MATHEMATICS
GRADE 9

DATE: ....

TOPIC: GRAPHS

CONCEPTS & SKILLS TO BE ACHIEVED: **By the end of the lessons learners should know and be able to:** **INTERPRETING GRAPHS:** • Analyse and interpret global graphs of problem situations, with a special focus on linear and non-linear, constant, increasing or decreasing, maximum or minimum, discrete or continuous. • Extending the focus on features of linear graphs: x-intercept and y-intercept and gradient. **DRAWING GRAPHS:** • Draw global graphs from given descriptions of a problem situation identifying features listed above. • Use tables of ordered pairs to plot and draw graphs on the Cartesian plane. • Extend the above with a special focus on: drawing linear graphs from given equations, determine equations from given linear graphs.	
RESOURCES:	DBE Workbook, Sasol-Inzalo book, Textbooks,
ONLINE RESOURCES	https://www.visnos.com http://www.virtualnerd.com

DAY 1:

INTRODUCTION: READ THE FOLLOWING TO FAMILIARISE YOURSELF WITH WHAT THIS TOPIC IS ABOUT:

INTERPRETING GRAPHS:

In these lessons we will revise the following section done in Grade 8:

- **Linear & Non-linear graphs:**
  - **Linear graphs** have a constant difference between the terms which causes a linear pattern – straight line graph.
  - **Non-linear graphs** do not have a constant difference and the rate of change changes between terms. This will cause the graph to have a curve or change in direction.
- **Constant, increasing or decreasing trends:**
  - **Constant function –** When one of the y-axis variable remains unchanged while the x-axis variable changes. This will cause the graph to be parallel to one of the axis.
  - **Increasing function –** When the relationship between the x- and y-axis are in direct proportion, as the x-axis values increases the y-axis values also increase the graph is seen as an increasing graph. The graph is moves upwards from left to right.
  - **Decreasing function –** When the relationship between the x- and y-axis are in indirect proportion, as the x-axis values increases the y-axis values decreases the graph is seen as a decreasing graph. The graph moves downwards from left to right.

- **Maximum & minimum values:**
  - **Maximum value –** The highest point on the graph is called the maximum value/point.
  - **Minimum value –** The lowest point on the graph is called the minimum value/point.
- **Discrete & continuous data:**
  - **Discrete data:** This data that can be counted. It can only be whole numbers. This graph will be indicated by dots that are not joined by a line.
  - **Continuous data:** This is data that can be measured. Involves real numbers rather than just whole numbers. This graph will be indicated by a lot of dots that will make it appear like a solid straight line or curve.

We will extend on the above by investigating the following:

- **x-intercept and y-intercept:**
  - **x-intercept –** is the point on the graph where the line cuts the x-axis and can be calculated by substituting $y = 0$ in the equation of the graph.
  - **y**-intercept - is the point on the graph where the line cuts the y-axis and can be calculated by substituting $x = 0$ in the equation of the graph.
- **Gradient:**
  - Referred to as the slope/steepness of the graph. The steeper the slope is the bigger the rate of change between the x-coordinate and y-coordinate.
  - It is calculated by using the following equation:

$$\text{Gradient} = \frac{\text{change in } y\text{-values}}{\text{change in } x\text{-values}}$$

  - A positive gradient has an upward slope (increasing function) and a negative gradient has a downward slope (decreasing function).
  - The bigger the gradient the bigger/steeper the slope of the graph.

DRAWING GRAPHS

- **Draw global graphs from given descriptions of problem situations:**
  - Identifying the variables that are in relationship with each other.
  - Understand the relationship between the dependant and independent variables.
  - Independent variable placed on the x-axis and the dependant variable placed on the y-axis.
- **Use tables of ordered pairs to plot points on a Cartesian plane:**
  - Cartesian plane is a system where all points can be described by x- and y-coordinates
  - Understand that the horizontal line represents the x-axis and the vertical line represents the y-axis.
  - Where the x-axis and y-axis intersect is referred to as the Origin – both axis has a 0 value.
  - Both axis has intervals numbered by integers.
  - Set of x- and y-values are called ordered pairs. Numbers are written inside brackets and separated by a semicolon e.g. (-5;4).
  - The first number of an ordered pair is how far left or right the value is on the x-axis.
  - The second number of an ordered pair shows how far up or down to move from zero on the y-axis

We will extend on the above by investigating the following:

- **Drawing linear graphs from given equations:**
  - Emphasise that the x-value is the independent variable and the y-value is the dependant variable.

- The equation can be used to substitute the x-value to calculate the corresponding y-value.
- The x-value and y-value becomes an ordered pair is plotted accordingly on the Cartesian plane.
- The x-intercept and the y-intercept can be used to draw linear graphs.
- The effect of changing the y-intercept on the linear graph.

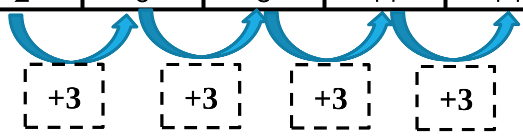
- **Determining equations from given linear graphs:**
  - Revise standard equation of a linear graph.
  - Using the gradient as well as the y-intercept to formulate the equation of the linear graph.

LESSON DEVELOPMENT:
LINEAR & NON-LINEAR GRAPHS:
INTERPRETING GRAPHS:

- We will revise different types of real-world graphs called global graphs that was completed in Grade 8.

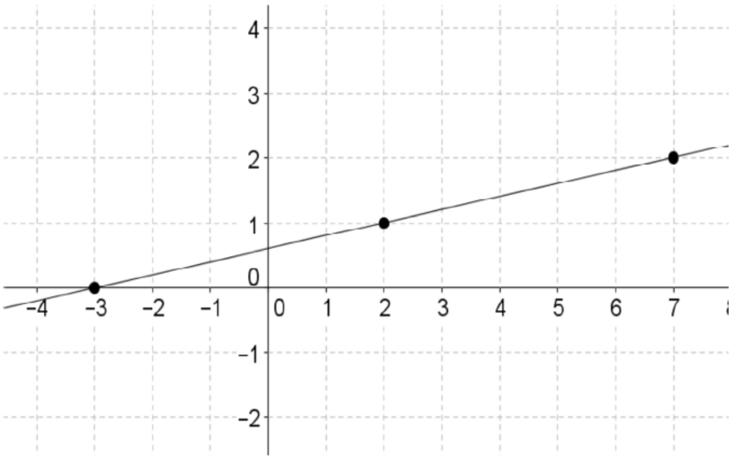
- **LINEAR GRAPHS:**
  - **What makes a graph linear?**
    - Graphs will be linear when the rate of change is constant.
    - Examples of such patterns:

n	1	2	3	4	5
T(n)	2	5	8	11	14



As we can see there is a constant difference of +3 between consecutive terms.

- Graphs with a linear pattern will follow a straight-line pattern.
- An example of a linear graph is shown below.



Linear Graph

- When the value of the exponent of the unknown in a pattern is 1, the pattern is said to be linear and will always result in a linear graph.

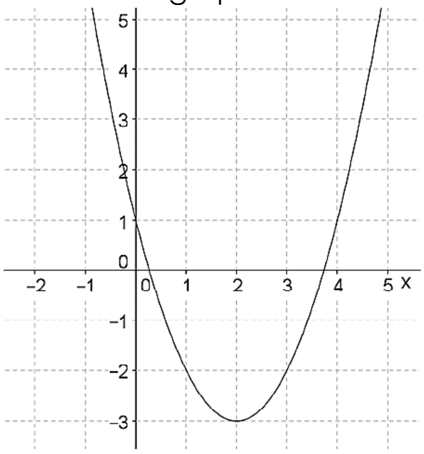
- **NON-LINEAR GRAPHS:**
  - **What makes a graph non-linear?**
    - Graphs will be non-linear when the rate of change changes and is no longer constant.
    - Examples of such patterns:

n	1	2	3	4	5
T(n)	1	3	9	27	81

+2 +6 +18 +54

As we can see there is not a constant change between the terms but rather a changing rate.

    - Graphs with a non-linear pattern will follow a curved pattern.
    - Any graph that is curved or changes direction in some way is a non-linear graph.
    - An example of a non-linear graph is shown below.



Non-Linear Graph

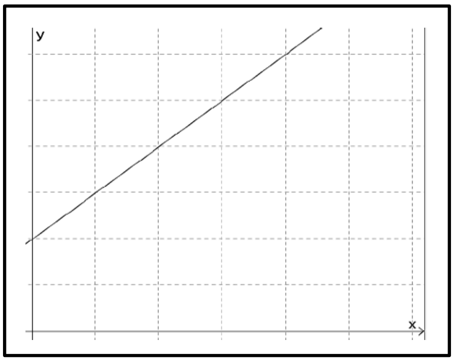
    - When the value of the exponent of the unknown in a pattern is more than 1, the pattern is said to be non-linear and will always result in a non-linear graph.

- We will revise different types of real-world graphs called global graphs that was completed in Grade 8.

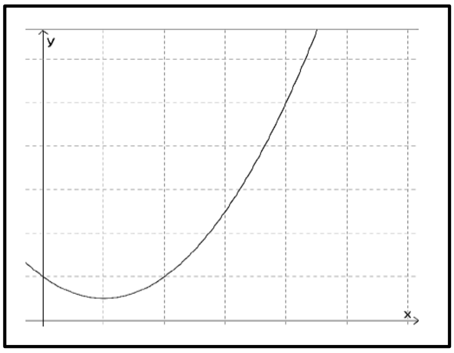
CLASSWORK:
Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:
ACTIVITY 1:

State whether the following graphs are linear or non-linear graphs:

a.



b.



ACTIVITY 2:

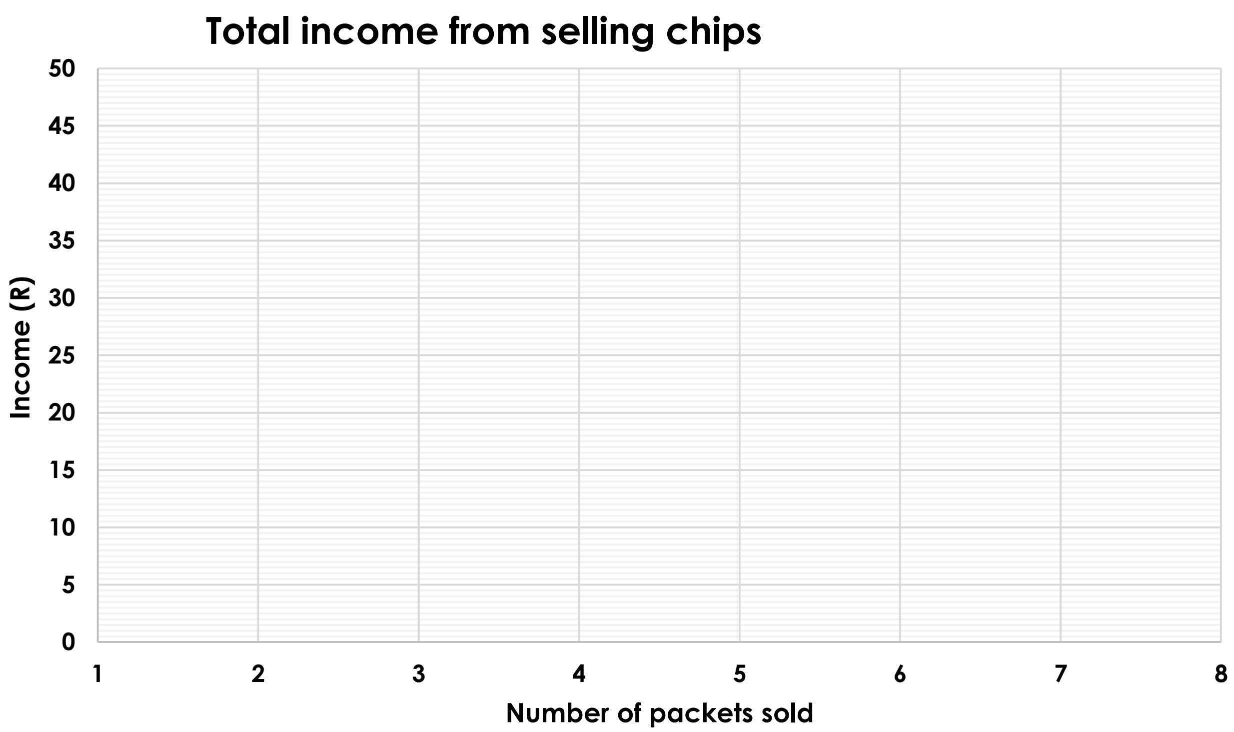
A packet of chips costs R 6,50. The following table shows the relationship between the number of packets of chips sold and the total cost.

Use the information above and answer the following questions:

a. Complete the following table.

# of packets of chips sold	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Total cost (R)	6,50			26,00		39,00	

b. Use the table above and represent it on a graph.



c. Did the cost of the chips per package change as more packets were sold? Explain your answer.

d. Will you be able to say that the example above is an example of a linear graph? Motivate your answer.

ACTIVITY 3:

When bacteria reproduce they follow a reproduction cycle where every cell divides into two new cells. This type of growth is called exponential growth.

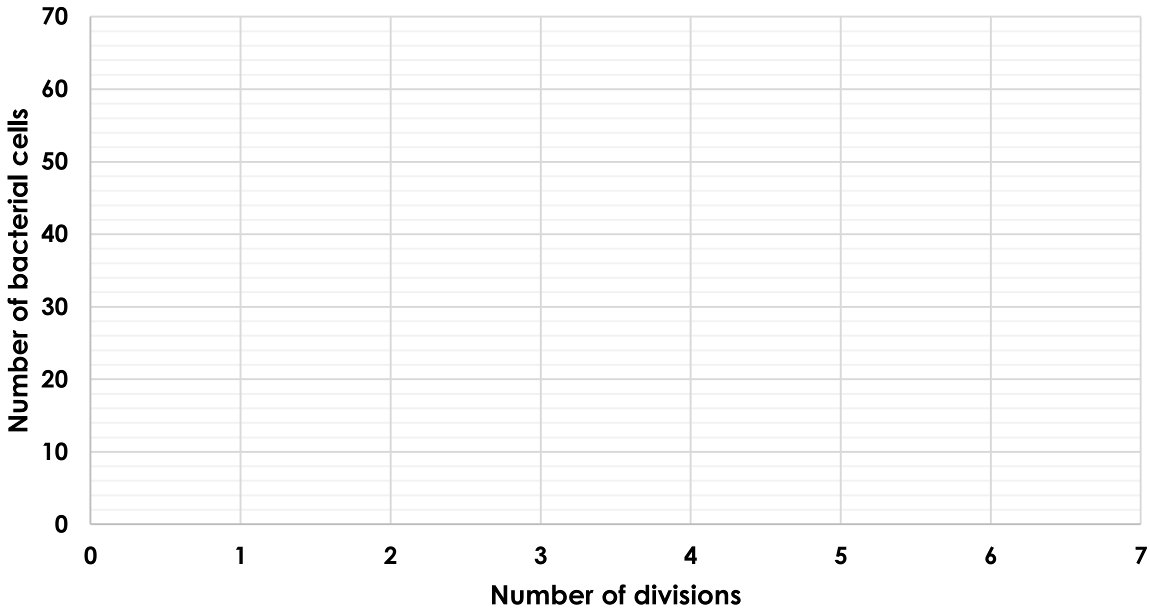
The following table indicates the number of bacteria cells for a certain number of divisions.

# of divisions	**0**	**1**	**2**	**3**	**4**	**5**	**6**

# of new cells	1	2	4	8	16	32	64

a. Use the table and represent it on a graph.

Reproduction of bacterial cells



b. Did the number of bacteria cells increase at the same rate as the number of divisions? Explain your observation.

c. Is the example above an example of a linear or a non-linear trend? Motivate your answer.

IT IS IMPORTANT TO REMEMBER:

- When a rate of change is constant then the graph will be linear (straight line graph).
- When the rate of change is not constant but changing then the graph will be non-linear.

HOMEWORK:

Do the following exercises,applying what you have learnt today. FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON.

QUESTION 1:

Michael collects honey on his farm and puts it in large jars to sell to the public. His business has been doing very well and he needs to employ an additional worker to assist him. Michael knows that one person can normally fill two jars in three days. He set up the table to determine how many full-time workers he should employ to fill different numbers of jars in a **five-day week**.

The table below show the number of jars that a certain number of workers can fill in a five-day week.

# of workers	**1**	**2**	**3**	**4**	**5**	**6**	**7**
# of jars per week	$3\frac{1}{3}$	$6\frac{2}{3}$	10	$13\frac{1}{3}$	$16\frac{2}{3}$	20	$23\frac{1}{3}$

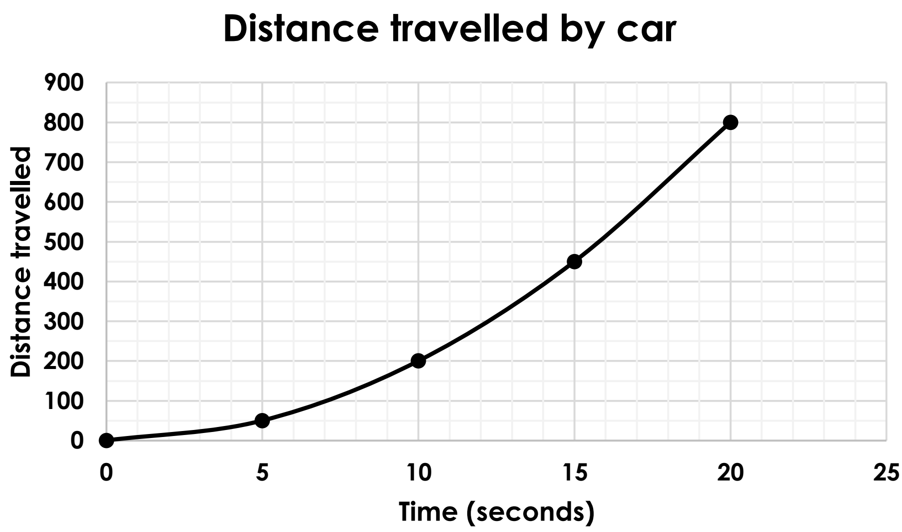
Use the table above to answer the following questions:

a. If Michael needs to produce 40 jars of honey a week, how many workers does he need?
b. How many jars can 9 workers fill in one week?
c. How many workers does Michael need to produce 15 jars per week?

QUESTION 2:

The following table and graph indicates the distance a car travelled over a certain time. The car that started at rest (stationary) and accelerated at a constant acceleration for a set time.

Time (seconds)	**0**	**5**	**10**	**15**	**20**
Distance travelled (m)	0	50	200	450	800



a. How far did the car travel after 15 seconds?
b. What was the distance travelled between the 10th and 20th second?

c. Is the graph an example of a linear or non-linear graph? Explain your answer.

MEMORANDUM: DAY 1:

CLASSWORK:

ACTIVITY 1:

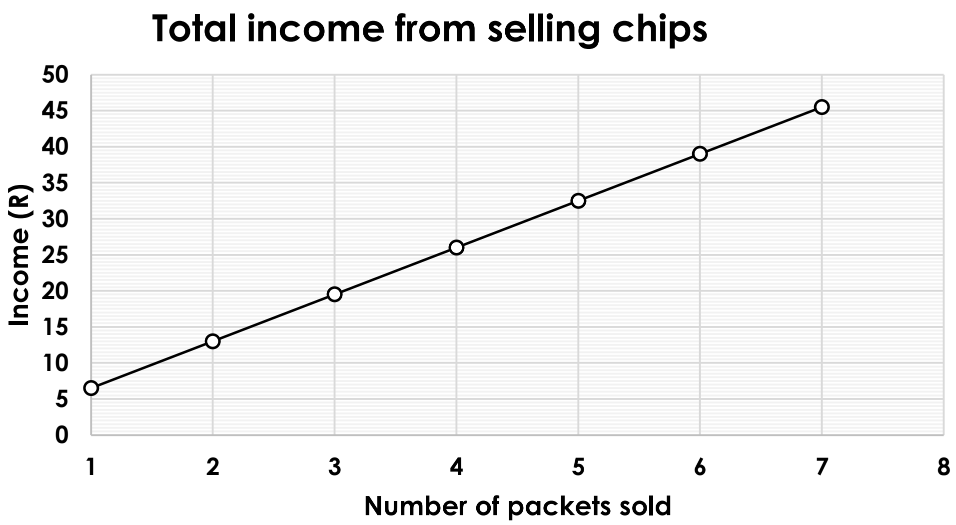
- **a.** Linear graphs
- **b.** Non-linear graph

ACTIVITY 2:

a.

# of packets of chips sold	1	2	3	4	5	6	7
Total cost (R)	6,50	13,00	19,50	26,00	33,50	39,00	45,50

b.

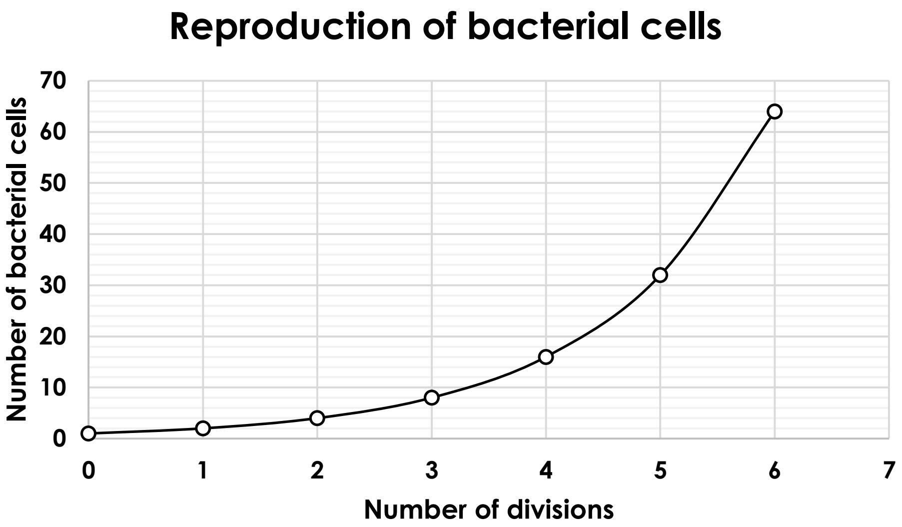


c. Yes, it changed in direct proportion to the number of packets sold. For every packet sold the income increased by R 6,50.

d. Yes. There is a constant increase of R 6,50 for every additional packet sold.

ACTIVITY 3:

a.



b. No, with every additional division in cells the number of cells doubles.

c. Non-linear function. There is no constant difference between consecutive terms.

HOMEWORK:

QUESTION 1:

a. We can see that there is a constant difference of $3\frac{1}{3}$ between consecutive terms. We can clearly state that it is an example of a linear function which means that we can double the amount of workers used to fill 20 jars a week to determine how many workers can fill the 40 jars a week.
$\therefore$ 6 workers are needed to fill 20 jars of honey so we double the 6 workers.
$\therefore$ 6 workers × 2 = 12 workers needed to fill 40 bottles

b. We apply the same method here, we can say that 9 is 3 times more than 3, so we multiply the number of bottles that 3 workers can fill by 3.
$\therefore$ 10 bottles × 3 = 30 bottles

c. This we can find by looking at the values in the table.
4 workers can fill $13\frac{1}{3}$ and 5 workers can fill $16\frac{2}{3}$.
$\therefore$ He needs 5 workers to fill 15 bottles per week because 4 will only be able to fill $13\frac{1}{3}$

QUESTION 2:

a. 450 metres

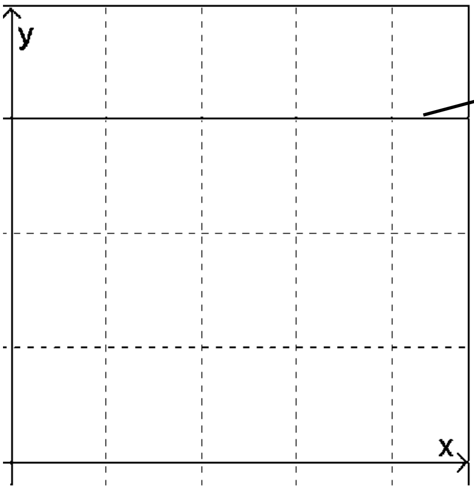
b. 20 seconds = 800 m
10 seconds = 200 m
$\therefore$ distance travelled = 800 m – 200 m
Distance travelled = 600 m

c. Non-linear graph, we can see from the graph that it is not a straight line graph and from the table we can see that there is not a constant difference between consecutive terms.

DAY 2:

- **LESSON DEVELOPMENT: Constant, increasing or decreasing trends:**
  - **Constant function –** When one of the y-axis variable remains unchanged while the x-axis variable changes. This will cause the graph to be parallel to one of the axes. This can be any of the two axes.

    An example such a trend is represented in the following graph:



We can see on this graph that the line stays parallel to the x-axis for the whole duration.

This means that as the x-value increases the y-value is the same for all x-values.

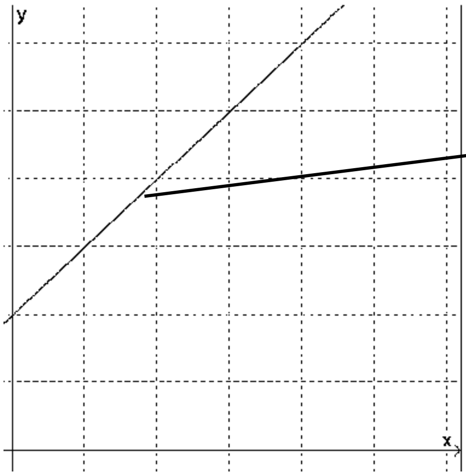
A table with a set of values for a trend like this is shown below:

Time (minutes)	0	1	2	3	4
Distance travelled (m)	15	15	15	15	15

0 0 0 0

We can see that as the time (independent variable) increases the distance travelled remained the same, there was no change in the y-axis values. In this example of distance travelled it is an example where the object was no longer moving as time carried on.

- **Increasing function –** When the relationship between the x- and y-axis are in direct proportion, as the x-axis values increases the y-axis values also increase the graph is seen as an increasing graph. The graph is moved upwards from left to right.
  An example such a trend is represented in the following graph:



We can see on this graph that the line is moving in an upwards direction from left to right.

This means that as the x-value increases the y-value is also increasing at a constant rate.

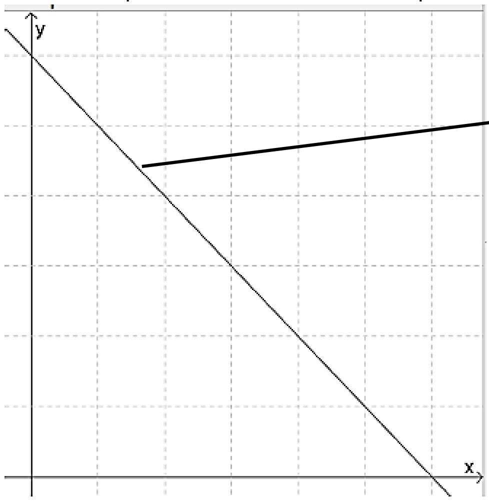
A table with a set of values for a trend like this is shown below:

Number of tracksuits	0	1	2	3	4
Cost (R)	100	150	200	250	300

+50 +50 +50 +50

Here we have an example where the x-axis value increases the y-axis values also increases. This is referred to as a direct proportion/relationship.
As mentioned in the previous lesson, because the change is constant this will have a linear graph.

- **Decreasing function –** When the relationship between the x- and y-axis are in indirect proportion, as the x-axis values increases the y-axis values decreases the graph is seen as a decreasing graph. The graph moves downwards from left to right.
  An example such a trend is represented in the following graph:



We can see on this graph that the line is moving in a downwards direction from left to right.

