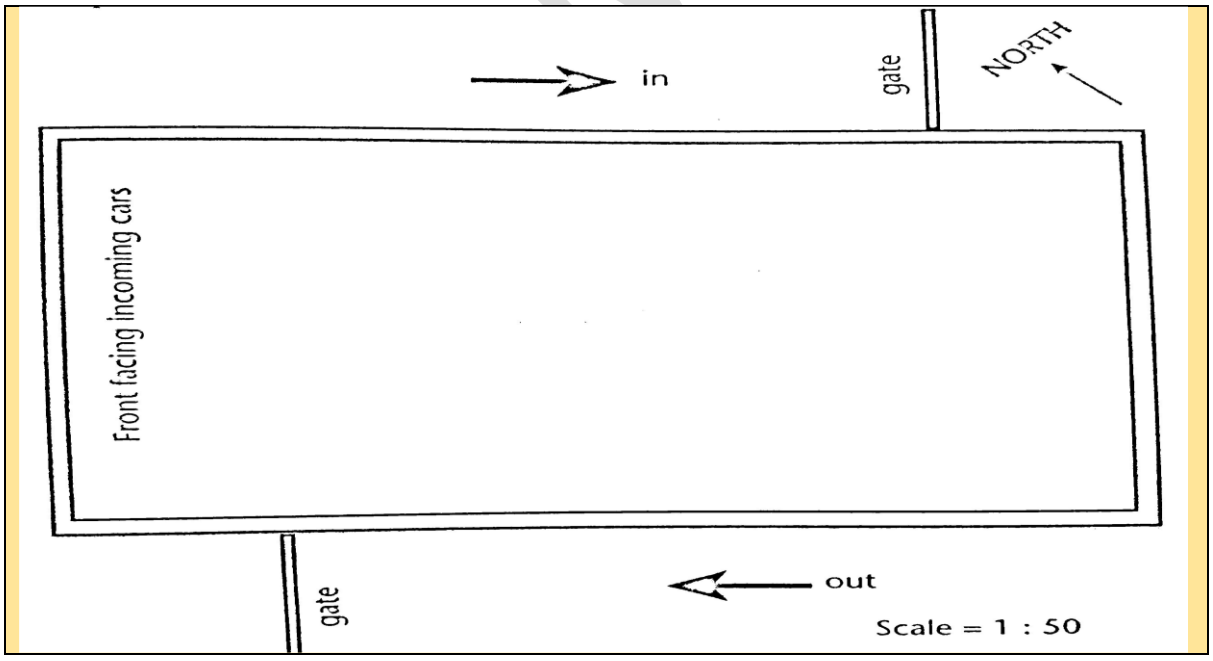
2-D models	A diagram or picture having length and width only.
2-dimensional plans	A plan or design having length and width only, but possibly representing three dimensional objects.
3-D models	A dimensional construction of real-life objects.
Elevation plans	Show the design and dimensions of the outside of a building from a side view.
Floor plan	Shows the design and dimensions of the inside of a building, from a top view.
North elevation plan	Shows the side of the building that is in front of you when you are facing the compass direction 'North'
Scaled elevation plans	Show the design and dimensions of the outside of a building from a side view using a specific scale.

Floor plans or Layout plan

- It is a line drawing showing rooms as though seen from above without a roof
- Shows a top view of a building floor (room, office, house, etc.).
- The floor plan for a house usually shows the layout of different rooms, the position of windows and doors as well as the position of fittings like cupboards, stoves, toilets, etc.
- Symbols are used in the floor plan or layout plan such as doors, windows, etc.
- The purpose of a plan is to show the layout and design of the 3-dimensional structure
- May include compass direction indicators.
- Floor plans are drawn to scale just like maps
- Plans will show a scale viz. a ratio or a bar scale.
- Working with this scale is exactly the same as working with scales given on maps.

Example 1

The floor plan of a security room at the entrance of Birchwood Hotel is shown below. Window(s) and Door(s) have not yet been shown. Study the plan below and answer the questions that follow.



a) In which direction is the security room facing?
b) On which side do the cars stop that enter the hotel? Give the compass direction.
c) Write down the outside measurements of the security room in mm by using a ruler.
d) Use the scale to determine the actual dimensions of the room in metres.

Elevation Plans

LESSON NOTES 

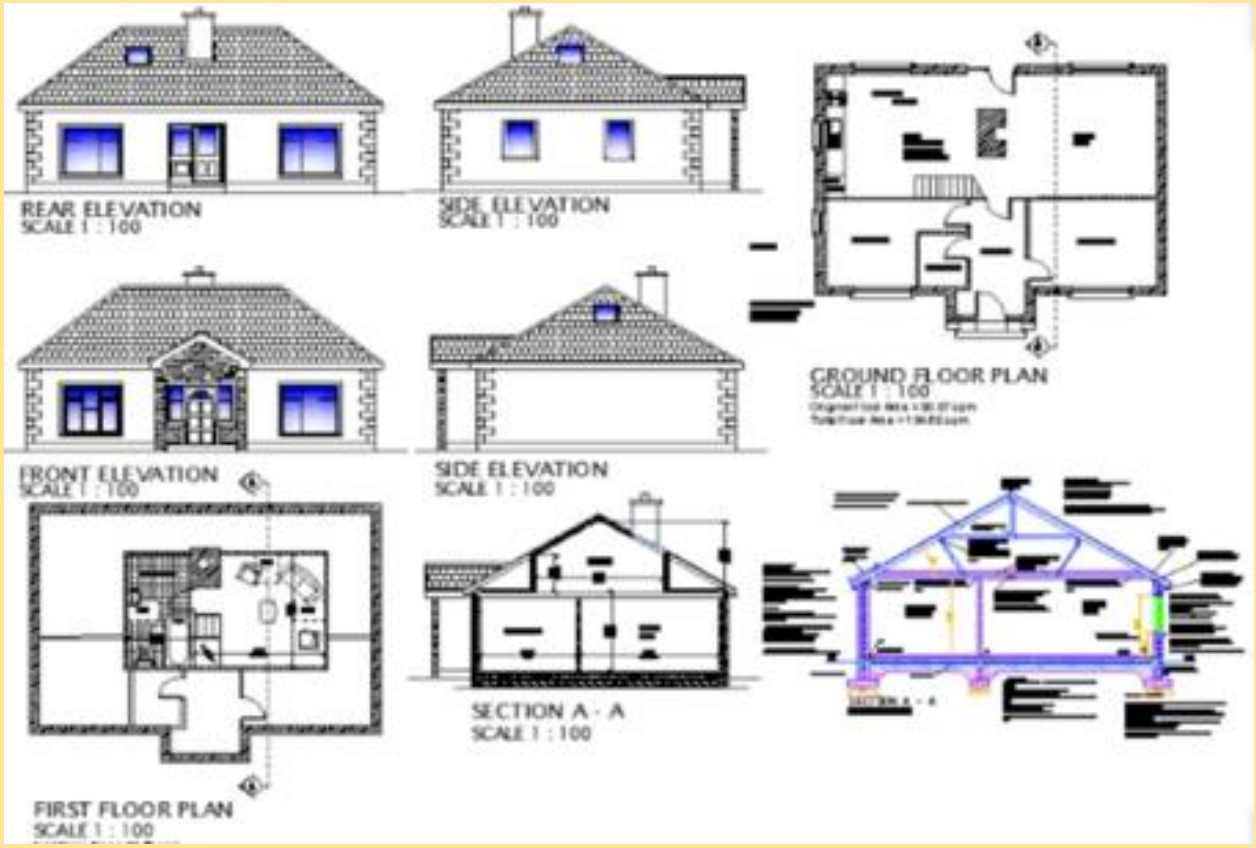
Elevation plans

- Elevation plans show the design of the ***outside*** of a building
- Elevation is a side-view as viewed from the front, back, left or right.
- These plans will give details such as the height of the walls and the sizes of the windows and doors.
- Elevation plans are generally named for the compass direction that the particular side of a building is facing.
- For example, if the front of a house is facing North, the side that you will be looking at when you are facing the front of the house, will be called the North elevation.
- However, if the direction is not obvious, elevations can be called the front, rear, left or right elevation.

- Elevation plans are usually labelled:
  - ✓ North Elevation, is the side of the house that you are facing when you are facing towards North
  - ✓ South Elevation
  - ✓ East Elevation, is the side of the house that you are facing when you are facing Eastwards
  - ✓ West Elevation
- Below is an example of an elevation plan showing different views:

Example

Use the Elevation and Floor plan below to answer the questions that follow:

