

Western Cape Education Department

MATHEMATICAL LITERACY

Grade 12 Term 2

2025

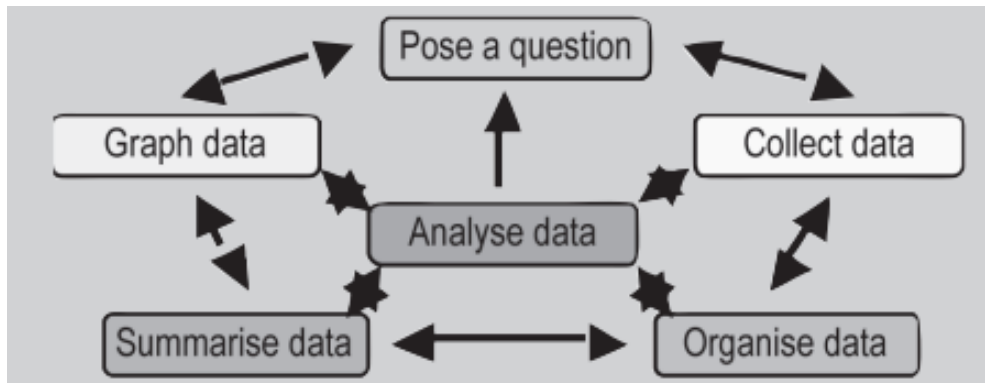
Learner Material

DATA HANDLING

DATE: TERM 2 SESSION 1 2025

DATA HANDLING

Data is raw information that has been collected without being organised or analysed. Every statistical process is made up of at least six inter-connected stages:



Every stage in the process is dependent on the stage that precedes it and directly impacts on the stage that follows.

STEP 1: POSING A QUESTION

A new idea or concept is investigated. Thus, certain questions will need to be asked in order to collect the information.

STEP 2: COLLECT DATA

Various instruments will be used to collect the data such as observation (physically looking at how many learners wear glasses), interviews (asking the learners what they would like their tuckshop to sell), surveys and questionnaires (forms that are filled in).

POPULATION VS SAMPLE:

The population consists of all the data values in the data set. A sample is a representative of the population. The sample **MUST BE** unbiased and a true representative of the population. If the data that is collected is biased, then every following stage will be flawed; or if the data is summarised using an inappropriate average, then the analysis of the data will be incorrect.

STEP 3: CLASSIFYING AND ORGANISING THE DATA

Data can be classified into two groups:

- 1) **NUMERICAL DATA:** Consists of quantities or numerical values. This can be split further into two groups:

- Continuous data is data that you measure, e.g. The height of a learner, the time taken to run a race.
 - Discrete data is data that is counted, e.g. The number of children in a family, the number of cars in a parking lot.
- 2) **CATEGORICAL DATA:** is generally descriptive in nature, as data is classified and organised into categories e.g. textures, smells, tastes, gender and eye colour.

Collected data can be organised by using tallies and frequency tables.

EXAMPLE QUESTION [TUTOR & LEARNER]

Your school is busy organising the matric dance and is trying to decide on a theme. Each Grade 12 learner received a copy of the survey and handed their request in. The survey and results were as follows:

<i>THEME FOR MATRIC DANCE 2023:</i> ○ <i>Masquerade Ball 40</i> ○ <i>Under the Sea 12</i> ○ <i>Around the World 6</i> ○ <i>Through the Decades 27</i> <i>Please select ONE theme ONLY!</i>

- 1.1 Write down why this data is considered as the population and not the sample. (2)
- 1.2 Write down what type of data is represented above. (2)
- 1.3 Write down what other type of instrument could have been utilised to collect the information. (2)

[6]

LEARNER ACTIVITIES: TRY THIS ON YOUR OWN

Harry decided to open a carwash and observed the number of cars that was washed on a Saturday and a Sunday.

TYPE OF CAR	SATURDAY	SUNDAY
RENAULT	8	6
TOYOTA	15	4
MAZDA	7	3
BMW	3	1

- 2.1 Write down the data collection method that Harry used. (2)
- 2.2 State whether the cars washed is considered discrete data or continuous data. (2)
- 2.3 Calculate the number of cars that were washed on Saturday. (2)
- 2.4 Write down which brand of vehicle is the least popular at the car wash. (2)
- [8]**

STEP 4: SUMMARISE DATA

Data is summarised by using the using the measures of central tendency or the measures of spread.

MEASURES OF CENTRAL TENDENCY:

MEAN	$\frac{\text{The sum of all the data values in the data set}}{\text{The number of data values in the data set}}$
MEDIAN	The middle of the organised data set. If an uneven data set: ORGANISE AND TAKE THE MIDDLE VALUE 1 3 5 6 8 Median = 5 If an uneven data set: ORGANISE, TAKE THE TWO MIDDLE VALUES AND DIVIDE BY TWO 1 3 5 7 8 9 Median = $\frac{5+7}{2} = 6$
MODE	The value that appears the most. TAKE NOTE: There can be more than one mode or no mode at all.

EXAMPLE QUESTION [TUTOR & LEARNER]

The Kyle family visits a farm where auctions are held. 24 different cattle trucks arrive at the auction on the Friday and 23 trucks on the Saturday. At the entrance they tally the cattle per truck.



Friday

17	12	24	19	12	13	10	22	12	9	27	12
27	8	23	12	16	27	11	19	22	15	13	26

Saturday

23	12	8	29	15	13	28	7	18	24	27	13
11	18	13	26	6	25	9	17	14	13	22	

- 3.1 State whether the data displayed above is discrete or continuous data. Give a reason for your answer. (3)
- 3.2 Calculate the mean number of cattle that arrived on Friday. (3)
- 3.3 Determine the median number of cattle that have arrived on Friday. (3)
- 3.4 Mr Kyle stated that more cattle arrived on Friday. His wife stated it was on Saturday. Justify with calculations if Mr Kyle was correct. (3)
- 3.5 Determine, as a simplified fraction, the probability of choosing a cattle truck with 13 cows on Friday. (3)

[15]

LEARNER ACTIVITIES: TRY THIS ON YOUR OWN

TABLE 1 below shows the estimated provincial half-yearly livestock numbers (in thousands) for the nine provinces in South Africa for August 2020 and February 2021.

**TABLE 1: ESTIMATED PROVINCIAL LIVESTOCK NUMBERS
(IN THOUSANDS) IN SOUTH AFRICA (AUG 2020 AND FEB 2021)**

Province	ESTIMATED LIVESTOCK NUMBERS (IN THOUSANDS)					
	Cattle		Sheep		Goats	
	Aug '20	Feb '21	Aug '20	Feb '21	Aug '20	Feb '21
Western Cape	466	466	2 545	2 497	202	199
Northern Cape	419	418	5 182	5 079	448	446
Free State	2 054	2 023	4 330	4 362	215	211
Eastern Cape	3 050	3 059	6 513	6 394	1 991	1 968
KwaZulu- Natal	2 380	2 320	628	610	662	651
Mpumalanga	1 248	1 243	1 527	1 508	78	76
Limpopo	860	850	A	192	902	909
Gauteng	246	246	84	83	21	20
North West	1 576	1 545	596	585	651	641
Total:	12 299	12 170	...	21 310	5 170	5 121

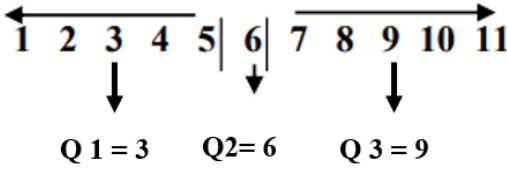
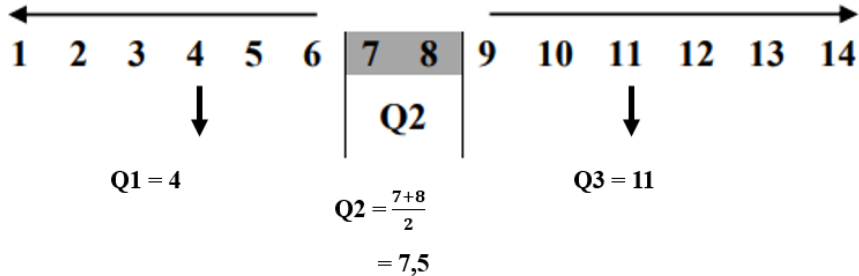
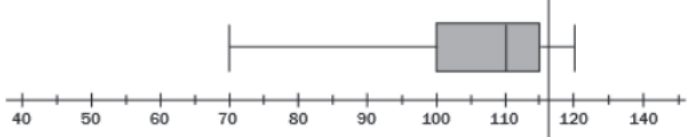
[Adapted from www.dalrrd.gov.za]

- 4.1 Write down the province with the second highest number of sheep for February 2021. (2)
- 4.2 Calculate the total estimated provincial livestock numbers for the Eastern Cape in August 2020. (3)
- 4.3 Determine (as a percentage) the probability of randomly selecting a province in February 2021 with less than 1 500 000 sheep. (3)
- 4.4 Determine the median number of goats in February 2021. (3)
- 4.5 Identify the modal number of livestock in Gauteng. (2)
- 4.6 The provincial mean number of sheep is 2 400 444.

A farmer in Limpopo stated that the missing value **A** in the table is less than 200.

Verify, showing ALL calculations, whether the farmer's statement is valid. (7)

MEASURES OF SPREAD:

RANGE	Maximum – Minimum Highest value – Lowest value
QUARTILES	Quartiles divide the data into 4 even parts. To calculate, do the following: 1) Arrange the data from smallest to biggest. 2) Q2 – is the same as the median. Thus, divide the data set in 2 groups. 3) Q1 - is the middle value in the group below the median 4) Q3 - is the middle value in the group above the median ▪ Example A:  Q 1 = 3 Q2 = 6 Q 3 = 9 • Example B:  Q1 = 4 $Q2 = \frac{7+8}{2} = 7,5$ Q3 = 11
INTERQUARTILE RANGE	Q3 – Q1
FIVE NUMBER SUMMARY	Displayed in a box and whisker diagram: 1) Minimum value 2) Lower Quartile Q1 3) Median Q2 4) Upper Quartile Q3 5) Maximum value 

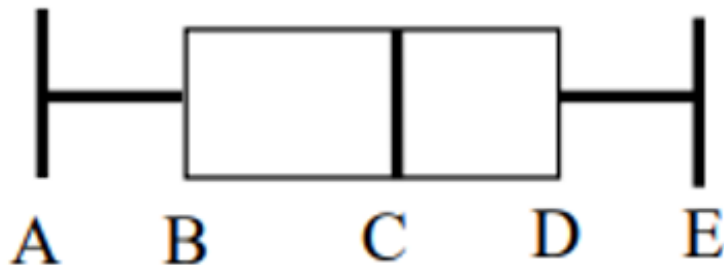
PERCENTILES: [ONLY INTERPRET]

Percentiles are the values that divides the data set into 100 equal parts.

Q1 = 25th percentile, Q2 = 50th percentile, Q3 = 75th percentile

EXAMPLE QUESTION [TUTOR & LEARNER]

A box and whisker plot is given below, as well as terms that describe the different letters on the diagram.



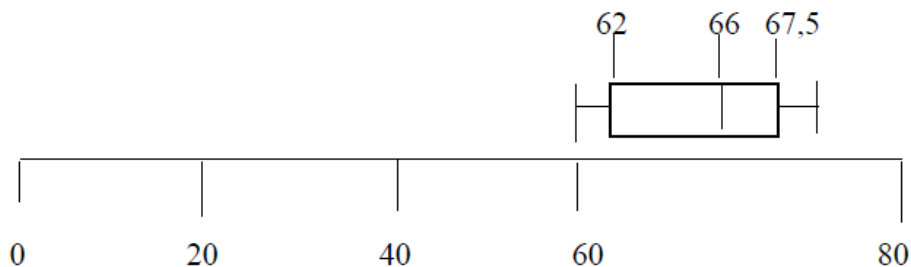
Terms: Median ; Maximum; Quartile 3; Minimum; Quartile 1

5.1 Provide labels for the box and whisker plot by matching the terms with the letters shown on the diagram. Write ONLY the letter and correct term. (5)

5.2 Complete by using the correct letters: (2)
Inter quartile range = ... -

[7]

LEARNER ACTIVITIES: TRY THIS ON YOUR OWN



Study the box and whisker diagram above and answer the question that follow.

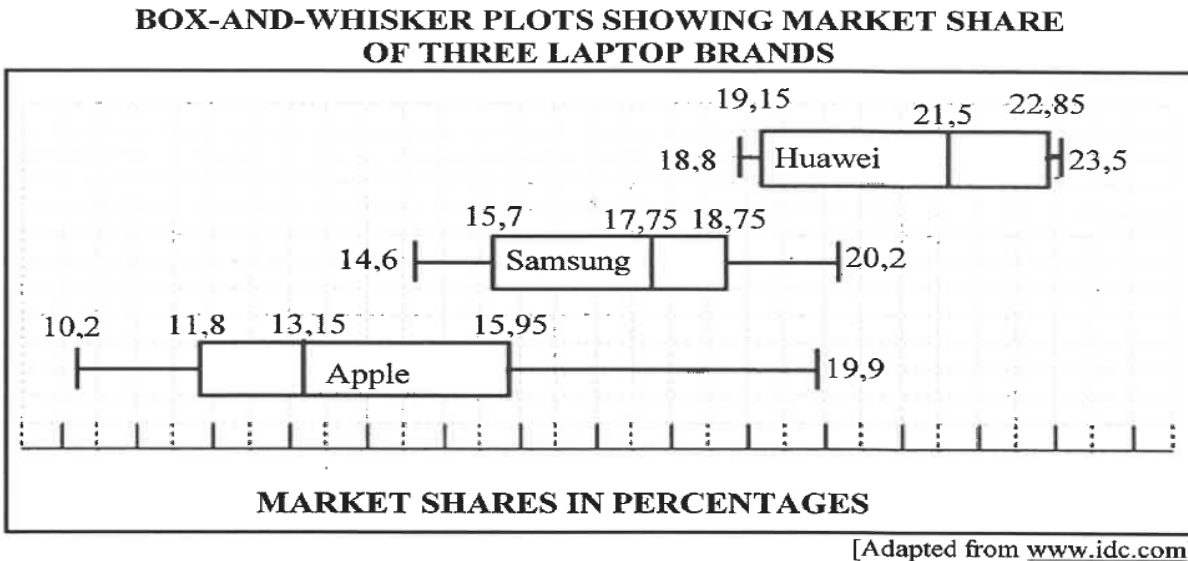
6.1 Identify the values of Q1, Q2 and Q3. (3)

6.2 Calculate the interquartile range. (3)
[6]

EXAMPLE QUESTION [TUTOR & LEARNER]

Marius wants to buy a new laptop. He studied the available data for the three most popular brands of laptops sold in South Africa.