This means that as the x-value increases the y-value is decreasing at a constant rate.

A table with a set of values for a trend like this is shown below:

Number of cars sold	0	10	20	30	40

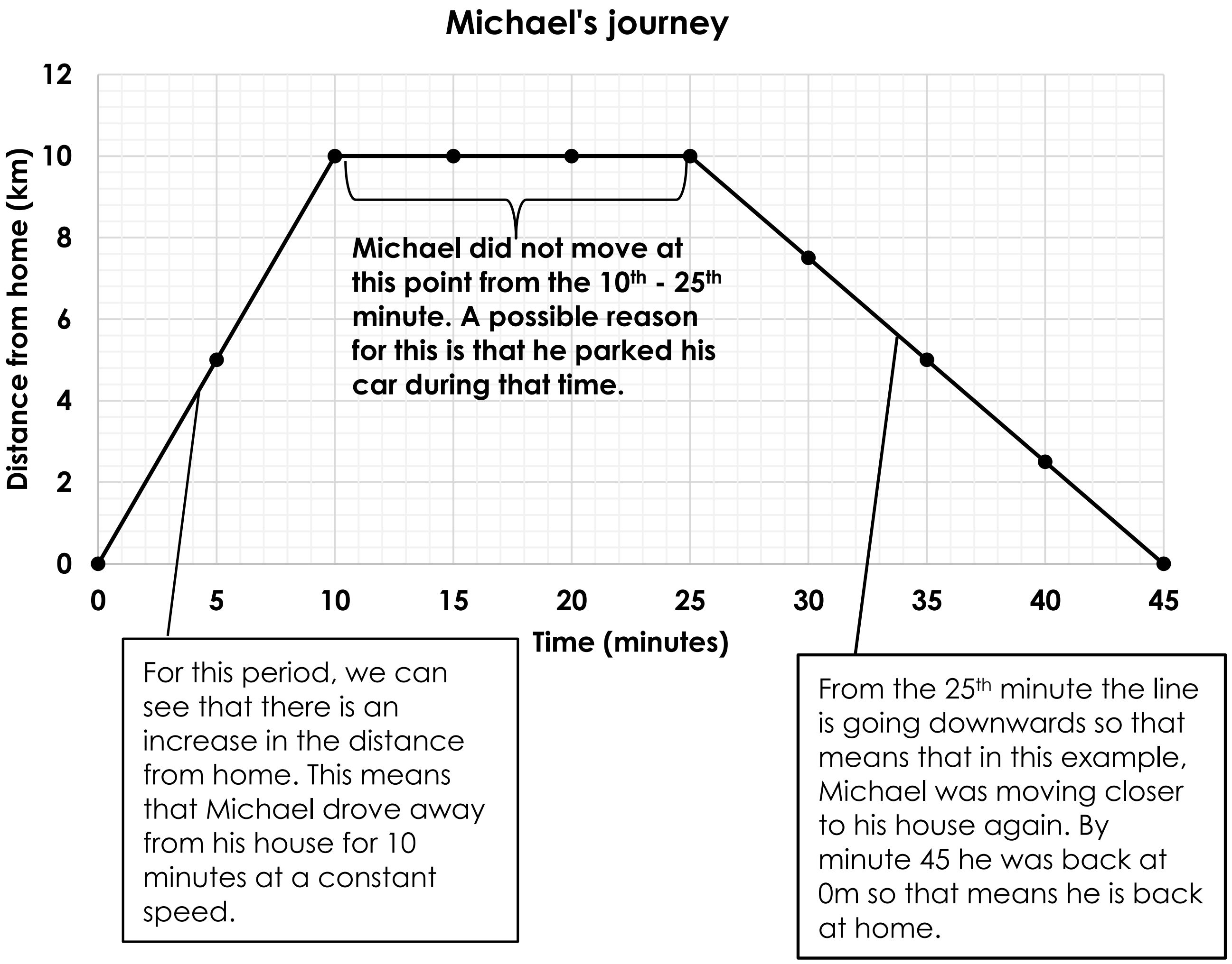
Stock on hand	100	90	80	70	60

-10 -10 -10 -10

Here we have an example where the x-axis value increases the y-axis value decreases. This is referred to as an indirect proportion/relationship.
As mentioned in the previous lesson, because the change is constant this will have a linear graph.

In Global graphs it is also possible to work with graphs that contains all three of the above in the same graph. This will be normal and must be interpreted in the same way.

An example of this is seen below:



As we can see from the graph there is a difference between the slope of the increasing graph and the decreasing graph. In this example it means that he was driving faster during minutes 0 – 10 compared to minutes 25 – 45.

CLASSWORK:

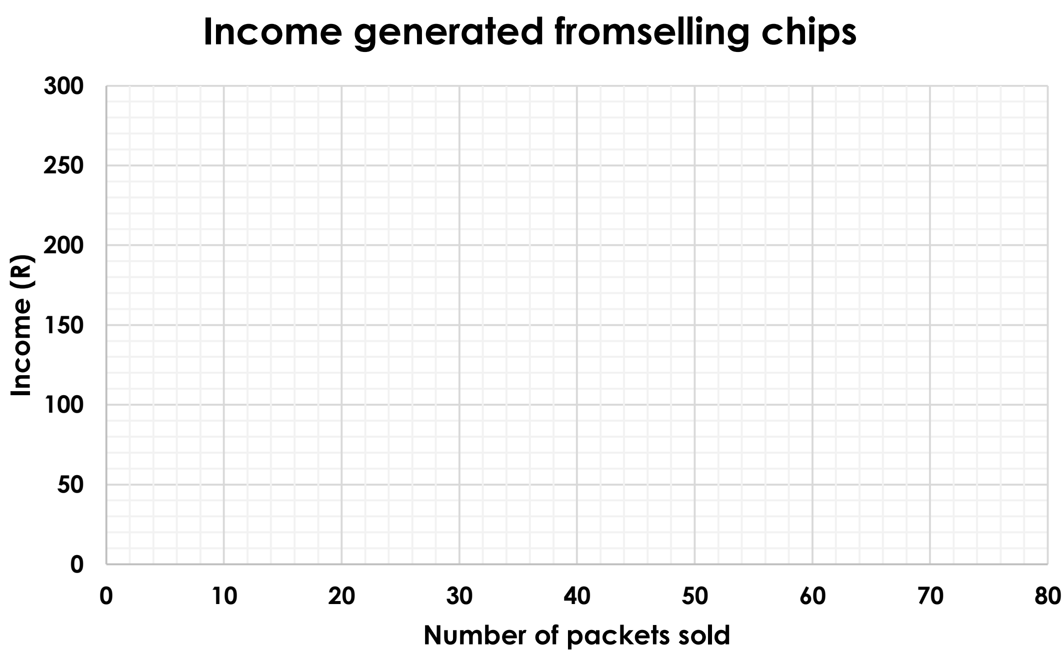
Work through the following examples. Only look at the answers at the end of the lesson after you have completed all of the activities.

ACTIVITY 1:

A shop owner sells packets of chips at R 3,50 per packet. The following table shows the relationship between the number of packets sold and the income of the chips in Rand.

Number of packets sold	10	20	30	40	50	60	70
Income in Rand		70		140		210	

a. Complete the table above and represent it on a graph on the attached set of axis.



b. What happens to the income of the chips as more packets are sold?

c. Is it possible to use the graph to determine the income if 25 packets of chips were sold? Explain your answer.

d. Complete the following sentence:
As the number of chip packets sold (x-axis) increase, the value of the income (y-axis) ____________.

ACTIVITY 2:

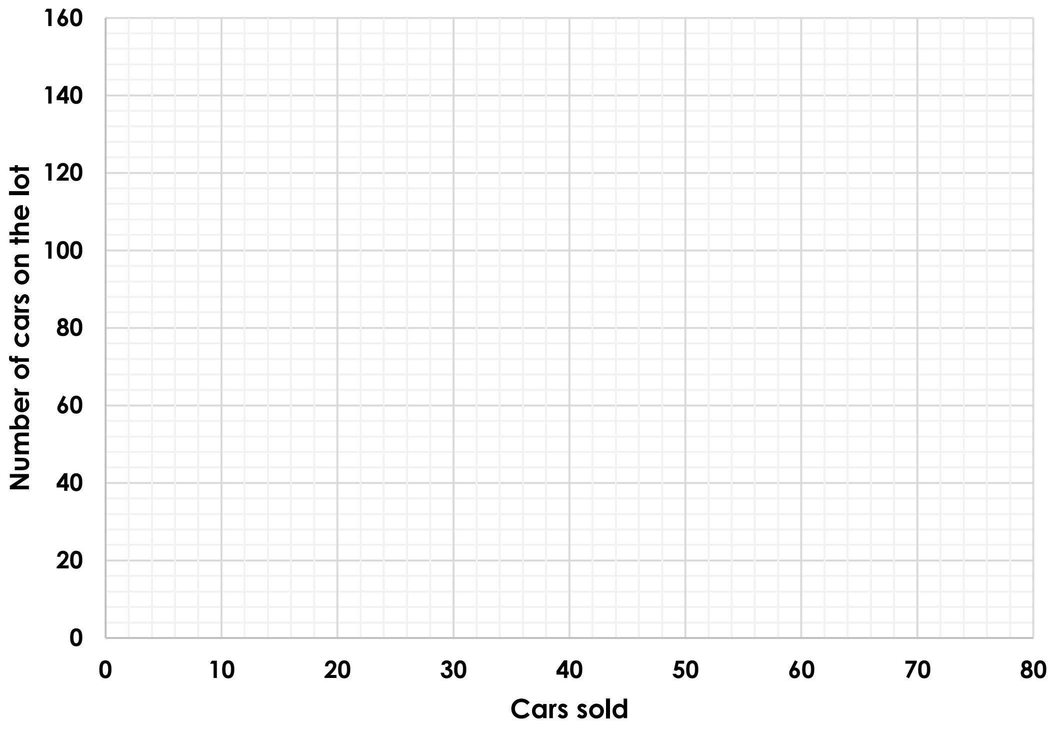
A motor car retailer has realised he has to many older model vehicles on his lot. He set a challenge for his employees to sell at least 15 motor cars a month so that he can clear the total of 150 older model vehicles on his lot.

The following table indicates the total number of vehicles on his lot in relation to the number of cars sold.

Number of cars sold	0	15	30	45	60	75
Stock on hand	150					

a. Complete the table above and represent it on a graph on the attached set of axis.

Cars remaining on the lot

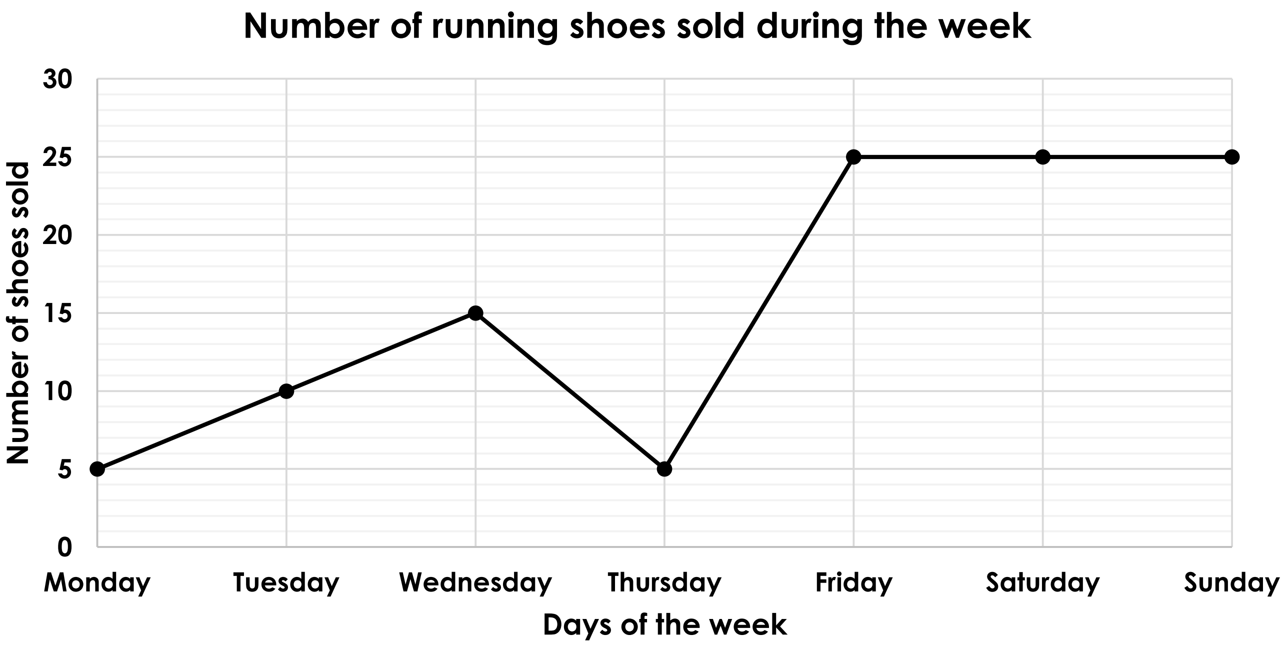


b. What happens to the number of motor vehicles on the lot as more vehicles are sold?

c. Complete the following sentence:
As the number of vehicles sold (x-axis) increase, the number of vehicles remaining on the lot (y-axis) ____________.

ACTIVITY 3:

The following graph shows the number of running shoes sold by Total Sports per week.



- **a.** During which days of the week was there an increase in the sales?
- **b.** During which day was there a decrease in sales?
- **c.** What happened to the number of sales from Friday to Sunday?
- **d.** How would you describe the slope of the sales from Monday to Wednesday.

IT IS IMPORTANT TO REMEMBER:

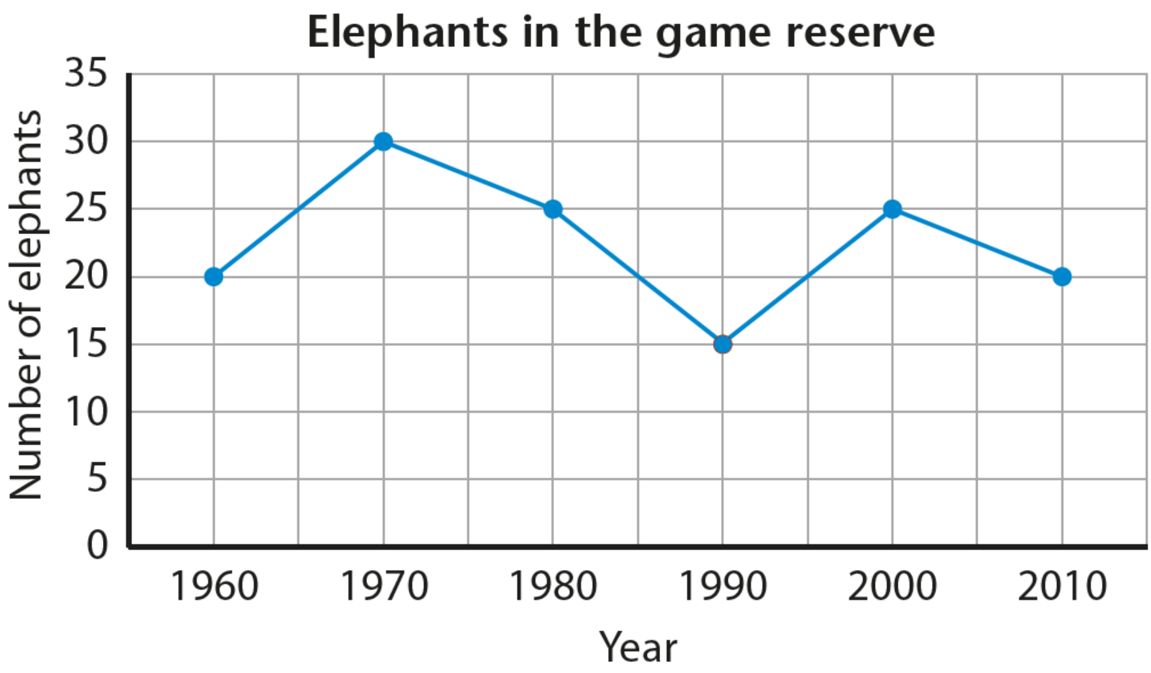
- We read a graph from left to right.
- When the relationship between the two variables are in direct proportion, when the one variable increases the other variable will also increase. The graph will move upwards from left to right.
- When the relationship between the variables are in indirect proportion, when the one variable increases the other variable decreases. The graph will move downwards from left to right.

When the relationship of one variable remains unchanged as the other one changes the graph is parallel to one of the axes. If the y-axis value does not change as the x-axis values change the graph is parallel to the x-axis and the relationship is described as constant.

HOMEWORK:

Do the following exercises,applying what you have learnt today.
FIRST, ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:
The graph below shows the population of elephants at a game reserve in South Africa between 1960 and 2010. Study the graph and answer the questions that follow.

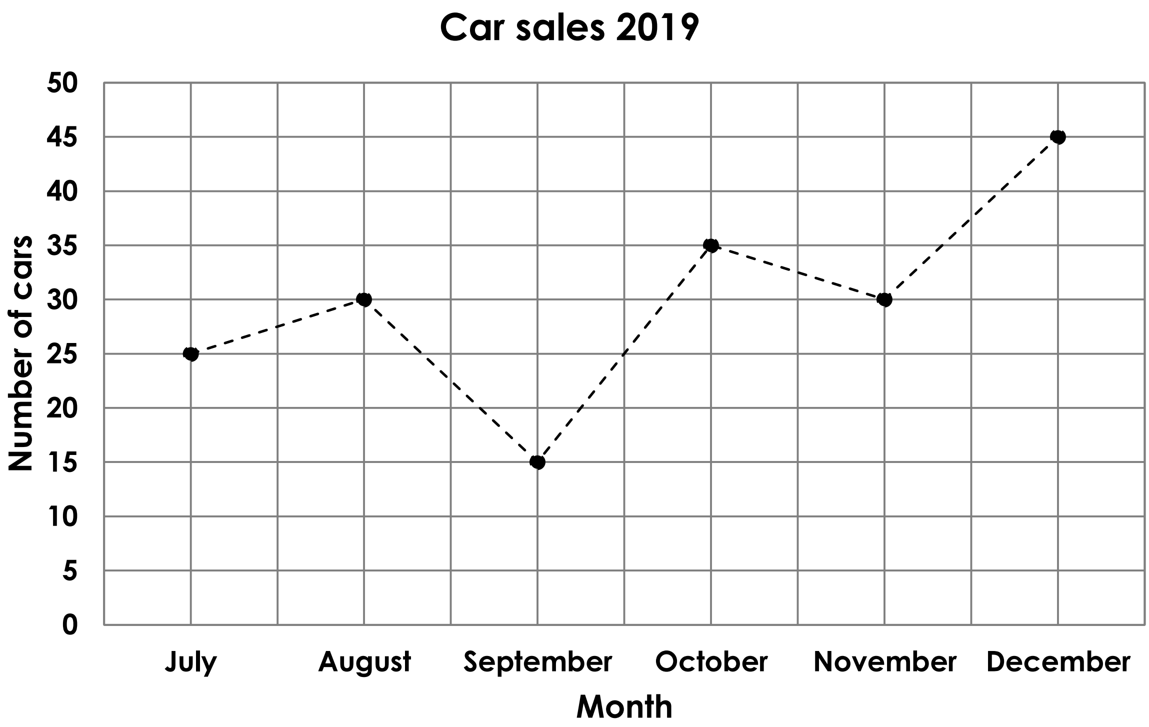


- **a.** Did the elephant population increase or decrease between 1970 and 1990?
- **b.** Between which years did the elephant population increase?
- **c.** In which year were there the most elephants on the game farm?
- **d.** Approximately how many elephants do you think were on the game reserve in 1995?
- **e.** The following table shows the number of elephants at a different game reserve. Plot this information on the same set of axis as above.

Year	**1960**	**1970**	**1980**	**1990**	**2000**	**2010**
Elephants	30	25	20	15	20	35

- **f.** Would you say that the second game reserve had more elephants than the first game reserve between 1960 and 2010? Explain your answer.

QUESTION 2:
The following line graph shows the number of cars that a company sold between July and December of 2019.



a. How many cars were sold in August?

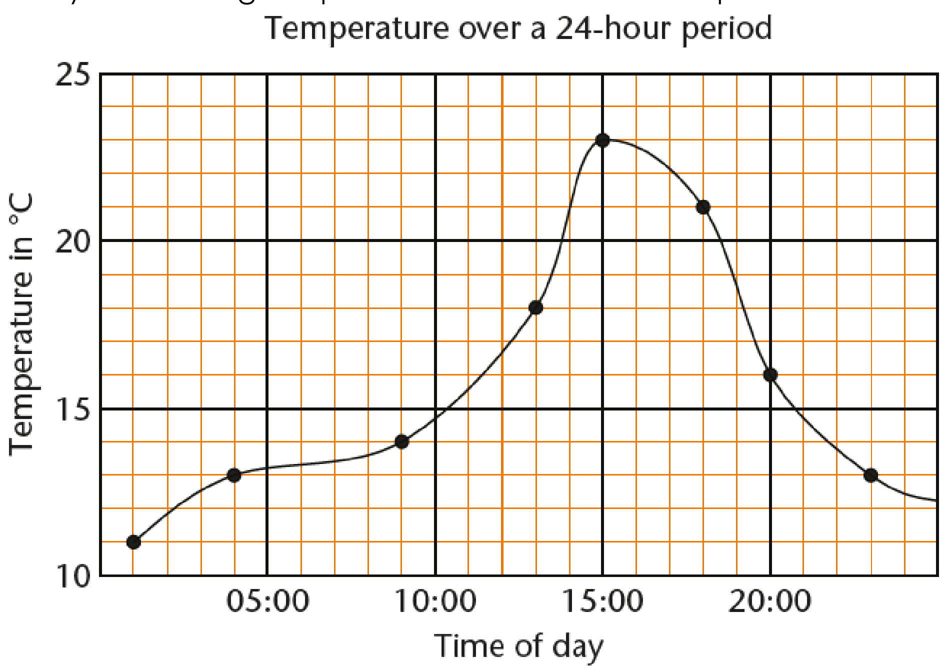
b. How many more cars were sold in November than July?

c. Between which months did the car sales decrease?

d. Would you say that the car sales generally imporved over the 6 months? Explain your answer.

QUESTION 3:

The graph below shows the temperature over a 24-hour period in a town in the Free State. The graph was drawn by connecting the points that show actual temperature readings.



a. Do you think the above temperatures were recorded on a summer day or winter day?
b. At what time of the day was the highest temperature recorded, and what was this temperature?
c. During what part of the day did the temperature rise, and what part did the temperature drop.
d. During what part of the day did the temperature rise most rapidly?
e. During what part of the day did the temperature drop most rapidly

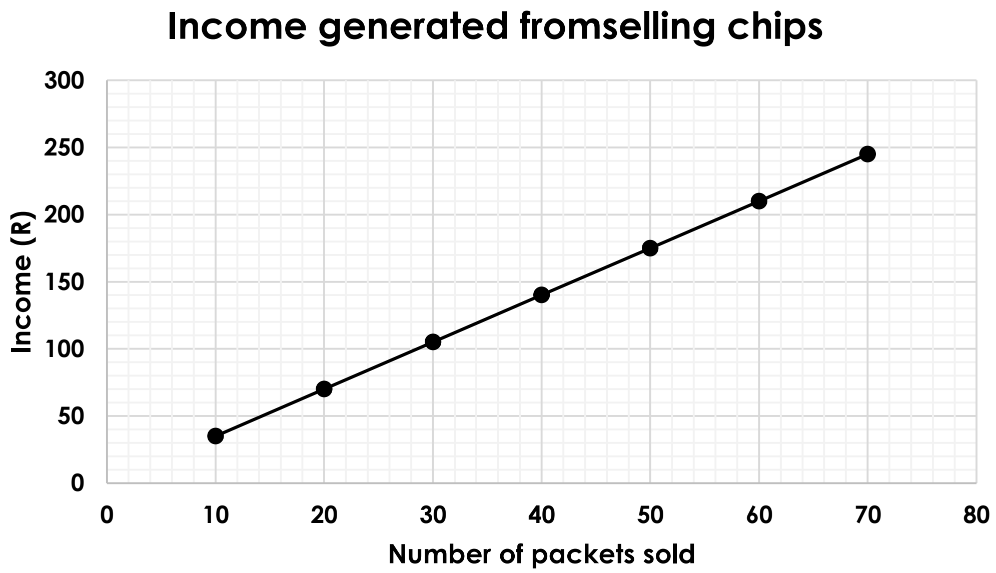
MEMORANDUM: DAY 2:

CLASSWORK:

ACTIVITY 1:

a.

Number of packets sold	**10**	**20**	**30**	**40**	**50**	**60**	**70**
Income in Rand	35	70	105	140	175	210	245

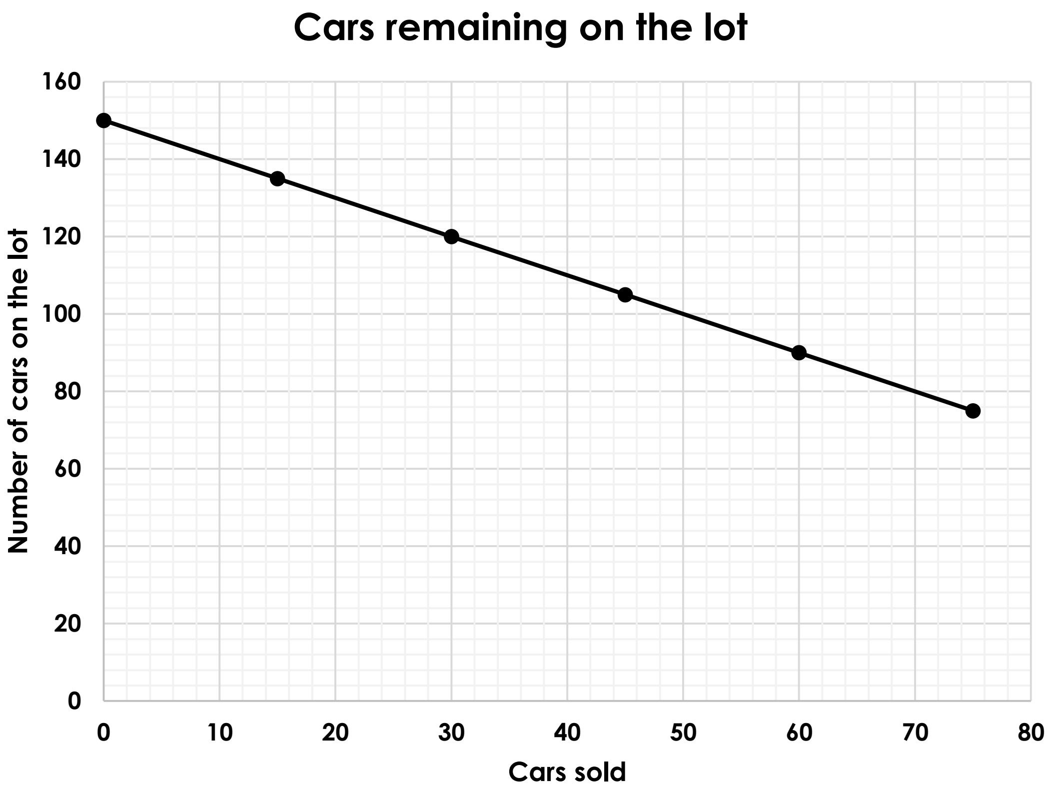


b. The income is increasing at a constant rate as more packets are sold.
c. Yes, because it is increasing at a constant rate we can go to 25 on the x-axis and read off the value on the y-axis. Will be approximately R 90.
d. Increases

ACTIVITY 2:

a.