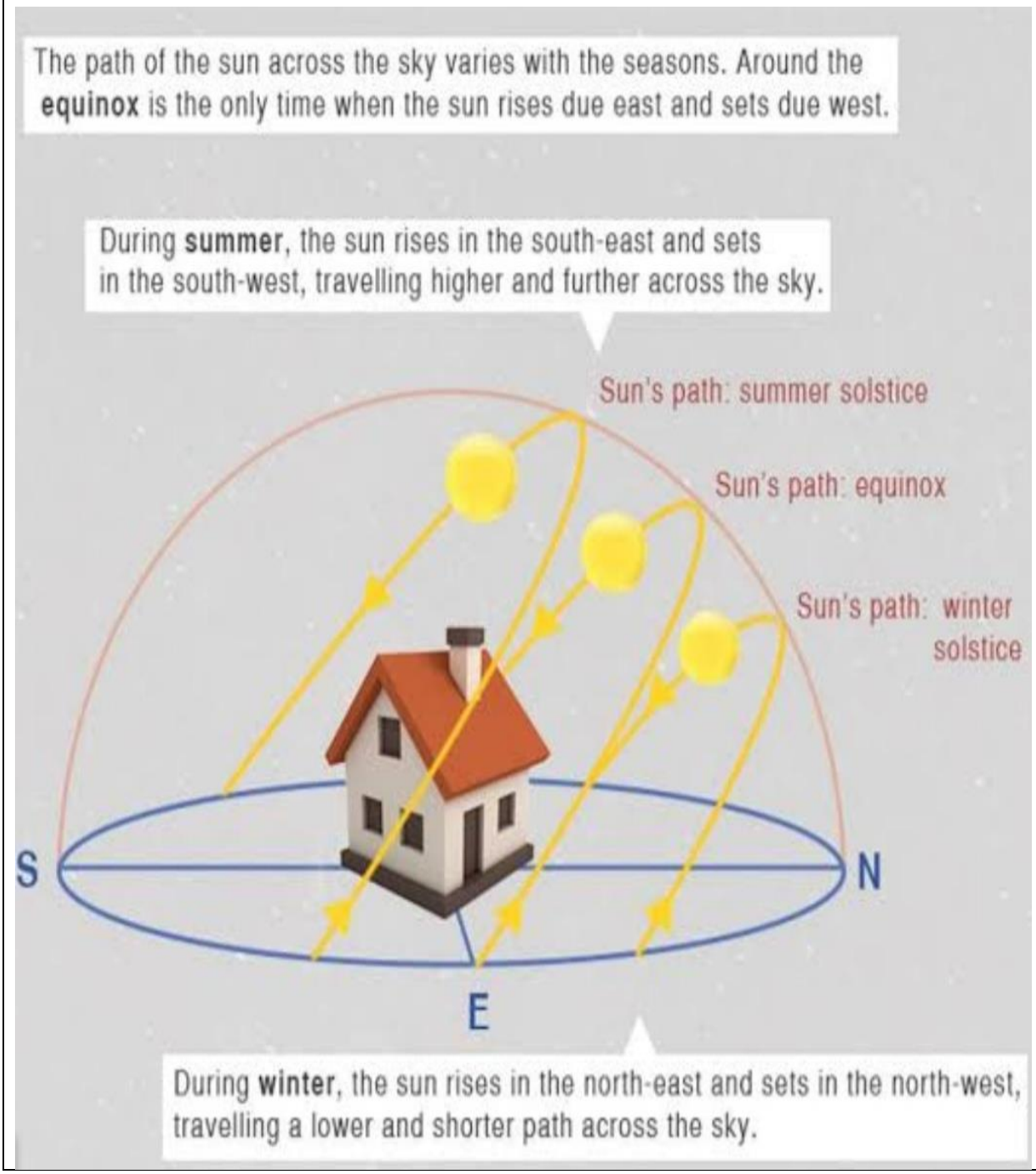


a) How many doors and windows does the ground floor of this plan have?
b) Refer to the first floor plan and determine the actual length of the plan in metres.
c) Determine the Actual Area of the Ground floor plan in m^2 ignore the door openings and windows.

Additional Notes:

Compass directions in house construction

- Compass directions are also used in the construction industry.
- Architects and builders should choose the best position for a building in relation to the sun's location at different times of the day and during different seasons.



Activity 1.3.1 Individual Work (15 Minutes)

Instructions

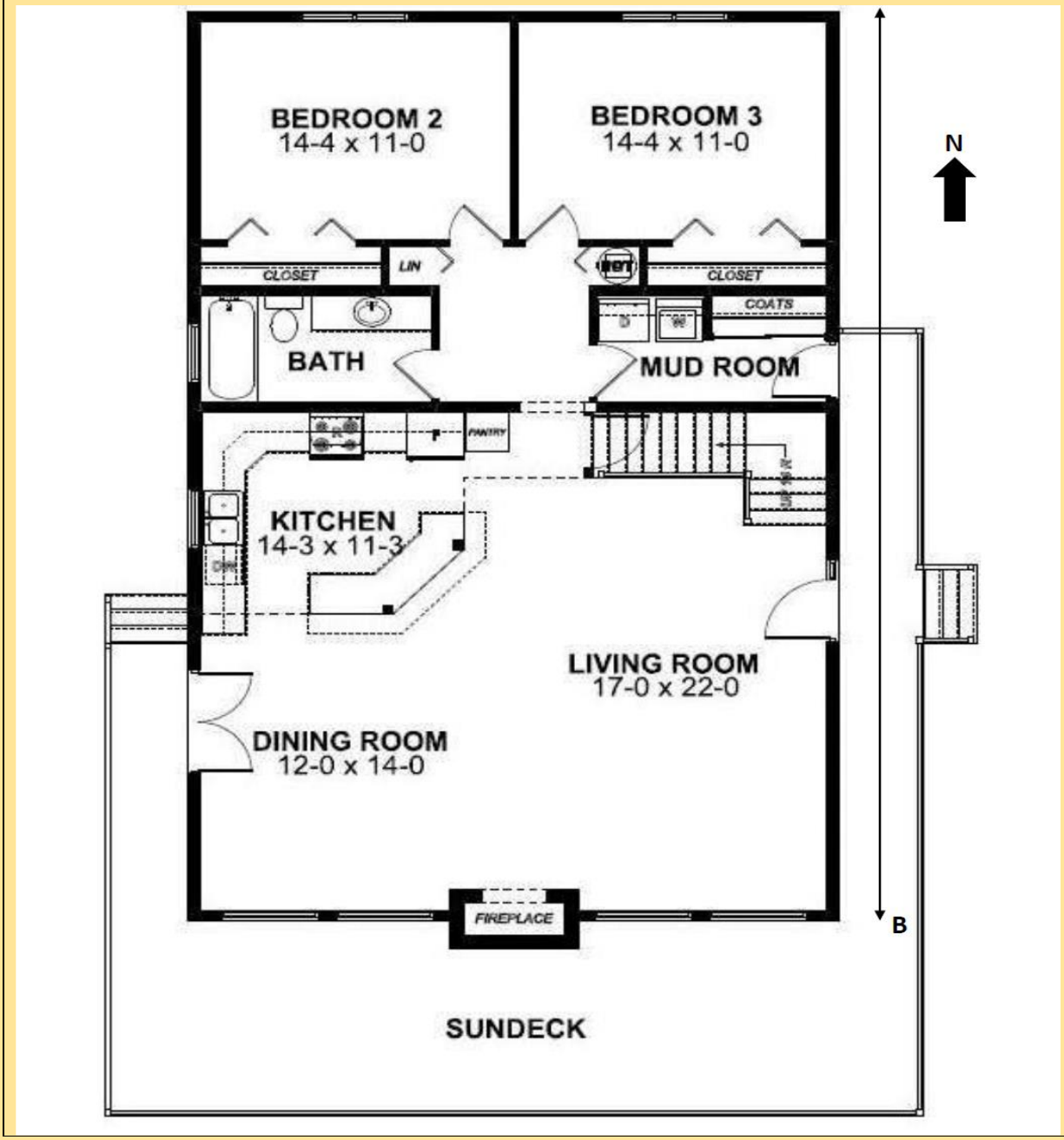
Refer to the context provided

- These questions are intended to advance skills that can be used in the classroom and possible ways in which this section can be taught
- Task 1: Answer the questions and allocate marks or indicate were marks are allocated.
- Task 2: Identify the taxonomy levels for each questions
- Report Back and Discussion
- Resources Training manual and Note pad

Adapted from IEB 2017, P1

1. The Malema family decides to go on holiday and books a chalet in the game park. The chalet looks like the picture below.
   If a sketch of the north elevation of the chalet looks like the sketch below, sketch the west elevation.

2. The floor plan of the chalet is given below, use it to answer the questions that follow:



a) The total width of the chalet shown on the diagram is 8 m and the total length is 12 metres. Determine the total floor area.
b) Measure and write down (in cm) the length of the chalet excluding the "sundeck" (A to B on the floor plan)
c) The scale of the floor plan is 1 : 64. Determine (in metres) the actual length of bedroom 2 if it measures 59 mm on the floor plan.
d) Determine in which compass direction bedroom 2 is from the living room.
e) The width of the sundeck on one side of the chalet is 94,4 cm, which is a third of the width of the front of the sundeck. Calculate the width (in cm) of the front of the sundeck.

Activity 1.3.2. Group Discussion (15 Minutes)

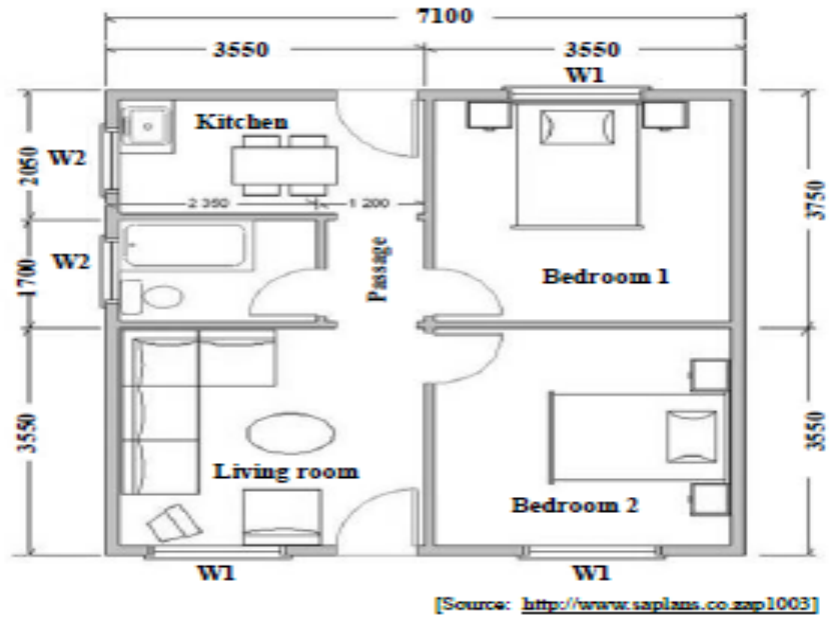
Instructions

- Participants should form groups of 4 – 5
- Refer to the questions provided
- Task 1: Answer the questions and allocate marks or indicate were marks are allocated.
  Task 2: Identify the taxonomy levels for each questions
- To choose the best position for a house in relation to the sun's location at different times of the day and winter
- Report Back and Discussion
- Resources: Training manual and Note pad

Adapted from NCS P1 March 2018

1. Thabo visited Port Elizabeth to check on the progress made on the house being built for his parents. The floor plan of the house is shown below.