The box and whisker plots below show (in percentages) the spread of the market share of the Samsung, Apple and Huawei laptop brands from the fourth quarter in 2019 to the third quarter in 2020.



Use the box and whisker plot above to answer the questions that follow.

- 7.1 Write down the name of the most popular laptop brand. (2)
- 7.2 Write down the 50th percentile of the brand identified in 7.1. (2)
- 7.3 Calculate the interquartile range (IQR) of the Samsung Brand. (4)
- 7.4 A data analyst claims that 75% of the dataset of Apple was less than 16%. Explain whether his statement is valid. (2)

[10]

LEARNER ACTIVITIES: TRY THIS ON YOUR OWN

During 2020, many COVID-19 positive cases were reported. The table below indicates the number of cases reported during June 2020. Refer to the table below and answer the questions that follow.

<u>Case Data</u>		
PROVINCE	Total cases for 15 June 2020	Percentage total
Eastern Cape	10 597	14,4
Free State	512	0,7
Gauteng	12 193	16,6
KwaZulu-Natal	3 959	5,4
Limpopo	362	0,5
Mpumalanga	322	0,4
North West	1 177	1,6
Northern Cape	205	0,3
Western Cape	44 143	60,0
Unknown	63	0,1
Total	A	100,0

[Source: www.slideshare.net]

8.1 Explain the difference between *discrete* and *continuous* data. (2)

8.2 Determine the median of the reported cases. (3)

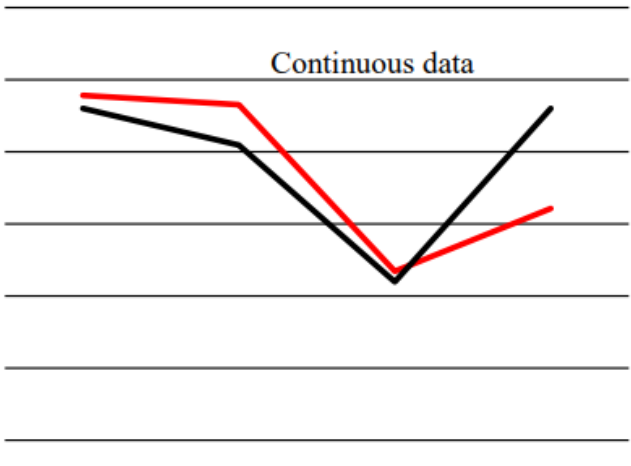
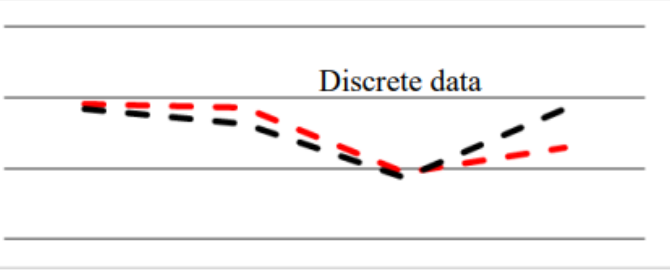
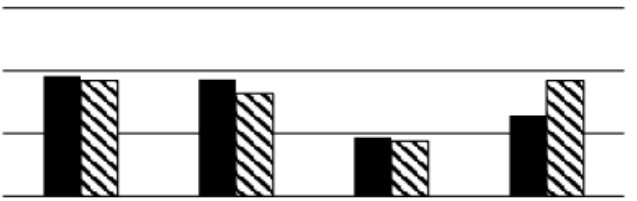
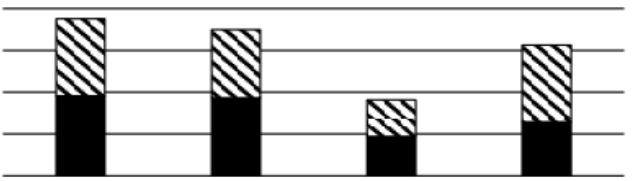
8.3 Calculate the Inter Quartile Range for the number of cases.

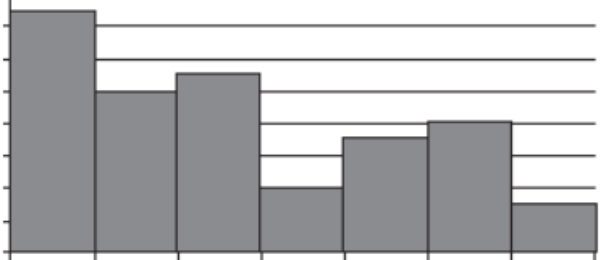
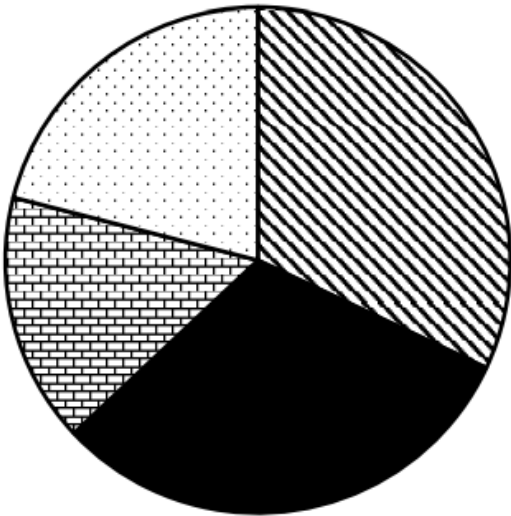
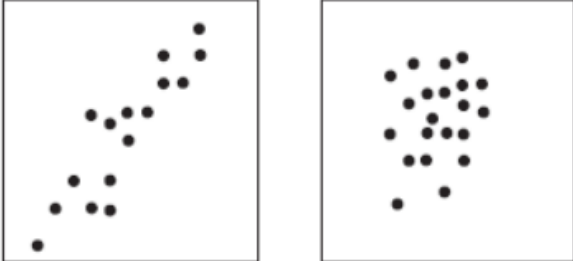
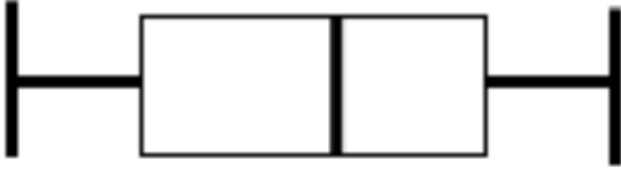
You may use the following formula:

$$\text{IQR} = Q3 - Q1$$
 (4)

[9]

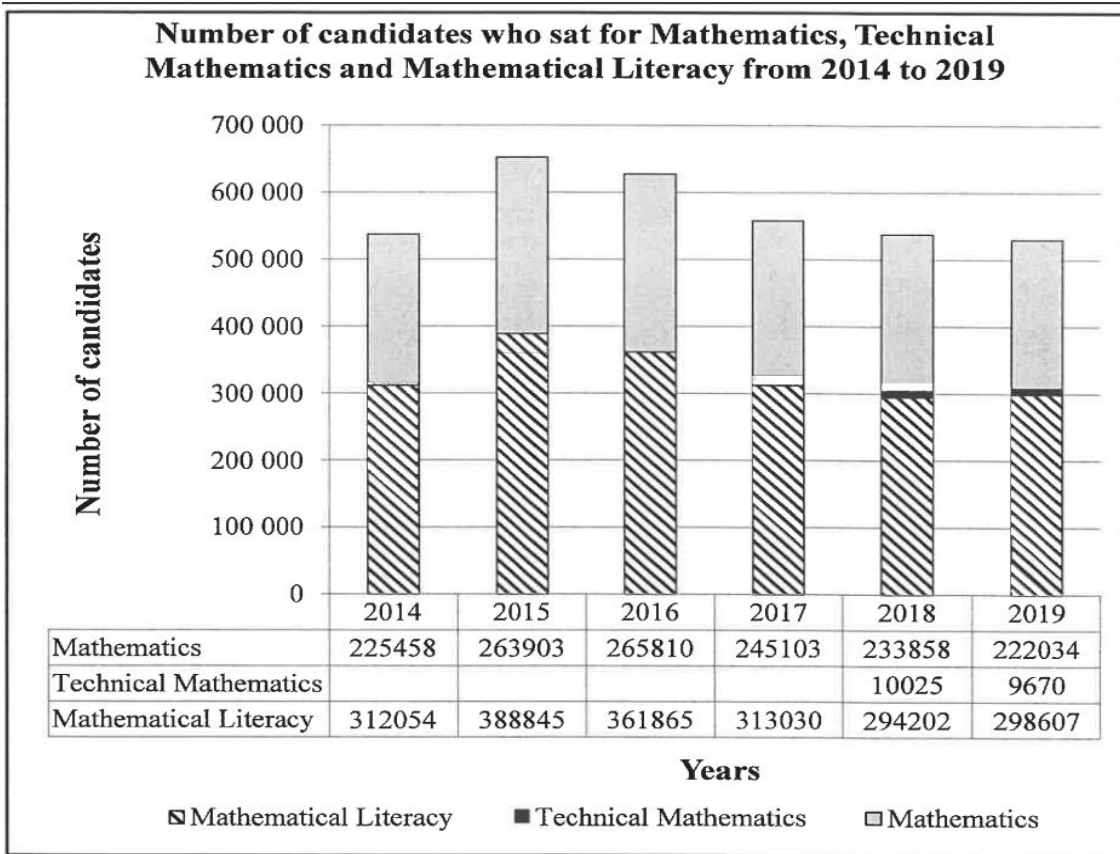
STEP 5 & 6: REPRESENTING AND ANALYSING DATA

Line graphs: Broken line graphs	In data handling we use line graphs to show the relationship between two quantities. A line graph is formed by using lines to join data points which have been mapped on a grid. It is used to show the change of information over time. A line graph shows the trend between plotted points.	Continuous data  Discrete data 
Single bar graphs	A bar graph is used to represent data that is sorted into categories. Display data is compared in categories. Each bar shows the number of items in that category and there are spaces between the bars.	
Multiple (double) bar graphs		
Compound (stacked) bar graphs		

Histograms	Histograms are different from bar graphs in that they represent continuous data. Data that is displayed on a histogram is also grouped. There are no spaces between the bars.	
Pie Charts	Pie charts are circular graphs, divided into sectors. They are used to show the parts that make up a whole. They can be useful for comparing the size of relative parts. The information is often presented as percentages that must add up to 100%. They are often used in media to show clear and important differences, but they cannot show shape and spread of data.	
Scatter plots	A scatter plot is the most useful graph for studying the relationship (correlation) between two variables.	
Box-and-whisker plots	Box and whisker plots are graphical representation of the five number summary of a set of data. The five number summary: - Minimum value - Lower quartile (Q1) - Median (Q2) - Third quartile (Q3) - Maximum value	

EXAMPLE QUESTION [TUTOR & LEARNER]

The graph below shows the number of candidates who sat for the National Examinations in Mathematics, Technical Mathematics and Mathematical Literacy from 2014 to 2019.



Use the graph above to answer the questions that follow.

- 9.1 Name the type of graph drawn. (2)
- 9.2 Write down, in words, the number of learners who sat for the Mathematical Literacy examination in 2018. (2)
- 9.3 Determine how many more learners sat for Mathematical Literacy than for Mathematics and Technical Mathematics combined in 2019. (3)
- 9.4 Calculate the mean number of learners doing Mathematics over the period shown. (3)
- 9.5 Determine the range of the Mathematical Literacy learners over the period shown. (2)
- 9.6 The total number of candidates doing the examinations in the three subjects in 2019 was 530 311.

Calculate (rounded to ONE decimal place) the difference in the percentage of learners doing Mathematics instead of Mathematical Literacy in South Africa.

