FACILITATOR'S GUIDE

2015 TERM 3 TRAINING WORKSHOP

MATHEMATICS

GRADES 8-9

PILO
IMPROVING LEARNER PERFORMANCE

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Just-in-Time Training
Workshop Term 3

Facilitator's Manual

Grades: 8 & 9
Subject: Mathematics

Jika iMfundo
what I do matters

Endorsed by:

SADTU
NATU
NAPTOSA

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1. INTRODUCTION

Jika iMfundo (Turn Education Around), is a programme which its main focus is on Heads of Department for Mathematics, Natural Sciences and English First Additional Language. This workshop is mainly for the Mathematics Heads of Department in GET. In some cases where an HoD is not a Mathematics specialist, a senior Mathematics Teacher at the school attends the workshop.

The fundamental purpose of Jika iMfundo is to capacitate the HoD's and Senior teachers about their roles so that they make sure the curriculum is covered with justice and the Curriculum Assessment Programmes (CAPS) is followed in accordance with the Department of Basic Education Policies.

This workshop is composed of three sessions, namely, reflection on the second term curriculum tracker, Relations and Functions and lastly general activities on Graphs.

SESSION 1

2. REFLECTION ON THE MATHEMATICS GRADE 8 & 9 CURRICULUM TRACKERS

The Objectives of this session are:

1. To solicit attitude opinions about the curriculum tracker
2. Deepen the use of the curriculum tracker
3. To draw attention of the HoDs / Teachers on the important features of the curriculum tracker.
4. To highlight the benefits of using the curriculum tracker
5. To reinforce the role of HoDs in relation to curriculum coverage
6. To familiarise HoDs and senior teachers with the importance of functions and graphs in the teaching and learning of mathematics

2.1 PROVISIONS AND BENEFITS

Activity 1

2.1.1 Complete the following activity as a pair. List all you know the Trackers provide.

As a curriculum management tool, the Tracker provides:

1. Daily tracking of one's pace and content delivery
2. Links to Maths CAPS Senior phase and work schedule
3. Links to textbook/s and DBE workbook
4. Available resources in a classroom
5. Assessments and record sheets for the Formal Assessment required by CAPS
6. A reflection tool to monitor and support teaching in a classroom.

2.1.2 As a pair, list all the benefits of using the Curriculum Trackers.

1. Easy to plan and prepare for you lessons
2. Help you manage your time well
3. Help you cover the content of the curriculum in full
4. Help you cover content sequentially
5. Ensures that you complete the required formal assessments.

2.2. KNOWLEDGE AND UNDERSTANDING OF THE CURRICULUM TRACKER AND RESOURCES.

Activity 2 (Individual)

2.2.1 What does the Curriculum Tracker mean to you?

- Curriculum management tool for teachers
- Works the same as pace-setter
- A plan to cover curriculum in full
- Monitoring tool for HoDs
- Supports the CAPS
- Guides teachers' n curriculum coverage.

2.2.2 Briefly explain the meaning of '*select' and '*supplement' as found in Curriculum Trackers.

- *Select means that the book tracked has too many activities for that specific concept on that day therefore the teachers should select few enough for classroom practice. It can be suggested that the remaining activities be given as homework or part of assignment.
- *Supplement means that the book tracked does not have enough activities for that particular concept on that day therefore the teacher should find extra resources to beef up activities on that concept.

2.2.3 List subheadings that are found under the First main heading (A) in the Curriculum Tracker

i. Purpose of the tracker
ii. Links to CAPS
iii. Links to textbooks
iv. Links to the DBE workbooks
v. Managing time allocated in the tracker
vi. Sequence adherence
vii. Links to assessment and viii. Resources

2.2.4 Write at least two aspects that you have found useful about the Curriculum Tracker and explain why or how?

i. Pacing of concepts and spread throughout the four terms. It helps the teacher stick to the CAPS prescribed content and ensures conceptual progression throughout the year.

ii. The curriculum planner makes good suggestions on when to assess and the types of assessment. It helps the teacher check learner understanding in time and institute remedial if need arises from the assessment. No surprises later in the year!

iii. Provides a professional conversation as colleagues and between HoDs and teachers.

2.2.5 Write one aspect you are still not sure about / worried about / concerned about in relation to the Curriculum Tracker from experience with it so far..

i. How to use assessment planner

ii. What to do with the test attached at the end of the tracker document

iii. How to complete the reflection part after every week

iv. What to do in case of disturbances at my school and did not complete all the work planned for the week.

The purpose of this activity is to gauge the extent to which teachers use other components of the tracker other than the pacesetters. Those that use these components will know the benefits derived from these components and are most likely to rate it highly. The idea then is to assess the average use for all the attendees and generalise if there is a need to explain more about how these can be of use to teachers.

2.2.6 In a Likert scale of 1 to 5, indicate how satisfied you are with the inclusion of the following in the trackers (1 = completely dissatisfied; 2= dissatisfied; 3= not sure; 4= just satisfied and 5 = completely satisfied):

No	Aspect found on the tracker	Your rating
(a)	Daily teaching programme of ‘a’ book	
(b)	Lesson preparation key steps	
(c)	Assessment Term plan	
(d)	Suggested assessment record sheet for the term	
(e)	Exemplar test and memo	

Facilitator must try to assess, given their classroom context, where HoDs and senior teachers are with the use of these components and make a decision to re-emphasise or not.

- Some teachers complain that there are always disturbances at school that prevent them from completing the work planned for the term. What advice can you give them as an HoD?

i. Support and ensure that every teacher can complete the reflection part of the week in a tracker.
ii. Encourage adherence to the use of tracker as a curriculum management tool.
iii.
iv.
v.
vi.

SESSION 2

3. RELATIONSHIPS AND FUNCTIONS AND GRAPHS.

The objectives of this section are to:

1. Recap on basic concepts of Functions and Graphs
2. Create awareness of the difference between functions and relations
3. Analyse and interpret global graphs of problem situations, with a special focus on the features and trends;
   (i) Linear and non-linear
   (ii) Constant, increasing and decreasing
   (iii) Maximum and minimum
   (iv) Discrete and continuous

4. Extend the above on linear graphs
   (i) X-intercept and y-intercept
   (ii) Gradient
   (iii) Domain and the Range

5. Draw global graphs from given descriptions of a problem situation, identifying features state above.
6. Use tables of ordered pairs to plot points and draw graphs on the Cartesian plane.
7. Extend the above with special focus on;
   (i) Drawing linear graphs
   (ii) Determining equations from given linear graphs.

BACKGROUND

One of the first mathematicians who studied graphs was Rene' Descartes. He was born in 1596 and died in 1650. He was a philosopher. He introduced the system of axes on which to plot points. The location of a point is labelled using the coordinates of the points. The “Cartesian plane “is named after him.

