MATHEMATICS LESSON

GRADE 7

DATE: ……

TOPIC: ALGEBRAIC EXPRESSIONS:

CONCEPTS & SKILLS TO BE ACHIEVED:
By the end of the lesson learners should know and be able to:

- **Describing and doing computations**: Looking at different ways of describing a computation; describing patterns using algebraic expressions
- **Relationships represented in formulae:** Understanding variables and constants in formulae and expressions
- **Interpret rules to calculate values of a variable**: Rules to calculate values if variables are given in words and are translated into expressions; expressions are translated into words; rules are compared to find different forms of the same rule; brackets are removed.
- **Slightly different kinds of rules Integers** are used as constants in the expressions; additive inverses are used to write rules for relationships as expressions1

RESOURCES:	DBE Workbook 2, Sasol-Inzalo book, Textbooks

DAY 1

INTRODUCTION: CLARIFICATION OF KEY TERMINOLOGY

There are new words that you will be introduced to such as algebra, expressions, variables, formula, computation, constant and values.

- In numeric patterns you speak about the rule of a pattern.
  For example, a number pattern is 3, 5, 7, 9. The pattern is counting on in 2s.
- The rule is written as a number sentence. Any formula can be written down as a number sentence.

Algebra has its own language. To assist you in your understanding of algebra, let us unpack the meanings of each word. You may know a few already. All of these concepts will unfold as we go through the lessons.

In **algebra,** letters are used to represent unknown values. Any letter can be used to represent an unknown value.

1. An **algebraic expression** is made up of variables and constants along with **algebraic** operations (addition, subtraction, etc.). The groups of numbers and letters either side of the equals sign are called expressions.
2. **Computation** simply means finding an answer by using mathematics or logic. You do simple computations when you add, subtract, multiply, etc.
3. In mathematics, a **constant term** is a term in an algebraic expression that has a value that is **constant** or cannot change.
4. When a letter is used in algebra to represent an unknown value, it is called a **variable**. Any letter of the alphabet can be used to represent the variable but x, y is mainly used. A variable is a quantity that is prone to change with the context of the situation. An **unknown** is a number we do not know. They are commonly used in algebra, where they are called **variables.**
5. The **value** of a variable or a constant is any number or other **mathematical** object assigned to it.
6. Any **formula** can be written down as a number sentence. The groups of numbers and letters either side of the equals sign are called expressions.
   Example: Area = $l \times b$

LESSON DEVELOPMENT: CLASSWORK

DESCRIBING AND DOING COMPUTATIONS DIFFERENT WAYS OF DESCRIBING A COMPUTATION

Work through the following examples demonstrating the basics of the concepts to you

1.The diagrams in question below represent the even numbers. Work from the pattern to the table and the flow diagram and then to the expression; following the explanation in and represent the expression as another way of describing the patterns.

Let us look at each diagram and see if we can identify how the small circles are arranged: Work through the example:

Row 1
Row 2

Diagram 1 Diagram 2 Diagram 3 Diagram 4 Diagram 5

The table below relates to the diagram. It is a good way of see patterns. We work from geometric patterns to numeric to number sentence. The table will be used to draw the flow diagram and then to the expression.

(a) How many rows do you see?

(b) In each row how many circles do you see?

(c) What is the total number of circles per diagram?

Diagram	1	2	3	4	5
Number of rows	2	2	2	2	2
Number of circles row 1	1	2	3	4	5
Number of circles row 2	1	2	3	4	5
How to calculate the total number of circles per diagram (**rule**)	2	4	6	8	10

You notice that there is a constant of 2 rows. The number of circles per diagram varies. We see that the pattern is showing add 2 circles each time. 2 rows x the number of circles which is the same as 2 multiply by n.

(d) What is the rule?

The answer is $2 \times n$. What does mean in algebraic language?

Did you notice that the diagrams represent the even numbers?

The rule for even numbers is $2 \times n$ which we write as $2n$.

$$2 \times n$$

constant

variable

It can be used to determine the total number of circles in a diagram. The number 2 in the rule 2 × n remains **the same** all the time. We say it is a **constant.**

The letter symbol **n** represents the number of circles per row and that is a **variable** because it **changes**.

Diagram	n	21	31	41	80
How to calculate the total number of circles per diagram (**rule**)	$2\ rows \times n$	2 rows x 21 circles	2 rows x 31 circles	2 rows x 41 circles	$2\ rows \times n$
	$2 \times n$	2 x 21	2 x 31	2 x 41	2×80
Even number answers	$2n$	42	62	82	160

Now let's see if our conclusion above applies further without drawing the circles. Number of rows multiply by the number of circles per row.

The **independent variable**, is the **input.** The expression tells you what calculations should be performed on the input variable to produce an answer, called the output variable. The functions can be shown in a table or a flow diagram. **The rule to generate output numbers is written as an expression the output values.**

CLASSWORK

Watch this video if you want more explanations https://cutt.ly/yi0wvp

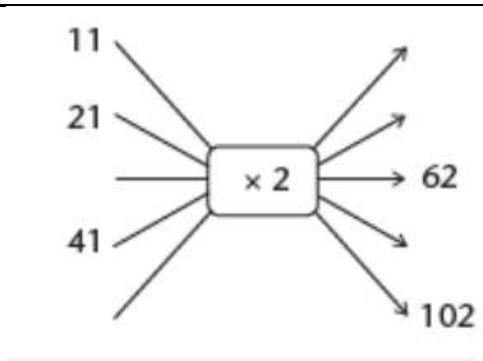
ACTIVITY 1: Answer the following questions by completing it in your classwork book. First attempt to do all the questions before you consult the memorandum at the end of these lessons.

