MATHEMATICS

GRADE 9

DATE: ....

TOPIC: Functions and Relationships

CONCEPTS & SKILLS TO BE ACHIEVED: **By the end of the lesson learners should know and be able to:** • Determine input values, output values or rules for patterns and relationships using, tables, formulae, equations • Determine, interpret and justify equivalence of different descriptions of the same relationship or rule presented: – by equations/expressions – by graphs on a Cartesian plane	
RESOURCES:	DBE Workbook, Sasol-Inzalo book, Textbooks,
ONLINE RESOURCES	Refer to page 12 and 15. When you see the icon below: 

DAY 1:
LESSON DEVELOPMENT

Introduction - Let's consider the following 4 situations:

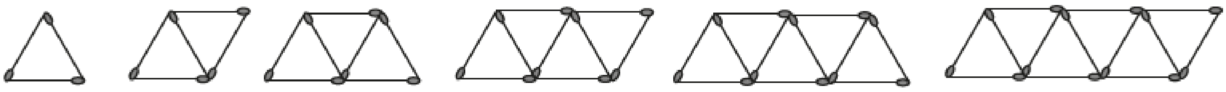
There are two quantities in each situation **(Pay attention to how these quantities behave.)**

1. The number of calls you make, and the airtime left on your cell phone.
   - **The more calls you make, the less airtime will be left on your cellphone.**

2. The number of learners at a school and the number of classrooms needed.
   - **The more learners, the more classrooms needed.**

3. The number of songs performed and the duration of the concert.
   - **The more songs performed , the longer the concert.**

4. The number of matches in each arrangement, and the number of triangles in the arrangement:



   - **As more triangles are made, more matches are needed.**

What do we notice:

The one variable quantity is influenced by another, we say there is a **relationship** between the two variable quantities.

Let's take it a step further:

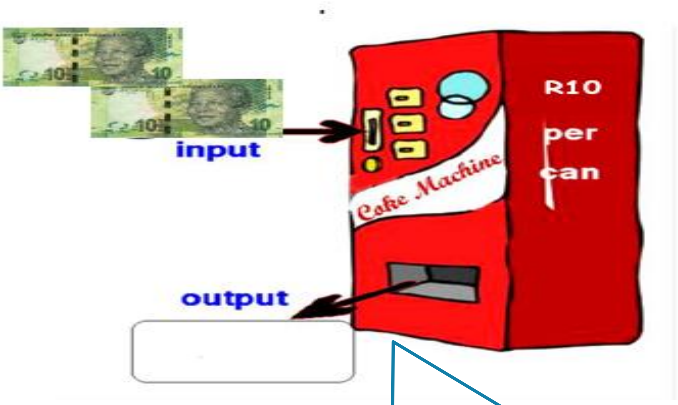
A relationship between two variables in which there is only one output number for each input number, is called a **function.**

<u>Let's illustrate:</u>

The price the customer pays is dependent on how many cans of coke he buys.

A can of Coke costs R10.

If you put two R10 notes in the Coke Machine, determine how many can(s) you will receive.



Function rule:

Number of cans = $\frac{Rands}{10}$

Let's discuss:

A Coke machine operates in much the same way as a mathematical function:

- **The money we insert into the coke machine is the input.**
- **A function is an equation for example [Output = $\frac{Input}{10}$] which shows the relationship between the input and the output and where there is exactly one output for each input.**
- **The can(s) of coke we receive in return is our output.**

Below is a **function table** to represent the Coke Machine's input and output.

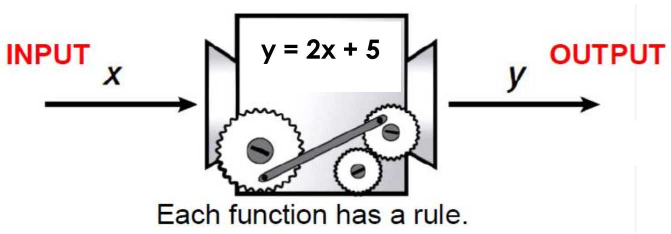
Function rule: Output = $\frac{Input}{10}$

Input Rand	10	20	30	40
Output Can(s) of Coke	1	2	3	4

CLASSWORK:

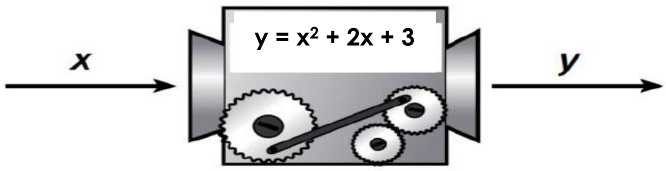
Machine diagrams are used to represent functions. In the function machine below, the inputs are labelled **x** of the function and the outputs are labeled ***y*** of the function.

1.



1.1 If x = 7 is used as an input, what is the output y?
1.2 If x = -2 is used as an input, what is the output y?
1.3 If x = 1 is used as an input, what is the output y?

2.



Note:

Output values for given input values can be calculated by using a formula.

Example:

If the **formula is** $y = 2x - 3$ and the **input values are 5 and 10**, the corresponding **output values** can be **calculated by substitution**:

$\boldsymbol{Formula}$: $y = 2x - 3$
$y = 2\,(\mathbf{5}) - 3$ → (put 5 where x is)
$y = 10 - 3$
$y = 7$ → (output value)

and

$y = 2\,(\mathbf{10}) - 3$ → (put 10 where x is)
$y = 20 - 3$
$y = 17$ → (output value)

2.1 Determine the y values.

Input values: x	-1	0	1	2
Output values: y				

CONSOLIDATION

IT IS IMPORTANT TO REMEMBER:

Relation:

If one variable quantity (input value) is influenced by another(output value), we say there is a **relationship** between the two variables.

Function:

A function is an equation/rule which shows the relationship between the input and the output and where there is exactly one output for each input.

Output value:

Value that you obtain when you apply the rule to the input numbers.

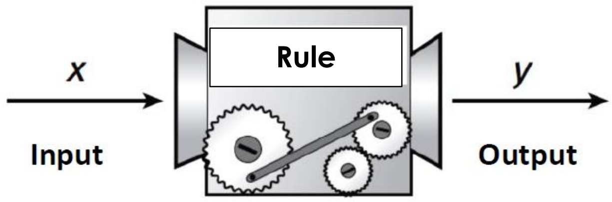
Input value:

The input is the number you feed into the function rule.

HOMEWORK:

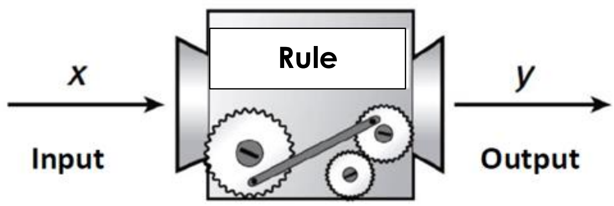
Create your own rule in the function machine. Write your rule in the white box of the machine. Set an input value and calculate the output value.

1.



x = ______ y =_______

2.



x = ______ y =_______

DAY 2:

LESSON DEVELOPMENT

Finding the Input values:

To calculate the input value, we will make use of **inverse operations** that sends the set of output values back to the input values.

Let's illustrate:

If you are bare feet and want to wear your socks and shoes the process would be as follows:

Bare feet → Put on socks → Put on shoes → Socks And shoes

Now, if you are wearing socks and shoes and want to be bare feet, you would make use of the reverse process to get back to being bare feet:

Bare feet ← Take off socks ← Take off shoes ← Socks And shoes

Let's apply the above-mentioned principle, mathematically using inverse operations to determine the input value to the flow diagram below.

Example:

Use inverse operations to find the missing input values (a – c).

Input		Output
a	$2x - 5$	1
b		5
6		7
c		11
10		15

Method:

6 → Multiply by 2 → Subtract 5 → 7

6 ← Divide by 2 ← Add 5 ← 7

Inverse Operations:

$+ \leftrightarrow -$

$\times \leftrightarrow \div$

$x^2 \leftrightarrow \sqrt{\ }$

You try:

Calculate the Input values **a, b and c** from the example above.

CLASSWORK:

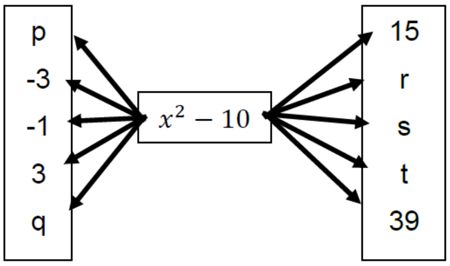
1. For each output, multiply the input by 4, then subtract 5.