Algebra is a branch of **mathematics** that uses **mathematical** statements to describe relationships between things that vary over time. These variables include things like the relationship between supply of an object and its price. This session will now discuss the following important concepts: Relationships and functions, domain and range (input and output), vertical line test etc.

Activity 3

In groups, define the following terms and illustrate with examples. One member of the group will present.

(a) Relationships

Relationships can be any association between sets of numbers while functions have only one output for a given input. A relation is a rule that relates one kind of an aspect to another. The first kind of that particular aspect is often called an *input*, and the collection of all possible inputs is the *domain* of the relation. The second kind produced is called an *output*, and all the possible outputs belong to a set called the *range* of the relation.

(b) Functions

A function is a special kind of relation. A relation is called a function if it has only one output for any given input. The relation R given as an example above is a function. A relation that is not a function is the square root relation.

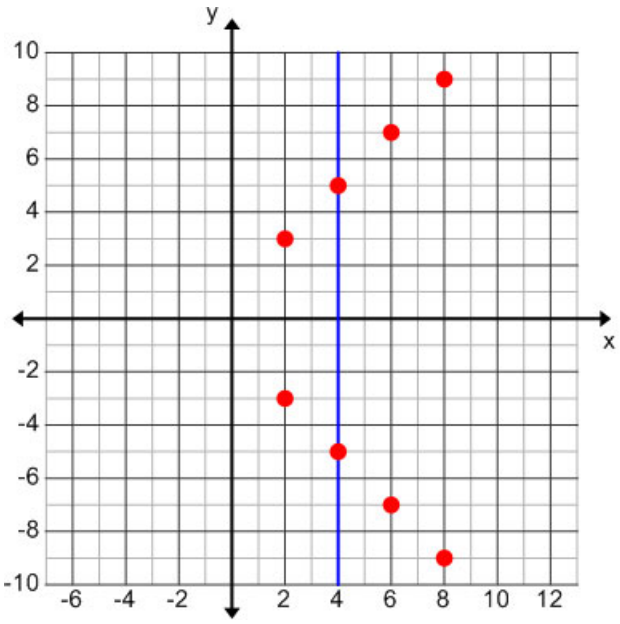
An example of a function is the relation between people and their ages. At a given time, one person can only have one age; while several people could have the same age. This relation about ages, it is indeed a function. The following mapping diagrams illustrate this idea.

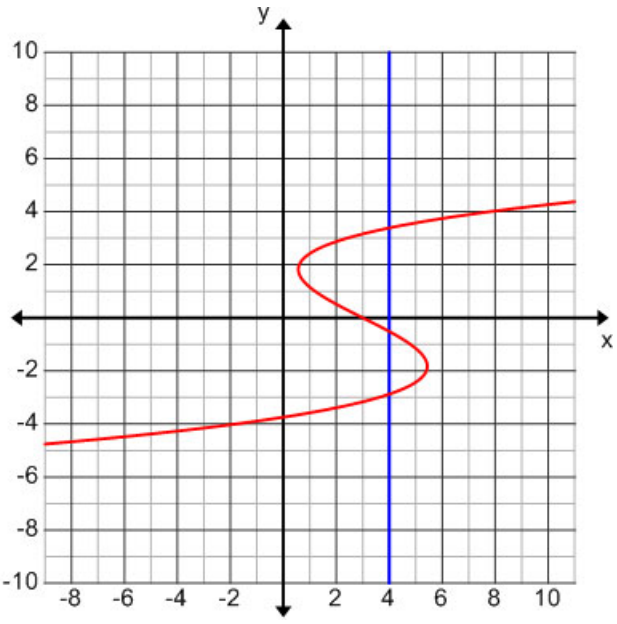
Person	Age	Person	Age
Themba →	21	Themba →	21
Zuzile →	19	Zuzile	
Nozipho →	21	Nozipho	19
Thandi →	19	Thandi	
Musa →	17	Musa →	17
Sanjiet →	17	Sanjiet	
Thandazile →	16	Thandazile →	16

This is a function where different people could have the same age. Therefore, the diagram could be drawn as the one on the right.

(c) The Vertical Line Test

The vertical line test is a simple way of checking if a numerical relation is or is not a function by looking at its graph. If ***R*** is a numerical relation, then for a given number **x** in the domain of ***R***, the values y such that $x \longrightarrow y$ are recorded in the graph of ***R*** as points (x,y). For the given ***x***, all the related values of y give points (x, y) that lie on the vertical line through ***(x, 0)***. If ***R*** is a function, there should be only one such y, and therefore the graph of ***R*** will intersect each vertical line in at most one point. In other words, on a graph of a relation, if a vertical line passes through more than one point, the relation is not a function.



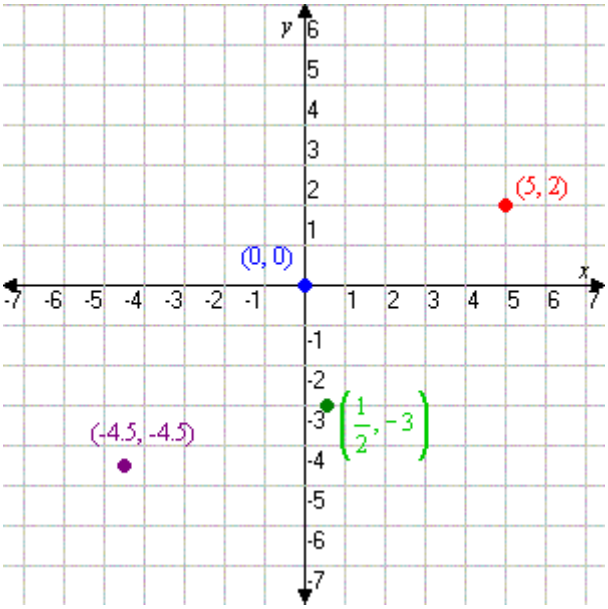


The two relations whose graphs are shown in the above figures do not represent functions because the vertical line is touching the graph at more than one point.

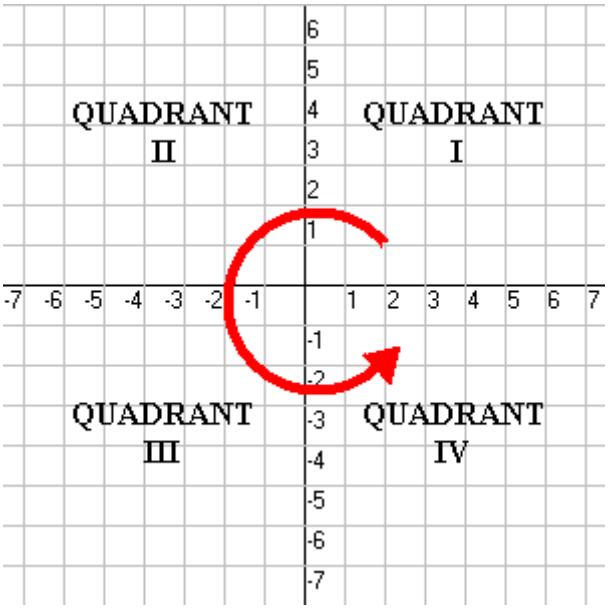
(d) A **Cartesian plane** (named after French mathematician Rene Descartes, who formalized its use in mathematics) is defined by two **perpendicular number lines**: the ***x*-axis**, which is horizontal, and the ***y*-axis**, which is vertical. Using these axes, we can describe any point in the plane using an **ordered pair** of numbers.