The geometric pattern was represented numerically within a table. We worked together in finding the rule to determine the total number of circles in the above diagram.

Diagram	1	2	3	4	5
Number of rows	2	2	2	2	2
How to calculate the total number of circles per diagram	2	4	6	8	10

The rule **is** $\mathbf{2 \times n}$

(a) Draw a flow diagram using the information from the table and rule above.
(b) What remains the same in the diagrams above?
(c) What changes in the diagrams? In other words, what are the variable quantities in the situation?
(d) Copy and complete the flow diagram on the right. x represents the input



The number 2 in the rule $\mathbf{2} \times \boldsymbol{n}$ remains the same all the time.

(d) How many circles will diagram 11 have if the pattern is extended? Explain.
(e) What does the number 2 in the rule $2 \times n$ represent?
(f) What does the letter symbol n represent in the rule $2 \times n$?

How to do this this sum

ACTIVITY 2

The circle diagrams in activity 1 represented the even numbers. The rule is $2 \times n$. The rule for the odd numbers can be derived from the rule for the even numbers.

(a)

Diagram	1	2	3	4	5
Number of rows	2	2	2	2	2
How to calculate the total number of circles per diagram	1	3	5	7	9

The rule for odd numbers is $2 \times n - 1$. If 2 is the first even number, generated by $2 \times n$, the first odd number is one less therefore $2 \times 1 - 1$, and so on.

The numbers 2 and −1 remain the same all the time; we call them **constants**. The numbers in italics ***1, 2, 3*** change according to the position of the odd number in the sequence. We call them **variables**

Now complete the questions below.

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(b)What is the tenth odd number?
(c) What is the thirtieth odd number?
(d) What is the hundredth odd number?
(e) What is the nth odd number?

ACTIVITY 3:

The rule $2 \times n - 1$ can be used to determine any odd number in the sequence 1; 3; 5; 7; 9; ... What does the letter symbol n represent in the rule $2 \times n - 1$?

In the questions above we have used the letter symbol n to represent:

- a changing number in the rule $2 \times n$. (n represents the number of circles in a row
- the position of the odd number in a sequence in the rule $2 \times n - 1$.

CONSOLIDATION

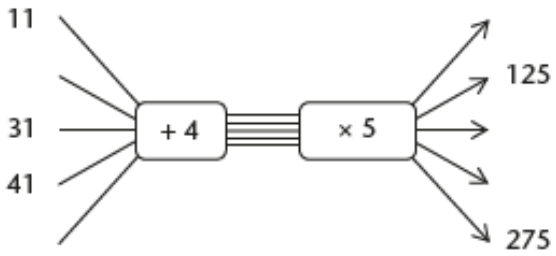
YOU SHOULD REMEMBER FROM TODAY'S WORK THAT:

- A symbol which has a **fixed numerical value** is called a **constant**
- A quantity which has **no fixed value** but takes no various numerical values is called a **variable.**
- Any letter symbol can be chosen to represent a variable but that those most often used are x, y, z and n.
- Input and output numbers in a flow diagram or a table.
- **x** represents the i**nput**
- **The rule to** generate output numbers is written as an **expression,** for example 5 x x + 4 represents the **output** values.

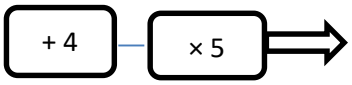
HOMEWORK: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons.

ACTIVITY 1:

1(a) Copy and complete the flow diagram.



(b) Which of the following instructions did you follow to calculate the output values of in (a)?



ACTIVITY 2:

Write out and place a tick mark (✓) next to the correct answer.

2(a) Multiply the input number by 5 and then add 4.
(b) Add 45 to the input number.
(c) Add 4 to the input number and then multiply by 5

ACTIVITY 3:

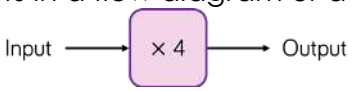
Use **10 as the input number** and calculate the output number for each of the word formulae.

3(a) Multiply the input number by 5 and then add 4.
(b) Add 45 to the input number.
(c) Add 4 to the input number and then multiply by 5.

DAY 2

INTRODUCTION: Describing and forming a computation

- Input and output numbers in a flow diagram or a table.
- **x** represents the **input**

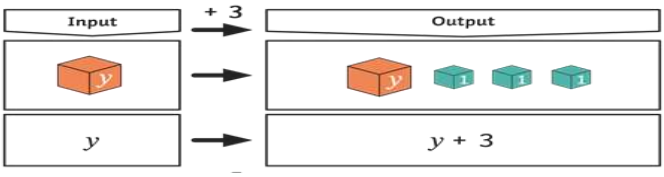


- **The rule to** generate output numbers is written as an **expression**, for example 5 x x + 4 represents the **output** values.

LESSON DEVELOPMENT

Developmental activities: Study the following examples that will enable you to understand, write and do computations;

1. Writing expressions for flow diagram:



Explanation

There is 1 big cube y. 3 smaller cubes b are added. What is the expression? y + **3**.

Explanation

The word problems below are examples of how we can write a number sentence using variables and constants. Read these stories and understand the order that it is happening. This will determine which part of the problem you do first.

Do the calculations in **brackets first**, then do multiplication and division in the order they appear and lastly, do the additions and subtractions in the order that they appear.