Input x	2	3	4	7	**a**	**b**
Output y	3	7	11	23	35	55

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

Input x	**c**	2	4	10	**d**	**e**
Output y	4	5	6	9	12	17

3. Find the missing values of **p, q, r, s and t**.



CONSOLIDATION

IT IS IMPORTANT TO NOTE:

<u>Alternative method:</u>

If the **output value (y) is given**, it can be **substituted** in the formula and **solving** this **equation** gives an input value **(x)**.

<u>Example:</u>

Input value(x) ⟹ $y = 2x - 3$ ⟹ 13

Output value 13 is given, it can be substituted in the formula to produce the equation and solving this equation **using inverse operation** gives an input value of $x = 8$.

Rule:

$y = 2x - 3$ (substitute the letter y with output value13)

$13 = 2x - 3,$

$13 + \mathbf{3} = 2x - 3 + \mathbf{3}$ (add 3 both sides)

$16 = 2x$

$\frac{16}{\mathbf{2}} = \frac{2x}{\mathbf{2}}$ (divide by 2 both sides)

$8 = x$ (input value)

∴ **8** ⟹ $\mathbf{y = 2x - 3}$ ⟹ **13**

HOMEWORK:

A set of rectangles all have a perimeter of 24 units. The breadth of each rectangle (y) varies in relation to the length (x) using the **formula** $\mathbf{2(x + y) = 24}$. Complete the table of values to represent this situation.

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

DAY 3:

LESSON DEVELOPMENT

<u>Finding the Function Rule:</u>

Example 1

Rule: y =?

Input	1	2	3	4
Output	3	5	7	9

+2 +2 +2

The input values increase by 1 each time and the output values increase by 2 each time.
The common difference between the output values is 2.

This tells us that the first operation performed on the input was to multiply it by 2. Hence, part of the function is $2 \times x$.

$y = 2 \times x$ _____

We now must determine the relationship between the input values and output values.

Input (x)	1	2	3	4
$2 \times x$	2 x 1 + ____	2 x 2 + _____	2 x 3 + _____	2 x 4 + _____
Output (y)	3	5	7	9

Input (x)	1	2	3	4
$2 \times x$	2 x 1 + 1	2 x 2 + 1	2 x 3 + 1	2 x 4 + 1
Output (y)	3	5	7	9

Hence, our rule is $2x + 1$ which, as a function relating x and y, is $y = 2 \times x + 1$.

$$\therefore y = 2x + 1.$$

Example 2

Find the function rule for the following input-output table.

Input (x)	1	3	5	8	11
Output (y)	3	11	19	31	43

		+2	+2	+3	+3
Input (x)	1	3	5	8	11
Output (y)	3	11	19	31	43
		+8	+8	+12	+12

At first glance, it looks like there is no common difference between the output values.

However, this is because the difference between the input terms is also not constant.
In fact, there are the following relationships between the input and output:

Increase input by 2 ⟶ increase output by 8,

Increase input by 3 ⟶ increase output by 12.

This suggests that there is a common difference between consecutive terms, following the pattern.

Increase input by 1⟶ increase output by 4.

Hence, the rule is $y = 4 \times x$ __________

We now must determine the relationship between the input values and output values.

Input (x)	1	3	5	8	11
$4 \times x$	4 x 1 - 1	4 x 3 - 1	4 x 5 - 1	4 x 8 - 1	$4 \times 11 - 1$
Output (y)	3	11	19	31	43

Hence the function rule is $y = 4 \times x - 1$.

$$\therefore\ y = 4x - 1$$

CLASSWORK:

Find the rules for the following function tables.

1.

x	1	2	3	4	5
y	10	14	18	22	26

2.

x	1	4	10
y	9	12	18

3. Find the function rule for this table. Then calculate the two missing numbers.

x	12	13	14	15	16
y	76	82	88	**a**	**b**

HOMEWORK:

At Sunningdale Primary School, seventh graders spend 3 hours every night studying, eighth graders spend 4 hours, nine graders spend 5 hours.

Let the students' grade be the input (x). What is the function rule between the students' grade and the amount of time the students spend on homework every night?

DAY 4:

LESSON DEVELOPMENT

<u>Representation of a Function</u>

Discuss:

A functional rule can be **represented** in a variety of ways.
For example, we can indicate how to get from a **function's** input to its output using a **formula,** a **graph**, or a **table** of values and a **flow diagram**.

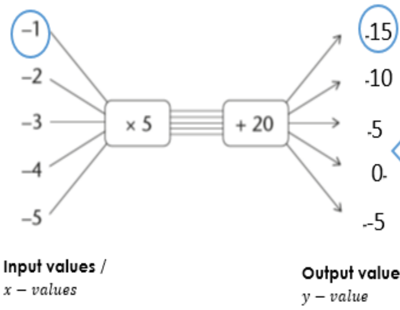
We can represent a function in a number of different ways:

Algebraic Formula :

Output $= 5x + 20$

Output numbers are numbers that you obtain when you apply the rule to the input numbers.

Flow Diagram:



The 1st input is −1. Use the rule:

−1 x 5 = −5

then

- 5 + 20 = 15.

So, the output is 15.

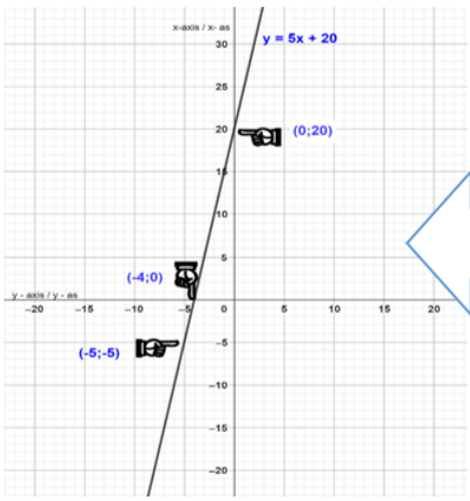
Table of values for the function described as $y = 5x + 20$:

Input values $(x - values)$	-1	-2	-3	-4	-5
Output Values $(y - values)$	15	10	5	0	-5

We can write the values from the table as **ordered pairs.**

The **x-coordinate** is always first,
the **y-coordinate** is always second.
(x; y)
The ordered pairs from the table are (−1; 15) (−2; 10) (-3; 5) (-4; 0) (-5; -5)

Graph: $y = 5x + 20$



The ordered pairs can be plotted on the **Cartesian plane.**

In this example, the points lie on a straight line and x, y ∈ R,

so, we can join them with a straight line.

Further Discussion:

Tables and Graphs

Formula: $y = 2x - 3$

Input x	-5	0	2	4	**6**	8
Output y	-13	-3	1	5	**9**	13

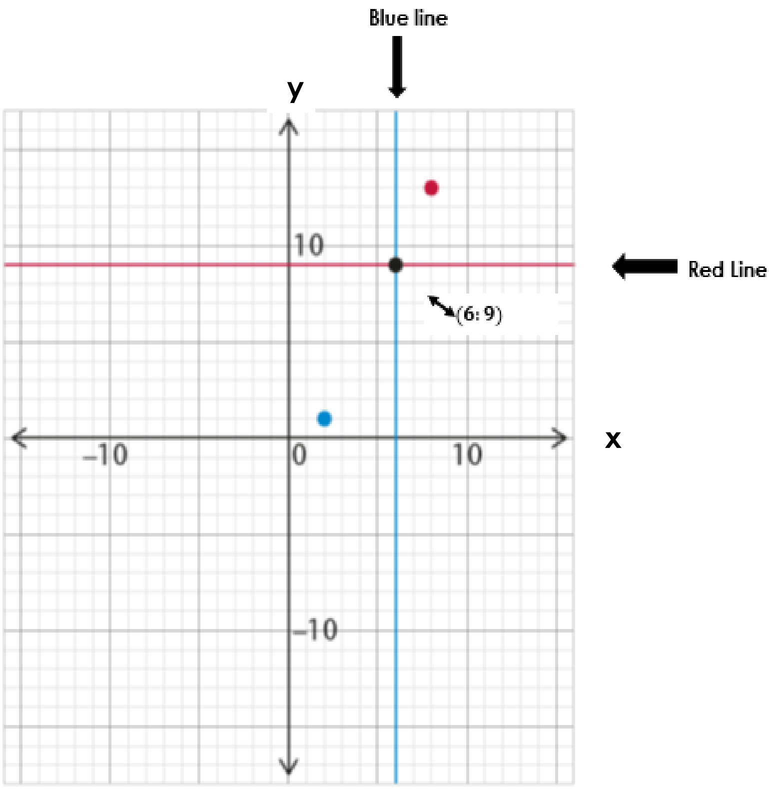
Note:

The vertical blue line on this graph represents the input number 6.