FLOOR PLAN OF A HOUSE IN PORT ELIZABETH



[Source: http://www.saplans.co.za/p1003]

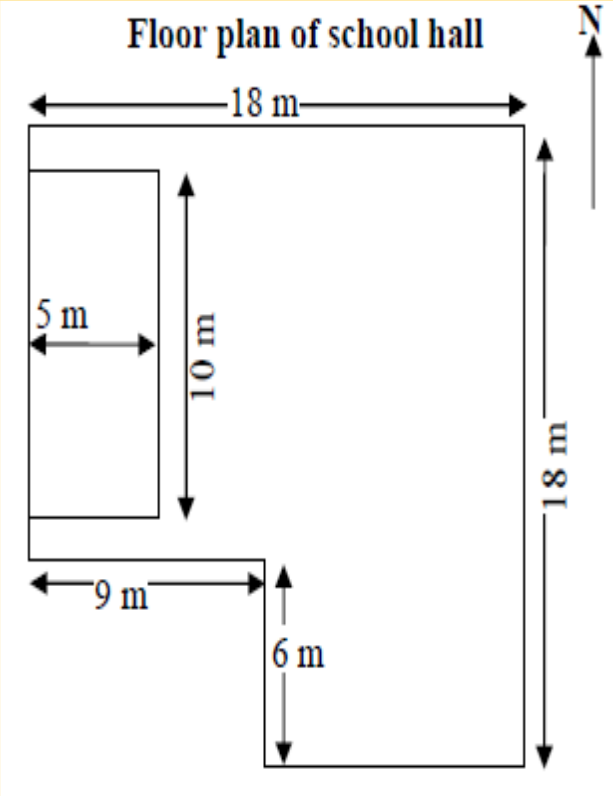
NOTE: All measurements are in **millimetres**.

KEY:	ITEMS	DESCRIPTION
	W1 =	Window opening
	W2 =	Window opening
		Opening requiring solid door

a) Give (in mm) the external length of the wall that makes the area of Bedroom 1 larger than Bedroom 2.
b) Determine (in m) the total external length of the western wall of the house.
c) Name the room(s) that has more than ONE entrance.
d) Identify the room that has the same floor area as the living room.
e) Why is it acceptable for the kitchen and the living room to only have door openings (without doors) leading into the passage?
f) Which rooms shown on the plan will be much cooler during winter? Give a reason for your answer.
g) Use the $7\ 100\ mm$ length of the plan to determine the scale of the plan.
h) Which bathroom fixture is NOT shown on the floor plan?

2. Sapphire High School decides to tile the floor of their school hall using black and grey tiles.

- The hall is L-shaped.
- A rectangular stage is located against one wall of the hall as illustrated in the sketch below.
- The width of the stage is 5 m, and the length is 10 m.
- The stage is not going to be tiled.
- The size of a square tile is 50 cm by 50 cm. The school needs to calculate how many tiles to buy.



a) A scale drawing is to be made of the hall. Determine the scale (in simplified form) to be used if the length of the north wall of the hall is 60 mm.

b) Calculate the area of the floor (excluding the stage) to be tiled.
(Area of a rectangle = length × breadth)

Activity 1.3.3. Group Discussion (20 Minutes)

Instruction:

- Participants should form groups of 4-5.
- Refer to the questions provided.
- Answer the questions and allocate marks.
- Identify the taxonomy levels for each question.
- These questions are intended to prompt participants to consolidate the section and possible ways in which the section can be taught.
- Report back and discuss. **(Take note – diagrams are not necessarily drawn to scale)**

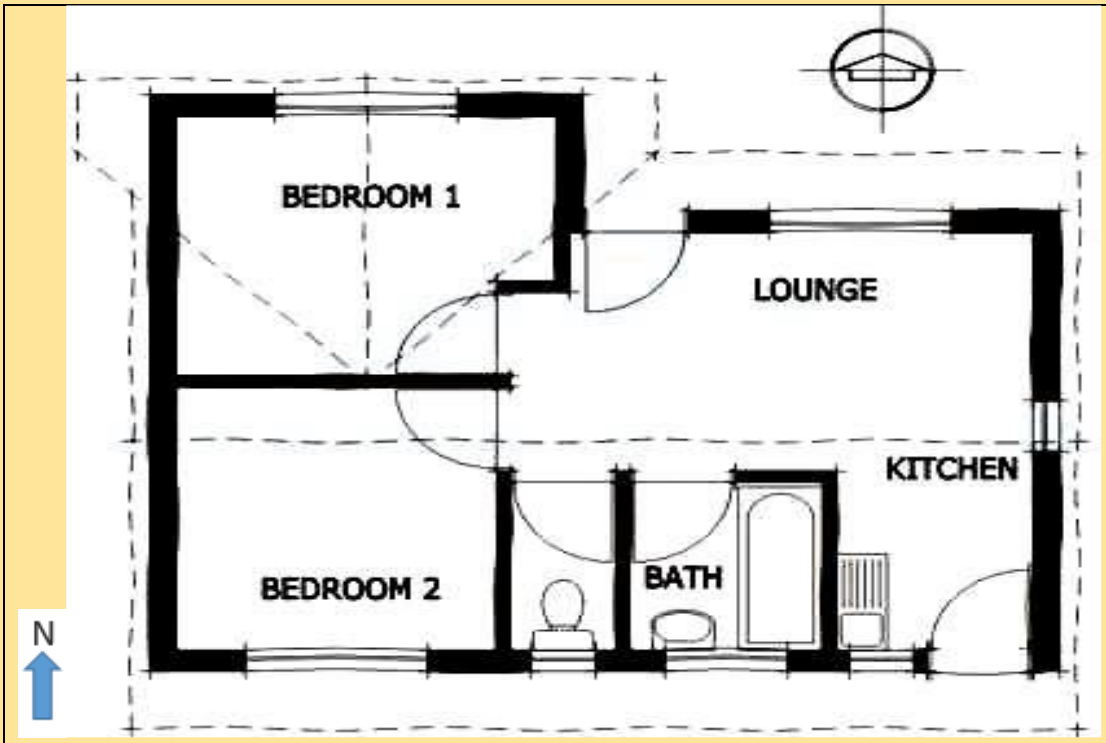
1. The other side of the Game park has different Chalets as compared to the ones chosen by the Malema family. A floor plan of one of those chalets at the resort is indicated below.

KEY	
	Door
	Window

a) Explain the meaning of the term floor plan.
b) Write down the ratio of the number of rooms to the number of windows found on the plan, in the form 1: …
c) Identify the exterior wall that doesn't have windows.

2. The diagram below is the floor plan of Lesedi's new home.
   - The height of the Inside Walls of all rooms, from the floor to the ceiling is 2 400 mm.
   - The dimensions of the windows in each Bedroom are 160cm by 130 cm
   - The height of a door opening is 2,14m.
   - The following formula may be used : Area = Length × Breadth

   Use the floor plan and the information provided above to help you answer the questions that follow:



a) In which general direction does the window in the Bedroom 2 face?
b) The area of a door opening is 9% more than the area of a bedroom window. Calculate the width of a door opening in metres.
c) Lesedi wants to paint the inside walls of the two bedrooms. The inside walls of Bedroom 1 have a total area of 28,44m^2. Calculate the total inside wall area of Bedroom 2.
d) Lesedi estimated that the paint for both Bedrooms will cost less than $R500{,}00$. She intended using paint that covers $4m^2$ per litre and which is sold in 5 containers at a price of $R169{,}99$ per container. Verify, showing ALL calculations, whether her estimation was correct.

ACTIVITY 1.3.4

Instructions

- Individual activity
- Duration: 10 minutes
- This activity is intended to advance ICT skills that can be used in the classroom
- **Task :** Download and save a video lesson on the house plan
- Report Back and Discussion
- Resources: Training manual, Laptop and Wi-fi

RECOURCES FOR MODULE 1

1. Mpumalanga 2019 Preliminary Paper 1, Question 4
2. NSC Question Paper, 2018 Paper 2 Question 2
3. IEB Question Paper, 2017 P1
4. Free state 2018 Preliminary Paper 1 Question 1
5. DBE 2018 NSC Paper 2 Question 2
6. Mpumalanga 2018 Preliminary Paper 2 Question 3
7. Western Cape 2018 Preliminary Paper 2 Question 4
8. North West 2018 Preliminary Paper 2 Question 5

MODULE SUMMARY

In this module, participants worked with two types of scales viz. number and bar scale; calculated the actual length and distance when plan measurements are known and worked with and interpreted elevation plans or different views of buildings.

REFLECTION

In this module, learners need more practice on questions involving general direction questions and questions on a given set of directions. You should note that when a scale is given, there is every chance that some actual measurement will be done. Therefore, learners should be afforded the opportunity to use their rulers in class to measure classroom items (books, pens, pencils, etc.) on a regular basis.

END OF MODULE 1

MODULE 2: MEASUREMENTS

INTRODUCTION

In this module you will look at the concept of measurement with specific focus on:

- Conversions within and between the metric and imperial systems; Measuring/calculating time and timetables; speed, distance and time.
- Area and volumes of rectangles, circles and other circular objects
- Volume and surface areas of rectangular, triangular prism, cylindrical prism pyramids, cones and spheres

OVERVIEW

In this topic, you will work with complex projects in familiar and unfamiliar contexts

SPECIFIC OBJECTIVES

At the end of this module you will be able to:

- Read, record and perform calculations involving time values and timetables
- Calculate speed, distance and time
- Calculate/measure the perimeter, area, surface area and volume of objects.
- Calculate/measure the Volume and surface areas of rectangular, triangular prism, cylindrical prism pyramids, cones and spheres.
- Determine/calculate appropriate quantities of materials/components required to complete a task or project.

GLOSSARY OF TERMS

Term / concept	**Definition/ Explanation**
Area	The amount of two-dimensional (2-D) space occupied by a 2-D shape. Area of a shape is the size of its surface. It is measured in square units.
Two-Dimensional drawings	A diagram or picture having length and width only
Two-Dimensional plans	A plan or design having length and width only, but possibly representing three dimensional objects
Three Dimensional models	A dimensional construction of a real-life object. It is a solid, it has length, breadth/ width and height
Circle	A closed curve that is everywhere at the same distance from a fixed point
Circumference	Distance around a circle / perimeter of a circle
Conversion	A change from one system /unit to another
Conversion factor	Values used to convert/ change quantities from one measuring system to another.