2. My grandma gave me R50 for my birthday. I spent R8 on sweets. How will I write an expression to complete the formula by using **x** for "the input number"?

First the R50 received and then R8 spent. We do not know how much money there initially was. This is the variable.

Answer: $\mathbf{x + 50 - 8}$

3. I spent half of my pocket money at the movies. I earned R7 for washing the car. How will I write an expression to complete the formula by using **x** for "the input number"?

Spent half of the money. We do not know how much money it is. This is the variable. R7 earned for washing the car.

Half is the same as dividing by 2. Earning money is to make more so it is adding.

Answer: $\mathbf{x \div 2 + 7}$ or $\mathbf{\frac{1}{2}x + 7}$

4. Write an expression to complete the formula by using $\mathbf{x}$ for "the input number"?

(a) **Halve** the input number and **plus 2.**

ANSWER: $\mathbf{x \div 2 + 2}$ **or** $\mathbf{\frac{1}{2}x \, x + 2}$

(b) **Multiply** the input number **by 6** and **subtract 2.**

ANSWER: $\mathbf{6 \, x \, x - 2}$

(c) **Multiply** the **sum of (add)** the input number **and 3 by 10.**

ANSWER: $\mathbf{(x + 3) \, x \, 10}$

(d) **Subtract 4 from** the **input number** and **multiply the answer by 7.**

ANSWER: $\mathbf{(x - 4) \, x \, 7}$

5. Write an expression to complete the formula by using the flow diagram by using $\mathbf{x}$ for "the input number.

(a) Input → +2 → −8 → Output **ANSWER:** $\mathbf{x + 2 - 8}$

The rule add 2 to the input number and subtract 8

(b) Input → × 4 → Output **ANSWER:** $\mathbf{x \times 4 \text{ or } 4x}$

The rule multiply by 4

(c) Input → × 2 → −8 → Output **ANSWER:** $\mathbf{x \times 2 - 8 \text{ or } 2x - 8}$

The rule multiply by 2 to the input number and subtract 8

In this expression, the symbol x represents the input variable (the values of x).

CLASSWORK

Watch this video if you want more explanations https://cutt.ly/Ai5qk7

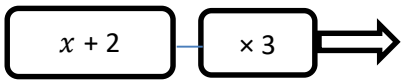
ACTIVITY 1: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons.

1. Cardo's teacher writes on the board: "Add 2 and then multiply the answer by 3." The class must use 5 as an input number to complete the formula.

(a) Cardo uses 5 as the input number and writes: $(5 + 2) \times 3$. Paul says $(5 + 2) \times 3$ is 7×3 which is 21. Is Paul right?

(b) Explain your answer in (a).

(c) Represent this operator part of a flow diagram as an algebraic expression



2. Write an expression to complete the formula by using **x** for "the input number.

(a) Multiply by 4 and then subtract 8.

(b) Subtract 8 and then multiply by 4.

(c) Add 15 and then divide by 5.

(d) Divide by 5 and then add 15.

CONSOLIDATION

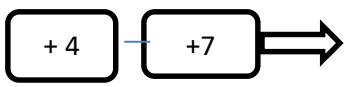
- When writing number sentences (algebraic expressions) remember the way the sentence is expressed in words.
- To find the value of an expression for particular values of the variable or variables, the normal rules of arithmetic apply – i.e. do the calculations in **brackets first,** then do multiplication and division in the order they appear and lastly, do the additions and subtractions in the order that they appear.
- If a relationship is given as a table or in words, it can usually be given in an expression as well.

Homework: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons.

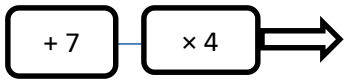
ACTIVITY 1:

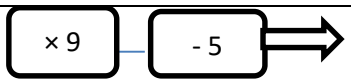
1. Describe each expression in words.

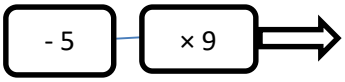
(a)



(b)



(c) 

(d) 

2. Two algebraic expressions are given in the table. Copy the table and use the given input values (x values) to work out the output values. **THE FIRST TABLE IS AN EXAMPLE**

EXAMPLE x	Write it out in words	**1**	**2**	**3**
$6 \times x + 8$	x 6 multiply add 8	$2 \times 6 + 8 = 14$	$2 \times 6 + 8 = 20$	$3 \times 6 + 8 = 26$
$2 \times x \times (3 + 4)$	x multiply by 2 but first do brackets (3+4)	$1 \times 2 \times (3+4)$ $1 \times 2 \times 7 = 14$	$2 \times 2 \times (3+4)$ $2 \times 2 \times 7 = 24$	$3 \times 2 \times (3+4)$ $3 \times 2 \times 7 = 42$

Copy the table and use the given input values (x values) to work out the output values.

x		**1**	**2**	**3**	**4**	**5**	**6**
$6 \times x + 8$		14	20	26			
$2 \times x \times (3 + 4)$							

DAY 3

INTRODUCTION: Relationships represented in formulae; making sense of variables and constants in formulae.

- An algebraic expression is a symbolic description of a set of calculations that can be performed on different values of a variable.

NOTES ON FORMULAE:

- A formula is a group of letters, numbers or other symbols which represents a scientific or mathematical rule or principle.
- It is frequently expressed in algebraic symbols such a symbolic expression.
- It usually has: an equal sign (=) ; two or more variables (x, y, etc)
- An example is when finding area of a rectangle. The formula is A = l × b.