The heavy horizontal red line represents the output number 9.

The black point where the blue and red lines intersect indicates that the input number 6 is associated with the output number 9

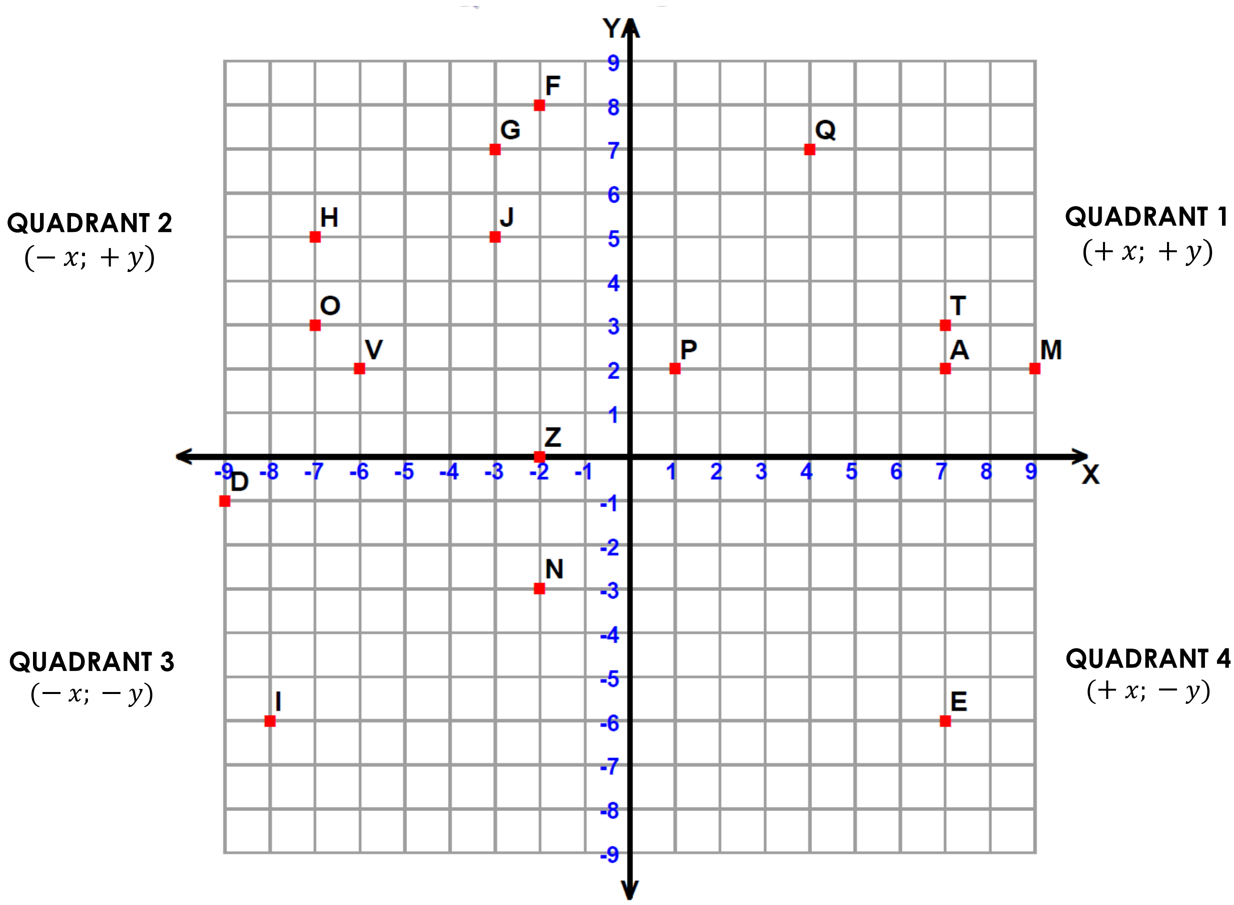
We also say the black point represents the **ordered number pair** (6; 9).



https://tinyurl.com/mecxvxl **(When accessed the website, click on the step by step button.)**

CLASSWORK: (Starter Activity)

Study the diagram and complete the worksheet below.



Tell what point is located at each ordered pair.

1) (-9,-1) _____	3) (-3,+5) _____	5) (-6,+2) _____	7) (+7,-6) _____
2) (+4,+7) _____	4) (+7,+3) _____	6) (-2,+8) _____	8) (-2,-3) _____

Write the ordered pair for each given point.

9) **M** _______	11) **H** _______	13) **Z** _______	15) **P** _______
10) **G** _______	12) **O** _______	14) **I** _______	16) **A** _______

Plot the following points on the coordinate grid.

17) **S** (-3,-1)	19) **U** (-4,+7)	21) **X** (-7,-1)	23) **Y** (+7,-7)
18) **L** (-4,-6)	20) **B** (+2,+5)	22) **K** (+3,-9)	24) **C** (-5,-4)

HOMEWORK:

Section A

On separate pages, represent each of the following functions with the following:

(a) a flow diagram

(b) a table of values for the set of integers from -5 to 5

(c) a graph

1. The relationship described by the expression $3x + 4$.
2. The relationship described by the expression $-3x + 4$.
3. The relationship described by the expression $\frac{1}{2}x + 2$.

Section B

Match each of the four equations provided below with one of the following tables of the values and a graph.

1.1 $y = 2x + 4$

1.2 $2x + 3y = 6$

1.3 $xy = 12$

1.4 $y = x^2 - 1$

Table A

x	-3	0	2	9	11	20
y	8	-1	3	80	120	399

Table B

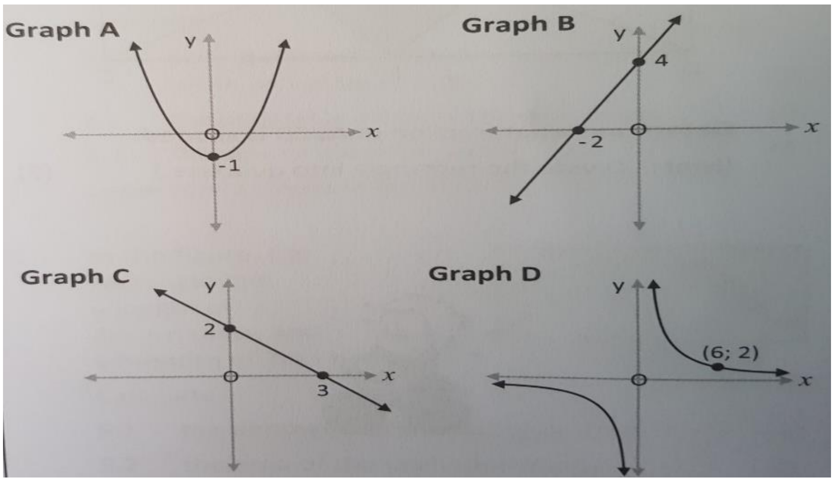
x	1	2	3	4	6	12
y	12	6	4	3	2	1

Table C

x	-3	0	3	6	9	12
y	4	2	0	-2	-4	-6

Table D

x	2	4	5	8	15	50
y	8	12	14	20	34	104



DAY 5:
REVISION

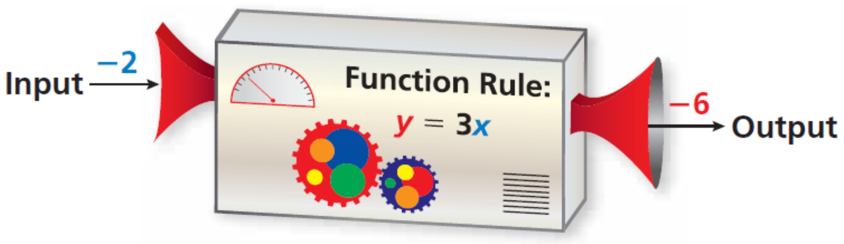
Let's revise what we have learned this week:

- A **function** is a relationship between an input and an output which assigns **exactly one output to each input.**

How to Find a Function When Given

- A **function rule** is an equation that describes the relationship between inputs and outputs.
- **The input** of a function is the number you feed into the expression.
- **The output** of a function is the value that results from substituting in a value for the input.