Number of cars sold	**0**	**15**	**30**	**45**	**60**	**75**
Stock on hand	150	135	120	105	90	75



- **b.** The number of vehicles on the lot decreases as more vehicles are sold.
- **c.** Decreases

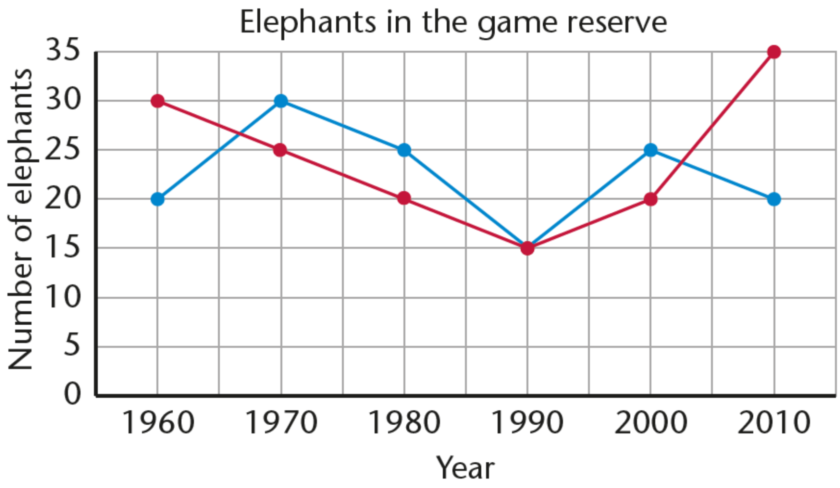
ACTIVITY 3:

- **a.** From Monday – Wednesday and then again from Thursday – Friday.
- **b.** From Wednesday – Thursday.
- **c.** They remained constant.
- **d.** There was a constant increase from Monday – Wednesday.

HOMEWORK:

QUESTION 1:

- **a.** There was a drcease from 1970 to 1990.
- **b.** Between 1960 – 1970 and between 1990 – 2000.
- **c.** 1970
- **d.** 20 elephants.
- **e.** graph



- **f.** No, they only had more elephants before about 1967 and after about 2002. The rest of the time they had fewer.

QUESTION 2:

- **a.** 30 cars.
- **b.** November = 30
  July = 25
  ∴ 30 – 25 = 5 more cars.
- **c.** Between August -September and also between October – November.
- **d.** Yes, the general trend was an increase. Started by 25 in July and increased to 45 by December. It was only between August -September and also between October – November that there was a decrease. The rest of the months had an increase.

QUESTION 3:

- **a.** The temperature would be in Summer rather than in Winter in the Free State.
- **b.** 15:00 and the temperature was 23°C.
- **c.** The temperature rose between 01:00 and 15:00 and dropped between 15:00 and 24:00.
- **d.** 13:00 and 15:00
- **e.** 18:00 and 20:00

DAY 3:

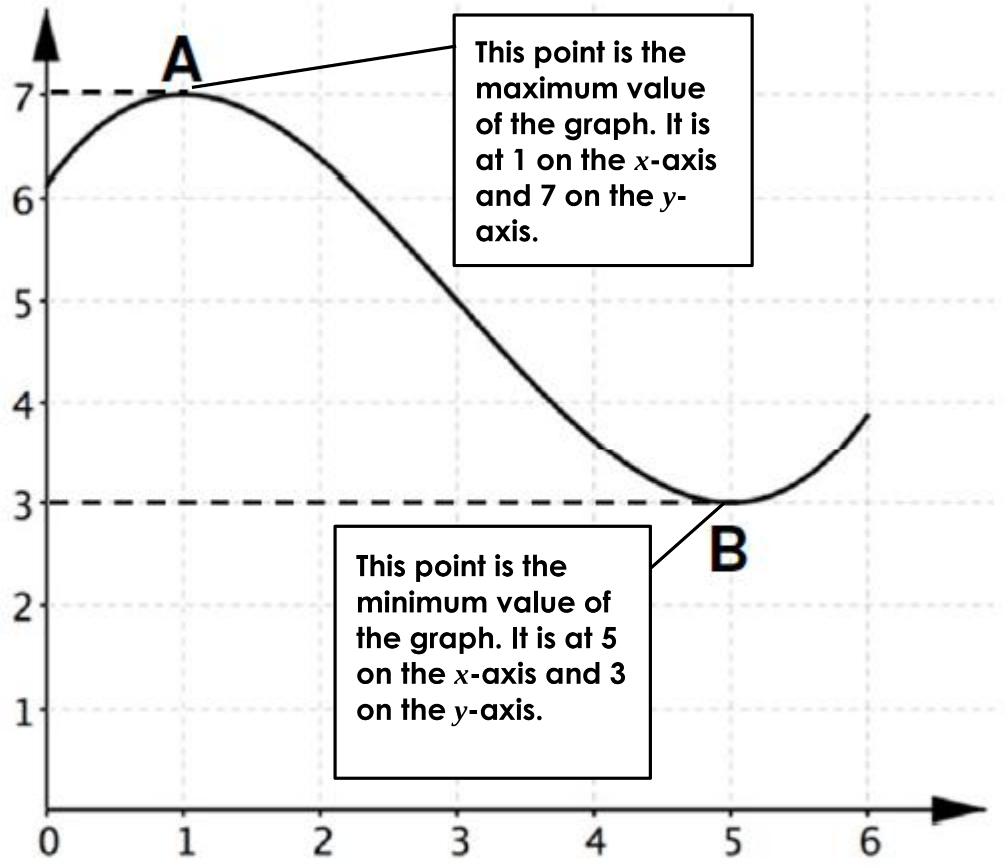
LESSON DEVELOPMENT: **maximum and minimum values**

Maximum value:

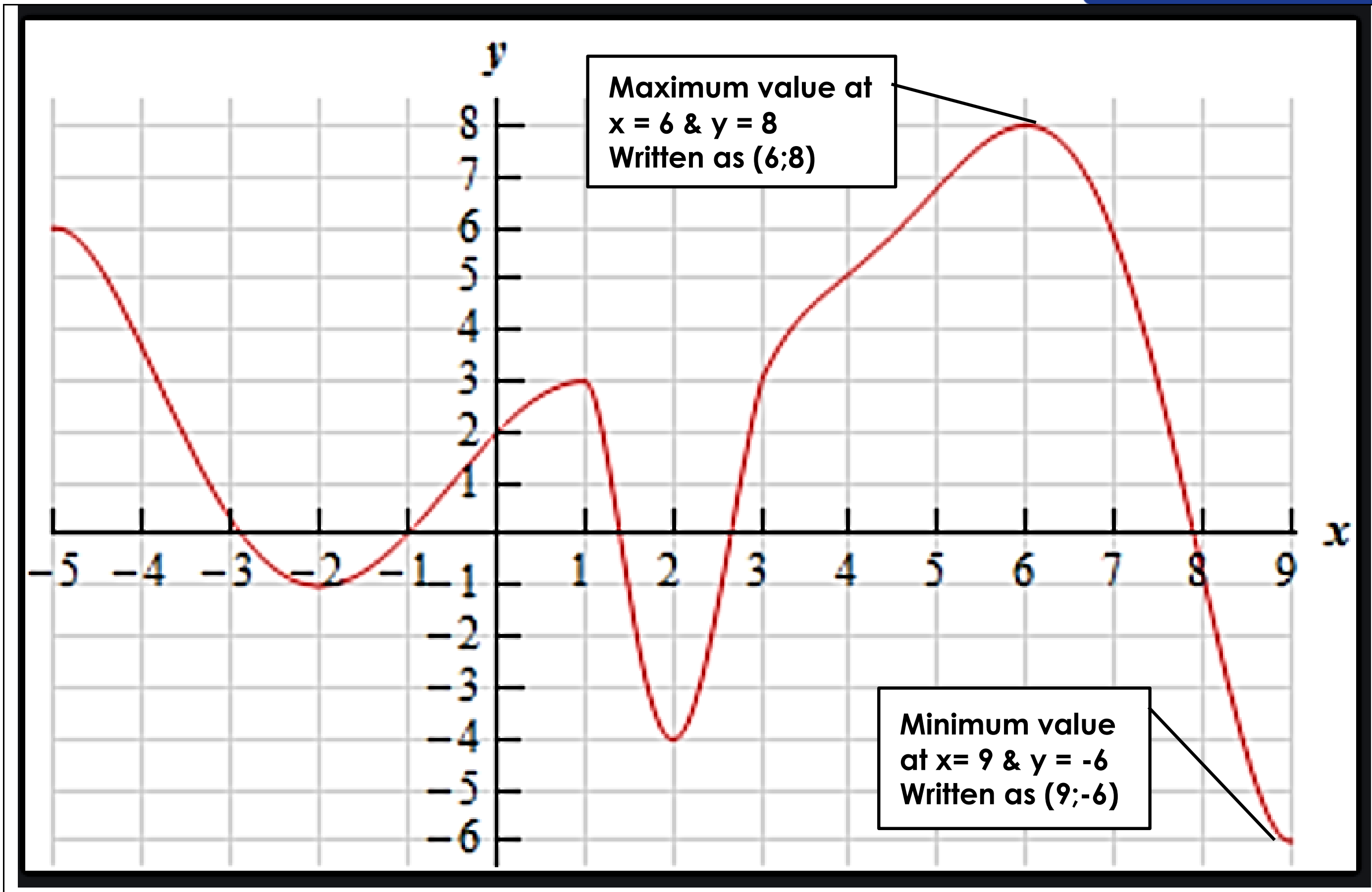
The maximum value of a graph is the highest point on the y-axis. This value does not have to be a positive value, can also be a negative value.

Minimum value:

The minimum value of a graph is the lowest point on the y-axis. This value does not have to be a positive value, can also be a negative value.



The graph above was a very easy one to identify the maximum and minimum values seeing that it is a fairly basic graph. The following graph indicates a more complex scenario where we will identify the maximum and minimum values.



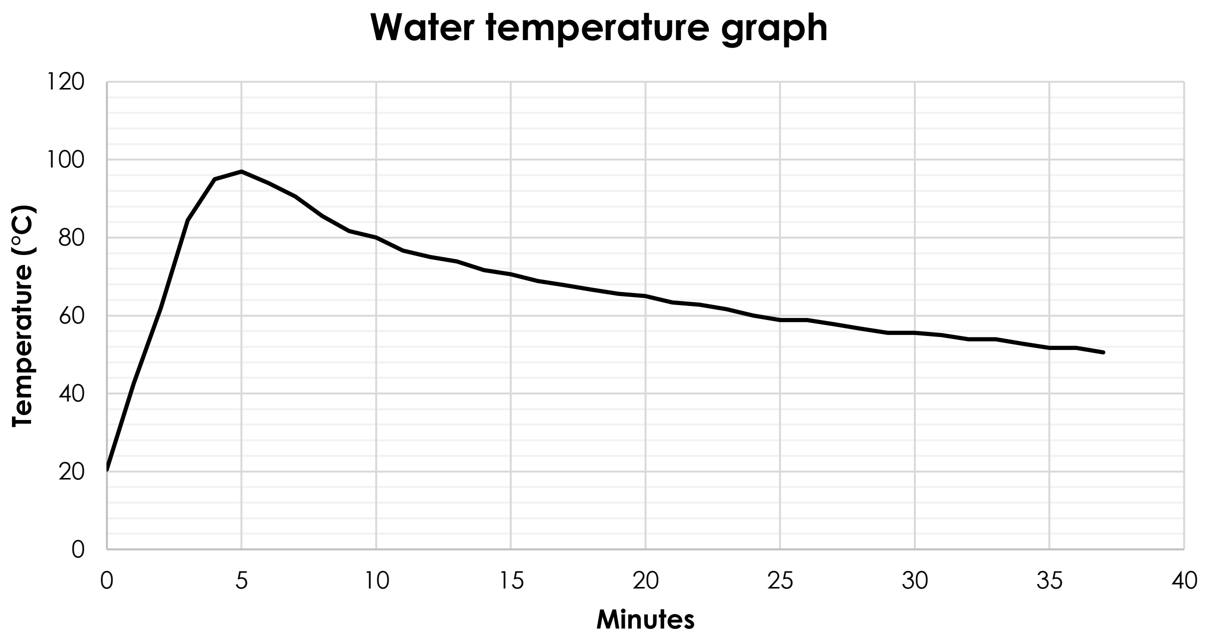
As we can see on the graph we have quite a few curves where there is a change from an increase in the values to a decrease. The maximum and minimum values here is at (6;8) and (9;-6) respectively. We call these ordered pairs but we will learn more about this at a later stage.

CLASSWORK:

Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

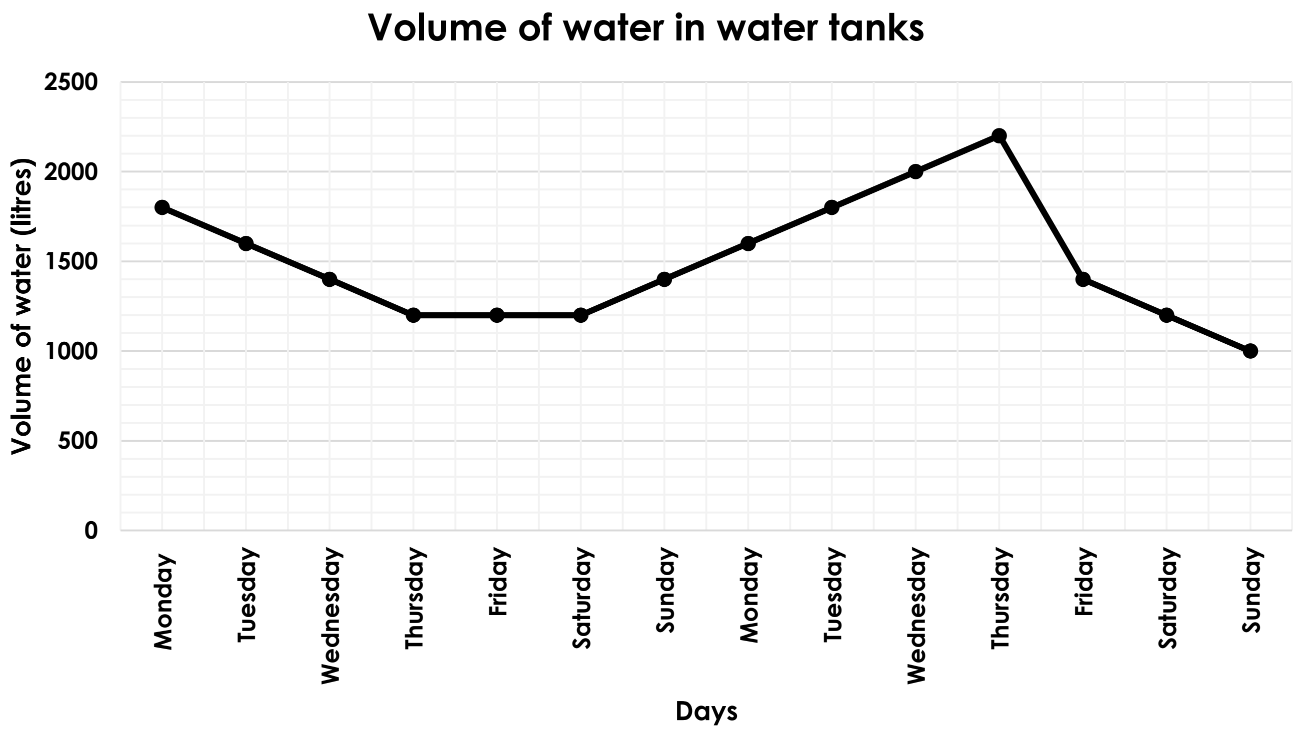
ACTIVITY 1:

The following graph is indicating the boiling of water and the cooling thereof.
Study the graph and answer the following questions.



a. How long did the water take to reach its maximum temperature?
b. What was the maximum temperature reached?
c. What is the minimum temperature as shown on the graph?

ACTIVITY 2:
The following graph shows the volume of water in a water tank over a period of two weeks.



a. What happened to the water in the tank during the first four days?
b. Was this change in volume a linear decrease? Explain your answer.
c. What was the maximum volume of water in the water tank?
d. What is the minimum volume of water that the tank held during this period?

e. Was the tank ever empty during this two-week period?
f. When was the volume of water constant?

IT IS IMPORTANT TO REMEMBER:

- The highest point on a graph is called the maximum value.
- The lowest point on a graph is called the minimum value.

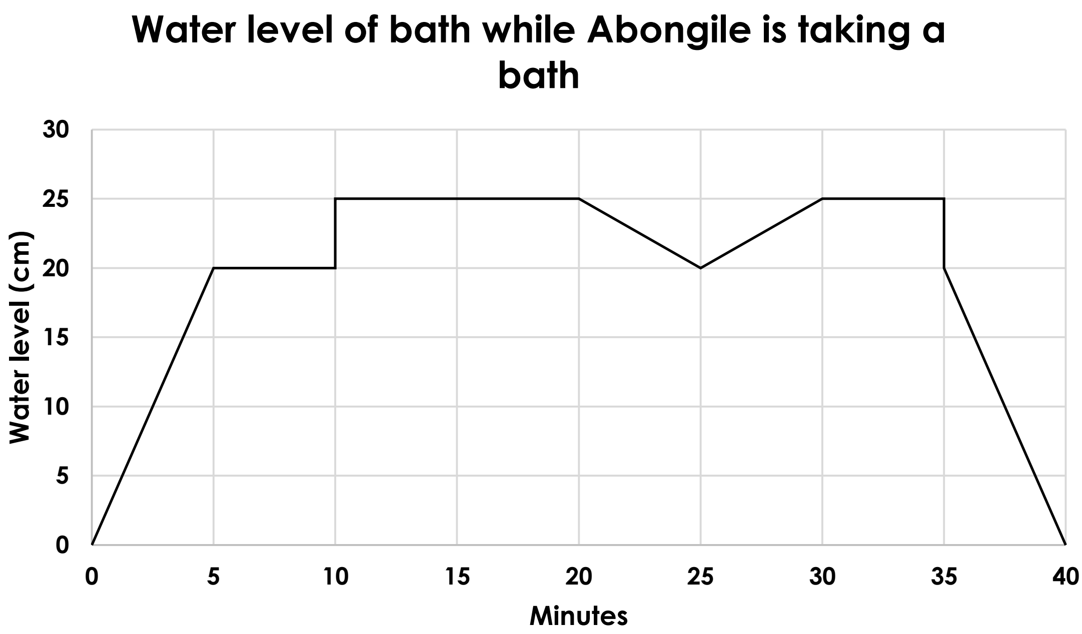
HOMEWORK:

Do the following exercises,applying what you have learnt today.

FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:

Abongile took a bath for and the following graph indicates the water level in the bath.



By the 10th minute since she started running the bath she got into the bath and that explains the rapid rise in water level.

a. What happened between minutes 20 – 30?
b. What was the maximum level of the water and during which period did it take place?
c. What happened by the 35th minute that there was such a rapid decline in the water level?
d. What was the minimum water level between minutes 5 – 35?

MEMORANDUM: DAY 3:

CLASSWORK:

ACTIVITY 1:

- **a.** 5 minutes
- **b.** ± 96 °C
- **c.** 20 °C

ACTIVITY 2:

- **a.** The amount of water (volume) decreased during the first four days.
- **b.** Yes, it was. It decreased by the same amount over the days.
- **c.** 2 200 litres
- **d.** 1 000 litres
- **e.** No, it never reached 0 litres over the period indicated.
- **f.** The first Thursday – Saturday.

HOMEWORK:

QUESTION 1:

- **a.** Abongile must have let some water out and refilled it again. The water might have gotten cold and she let some out to fill up with warm water again.
- **b.** 25 cm. Minutes 10 – 25 and again during minutes 30 – 35.
- **c.** She got out of the bath.
- **d.** 20 cm.

DAY 4:

LESSON DEVELOPMENT: Discrete and continuous variables.

Discrete data:

- Unconnected data points - Discrete data has data points that cannot be joined because the values between the points are not possible
- Can be counted
- Can be grouped
- Can only take on a certain value

Continuous data:

- Uninterrupted
- Connected data points - Continuous data can be joined because the values between data points are possible.
- Measureable
- Can take on any value

These are a few examples of types of discrete and continuous variables

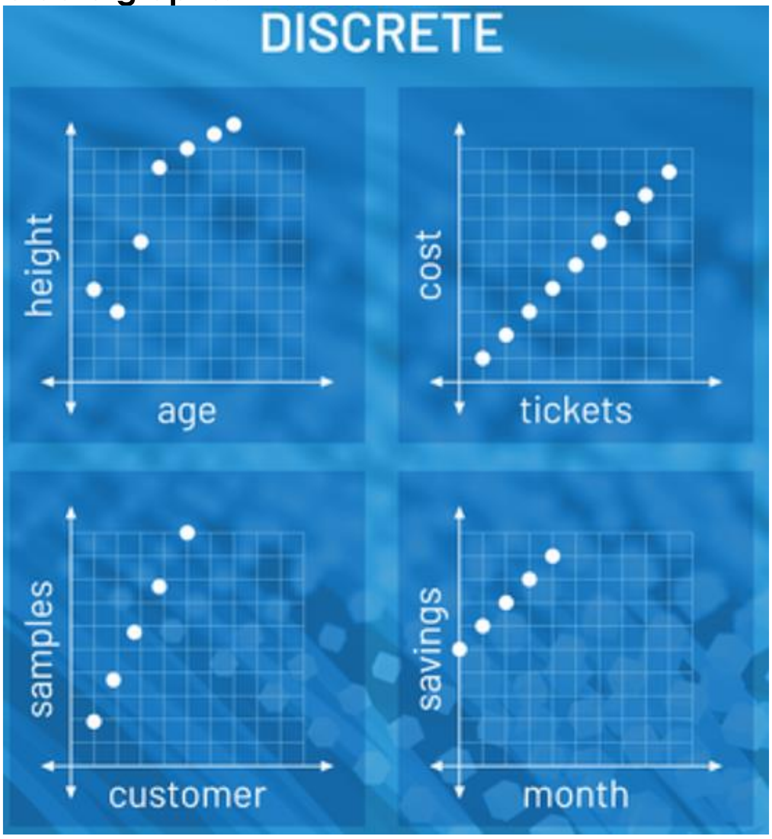
Discrete	Continuous
• # of eggs in a basket • # of kids in a class • # of Facebook likes • # of diaper changes in a day • # of wins in a season • # of votes in an election	• Weight difference to 8 decimals before and after cookie binge. • Wind speed • Water temperature • Volts of electricity

- **Discrete Variables:** Can take on only certain values along an interval
  - the number of sales made in a week
  - the volume of milk bought at a store
  - the number of defective parts

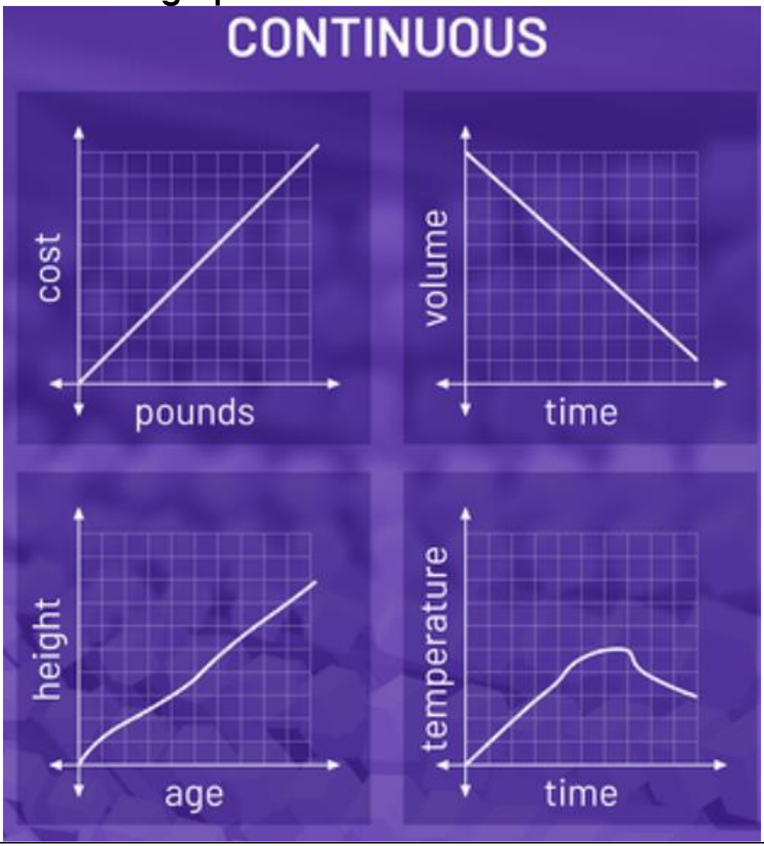
- **Continuous Variables:** Can take on any value at any point along an interval
  - the depth at which a drilling team strikes oil
  - the volume of milk produced by a cow
  - the proportion of defective parts

As we can see from the examples above the discrete variables are examples of objects that cannot be broken into smaller parts and has to be counted. The continuous variables can be measured in different quantities and can be parts of a whole.

Examples of Discrete data graphs:



Examples of Continuous data graphs:



CLASSWORK:

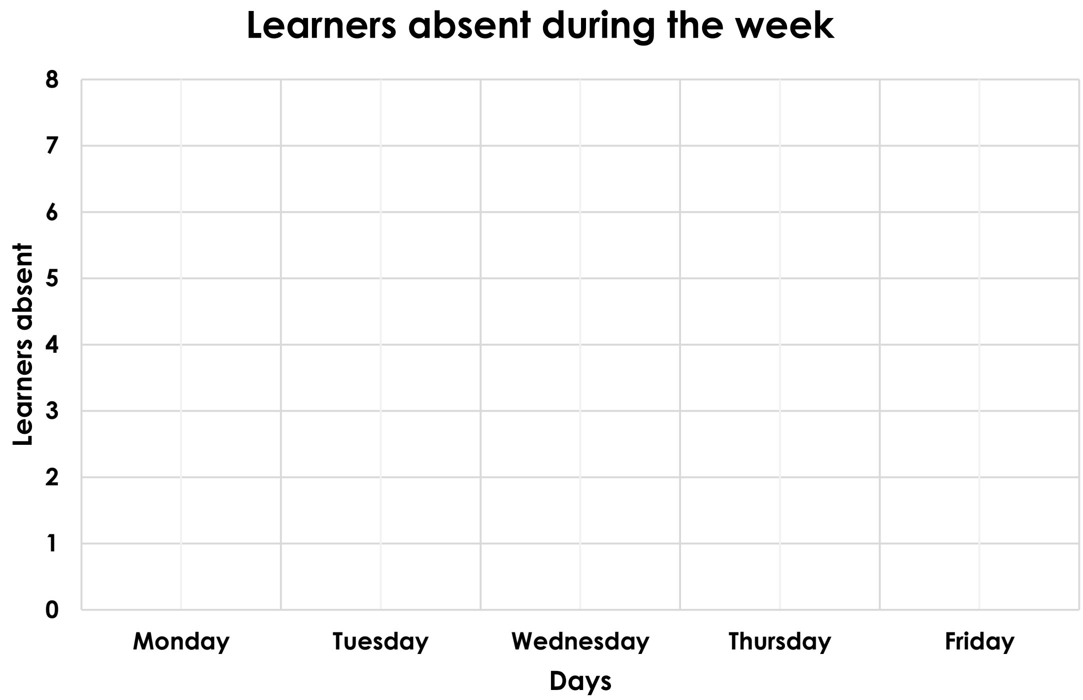
Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

ACTIVITY 1:

The table below shows the number of learners in a class that were absent from school in the first week of term.