LESSON DEVELOPMENT

DEVELOPMENTAL ACTIVITY: Work through the examples to familiarise yourself with the development of this concept

1. Chris uses the formula **P = 2 × l + 2 × b** to calculate **the perimeters** of rectangles of differing lengths and breadths as shown in the table. He also calculates the **area** of each **rectangle** using the f**ormula** $\mathbf{A = l \times b}$.

Perimeter is the distance around the outside of a shape. **Area** measures the space inside a shape. A rectangle has 2 lengths and 2 breadths.

Rectangle	1	2	3	4
Length (l)	24	6		
Breadth (b)	1	4		
P = 2 x l + 2 x b	24 +24+1+1	6+6+4+4		
Perimeter	50	20		
A = l x b	24 x 1	6 x 4		
Area	24	24		

2. Rita calculates the perimeter of a rectangle in a different way.
   She adds the value of the length of the rectangle to the value of the breadth of the rectangle and then multiplies the answer by 2.
   Write down the formula that Rita uses to calculate the perimeter of each rectangle. Test whether or not Rita's formula produces the same results as Chris's.

SOLUTION: Rita P = 2 × (l + b)

Chris: testing for rectangle 1: 2 × (24 + 1) = 2 × 25 = 50

A formula is a group of letters, numbers, or other symbols which represents a scientific or mathematical rule. a rule or principle, frequently expressed in algebraic symbols such a symbolic expression. It usually has: • an equals sign (=) • two or more variables (x, y, etc)

Algebraic expressions that have the same numerical value for the same values of x, but look different, are called **equivalent expressions**.

Let us use an example from yesterday's lesson.

3. My grandma gave me R50 for my birthday. I spent R8 on sweets. How will I write an expression to complete the formula by using $\mathbf{x}$ for "the input number"?

> First the R50 received and then R8 spent. We do not know how much money there initially was. This is the variable.

$$\mathbf{x + 50 - 8}$$

Expression	**James**	**Bronwyn**
Own money $\mathbf{x}$	R120	R240
$\mathbf{x + 50 - 8}$	$\mathbf{120} + 50 - 8$	$\mathbf{240} + 50 - 8$
Amount left	R162	R282

4. I spent half of my pocket money at the movies. I earned R7 for washing the car. How will I write an expression to complete the formula by using $\mathbf{x}$ for "the input number"?

> Spent half of the money. We do not know how much money it is. This is the variable. R7 earned for washing the car.
>
> Half is the same as dividing by 2. Earning money is to make more so it is adding.

$$\mathbf{x \div 2 + 7} \quad \text{or} \quad \mathbf{\frac{1}{2}x + 7}$$

Expression	**Jabu**	**Shirley**
Own money $\mathbf{x}$	R440	R500
$\mathbf{x \div 2 + 7}$ **or** $\mathbf{\frac{1}{2}x + 7}$	$\mathbf{440 \div 2 + 7}$	$\mathbf{500 \div 2 + 7}$
Method	Half first plus 7	Half first plus 7
Amount left	R227	R257

Do the calculations in **brackets first,** then do **multiplication and division** in the order they appear and lastly, do the **additions and subtractions** in the order that they appear.
BODMAS OR BOMDAS is a quick way to remember it.

CLASSWORK

Watch this video if you want more explanations https://cutt.ly/Oi0w0s

ACTIVITY 1: Work through the 3 activities below about the representing relationships in formulae in your classwork exercise book.

1. Use the table to complete questions below. Refer to the **formula** $\mathbf{P = 2 \times (l + b)}$.

Rectangle	**1**	**2**	**3**	**4**
Length (l)	24	6	8	12
Breadth (b)	1	4	3	2
Perimeter	50	20	22	28
Area	24	24	24	24

(a) What does the number 2 represent in the formula?

(b) What is the number 2 called?
(c) Which letter symbols represent variables in the formula $P = 2 \times (l + b)$? Explain.
(d) What can you say about the area of all of these rectangles?

2. Sindi calculates her father's age by using the formula F = x + 37, where x is Sindi's age. Her father passed away when Sindi was 43 years old. How old was he then?

3. Jacob wants to buy the cheapest cell phone in the market. He has already saved R45 and decides to save R5 per week until he has enough money to buy the phone.

The formula **y = 45 + 5 × w** gives the amount of money (in rands) that Jacob has saved to buy the cell phone after w weeks.

Remember that **w is the variable.**

(a) Copy and complete the table. The first row has been done as an example.

Number of weeks (w)	**How to calculate $45 + 5 \times w$**	**Amount saved (y)**
0	45 +(5 x 0) Zero is the variable.	45
1	45 + (5 x 1)	
2		
4		
5		

(b) The cell phone that Jacob wants to buy costs R90. Will Jacob have saved enough money to be able to buy the cell phone by the eighth week? Explain.

(c) Copy and complete the table.

Formula $y = 45 + 5 \times w$		
Which are constants in the formula?		
Which letter symbols represent variable quantities in the formula?		

CONSOLIDATION

- The two formulae can be tested to show that they give the same result for the same values of l and b: **P = 2 x l + 2 x b and P = 2 x (l + b)**
- The formula can be changed: **P = 2 x l + 2 × b to P = 2 x (l + b)** by inserting the brackets.

HOMEWORK: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons.

ACTIVITY 1:

1. Copy the table. In each of the formulae in the table, identify the symbols that represent variables and constants and fill them in.

