

MATHEMATICS GRADE 8



DATE:
TOPIC: FUNCTIONS AND RELATIONSHIPS

CONCEPTS & SKILLS TO BE ACHIEVED:	
By the end of the lesson learners should know and be able to:	
<ul style="list-style-type: none"> Determine input values, output values or rules for patterns and relationships using: flow diagrams, tables, formulae, equations Determine, interpret and justify equivalence of different descriptions of the same relationship or rule presented verbally, in flow diagrams, in tables, by formulae or by equations 	
RESOURCES:	DBE Workbook, Sasol-Inzalo book, Textbooks,
ONLINE RESOURCES	https://www.visnos.com http://www.virtualnerd.com

DAY 1:

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

A functional relationship shows the **connection between a set of input values and a set of output values**. The input value is changed in a calculation to give the output value. For example, if apples are sold at R16,00 per kilogram then the more kilograms we buy, the higher the cost for the apples.

This is an example of a situation in which **one variable quantity** (in this case the cost of the apples) **depends** on **another variable quantity** (in this case the number of kilograms bought), and is uniquely determined by it.

In Mathematics, we refer to the **relationship between the corresponding values of such related variables as a “function”**.

- Input variable = independent variable, usually denoted by a symbol, x
- Output variable = dependent variable, usually denoted by a symbol, y.

A **functional relationship** is usually **represented** by a **function rule** where the dependent variable, y, is expressed in terms of the independent variable, x. In the example above the cost, y, for x kilograms of apples will be given by $y = 16,00x$. The cost, y, depends on the number of kilograms, x, of apples bought.

A function can be represented in more than one way: in words, in a table with each input value matching an output value, in a flow diagram, symbolically in an equation, in a graph.



LESSON DEVELOPMENT: Constant and variable quantities - Looking for connections between quantities

ACTIVITY 1:

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:

Consider the following seven situations. There are **two quantities** in each situation. For **each quantity, state** whether it is **constant** (always the same number) or whether it

changes. Also **state, in each case**, whether **one quantity** has an **influence on the other**.

If it has, try to say how the one quantity will influence the other quantity.

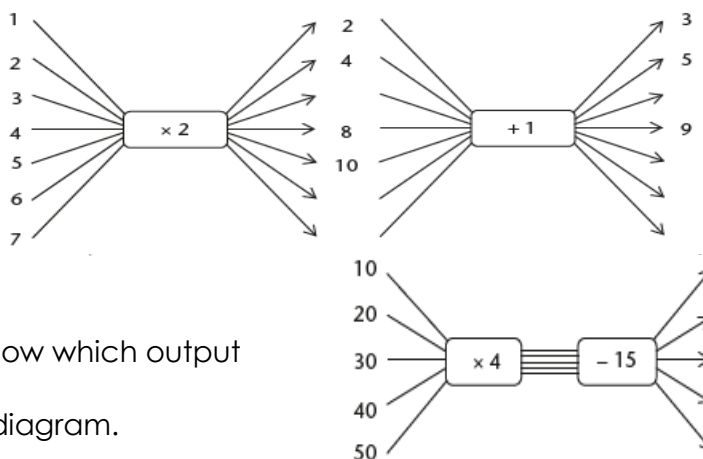
- Your age and the number of fingers on your hands
- The number of calls you make and the airtime left on your cell phone
- The length of your arm and your ability to finish Mathematics tests quickly
- The number of identical houses to be built and the number of bricks required
- The number of learners at a school and the length of the school day
- The number of learners at a school and the number of classrooms needed
- The number of matches in each arrangement, and the number of triangles in the arrangement:



- Look at the match arrangements in question 7. If you know that there are three triangles in an arrangement, can you say with certainty how many matches there are in that specific arrangement?
- How many matches are there in the arrangement with ten triangles?
- Is there another possible answer for question (b)?

A quantity that changes is called a variable quantity, or just a variable

- Copy and complete the flow diagram that represents the matches pattern in no.7



Flow diagram and a table representation

10 a. Describe, in words, how the following output numbers can be calculated:

b. Copy the following table and use it to show which output numbers are connected to which input numbers in the above flow diagram.