Cylinder	Three dimensional object with congruent parallel circles s bases that are joined by a curved surface
Diameter	A straight line passing through the centre of a circle and touching the circle at both ends thus dividing the circle into two equal halves.

CONTENT

You will study this module through the following units

Unit 1	Conversions, measuring time, timetables and speed.
Unit 2	Two-Dimensional Measurement
Unit 3	Three-Dimensional Measurement

UNIT 1: Conversions, Measuring Time, Timetables and Speed.

INTRODUCTION

In this unit you will look at the concept of Conversions, measuring time, timetables and speed.

LEARNING OUTCOME

At the end of this Unit, you should be able to:

- Convert within and between the metric and imperial systems, solid to liquid measurements and temperature.
- Measure time, calculate time differences, timetables, speed, distance and time

LESSON NOTES 

- **Metric System**
  - South Africa use measuring system called the **metric system**
  - However, some European countries use different system called the **imperial system**
  - Metric system works in the multiples of 10's
  - Imperial system doesn't work in the multiples of 10's and can be difficult to manipulate
  - Some common units used in the **metric system**:

Table 1: Length, Mass and Volume Units

Length (metres)	Mass (grams)	Volume (litres)
Km	Kg	Kl
H	H	H
D	D	D
m	g	l
d	d	d
cm	cg	cl
mm	mg	ml

NB: Use the first letters only

Symbol	**Prefix**						
k	Kilo	1					
h	Hecto	10	1				
d	Deca	100	10	1			
m or ℓ or g	**Base**	1000	100	10	1		
da	Deci	10 000	1000	100	10	1	
c	Centi	100 000	10 000	1000	100	10	1
m	milli	1000 000	100 000	10 000	1000	100	10

Length symbol	**Length**	**Volume unit**	**Volume**	**Weight unit**	**Weight**
km	Kilometre	kℓ	Kilolitre	kg	Kilogram
hm	Hectometre	hℓ	Hectolitre	hg	Hectogram
dm	Decametre	dℓ	Decalitre	dg	Decagram
m	**Metre**	**ℓ**	**Litre**	**g**	**Gram**
dam	Decimetre	daℓ	Decilitre	dag	Decigram
cm	Centimetre	cℓ	Centilitre	cg	Centigram
mm	Millimetre	mℓ	Millilitre	mg	Milligram

Example of pneumonic for conversion:

Keke **H**ate **D**oing **b**usiness **d**uring **c**old **m**onths

- **Imperial System**
  - Some countries such as USA and Liberia use different system called the imperial system
  - Imperial system doesn't work in the multiples of 10's and can be difficult to manipulate.
  - Working with imperial conversions, the conversions should be given to where it is required in a question.
  - Some units used in the imperial system:

Table 2: Length, Mass and Volume Units

Length	Mass	Volume
12 in = 1 ft	16 oz = 1 lb	16 floz = 1 pt
3 ft = 1 yard	14 lb = 1 stone	2 pt = 1 quart
1 769 yd = 1 mile	2 240 lb = 1 ton	4 quart = 1 gal

- **Temperature**
  - Temperature conversions between the metric and imperial system
  - To convert temperatures form Celsius to Fahrenheit or vice versa, one of the following formulae will be provided:

Table 3

^{0}Fahreinheit	^{o}Celsius
$°F = (1{,}8 \times °C) + 32°$	$°C = (°F - 32°) \div 1{,}8$

- **Solids to Liquids**
  - Volume can be measured using different units: either unit^3 or in litres.
  - Conversions are as follows and one of them should be given if it needs to be used:

Table 4

1 ml = 1 cm^3
1 l = 1 000 cm^3
1 kl = 1 m^3

- **Measuring Time and working with timetables**
  - Work with the following:

Table 5

- A minute has 60 seconds. - An hour has 60 minutes. - A day has 24 hours - A week has 7 days - A month we generally say has 4 weeks, but can also be 28, 29, 30 or 31 days. - A year has 12 months or 52 weeks or 365 days (We don't normally consider a leap year. - A decade has 10 years. - A century has 100 years.

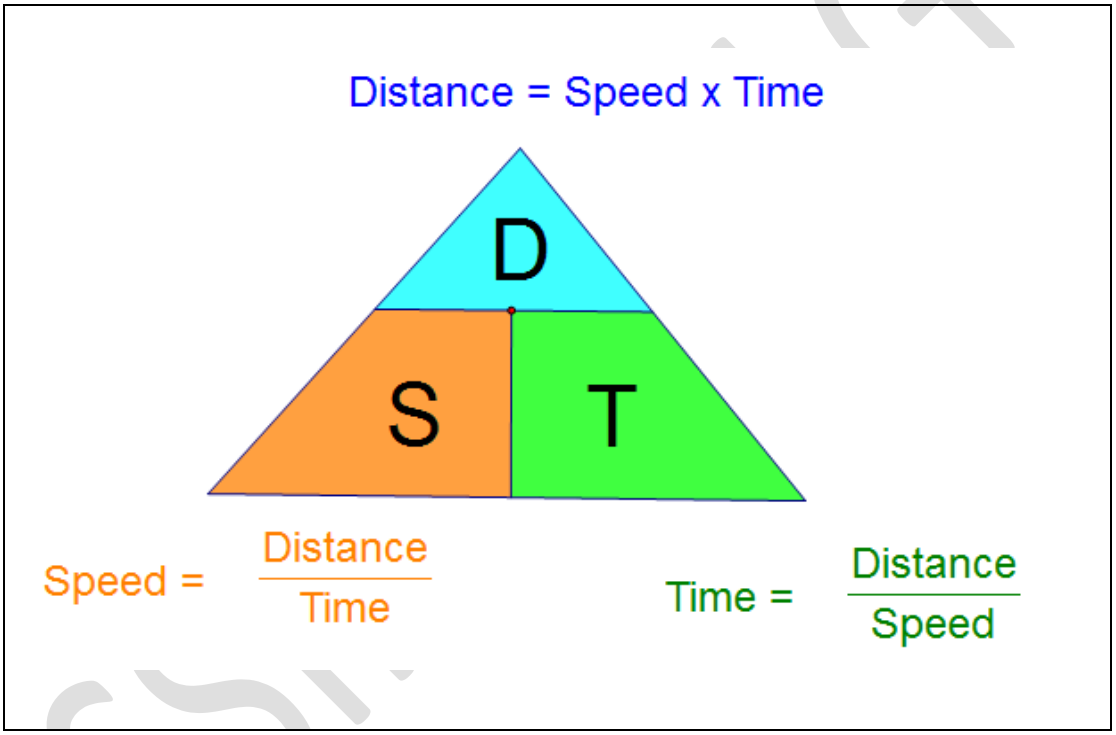
- Time can be written using a 12 hour clock or a 24 hour clock.

Table 6

12 hour clock format	24 hour clock format
8 am	08:00
8 pm	20:00
4:30pm	16:30
2:42 am	02:42

- **Working with Speed, Distance and Time**
  - One of the following formulae should be given when needed and the formula should be rearranged depending on what need to be calculated.

Table 7



ACTIVITY 1.1.1

Instructions

- Individual activity
- Duration: 30 minutes
- Refer to the questions provided
- Task 1: Answer the questions and allocate marks or indicate were marks are allocated.

  Task 2: Identify the taxonomy levels for each questions
- These questions are intended to prompt you to consolidate the unit and possible ways in which this section can be taught
- Report Back and Discussion
- Resources: Table 1 – 7, Training manual, Note pad, Pen and Calculator

1. A dog eats 150g of dog food twice a day. How many kg of dog food does the dog eat in a fortnight?

2. If ¼ of the volume of the coffee in the 1,7litre flask is milk, how many fluid ounces of milk is in the flask? Use 1 floz = 28 ml

3. Hardware sells nails by the kilogram. One inch of nails weigh approximately 18 mg. How long, in mm, is a 1 inch nail, correct to 1 decimal place?

4. The stove you have to bake in is an old one and only has the temperature in °Fahrenheit. You are making rusks and have to dry them overnight at a temperature of 176°F. Convert this temperature to °Celsius (80°C)

5. A container has the following dimensions: 120 cm × 300 cm × 430 cm. How many litres of liquid can the box hold?

6. The Vaal Dam can store 2536 million m^3 of water when full. However, it was 65,4% full on the 30 January 2020. How many litres of water was in the dam?

7. Two friends, Ben and Mike, take part in a 15km fun run. Ben took 1 h 23 min 12 sec and Mike took 1 h 39 min 4 sec. How long did Ben wait at the finish line for Mike?

8. Attached is a timetable showing school alarm times

	Monday	Tuesday	Wednesday	Thursday	Friday
Staff	07:30	07:30	07:30	07:30	07:30
Register	07:40				07:40
1	08:00	07:40	07:40	07:40	08:00
2	08:30	08:50	08:25	08:30	08:30
3	09:20	09:40	09:10	09:20	09:15
4	10:10	10:30	09:50	10:10	10:00
Break	11:00	11:20	10:35	11:00	10:45
5	11:55	11:50	11:00	11:55	11:15
6	12:40	12:40	11:40	12:40	12:00
7	13:25	13:25	12:20	13:25	12:45
	14:10	14:10	13:00	14:10	13:30

a) The staff has a meeting every morning. How long do they spend on meetings in a fortnight.
b) How many assemblies are there in a week?
c) Why do you think the school finishes so early on a Wednesday?
d) What is the average time per lesson on a Wednesday, correct to two decimal place?

9. Thabiso is riding a bicycle at a speed of 8,5 m/s.

a) Convert 8,5 m/s to km/h
b) How long will it take him to travel 45 km? Give the answer in hours, minutes and seconds.

UNIT 2: TWO-DIMENSIONAL MEASUREMENT

INTRODUCTION

In this unit participants will look at the concept of Perimeter/Area and Volumes of rectangles, circles and other circular objects

LEARNING OUTCOME

At the end of this Unit, participants should be able to:

- Calculate the perimeter, area, surface area and volume of an object
- Determine/calculate appropriate quantities of materials/components required to complete a task

LESSON NOTES

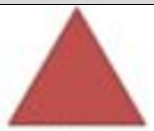
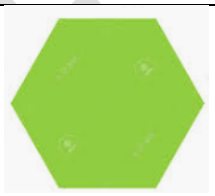
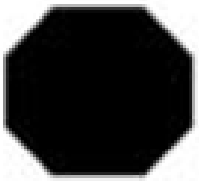
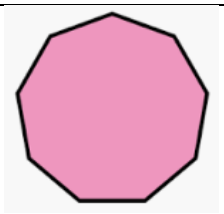
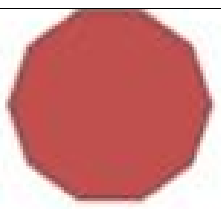
- **2-D shape/ diagram** is a flat figure with 2 dimensions; it does not have the thickness.