		Symbols for variables (s)	**Constant (s)**
(a)	$y = 5 \times x + 7$		
(b)	$y = 100 + x$		
(c)	$y = x + 5$		
(d)	$y = 5 \times x$		
(e)	$y = 0{,}7 \times x + 2{,}3$		

DAY 4

LESSON DEVELOPMENT

DEVELOPMENTAL ACTIVITY: Work through the examples to familiarise yourself with the development of this concept

Look at the table below. Multiply the input number by 20 and add 50 to the answer. Write the expression. $\mathbf{x \times 20 + 50}$ **or** $20x + 50$. It is the same expression.

A variable and a constant next each other without any other operation signs, like $20x$ means 20 multiply by x.

x	1	2	3	4	5	6	7	8	9
	1x20+50	2x20+50	3x20+50	4x20+50	5x20+50	6x20+50	7x20+50	8x20+50	9x20+50
y	70	90	110	130	150	170	190	210	230

- The same rule can be described with the algebraic expression $20x + 50$.
- In this expression, the symbol x represents the input variable (the values of x).
- The numbers 20 and 50 are constant; they remain the same for all the different values of x.
- The rule add 50 to the input number and multiply the answer by 20 can be described with the expression $20(x + 50)$

You may think that $3(x + 5)$ and $3x + 5$ give the same values (and are therefore equal). Describe the rules in words, you can know which expressions are equivalent. This means that they give the same output values for the same input values.

$3(x + 5)$ is read as $(x + 5)x\,3$ or 3 multiply x and 3 multiply 5

If x is 2 then $(2 + 5)x\,3 = 21$. BRACKETS FIRST

3×2 PLUS 3×5

$6 + 15 = 21$

CLASSWORK

Activity 1: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons.

1. Describe each of the following rules in words.

(a) $15x + 30$

(b) $30 + 15x$

(c) $15(x + 30)$

(d) $15(x + 2)$
(e) $15x - 30$
(f) $15(x - 30)$
(g) $15(x - 2)$

2. What is the difference between $3(x + 5)$ and $3x + 5$?

3. Copy and complete the table.

x	1	2	3	4	5	6	7	8	9
$15x + 30$									
$30 + 15x$									
$15(x + 30)$									
$15(x + 2)$									

Remember

If there are brackets in an algebraic expression, the operations in brackets are to be done first. If there are no brackets in an expression, multiplication is done first, even if it appears later in the expression like in $30 + 5x$.

4. Copy and complete the table.

	30	40	50	60	70	80	90
$15x - 30$							
$15(x - 30)$							
$15(x - 2)$							

CONSOLIDATION

- Algebraic expressions are instructions to calculate values.
- You may think that $3(x + 5)$ and $3x + 5$ give the same values (and are therefore equal).
- By describing rules in words, you can become aware of which expressions are equivalent, which means they give the same output values for the same input values.

HOMEWORK: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons

ACTIVITY 1

1.Investigate which of the following rules will produce the same output numbers. Use different input numbers. It is easier to start with 1,2 ,3

a: Multiply the input number by 10 and then add 20.
b: Add 20 to the input number and then multiply by 10.
c: Add 2 to the input number and then multiply by 10.
d: Multiply the input number by 3, add 15, add 7 times the input number, and then add 5.

x								
a								
b								
c								
d								

(e) Describe each of the above rules with an algebraic expression.

(2) Which of these rules do you think will produce the same output numbers?

a: $5\,x\, +\, 20$
b: $4\,x\, +\, 19$
c: $5(x\, +\, 20)$
d: $20\, +\, 5x$
e: $5(x\, +\, 4)$
f: $3\,x\, +\, 7\, +\, 2\,x\, +\, 13$

(b) Express each of the above rules in words.

(c) Copy and complete this table for the rules given in question (a).

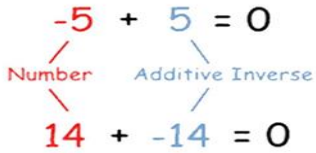
x	0	5	10	15
$5x + 20$				
$4x + 19$				
$5(x + 20)$				
$20 + 5x$				
$5(x + 4)$				
$3x + 7 + 2x + 13$				

(d) Use your completed table to check your answer in question (a).

DAY 5

INTRODUCTION: Slightly different kinds of rules subtract positive and negative quantities

- When a number is added to the number called its additive inverse, the **answer is 0**. **For example, 45 + (−45) = 0 and (−12) + 12 = 0.**



Additive inverse of a number

LESSON DEVELOPMENT: Study the following examples that will demonstrate and explain how we subtract positive and negative quantities

Subtraction

If both signs are negative, the answer will be negative.
If the signs are different subtract the smaller absolute value from the larger absolute value. The sign will be the sign of the integer that produced the large.

Addition

Same sign- keep and add
Different signs subtract, keep the sign of the bigger(whole) number.
If both signs are positive, the answer will be positive.