Input value	10	20			
Output Value					



IT IS IMPORTANT TO REMEMBER:

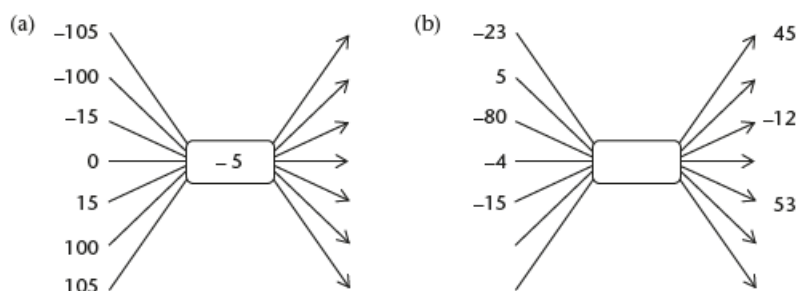
A quantity that changes is called a variable quantity, or just a variable



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 TODAY'S LESSON

1. Copy and complete



2. The following information is available about the floor space and cost of houses in a new development. The cost of an empty stand is R180 000.

Floor space	90	120	150	180	210
Cost of house and stand	540 000	660 000	780 000	900 000	1 020 000

- Represent the above information in the following flow diagram
- Show what the houses only will cost, if you get the stand for free
- Try to figure out what the cost of a house and stand will be, if there are exactly 100 m² of floor space in the house

MEMORANDUM: DAY 1:

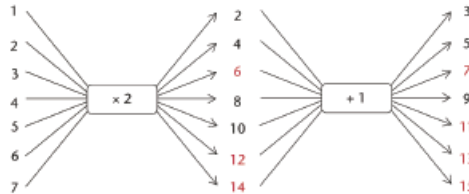
Activity 1:

- Age – changes; Number of fingers on hands – constant. No influence.
- Number of calls – change.; Airtime left on cellphone – changes.
The more calls you make, the less airtime will be left on your cellphone.
- Length of your arm – constant.; How quickly you can finish Mathematics tests – changes; No influence.
- Number of houses – changes; Number of bricks – changes; The more houses, the more bricks required.
- Number of learners at a school – changes; Length of the school day – constant; No influence.



6. Number of learners – changes; Number of classrooms – changes; The more learners, the more classrooms needed.
 7. Number of triangles – changes; Number of matches – changes; As more triangles are made, more matches are needed.
 8. (a) Yes, seven matches. (b) 21. For every triangle added to the (c) No already existing ones, you have to add two matches.

9.



10(a) Multiply the input number by 4 and then subtract 15 to get the output number.
 10 (b)

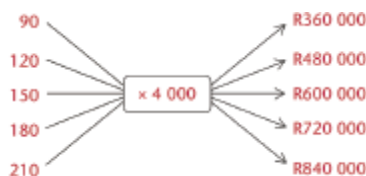
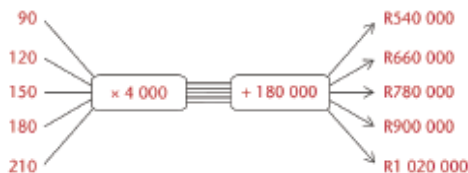
Input number	10	20	30	40	50
Output number	25	65	105	145	185

Homework :

1



2. a



b.

c. The input number is 100 square metres; apply the input number to the flow diagram in (a); $100 \times 4\,000 + 180\,000 = R580\,000$.

Revision Day 1

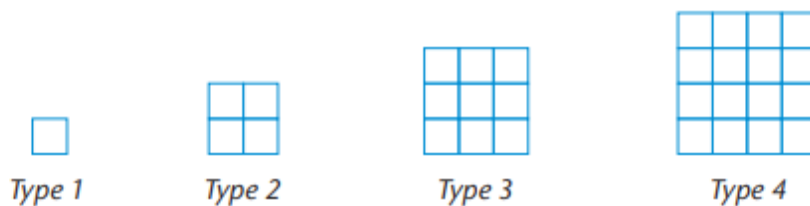
1. a) Find the missing m – values of the function $n = m + 3$

m			
n	5	0	-4

b) Represent this function in a flow diagram



2. A factory makes window frames. Type 1 has one windowpane, type 2 has four windowpanes, type 3 has nine windowpanes, and so on.



a) Complete the table

Frame type (x)	1	2	3	4	5	10
Number of window panes (y)	1	4	9	16		

b) Write the equation of the function.