The Cartesian plane extends infinitely in all directions. To show this, mathematicians place arrows at the ends of the axes in their drawings.

The location of a point in the plane is given by its coordinates, a pair of numbers enclosed in parentheses: (*x; y*). The first number *x* gives the point's horizontal position and the second number *y* gives its vertical position. All positions are measured relative to a "central" point called the origin, whose coordinates are (0, 0). For example, the point (5;2) is 5 units to the right of the origin and 2 units up, as shown in the figure. Negative coordinate numbers tell us to go left or down. See the other points in the figure for examples.



The Cartesian plane is divided into four quadrants. These are numbered from I through IV, starting with the upper right and going around counter clockwise. (For some reason everybody uses roman numerals for this).



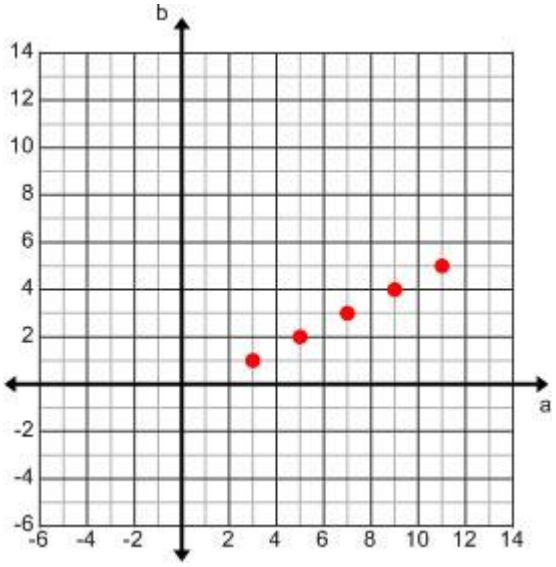
In Quadrant I, both the *x*– and *y*-coordinates are positive; in Quadrant II, the *x*-coordinate is negative, but the *y*-coordinate is positive; in Quadrant III both are negative; and in Quadrant IV *x* is positive but *y* is negative.

Points which lie on an axis (i.e., which have at least one coordinate equal to 0) are said not to be in any quadrant. Coordinates of the form (*x*, 0) lie on the horizontal *x*-axis, and coordinates of the form (0, *y*) lie on the vertical *y*-axis.

(e) and (f) Domain and Range

What values can you and can you not input into a function? What values can the function output? The **domain** is the set of values that the function is defined for (i.e., the values that you can input into a function). The **range** is the set of values that the function output can take on.

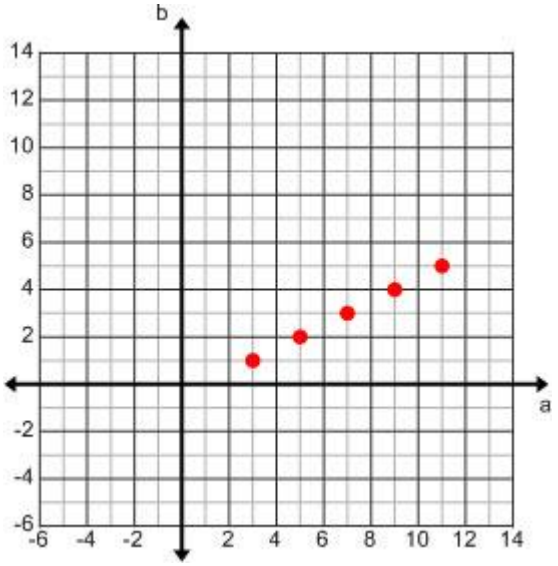
(g) Mapping diagram



A relation can also be described using what is called a "Mapping Diagram." Here is a mapping diagram for the relation ***R*** defined above.

Activity 4

1. In the following graph for G, complete the mapping diagram on the right below:

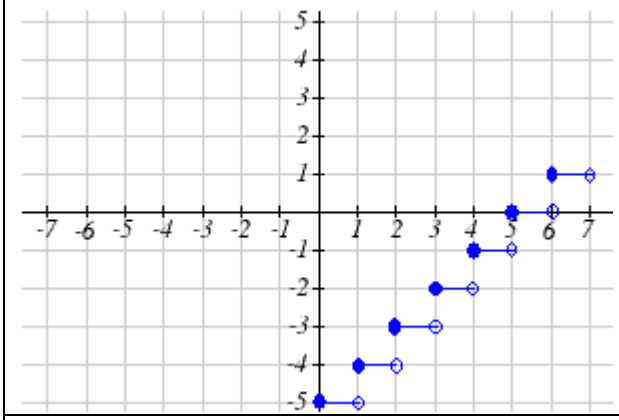
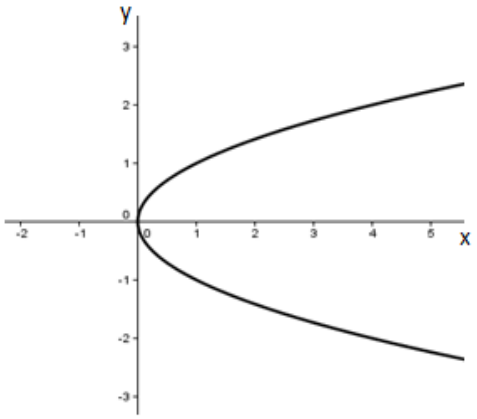
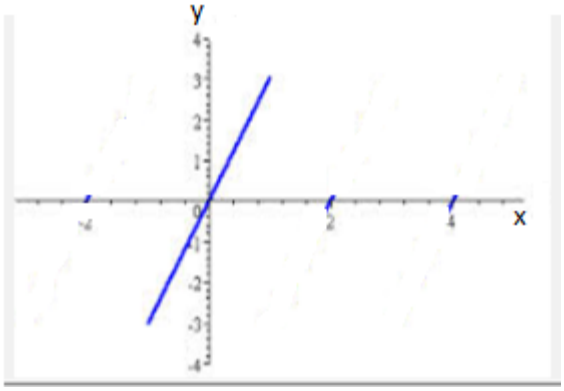
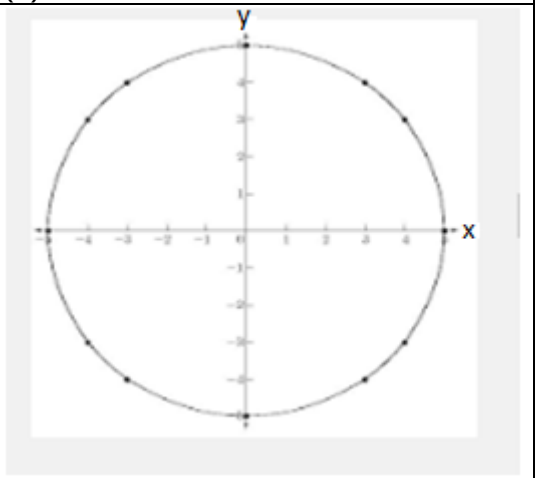