Let's illustrate:

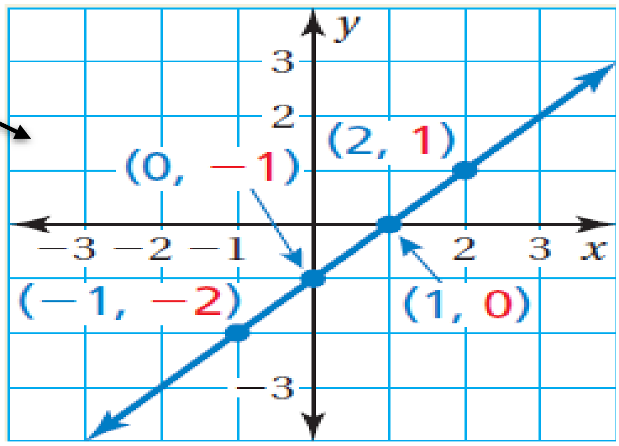


- Lastly, let's remember, a functional rule can be **represented in a variety of ways.**

Let's illustrate:

Graph the function rule $y = x - 1$, using the inputs -1, 0, 1, 2:

Input, x	$x - 1$	Output, y	Ordered Pair, (x, y)
-1	$-1-1$	-2	$(-1, -2)$
0	$0-1$	-1	$(0, -1)$
1	$1-1$	0	$(1, 0)$
2	$2-1$	1	$(2, 1)$

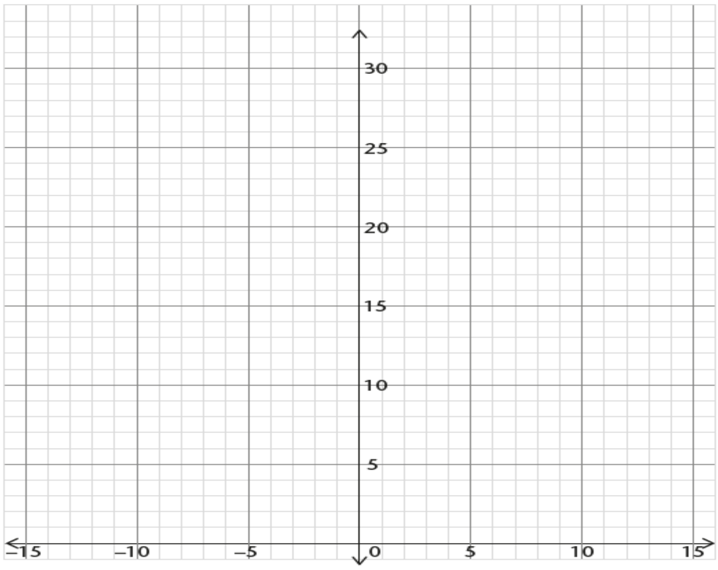


CLASSWORK:

1. Copy and complete the following table for the relationship described by $y = x^2$.

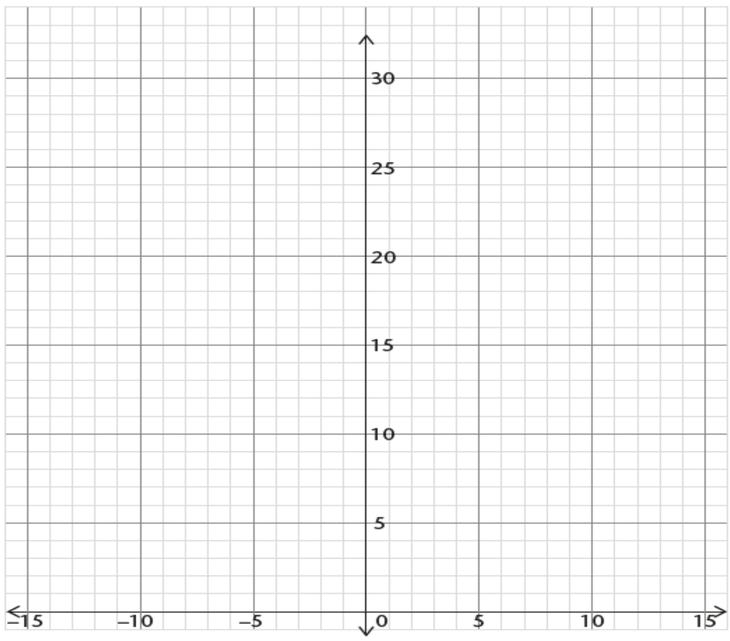
x	-5	-4	-3	-2	-1	0	1	2	3	4	5
y											

On a graph sheet, copy the axis as below and represent the ordered number pairs in the table and join the points.



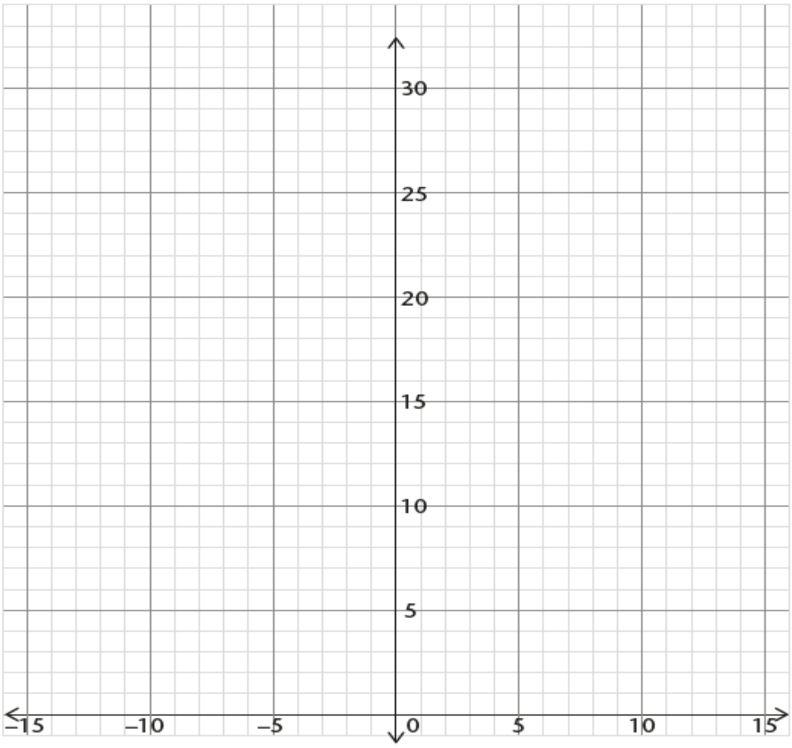
2. Copy and complete the table for the relationship $y = 15 + x$. Represent the ordered number pairs on the graph sheet and join the points.

x	-15	-10	-5	0	5	10	15
y							



3. Copy and complete the table for the relationship $y = 15 - x$. Represent the ordered number pairs on the graph sheet and join the points.

x	-15	-10	-5	0	5	10	15
y							



Refer to questions 1 – 3 to answer the questions 4 and 5:

4.
(a) The output values for $y = x^2$ and $y = 15 + x$ shows patterns.
Describe, in words, how the patterns differ.
Use the words **increase** and **decrease** in your description.

(b) Describe, in words, how the graphs of $y = x^2$ and $y = 15 + x$ differ.

5.
(a) Describe, in words, how the patterns in the output values for $y = 15 + x$ and $y = 15 - x$ differ.
Use the words **increase** and **decrease** in your description.

(b) Describe, in words, how the graphs of $y = 15 + x$ and $y = 15 - x$ differ.

MEMORANDUM: DAY 1:

Classwork:

$\boldsymbol{y = 2x + 5}$

1.1 $y = 2(7) + 5$
$y = 14 + 5$
$y = 19$

1.2 $y = 2(-2) + 5$
$y = -4 + 5$
$y = 1$

1.3 $y = 2(1) + 5$
$y = 2 + 5$
$y = 7$

2.1

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

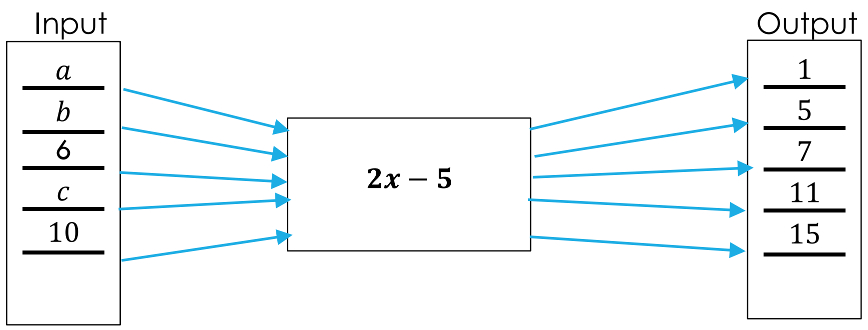
Input values: x	-1	0	1	2
Output values: y	2	3	6	11

Homework:

Any mathematically sound answer is accepted.