- Refer to the **rules adding and subtracting integers.**
- **Remember** to check for the **negative sign.**
- The expressions below are explained in the **x column.**
- Remember to **read the expression out loud to understand what you need to do.**
- Remember **BODMAS**

1. Describe the rules in words. Then we substitute the values of x

x	1	10	5	20	25
10x it means 10 multiply by x	**10 x 1**	**10 x 10**	**10 x 5**	**10 x 20**	**10 x 25**
	10	**100**	**50**	**200**	**250**
$50 - 10x$ 50 subtract 10 multiply by x	**50 – (10 x 1)**	**50 – (10 x 10)**	**50 – (10 x 5)**	**50 – (10 x 20)**	**50 – (10 x 25)**
	40	**-50**	**0**	**-150**	**-200**
$20 - 10x$	**20 – (10 x 1)**	**20 – (10 x 10)**	**20 – (10 x 5)**	**20 – (10 x 20)**	**20 – (10 x 25)**
	10	**-80**	**-30**	**-180**	**-230**

20 subtract 10 multiply by x					
$0 - 10x$	**0 – (10 x 1)**	**0 – (10 x 10)**	**0 – (10 x 5)**	**0 – (10 x 20)**	**0 – (10 x 25)**
0 subtract 10 multiply by x	**-10**	**-100**	**-50**	**-200**	**-250**

2. (a) Describe the rules in words. Then we substitute the values of x

x	0	5	10	15	20	25	30
$10x - 5$ it means 10 multiply by x subtract 5	**(10 x 1) -5**	**(10 x 5) - 5**	**(10 x 10) -5**	**(10 x 15) -5**	**(10 x 20) -5**	**(10 x 25) -5**	**(10 x 30) -5**
	-5	**45**	**95**	**145**	**195**	**245**	**295**
$5x - 10$	**-10**	**15**	**40**	**65**	**90**	**115**	**140**
$100 - 5x$	**100**	**75**	**50**	**25**	**0**	**-25**	**-50**
$-100 + 5x$	**-100**	**-75**	**-50**	**-25**	**0**	**25**	**50**
$5x - 100$	**-100**	**-75**	**-50**	**-25**	**0**	**25**	**50**
$5 - 10x$	**5**	**-45**	**-95**	**-145**	**-195**	**-245**	**-295**

(b) The values of $10x - 5$ increase as the values of x increase from 0 to 30. For which expressions in (a) do the values decrease when x is increased? **$100-5x$ or 5 - 10x**

(c) Do the values of $-100 + 5x$ increase or decrease when x is increased from 0 to 30? The values **increase.**

3.

x	1	5	10	20	25
5x	**5**	**25**	**50**	**100**	**125**
the additive inverse of 5x	**-5**	**-25**	**-50**	**-100**	**-125**
20 + (the additive inverse of 5x	**15**	**-5**	**-30**	**-80**	**-105**
20 − (the additive inverse of x5	**25**	**45**	**70**	**120**	**145**
3x	**3**	**15**	**30**	**60**	**75**
-3x	**-3**	**-15**	**-30**	**-60**	**-75**

When a number is added to the number called its additive inverse, the answer is 0. For example, $45 + (-45) = 0$ and $(-12) + 12 = 0$.

Instead of $(-10x) - 1\,000$ we may write $-10x - 1\,000$, in other words the brackets around the additive inverse may be left out. Similarly, $(-10x) + 1\,000$ may be written as $-10x + 1\,000$.

CLASSWORK:

ACTIVITY 1: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons.

1a) The values of the expression $5x - 10$ increase when x is increased from 0 to 30. Do you think the values will increase further when x is increased beyond 30, or will they start to decrease at some stage?

(b) Do you think the values of the expression 100 − 3 x will increase when x is increased from 0 to 30? Explain why you think they will or will not. The additive inverse of a number may Be indicated by writing a negative sign before the number. For example, the additive inverse of 8 can be written as −8.

2. Write the additive inverse of each of the following numbers:
20 ; 30 ; −25 ; −20 ; 40

3. Different values for x are given in the first row of the table below. Copy the table. Write the additive inverses of the x values in the second row, and then complete the table.

x	5	10	15	20	25	30
the additive inverse of x						
20 + (the additive inverse of x						
20 – (the additive inverse of x						
20 + x						
20 – x						

HOMEWORK: Complete in your classwork exercise books. First attempt to do all the questions before you consult the memorandum at the end of these lessons

ACTIVITY 1: Complete in your classwork exercise book.

1. Copy and complete the table.

x	-5	-10	-15	-20	-25	-30
the additive inverse of x						
20 + (the additive inverse of x						
20 − (the additive inverse of x						
20 + x						
20 – x						

2.**Expressions with additive inverses.**

Copy and complete the table.

x	1	5	10	20	25
5x					
the additive inverse of 5x					
20 + (the additive inverse of 5x					
20 − (the additive inverse of x5					
3x					
-3x					
10 +(– 3x)					
10 – 3x					
10-(-3x)					

3. Copy and complete the table below. Note that $(-10\,x)$ indicates the additive inverse of $10\,x$.

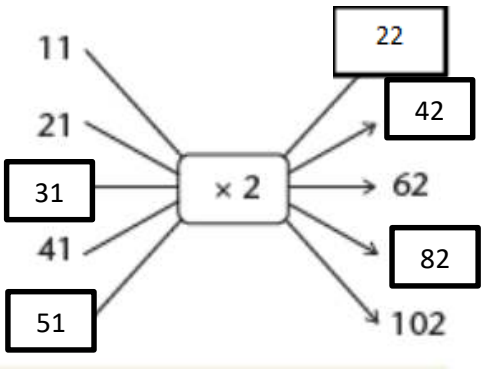
x	1	2	3	4	-4	-3	-2
$10x - 1\,000$							
$1\,000 - (-10x)$							
$1\,000 - 10x$							
$(-10x) + 1\,000$							
$10x - (+1\,000)$							

MEMORANDUM

DAY 1

CLASSWORK: MEMORANDUM DAY 1:

Describing and doing computations different ways of describing a computation
Activity 1
(a) The number of rows.
(b) The number of circles per diagram and the number of circles per row.
(c) Copy and complete the flow diagram on the right.