3. Complete the table and indicate your calculations.

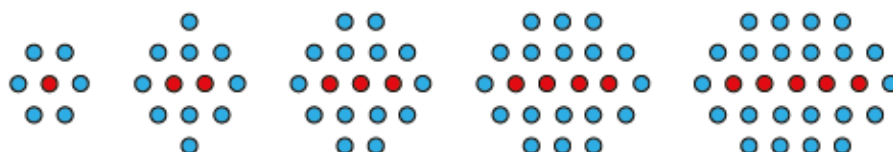
q	1	2	3	4	8
$p = q + 5$					
p	6	7	8	9	13

DAY 2:

LESSON DEVELOPMENT: Different ways to describe relationships

LET'S US WORK THROUGH THE NEXT ACTIVITY TO EXPLAIN TO YOU HOW WE CAN USE DIFFERENT WAYS TO DESCRIBE RELATIONSHIPS:

ACTIVITY 1: Work through the example and answer in your classwork book



1. How many blue dots are there if there is **one** red dot?
2. How many blue dots are there if there are **two** red dots?
3. How many blue dots are there if there are **three** red dots?
4. How many blue dots are there if there are **four** red dots?
5. How many blue dots are there if there are **five** red dots?
6. How many blue dots are there if there are **six** red dots?
7. How many blue dots are there if there are **seven** red dots?
8. How many blue dots are there if there are **ten** red dots?
9. How many blue dots are there if there are **20** red dots?
10. How many blue dots are there if there are **100** red dots?
11. Which of the following descriptions correctly describe the relationship between the number of blue dots and the number of red dots in the above arrangements?
Test each description thoroughly for all the above arrangements.

a) The number of red dots $\xrightarrow{\times 4} \xrightarrow{+ 2} \rightarrow$ the number of blue dots

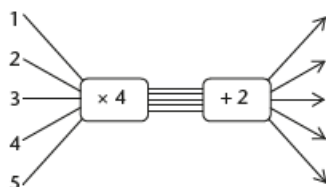
(b) To calculate the number of blue dots you multiply the number of red dots by 2, add 1 and multiply the answer by 2

(c) The number of blue dots = $2 \times$ the number of red dots + 4

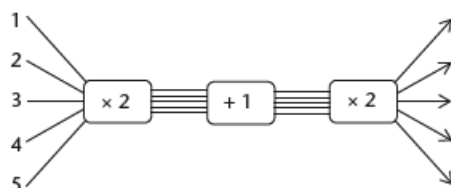
(d)

Number reds dots	1	2	3	4	5	6
Number blue dots	6	10	14	18	22	26

(e)



(f)



(g) The number of blue dots = $4 \times$ the number of red dots + 2

(h) The number of blue dots = $2 \times (2 \times$ the number of red dots + 1)

Remember that the calculations inside the brackets are done first.)

IMPORTANT: The descriptions in (c), (g) and (h) above are called word formulae.

ACTIVITY 2:

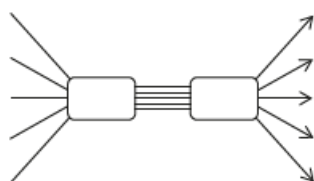
We will now work together through an example demonstrating different descriptions. Answer the questions in your classwork book:

The relationship between two quantities is described as follows:

The second quantity is always three times the first quantity plus 8.

The first quantity varies between 1 and 5, and it is always a whole number

1 (a) Describe this relationship using the flow diagram. (copy the diagram and complete)



(b) Describe the relationship between the two quantities using this table: (copy and complete the table)

(c) Describe the relationship between the two quantities using a word formula

IT IS IMPORTANT TO REMEMBER:

A relationship between two quantities can be described in different ways, including:

- a table of values of the two quantities
- a flow diagram
- a word formula
- a symbol formula (or symbolic formula).