MEMORANDUM: DAY 2:

Example:



3 ← divide by 2 ← add 5 ← 1 ∴ a = 3

5 ← divide by 2 ← add 5 ← 5 ∴ b = 5

8 ← divide by 2 ← add 5 ← 11 ∴ c = 8

Classwork:

1.

10 ← divide by 4 ← add 5 ← 35 ∴ a = 10

15 ← divide by 4 ← add 5 ← 55 ∴ b = 15

2.

0 ← multiply by 2 ← subtract 4 ← 4 ∴ c = 0

16 ← multiply by 2 ← subtract 4 ← 12 ∴ d = 16

26 ← multiply by 2 ← subtract 4 ← 17 ∴ e = 26

3.

p → $\mathbf{x^2 - 10}$ → **15**

$\pm$ **5** ← square root ($\sqrt[2]{\ }$) ← add 10 ← 15 ∴ p = $\pm$ 5

q → $\mathbf{x^2 - 10}$ → **39**

$\pm$ **7** ← square root ($\sqrt[2]{\ }$) ← add 10 ← 39 ∴ q = $\pm$ 7

OR

$p^2 - 10 = 15$
$\sqrt[2]{p^2} = 25$
$p = \pm 5$

$q^2 - 10 = 39$
$\sqrt[2]{q^2} = 49$
$q = \pm 7$

$r = (-3)^2 - 10$
$r = 9 - 10$
$r = -1$

$s = (-1)^2 - 10$
$s = 1 - 10$
$s = -9$

$t = (3)^2 - 10$
$t = 9 - 10$
$t = -1$

Homework: $\mathbf{2(x + y) = 24.}$

x	1	2	3	4	6	7	8	9	10	11
y	11	10	9	8	6	5	4	3	2	1

$2(x + y) = 24$

$so, x + y = 12.$

When $y = 5, x = 7.$

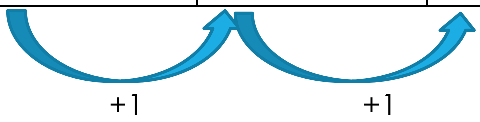
MEMORANDUM: DAY 3:

Classwork:

1. $y = 4x + 6$
2. $y = x + 8$
3. $y = 6x + 4 \quad a = 94\,; \quad b = 100$

Homework:

Students Grade x	7	8	9
Time spent in hours y	3	4	5

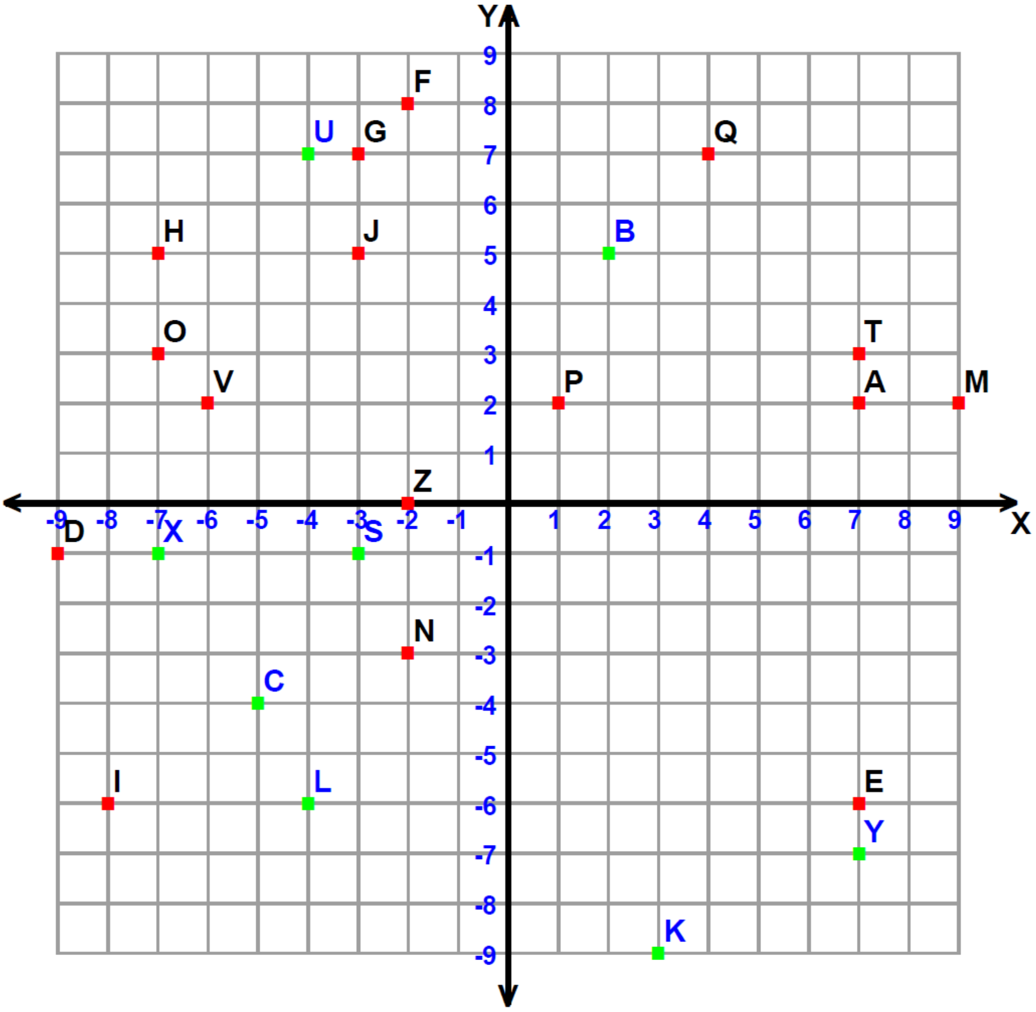


Students Grade x	7	8	9
$1 \times x$	$1\times 7 - 4$	$1\times 8 - 4$	$1\times 9 - 4$
Time spent in hours y	3	4	5

$$\therefore\ y = x - 4$$

MEMORANDUM: DAY 4:

Classwork: (starter activity)



Tell what point is located at each ordered pair.

1) (-9,-1) D
2) (+4,+7) Q
3) (-3,+5) J
4) (+7,+3) T
5) (-6,+2) V
6) (-2,+8) F
7) (+7,-6) E
8) (-2,-3) N

Write the ordered pair for each given point.

9) **M** (+9,+2)
10) **G** (-3,+7)
11) **H** (-7,+5)
12) **O** (-7,+3)
13) **Z** (-2,+0)
14) **I** (-8,-6)
15) **P** (+1,+2)
16) **A** (+7,+2)

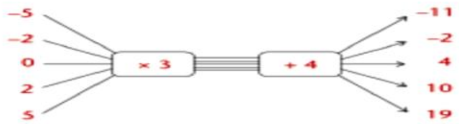
Plot the following points on the coordinate grid.

17) **S** (-3,-1)
18) **L** (-4,-6)
19) **U** (-4,+7)
20) **B** (+2,+5)
21) **X** (-7,-1)
22) **K** (+3,-9)
23) **Y** (+7,-7)
24) **C** (-5,-4)

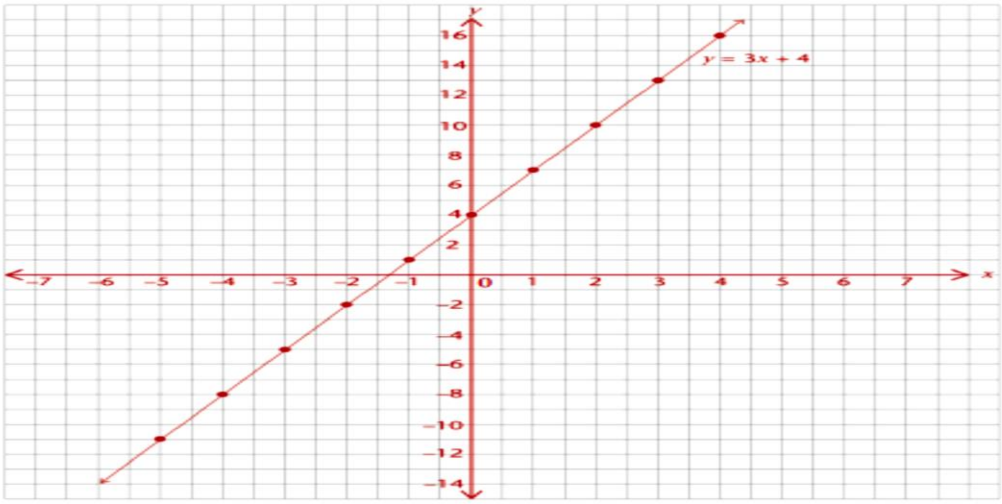
Homework:

Section A

1.