Day	**1**	**2**	**3**	**4**	**5**
Number of absentees	2	4	7	1	3

a. Represent the information in the table on the set of axis below.



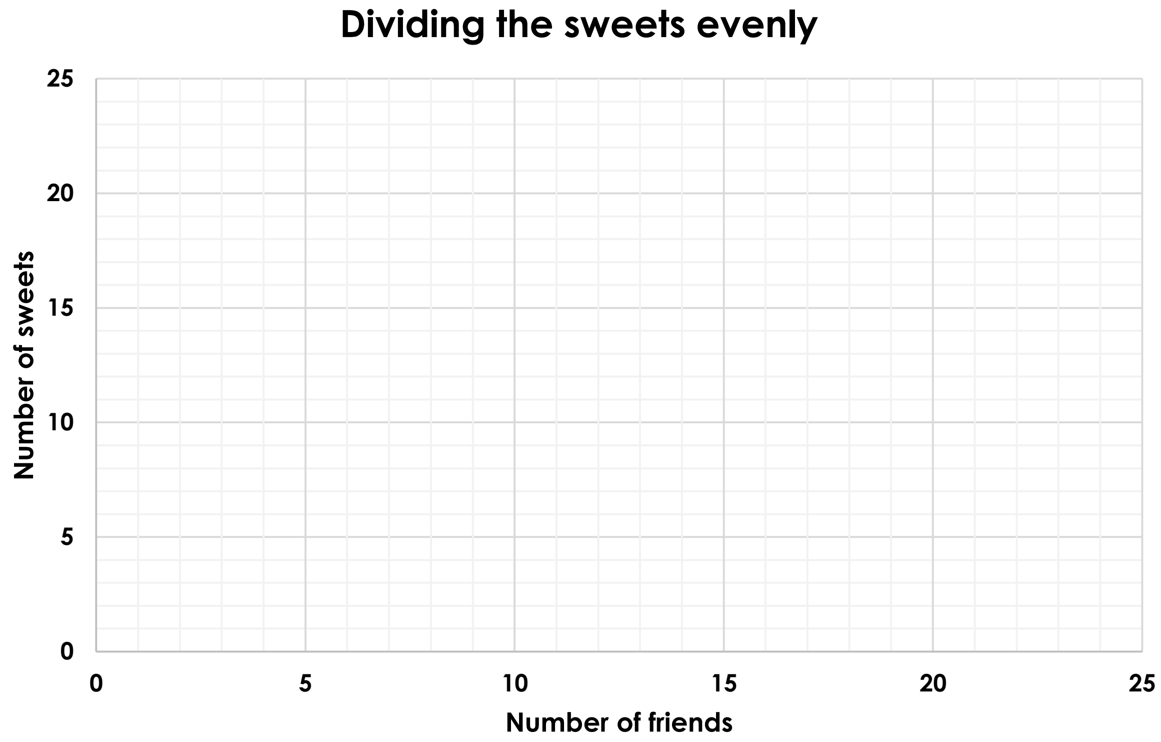
b. Explain why the graph must remain as discrete points.

ACTIVITY 2:

You recently bought a packet of sweets with 24 sweets in the packet. You have decided that you want to share your sweets with your friends. It is hard-boiled sweets so it is not possible to break the sweets into smaller parts.

Number of people that will share	**1**	**2**	**3**	**4**	**6**	**8**	**12**	**24**
Number of sweets that each will receive	24							1

a. Complete the table above and represent it on a graph on the attached set of axis.



b. Is this graph linear or non-linear?
c. Is this graph an increasing or decreasing function?
d. Is this graph an example of discrete or continuous graph? Explain your answer.

IT IS IMPORTANT TO REMEMBER:

- When data is continuous we can join the points with a line because the graph holds true for all values in between the data points.
- When data is discrete the points cannot be joined because the graph do not hold true for the values in between.

HOMEWORK:

Do the following exercises,applying what you have learnt today.

FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

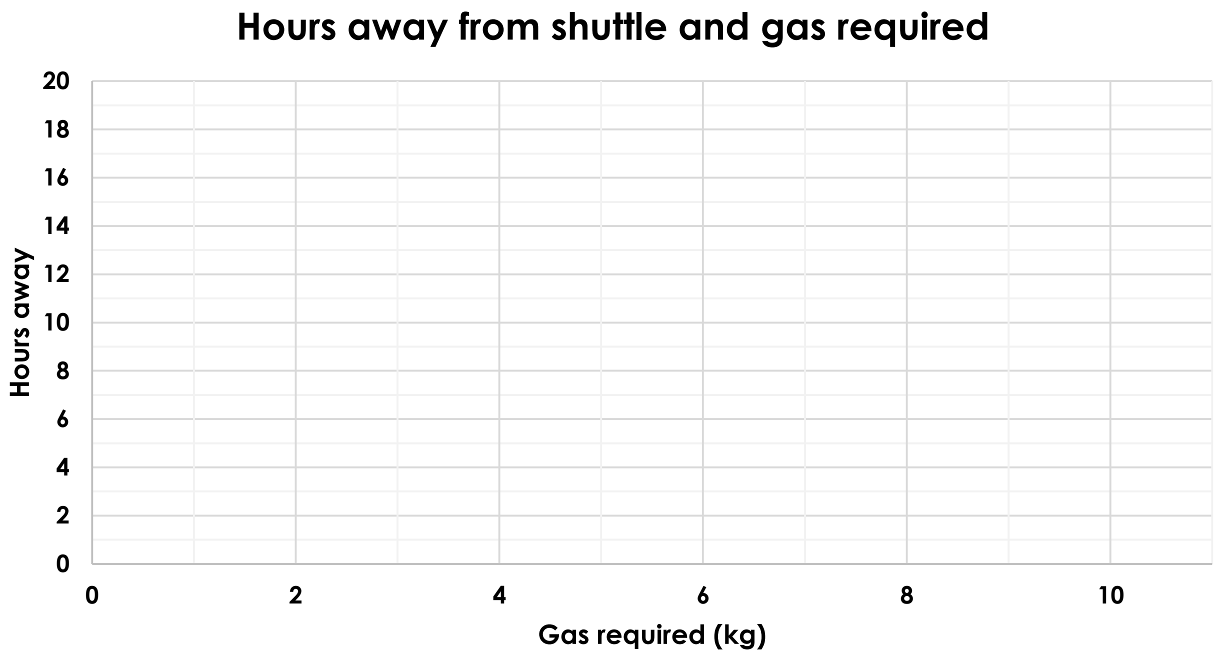
QUESTION 1:

When astronauts go on space expeditions their oxygen tanks only have a certain time that they work. The gas is consumed at a rate of 1 kilogram for every 2 hours. They need to remember to keep 1 kg of gas for returning to the space shuttle.

The table below shows the amount of hours that an astronaut can be on the expedition depending on the amount of oxygen remaining in their gas tanks.

Oxygen in tank (kg)	3	4	5	6		10
Hours away from the space shuttle.	5	7	9		15	

a. Complete the table above and represent it on a graph on the attached set of axis.



b. Is this graph linear or non-linear?
c. Is this graph an increasing or decreasing function?
d. Is this graph an example of discrete or continuous graph? Explain your answer.
e. Use your graph to determine how many hours they can stay away from the base if they have 4,5 kg of oxygen remaining in the tank.
f. Determine how many kilograms of oxygen they must have in their gas tanks if they want to go on an expedition of 7 hours.

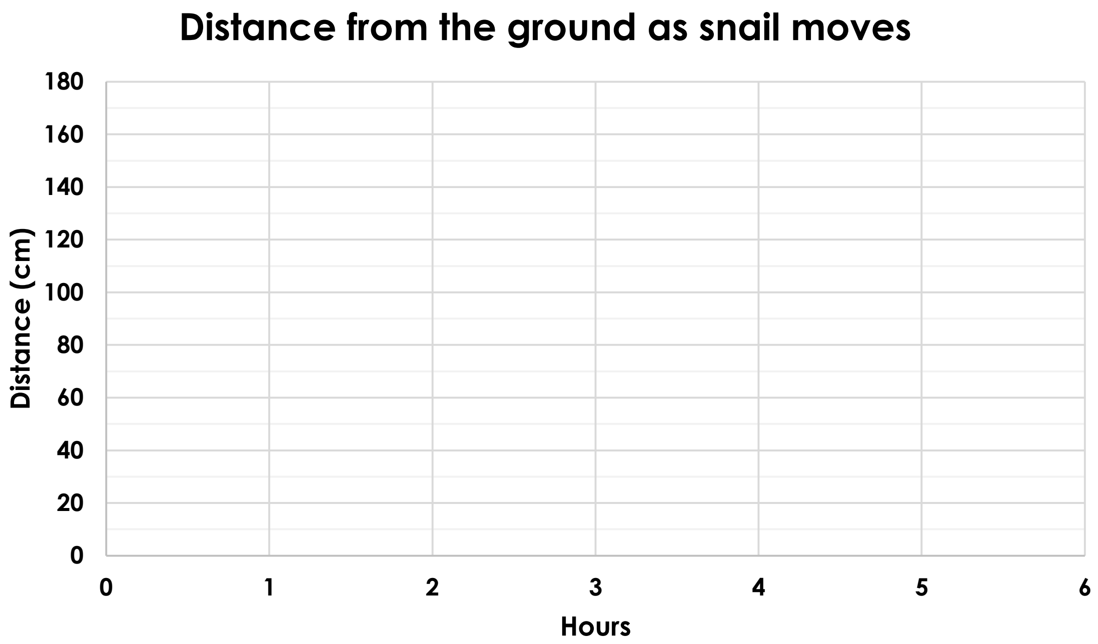
QUESTION 2:

Cassidy is looking at a snail that is climbing up the wall. When she saw it the first time it was 20 cm from the ground. Every hour she measures the height from the ground and determined that it climbed 30 cm for every hour.

a. Complete the following table that indicates the distance moved over a period of time.

Time (hours)	0	1	2	3	4	5
Distance from ground (cm)	20	50				

b. Use that table to draw the graph on the following set of axes.

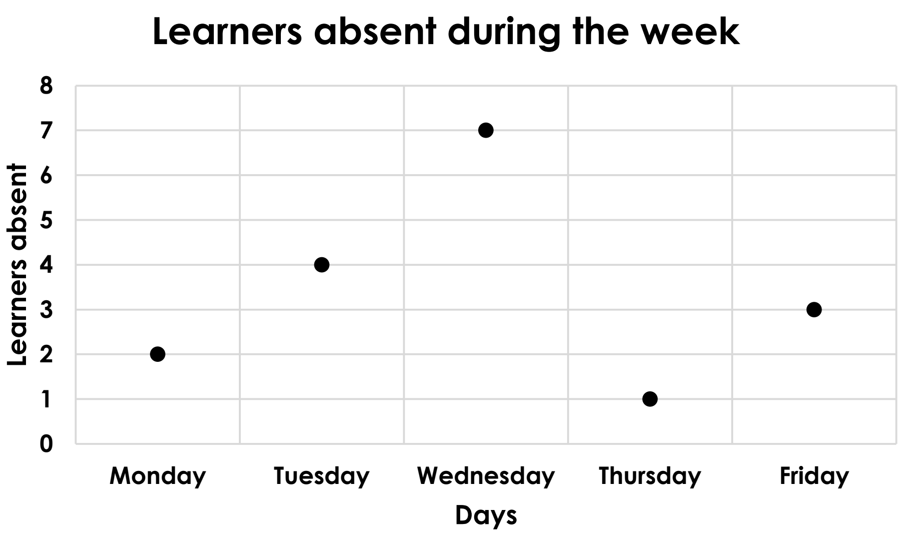


c. Is the graph linear or non-linear?

MEMORANDUM: DAY 4:

CLASSWORK:
ACTIVITY 1:

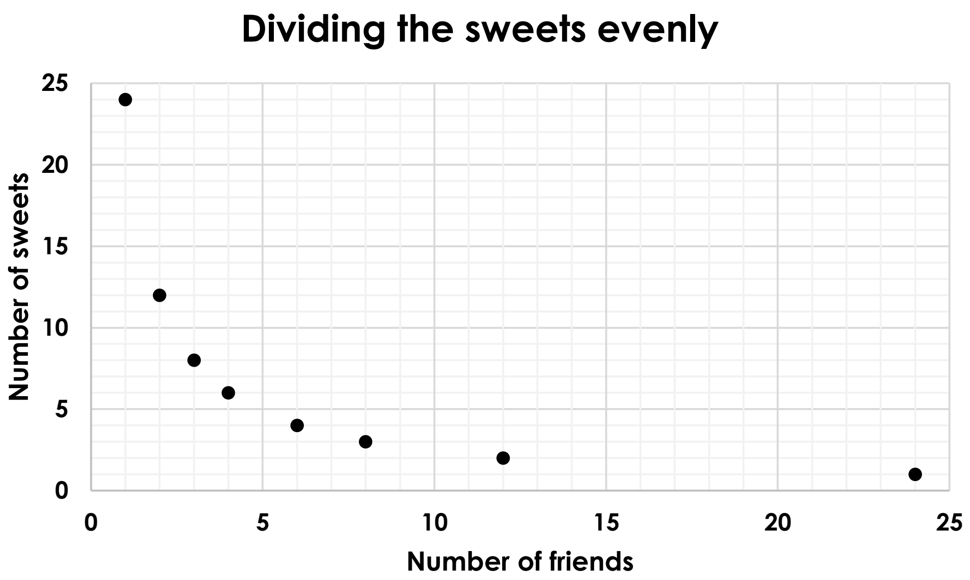
a.



b. We are working with discrete data so there can't be any values in between the whole numbers. We are therefore not joining the points because that would imply that you can find values between the whole numbers.

ACTIVITY 2:

a.



b. Non-linear graph.

c. Decreasing function

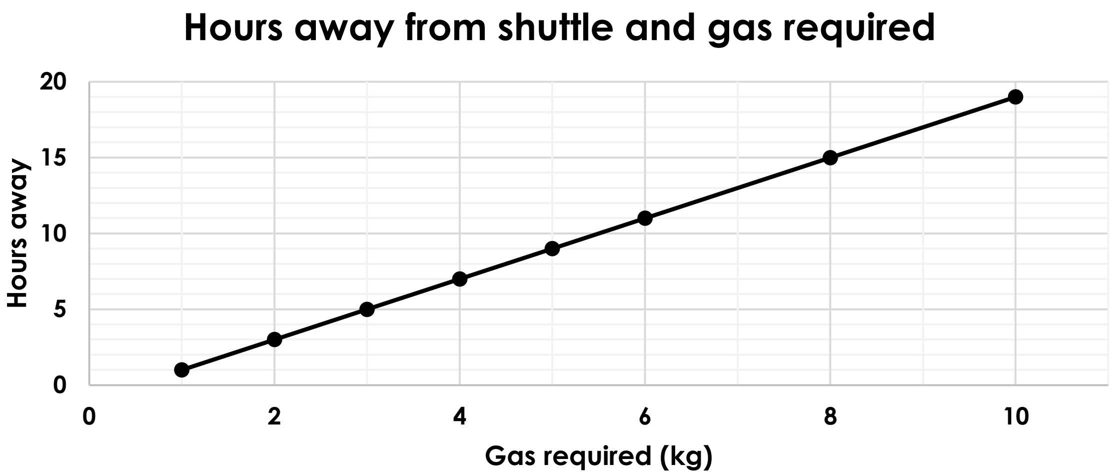
d. Discrete graph, we cannot break the sweets into parts of a sweet so we cannot join the points to imply that a person can get a part of a whole sweet.

HOMEWORK

QUESTION 1:

a.

Oxygen in tank (kg)	**3**	**4**	**5**	**6**	**8**	**10**
Hours away from the space shuttle.	5	7	9	11	15	19



b. Linear graph

c. Increasing function.

d. Continuous graph. The amount of kilograms in the tanks can be measured in parts of a kilogram as well.

e. Approximately 8 hours.

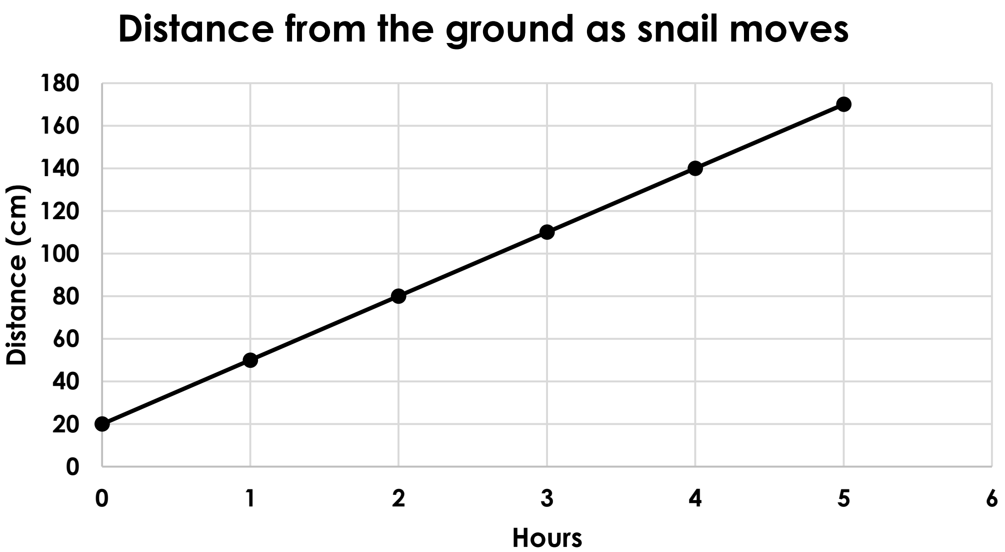
f. 4 kilograms

QUESTION 2:

a.

Time (hours)	**0**	**1**	**2**	**3**	**4**	**5**
Distance from ground (cm)	20	50	80	110	140	170

b.



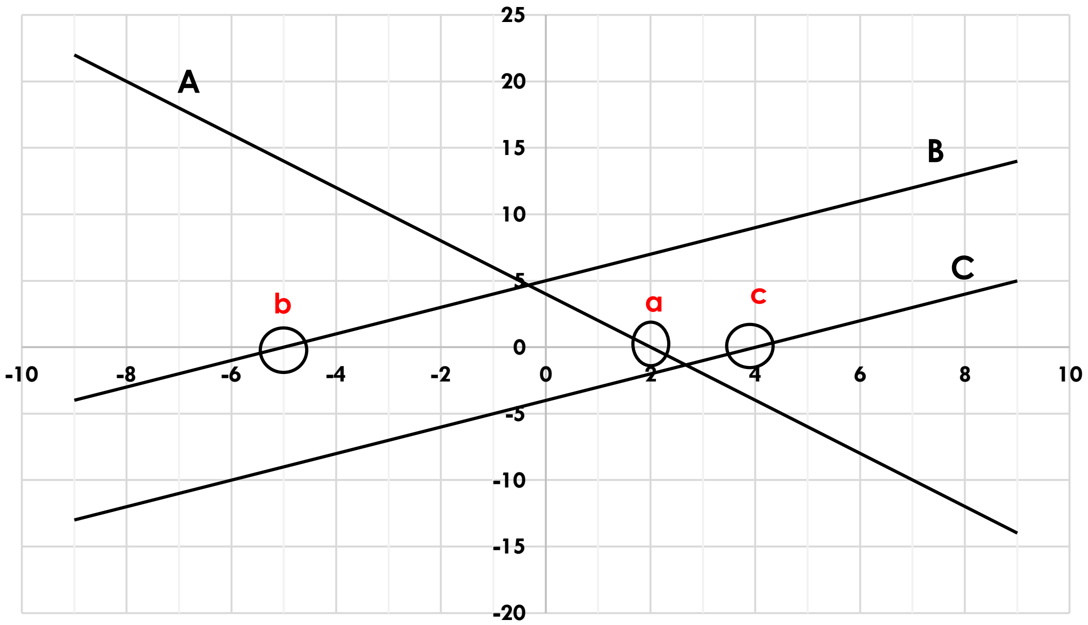
C. Linear graph

DAY 5:

LESSON DEVELOPMENT: x-intercept and y-intercept of linear graphs and gradients of linear graphs.

- x-intercept: it is the point on the graph that "cuts" the x axis.

  Here is an example of a graph drawn on a Cartesian plane.



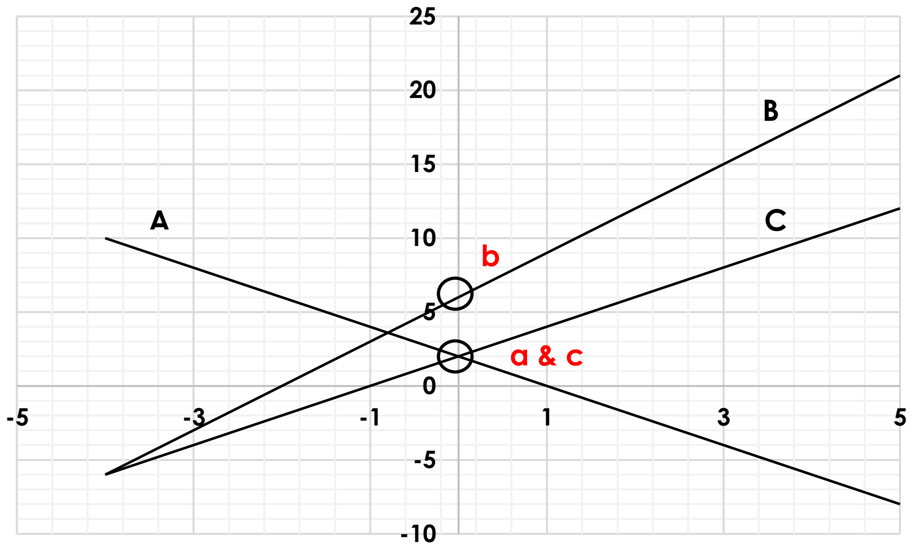
Let us look at lines A, B and C and the values of x and y where the line intersects the x-axis.

Point	x-value	y-value
a	2	0
b	-5	0
c	4	0

We can see that by all of the points where the line intersects the x-axis we have a y-value of 0.
We can make the deduction that where a line cuts the x-axis it will have a corresponding y-axis value of 0.
This means that if we have an equation for a line graph and we need to determine the x-intercept without a graph we can substitute y with 0 and solve the equation.

- y-intercept: it is the point on the graph that "cuts" the y axis.

  Here is an example of a graph drawn on a Cartesian plane.



Let us look at lines A, B and C and the values of x and y where the line intersects the y-axis.

Point	x-value	y-value
a	0	2
b	0	6
c	0	2

We can see that by all of the points where the line intersects the y-axis we have a x-value of 0. We can make the deduction that where a line cuts the y-axis it will have a corresponding x-axis value of 0. This means that if we have an equation for a line graph and we need to determine the y-intercept without a graph we can substitute x with 0 and solve the equation.

- Using an equation to determine the x- and y-intercepts:

$$y = 5x + 3$$

Step 1: To determine the x-intercept substitute $y = 0$.

$y = 5x + 3$

$0 = 5x + 3$

$-3 = 5x$

$x = -\frac{3}{5}$

Step 2: Write the x-intercept in coordinate form.

$(-\frac{3}{5}; 0)$

Step 3: To determine the y-intercept substitute $x = 0$

$y = 5x + 3$

$y = 5(0) + 3$

$y = 3$

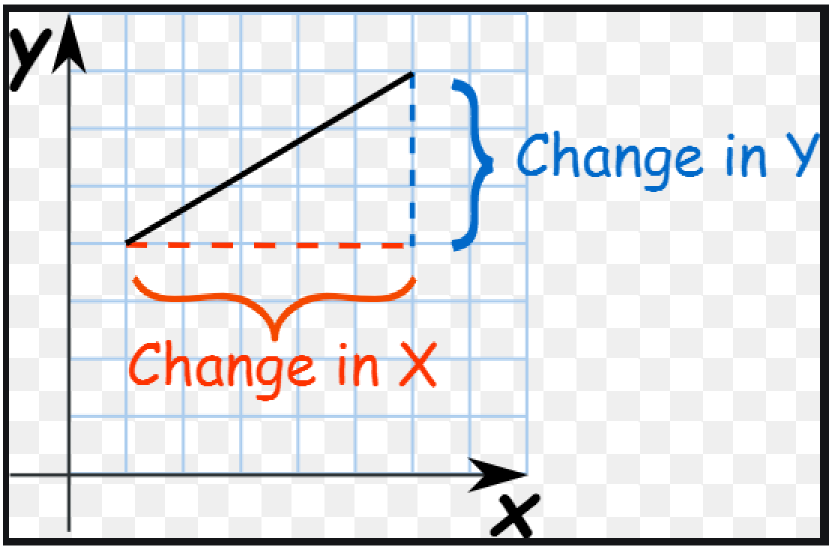
Step 4: write the y-intercept in coordinate form.

(0;3)

When we look at the original equation of $y = 5x + 3$ we can see that the y-intercept is the same as the constant (+3) of the equation. The standard form of a linear graph is $y = mx + c$ and from that we can see that the constant is indicated by the letter c. If we have the equation of a linear graph we can easily identify the y-intercept just by looking for the value of the constant.

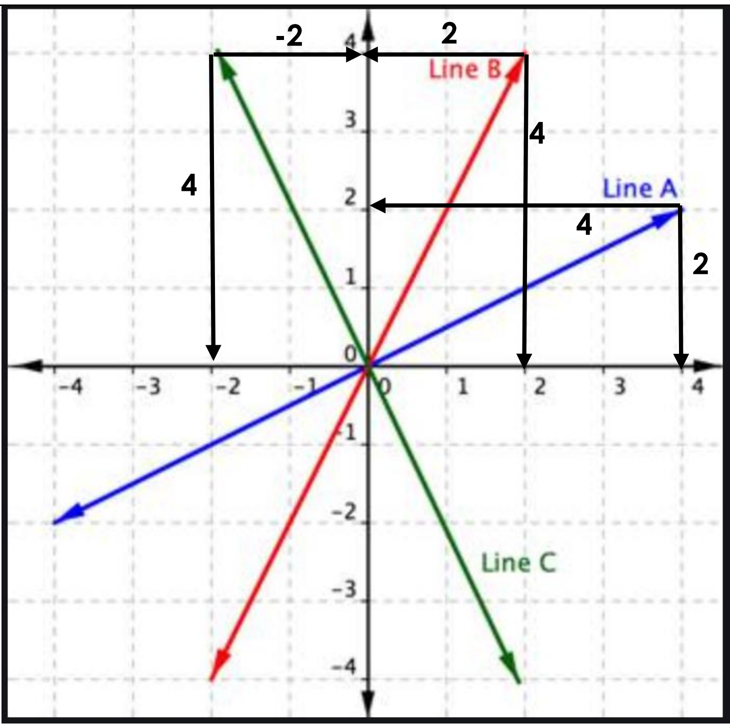
- Gradient: Referred to as the slope/steepness of the graph. It is defined as the rate at which the y-values change as the x-values change.
  It is calculated by using the following equation:

$$\text{Gradient} = \frac{\text{change in } y\text{-values}}{\text{change in } x\text{-values}}$$



The steeper the slope is the bigger the rate of change between the x-coordinate and y-coordinate which means it will have a bigger gradient.