- **Calculating perimeter**

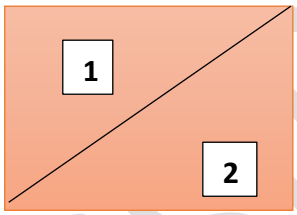
  - **Perimeter** is the total length/distance around a shape or around the boundary.
  - Perimeter of a circle is called the Circumference.
  - Perimeter is measured in single units e.g. m, cm, mm, etc
  - **Length** means measurement between two points in a straight line. E.g. length of a room.
  - **Circumference** is a distance around a circle.
  - When dealing with semi-circle, remember to divide the formula of **circle by 2**
  - Perimeter of a **semi-circle** is half perimeter of the circumference.
  - Ensure that all units are the same before calculating perimeter.
  - The inner part of the shape should be excluded when calculating the perimeter.
  - If the formula requires diameter, change the radius to diameter by multiplying radius by 2.
  - Use the value of π as (π = 3.142)

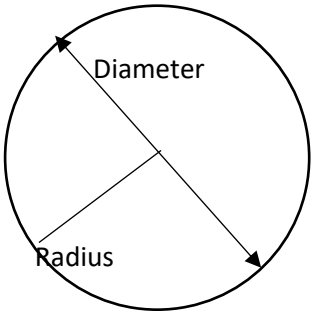
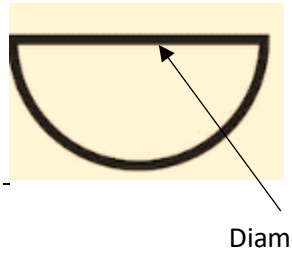
- **Calculating area**

  - **Area** is the amount of space occupied by a 2-D (2-Dimensional) figure.
  - It is measured in square units e.g. m^2, cm^2, etc
  - Substitute values on the formula and simplify
  - When dealing with complex figures, always divide it into smaller figures, calculate the segments and add the answers together.
  - Polygon: Is a two dimensional figure with many sides

Polygon	Description	Shape
Triangle	A polygon with 3 sides	
Quadrilateral	A polygon with 4 sides	
Pentagon	A polygon with 5 sides	
Hexagon	A polygon with 6 sides	
Heptagon	A polygon with 7 sides	
Octagon	A polygon with 8 sides	
Nonagon	A polygon with 9 sides	
Decagon	A polygon with 10 sides	

The perimeter and area of the following shapes should be considered:

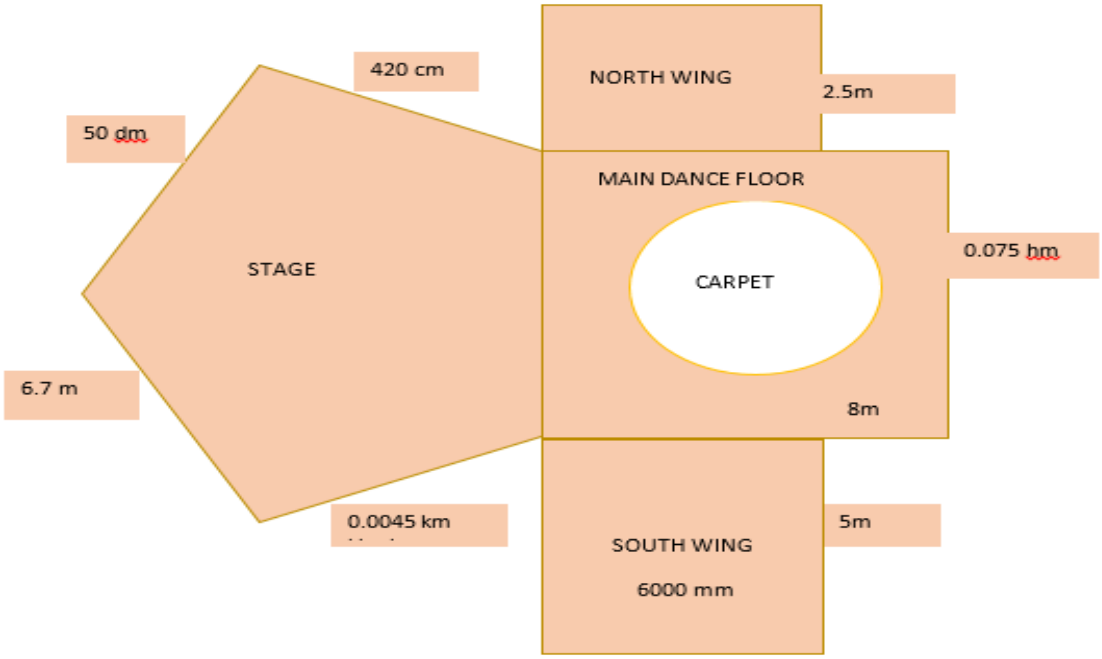
Shape	Perimeter	Area
Rectangle b  l	$P = l + l + b + b$ $P = 2l + 2b$	$A = l \times b$
Square s  s	$P = s + s + s + s$ $P = 4s$	$A = s \times s$
Triangle r  h b When a rectangle is divided diagonally into 2 halves, 2 triangles are produced.	$P = q + r + s$	$A = \frac{1}{2} \times b \times \perp h$

Circles  	$C = 2\pi r$ OR $C = \pi \times d$	$A = \pi \times r^2$
Semi-circle  	$P = \frac{1}{2}\pi d$	$A = \frac{1}{2}\pi r^2$
➢ **Diameter** is a straight line that divides a circle into two equal parts. ➢ **Radius** is half of the diameter.		

Additional Notes:

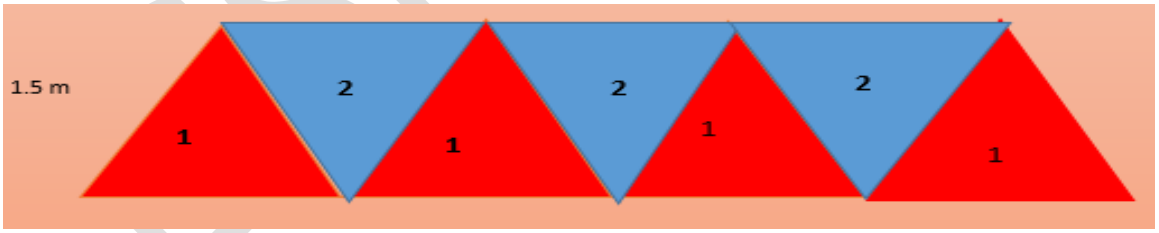
Example 1:

- Mahlodi is a manger at BKN dance studio.
- The North wing and the south wing have equal width of 2800mm and the diameter of the carpet is 2.4m.
- Study the floor plan of her studio and answer the following questions:



a) Name of the shape of the stage
b) Show that the perimeter of the stage is **27.9 m**
c) Determine the perimeter of the dance studio
d) Determine the area of the main dance floor that will be covered with a carpet.

Example 2:



Molo is designing traditional beads. She draws the triangles on the material she is using and decorate each peace with beads of different colours as indicated in the diagram above. The length of the material is 2m and the breadth is 1.5 m. The base of each triangle is 70 cm and the perpendicular height of 0.9 m .The opposite sides of a triangle are equal as it is an isosceles triangle. The sides equal to 55 cm.

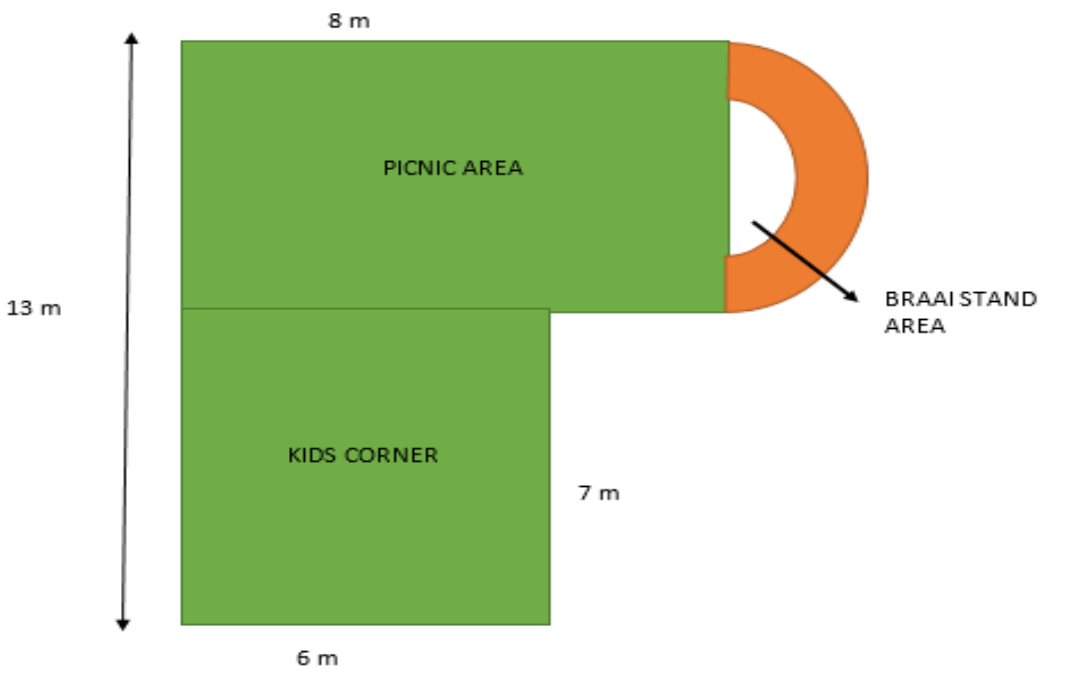
a) Find the perimeter of the material
b) Determine the perimeter of the drawn triangles
c) Show that surface area of the material to be cut is 2.205 m^2
d) Thuli claimed that the piece of material that will not be decorated is 1m^2, verify her claim.