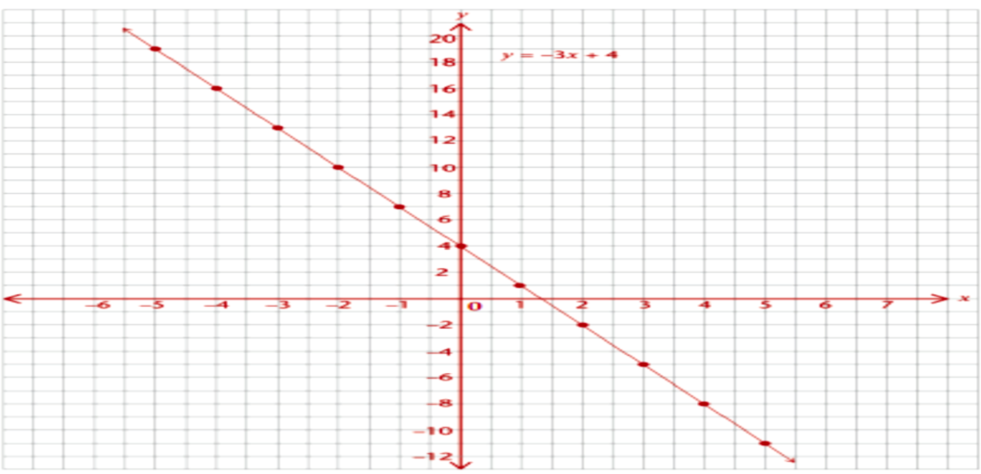


x	−5	−4	−3	−2	−1	0	1	2	3	4	5
$3x + 4$	−11	−8	−5	−2	1	4	7	10	13	16	19

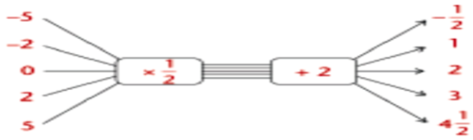


2.

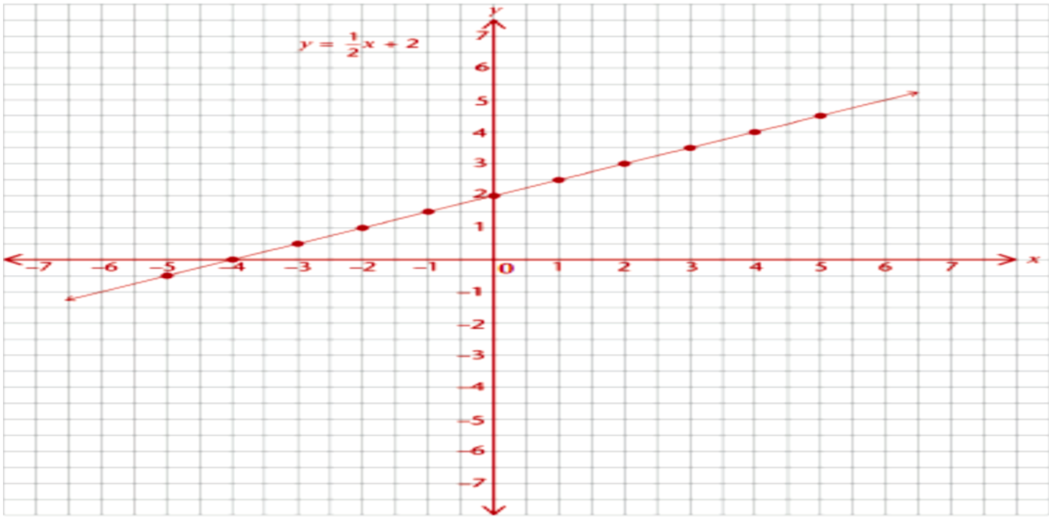
x	−5	−4	−3	−2	−1	0	1	2	3	4	5
$-3x + 4$	19	16	13	10	7	4	1	−2	−5	−8	−11



3.



x	−5	−4	−3	−2	−1	0	1	2	3	4	5
$\frac{1}{2}x+2$	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$



Section B

1.1 $y = 2x + 4$ → Table D → Graph B

$(2;8)$: $y = 2x + 4$ $\therefore y = 2(2) + 4$ $\therefore y = 8$
$(0;4)$: $y = 2x + 4$ $\therefore y = 2(0) + 4$ $\therefore y = 4$

1.2 $2x + 3y = 6$ → Table C → Graph C

$(0;2)$: $2(0) + 3y = 6$ $\therefore 0 + 3y = 6$ $\therefore 3y = 6$ $(\div 3)$ $\therefore y = 2$
$(3;0)$: $2(3) + 3y = 6$ $\therefore 6 + 3y = 6$ $\therefore 3y = 6 - 6$ $\therefore 3y = 0\ (\div 3)$ $\therefore y = 0$

1.3 $xy = 12$ → Table B → Graph D

$(6;2)$: $xy = 12$ $\therefore (6)(2) = 12$
$(1;12)$: $\therefore (1)(12) = 12$

1.4 $y = x^2 - 1$ → Table A → Graph A

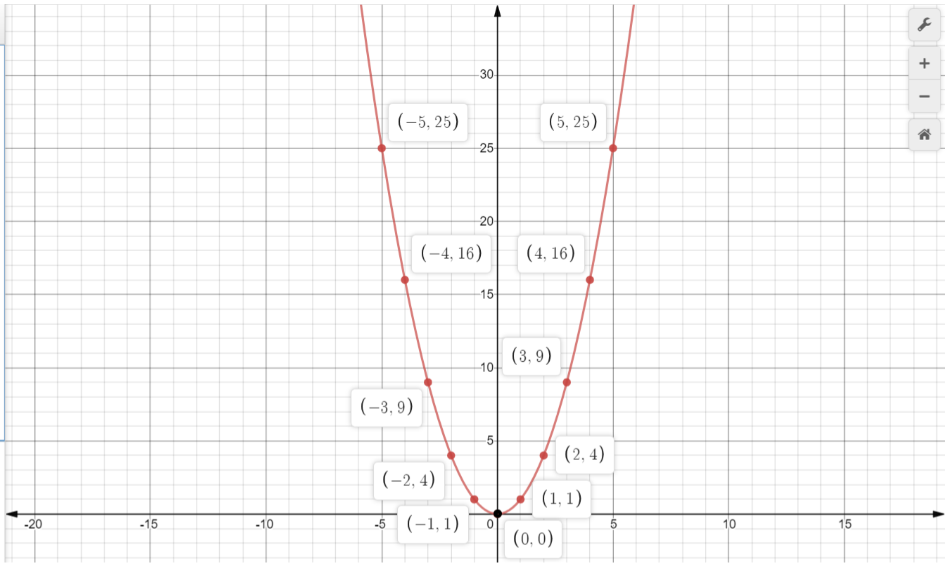
$(0;-1)$: $y = (0)^2 - 1$ $\therefore y = -1$
$(-3;8)$: $y = (-3)^2 - 1$ $\therefore y = 9 - 1$ $\therefore y = 8$

MEMORANDUM: DAY 5:

Classwork:

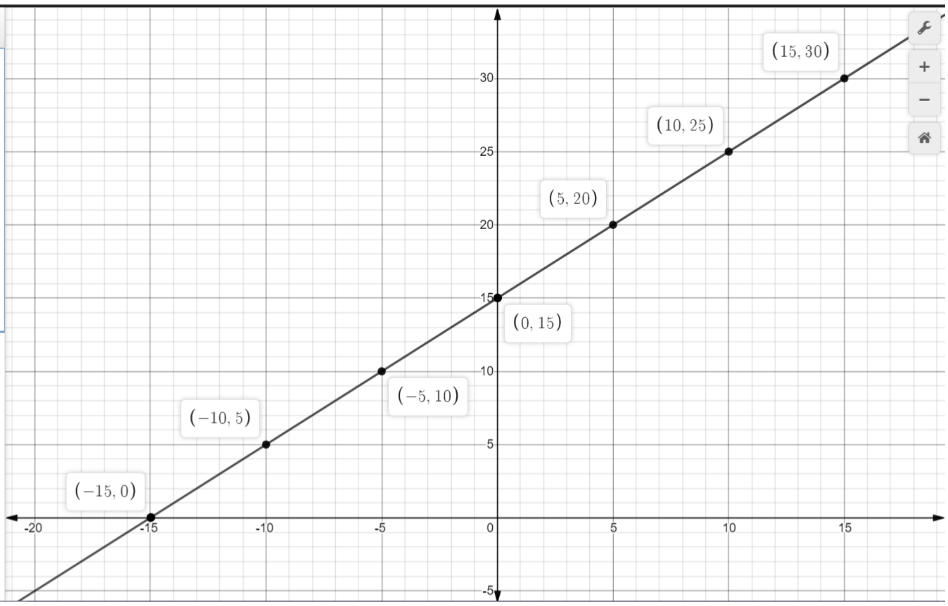
1.