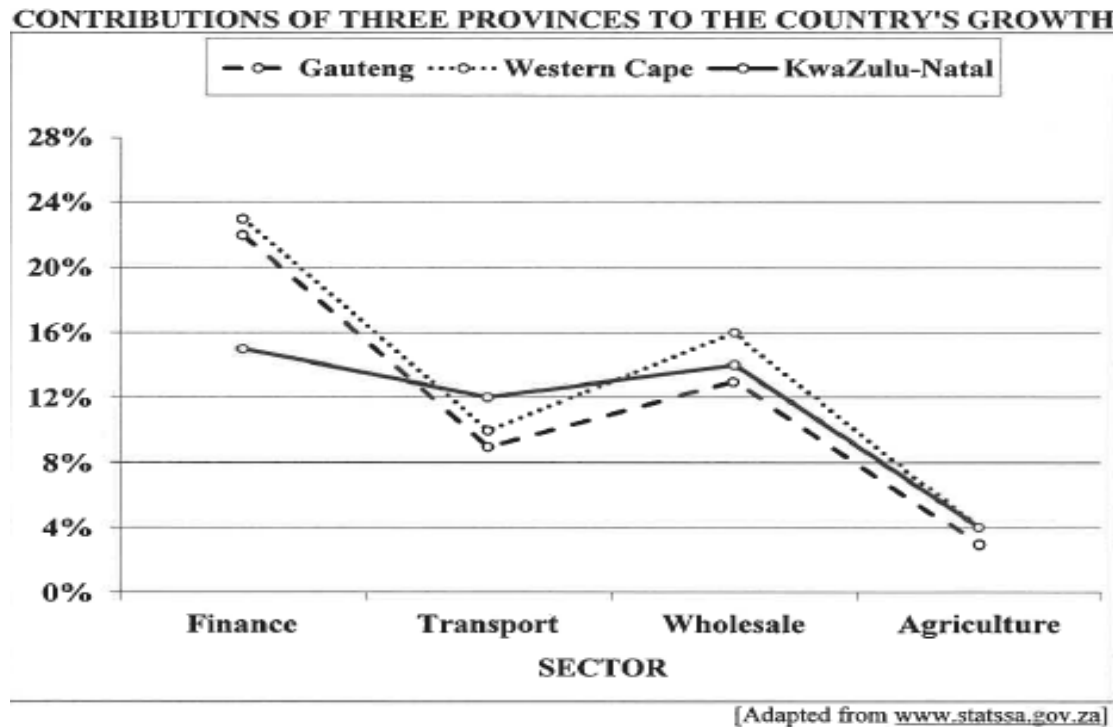
(5)

LEARNER ACTIVITIES: TRY THIS ON YOUR OWN

During the 2008 – 2012 period, South Africa recorded an average growth rate of just over 2%, largely due to the global economic recession.

Gauteng, KwaZulu-Natal and the Western Cape collectively contributed a significant portion to the country's growth.

The graph below shows the contributions of these three provinces towards the different sectors.



Use the above information to answer the questions that follow.

- 10.1 Write down the province that contributed the most to the wholesale sector. (2)
- 10.2 The total amount contributed by the three provinces to agriculture was R8,3 billion. Determine which part of this amount Western Cape contributed. (4)
- 10.3 Identify the sector in which KwaZulu-Natal made a 12% contribution. (2)
- 10.4 Name the sector that has the largest range. (2)
- 10.5 Name ONE province that made the most significant contribution towards the growth of most of the sectors. (2)

[12]

SURFACE AREA & VOLUME

SESSION 2

HOW TO ANSWER/APPROACH A MEASUREMENT QUESTION:

The following steps can be used for any measurement calculation:

EXAMPLE:

The following diagram is of a rectangular prism planter box used to plant flowers and vegetables. The planter box is made of recycled plastic material.

Picture of the rectangular planter box	Dimensions of the planter box
	Length = 1,5 m Width = 45 cm Height = 400 mm
Volume of a rectangular prism = length × width × height	
NOTE: 1 litre = 1 000 cm³	

Use the information above to answer the following questions:

Calculate the volume, in cm³, of the recycled plastic needed to make the planter box, if the planter box can hold a maximum of 180 litres.

STEP 1:

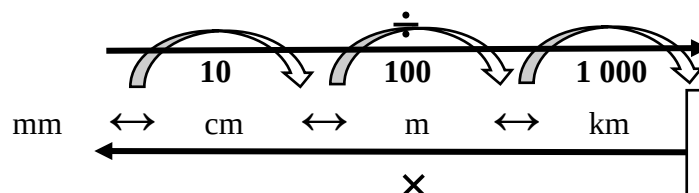
Read through the question and determine the unit the answer must be given in.

In this example it is cm³.

All the units of measurement that appears in this question, therefore must be converted to cm before any calculations is done.

STEP 2:

Convert all the relevant dimensions to cm.



You NEED to know this as this will not be given to you in the examination.

Length = 1,5 m

$\therefore$ Length in cm = $1,5 \times 100$

Length = 150 cm

Height = 400 mm

$\therefore$ Height in cm = $400 \text{ mm} \div 10$

Height = 40 cm

CONVERTED DIMENSIONS:

Length = 150 cm

Width = 45 cm

Height = 40 cm

STEP 3:

Substitute the dimensions into the correct formulae (Mostly given, but you will have to know basic formulae)

Volume of a rectangular prism = length $\times$ width $\times$ height

Volume = $150 \times 45 \times 40$

Volume = $270\,000 \text{ cm}^3$

From this we should be able to make the conclusion that this is the volume for the entire rectangular prism.

STEP 4:

The planter box has a capacity of 180 litres. This means the following:

Volume of planter box = recycled plastic used + empty space in planter box (the capacity given)

$\therefore$ 180 litres (capacity of planter box) need to be converted to cm^3

GIVEN 1 litre = $1\,000 \text{ cm}^3$

$\therefore 180 \text{ litre} \times 1\,000 = 180\,000 \text{ cm}^3$

We can now just substitute and calculate the missing amount.

Volume of planter box = recycled plastic used + empty space in planter box (the capacity given)

$270\,000 \text{ cm}^3 = \text{recycled plastic used} + 180\,000 \text{ cm}^3$

$\therefore$ recycled plastic used = $270\,000 \text{ cm}^3 - 180\,000 \text{ cm}^3$

Recycled plastic used = $90\,000 \text{ cm}^3$

STEPS 1 – 3 WILL PROBABLY BE USED IN MOST MEASUREMENT CALCULATIONS.

STEP 4 WILL ONLY BE USED IN THE MORE COMPLEX MEASUREMENT QUESTIONS.

SURFACE AREA:

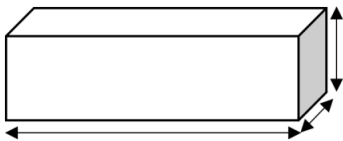
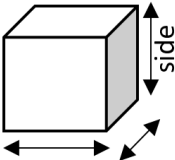
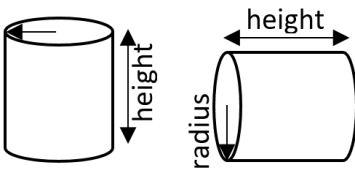
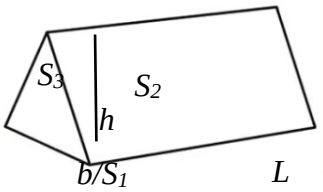
NOTES TO SURFACE AREA:

What is the difference between Area and Surface Area?

Area refers to the area occupied by a two-dimensional flat surface and Surface Area is the area of all the exposed surfaces of a three-dimensional (3-D) object.

Even though the Surface area works with 3-D objects the unit of measurement is still squared units (mm^2 , cm^2 , m^2 , km^2 , in^2 , ft^2 , mile^2 etc.)

The following table gives a summary of the formulae for surface area of four 3D shapes.

SHAPE	RECTANGULAR PRISM	CUBE	CYLINDER
			
FORMULA	Surface Area = $2(l \times b) + 2(l \times h) + 2(b \times h)$,	Surface Area = $6(\text{side} \times \text{side})$	Surface Area = $2\pi r^2 + 2\pi rh$ or $2\pi r(r + h)$
Where: l = length, b = breadth and h = height			
SHAPE	TRIANGULAR PRISM		
			
FORMULA	Surface area = (Perimeter of the base $\times$ Length of the prism) + (2 $\times$ Base Area) $= (S_1 + S_2 + S_3)L + bh$		

Where:

h = height, b/S_1 = breadth and L = length

S_1 = a side of triangle which can be the base in relation to the perpendicular height,

S_2 = second side of triangle

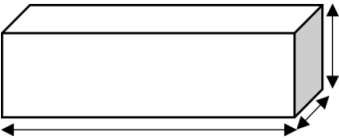
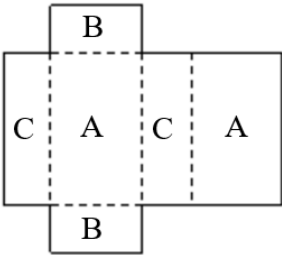
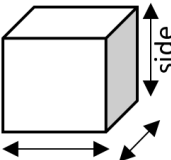
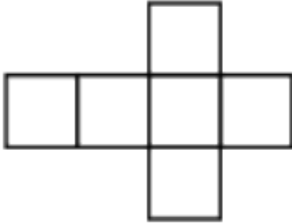
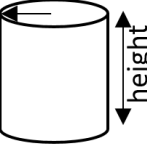
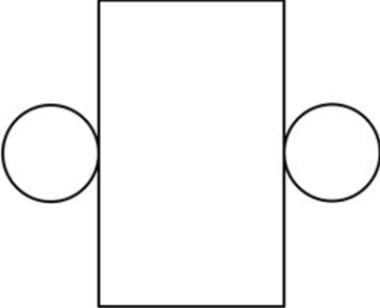
S_3 = third side of triangle

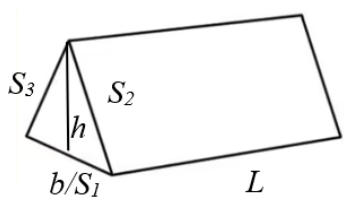
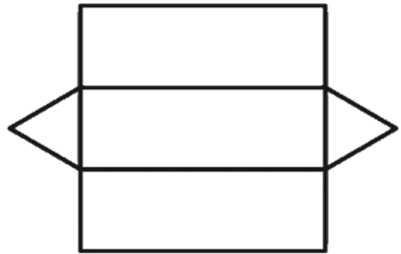
It is very important to remember that all the units must be the same before any calculations are done and that we use the radius when working with cylinders and not the diameter.

The nets of the various 3D shapes are a good way to understand the interpretation of Surface Area.

NOTE:

Some 3D shapes will be tested as open and closed shapes. In such cases, you will need to omit one side.

	3D - objects	Nets	Consists of ...
Rectangular			$2(A)+2(B)+2(C)$ Where one of A, B or C must be a rectangle, but one could be a square.
Cube			$6 \times \text{squares}$
Cylinder			$(2 \times \text{circles}) + 1 \text{ rectangle}$ Note: Rectangle = Height $\times$ circumference

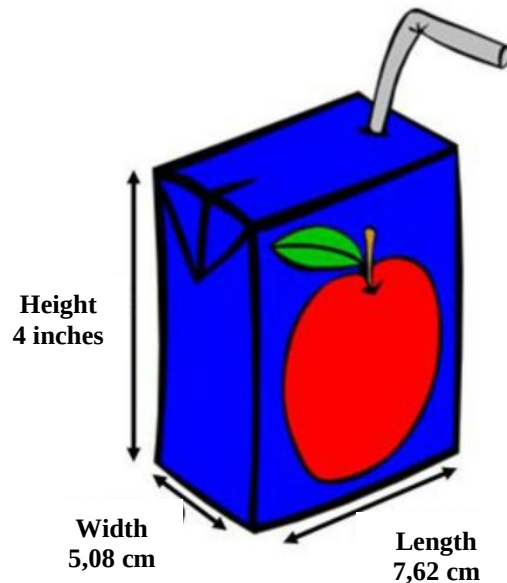
Triangular Prism			$(2 \times \text{isocoeles triangles}) + (3 \times \text{rectangles})$
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EXAMPLE QUESTION: SURFACE AREA

Juice boxes are so convenient – just poke the straw in and enjoy.

The juice boxes are generally in the shape of rectangular prisms and with this shape it is easy to calculate the amount of packaging material (surface area) that was required to make the box.

The diagram below shows a typical juice box with dimensions.



- A Calculate the height of the juice box if 1 inch = 2,54 cm.
- B Calculate the total surface area of the juice box in cm^2 .

You may use the following formula:

$$\text{Surface Area} = 2(l \times w) + 2(l \times h) + 2(w \times h)$$

EXAMPLE QUESTION ANSWERS:

- A Here you need to use the conversion factor given (1 inch = 2,54 cm) to convert the height to centimetre.

$$\begin{aligned} &\therefore 4 \text{ inches} \times 2,54 \text{ cm per inch} \\ &= 10,16 \text{ cm} \end{aligned}$$

- B To calculate the surface area, we need to substitute the values into given formulae seeing that all values are given and is relevant.

$$\therefore \text{Surface Area} = 2(\text{length} \times \text{width}) + 2(\text{length} \times \text{height}) + 2(\text{width} \times \text{height})$$

$$\text{Length} = 7,62 \text{ cm}$$

$$\text{Width} = 5,08 \text{ cm}$$

$$\text{Height} = 10,16 \text{ cm}$$

$$\text{Surface Area} = 2(7,62 \times 5,08) + 2(7,62 \times 10,16) + 2(5,08 \times 10,16)$$

$$\text{Surface Area} = 77,4192 \text{ cm}^2 + 154,8384 \text{ cm}^2 + 103,2256 \text{ cm}^2$$

$$\text{Surface Area} = 335,4832 \text{ cm}^2$$

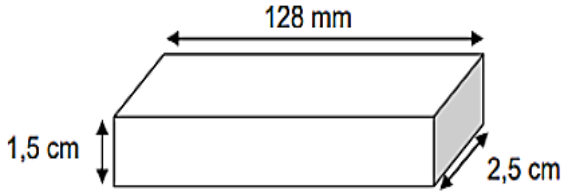
LEARNER ACTIVITIES: SURFACE AREA

Complete these activities as a time-based exercise. This means that you should work at a rate of approximately one mark per minute. This will prepare you to work at the pace required to complete the NSC examination within the allotted time frame.

QUESTION 1:

Bar One is one of the most popular chocolates in South Africa. The Bar One consists of malted nougat with a caramel topping and covered in milk chocolate.

The chocolate bar is in the shape of a rectangular prism as shown in the diagram below.

PICTURE OF A BOX OF SMARTIES CHOCOLATE.	DIAGRAM OF A BOX OF SMARTIES CHOCOLATE WITH MEASUREMENTS
	

Use the information above to answer the following questions:

- 1.1 Calculate the surface area (in cm^2) of the boxes of Smarties Chocolate.

You may use the following formula:

$$\text{Surface Area} = 2(\text{length} \times \text{width}) + 2(\text{length} \times \text{height}) + 2(\text{width} \times \text{height}) \quad (5)$$

- 1.2 The boxes that will be used also needs flaps in order to fold and paste it.