Activity 2.1.1 Group Discussion (15 Minutes)

Instructions

- Participants should form groups of 4 – 5
- Refer to the questions provided
- Task 1: Answer the questions and allocate marks for each solution.
  Task 2: Identify the taxonomy levels for each questions
- Report Back and Discussion
- Resources: Training manual, laptop and Calculator

Pitso has upgraded the area at the back of his house. He has added the picnic area, braai area and kids' corner where his family can relax during their spare time. Study the sketch of the upgraded area below and answer the following questions:



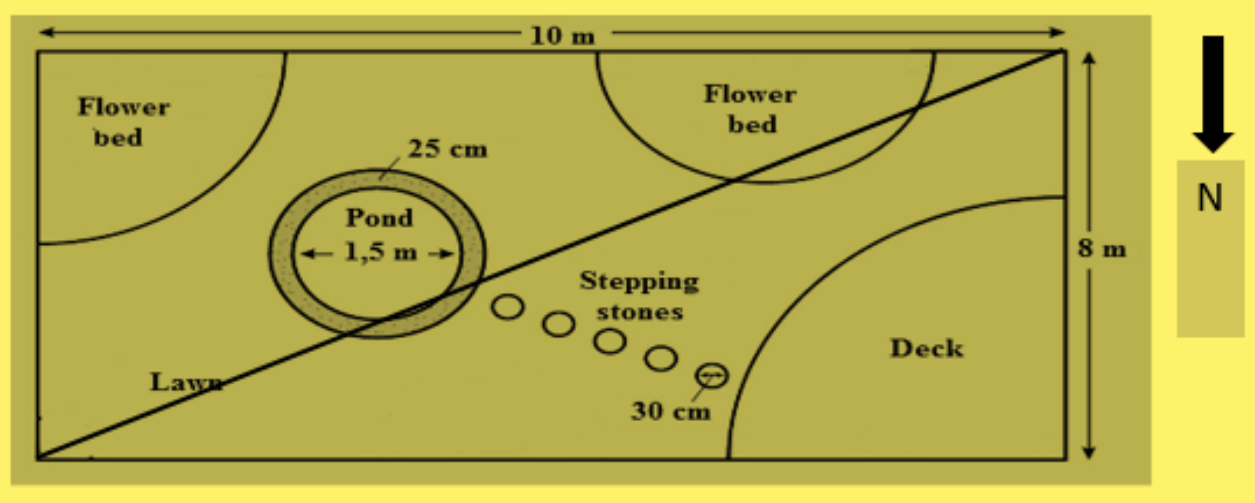
1. Define perimeter in this context.
2. Hence determine the perimeter of the upgraded area. Round off your final answer to 1 decimal place. You may use the formula: Area of a circle = $\pi \times d$
   a) The picnic area and Kids corner will be covered with an artificial grass carpet. Determine the amount of artificial grass needed to cover the two areas.
   b) MHM traders are selling the artificial grass carpet for R299 per 2 m × 1.5 m, excluding VAT Determine the total cost **(VAT inclusive)** of the artificial carpet needed.
   c) Moosa, the manager at MHM is buying 30 m of artificial grass carpet from India at 7160 INR (Indian Rupee) including shipping. Pitso claims that his profit is more than 50%. Verify his claim. **N.B Use Xe currency converter to find the exchange rate.**
3. A portion of the braai area will be occupied by a braai stand as indicated in the diagram.
4. The diameter of the **braai stand area** is 3.5 m. The remaining portion of the braai area will be plastered
   a) Determine the area that will be occupied by the braai stand.
   b) Show that the area to be plastered is 10.02 m^2.

Activity 2.1.2 Individual Activity (30 Minutes)

Instructions

- Refer to the context provided
- These questions are intended to advance skills that can be used in the classroom and possible ways in which this section can be taught
- Task 1: Prepare solutions for this activity
- Task 2: Show mark allocation and explanation thereof.
- Solutions and Discussion
- Resources: Training manual, Flip chart, Koki pens

Lesego is upgrading her garden by putting in a flower bed, pond, stepping stones and a new deck. She asked a landscape architect to design the new garden



1. Five stepping stones are placed from the deck to the pond. Determine the area (in cm^2) of all the stepping stones, if the diameter of a stepping stone is 30 cm.
   Area = $\pi \times (\text{radius})^2$
   Use $\pi = 3{,}142$

   ---

2. Convert the inner diameter of the pond to inches if 1 millimetres equals to 0.039 inches.

   ---

3. Pieces of grass are used to cover the lawn area. The length of each piece of grass is 700 mm and the width is 500 mm.
   Calculate the area of one piece of grass in square metres (m^2).

   ---

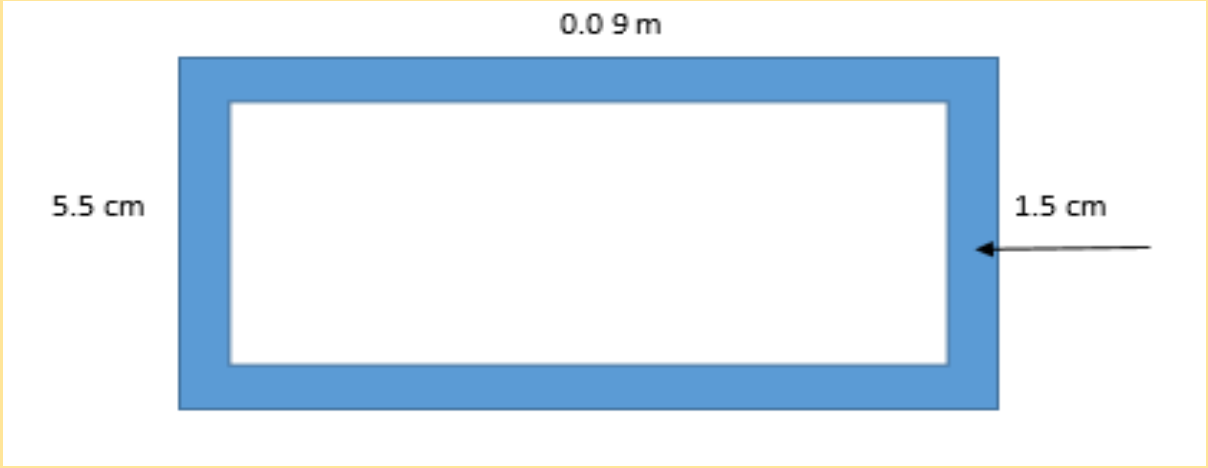
4. Lesego has observed that the shade from the house divides the garden diagonally into 2 parts during mid-day as indicated in the diagram. It covers the East part of the garden. Determine the area of the garden that will not be covered by the shade.

Instructions

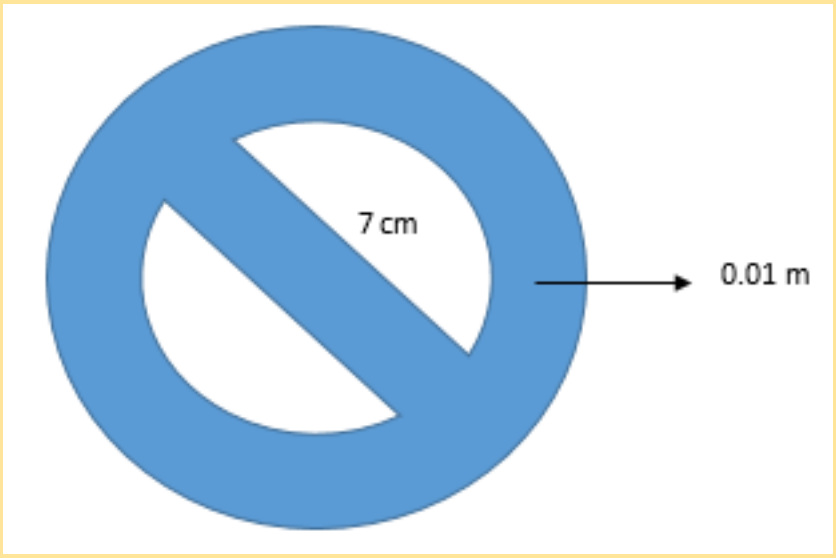
Activity 2.1.3 Group Discussion (30 Minutes)

- Participants should form groups of 4 – 5
- Refer to the context provided
- This activity is intended to advance skills that can be used in the classroom and possible ways in which this section can be taught
- Task 1: Develop a context and three possible questions (TL 2 – 4) based on the resource provided
- Task 2: Prepare solutions for the questions, indicating mark allocation.
- Report Back and Discussion
- Resources: Training manual, Flip chart, Koki pens

Resource A:



Resource B:



UNIT 3: THREE-DIMENSIONAL MEASUREMENT

INTRODUCTION

In this unit participants will look at the concept of Surface Area and Volumes of cubes, prisms, rings and other complex shapes.