x	x^2
−5	25
−4	16
−3	9
−2	4
−1	1
0	0
1	1
2	4
3	9
4	16
5	25

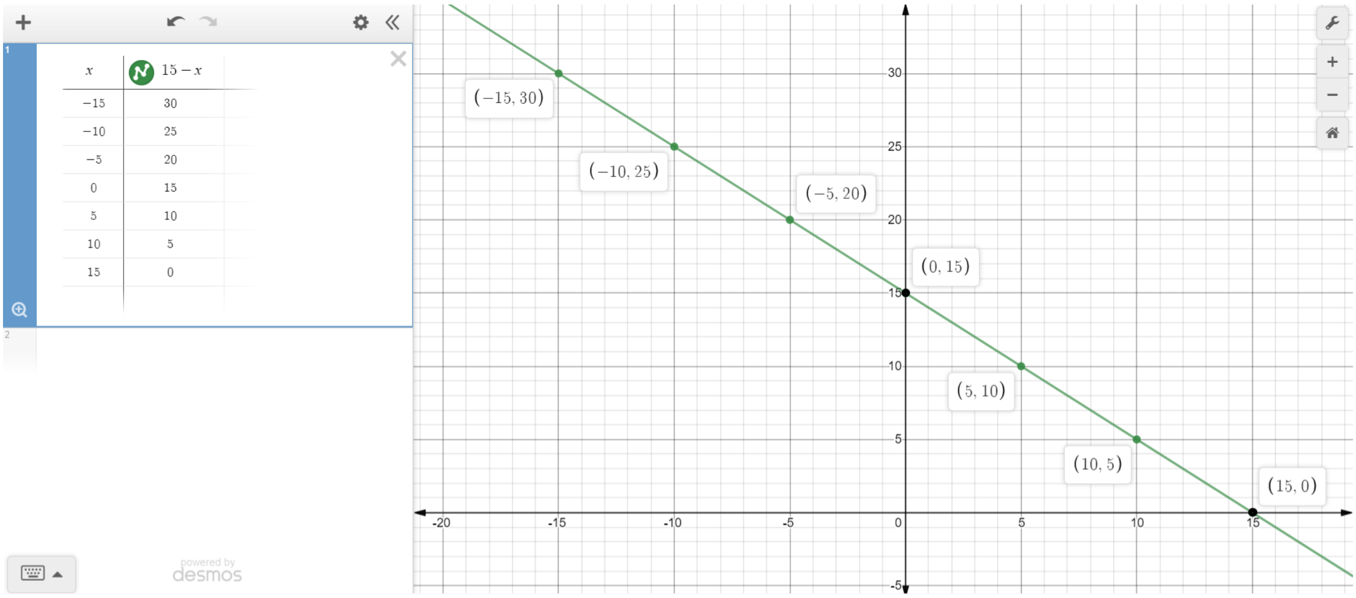


2.

x	$15 + x$
−15	0
−10	5
−5	10
0	15
5	20
10	25
15	30



3.



4.

a) For $y = x^2$ the rate at which the output values increase, and decrease is not constant, but for $y = 15 + x$, the output values increase at a constant rate.

b) The graph of $y = x^2$ is a curve and the graph of $y = 15 + x$ is a straight line.

5.

a) For $y = 15 + x$ the output values increase by 5,
for $y = 15 - x$ they decrease by 5.
In both cases the input values increase by 5.

b) Both are straight lines, but their directions differ:
$y = 15 + x$ goes upwards from left to right as the input values increase, and
$y = 15 - x$ goes downwards from left to right as the input values increase.

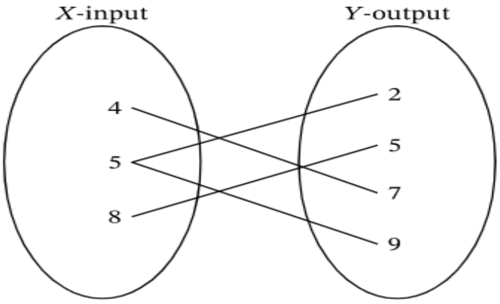
ASSESSMENT / REVISION TASK GRADE: 9

TOPIC: FUNCTIONS & RELATIONSHIPS

Question 1

In a discussion between Madison and Benjamin about functions, Benjamin said that the diagram below represents a function, but Madison argued that it does not. Who is right?

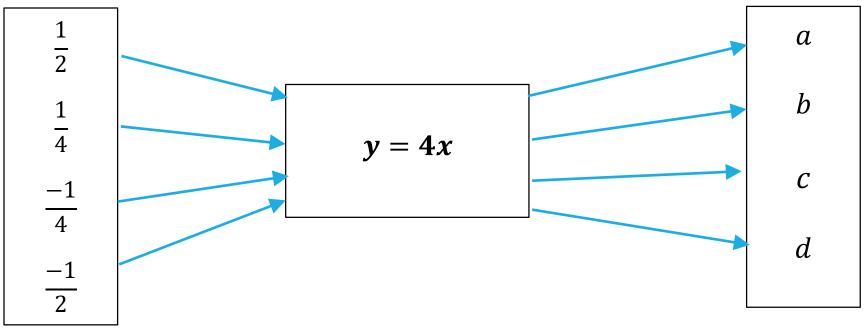
Motivate your answer.



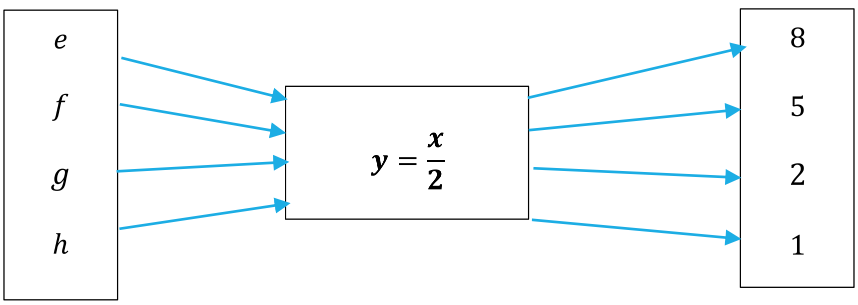
Question 2

Complete the following flow diagrams:

2.1



2.2



2.3 In each case consider the input values and state whether they are irrational numbers, natural or rational numbers.

Question 3

+1 +1 +1 +1 +5 +5 +10 +10

Input	6	7	8	9	10	15	20	30	40
Output			22	25	28	43	58	88	

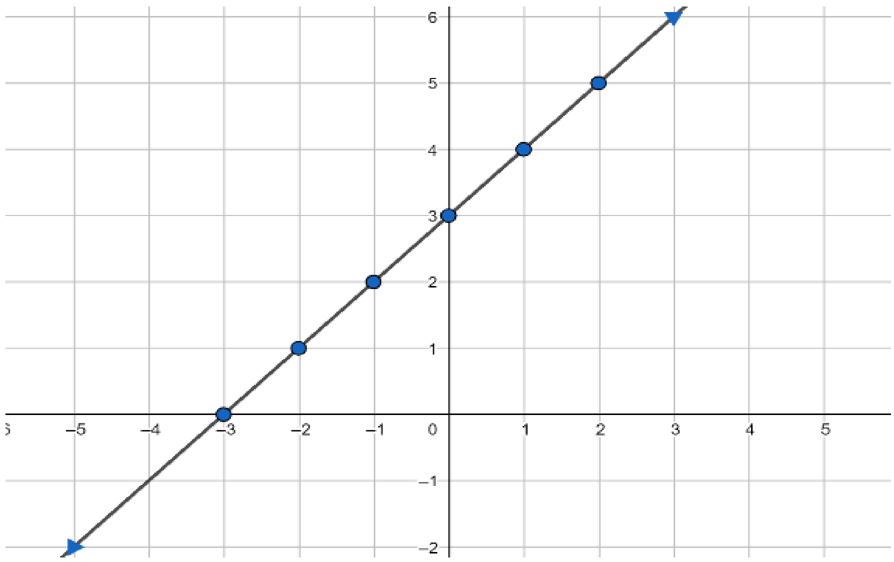
+__ +__ +__ +__ +__ +__ +__ +__

3.1 Copy and complete the table.

3.2 By how much will the output number increases if the input number increases by 1?

3.3 Determine the function rule for the function table above.

Question 4



4.1 Use the graph above to complete the table.

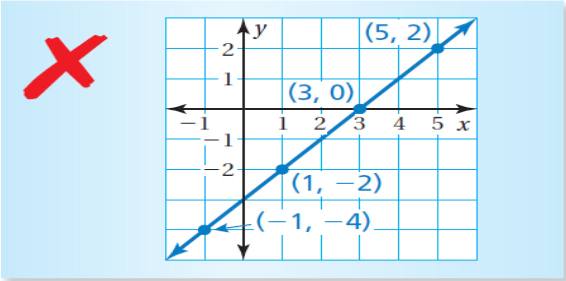
x	-2	-1	**c**	**d**	2	3
y	**a**	**b**	3	4	**e**	**f**

4.2 Determine a function rule to describe the relationship between x and y.

Question 5

Describe and correct the error in graphing the function represented by the input-output table.