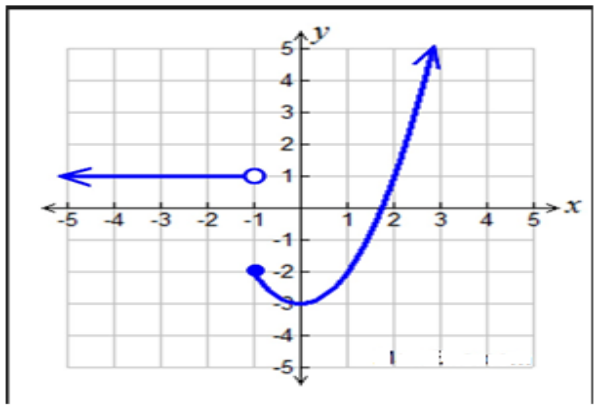
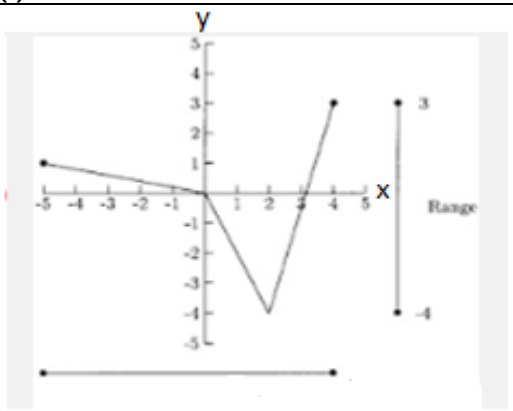
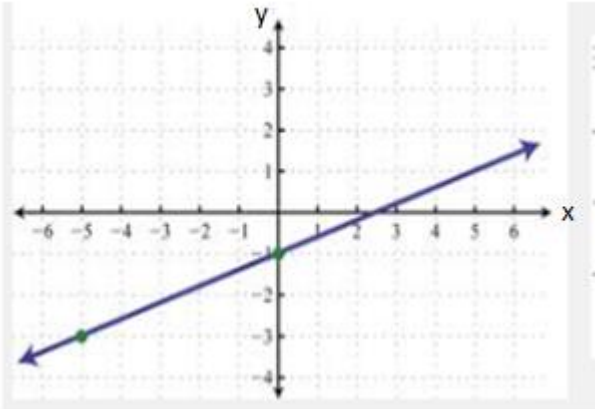
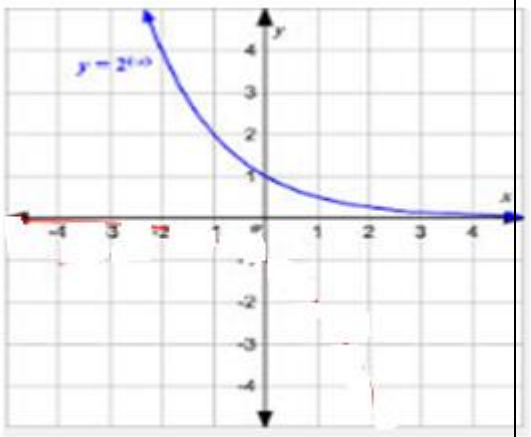
Domain / Input	**Range / output**
3	**1**
5	2
7	**3**
9	**4**
11	**5**

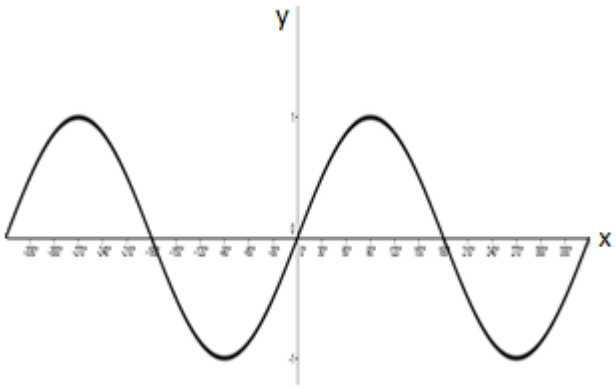
Mapping diagrams are very useful when trying to understand the concept of functions in comparison with relations. While in relations, input values could be repeated for the values of the outputs, in functions, this repetition is not admitted.

Activity 5

Explain the features and trends in the following graphs by using the words continuous, linear, constant, non-linear, increasing, function, not a function, discrete maximum, minimum and decreasing.

<table>
<tr><td>(a)</td><td>(b)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>• Min = -5 increasing
• Max = 1
• Not continious
• Function
• Non-linear</td><td>• Not a function
• Continuous
• Non-linear</td></tr>
<tr><td>(c)</td><td>(d)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>• Function
• Continuous
• Max = 3
• Min = -3
• Increasing</td><td>• Not a function
• Max =5
• Min = -5
• Non-linear
•</td></tr>
</table>

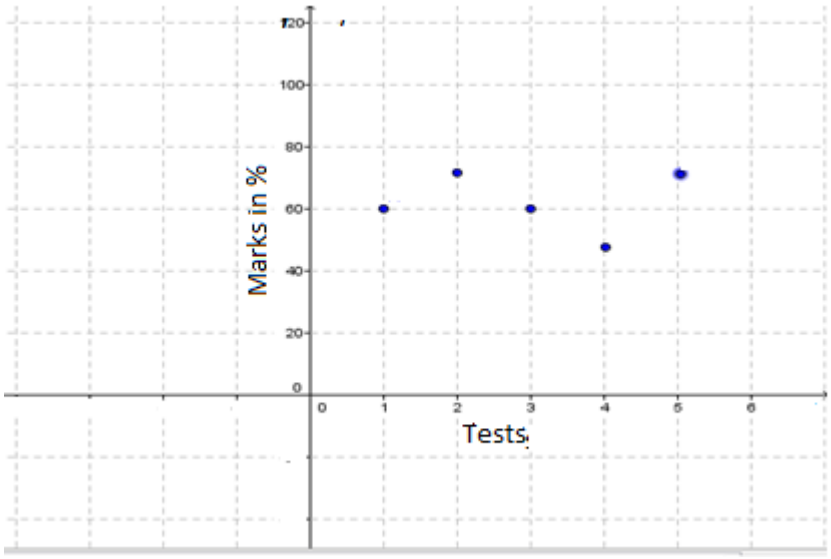
(e)	(f)
	