Line B: Changes in $y = 4$ Changes in $x = 2$ $\therefore$ Gradient $= \frac{4}{2}$ $= 2$
Line A: Changes in $y = 2$ Changes in $x = 4$ $\therefore$ Gradient $= \frac{2}{4}$ $= \frac{1}{2}$
Line C: Changes in $y = 4$ Changes in $x = -2$ $\therefore$ Gradient $= \frac{4}{-2}$ $= -2$

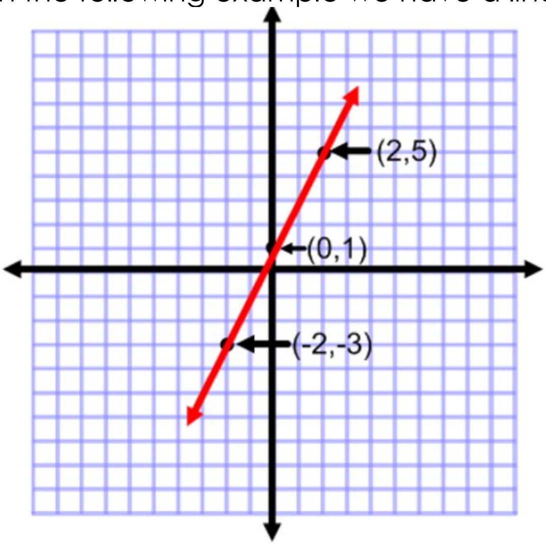


We can see that line B is steeper than line A, when we look at the values of the gradients we notice that the gradient of Line B is also higher than that of Line A. **We can make the deduction that the higher the gradient the steeper the line will be.**

We can also notice that Line B and Line C have similar steepness, the only difference is that Line C is a decreasing function. We can see that Line C has a negative gradient. We can make the deduction that a negative gradient causes the graph to be a decreasing function.

When we have a graph with sets of ordered pairs we can also determine the gradient by using the equation below.

In the following example we have a line graphs with sets of ordered pairs.



Use the following equation to determine the gradient of each. Gradient $= \frac{y_b - y_a}{x_b - x_a}$ Here the a's and the b's represent the sets of ordered pairs.

Here we can choose any two of the three sets of ordered pairs, if we use the set of (2;5) as the first set it will be put into the place of the y_a and x_a and the other set you choose in the place of y_b and x_b.

Let us choose the ordered pairs of (2;5) and (-2;-3).

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

$$\text{Gradient} = \frac{-3-5}{-2-2}$$

$$\text{Gradient} = \frac{-8}{-4}$$

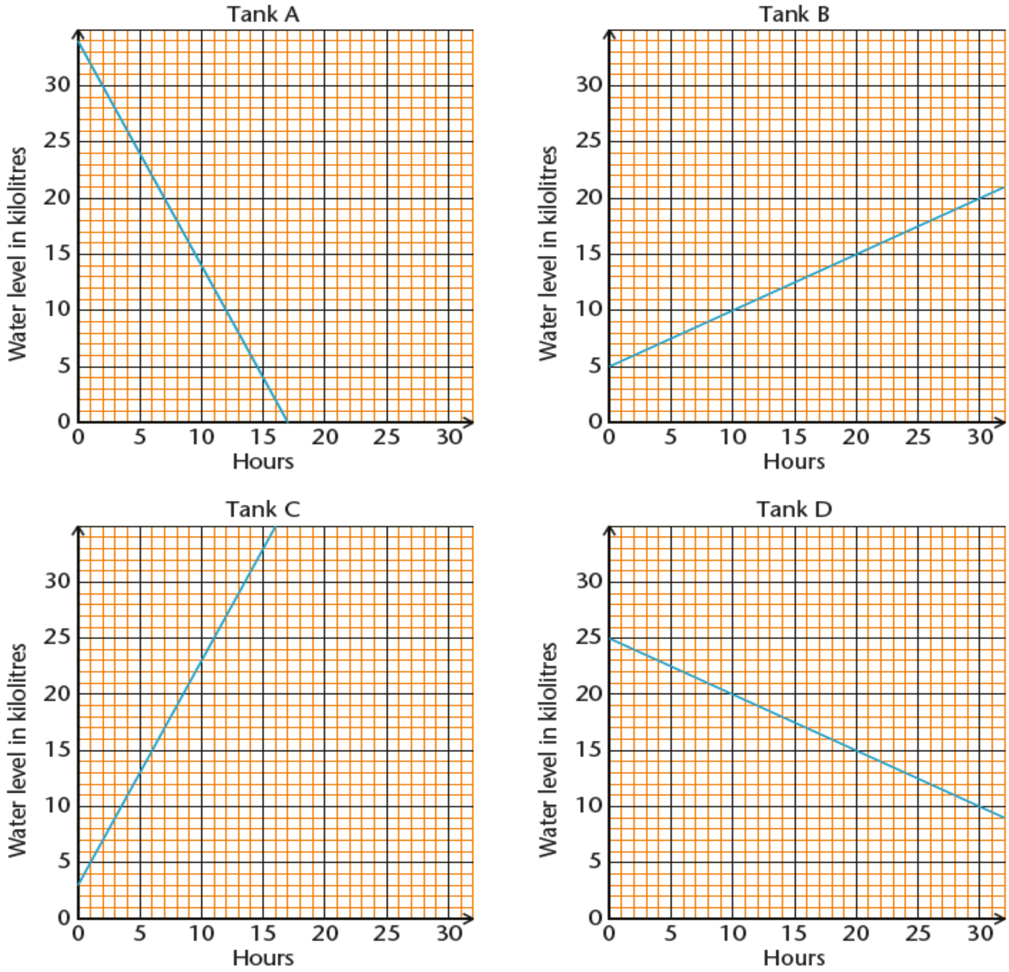
Gradient = 2

CLASSWORK:

Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

ACTIVITY 1:

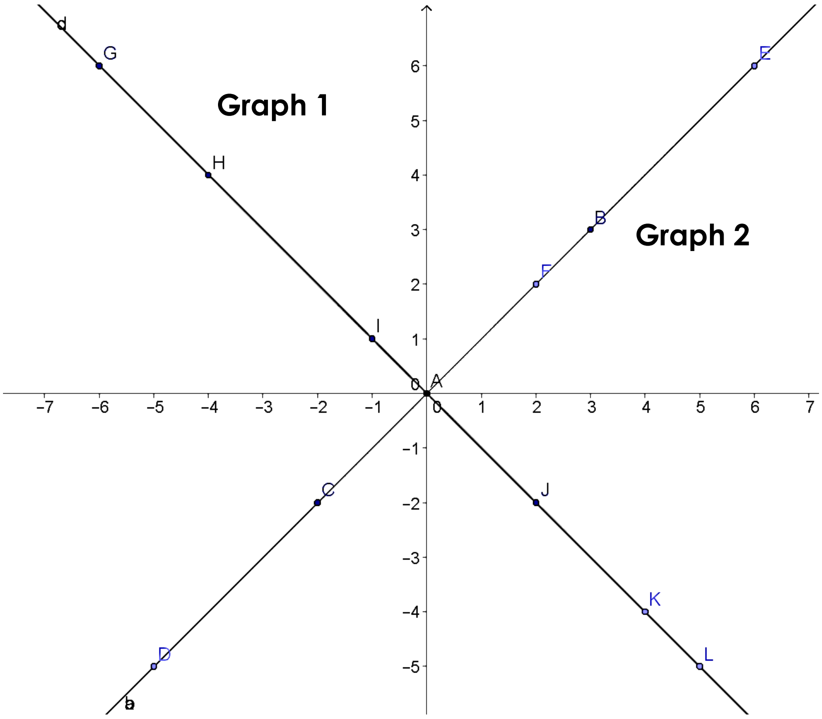
The water levels in kilolitres (k*l*) in different water storage tanks over a period of 30 hours are represented on the graphs below.



- **a.** In which tanks does the water level rise during the 30-hour period?
- **b.** In which tanks does the water level drop during the 30-hour period?
- **c.** How much water is there in each of the tanks at the start of the 30-hour period?
- **d.** Which tank is losing water most rapidly? Explain your answer.
- **e.** Which tank is gaining water the slowest, Explain your answer.

ACTIVITY 2:

The following graph is shown below.



a. What is the difference between the two graphs in terms or direction?
b. Write the coordinates of points B; C; H and I as ordered pairs.
c. Determine the gradients of Graph 1 and Graph 2.

IT IS IMPORTANT TO REMEMBER:

- *x*-intercept: it is the point on the graph that "cuts" the x axis. Where the line cuts the x-axis the y-value will be 0.
- *y*-intercept: it is the point on the graph that "cuts" the y axis. Where the line cuts the y-axis the x-value will be 0
- Gradient: Referred to as the slope/steepness of the graph. It is defined as the rate at which the y-values change as the x-values change.
  It is calculated by using the following equation:

$$\text{Gradient} = \frac{\text{change in } y\text{-values}}{\text{change in } x\text{-values}}$$

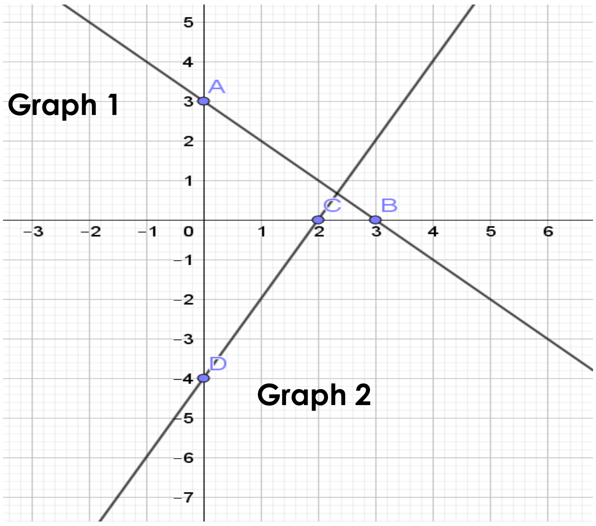
- The higher the gradient, the steeper the line.
- A positive gradient will result in a positive function.
- A negative gradient will result in a negative function.

HOMEWORK:

Do the following exercises,applying what you have learnt today. FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:

Use the following graphs to answer the following questions.



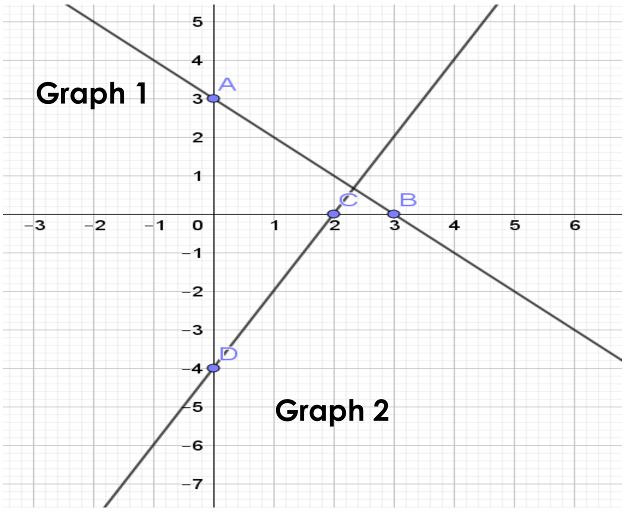
a. Determine the x-intercepts of Graph 1 and Graph 2.

b. Determine the y-intercepts of Graph 1 and Graph 2.

c. Which graph is an increasing function. Explain your answer.

QUESTION 2:

The following graphs are given:



a. What is the difference about the orientation of Graph 1 and Graph 2?

b. Write points A, B, C & D as ordered pairs.

c. Determine the gradients of Graph 1 and Graph 2.

d. Which graph is a decreasing function? Explain your answer.

MEMORANDUM: DAY 5:

CLASSWORK:

ACTIVITY 1:

a. Tank B and Tank C.
b. Tank A and Tank D
c. Tank A = 34 kilolitres
Tank B = 5 kilolitres
Tank C = 3 kilolitres
Tank D = 25 kilolitres
d. Tank A = Loses all of the water after17 hours and Tank D still had water left inside after 30 hours. Tank A's gradient is steeper which means a faster decline.
e. Tank B, its gradient is flatter so that means it is increasing slower than Tank C.

ACTIVITY 2:

a. Graph 1 is a decreasing graph (downwards from left to right) and Graph 2 is an increasing graph (upwards from left to right).
b. B = (3;3)
C = (-2;-2)
H = (-4;4)
I = (-1;1)
c. **Graph 1:**

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

$$\text{Gradient} = \frac{4-1}{-4-(-1)}$$

$$\text{Gradient} = \frac{3}{-3}$$

$$\text{Gradient} = -1$$

Graph 2:

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

$$\text{Gradient} = \frac{3-(-2)}{3-(-2)}$$

$$\text{Gradient} = \frac{3+2}{3+2}$$

$$\text{Gradient} = \frac{5}{5}$$

Gradient = 1

HOMEWORK:

QUESTION 1:

a. Graph 1:
x-intercept = 3
Graph 2:
x-intercept = 2

b. Graph 1:
y-intercept = 3
Graph 2:
y-intercept = -4

c. Graph 2. It is increasing function because it is moving upwards from left to right.

QUESTION 2:

a. Graph 1 is a decreasing graph (downwards from left to right) and Graph 2 is an increasing graph (upwards from left to right).

b. A = (0;3)
B = (3;0)
C = (2;0)
D = (0;-4)

c. Graph 1:

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

$$\text{Gradient} = \frac{3-0}{0-3}$$

$$\text{Gradient} = \frac{3}{-3}$$

$$\text{Gradient} = -1$$

Graph 2:

$$\text{Gradient} = \frac{0-(-4)}{2-0}$$

$$\text{Gradient} = \frac{0+4}{2}$$

$$\text{Gradient} = \frac{4}{2}$$

Gradient = 2

d. Graph 1. It is a decreasing function because it is moving downwards from left to right. It also has a negative gradient which indicates a decreasing function.

DAY 6:

LESSON DEVELOPMENT:

Draw global graphs from given descriptions of problem situations:

- Identifying the variables that are in relationship with each other.
    - When we work with the data used to draw graphs we need a clear understanding of which set is the dependent variable and which set is the independent variable.
      When we work in a table it is easy to distinguish which one is the dependent and which one is the independent variable.

Number of tracksuits	0	1	2	3	4
Cost (R)	100	150	200	250	300

- Independent variable – The number of tracksuits, this will go on the x-axis.
- Dependent variable – Cost (R), this will go on the y-axis.

An easy way to remember it is to think of when we use a table with x- and y-values,

Independent variables

Dependent variables

x	1	2	3	4	5
y	2	5	8	11	14

In these tables the x-values (independent variable) are on top and the y-values (dependent variables) are at the bottom, the same can be said for the examples we work with in global graphs.

When we work with vertical graphs the x-values will be the column on the left and the y-values on the right.

Independent variables

x	y
1	2
2	5
3	8
4	11
5	14

Dependent variables

- Understand the relationship between the dependant and independent variables.
    - The independent variable can be changed without it having an effect on the other variable.
    - The dependent variable will change according to the other variable.
- Independent variable values are placed on the x-axis and the dependant variable values are placed on the y-axis.

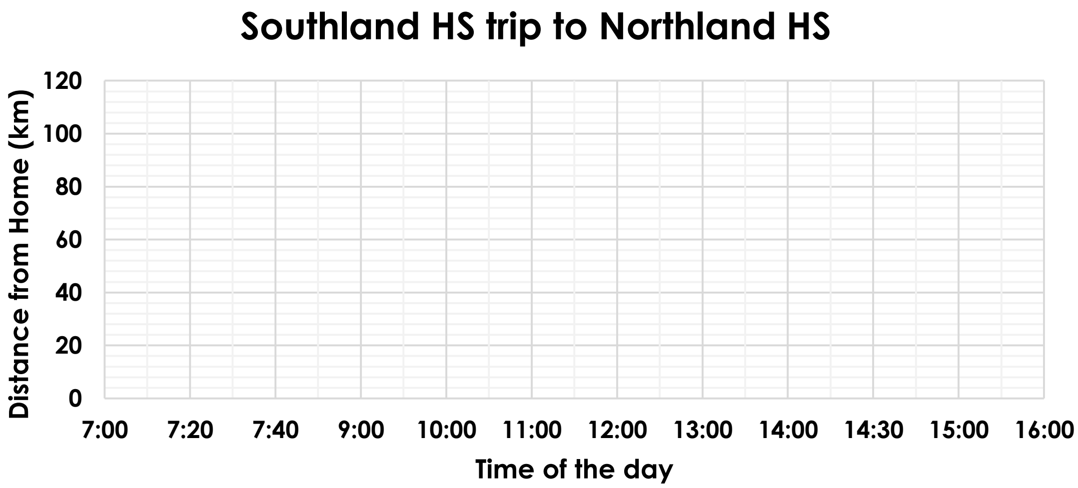
CLASSWORK:

Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

ACTIVITY 1:

The rugby team left Southland High School to play a match against Northland High School. The team left at 07:00 in the morning. They stopped for 20 minutes at a garage, 10 km away from the school to put in petrol. They continued their journey of 100 km. They arrived at Northland High School at 09:00. The matches ended at 14:00. The team started its journey back to Southland High School. On its way back, 50 km away from home, the bus got a puncture which took 30 minutes to fix. They arrived back home at 16:00.

- **a.** Name the two variables in the example above.
- **b.** Which variable is the dependent variable?
- **c.** Represent the situation above in a graph on the attached set of axes.



ACTIVITY 2:

Peter puts 50 litres of water in his bath to wash and spends 15 minutes bathing. He gets out and pulls out the plug to let the water out. The bath loses water at a rate of 10 litres per 30 seconds.

- **a.** Name the two variables in the example above.
- **b.** Which variable is the independent variable?

IT IS IMPORTANT TO REMEMBER:

- When we work with the data used to draw graphs we need a clear understanding of which set is the dependent variable and which set is the independent variable.
- Understand the relationship between the dependant and independent variables.
  - The independent variable can be changed without it having an effect on the other variable.
  - The dependent variable will change according to the other variable.
- Independent variable values are placed on the x-axis and the dependant variable values are placed on the y-axis

HOMEWORK:

Do the following exercises,applying what you have learnt today. FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:

Meagan rides her bike to a friend's house for a visit. She leaves home at 13:00, ride 5 km and arrives at her friend's house at 14:00. They watch a movie till 16:00 after which she goes back home. On her way home she stops for 15minutes at the tuck shop for a cold drink. She arrives home at 16:30

- Name the two variables in the example above.
- Which variable is the independent variable?

QUESTION 2:

Peter is practicing for a marathon. His practice session is as follows:

- He runs a distance of 10km in 40 minutes
- He rests for 5 minutes
- It takes him another 20 minutes to run a distance of 5 km.
- He rests for another 5 minutes while he stopped at the shop.
- He turns around and it takes him 45 minutes to run the 15 km home.

a. Name the two variables in the example above.
b. Which variable is the dependent variable?
c. Represent the situation above in a graph on the attached set of axes.

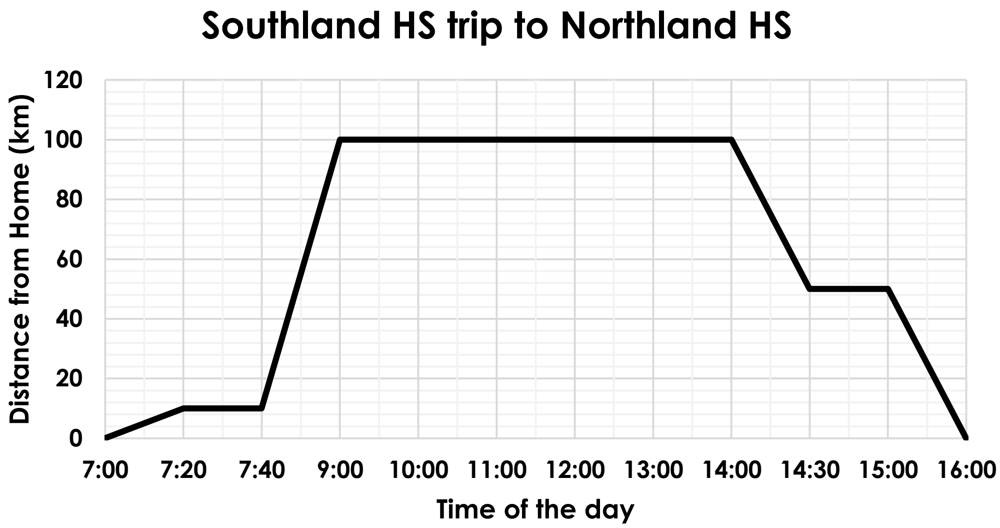
d. What was the total distance of his practice session?
e. How long did his practice session last?
f. During which session did he run the fastest?

MEMORANDUM: DAY 6:

CLASSWORK:

ACTIVITY 1:

- **a.** Distance away from home and time of day.
- **b.** The distance away from home
- **c.**



ACTIVITY 2:

- **a.** Water in the bath and time bathing
- **b.** Time bathing

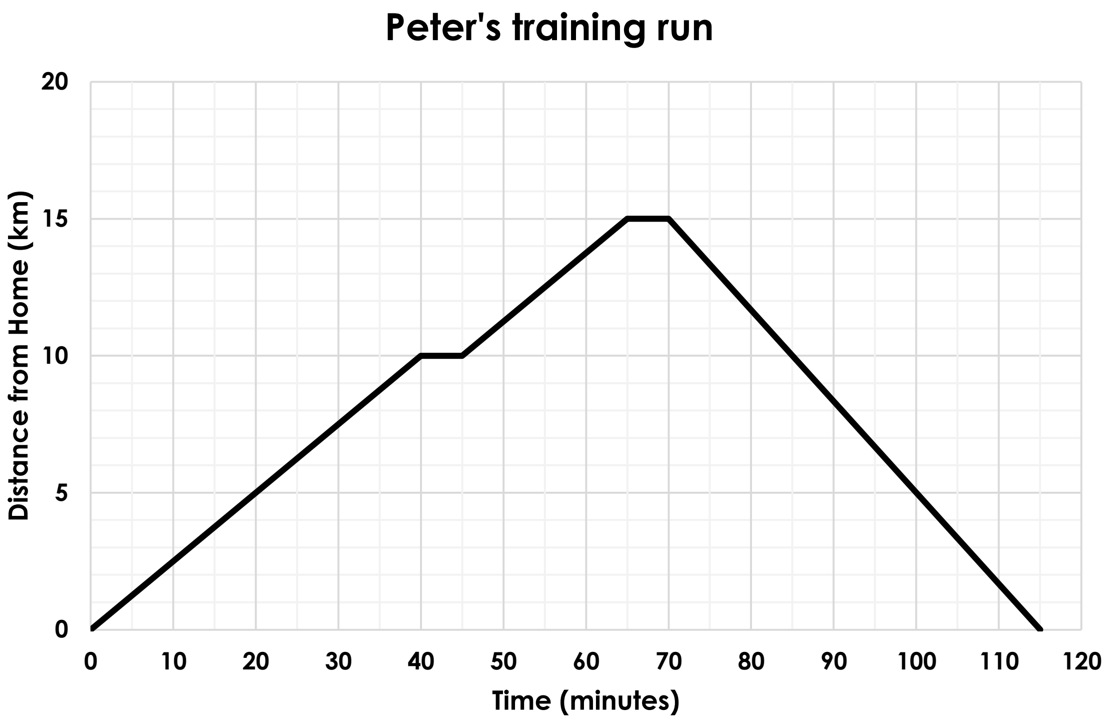
HOMEWORK:

QUESTION 1:

- **a.** Time of the day and distance from home
- **b.** Time of the day

QUESTION 2:

- **a.** Distance from home and time
- **b.** Distance from home.
- **c.**



d. 30 kilometres

e. 115 min

f. When he turned around, his gradient is steeper for that session which means he had a faster rate of change (ran faster)

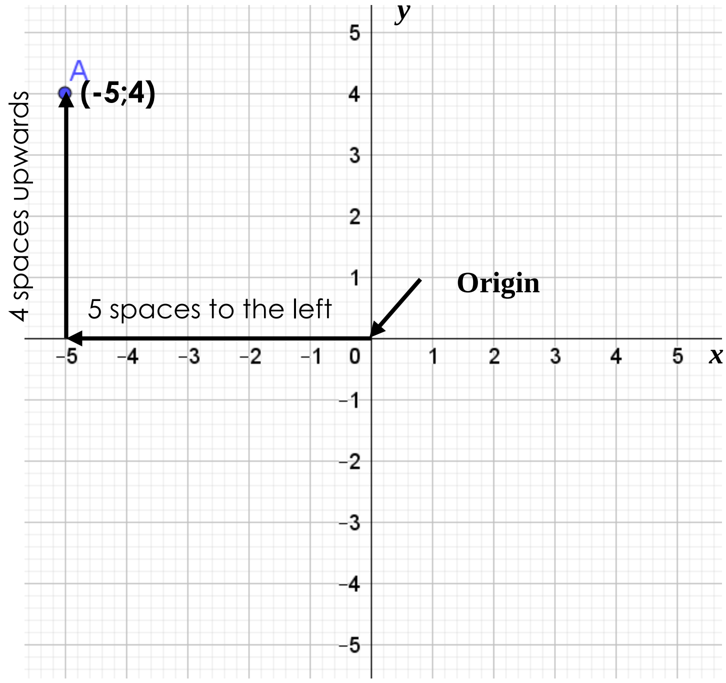
DAY 7:

LESSON DEVELOPMENT:

Use tables of ordered pairs to plot points on a Cartesian plane:

- Cartesian plane is a system where all points can be described by x- and y-coordinates, the Cartesian plane allows for both positive and negative values on the x- and y-axes.
- Understand that the horizontal line represents the x-axis and the vertical line represents the y-axis.
- Where the x-axis and y-axis intersect is referred to as the Origin – both axes has a 0 value.
- Both axes has intervals numbered by integers.
- Set of x- and y-values are called ordered pairs. Numbers are written inside brackets and separated by a semicolon e.g. **(-5;4).**
- The first number of an ordered pair is how far left or right the value is on the x-axis. With (-5;4) the -5 represents the x-axis value. This means that we have to move 5 spaces to the left from the origin.
- The second number of an ordered pair shows how far up or down to move from zero on the y-axis. With (-5;4) the 4 represents the y-axis value. This means that we have to move 4 spaces upwards from the x-axis at -5.

Below is an example of a Cartesian plane with the above mentioned indicated.