The flaps that are needed is 11,75% more that the surface area of the box of Smarties chocolate.

Calculate how much wrapping is needed for one box of Smarties chocolate. (3)

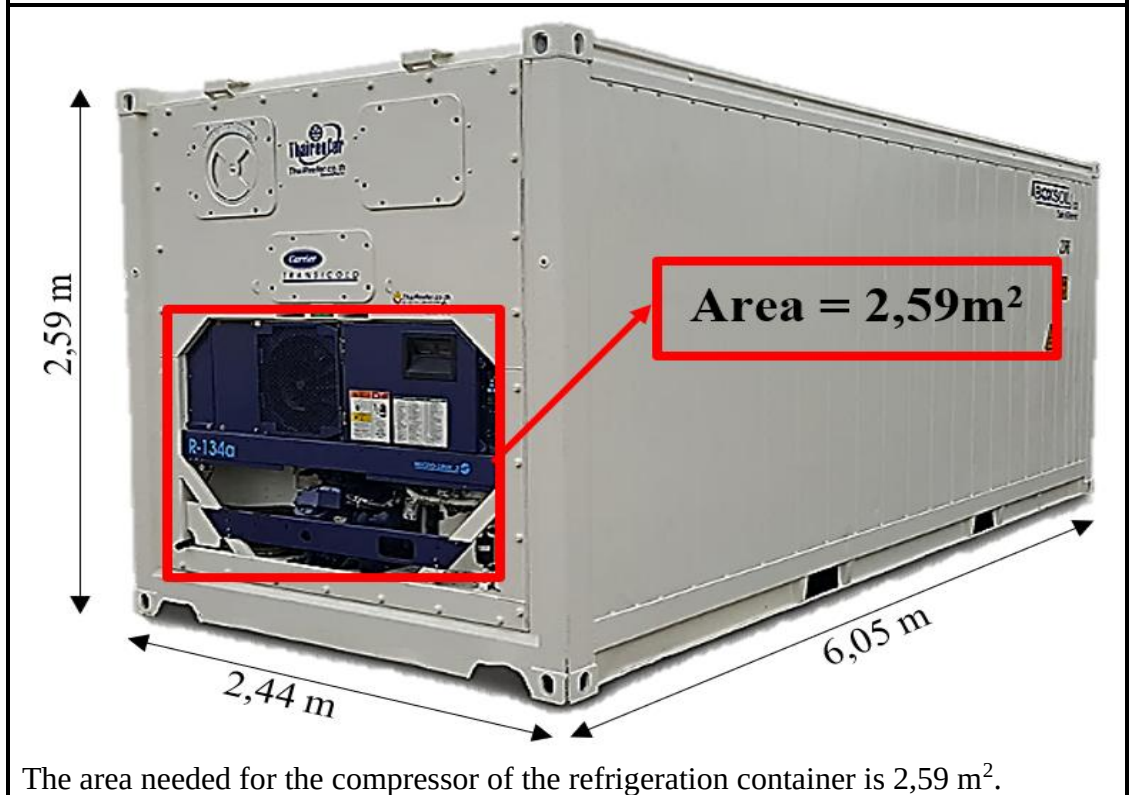
- 1.3 Bar One is made in South Africa and exported to India.

It is one of the top 5 most popular chocolate bars in India.

During the exporting process the chocolate bars are packed into a refrigerated shipping container to ensure that they remain fresh.

An example of a refrigerated shipping container is shown below:

PICTURE OF A REFRIGERATED SHIPPING CONTAINER WITH DIMENSIONS.



Use the following information to answer the question that follow:

1.3.1 Calculate the surface area (in m²) of the refrigerated container.

You may use the following formula:

$$\text{Surface Area} = [2(\text{length} \times \text{width}) + 2(\text{length} \times \text{height}) + 2(\text{width} \times \text{height})] - \text{area needed for the compressor} \quad (4)$$

1.3.2 The Epicon Marine Finish paint that is used to paint the containers has a spread rate of 8 m² per litre.

Calculate the amount of paint required (rounded to full litres) to paint the shipping container with two coats of paint. (4)

1.3.3 The Epicon Marine Finish paint is sold at R1 154,71 per 5 litre can.

Calculate the cost to paint 10 shipping containers with the Marine Finish paint. (6)

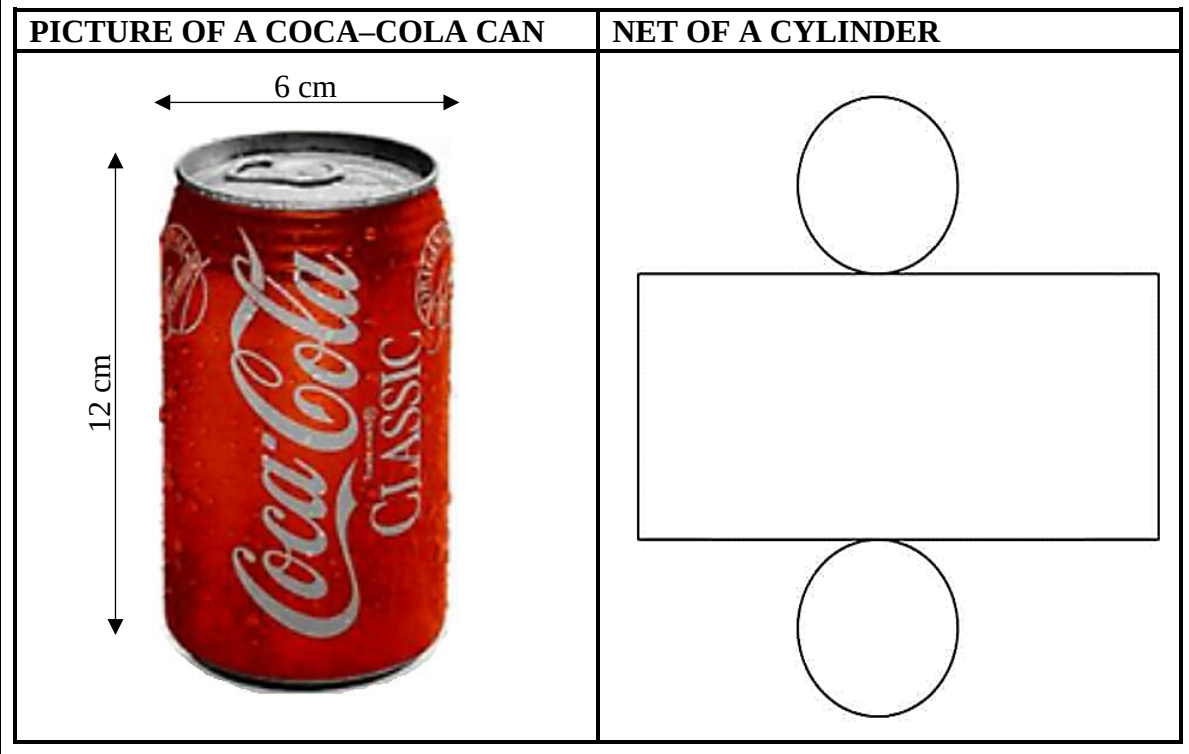
QUESTION 2

2.1

One of the most popular cool drink in the world is Coca-Cola or also known as Coke.

The Coca-Cola can is made from material that costs R25,75 (15% VAT inclusive) per dozen of cans.

The following diagram shows a picture of a Coca-Cola can with dimensions as well as the net of a cylinder.



Use the following information to answer the question to follow.

2.1.1 Calculate the surface area of the Coca-Cola can.

You may use the following formula:

$$\text{Surface Area} = 2\pi r (r + h); \text{ where } \pi = 3,142 \quad (4)$$

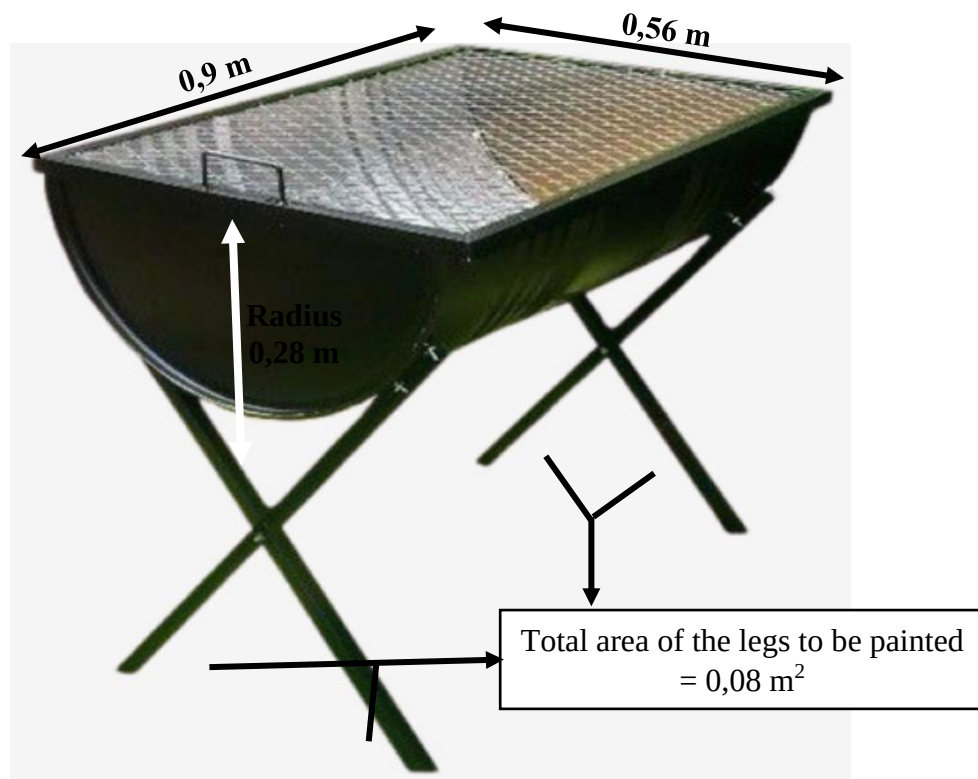
2.1.2 Calculate the cost, excluding VAT, of the material per can. (4)

- 2.2 David and James started their own business where they use oil drums and galvanised iron pipes and makes a braai stand. They cut these oil drums in half and use one half for a braai.

They paint the outside of these drums and all the legs with heat resistant paint and sell them to the public.

The following picture shows an image of an example of the braai stand as well as a diagram with the dimensions.

PICTURE OF A BRAAI STAND WITH DIMENSIONS



The area of the legs of the braai stand is 0,08 m² per braai stand.

Use the information above to answer the following.

- 2.2.1 Calculate the total surface area (in m²) of the braai drum to be painted with the heat-resistant paint.

You may use the following formula:

$$\text{Surface Area} = \frac{1}{2} [(2 \times \pi \times r^2) + 2(\pi \times r \times h)]; \text{ where } \pi = 3,142$$

(5)

2.2.2 David and James used the Duram NS7 Heat Resistant paint for the exterior of the braai stand.

The heat-resistant paint has a spread rate of 6 m^2 per litre.

Calculate the amount of paint (in litres) that is required to paint the braai stand with three coats. (3)

2.2.3 The Duram NS7 Heat Resistant paint is sold at R599,00 per litre.

Calculate the cost to paint 20 braai stands. (3)

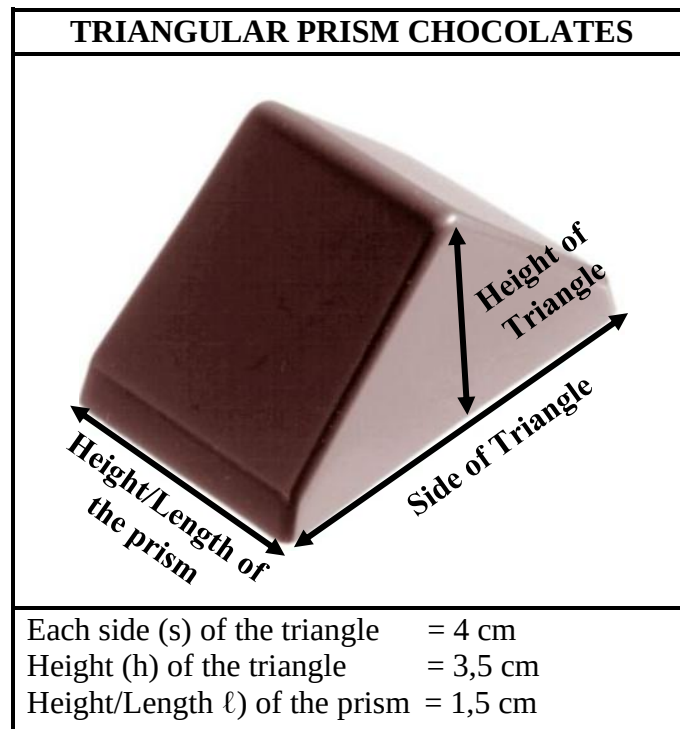
QUESTION 3:

The RCL of South Bank High School decides that they will have a fundraiser at their school and made chocolates to sell to the learners and the community.

They use a mould that allows them to make triangular prism chocolates.

They need to wrap the chocolates in a foil wrapping that is 10% more than the surface area of the chocolates.

The diagrams below show the dimensions of the two different shapes of the chocolates.