• Function • Not continuous • Non-linear • Min = -3	• Function • Not continuous • Non-linear • Max =3 • Min = -4 •
(g)	(h)
	
• Function • Continuous • Linear • Increasing	• Function • Continuous • Non Linear

(i)	
	
• Function • Continous • Max = 1 • Min = 1 • Non-linear	

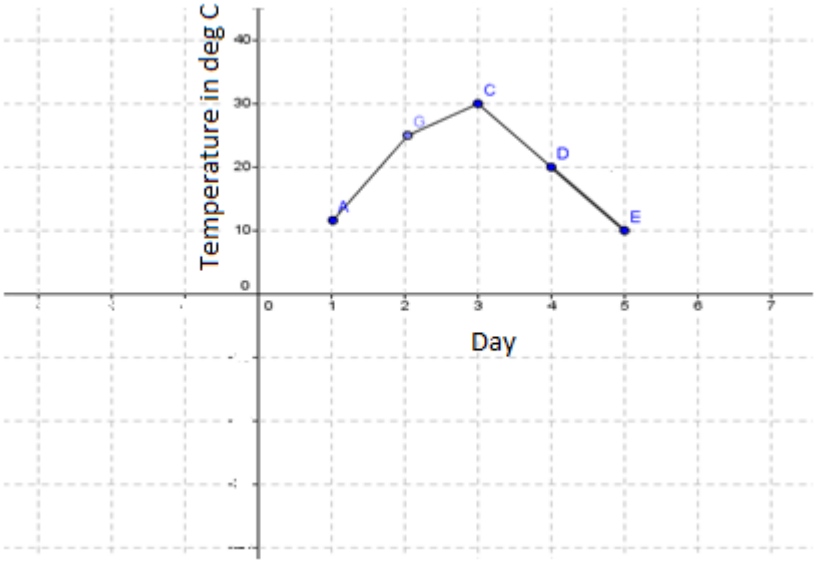
4. INTERPRETATION OF GRAPHS.

Activity 6

The first table gives an example of how the trends and features of the graphs. Interpret the remaining graphs.

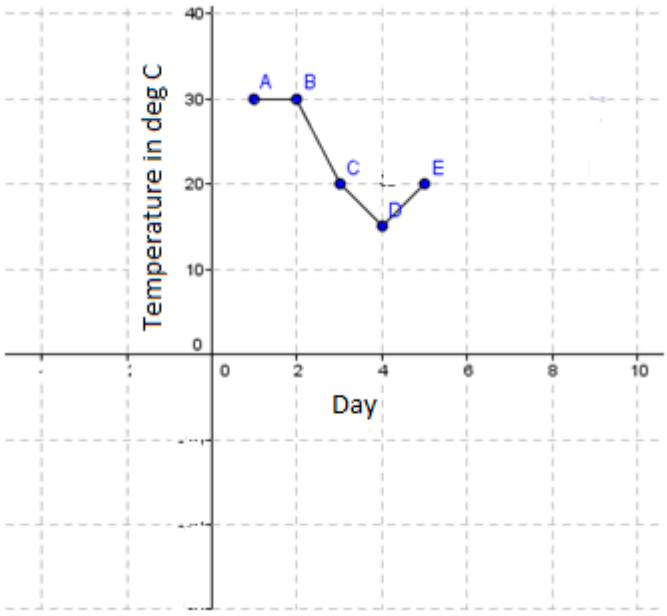
Graph	Trends and features
The graph shows mathematics marks in % for five tests 	The graph is discrete because it only contains dots. In this regard the readings between the dots have no meaning. For an example the learner did not write 4.5 tests. Trends: From test 1 to test two there was improvement. Test 3 and 4 the performance dropped. Test 5 there was improvement.

The graph shows the temperature in a town over a period of five days.

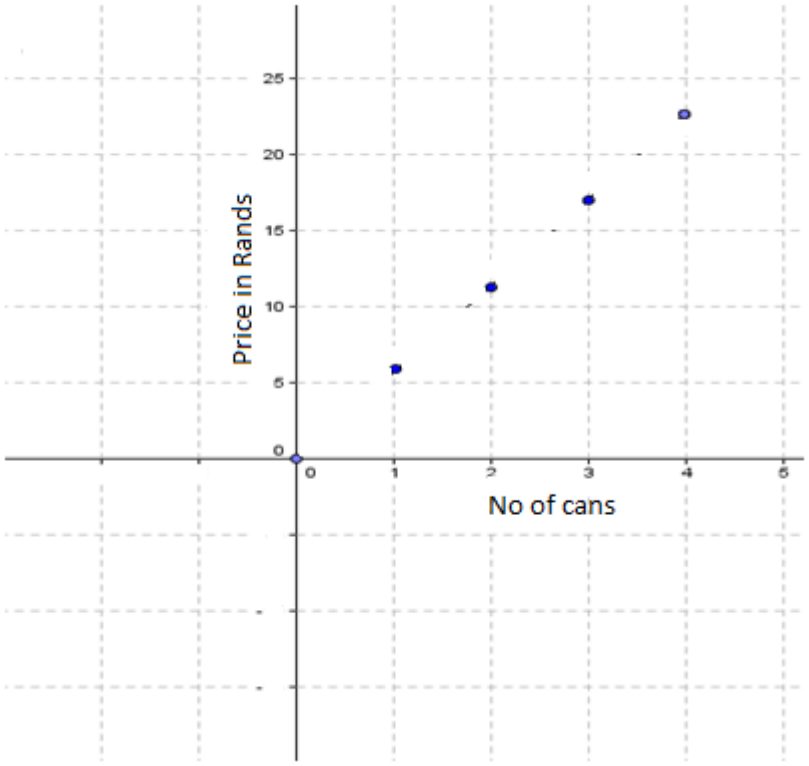
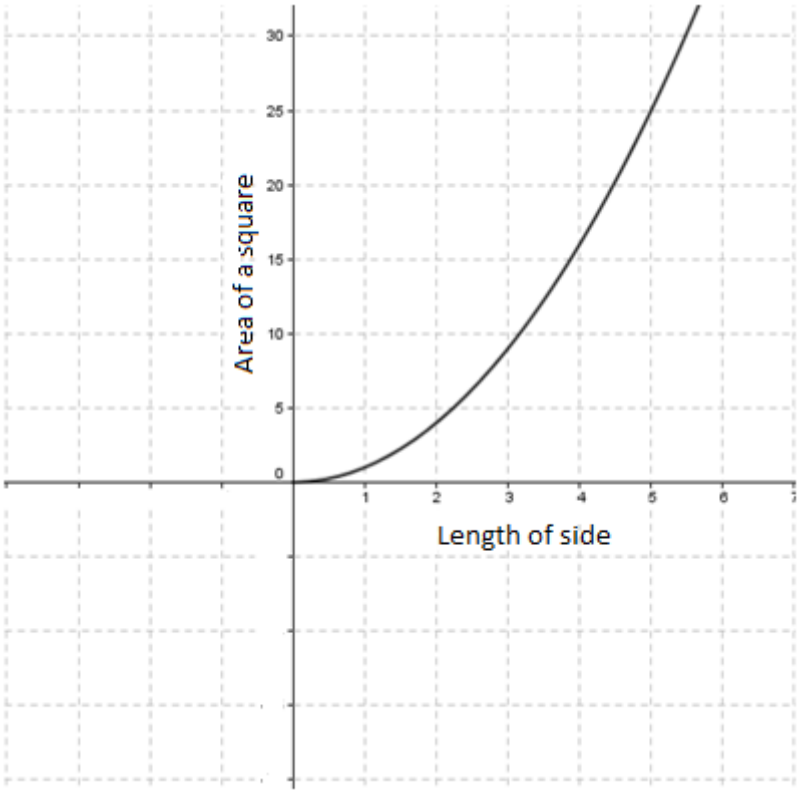