LEARNING OUTCOME

At the end of this Unit, participants should be able to:

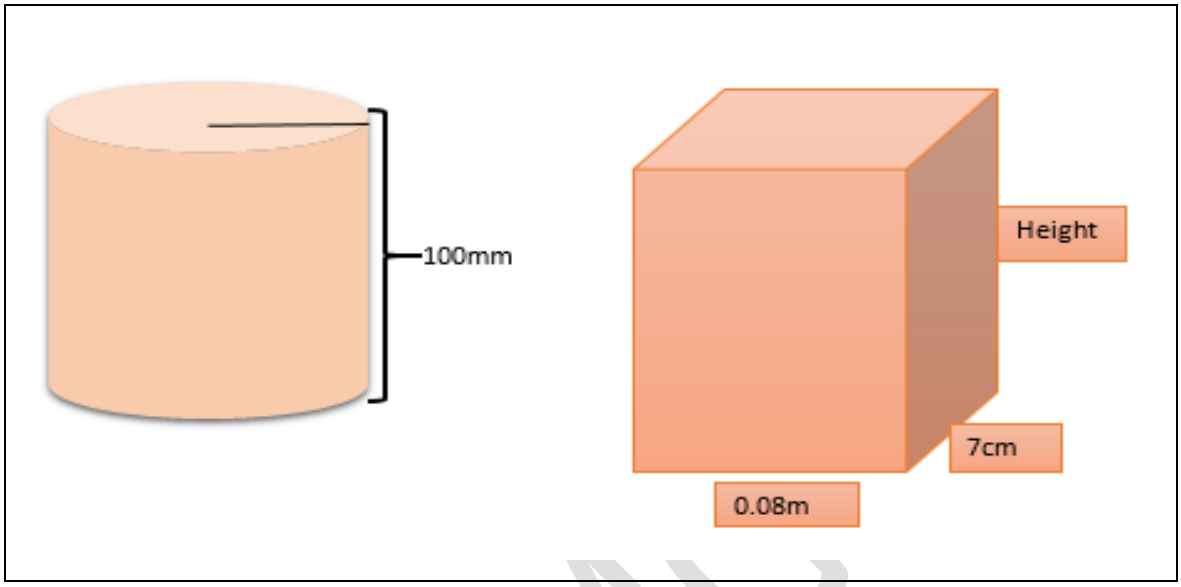
- Calculate the surface area and volume of an object
- Determine/calculate appropriate quantities of materials/components required to complete a task

LESSON NOTES: 

- **3-D shape/diagram:** A dimensional construction of a real-life object. It is a solid, it has length, breadth/ width and height.
- **Calculating surface area:**
  - Break the complex shape down into its basic shapes such as square, rectangle, triangle or circle.
  - Units must always be the same when calculating area.
  - Use the given formula or choose the suitable formula
  - Add the areas of all the basic shapes together to get the total area of the complex shape.
  - To find the net shape , subtract the areas
  - Area determined by multiplying 2 sides or squaring the radius when working with circle, the unit is always squared
- **Calculating volume:**
  - Volume: Amount of space that an object or substance occupies.
  - Capacity: The maximum amount that something may contain
  - Units must always be the same when calculating area.
  - Use the given formula or choose the suitable formula
  - The volume is determined by multiplying 3 sides, therefore the units are always cubed

Example 1

Puseletso is selling 0.75 litre of pine-gel and she uses two types of containers to package it. As indicated in the diagram below. The volume of the cylindrical container is 785.5m^3, while the volume of a rectangular container is 812 cm^3. Study the diagrams below and answer the questions that follow:



1. Define volume in the given context.

   ---

2. Determine the diameter of a cylindrical container in centimetres.

   ---

3. Show that the height of the rectangular container is 14.5 cm.

   ---

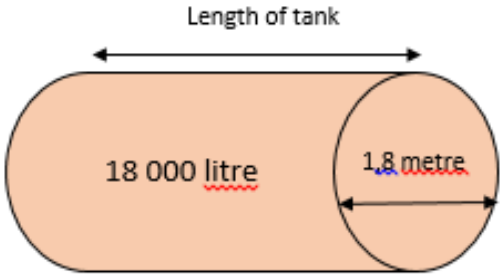
4. Which of the two containers do you think will attract more customers? Explain the volume of a cylinder to litres.
   NB: 1 litre = 1 000 cm^3

Example 2

Traveling Water is the name of a company hiring water tank trucks to transport water to building sites.

The picture below shows a water truck with a capacity of 18 000 litre. The truck has a cylindrical shape water tank.

A PICTURE OF A WATER TRUCK WITH A CAPACITY OF 18 000 LITRE



Use the information above to answer the questions that follow:

1. Explain the term capacity in the given context.

   ---

2. If the water tank is to be filled to 80% of its capacity, how much water, in kilolitres, is needed to fill the tank to this level?

   ---

3. Determine (in metres) the radius of the water tank.

   ---

4. Convert 18 000 litres to cubic metres (m^3).

   ---

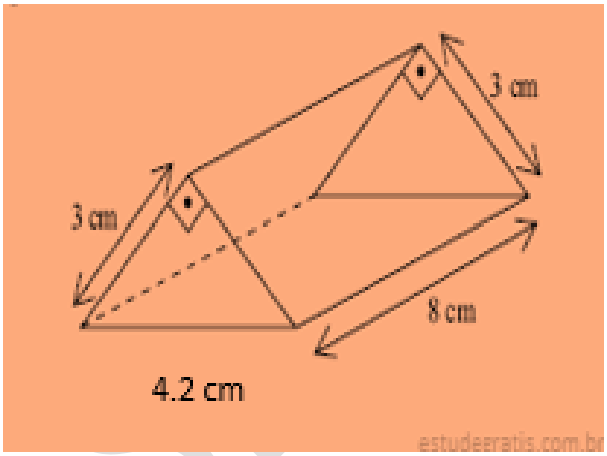
5. Calculate the inner length of the water tank. Round your answer off to ONE decimal place. You may use the following formula:

   Capacity = $\pi \times (\text{radius})^2 \times \text{length}$

   Use $\pi = 3{,}142$

Example 3

The chocolate below was given to all participants at the competition.
Study the diagrams below and answer the questions that follow.



1. Calculate the total area of all the rectangular sides of the chocolate pack.
   You may use the following formula:
   Area = length × Width

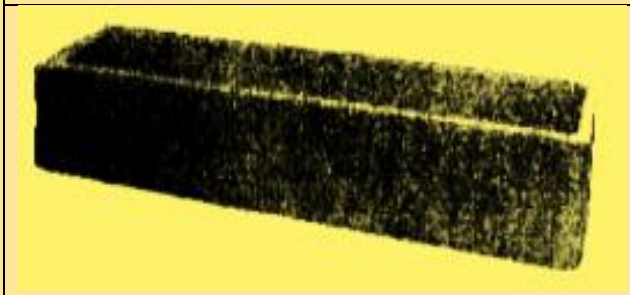
2. Calculate the perimeter of one triangle in mm.

Additional Notes----------

Activity 2.3.1 Group Discussion (30 Minutes)

Instructions

- Refer to the questions provided
- These questions are intended to advance skills that can be used in the classroom and possible ways in which this section can be taught
- Task 1: Answer all the questions
- Task 2: Allocate marks for each question
- Report Back and Discussion
- Resources: Training manual, Note Pad, Pen and Calculator

PICTURE OF A CONCRETE TROUGH	OUTER DIMENSIONS OF A TROUGH
	Length : 3 m Width : 685 mm Height : 40 cm
Volume of a rectangular prism = length × width × height Note : A trough is a long , narrow, open container for animals to drink from. 1ℓ = 1000 cm^3	

Use the information above to answer the following questions:

1. Calculate , in cm^3, the volume of concrete used to make this trough if the trough can hold a maximum of 485 ℓ of water.

   ---

2. A cow drinks 56 ℓ of water per day. Alfred stated that a full trough has enough water for 6 cows per day. Verify , with calculations , whether this statement is CORRECT.

   ---

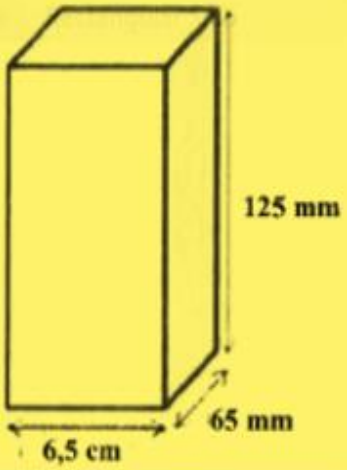
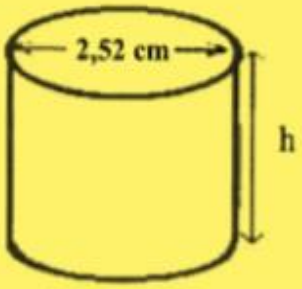
3. Determine how long , to the nearest minute, it will take to fill a half empty trough if the water flos in at a rate of 14.5ℓ per minute.

Activity 2.3.2 Group Discussion (30 Minutes)

Instructions

- Participants should form groups of 4 – 5
- Refer to the questions provided
- These questions are intended to advance skills that can be used in the classroom and possible ways in which this section can be taught
- Task 1: Answer all the questions
- Task 2: Identify the taxonomy levels for each questions
- Report Back and Discussion
- Resources: Training manual, Note Pad, Pen and Calculator

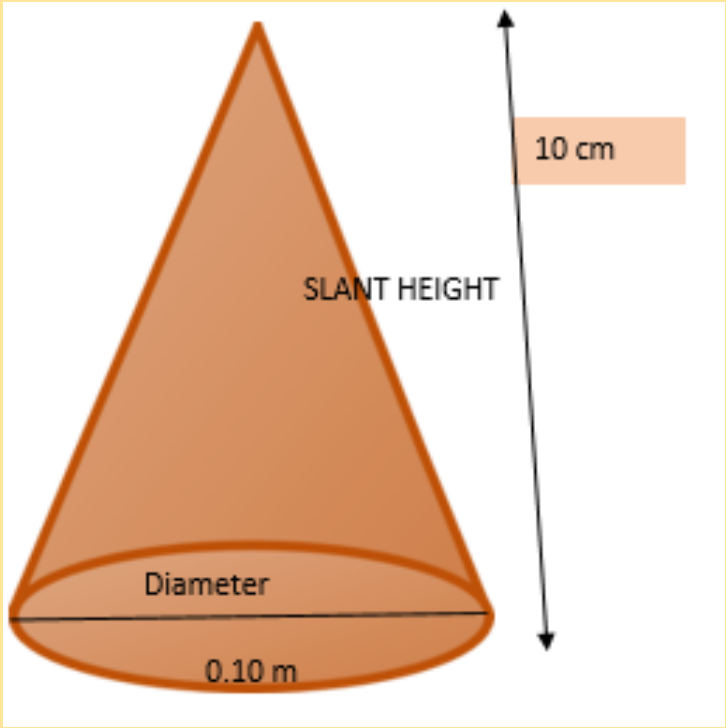
During winter many children develop coughs.
Cough syrups are sold in bottles packed in rectangular prism-shaped boxes.
Children are given cough syrup using a cylindrical measuring cup.
The diagrams below show the bottle, the box and measuring cup.