Use the information above and answer the questions that follow:

3.1 Calculate the surface area (in cm^2) of the triangular prism chocolate.

You may use the following formula:

$$\text{Surface Area} = (S_1 + S_2 + S_3)\ell + s \times h \quad (3)$$

3.2 Calculate the amount of foil wrapping needed for the chocolate. (3)

3.3 The foil wrapping that they will use is sold at a price of R40 per m^2 .

Calculate the cost of the foil wrapping per chocolate if $1 \text{ m}^2 = 10\,000 \text{ cm}^2$. (4)

VOLUME

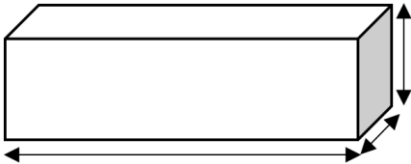
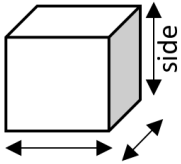
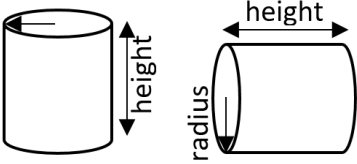
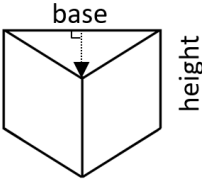
SUMMARY OF VOLUME

What is volume?

Volume is a measurement of how much space a three-dimensional object takes up.

This is always measured in cubic units – (units³); for example, mm³, cm³, m³, km³, in³, ft³, mile³ etc.

The following table gives a summary of the formulae for volume.

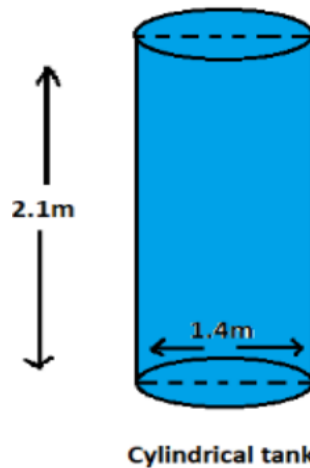
SHAPE	RECTANGULAR PRISM	CUBE
		
FORMULA	Volume = length × width × height	Volume = side × side × side / (side) ³
SHAPE	CYLINDER	TRIANGULAR PRISM
		
	Volume = $\pi \times \text{radius}^2 \times \text{height}$	Volume = $\frac{1}{2} \text{ base} \times \perp \text{ height} \times \text{height}$

It is very important to remember that all the units must be the same before any calculations are done and that we use the radius when working with cylinders and not the diameter.

EXAMPLE QUESTION: VOLUME

NY High School bought water tanks to collect rainwater that they can use to water the flower beds.

The measurements of the specific water tank are given below:



Use the information above to answer the questions that follow:

- A Calculate the radius of the water tank.
- B Calculate the volume of the water tank in m^3 .

You may use the following formula:

$$\text{Volume} = \pi \times r^2 \times h; \text{ where } \pi = 3,142$$

- C Calculate the amount of water in litres that this water tank can hold.

NOTE: $1 \text{ m}^3 = 1\,000$ litre.

EXAMPLE QUESTION ANSWERS:

- A Radius = diameter $\div$ 2
Radius = $1,4 \text{ m} \div 2$
Radius = $0,7 \text{ m}$
- B Volume = $3,142 \times 0,7^2 \times 2,1$
Volume = $3,23 \text{ m}^3$
- C Volume in litres = $3,233118 \times 1\,000$
Volume = $3\,230$ litres

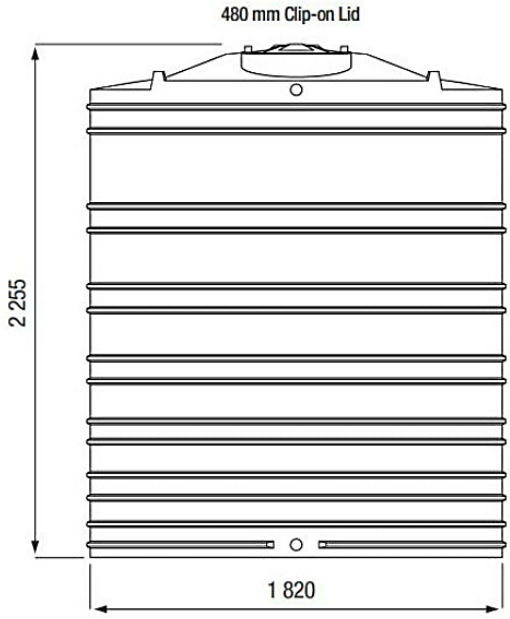
LEARNER ACTIVITIES: VOLUME

Complete these activities as a time-based exercise. This means that you should work at a rate of approximately one mark per minute. This will prepare you to work at the pace required to complete the NSC examination within the allotted time frame.

QUESTION 4:

Due to a drought in his town, Mr Andrews needs to purchase a water tank for his property as he is a lover of flowers.

He bought the following water tank at his local hardware store and had it installed on his property.

PICTURE OF A CYLINDRICAL WATER TANK	DIAGRAM OF A WATER TANK WITH DIMENSIONS
	 All measurements are in millimetres.

NOTE: $1 \text{ m}^3 = 1 \text{ kilolitre}$

Use the information above and answer the questions that follow:

4.1 Calculate the radius (in metres) of the water tank. (3)

4.2 Calculate the volume (in m^3) of the water tank.

You may use the following formula:

$$\text{Volume} = \pi r^2 \times h; \text{ where } \pi = 3,142 \quad (3)$$

4.3 Calculate the volume of water (in kilolitres) in the water tank if it is filled to 85% of the capacity. (3)

QUESTION 5:

The boundaries in cricket used to be indicated by a thick rope, this caused some injuries to the fielders as they attempted to stop a boundary from being scored.

Since the early 2000's they introduced the triangular prism wedges that is made from high density foam.

The picture below shows an example of these wedges.

PICTURE OF A WEDGE USED FOR THE BOUNDARY ROPE IN CRICKET.



h = height of the triangle
h = 0,2165 m

Use the information above and answer the questions that follow:

- 5.1 Calculate the volume of foam (in m^3) used to make one of these boundary wedges.

You may use the following formula:

$$\text{Volume} = \frac{1}{2} \text{ base} \times \text{height of the triangle} \times \text{height/length of the wedge} \quad (3)$$

- 5.2 The minimum distance around a cricket field for a professional match is 138 m.

Calculate the volume of foam needed for all the wedges required for a cricket field with a perimeter of 138 metres.

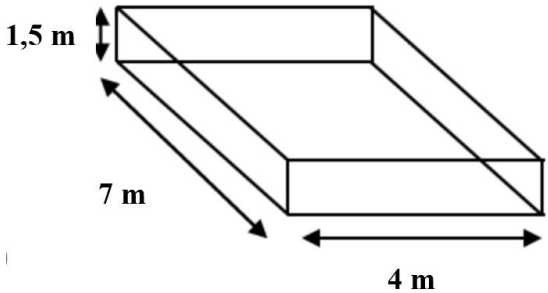
(2)

QUESTION 6

Jeremy is busy with renovations at his house and wants to build a swimming pool for his children.

He is building a simple rectangular swimming pool of which the depth is the same across the entire pool.

The diagram below shows an example of a rectangular swimming pool as well as a diagram with the dimensions.

EXAMPLE OF A RECTANGULAR SWIMMING POOL	DIAGRAM OF THE RECTANGULAR SWIMMING POOL WITH DIMENSIONS:
	

NOTE: $1 \text{ m}^3 = 1 \text{ kilolitre}$

Use the information above and answer the questions that follow:

- 6.1 Calculate the capacity (in m^3) that this swimming pool will be able to take.

You may use the following formula:

$$\text{Volume} = \text{length} \times \text{width} \times \text{depth} \quad (2)$$

- 6.2 Jeremy will fill his pool to $\frac{3}{4}$ of the capacity.

Calculate the cost to fill the pool if he uses a company that supplies pool water at R10 per kilolitres. (4)

LEARNER ACTIVITIES: COMBINED

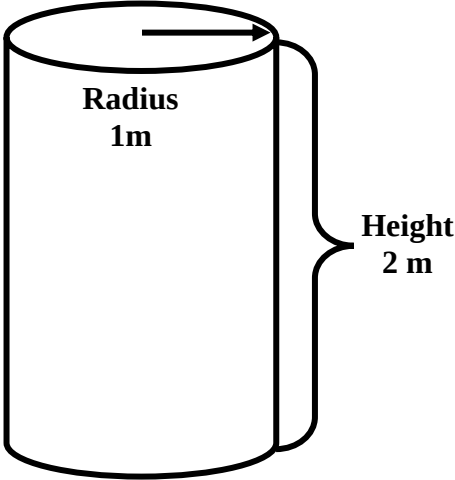
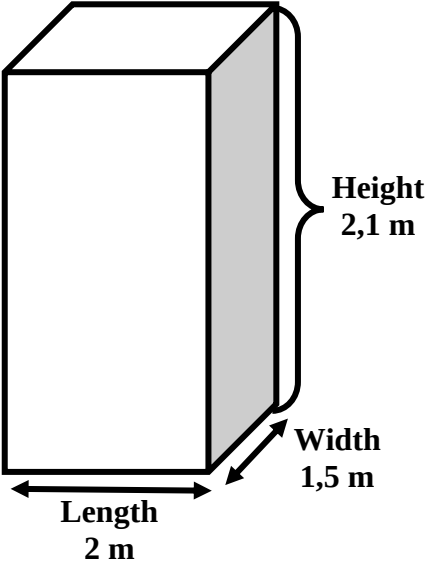
QUESTION 7:

WA Water is a company that sells filtered water to the public.

People can bring their own containers and pay according to the volume they bought.

They want to buy a water tank but want to limit the amount of material used.

They have the following two options available that have the similar volume:

CYLINDRICAL WATER TANK	RECTANGULAR WATER TANK
	
ADDITIONAL INFORMATION	
Surface Area of cylinder = $2\pi r^2 + 2\pi rh$ Surface Area of rectangular prism = $2(l \times b) + 2(l \times h) + 2(b \times h)$,	Volume = $\pi \times \text{radius}^2 \times \text{height}$ Volume of rectangular prism = $\text{length} \times \text{width} \times \text{height}$
NOTE: $\pi = 3,142$	

Use the information above and answer the questions that follow:

7.1 Verify by means of calculations that the two water tanks shown above has a similar volume. (5)

7.2 The material used to make both the water tanks cost the same.

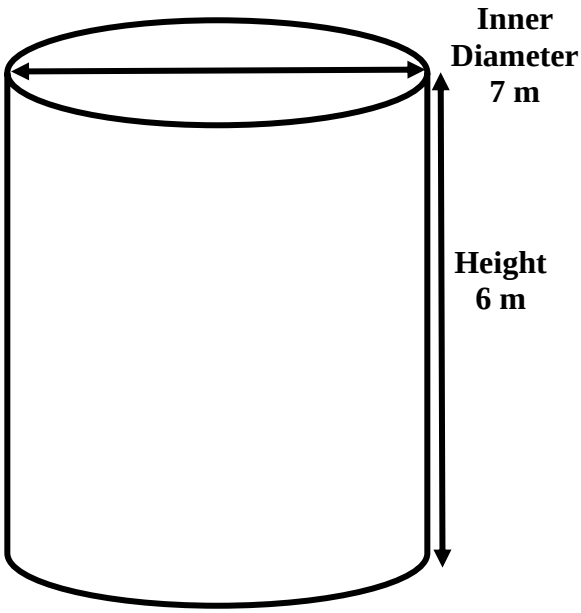
Show by means of calculations which water tank will use less material by calculating the Surface Area of both. (5)

QUESTION 8:

Water is scarce in South Africa. The average annual rainfall is 464 mm.

89% of South Africans have access to safe drinking water. Some of the other rural areas make use of water tanks to collect the rainwater.

The following diagram indicates an example of a water tank used to collect rainwater.

PICTURE OF A WATER TANK USED TO COLLECT WATER	DIAGRAM OF WATER TANK WITH DIMENSIONS
	

NOTE: $1 \text{ m}^3 = 1\,000 \text{ litre}$.

Use the information above and answer the questions that follow:

- 8.1 The inner surface of the water tank will be painted with a waterproofing paint to ensure that no water will leak out of the tank.

Calculate the inner surface area (in m^2) of the water tank.

You may use the following formula:

$$\text{Inner Surface Area} = 2\pi r^2 + 2\pi rh; \text{ where } \pi = 3,142$$

(4)

- 8.2 The waterproofing paint used has a spread rate of 6 m^2 per litre and costs R185 per litre.
Calculate how much it will cost to paint the water tank with two layers of waterproofing paint. (4)

- 8.3 Calculate the volume of water that this water tank can collect.

You may use the following formula:

$$\text{Volume} = \pi \times \text{radius}^2 \times \text{height}; \text{ where } \pi = 3,142 \quad (2)$$

- 8.4 The flow rate of the water going out of the tap is 15 litres per minute.

Calculate how long (in hours and minutes) it will take for the tank to be emptied if the tap is continuously running. (4)

MAPS AND PLANS (SESSION 3)

MAPS AND SCALE (PAPER 2 = 40%)

SCALE

- Scale (ratio, bar)
- Determine actual lengths and distances from a given scale
- Determine a scale for drawings and models
- Determine a scale in which to draw diagram or construct a model

MAPS

- Grid reference
- Compass directions
- Slope on map

MAPS/PLANS

OBJECTIVES

By the end of this section learners must be able to:

- Describe the position of an object in relation to the surrounding objects.
- Find locations, follow directions and describe directions for travelling between two or more locations.
- Estimate distances using a given scale.
- Estimate the time it will take to travel between two or more locations.
- Estimate the amount and cost of fuel that will be used to travel between two or more locations.
- Estimate the average speed travelled during a trip.
- Determine appropriate stopping locations.
- Plan and cost trips using timetables, fare charts, distance charts and budget.
- Work with combination of maps showing different perspectives and scale.
- Interpret compass directions in the context of appropriate maps and plans.
- Understand directions and signboards on roads and in map books.
- Interpret elevation plans of building.

TERMINOLOGY:

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 3 - dimensional construction of real-life objects. 3 – D refers to a model/object that has three dimensions such as length, width and height.

Actual length Accurate length as 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 The length of the space between two points

Elevation map: Information about the profile of a route as seen from the side.

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.

Highway: A major road that links major cities.

Length: The measurement of something from end to end

National road map: Shows major roads linking major cities to each other.