- Non Linear
- Continuous
- Maximum at C
- Minimum at E.
- Increasing from A to C.
- Decreasing uniformly from C to E.

The graph shows the temperature over a period of five days



- Non Linear
- Continuous
- Maximum at 30 and minimum 15.
- Constant between A and B.
- Decreasing from B to D
- Increasing from D to E.

The graph shows the prices of a different numbers of cans of coke.  	• Linear • Not continuous. • Increasing uniformly. • Minimum at origin Maximum at approx. R22.50
The graph shows the relationship between the length of the sides of a square and its area.  	• Non Linear • Continuous • Increasing

5. REPRESENTATION OF FUNCTIONS

Functions can be represented in four different ways, namely, **verbally**, **algebraically**, **numerically** and **visually** (using a graph), for example:

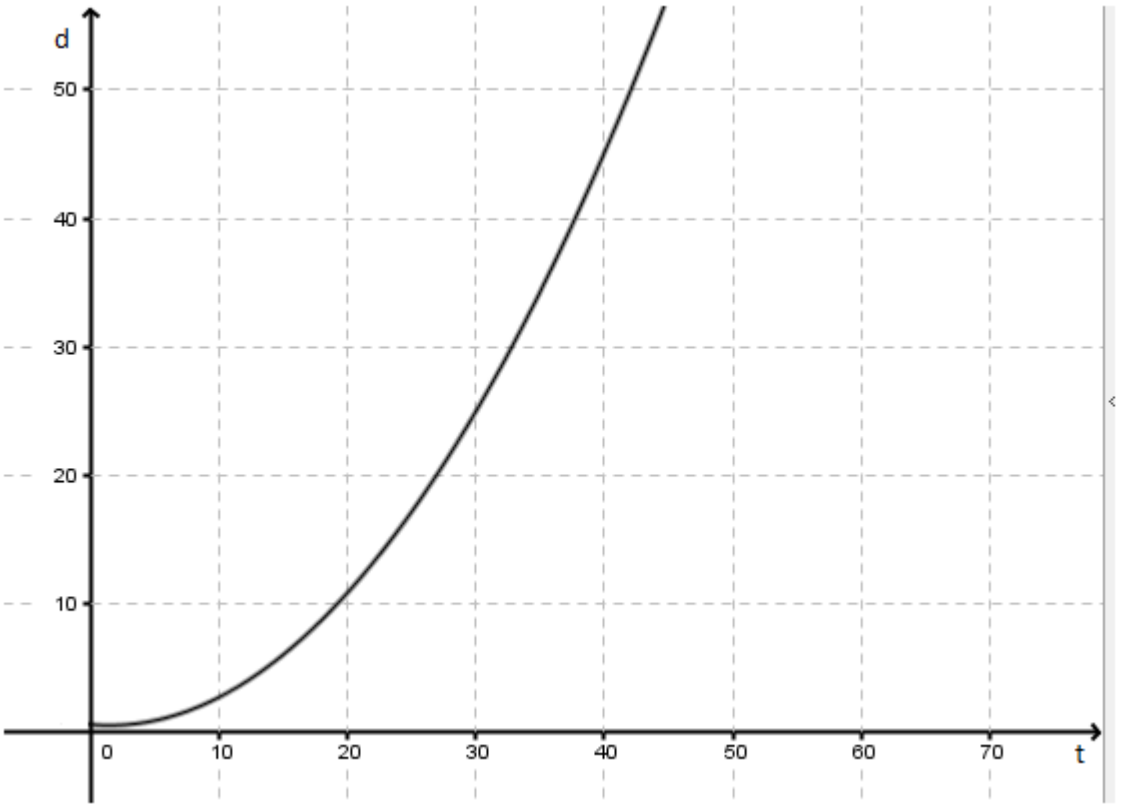
Verbally: Using description in words: The distance Themba travelled to Soweto in his car is a function of how long he has been driving.

Algebraically: $d= 0.03t^2-0.41t+0.28$

Numerically:

Time (Min)	20	30	40	50	60	70
Distance (km)	4.08	14.98	31.88	54.78	87.78	118.58

Visually:



6. PLOTTING OF POINTS ON A CARTESIAN PLANE AND DRAWING OF GRAPHS

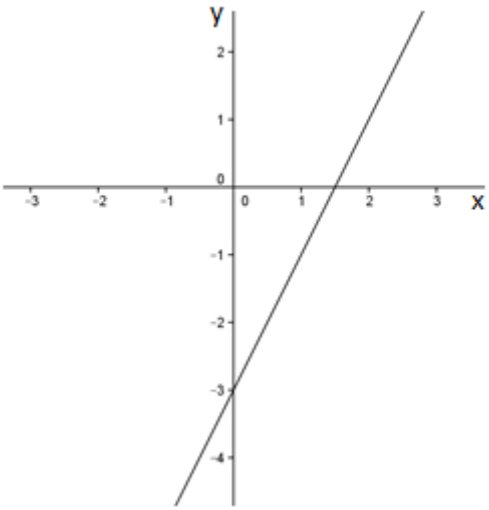
Activity 7

1. Given $y = 2x - 3$,

1.1 Use substitution to complete the following table.

x	-2	-1	0	1	2
y	-7	-5	-3	-1	1

1.2 Draw the graph using the table.

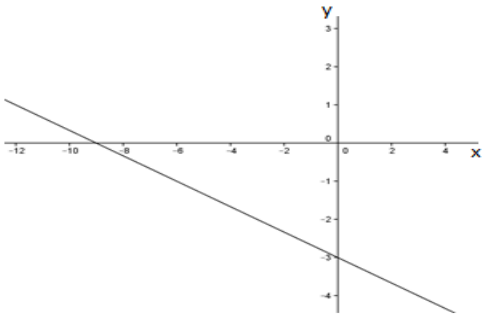


1.3 Describe the features of the graph drawn.

- The graph is drawn from first to third quadrant.
- Has a positive gradient,
- Therefore increasing.