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 TODAY'S LESSON**

1. The relationship between two quantities is described as follows:

The input numbers are the first five odd numbers.

Value of the one quantity $\xrightarrow{+5} \xrightarrow{\times 3} \rightarrow$ the corresponding value of the other quantity

(a) Describe this relationship using a table.

(b) Describe the relationship using a word formula.

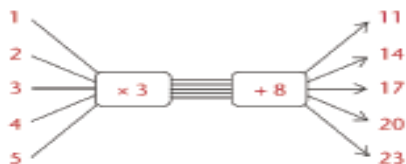
MEMORANDUM: DAY 2:

ACTIVITY 1:

- 6
- 10
- 14
- 18
- 22
- 26
- 30
- 42
- 82
- 402
- (a); (b); (d); (e); (f); (g); (h)

ACTIVITY 2:

1a



b.

Input number	1	2	3	4	5
Output number	11	14	17	20	23

c. output number = input number \times 3 + 8



Homework:

1a.

Input number	1	3	5	7	9
Output number	18	24	30	36	42

b. output number = (input number + 5) × 3

Revision: Day 2

1. Describe each of the functions below in words:

a) $y = 2x$ b) $n = m^2 + 1$ c) $s = \frac{d}{t}$

2. Complete a flow diagram for each of the functions below:

a) $y = -3x$ b) $y = x^2$ c) $y = 1 - x$

3. Determine the rule that represents the relationship between the x and the y- values.

Hours	-2	0	2	4
income	10	0	-10	-20

4. Peter works at Vodacom over weekends They pay him R30 per hour.

a) Complete the table indicating how much hours he works.

Hours	1	2	3	5	10
income	R30	R60			

b) The shop changed the salary structure. They have replaced the R30 per day to paying Peter R100 per day and a R15 commission for each cell phone that he sells. Set up a new table that will indicate his income based on the number of cell phones that he sells.

c) Write a function for the new table.



DAY 3:

LESSON DEVELOPMENT: Formulae with symbols

CLASSWORK:

Instead of writing “input number” and “output number” in formulae, you may just write a single letter symbol as an abbreviation.

Many years ago, mathematicians adopted the convention of using the letter symbol x as an abbreviation for the “input number”, and the letter symbol y as an abbreviation for the “output number”.

The word formula for: **input number** $\xrightarrow{\times 10} \xrightarrow{+ 15}$ **output number** can be written more shortly as: $y = 10 \times x + 15$

Mathematicians have also agreed that one may leave the x sign (multiplication sign) out when writing **symbolic formulae**.

Thus we can write it as: $y = 10x + 15$

ACTIVITY 1: 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:

1a. Write a word formula for the following relationship: $y = 7x + 10$

IT IS IMPORTANT TO REMEMBER:

The convention of using the letter symbol x as an abbreviation for

the “input number”, and the letter symbol y as an abbreviation for the “output number”.



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 TODAY'S LESSON

2. Describe each of the following relationships with a symbolic formula:
- To calculate the output number, the input number is multiplied by 4 and 7 is subtracted from the answer.

MEMORANDUM: DAY 3:

ACTIVITY 1

1a. output number = input number $\times 7 + 10$

HOMEWORK:

- $y = 4x - 7$



Revision: Day 3

1. For each of the tables below determine which of the following formulae could have been used to complete the table. The letter symbol x is used to represent the input numbers and the symbol y represents the output numbers.

A. $y = x^2$

B. $y = 10x$

C. $y = 10x - 1$

D. $y = x^2 + 2$

E. $y = 5x + 2$

F. $y = -5x + 2$

G. $y = 3^x$

(a)

Input (x)	1	4	11	30	40	60
Output (y)	7	22	57	152	202	302

.....

(b)

Input (x)	1	6	9	12	18	20
Output (y)	1	36	81	144	324	400

.....

(c)

Input (x)	1	6	9	12	18	20
Output (y)	3	38	83	146	326	402

.....