North elevation plan: Shows the side of the building that is in front of you when you are facing the compass direction 'South'

Number scale: A number scale such as 1: 50 000 means that 1 unit on the map represent 50 000 units in real life

Scale: Determines how many times smaller an object shown on a plan or map is that its actual size

Scale drawings A diagram or real object drawn in proportion.

Scale elevation plans: Show the design and dimensions of the exterior of a building from a side view using specific scales.

Maps: A symbolic representation of certain characteristics of a place drawn on a flat surface.

Street map a map of a small area such as a town or city.

Strip map a map showing a section of a travel route.

Route map Shows specific routes, for an event as seen from above.

(ROUTE MAP IN THE CONTEXT OF A MARATHON OR RACE)

- It is a map that shows the path/course that runners will follow
- A map showing the path/way/direction that the runners will run.
- A map showing the path the marathon follows.

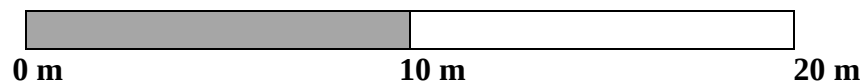
SCALE: TYPES OF SCALE

A. BAR SCALE

The bar scale is used to develop the numeric scale, each segment or part must be measured in order to create a ratio scale.

It is given as a picture **e.g.**

The length of the bar needs to be **measured with a ruler**



e.g., If the length of the bar from 0m to 20 m is 8 cm then it means 8 cm on the map is equal to 20 m in reality/on ground/ on land.

DETERMINE A SCALE:

That means the scale is 8 cm = 20 m and it can be simplified like we simplify a ratio.

8 cm : 200 cm (convert to the same units)

1 : 25 ($\div 8$)

NB: Scale factor is 25

Advantages and disadvantages of a bar scale

Advantages	Disadvantages
Bar scales are quick and easy to use.	Measurements (using a ruler, string or markings) obtained using bar scales tend to be less accurate.

You may be able to determine actual lengths and distances without doing calculations.	Bar scales may still require calculation actual lengths and distances.
--	--

B. NUMBER/RATIO/NUMERIC SCALE

This scale is expressed as a ratio, e.g. 1 : 500. This means that for every 1 unit on the map/image is equivalent to 500 units in reality.

Advantages and disadvantages of a number scale

Advantages	Disadvantages
Number scales are more accurate than bar scales.	Number scales require the use of calculators in determining actual distances
Number scales are more convenient to use when working with small scales e.g. 1: 50 000 000.	With digital printing, number scales become inaccurate and useless if there is any resizing of the map or plan

NO SCALE / NOT DRAWN TO SCALE:

- There is no relationship between the distances on a map/plan and the corresponding distances in reality or on the ground.
- You cannot measure the distances on the map and expect to calculate the actual distances.
- No specific scale was consistently used to draw a map/plan e.g. 1 : 100 was not used.
- Not to scale means the dimensions or measurements on the map/plan are not accurate.

For example Strip maps is not drawn to scale.

EXAMPLE QUESTION [TUTOR & LEARNER]

WORKED EXAMPLES (1 to 4)

1. You are given a map with the number scale of 1: 60. You measure a length (on the map) of 10 cm. What is this distance in real life?
2. The distance on the map from Durban to Pietermaritzburg is 2,5 cm.
Use the number scale of 1:3 120 000 to calculate the actual distance in km.
3. You are given the following bar scale:



You measure the distance on the map to be 15 cm. Determine the actual distance

MAPS/PLANS

4. LAYOUT PLANS

Explain what a layout plan is.

A layout plan is a top view that shows the arrangement of features. OR/OF

A layout plan is the structural arrangement of items within a certain space. OR/OF

Plan of the entire inside cabin, showing location of seats, exit doors etc. OR/OF

Drawing to scale showing physical arrangements of all resources that consume space within facilities.

- Uses icons with names to show different buildings or structures.
- Symbols are also used where necessary to make the diagram clear.
- Compass direction indicators are also common.

LAYOUT OF THE BUILDING



4.1 Draw the symbol for the following:

4.1.1 Door:

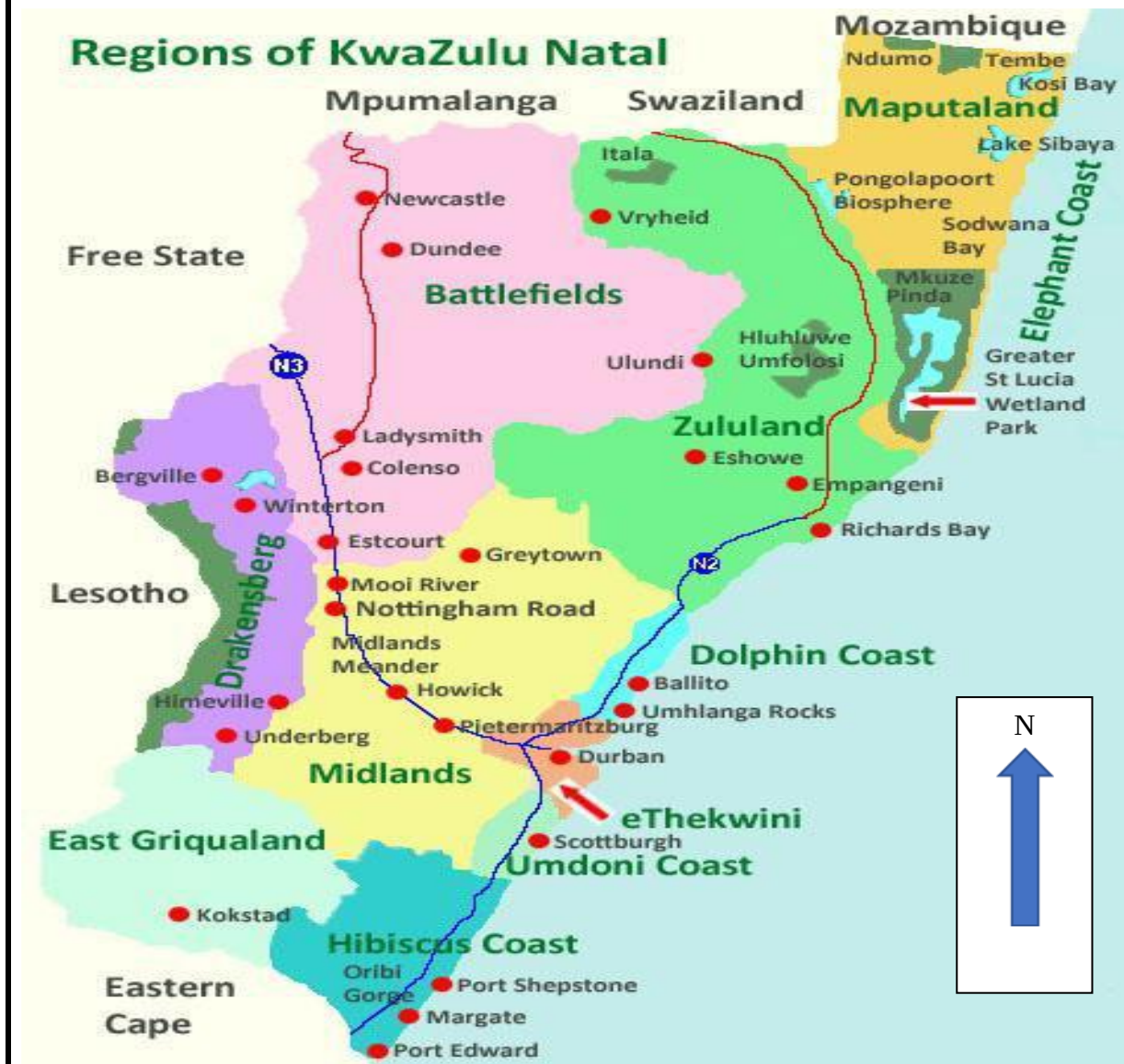
4.1.2 Sliding door:

4.1.3 Window:

- 4.2 Write down the number of windows that are on the plan.
- 4.3 Write down the number of doors that are in the house.
- 4.5 The main entrance (at the hall) faces north. Draw a compass on the above plan.

LEARNER ACTIVITIES

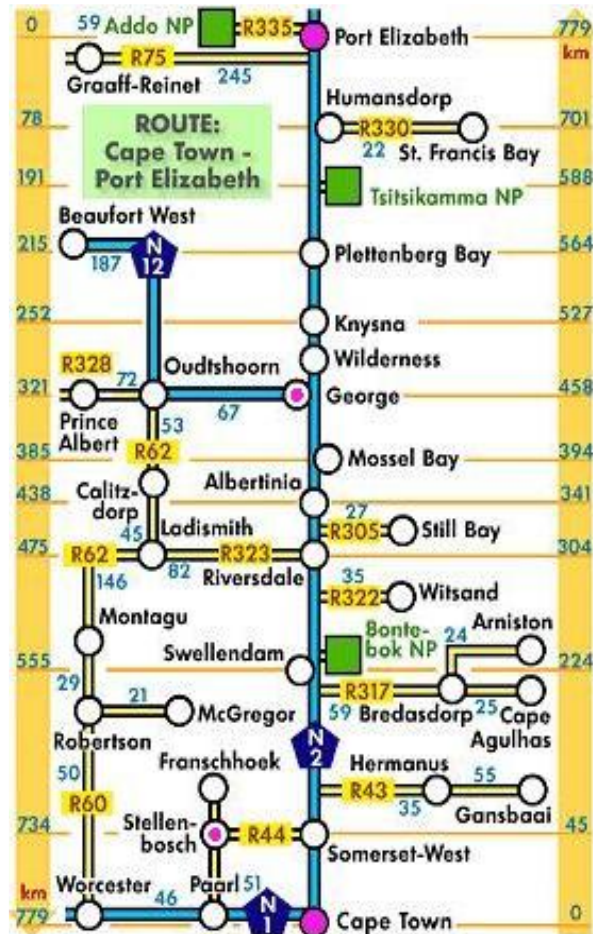
1. Mrs Tshabalala stays in Lesotho. She is planning to have a holiday in KwaZulu Natal. Below is the Map she will be using to decide on places to visit.



Use the information above to answer the following questions.

- 1.1 Write down the number National Road(s) that is on this map. (2)
- 1.2 Write down the general direction of Ulundi from Lesotho. (2)
- 1.3 Write down the name of the province that is east of Lesotho. (2)
- 1.4 The distance from Lesotho to Ulundi is 734 km. Mrs Tshabalala is driving at an average speed of 120km/h. Determine how long will it take her to reach Ulundi. Write your answer in hours and minutes.
You may use the following formula
Average speed = $\frac{\text{Distance in km}}{\text{Time in hours}}$ (4)
- 1.5 Mrs Tshabalala will first go to Free State to pick her son. Her car's fuel consumption is 19.62 km per litre and the cost of petrol is R17.00 per litre.
- 1.5.1 Describe the route for the Tshabalala's to get to Umhlanga Rocks, where they plan to spend a day with a family friend before going to Ulundi. (2)
- 1.5.2 Calculate the number of litres of petrol that Mrs Tshabalala needs for the return trip from Lesotho to Ulundi. (3)
- 1.5.3 Hence, calculate the amount of money that Mrs Tshabalala will need for petrol. (2)
- 1.5.4 Give a reason why there is a bold line between Lesotho and South Africa. (2)

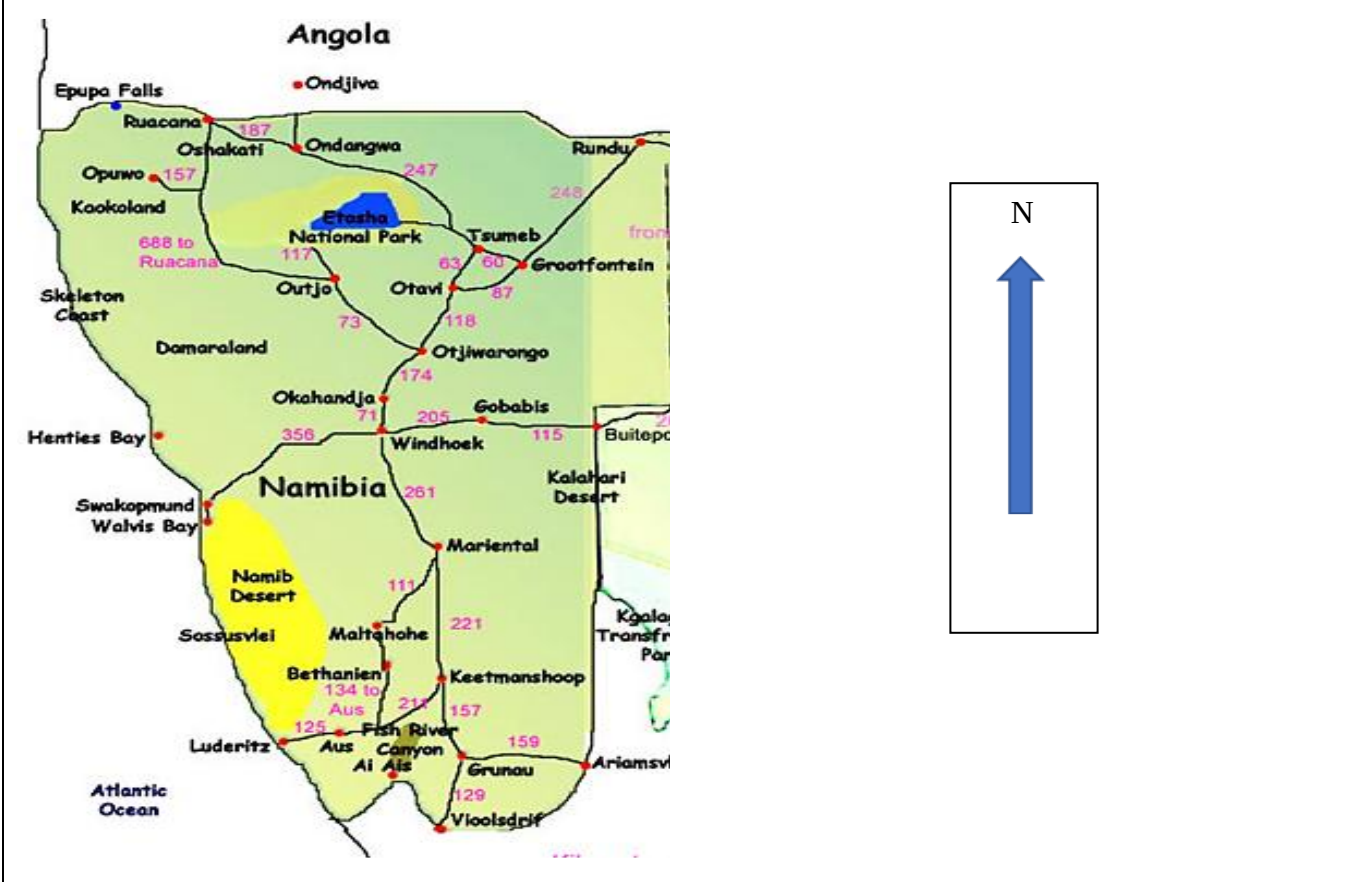
2. The strip map shows the distance from Cape Town to Port Elizabeth. Mpilenhle will be driving from Cape Town to Beaufort West via George. He drives a Mercedes-Benz C 63 AMG with a 70 litre fuel tank capacity and fuel consumption of 10,3 ℓ / 100 km.