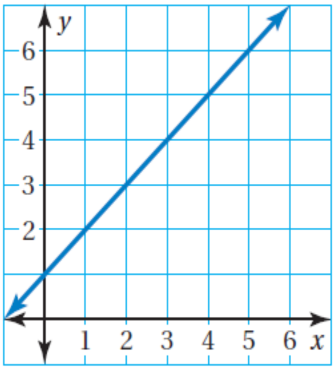
x	−4	−2	0	2
y	−1	1	3	5



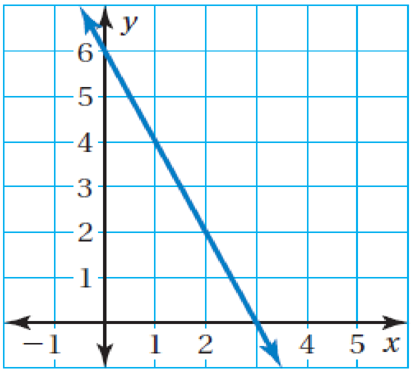
Question 6

Match the graph with the function rule it represents.

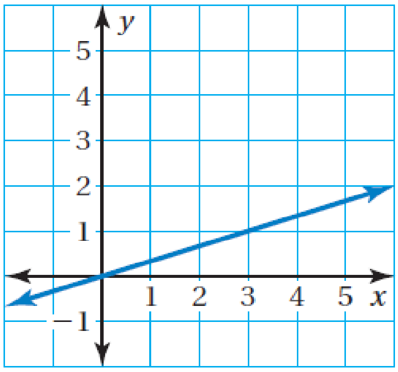
6.1



6.2



6.3



A. $y = \frac{x}{3}$

B. $y = x + 1$

C. $y = -2x + 6$

The End

ASSESSMENT / REVISION TASK GRADE: 9

TOPIC: FUNCTIONS & RELATIONSHIPS
MEMORANDUM

Question 1

Madison: A function is a relationship that assigns exactly one output value for each input value.

The input value of five has two outputs. It has an output of two and nine. So that input value of five does not have exactly one output; it has two. That means this figure cannot represent a function. So, our answer is: False.

Question 2

2.1

a	$y = 4x$	$\therefore y = 4 \times \frac{1}{2}$	$\therefore y = 2$
b	$y = 4x$	$\therefore y = 4 \times \frac{1}{4}$	$\therefore y = 1$
c	$y = 4x$	$\therefore y = 4 \times \frac{-1}{4}$	$\therefore y = -1$
d	$y = 4x$	$\therefore y = 4 \times \frac{-1}{2}$	$\therefore y = -2$

2.2

e	$y = \frac{x}{2}$	$\therefore$ e $\leftarrow multiply\ by\ 2 \leftarrow 8$	$\therefore 16 \leftarrow multiply\ by\ 2 \leftarrow 8$
f	$y = \frac{x}{2}$	$\therefore f \leftarrow multiply\ by\ 2 \leftarrow 5$	$\therefore 10 \leftarrow multiply\ by\ 2 \leftarrow 5$
g	$y = \frac{x}{2}$	$\therefore g \leftarrow multiply\ by\ 2 \leftarrow 2$	$\therefore 4 \leftarrow multiply\ by\ 2 \leftarrow 2$
h	$y = \frac{x}{2}$	$\therefore h \leftarrow multiply\ by\ 2 \leftarrow 1$	$\therefore 2 \leftarrow multiply\ by\ 2 \leftarrow 1$

2.3

2.3.1 $\left\{\frac{1}{2}; \frac{1}{4}; \frac{-1}{4}; \frac{-1}{2}\right\}$ → rational numbers

2.3.2 $\{16; 10; 4; 2\}$ → natural numbers

Question 3

3.1

	+1	+1	+1	+1	+5	+5	+10	+10	
Input	6	7	8	9	10	15	20	30	40
Output	**16**	**19**	22	25	28	43	58	88	118
	+ 3	+ 3	+ 3	+ 3	+ 15	+ 15	+ 30	+ 30	

3.2 Output will increase by 3

3.3

Input	6	7	8	9	……
$3 \times x$	3×6 ____	3×7_____	3×8____	3×9_____	……
$3 \times x - 2$	$3 \times 6 - 2$	$3 \times 7 - 2$	$3 \times 8 - 2$	$3 \times 9 - 2$	……
Output	16	19	22	25	…….

$$\therefore y = 3x - 2$$

Question 4

4.1

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

4.2

Constant difference: +1

Input	-2	-1	0	1	2	3
$1 \times x$	1×-2 ____	1×-1____	1×0____	1×1_____	1×2	1×3
$1 \times x + 3$	$1 \times -2 + 3$	$1 \times -1 + 3$	$1 \times 0 + 3$	$1 \times 1 + 3$	$1 \times 2 + 3$	$1 \times 3 + 3$
Output	1	2	3	4	5	6

$$\therefore y = x + 3$$

Question 5

The ordered pairs are written incorrectly from the table and therefor plotted wrong on the Cartesian plane.

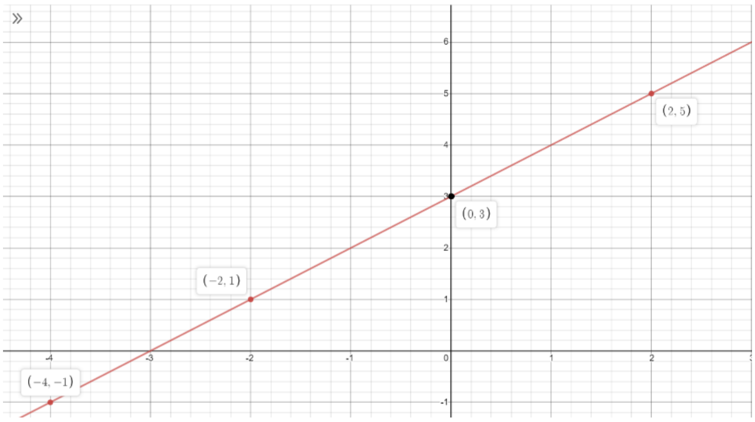
The $x\ coordinate$, which is the input value is always first.

The $y\ coordinate$, which is the output value is second.

Therefore : $(x - coordinate\ ;\ y - coordinate)$

Input x	-4	-2	0	2
Output y	-1	1	3	5

$(-4;-1)\ (-2;1)\ (0;3)\ (2;5)$



Question 6

Choose any coordinate on a straight line and substitute into respective equation.

$(\mathbf{0};\mathbf{1})$: $y = x+1$
$\therefore y = (0)+1$
$\therefore y = 1$

$(\mathbf{2};\mathbf{3})$: $y = x+1$
$\therefore y = (2)+1$
$\therefore y = 3$

$\therefore$ **6.1** $y = x+1\ \ (B)$

$(\mathbf{1};\mathbf{4})$: $y = -2x+6$
$\therefore y = -2(1)+6$
$\therefore y = -2+6$
$\therefore y = 4$

$(\mathbf{3};\mathbf{0})$: $y = -2x+6$
$\therefore y = -2(3)+6$
$\therefore y = -6+6$
$\therefore y = 0$

$\therefore$ **6.2** $y = -2x+6\ \ (C)$

$(\mathbf{0};\mathbf{0})$: $y = \frac{x}{3}$
$\therefore y = \frac{0}{3}$
$\therefore y = 0$

$(\mathbf{3};\mathbf{1})$: $y = \frac{x}{3}$
$\therefore y = \frac{3}{3}$
$\therefore y = 1$

$\therefore$ **6.3** $y = \frac{x}{3}\ \ (A)$

The End