(d) There will be 22 circles because diagram 11 will have 2 rows of 11 circles per row.
(e) It represents the number of rows.
(f) The letter symbol n represents the number of circles in a row.

Activity 2

(a) The rule for odd numbers is $2 \times n - 1$. If 2 is the first even number, generated by 2 x n, the first odd number is one less therefore $2 \times 1 - 1$, and so on.

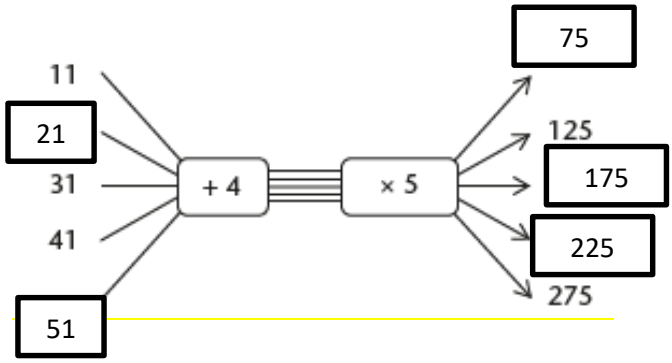
Diagram	1	2	3	4	5
The total number of circles per diagram	2 x 1	2 x 2	2 x 3	2 x4	2 x 5
Even number answers	2	4	6	8	10
Subtract 1	-1	-1	-1	-1	-1
The odd number is one less than the even	$2 - 1$	$4 - 1$	$6 - 1$	$8 - 1$	$10 - 1$
	1	3	5	7	9

(b) 2 × 10 − 1 = 20 − 1 = 19
(c) 2 × 30 − 1 = 60 − 1 = 59
(d) 2 × 100 − 1 = 200 − 1 = 199
(e) 2 × n − 1

Activity 3
The letter symbol n represents the position of the odd number in the sequence.

HOMEWORK: MEMORANDUM DAY 1

Activity 1



Activity 2

C: Add 4 to the input number and then multiply by 5.

Activity 3
The input number is 10.

(a) $10 \times 5 + 4 = 54$
(b) 10 + 45 = 55
(c) $(10 + 4) \times 5 = 14 \times 5 = 70$.

DAY 2

CLASSWORK: MEMORANDUM DAY 2:

Activity 1

(a) Yes, Paul is correct.

(b) Cardo's expression means you first add 5 and 2 to get 7 and then multiply the answer by 3. By convention, the operation in brackets is done before any other operation.

(c) $(x + 2) \times 3$

Activity 2

(a) $x \times 4 - 8$

(b) $(x - 8) \times 4$ or $4 \times (x - 8)$

(c) $(x + 15) \div 5$ or $\frac{x+15}{5}$

(d) $(x \div 5) + 15$ or $\frac{x}{5} + 15$

Homework: MEMORANDUM DAY 2:

Activity 1:

(a) Multiply by 4 and then add 7.

(b) Add 7 and then multiply the answer by 4.

(c) Multiply by 9 and then subtract 5.

(d) Subtract 5 and then multiply the answer by 9

Activity 2:

x	1	2	3	4	5	6
$6 \times x + 8$	14	20	26	32	38	44
$2 \times x \times (3 + 4)$	14	28	42	56	70	84

DAY 3

CLASSWORK: MEMORANDUM DAY 3:

Relationships represented in formulae making sense of variables and constants in formulae

Actvity 1

Rectangle	**1**	**2**	**3**	**4**
Length (l)	24	6	8	12
Breadth (b)	1	4	3	2
Perimeter P = 2 x l + 2 x b	**50**	**20**	**22**	**28**
Area A = l x b	**24**	**24**	**24**	**24**

(a) There are two lengths (longer sides) and two breadths (shorter sides) in every rectangle.
(b) It is called a constant.
(c) The letter symbols P, l and b. All (perimeter, length and breadth) have changing values.
(d) The area of all of the rectangles is 24, so the area stays constant.

Activity 2:
Substitute Sindi's age then for x:
F = 43 + 37
∴ F = 80
Sindi's father was 80 years old when he died.

Activity 3:
(a)

Number of weeks (w)	**How to calculate $45 + 5 \times w$**	**Amount saved (y)**
0	45 + 5 x 0 = 45 + 0	45
1	45 + 5 x 1 = 45 + 5	50
2	45 + 5 x 2 = 45 + 10	55
4	45 + 5 x 4= 45 + 20	65
5	45 + 5 x 5= 45 + 25	70

(b) No, because by the eighth week he will have saved only 45 + 5 × 8 = 45 + 40 = R85.
(c)

Formula $y = 45 + 5 \times w$		
Which are constants in the formula?	45 and 5	These numbers remain the same all the time
Which letter symbols represent variable quantities in the formula?	y and w	The number of weeks his has been saving and the total of his savings after each week change all the time.

HOMEWORK: MEMORANDUM DAY 3:

		Symbols for variables (s)	Constant (s)
(a)	$y = 5 \times x + 7$	y and x	5 and 7
(b)	$y = 100 + x$	y and x	100
(c)	$y = x + 5$	y and x	5
(d)	$y = 5 \times x$	y and x	5
(e)	$y = 0{,}7 \times x + 2{,}3$	y and x	0,7 and 2,3

DAY 4

MEMORANDUM DAY 4: CLASSWORK

Activity 1

Describe each of the following rules in words.