Use the strip chart above to answer the following questions.

- 2.1 Describe the route, including Mpilenhle will follow on the available . (3)
- 2.2 Calculate the total distance in 2.1 above. (2)
- 2.3 Use the given fuel consumption rate to advise Mpilenhle on the number of times he will need to refuel his car to get to his destination. (5)

Amukele went to Namibia for a holiday. Use the map to answer the questions below.



Swartkopmund					
297	Sesriem				
205	83	Solitaire			
552	745	684	Tsumeb		
31	266	205	673	Walvis Bay	
356	319	258	428	389	Windhoek

- 3.1 Determine the general direction of the Kalahari Desert from Vioolsdrift. (2)
- 3.2 Use the distance chart to determine the distance between Swartkopmund and Walvis Bay. (2)
- 3.3 Consider the actual distance from Keetmanshoop to Windhoek. Measure the distance between the two places on the map. Hence, calculate the number scale used to draw the map. (6)
- 3.4 Determine the actual distance from Gobabis to Grootfontein on the map. (3)
- 3.5 Amukele leaves Gobabis at 7:45 and travels at an average speed of 90 km/hour. He states that he will arrive in Grootfontein at 12 noon, if he travels at the same speed. Verify, using calculations if his timing is **CORRECT**.

You may use the formula: $\text{Time} = \frac{\text{Distance}}{\text{speed}}$

(6)

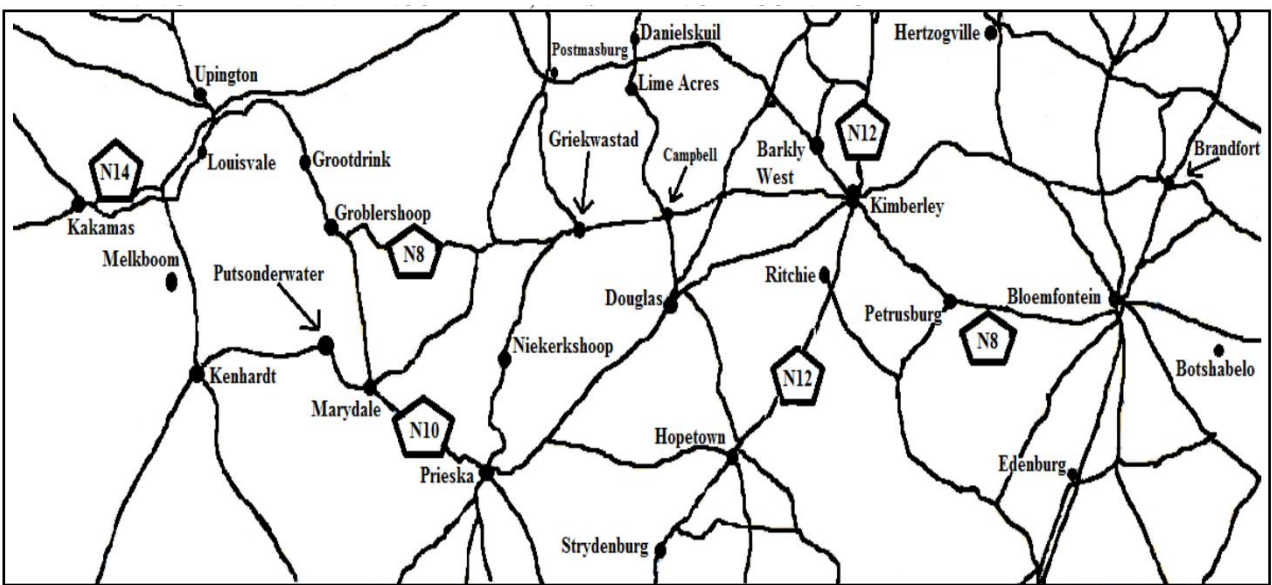
- 3.6 Calculate the cost of petrol to travel from Gobabis to Grootfontein, if the car's petrol consumption is 8 litres per 100 km and petrol cost R16,45 per litre.

(4)

4.1

Alida is a Grade 12 learner who lives in Grootdrink in the Northern Cape. She intends studying at a university in Bloemfontein. She and her parents plan to attend the university's open day for prospective students.

A map on ANNEXURE B shows a part of the Northern Cape, Free State and surrounding areas.



Use the map above to answer the following questions.

- 4.1.1 Write down the general direction from Bloemfontein to Grootdrink. (2)

- 4.1.2 State the national road they will use to travel to Bloemfontein. (2)

- 4.1.3 Write down the name of the third town they will pass en route to Bloemfontein. (2)

- 4.1.4 Alida and her parents leave Grootdrink at 04:00 and travel a distance of 496,9 km to Bloemfontein.

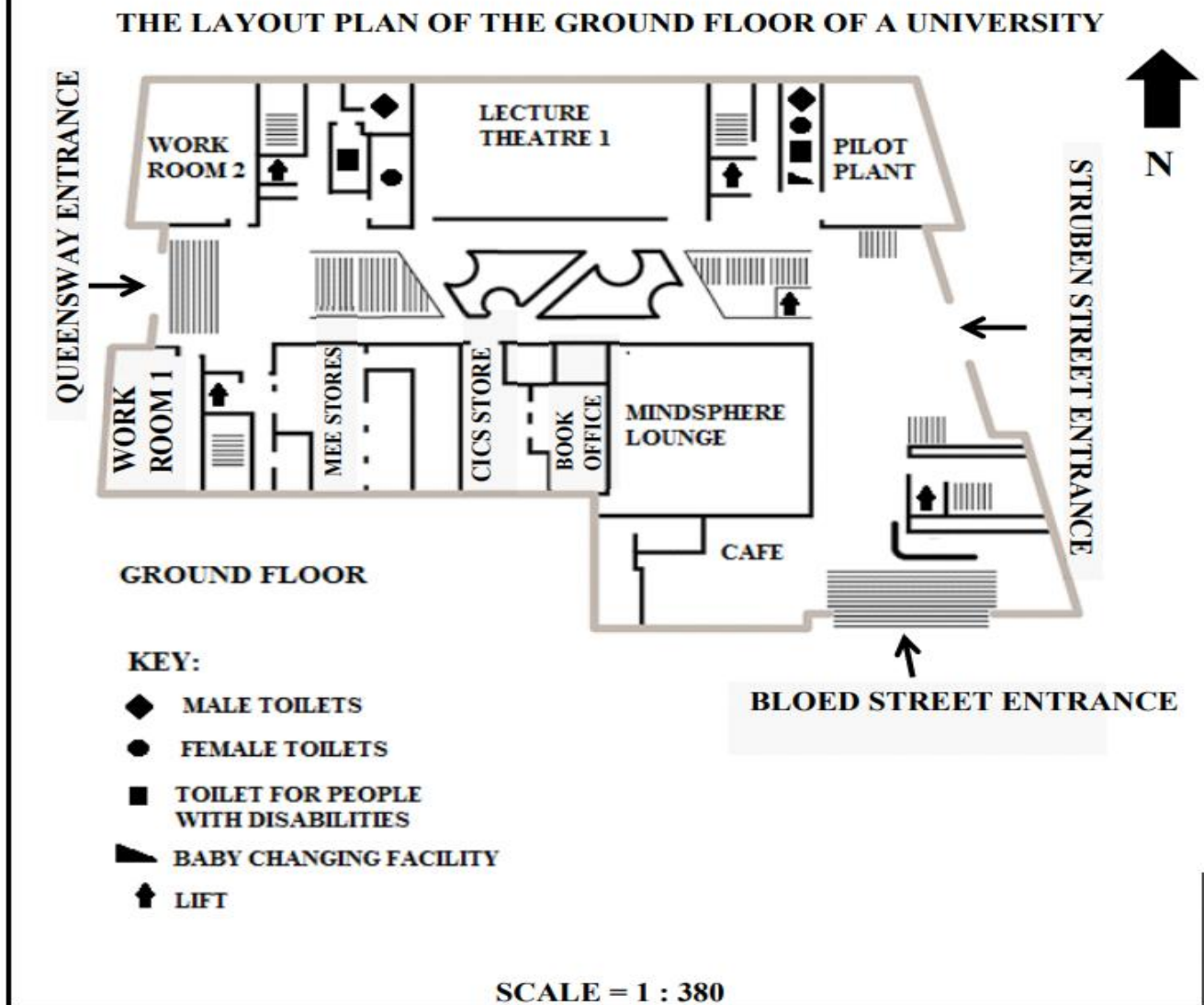
Determine (up to the nearest km/h) average speed they need to drive to arrive in Bloemfontein at 9:30.

Use the following formula: $\text{Average speed} = \frac{\text{Distance}}{\text{Time}}$

(4)

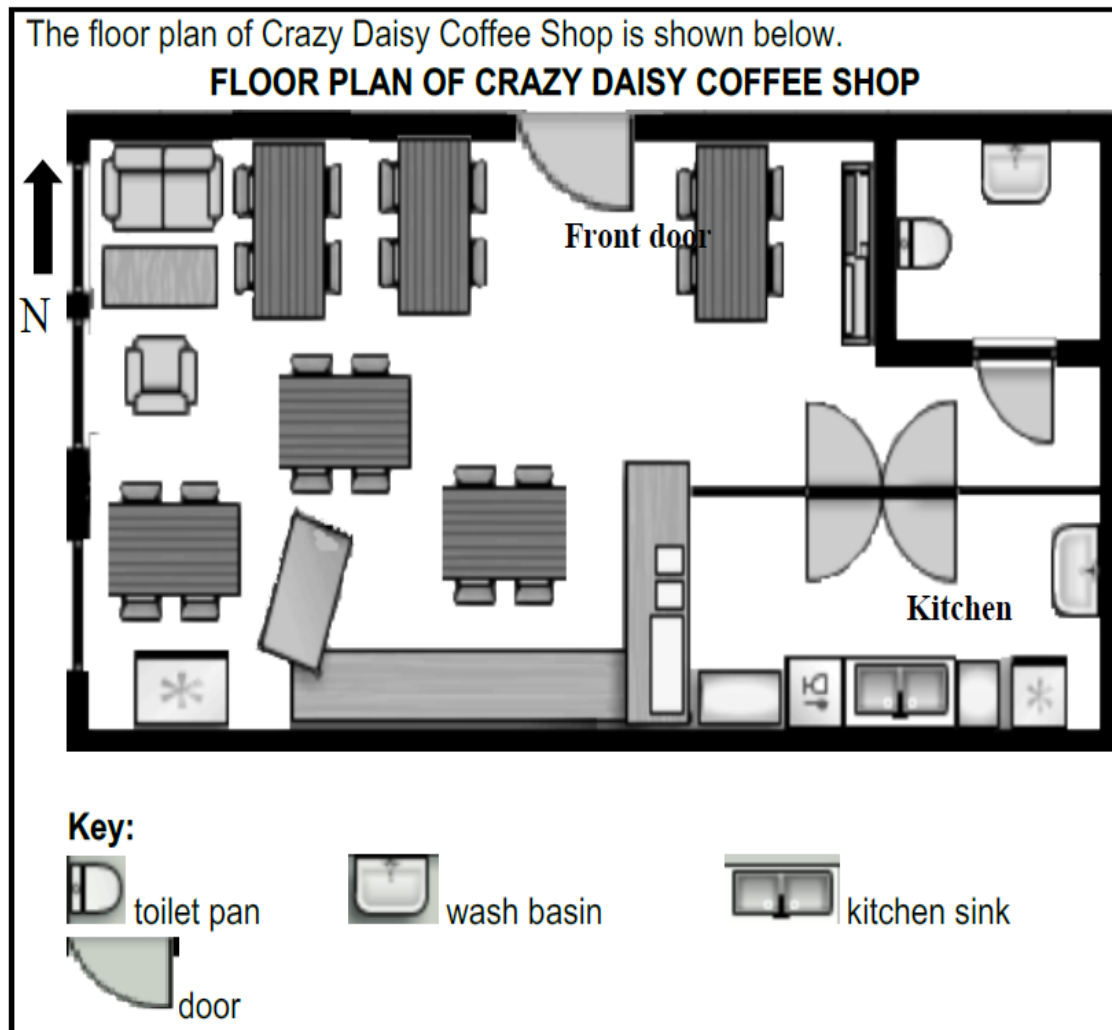
4
.
2

The layout plan of the ground floor of a university is given below.