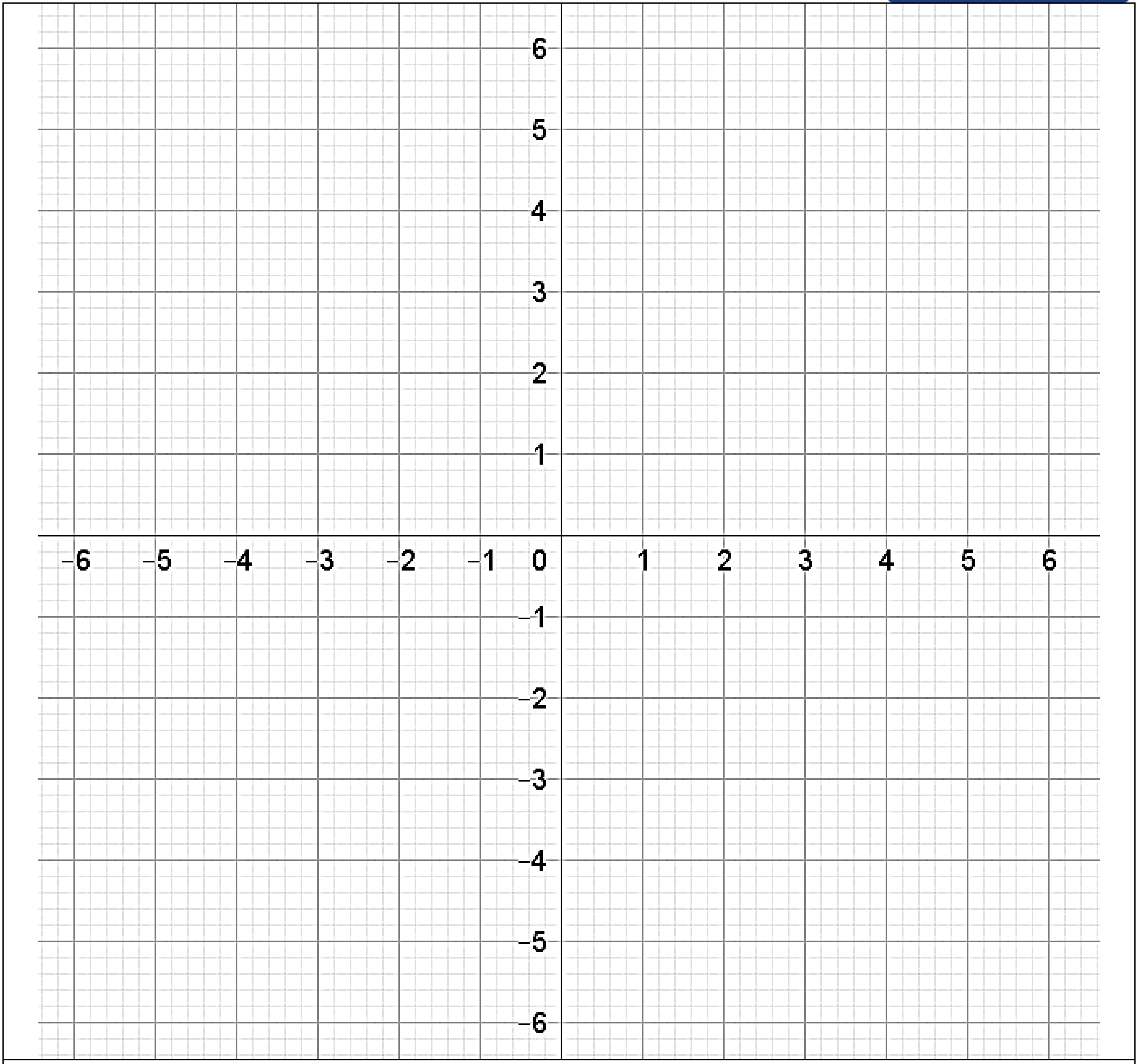
CLASSWORK:

Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

ACTIVITY 1:

Plot the following points on a Cartesian plane.

- **a)** (-4;3)
- **b)** (3;4)
- **c)** (0;2)
- **d)** (3;0)
- **e)** (-3;-4)
- **f)** (2;-3)



IT IS IMPORTANT TO REMEMBER:

- The Cartesian plane is a system where all points can be described by x- and y-coordinates.
- The horizontal number line represents the x-axis.
- The vertical number line represents the y-axis.
- The x-coordinate is the position along (how far left or right) the x-axis.
- The y-coordinate is the position along (how far up or down) the y-axis.
- The origin is the point where the horizontal and vertical axes meet.
- An ordered pair is given in the form $(x;y)$.

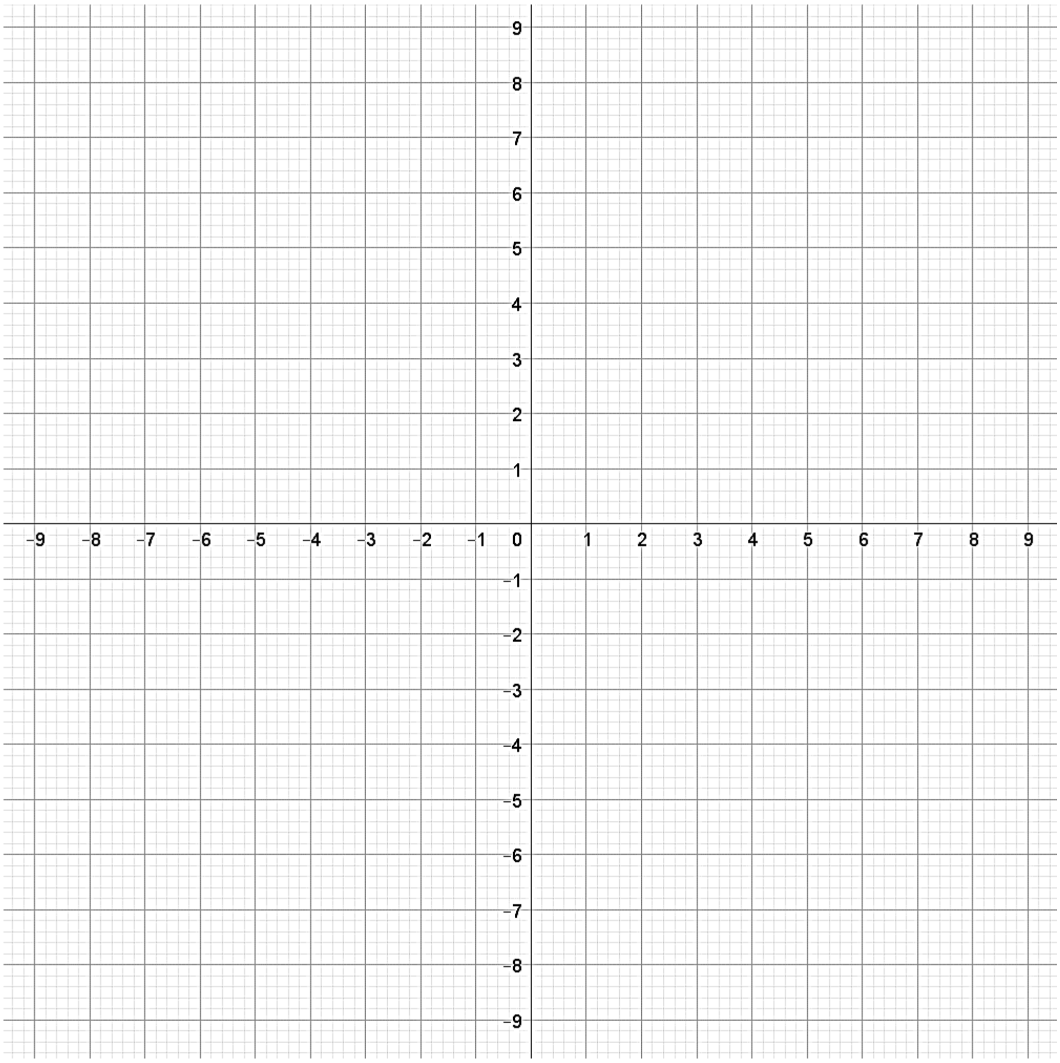
HOMEWORK:

Do the following exercises,applying what you have learnt today. FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:

Plot the following points on the Cartesian plane:

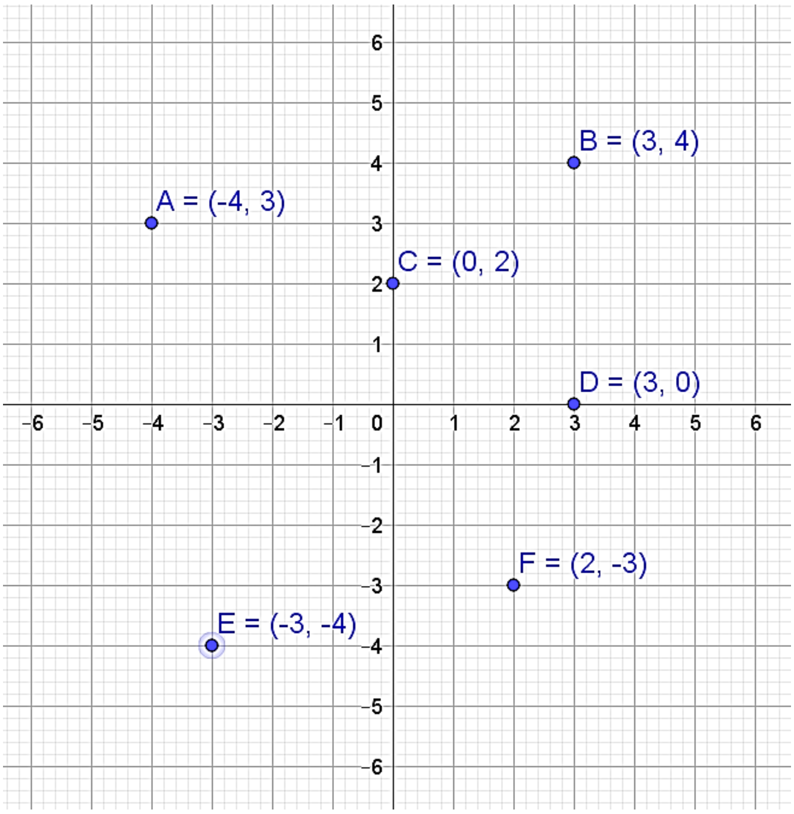
- **a)** (-4;2)
- **b)** (8;0)
- **c)** (-5;-4)
- **d)** (0;-5)
- **e)** (-7;5)
- **f)** (8;9)



MEMORANDUM: DAY 7:

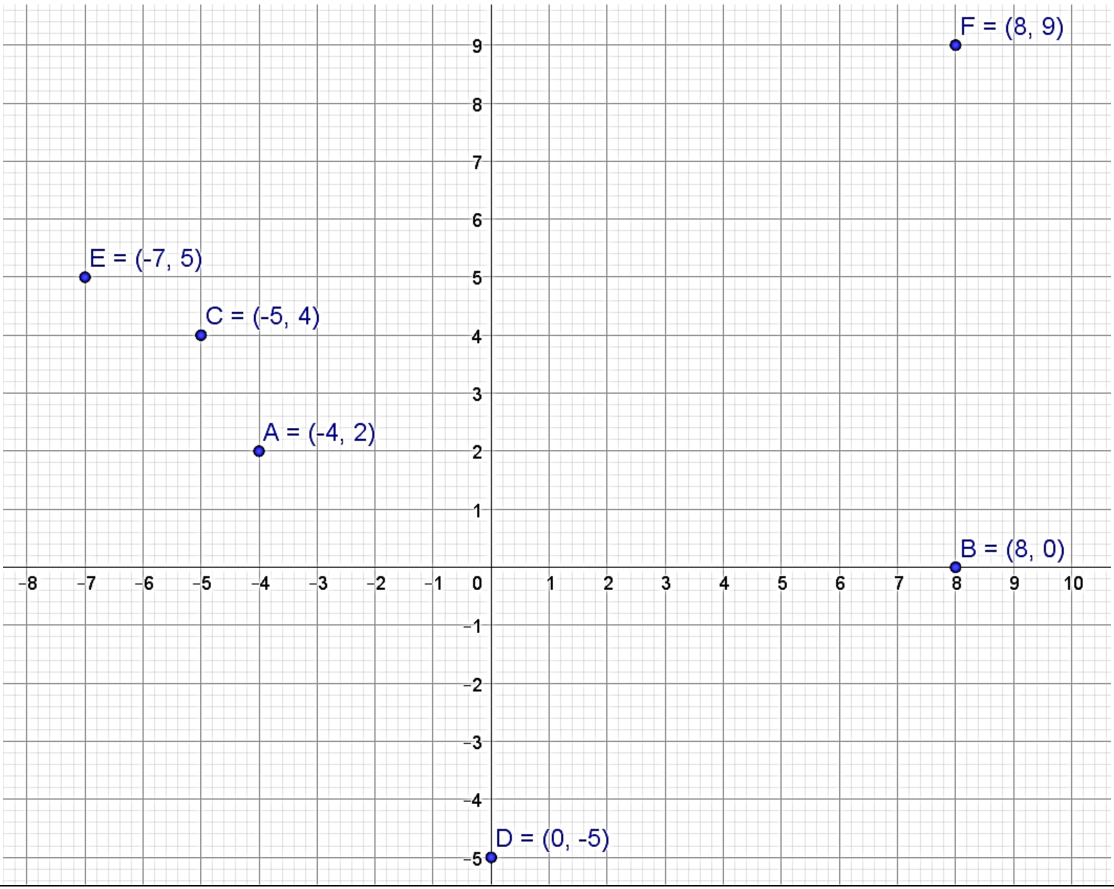
CLASSWORK:

ACTIVITY 1:



HOMEWORK:

QUESTION 1:



DAY 8:

LESSON DEVELOPMENT:

Drawing linear graphs from given equations:

- Emphasise that the x-value is the independent variable and the y-value is the dependant variable.
  - As we discussed in the Lesson 6, it is very important to understand which variable is the dependent variable and which one is the independent variable when working with a table of values.
  - **An easy way to remember it is to think of when we use a table with x- and y-values,**

Independent variables	x	1	2	3	4	5
Dependent variables	y	2	5	8	11	14

  - In these tables the x-values (independent variable) are on top and the y-values (dependent variables) are at the bottom, the same can be said for the examples we work with in global graphs.
  - When we work with vertical table the x-values will be the column on the left and the y-values on the right.

Independent variables | **Dependent variables**

x	y
1	2
2	5
3	8
4	11
5	14

- The equation can be used to substitute the x-value to calculate the corresponding y-value.
  - When we do this method we are going to set up our own table of corresponding x- and y-values through substitution. These values will become ordered pairs that we will plot on a Cartesian plane as done in the previous lesson (Lesson 7).

Example: Sketch a graph of a linear function given by the equation $y = 2x + 3$.

Follow these steps to draw the linear function:

1. The x-value is the dependent variable so select a set of x-values to represent x and that will be used to determine their corresponding y-values.
Let's use the integers from -3 to 3.

x	-3	-2	-1	0	1	2	3
y							

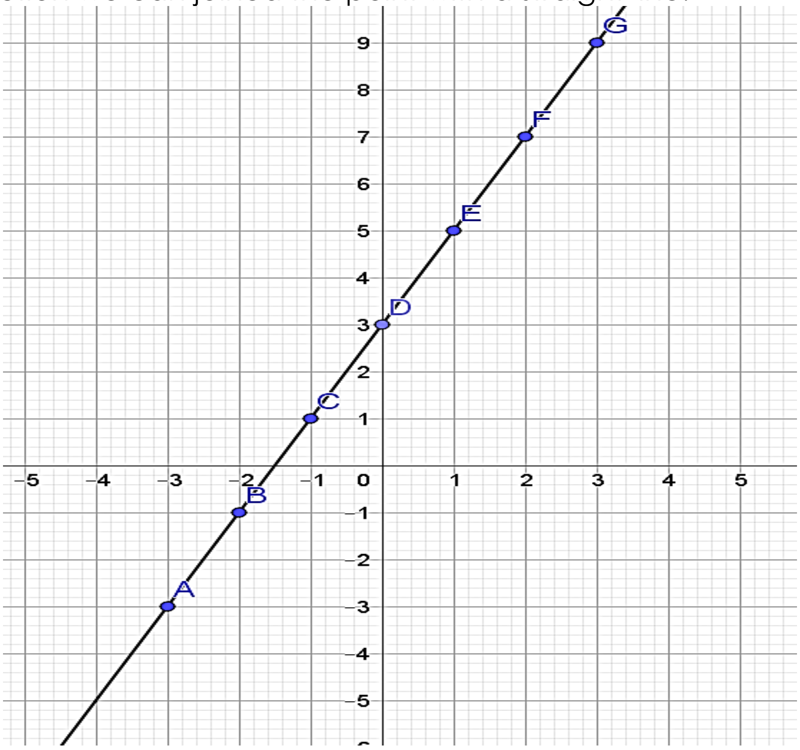
2. Use the given equation and substitute the values in the table above into the place of x to determine the corresponding y-value.
Equation: $y = 2x + 3$
$y = 2(-3) + 3 = -3$
$y = 2(-2) + 3 = -1$
$y = 2(-1) + 3 = 1$
$y = 2(0) + 3 = 3$
$y = 2(1) + 3 = 5$
$y = 2(2) + 3 = 7$
$y = 2(3) + 3 = 9$

These values that we calculated will be added to the table above that we create the ordered pairs.

x	-3	-2	-1	0	1	2	3
y	-3	-1	1	3	5	7	9

Ordered pairs that we will use to plot on the Cartesian plane

3. We can now use these ordered pairs to plot on the Cartesian plane and because it is a linear function we can joined the point with a straight line.



- The x-intercept and the y-intercept can be used to draw linear graphs.
  - This method is called the dual intercept method.
  - We will determine the x- and y-intercepts of the graph by using the equation.
  - We will use these points to plot on a Cartesian plane and join the two intercepts with a straight line to draw the linear function.

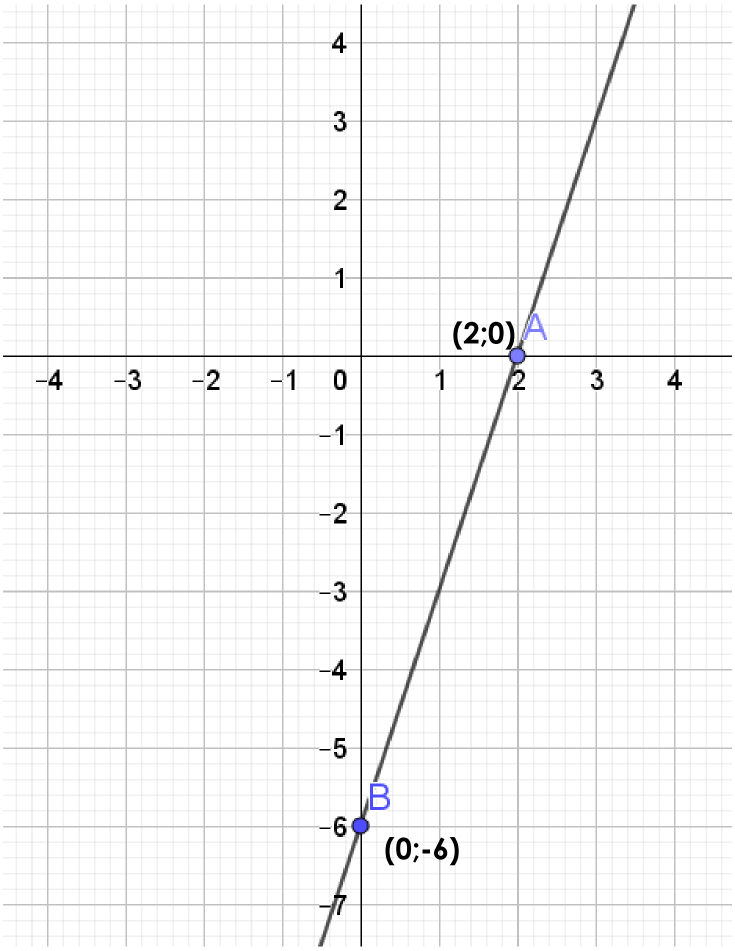
Example: Sketch a graph of a linear function given by the equation $y = 3x - 6$ by using the dual intercept method.

Follow these steps to draw the linear function:

1. Determine the x-intercept by substituting y = 0 into the equation. And write the answer as an ordered pair in the form (x;0)
   x-intercept: Let y = 0
   $y = 3x - 6$
   $0 = 3x - 6$
   $3x = 6$
   $x = 2$
   This will then get written as (2;0)

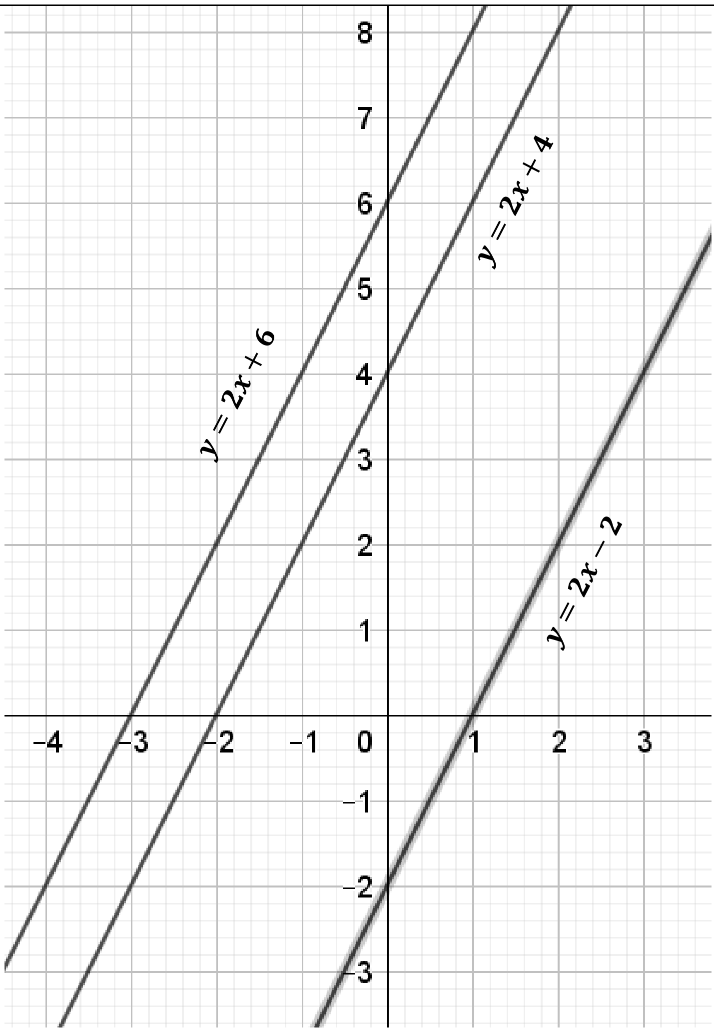
   When we get to this point we just have to solve for x in the equation.

2. Determine the y-intercept by substituting x = 0 into the equation. And write the answer as an ordered pair in the form (0;y)
   y-intercept: Let x = 0
   $y = 3x - 6$
   $y = 3(0) - 6$
   $y = -6$
   This will then get written as (0;-6)
3. We will plot these two ordered pairs on the Cartesian plane and join the points with a straight line.



- The effect of changing the y-intercept on the linear graph.
  When we change the value of the y-intercept on a linear graph we will be moving the graph upwards when we increase the value of the y-intercept and downwards when we decrease the value of the y-intercept.

  Let us start with an equation of $y = 2x + 4$ and we will increase the y-intercept to +6 ($y = 2x + 6$)and also decrease it to -2 ($y = 2x - 2$).



From the graph above we can see that increasing the value of the y-intercept to +6 it shifted the y-intercept 2 units higher to +6. The graph shifted upwards by 2 units. When we changed the y-intercept from +4 to -2 we shifted the y-intercept of the graph 6 units down to -2.
The shifting by changing the y-intercept had no effect on the gradient – the lines remains parallel to each other and that means that the gradients did not change.

CLASSWORK:

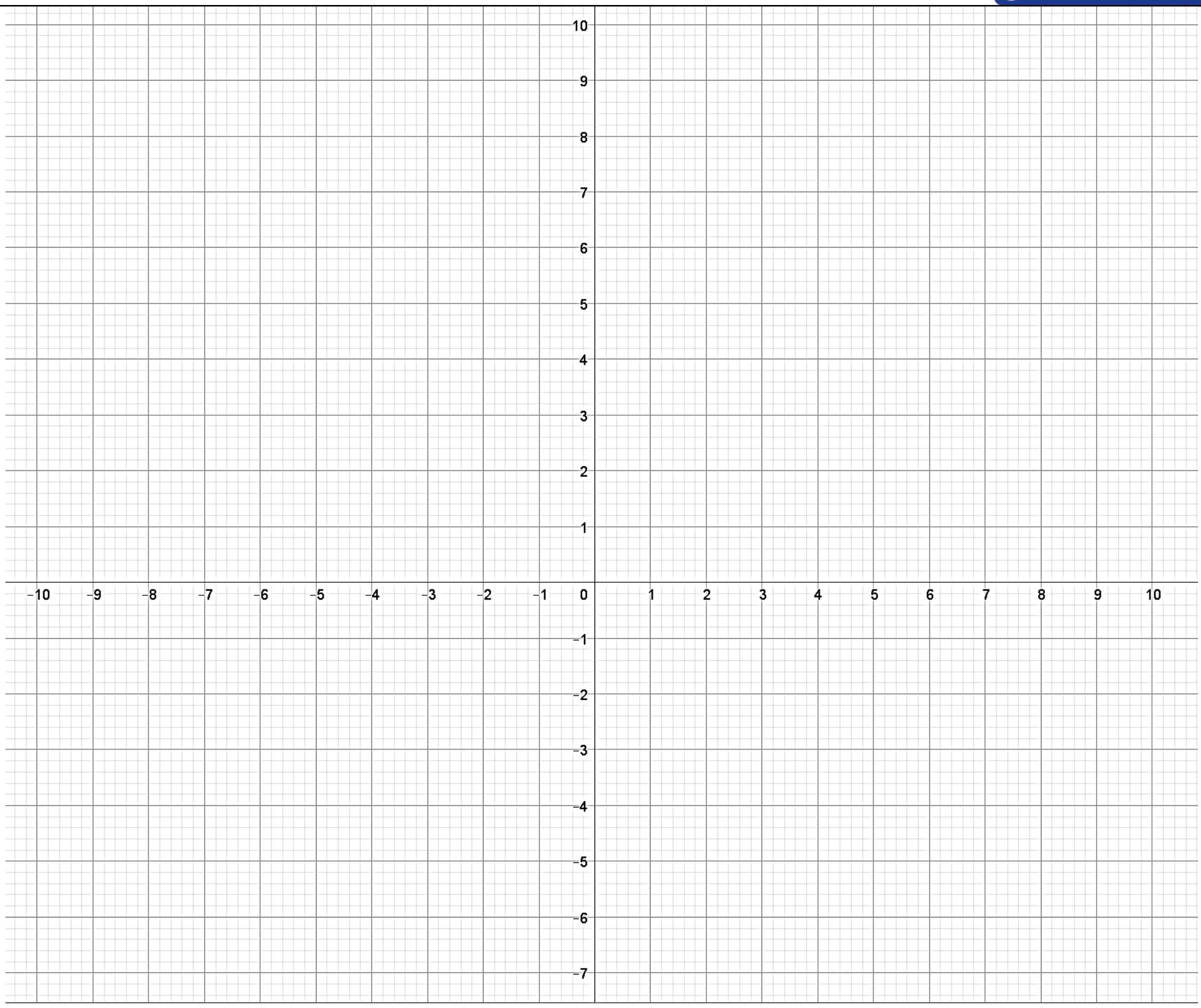
Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

Use the Cartesian plane below to plot your points for ACTIVITIES 1 – 3.