(d)

Input (x)	3	11	19	27	45	70
Output (y)	30	110	190	270	450	700

.....

(e)

Input (x)	3	11	9	12	18	20
Output (y)	29	109	189	269	449	699

.....

(f)

Input (x)	1	2	3	4	5	6
Output (y)	3	9	27	81	243	729

.....

DAY 4:

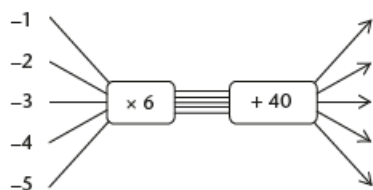
CONSOLIDATION

TODAY WE WILL WORK THROUGH MORE EXAMPLES TO CONSOLIDATE WHAT YOU HAVE LEARNT FROM FUNCTIONS

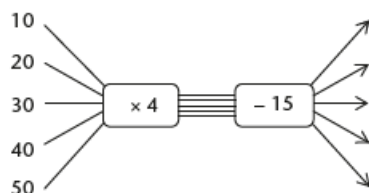
HOMEWORK:

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 TODAY'S LESSON

1. Copy and complete the following flow diagram:



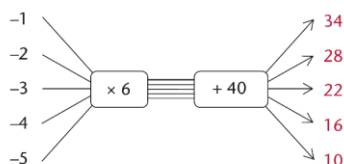
2 a. Describe, in words, how the following output numbers can be calculated:



b. Copy the following table and use it to show which output numbers are connected to which input numbers in the above flow diagram.

MEMORANDUM: DAY 4:

1.



2. a. Multiply the input number by 4 and then subtract 15 to get the output number.

b.



Input number	10	20	30	40	50
Output number	25	65	105	145	185

Revision Day 4

Formula	Flow-diagram	Table	Verbal description										
$y = 4x$		<table border="1"> <tr> <td>x</td> <td>0</td> <td>3,5</td> <td>7</td> <td>0.3</td> </tr> <tr> <td>y</td> <td>0</td> <td>14</td> <td></td> <td></td> </tr> </table>	x	0	3,5	7	0.3	y	0	14			
x	0	3,5	7	0.3									
y	0	14											
		<table border="1"> <tr> <td>x</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> </table>	x	2	3	4	5	y	1	2	3	4	
x	2	3	4	5									
y	1	2	3	4									
		<table border="1"> <tr> <td>x</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y</td> <td>7</td> <td>11</td> <td>15</td> <td>19</td> </tr> </table>	x	2	3	4	5	y	7	11	15	19	Multiply the input number by 4 then subtract 1.
x	2	3	4	5									
y	7	11	15	19									
$y = 2(x + 1)$		<table border="1"> <tr> <td>x</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> </table>	x	2	3	4	5	y	1	2	3	4	
x	2	3	4	5									
y	1	2	3	4									
$y = 2x + 2$		<table border="1"> <tr> <td>x</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> </table>	x	2	3	4	5	y	1	2	3	4	Multiply the input number by 2 then add 2.
x	2	3	4	5									
y	1	2	3	4									
$y = 2x + 1$		<table border="1"> <tr> <td>x</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> </tr> <tr> <td>y</td> <td>-2</td> <td>0</td> <td>2</td> <td>4</td> </tr> </table>	x	-2	-1	0	1	y	-2	0	2	4	Multiply the input number by 2 then add 1.
x	-2	-1	0	1									
y	-2	0	2	4									

DAY 5:

CONSOLIDATION:

TODAY WE WILL WORK THROUGH MORE EXAMPLES TO CONSOLIDATE WHAT YOU HAVE LEARNT FROM FUNCTIONS

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 TODAY'S LESSON



1. Write a word formula for each of the following relationships:

a) $y = 7(x + 10)$ b. $y = 7(2x + 10)$

2. Describe each of the following relationships with a symbolic formula:

a. To calculate the output number, 7 is subtracted from the input number and the answer is multiplied by 5.

b. To calculate the output number, 7 is subtracted from the input number, the answer is multiplied by 5 and 3 is added to this answer

3. Complete the table using the word formula:

input number $\xrightarrow{\times 2}$ $\xrightarrow{+ 3}$ $\xrightarrow{\times 5}$ \rightarrow output number

Input number	5	10	15	20	25	30
Output number						

MEMORANDUM: DAY 5:

1.
a. output number = (input number + 10) × 7
b. output number = (input number × 2 + 10) × 7

2.
a. $y = 5(x - 7)$
b. $y = 5(x - 7)$

3.