2. Given the equation $y = -\frac{1}{3}x - 3$.

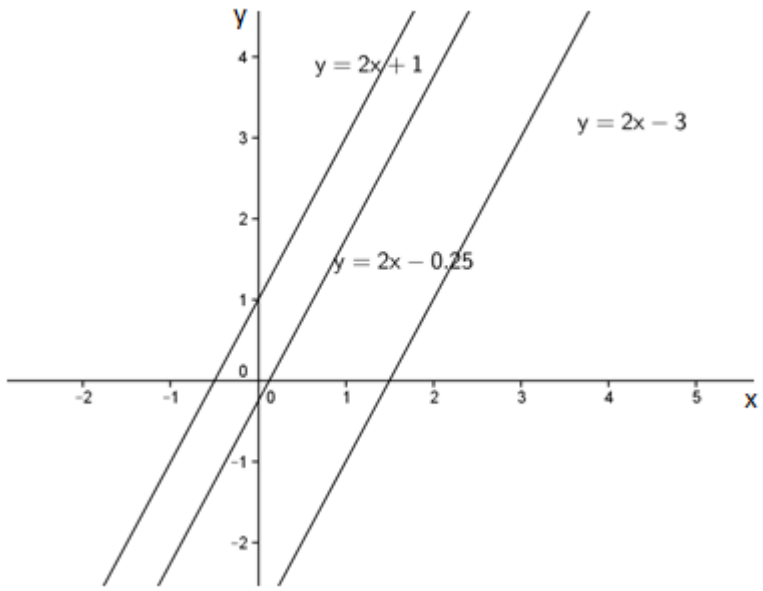
2.1 Draw the graph to represent the relationship above.



2.2 Using the graph drawn in 3 show how the gradient can be found.

By using any two point on the straight line.

3. Draw the graphs of $y = 2x - 3, y = 2x + 1 \; and \; y = 2x - \frac{1}{4}$ on the same set of axis.

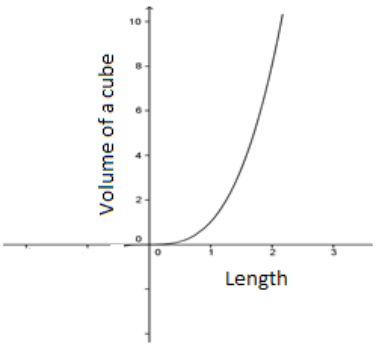


4. Describe the features of the graphs in 5 above and draw a conclusion.
   The 3 graphs have the same gradient: m = 2
   Therefore straight lines with the same gradient are parallel
5. The table below shows the relationship between the length of a cube and its volume.

5.1 Complete the table

Length of s cube.	1	2	3	4
The volume of a cube	1	8	27	81

5.2 Sketch the graph which represents the relationship between the length of a cube and its volume.



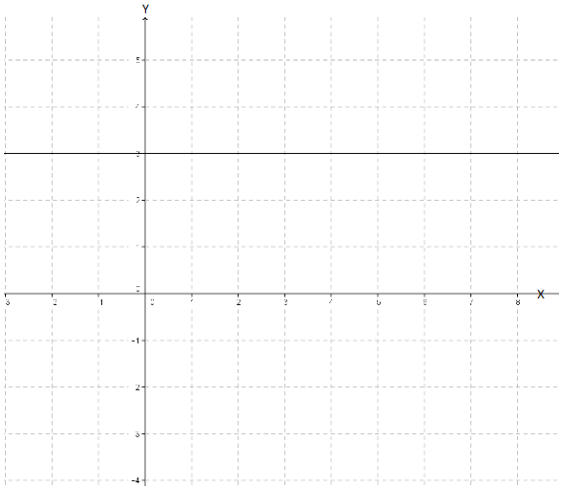
5.3 Describe the features of the graph, for example state if the graph is increasing, decreasing, etc.
   The graph is increasing and stationery at one point (0; 0) only.

6. Are all linear graphs functions?

   No. some are not.

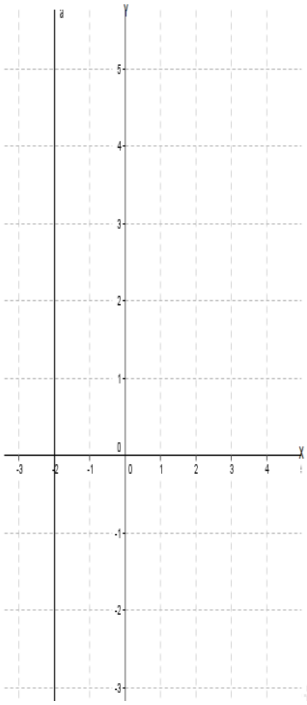
7. Give the equations of the following graphs from (a) to (d) and describe their features.

(a)



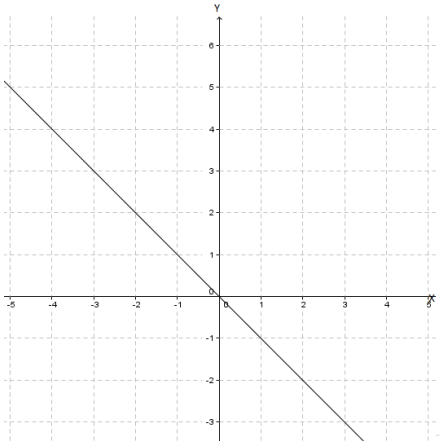
- It is a function.
- The gradient is zero.
- The graph is parallel to the x-axis.

(b)



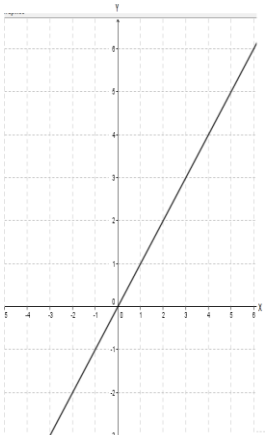
- It is not a Function.
- The gradient is undefined
- The graph is parallel to the y-axis

(c)



- It is a function.
- For each value of the input, we get an equal but negative numerical value of the output.

(d)



- It is a function.
- For each value of the input, we get an equal value of the output with the same charge.