ACTIVITY 1:

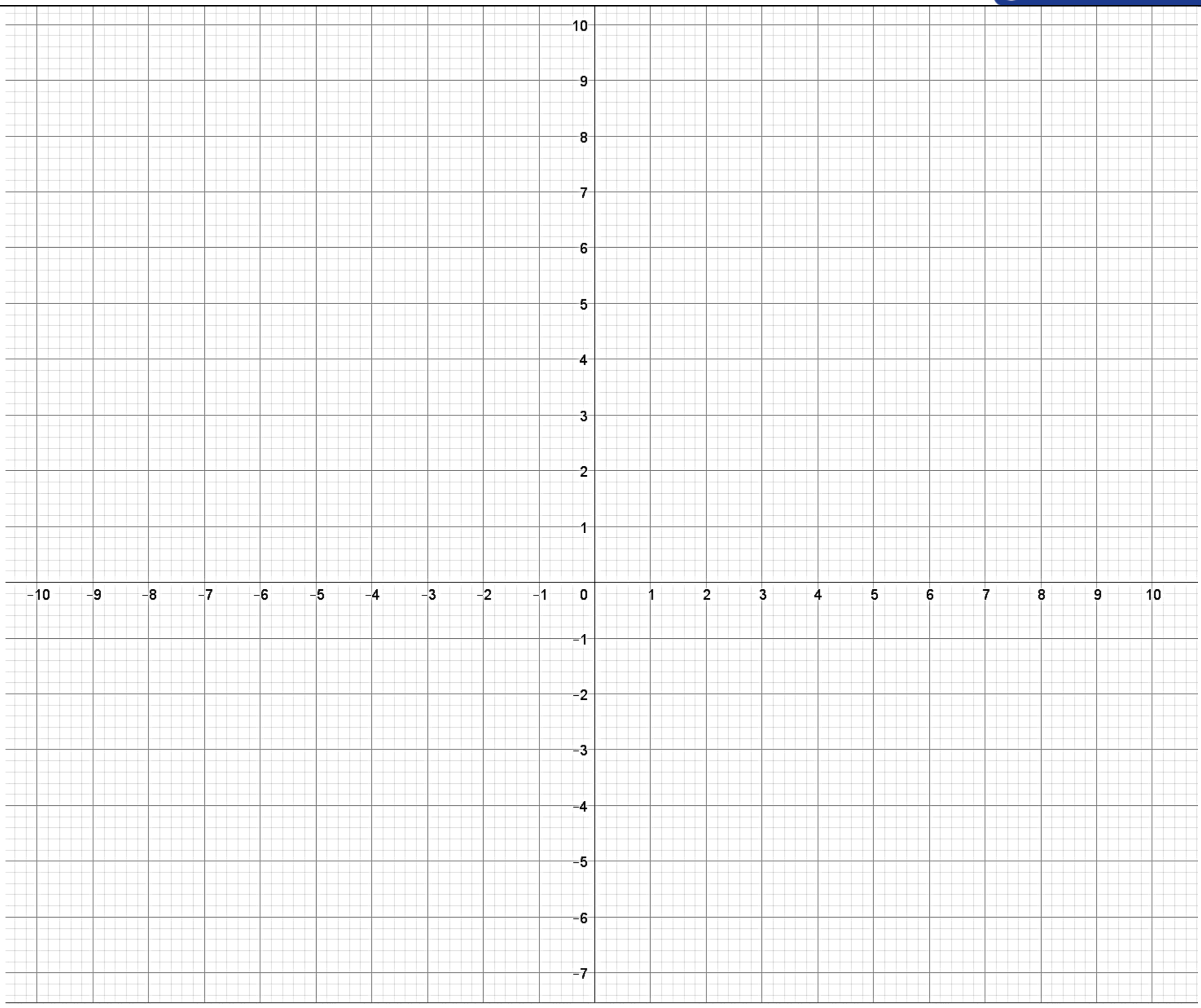
From the equation $y = -x + 4$, complete the tables and write down the ordered pairs. Plot the points on a Cartesian plane. Join the points to form a straight line.

x	-3	-2	-1	0	1	2	3
y							



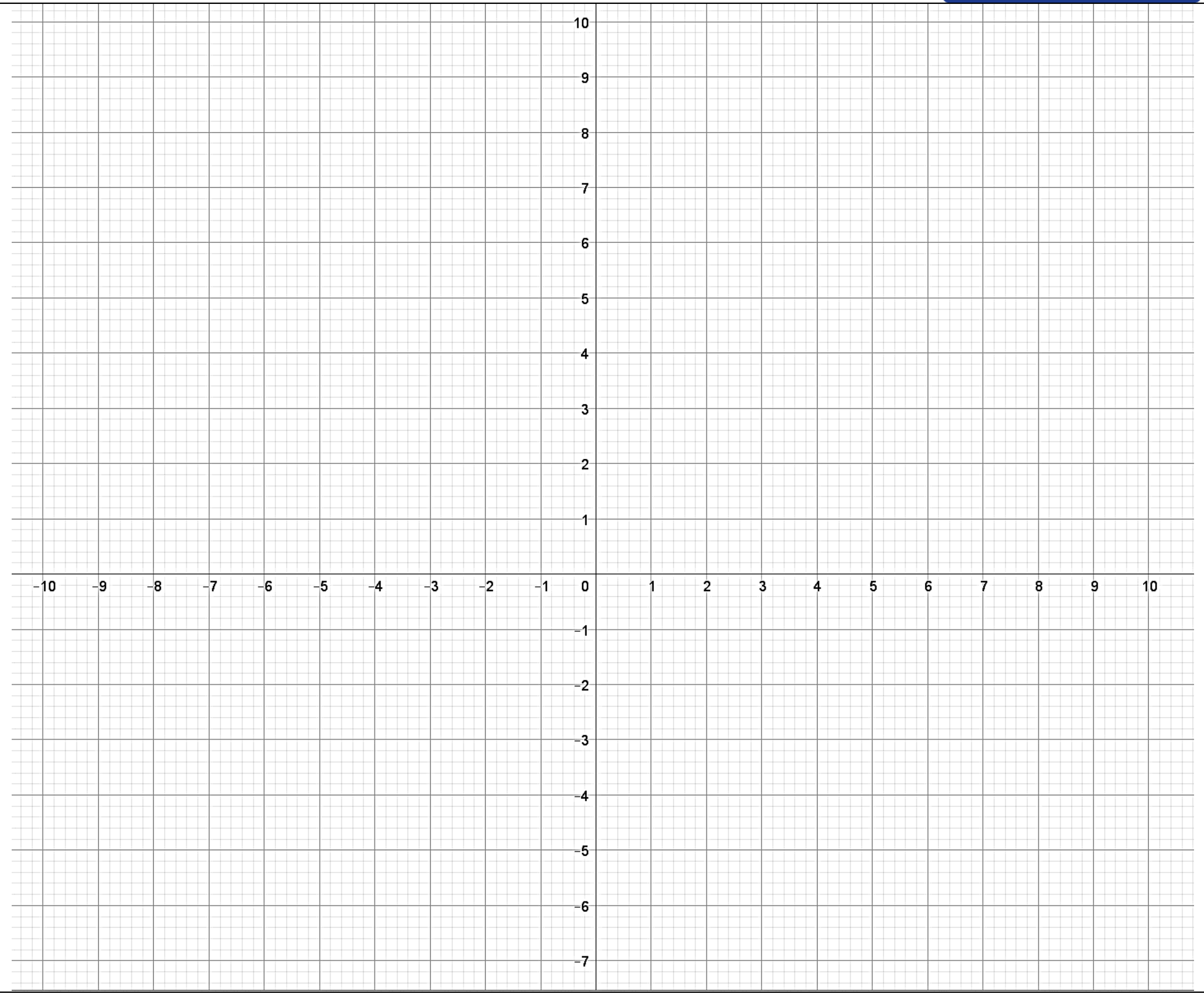
ACTIVITY 2:

Use the dual intercept method to draw the graph of $y = 2x + 2$.



ACTIVITY 3:

Use any method to draw the graph of $3y - 3x = 6$



IT IS IMPORTANT TO REMEMBER:

- **Drawing linear graphs from given equations:**
  - Emphasise that the x-value is the independent variable and the y-value is the dependant variable.
  - The equation can be used to substitute the x-value to calculate the corresponding y-value.
  - The x-value and corresponding y-value becomes an ordered pair is plotted accordingly on the Cartesian plane.
  - The x-intercept and the y-intercept can be used to draw linear graphs.
  - The effect of changing the y-intercept on the linear graph, when we increase the value of the y-intercept we shift the graph upwards and when we decrease the value of the y-intercept we shift the graph downwards.

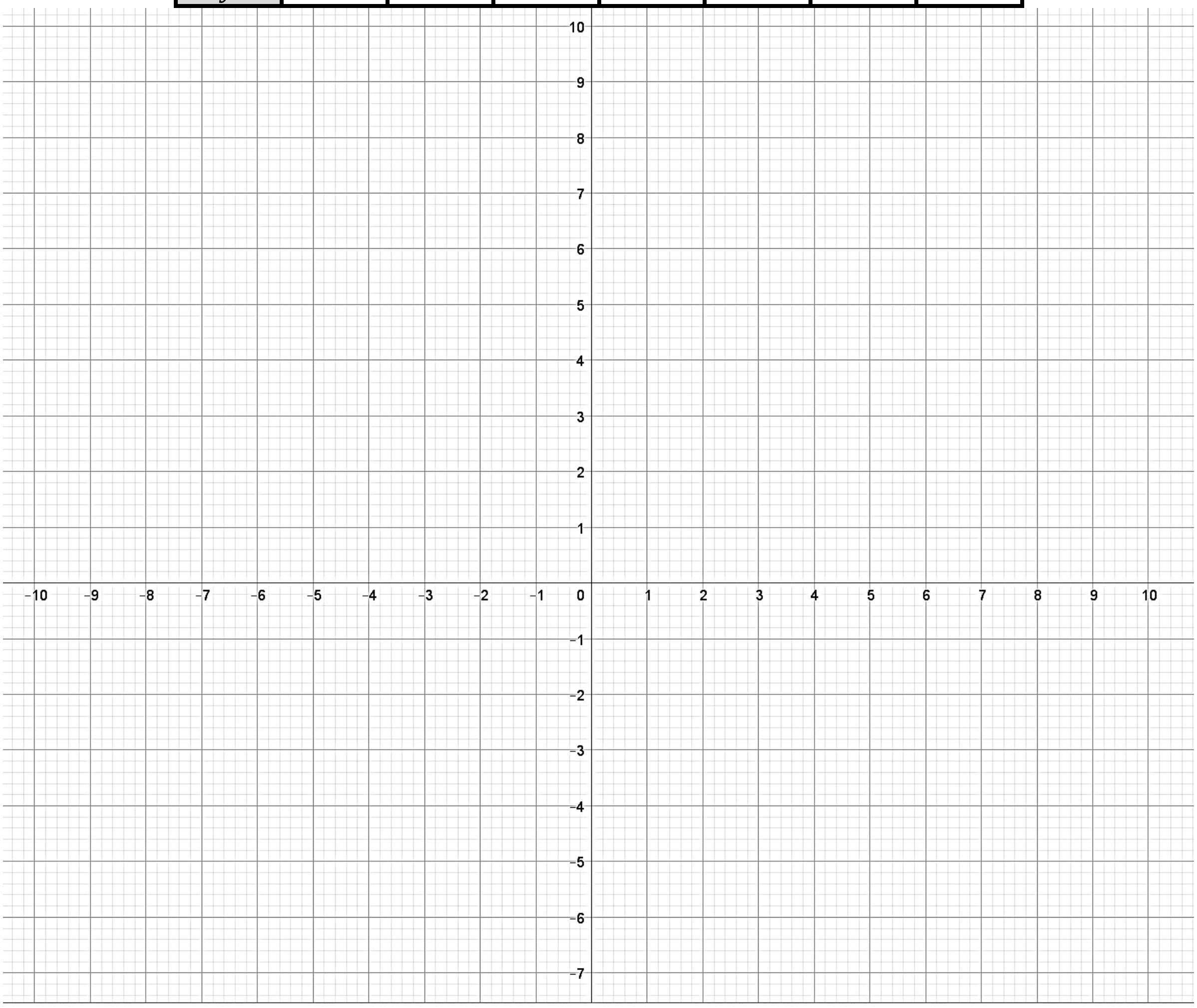
HOMEWORK:

Do the following exercises,applying what you have learnt today. FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:

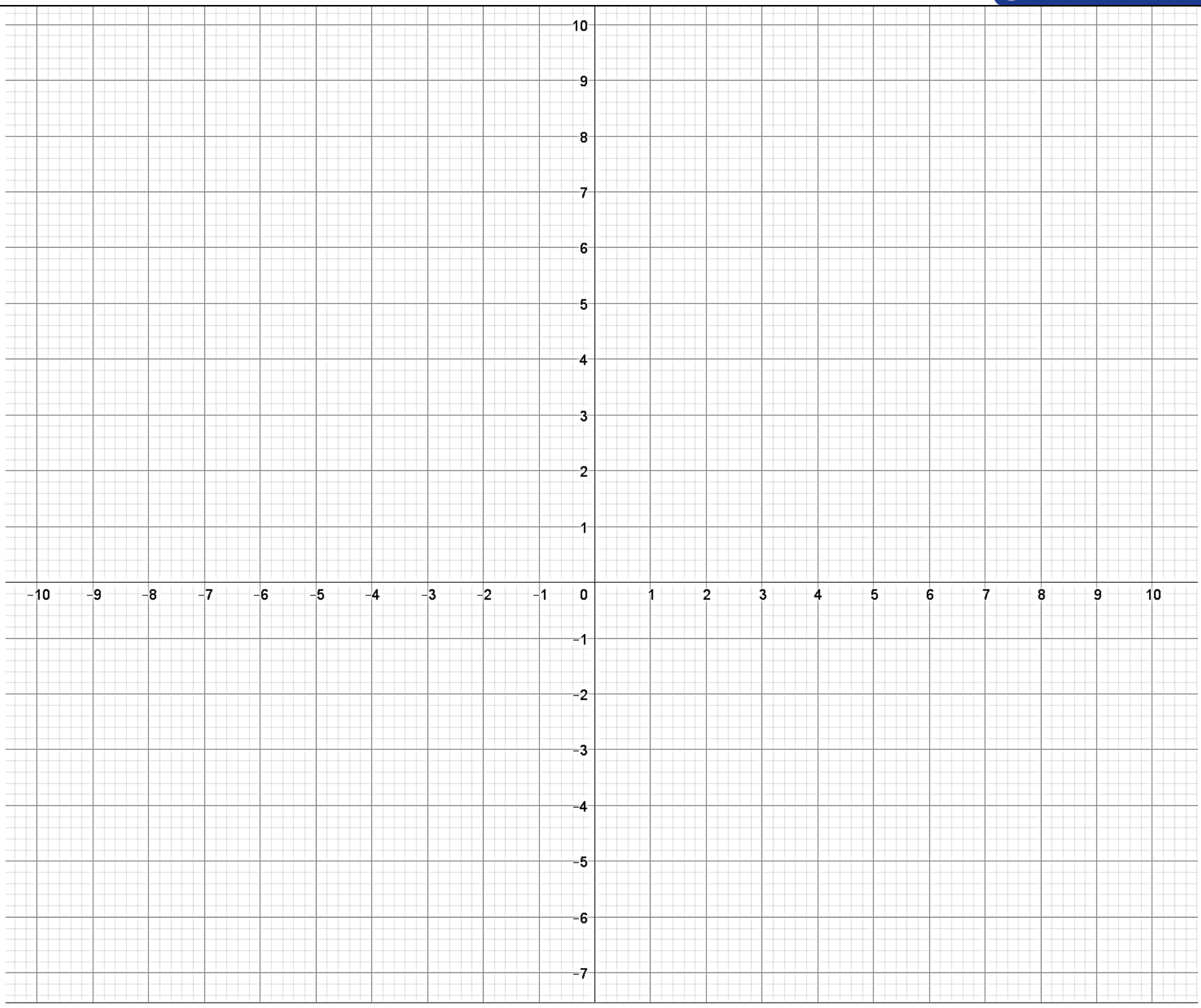
From the equation $y = -2x + 4$, complete the tables and write down the ordered pairs. Plot the points on a Cartesian plane. Join the points to form a straight line.

x	-3	-2	-1	0	1	2	3
y							



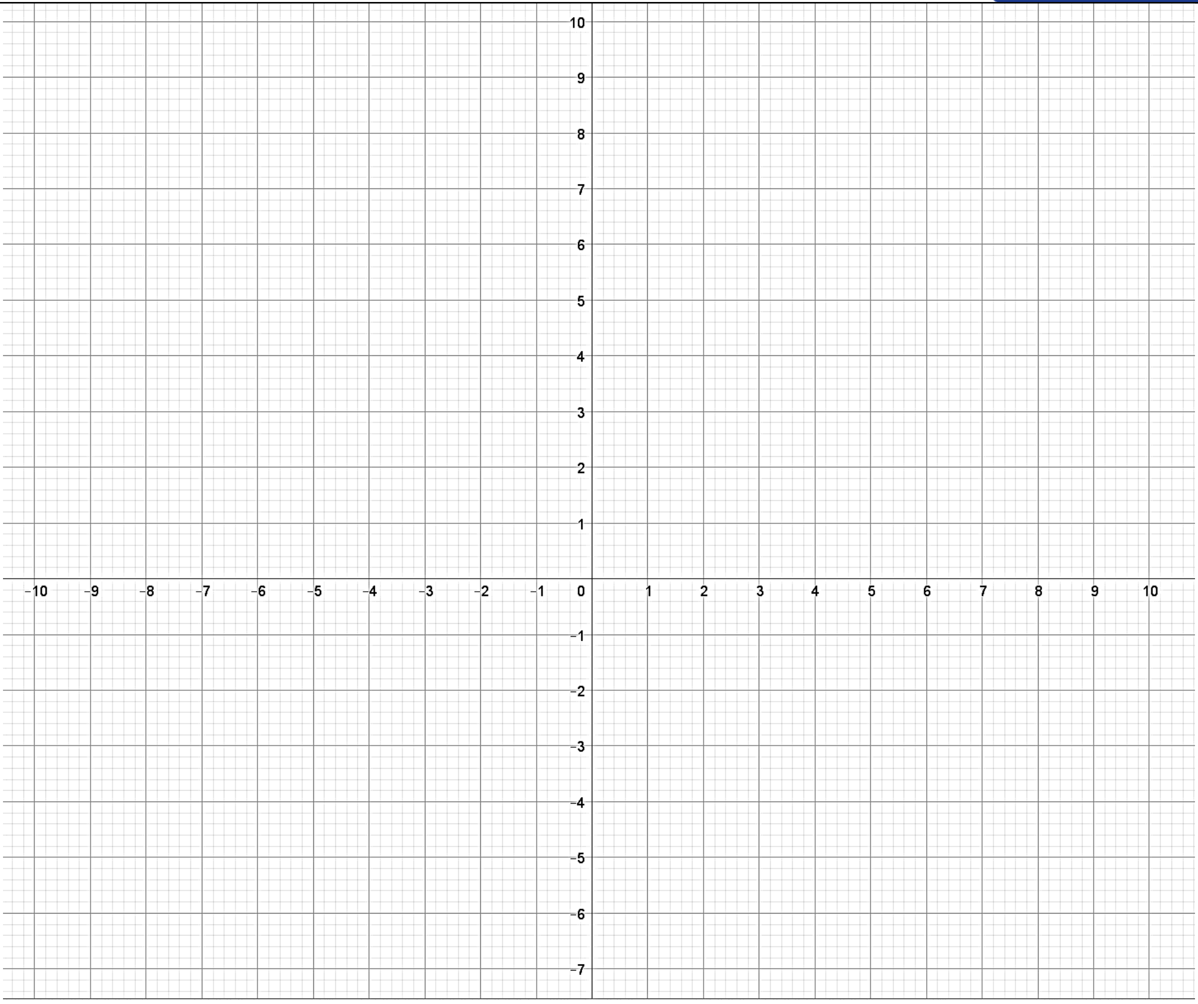
QUESTION 2:

Use the dual intercept method to draw the graph of $y = x + 6$.



QUESTION 3:

Use any method to draw the graph of $2y - 4x = 6$



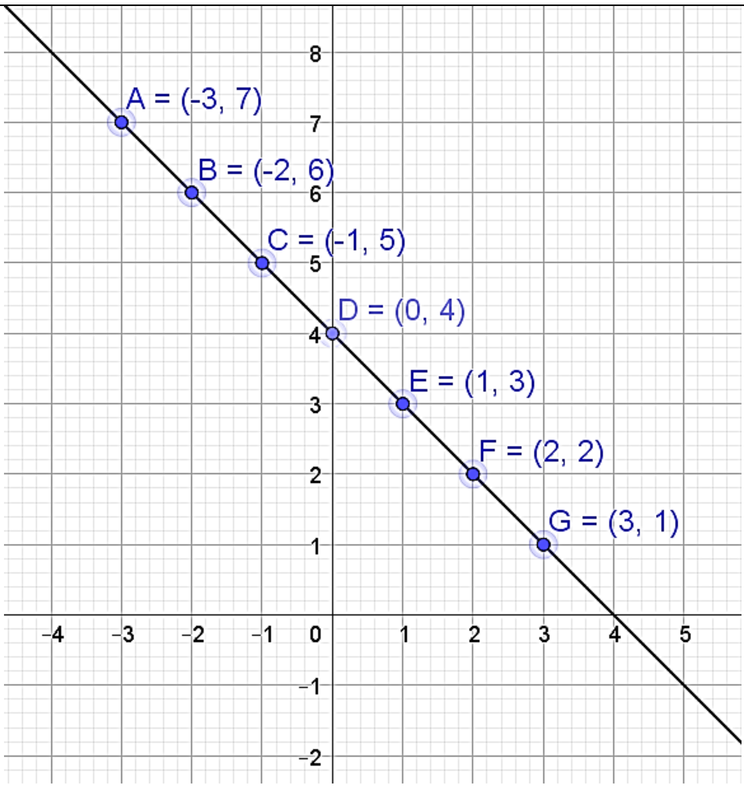
MEMORANDUM: DAY 8:

CLASSWORK:

ACTIVITY 1:

$$y = -x + 4$$

x	-3	-2	-1	0	1	2	3
y	7	6	5	4	3	2	1



ACTIVITY 2:

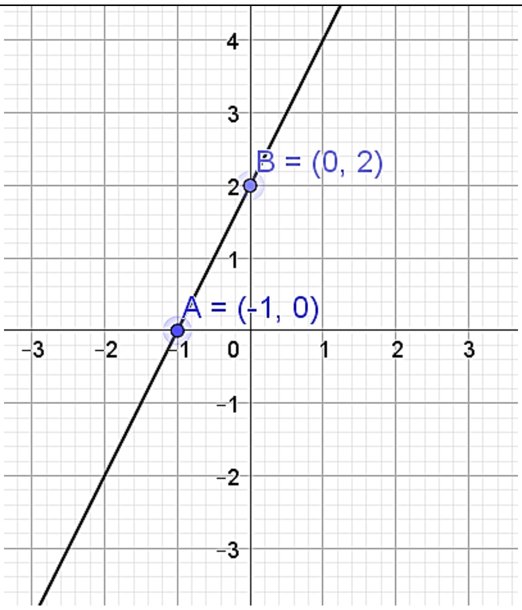
$$y = 2x + 2$$

x-intercept: Let y = 0

$y = 2x + 2$
$0 = 2x + 2$
$-2x = 2$
$x = -1$
(-1;0)

y-intercept: Let x = 0

$y = 2x + 2$
$y = 2(0) + 2$
$y = 2$
(0;2)



ACTIVITY 3:

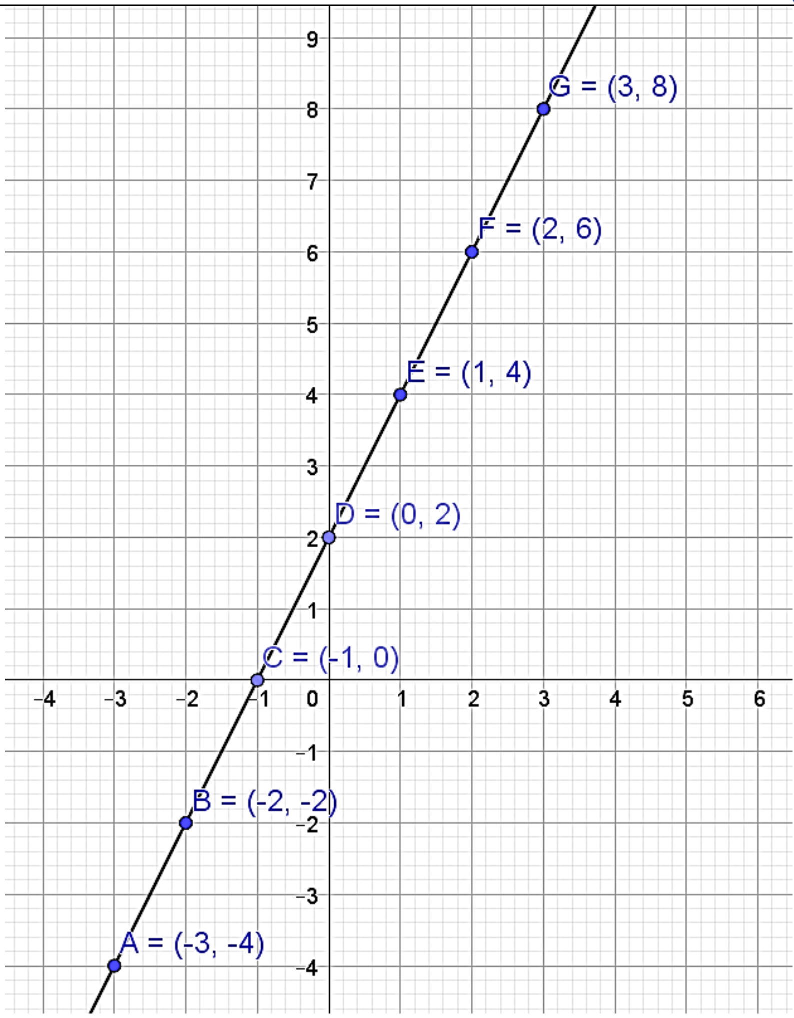
$$\mathbf{3y - 3x = 6}$$

$$3y = 3x + 6$$

$$y = \frac{3}{3}x + \frac{6}{3}$$

$$y = 2x + 2$$

x	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**
y	-4	-2	0	2	4	6	8

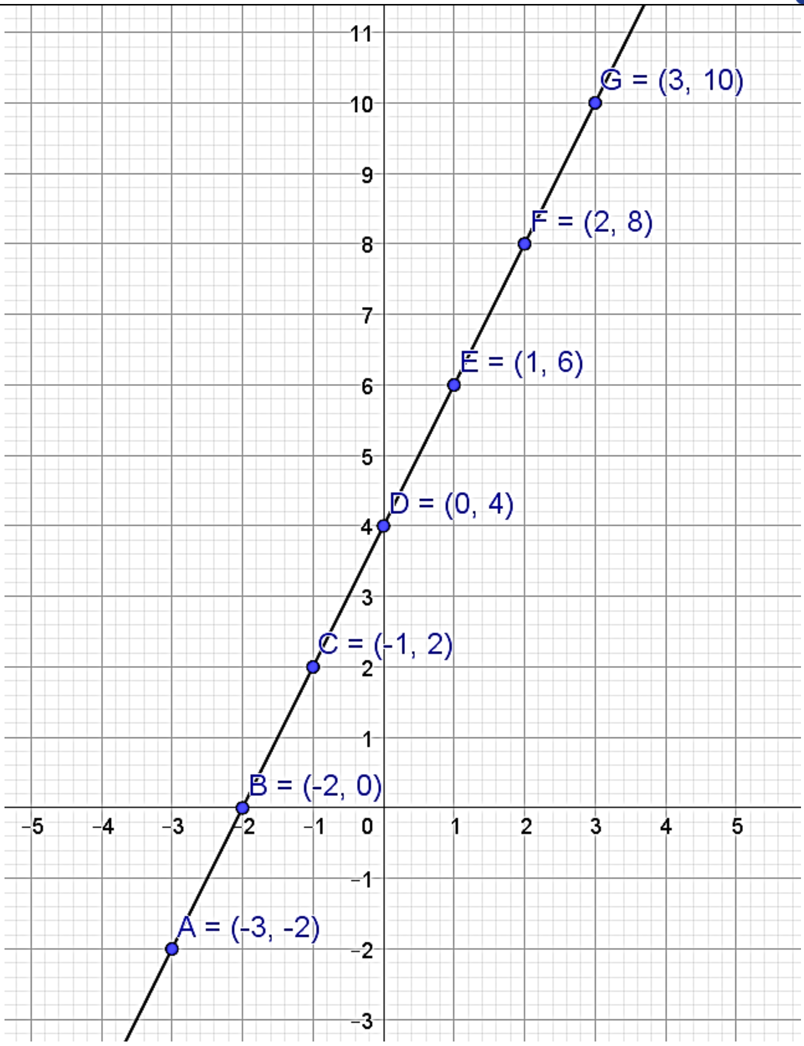


HOMEWORK:

QUESTION 1:

$$y = -2x + 4$$

x	-3	-2	-1	0	1	2	3
y	-2	0	2	4	6	8	10



QUESTION 2:

$$y = x + 6$$

x-intercept: Let y = 0

$y = x + 6$

$0 = x + 6$

$-x = 6$

$x = -6$

(-6;0)

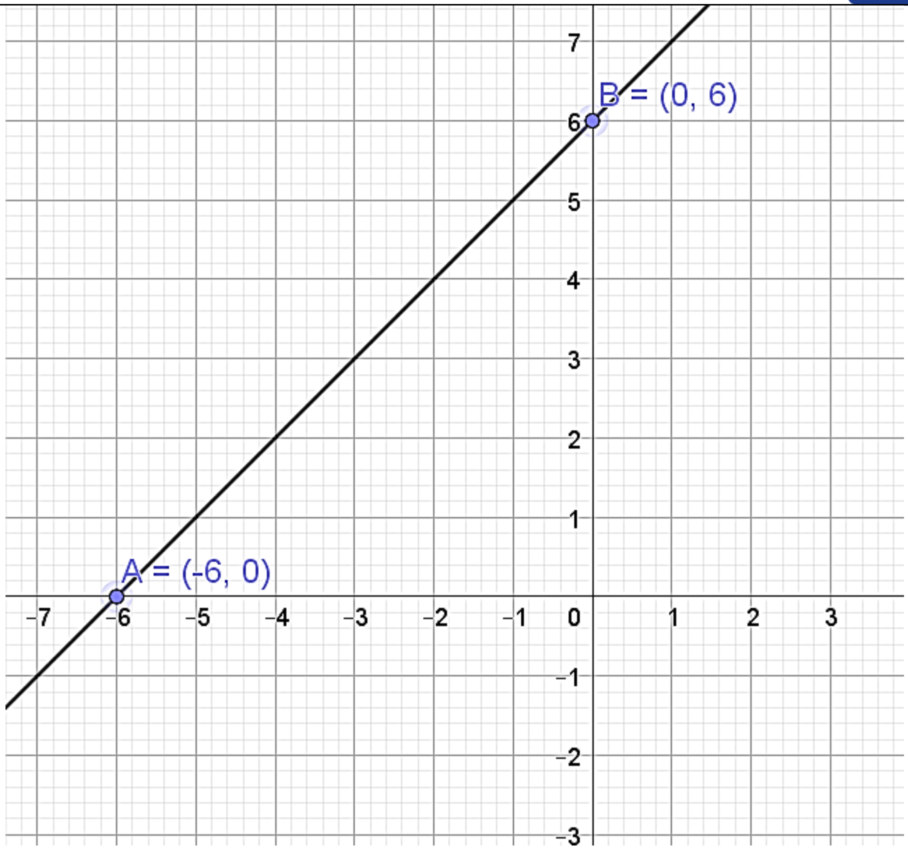
y-intercept: Let x = 0

$y = x + 6$

$y = (0) + 6$

$y = 6$

(0;6)



QUESTION 3:

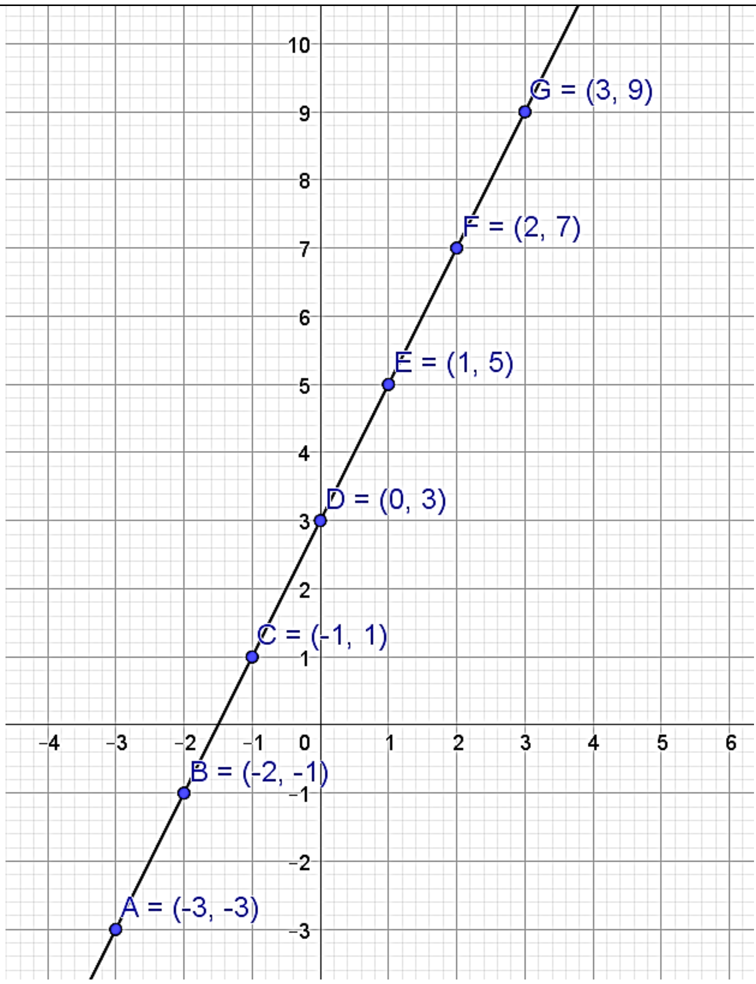
$2y - 4x = 6$

$2y = 4x + 6$

$y = \frac{4}{2}x + \frac{6}{2}$

$y = 2x + 3$

x	-3	-2	-1	0	1	2	3
y	-3	-1	1	3	5	7	9



DAY 9:

LESSON DEVELOPMENT:

Determining equations of linear graphs:

- Revise standard equation of a linear graph.
- Using a set of values to determine the equation of a linear graph.
- When we work with a linear graph we know the standard form of the equation is:

$$y = mx + c$$

m = gradient | **c = y-intercept**

It is very important to understand the concept that the m and c have specific roles in the equation.

It is easy to determine the values of the gradient and the y-intercept as mentioned above if we have a table with a set of values.

EXAMPLE:
Let us look at the following table.

Value of c (y-intercept)

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

+2 **+2** **+2** **+2** **+2** **+2** → **Value of m**

We need to remember that we are working with a linear function so that means that we will have a constant difference between terms. This constant difference is the value that we will substitute into the place of m.

In the example above it is easy to determine the value of c (y-intercept) because we know that the y-intercept is the place where x has a value of 0. So in this example we have c = 1. What we can do now is substitute the value of m (+2) and c (1) into the standard form of $y = mx + c$.

$\therefore \boldsymbol{y = mx + c}$
$\boldsymbol{m = +2}$ **&** $\boldsymbol{c = +1}$
$\boldsymbol{y = 2x + 1}$

If we do not have a table where the value of x = 0 is indicated, we can use the value of m and substitute any of the ordered pairs to calculate the value of c.
EXAMPLE:
The following sequence is given:
5; 7; 9; 11 …

Use the sequence and determine the general rule for the sequence.

- Because we can see that it is a constant difference it means that it will be a linear function with a standard form of $y = mx + c$.
- We can set up a table to represent the sequence in terms of x's and y's.

x	1	2	3	4
y	5	7	9	11

Initial sequence given

From the sequence above we can see that the constant difference is **+2** so that will be placed into the equation in the place of $\boldsymbol{m}$

When we do that we end up with an equation looking like this:

$$\boldsymbol{y = 2x + c}$$

To determine the value of c we need to substitute a set of ordered pairs (any set can be used from the table) into the equation and solve for c.

Let us choose the set of (2;6) and substitute into $\boldsymbol{y = 2x + c}$.

$\therefore \boldsymbol{6 = 2(2) + c}$
$\boldsymbol{6 = 4 + c}$
$\boldsymbol{6 - 4 = c}$
$\therefore \boldsymbol{c = 2}$

We can now go back and substitute the value of c (2) back into the equation used.
$\therefore \boldsymbol{y = 2x + 2}$

CLASSWORK:

Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

ACTIVITY 1:

The following table is given:

x	0	1	2	3	4	5	6
y	2	5	8				

a. Complete the table above.
b. Use the information to determine the equation of the linear function.

ACTIVITY 2:

The following table is given:

x	0	1	2	3	4	5	6
y	3	1	-1	-3			

a. Complete the table above.
b. Use the information to determine the equation of the linear function.

ACTIVITY 3:

The following sequence is given:

6; 3; 0; -3; …

a. Use the sequence above to determine the equation of the linear function.

IT IS IMPORTANT TO REMEMBER:

- When we work with a linear graph we know the standard form of the equation is:

$$\boldsymbol{y = mx + c}$$

m = gradient

c = y-intercept

- If we do not have a table where the value of x = 0 is indicated, we can use the value of m and substitute any of the ordered pairs to calculate the value of c.

HOMEWORK:

Do the following exercises,applying what you have learnt today. FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:

The following table is given:

x	0	1	2	3	4	5	6
y	-10	-5	0	5			

a. Complete the table above.
b. Use the information to determine the equation of the linear function.

QUESTION 2:

The following table is given:

x	0	1	2	3	4	5	6
y	8	4	0				

c. Complete the table above.
a. Use the information to determine the equation of the linear function.

QUESTION 3:

The following sequence is given:

-3; 5; 13; 21; …

1. Use the sequence above to determine the equation of the linear function.

MEMORANDUM: DAY 9:

CLASSWORK:

ACTIVITY 1:

a.

x	0	1	2	3	4	5	6
y	2	5	8	11	14	17	20

b. Constant difference = +3 (value of m)
Table is giving the y-intercept (value of c) at (0;2), where x = 0.
$\therefore y = 3x + 2$

ACTIVITY 2:

a.

x	0	1	2	3	4	5	6
y	3	1	-1	-3	-5	-7	-9

b. Constant difference = -2 (value of m)
Table is giving the y-intercept (value of c) at (0;3), where x = 0.
$\therefore y = -2x + 3$

ACTIVITY 3:

6; 3; 0; -3; …

x	1	2	3	4
y	6	3	0	-3

Constant difference = -3 (value of m)

$$\therefore \boldsymbol{y = -3x + c}$$

Substitute any ordered pair into equation above and solve for c.

$\therefore 6 = -3(1) + c$

$6 = -3 + c$

$6 + 3 = c$

$c = 9$

$\boldsymbol{y = -3x + 9}$

HOMEWORK:

QUESTION 1:

a.

x	0	1	2	3	4	5	6
y	-10	-5	0	5	10	15	20

b. Constant difference = +5 (value of m)
Table is giving the y-intercept (value of c) at (0;-10), where x = 0.
$\therefore y = 5x - 10$

QUESTION 2:

a.

x	0	1	2	3	4	5	6
y	8	4	0	-4	-8	-12	-16

b. Constant difference = -4 (value of m)
Table is giving the y-intercept (value of c) at (0;8), where x = 0.
$\therefore y = -4x + 8$

QUESTION 3:

-3; 5; 13; 21; …

x	1	2	3	4
y	-3	5	13	21

Constant difference = +8 (value of m)

$$\therefore y = 8x + c$$

Substitute any ordered pair into equation above and solve for c. Let's use (2;5)

$\therefore 5 = 8(2) + c$

$5 = 16 + c$

$5 - 16 = c$

$c = -11$

$\boldsymbol{y = 8x - 11}$

DAY 10:

LESSON DEVELOPMENT:

Determining equations from given linear graphs:

Using ordered pairs as well as the x- and y-intercept to formulate the equation of the linear graph.

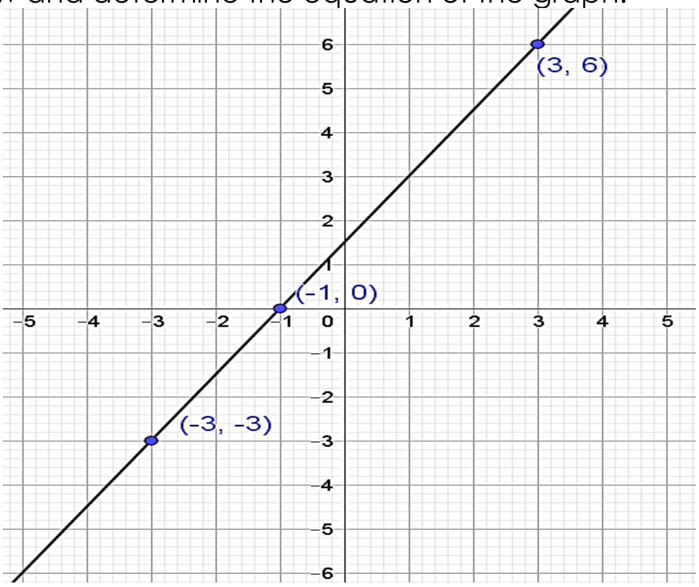
- In Lesson 5 you were exposed to working with gradients and using the formula below:

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

We will use this formula again during this lesson but also extend it to determining the equation of linear graphs, we will also use the skills from the previous lesson to determine the value of c by using one of the ordered pairs.

EXAMPLE:

Look at the graph below and determine the equation of the graph.



STEPS TO FOLLOW TO DETERMINE THE EQUATION:

1. Determine the value of the gradient (m) and substitute into the standard form of a linear graph $(y = mx + c)$

   We will use the following formula to determine the gradient:

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

Choose two sets of ordered pairs and substitute them into the equation.
$(x_a; y_a) = (3;6)$ & $(x_b; y_b) = (-3;-3)$

$\therefore$ Gradient $= \dfrac{-3-6}{-3-3}$

Gradient $= \dfrac{-9}{-6}$

Gradient $= \dfrac{3}{2}$

$\therefore$ m $= \dfrac{3}{2}$

$\therefore y = \frac{3}{2}x + c$

2. To determine the value of c, we chose any pair or ordered pairs and substitute into the equation and solve for c.

   Let us choose the ordered pair of (3;6) to substitute.

   $\therefore 6 = \frac{3}{2}(3) + c$

   $6 = \dfrac{9}{2} + c$

   $\therefore 6 - \frac{9}{2} = c$

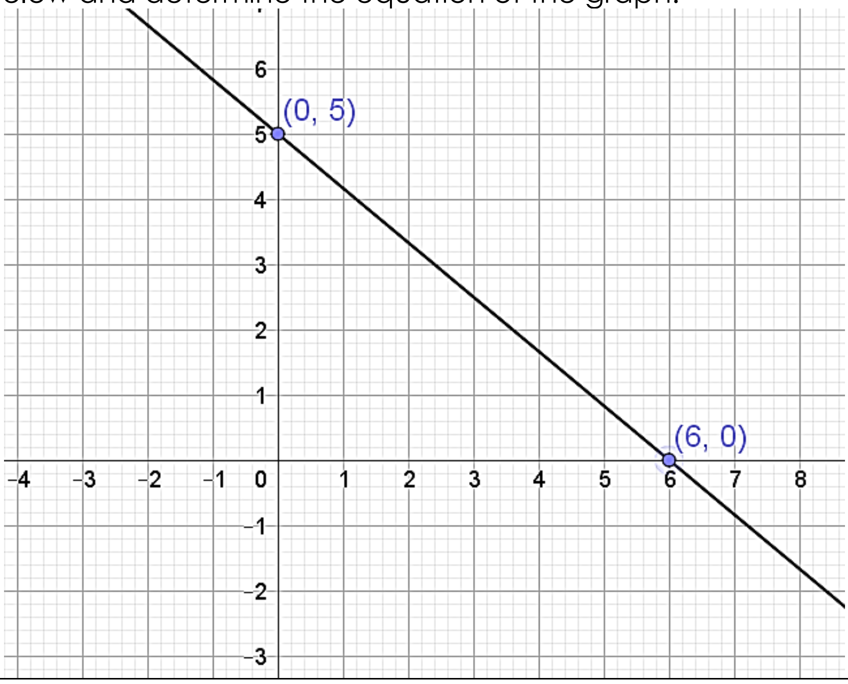
   $\therefore c = \dfrac{3}{2}$

3. We substitute the value of c back into the equation and that will give us the equation of the linear graph.

$$\boldsymbol{y = \frac{3}{2}x + \frac{3}{2}}$$

- In Lesson 8 we used the dual intercept method to draw graphs, we will now use the x- and y-intercepts from given graphs to determine the equation of the linear graph.

EXAMPLE:
Look at the graph below and determine the equation of the graph.



This example makes it a bit easier with the knowledge that the y-intercept is represented by c in the standard form of the equation. Thus, we only have to calculate the gradient of the line to determine the equation of the linear graph.

STEPS TO FOLLOW:

1. Write the x- and y-intercepts as ordered pairs.
   x-intercept = (6;0)
   y-intercept = (0;5)
   Use the gradient formula with these ordered pairs to calculate the gradient and substitute into the standard form.
   $\therefore \text{Gradient} = \frac{5-0}{0-6}$
   $\therefore \text{Gradient} = -\frac{5}{6}$
   $\therefore\ m = -\frac{5}{6}$
   $\therefore y = -\frac{5}{6}x + c$
2. With the knowledge that the y-intercept is represented by c in the standard form, we can just substitute 5 into the place of c.

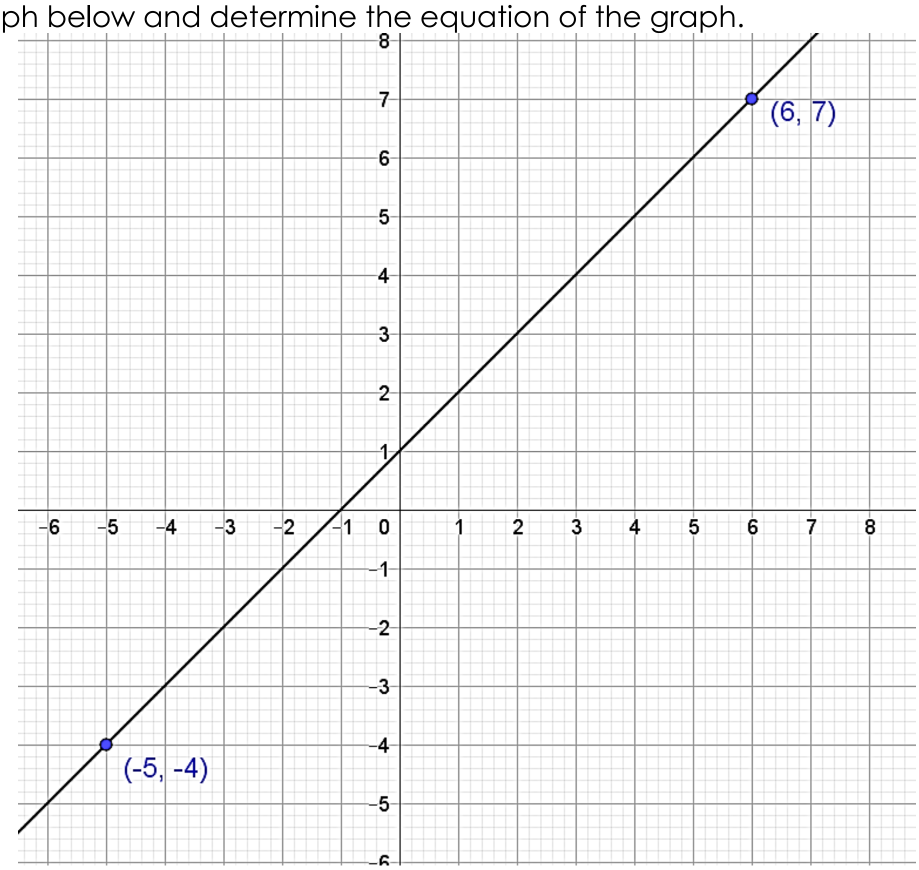
$$\therefore y = -\frac{5}{6}x + 5$$

CLASSWORK:

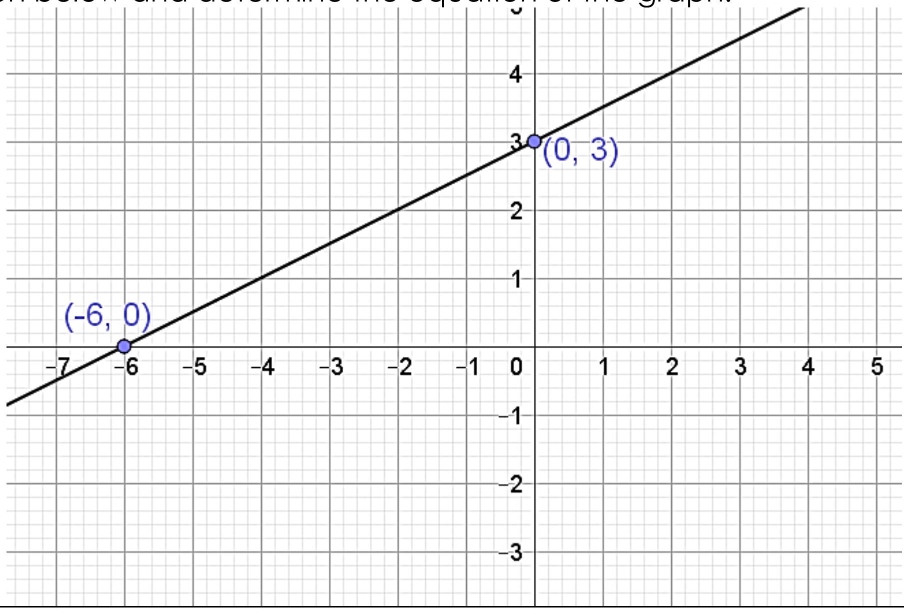
Work through the following exercises and write the answers in your classwork book. The answers can be found at the end of the day's lesson:

ACTIVITY 1:

Look at the graph below and determine the equation of the graph.



ACTIVITY 2:
Look at the graph below and determine the equation of the graph.



IT IS IMPORTANT TO REMEMBER:

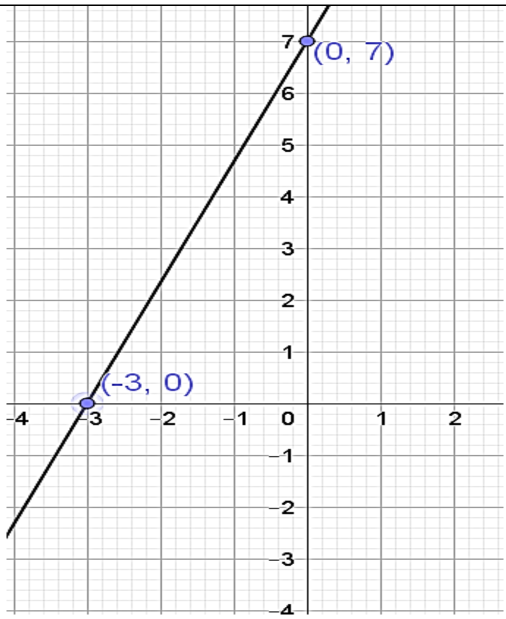
- When we are given graphs with either the x- and y-intercepts given or sets of ordered pairs we can use them to determine the equation of the linear graph.
- Equations of linear graphs are written in the standard form of $y = mx + c$, where m represents the gradient and c represents the y-intercept.
- The gradient can be calculated by using the following formula.

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

HOMEWORK:

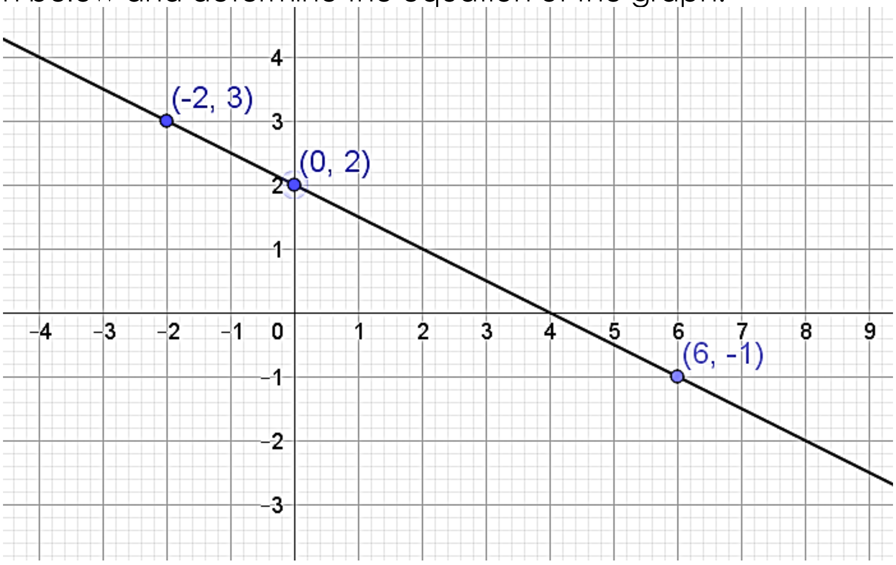
Do the following exercises,applying what you have learnt today. FIRST ATTEMPT TO DO ALL YOUR HOMEWORK BEFORE YOU CHECK YOUR ANSWERS IN THE MEMORANDUM BELOW TODAYS LESSON

QUESTION 1:
Look at the graph below and determine the equation of the graph.



QUESTION 2:

Look at the graph below and determine the equation of the graph.



MEMORANDUM: DAY 10:

CLASSWORK:

ACTIVITY 1:

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

$$\text{Gradient} = \frac{7-(-4)}{6-(-5)}$$

$$\text{Gradient} = \frac{7+4}{6+5}$$

$$\text{Gradient} = \frac{11}{11}$$

$\therefore$ m = 1

$\therefore y = x + c$
Let's us substitute (6,7) into the equation above:
$7 = (6) + c$
$7 - 6 = c$
$1 = c$
$\boldsymbol{y = x + 1}$

ACTIVITY 2:
Write the x- and y-intercepts as ordered pairs.
x-intercept = (-6;0)
y-intercept = (0;3)
Use the gradient formula with these ordered pairs to calculate the gradient and substitute into the standard form.

$\therefore \text{Gradient} = \dfrac{3-0}{0-(-6)}$

$\therefore \text{Gradient} = \dfrac{3}{6}$

$\therefore \ \text{m} = \dfrac{1}{2}$

$\therefore y = \frac{1}{2}x + c$

With the knowledge that the y-intercept is represented by c in the standard form, we can just substitute 3 into the place of c.

$$\therefore y = \frac{1}{2}x + 3$$

HOMEWORK:
QUESTION 1:
Write the x- and y-intercepts as ordered pairs.
x-intercept = (-3;0)
y-intercept = (0;7)
Use the gradient formula with these ordered pairs to calculate the gradient and substitute into the standard form.

$\therefore \text{Gradient} = \dfrac{7-0}{0-(-3)}$

$\therefore \text{Gradient} = \dfrac{7}{3}$

$\therefore \ \text{m} = \dfrac{7}{3}$

$\therefore y = \frac{7}{3}x + c$

With the knowledge that the y-intercept is represented by c in the standard form, we can just substitute 7 into the place of c.

$$\therefore y = \frac{7}{3}x + 7$$

QUESTION 2:

$$\text{Gradient} = \frac{y_b - y_a}{x_b - x_a}$$

$$\text{Gradient} = \frac{3-(2)}{-2-(0)}$$

$$\text{Gradient} = \frac{1}{-2}$$

$$\text{Gradient} = -\frac{1}{2}$$

$$\therefore\ m = -\frac{1}{2}$$

$$\therefore y = -\tfrac{1}{2}x + c$$

Let's us substitute (6,-1) into the equation above:

$$-1 = -\frac{1}{2}(6) + c$$

$$-1 = -3 + c$$

$$-1 + 3 = c$$

$$2 = c$$

$$\boldsymbol{y = -\frac{1}{2}x + 2}$$