Input number	5	10	15	20	25	30
Output number	65	115	165	215	265	315



Revision Day 5

1. Explain why the two representations of a function is equivalent.

P	-2	0	1	3
M	-8	2	7	17

$$M = 5P + 2$$

2. Jenny is saving money to buy a cellular phone. She starts with R80 in her bank account and save R65 each month.
- Draw a table to indicate how much money she will have at the end of each month.
 - Write an equation that shows how much money she would have saved in q months.
3. The formula $y = 1,14x$ is used to calculate the price y of goods including VAT in rands, where x is the price in rands before VAT.
- How much will you pay at the counter for goods that cost R38,00 without VAT, and for goods that cost R50,00 without VAT? You may use a calculator.
 - Complete the table for the prices of goods with VAT.

x	1	2	3	4	5	6
y						

- Use your answers for question 3(b) to find the prices with VAT for goods with the following prices before VAT was added. Do not use a calculator at all in this question.
(1) R40 (2) R400 (3) R70 (4) R470 .
 - (1) An article costs R11,40 with VAT included. What is the price before VAT was added?
(2) An article costs R342 with VAT included. What is the price before VAT was added?
4. This formula is used to calculate the cost of hiring a caravan
 $C = -350d + 200p$ where d indicates the number of days and p the number of people.
- Use the formula to calculate the hiring of a caravan for 5 days and for 3 people.
 - A family hire a caravan for 7 days and it cost R3 250. How many people was in the family.

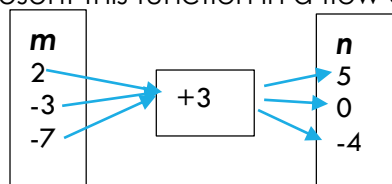
Memorandum of Revision Exercises

Day 1

1. a) Find the missing m - values of the function $n = m + 3$

m	2	-3	-7
n	5	0	-4

- b) Represent this function in a flow diagram



2. a)

Frame type (x)	1	2	3	4	5	10
Number of window panes (y)	1	4	9	16	25	100

b) $x^2 = y$ or $y = x^2$ $5^2 = 25$ $10^2 = 100$

3.

q	1	2	3	4	8
$p = q + 5$					
p	6	7	8	9	13

$6 = 1 + 5$
 $7 = 2 + 5$
 $8 = 3 + 5$
 $9 = 4 + 5$
 $13 = 8 + 5$

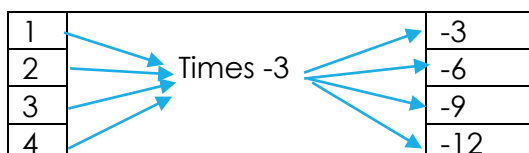
Day 2

1. Describe each of the functions below in words:

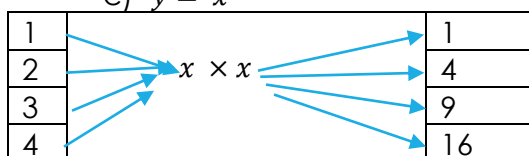
- a) $y = 2x$ multiply the input value(x) by 2 to find the output value(y)
- b) $n = m^2 + 1$ Square the input value(m) then add 1 to find the output value (n)
- c) $s = \frac{d}{t}$ Divide the input value (fraction) to find the output value

2. Complete a flow diagram for each of the functions below:

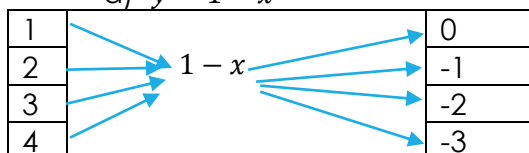
a) $y = -3x$



c) $y = x^2$



d) $y = 1 - x$



3. Determine the rule that represents the relationship between the x and the y- values.

Hours	-2	0	2	4
income	10	0	-10	-20

$y = -5x$ $10 = -2(-5)$



4. Peter works at Vodacom over weekends They pay him R30 per hour.

a) Complete the table indicating how much hours he works.