SESSION 3

7. Practice Activities: Suggested Answers

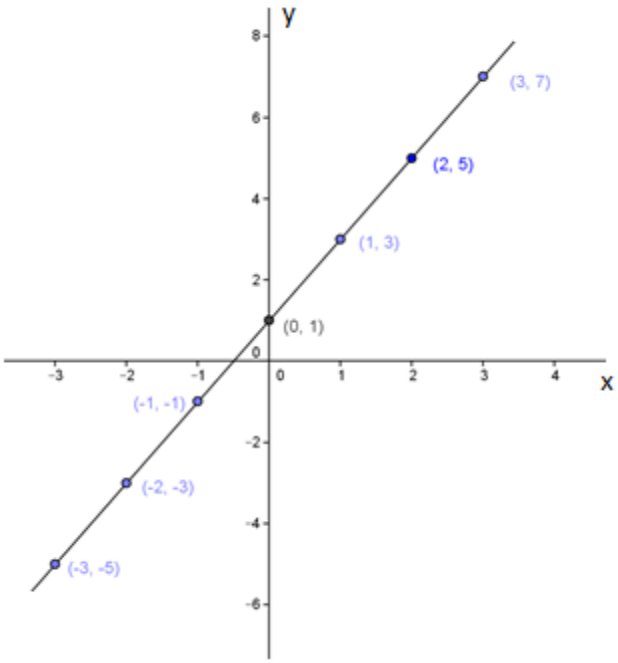
QUESTION 1

1.1 Complete the table, using the rule: $y = 2x + 1$.

x	–3	–2	–1	0	1	2	3
y	–5	-3	-1	1	3	5	7

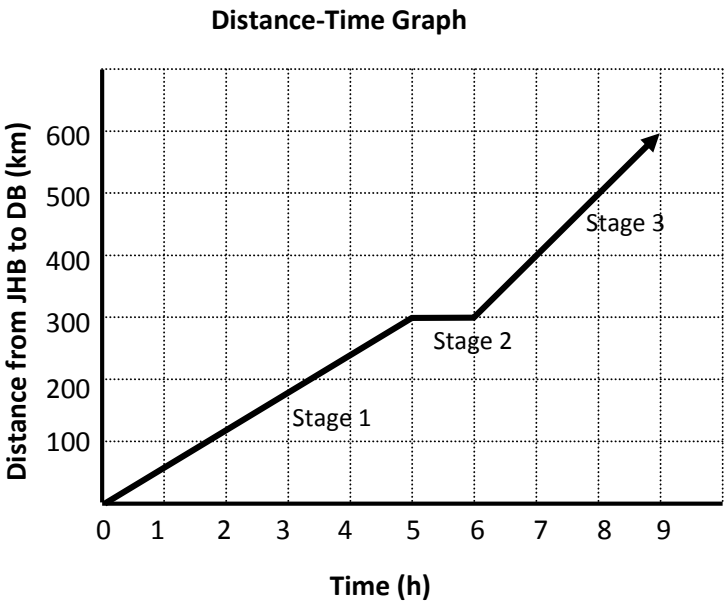
(2)

1.2 Plot the data from the table onto the Cartesian plane. (2)



[4]

QUESTION 2



The Distance-Time graph shows a journey by car from Johannesburg to Durban.

Use the information in the graph to answer the following:

2.1 Describe the difference between the 3 stages by comparing the distance covered and time per stage.

2.2 What was the average speed, for the whole distance from Johannesburg to Durban?

2.1 Stage 1: From Durban, 300km were covered in 5hrs at a constant speed.;

Stage 2: Along the way to Jhb, a rest for 1 hr was taken. No distance was travelled.

Stage 3: From rest, 300km further were travelled at a constant speed for 3 hrs to reach Jhb after 9hrs from Dbn (2)

2.2 Average speed = 66.67km/h (1)

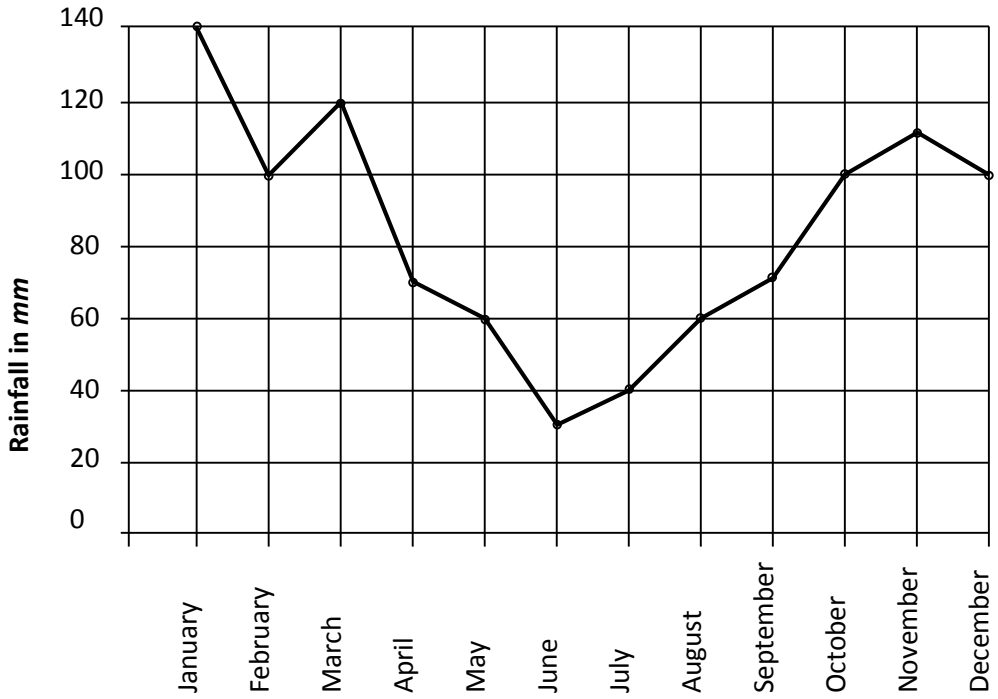
[3]

QUESTION 3

3.1 Use the graph to answer the following questions

The Grade 9 class recorded the rainfall for the year 2008 in Durban.

This is the graph they drew:



3.1.1. In which month did it rain the most?

January (1)

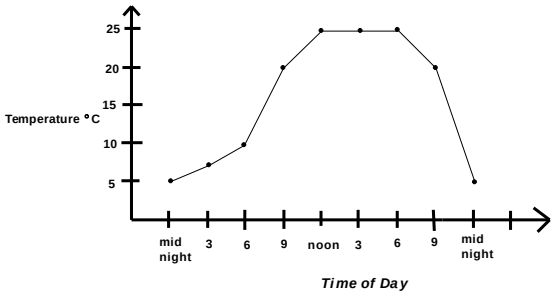
3.1.2 What was the difference between the rainfall in February and in August in *mm*?

100 – 60 = 40 *mm* (1)

3.1.3. Calculate the total rainfall for the first three (3) months of 2008 in Durban in *mm*.

140+100+120 = 360 *mm* (1)

3.2



This temperature graph shows that the temperature of 20°C was recorded at …

A. 6 am B. Noon

C. 9 am only *D. 9 am and 9 pm* (1)

8. REFERENCES

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