PICTURE OF A COUGH SYRUP BOX AND A BOTTLE OF SYRUP	DIMENSIONS OF A RECTANGULAR COUGH SYRUP BOX	SKETCH OF A CYLINDRICAL MEASURING CUP
		

Use the inofrmation above to answer the questions that follow:

1. Consider cough syrup box.
   (a) Calculate (in cm3) the total surface area of the cough syrup box.
   (b) Give a practical reason why a cartoon picture would feature on the box of cough syrup for children.
2. Calculate (in cm) the height of the medicine measuring cup in the diameter is 2.52 cm and the volume is 10 mℓ.

3. Nolo bought his son a chocolate from the supermarket after buying the cough syrup.
   The chocolate was wrapped in a cone wrap as shown in the diagram below . Determine the volume of the cone.
   You may use the formula : **Volume of a cone =** $\frac{1}{3}\pi \times r^2 \times h$



Additional Notes:

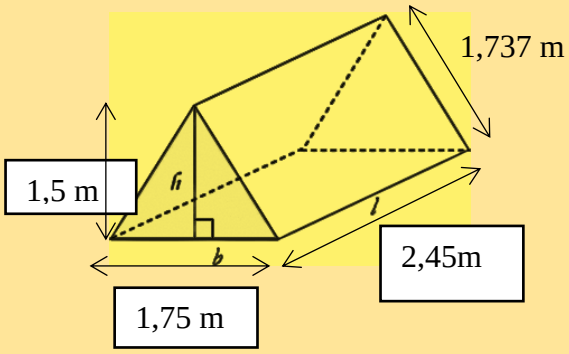
Activity 2.3.3 Group Discussion (30 Minutes)

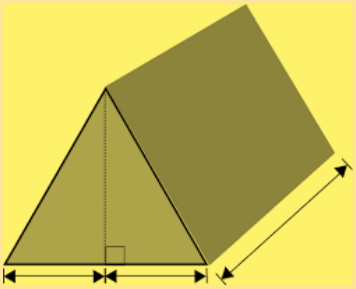
Instructions

- Participants should form groups of 4 – 5
- Refer to the questions provided
- These questions are intended to advance skills that can be used in the classroom and possible ways in which this section can be taught
- Task 1: Answer all the questions
- Task 3: Allocate marks for each question
- Report Back and Discussion
- Resources: Training manual, Note Pad, Pen and Calculator

Adapted from WC Prelim 2019 P2

Corniël made a tent for camping with his friends while fishing over the weekend as shown in the diagram below :





- **the length is 2,45m**
- **the breadth 1,75 m**
- **the slant height 1,737 m and**
- **the perpendicular height 1,5 m.**

1. Calculate the amount of material that is needed to make the tent. The ground cloth is attached to the structure of the tent. Use the formula:

Surface area = 2(length × slant height) + (length × breadth) + (base × perpendicular height)

Corniel brought his 3 sons along to teach them to catch fishes. He also brought a cricket ball and a spherical stress ball to enable them to play while relaxing. His older son clained that the cricket ball has a greater volume. Verify his claim.

You may use the formula : Volume of a sphere = $\frac{4}{3}\pi r^3$

The dimensions of the balls are indicated in the table below

	
Diameter = 2.59 inches 1 inch = 2.54 cm	Radius = 2 cm

Activity 2.3.4. Individual Work (20 Minutes)

Instructions

- Refer to the context provided: How to download a video lesson
- These questions are intended to advance ICT skills that can be used in the classroom
- **Task :** Download a video lesson for calculating volume of a Cone
- Report Back and Discussion
- Resources: Training manual, Laptop and Wi-fi

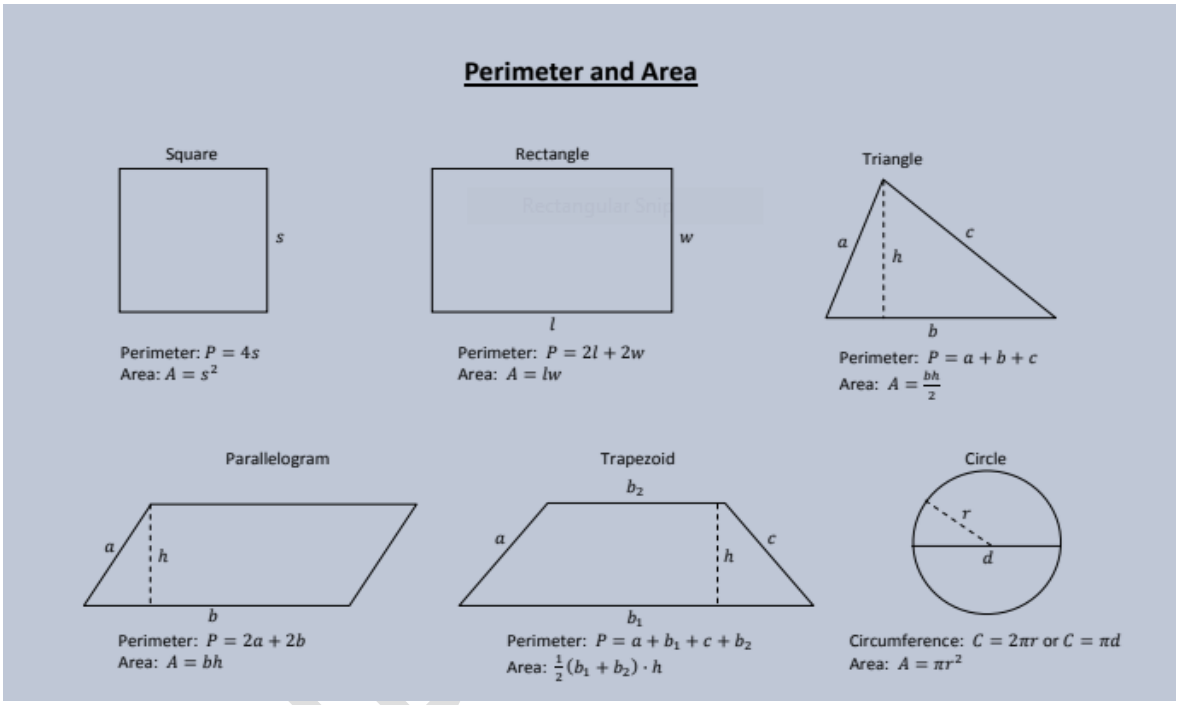
STEPS IN DOWNLOADING A VIDEO
savefrom.net

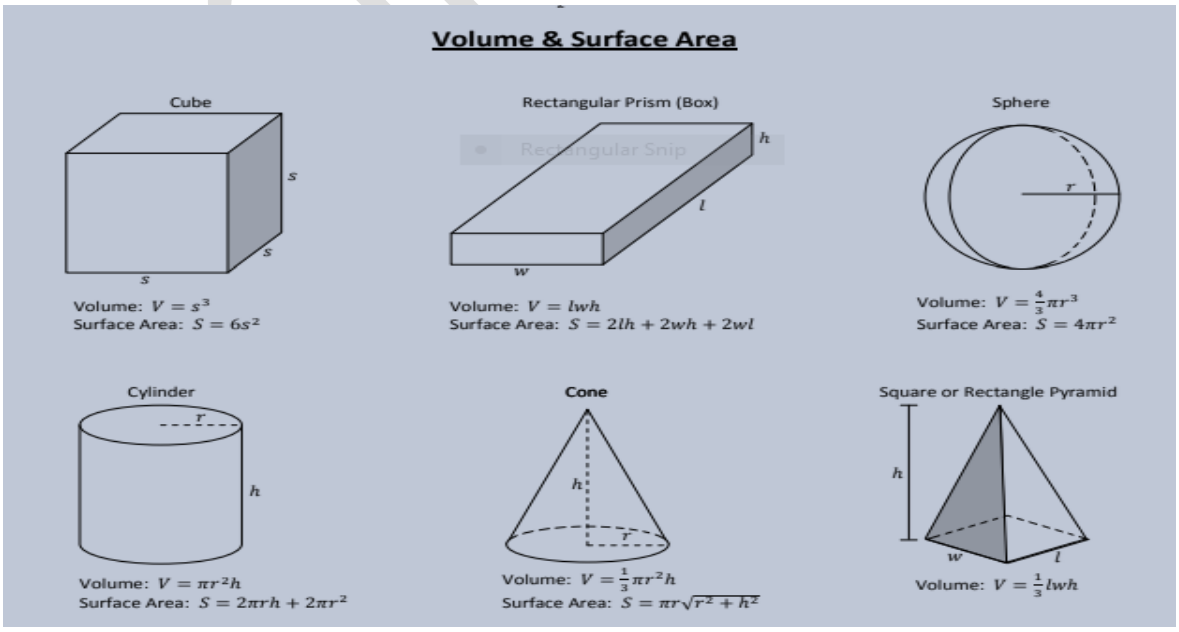
- In your BROWSER type YouTube or Go to YouTube
- Type the topic of your choice
- Click the video and type **ss** or **vd** in front of **youtube** on the link OR insert 'magic' between 'you' and 'tube'.
  For example:
  - ✓ Before typing ss or vd: https://www.youtube.com
  - ✓ After typing ss or vd: https://www.ssyoutube.com
- Then it will take you to the **savefrom.net** page
- Click download then save

SUMMARY FOR THE UNIT

- In this module, participants were exposed to calculating perimeter, area and volume including surface area and circumference; calculated rectangles, triangles and circles viz. quarter, semi and three –quarters using known formulae and calculated rectangular prisms, cylinders and cones using known formulae.

- Summary of 2D and 3D shapes





RECOURCES FOR MODULE 2

1. Free state 2019 Preliminary Paper 1
2. DBE 2019 June and November NSC Paper 2 Question 2
3. Mpumalanga 2019 Preliminary Paper 2
4. Western Cape 2019 Preliminary Paper 2

REFLECTION

You should provide learners with conversion tables or methods like 'King Henry Died a Miserable Death Called Measles' when doing conversions from one unit of measurement to another. Glossary of terms such as radius and diameter should be reinforced on a regular basis. Teachers should provide learners with enough exercises on how to substitute correct values into a given formula. Teachers should encourage learners to write a glossary at the back of their books of the different terms' meanings as they complete each topic

END OF MODULE 2