Hours	1	2	3	5	10
income	R30	R60	R90	R150	R300

b)

Per day (x)	0	1	2	3	4
Income + commission (y)	100	115	130	145	160

e) $y = 100 + 15(x)$

Day 3

a) E. $y = 5x + 2$

b) B. $y = x^2$

c) D. $y = x^2 + 2$

d) B. $y = 10x$

e) C. $y = 10x - 1$

f) G. $y = 3^x$

Day 4

Formula	Flow-diagram	Table	Verbal description										
$y = 4x$		<table border="1"> <tr> <td>x</td> <td>0</td> <td>3,5</td> <td>7</td> <td>0.3</td> </tr> <tr> <td>y</td> <td>0</td> <td>14</td> <td>28</td> <td>1.2</td> </tr> </table>	x	0	3,5	7	0.3	y	0	14	28	1.2	Multiply the input number by 4
x	0	3,5	7	0.3									
y	0	14	28	1.2									
$y = x - 1$		<table border="1"> <tr> <td>x</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> </table>	x	2	3	4	5	y	1	2	3	4	Subtract 1 from the input number.
x	2	3	4	5									
y	1	2	3	4									
$y = 4x - 1$		<table border="1"> <tr> <td>x</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>y</td> <td>7</td> <td>11</td> <td>15</td> <td>19</td> </tr> </table>	x	2	3	4	5	y	7	11	15	19	Multiply the input number by 4 then subtract 1.
x	2	3	4	5									
y	7	11	15	19									
$y = 2(x + 1)$		<table border="1"> <tr> <td>x</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> </tr> <tr> <td>y</td> <td>-2</td> <td>0</td> <td>2</td> <td>4</td> </tr> </table>	x	-2	-1	0	1	y	-2	0	2	4	Add 1 to the input number then multiply the answer by 2.
x	-2	-1	0	1									
y	-2	0	2	4									
$y = 2x + 2$		<table border="1"> <tr> <td>x</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> </tr> <tr> <td>y</td> <td>-2</td> <td>0</td> <td>2</td> <td>4</td> </tr> </table>	x	-2	-1	0	1	y	-2	0	2	4	Multiply the input number by 2 then add 2.
x	-2	-1	0	1									
y	-2	0	2	4									



$y = 2x + 1$		<table border="1" style="border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px 5px;">x</td> <td style="padding: 2px 5px;">-2</td> <td style="padding: 2px 5px;">-1</td> <td style="padding: 2px 5px;">0</td> <td style="padding: 2px 5px;">1</td> </tr> <tr> <td style="padding: 2px 5px;">y</td> <td style="padding: 2px 5px;">-3</td> <td style="padding: 2px 5px;">-1</td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">3</td> </tr> </table>	x	-2	-1	0	1	y	-3	-1	1	3	<p>Multiply the input number by 2 then add 1.</p>
x	-2	-1	0	1									
y	-3	-1	1	3									

Day 5

1. If you substitute the M – values of the table in the formula, you will find the corresponding P- values eg. $M = 5P + 2$ $P = 5(-2) + 2 = -8$

2.a)

m	1	2	3	4	5	6
s	145	210	275	340	405	470

b) $S = 80 + 65m$

3a) $1.14 \times R38 = R43.32$ and $1.14 \times R50 = R57$

3b)

x	1	2	3	4	5	6
y	1.14	2.28	3.42	4.56	5.70	6.84

c) 1. $10 \times 4,56 = R45.60$ 2. $100 \times 4,56 = R456$ 3. $70 \times 7,98 = R 79.80$ 4. $456 \times 79.80 = R535.80$

d) 1. 10 2. 300

4a) $C = - 350d + 200p$

$C = 350(5) + 200(3) = R2350$

b. $350(7) + 200(x) = R3250$

$x = 4$ four people in the family