- 4.2.1 Explain the meaning of the given scale. (2)
- 4.2.2 Mention a feature on the layout plan that indicates this is a multi-level building. (2)
- 4.2.3 Determine the number of toilets that are not suitable for people with disabilities on this layout plan. (2)
- 4.2.4 Identify the exit that is closest to the café. (2)
- 4.2.5 Determine the length (in m) of the east-facing wall of the Mindsphere Lounge. (3)

5
.



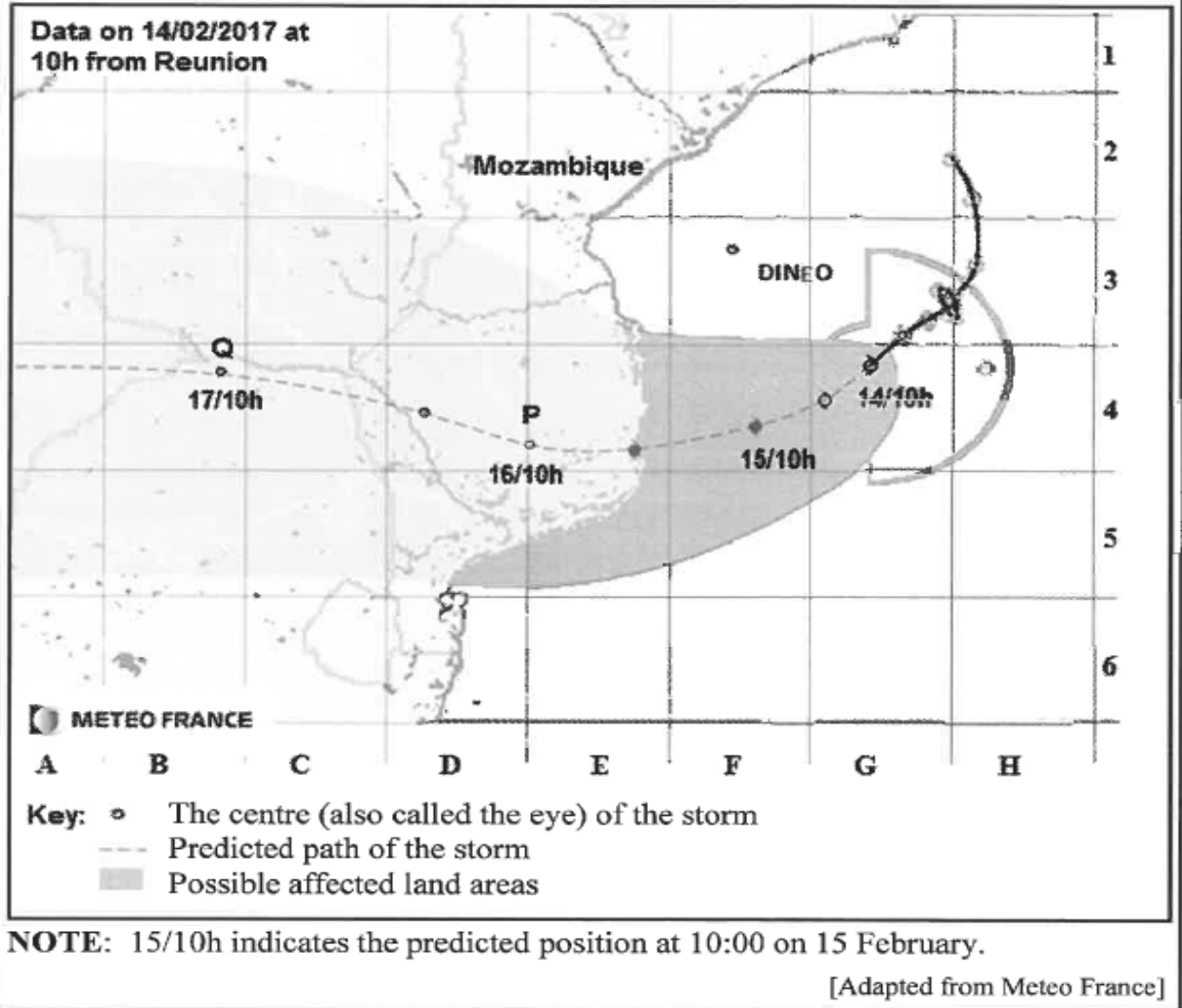
[Adapted from www.shopkeep.com]

Use the floor plan above to answer the questions that follow.

- 5.1 Explain the meaning of the term *floor plan* in this context. (2)
- 5.2 Identify the door on the northern side of the plan. (2)
- 5.3 Give the general direction of the kitchen from the front door. (2)
- 5.4 The measured width of the coffee shop is 70 mm. The actual width is 15 m. Determine the scale (rounded off to the nearest whole number) of the floor plan. (3)

6.

During February 2017 tropical storm Dineo caused damage to property in Mozambique, but it also brought much needed rain. Below is a chart issued by Meteo France (the French weather office) showing the projected path of the storm as well as likely affected land areas.



- 6.1 Dineo was classified as a Category 1 tropical storm with a maximum average wind speed of 95 miles per hour.

NOTE: 50 miles = 80,4672 km

Convert (rounded off to TWO decimal places) the average wind speed to kilometres per hour. (3)

- 6.2 Write down the grid reference of point P and Q respectively. (2)

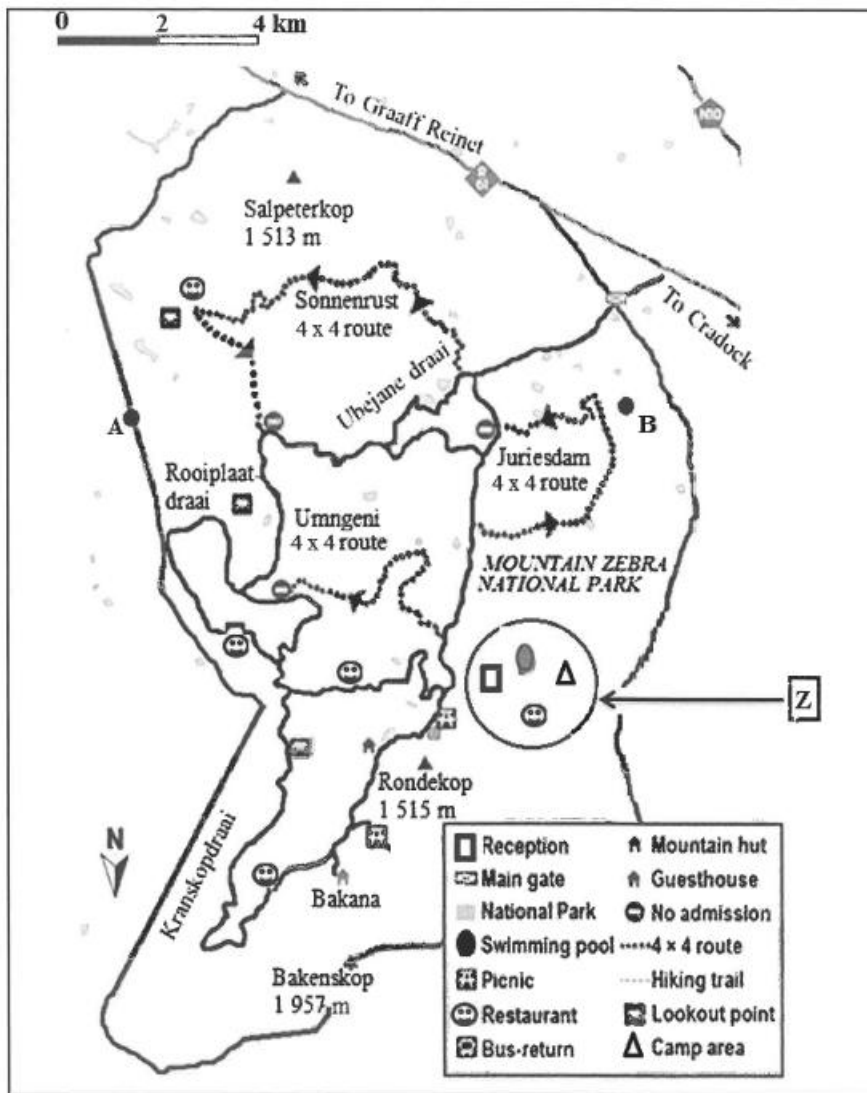
- 6.3 The distance between two vertical gridlines on the map is approximately 205,043 km.

Calculate, using the measured distance, the predicted average speed (in km/h) of the storm from point P to point Q.

You may use the following formulae: **Distance = average speed x time** (8)

7. The map below is of the Mountain Zebra National park. Use the map to answer the questions that follow.

MAP OF THE MOUNTAIN ZEBRA NATIONAL PARK



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[Adapted from www.grafieka24.com]

7.1.1 Write down ALL the activities offered in circle Z. (4)

7.1.2 Identify the 4 x 4 route north-east of the Juries Dam. (2)

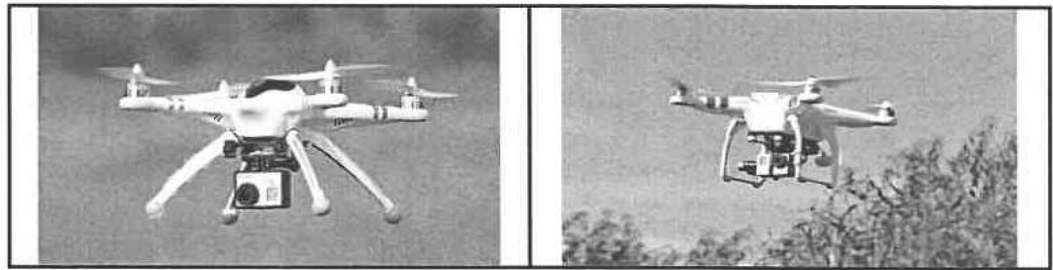
7.1.3 Determine the number of restaurants found on the map. (2)

7.1.4 Identify the type of scale shown on the map. (2)

7.1.5 The measured map distance between point A and point B is 10 cm.

Use the given scale to calculate the actual distance (to the nearest km) between point A and point B. (4)

7.1.6 The field guides sometimes use drones (remote controlled aircrafts) to monitor the movement of animals in the parks.



The drone travels an average speed of 30km/h. For a particular task, the drone flew 10 km from the guide and thereafter returned to the guide.

Calculate the total time (in minutes) for this particular task.

You may use the following formula:

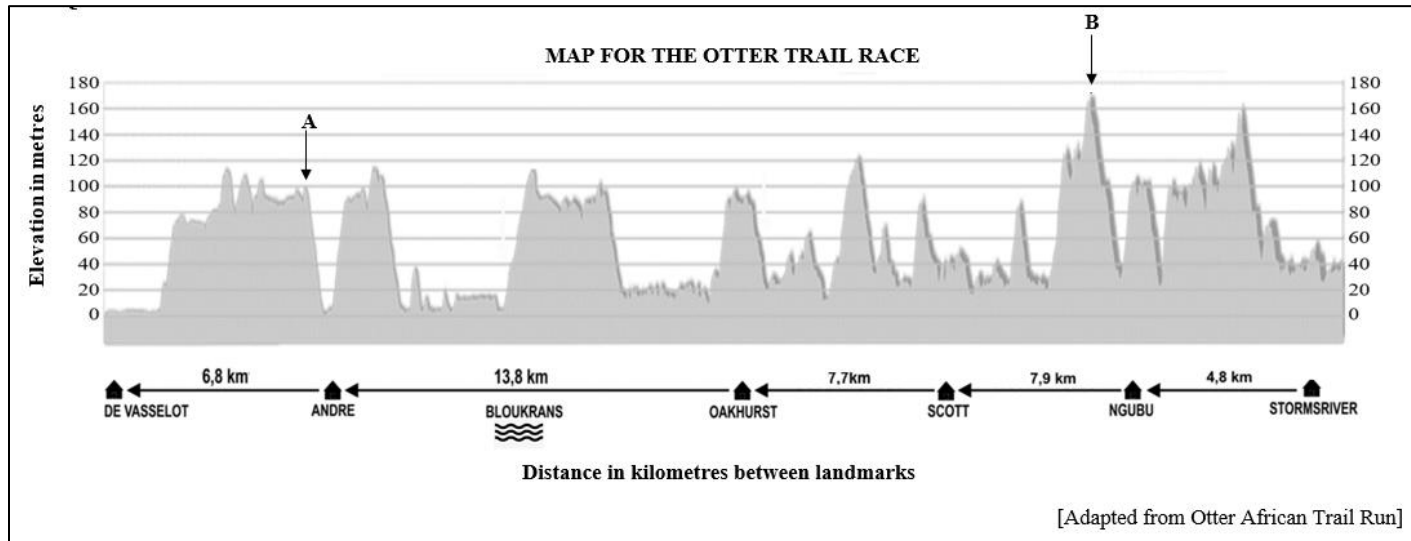
$$\text{Time} = \frac{\text{distance}}{\text{speed}} \quad (4)$$

8

Simnikiwe and her friends took part in the Otter Trail running race which covers a total distance of 41 km.

The race starts at Stormsriver and ends at De Vasselot.

The elevation and distance map of the Otter Trail Race is shown below.



Study the elevation and the distance map above to answer the questions that follow.

8.1.1 Determine the difference in elevation between point **A** and point **B** as shown on the elevation map. (2)

8.1.2 The cut off time for the Otter Trail Race is 11 hours.

Calculate the average speed in km/h that should be maintained by a participant to finish the race in exactly 11 hours.

You may use the following formula:

$$\text{Distance} = \text{Speed} \times \text{Time} \quad (3)$$

8.1.3 Simnikiwe claims that Bloukrans is the second landmark after the halfway mark.

Verify showing all your calculations if her claim is correct. Explain your answer. (4)

8.1.4 A runner is currently at Scott.

Calculate the distance that still needs to be covered, as a percentage of the total distance. (5)