(a) Multiply the number by 15 and then add 30 to the answer.
(b) Multiply the number by 15 and then add 30 to the answer.
(c) Add 30 to the number and multiply the answer by 15.
(d) Add 2 to the number and multiply the answer by 15.
(e) Multiply the number by 15 and subtract 30 from the answer.
(f) Subtract 30 from the number and multiply the answer by 15.
(g) Subtract 2 from the number and multiply the answer by 15.

2.
3(x + 5) means you first add 5 to the number and then multiply the answer by 3, while 3 x + 5 means you first multiply the number by 3 and then add 5 to the answer. The difference is 10.

3. Copy and complete the table.

x	1	2	3	4	5	6	7	8	9
$15x + 30$	45	60	75	90	105	120	135	150	165
$30 + 15x$	45	60	75	90	105	120	135	150	165
$15(x + 30)$	465	480	495	510	525	540	555	570	585
$15(x + 2)$	45	60	75	90	105	120	135	150	165

4. Copy and complete the table.420

	30	40	50	60	70	80	90
$15x - 30$	420	570	720	870	1 020	1 170	1 320
$15(x - 30)$	0	150	300	450	600	750	900
$15(x - 2)$	420	570	720	870	1 020	1 170	1 320

Homework: MEMORANDUM DAY 4:

Activity 1

1(a) A, C and D will produce the same outputs. Learners could use any values for **x**. Substitution.

a: Multiply the input number by 10 and then add 20.
c: Add 2 to the input number and then multiply by 10.

d: Multiply the input number by 3, add 15, add 7 times the input number, and then add 5.

x	1	2	10
a	(1 x 10)+ 20 = 30	(2 x 10)+ 20 = 40	(10 x 10)+ 20 = 120
c	(1 + 2) x 10 = 30	(2 + 2) x 10 = 40	(10 + 2) x 10 = 120
d	(1 x 3) + 15 +(7 x 1) + 5 = 30	(2 x 3) + 15 + (7 x 2) + 5 = 40	(10 x 3) + 15 + (7x10) + 5 = 120

(b)
a: Multiply the input number by 10 and then add 20 $\mathbf{10x + 20}$
b: Add 20 to the input number and then multiply by 10 $\mathbf{(x + 20 \times 10 \text{ or } 10(x + 20)}$
c: Add 2 to the input number and then multiply by 10 $\mathbf{(x + 2) \times 10 \text{ or } 10(x + 20)}$.
d: Multiply the input number by 3, add 15, add 7 times the input number, and then add 5. $\mathbf{3x + 15 + 7x + 5}$

(2a) Which of these rules do you think will produce the same output numbers?
(a): 5 x + 20
(b): 20 + 5x
(c): 5(x + 4)
(d): 3 x + 7 + 2 x + 13

(2b) Express each of the above rules in words.
a: Multiply the input number by 5 and then add 20
b: Multiply the input number by 4 and then add 19
c: Add 20 to the input number and then multiply by 5
d: Multiply the input number by 5 and then add 20
e: Add 4 to the input number and then multiply by 5
f: Multiply the input number by 3, add 7, add twice the number, and then add 13.

(2c) Copy and complete this table for the rules given in question (a).

x	0	5	10	15
$5x + 20$	**20**	**45**	**70**	**95**
$4x + 19$	**19**	**39**	**59**	**79**
$5(x + 20)$	**100**	**125**	**150**	**175**
$20 + 5x$	**20**	**45**	**70**	**95**
$5(x + 4)$	**20**	**45**	**70**	**95**
$3x + 7 + 2x + 13$	**20**	**45**	**70**	**95**

(d) The completed answer is in the table.

DAY 5

MEMORANDUM DAY 5: CLASSWORK

Activity 1

1(a) They will keep on increasing

(b) 100 - 3x decreases as x increases because the bigger x is, the more is subtracted from 100.

(2) -20 -30 25 20 -40

(3)Different values for x are given in the first row of the table below. Copy the table. Write the additive inverses of the x values in the second row, and then complete the table.

x	5	10	15	20	25	30
the additive inverse of x	**-5**	**-10**	**-15**	**-20**	**-25**	**-30**
20 + (the additive inverse of x	**15**	**10**	**5**	**0**	**-5**	**-10**
20 − (the additive inverse of x	**25**	**30**	**35**	**40**	**45**	**50**
20 + x	**25**	**30**	**35**	**40**	**45**	**50**
20 − x	**15**	**10**	**5**	**0**	**-5**	**-10**

Homework: MEMORANDUM DAY 5:

Activity 1:

(1)

x	-5	-10	-15	-20	-25	-30
the additive inverse of x	**5**	**10**	**15**	**20**	**25**	**30**
20 + (the additive inverse of x	**15**	**10**	**5**	**0**	**-5**	**-10**
20 − (the additive inverse of x	**25**	**30**	**35**	**40**	**45**	**50**
20 + x	**25**	**30**	**35**	**40**	**45**	**50**
20 – x	**15**	**10**	**5**	**0**	**-5**	**-10**

2: **Expressions with additive inverses.**

x	1	5	10	20	25
5x	**5**	**25**	**50**	**100**	**125**
the additive inverse of 5x	**-5**	**-25**	**-50**	**-100**	**-125**
20 + (the additive inverse of 5x	**15**	**-5**	**-30**	**-80**	**-105**
20 − (the additive inverse of x5	**25**	**45**	**70**	**120**	**145**
3x	**3**	**15**	**30**	**60**	**75**
-3x	**-3**	**-15**	**-30**	**-60**	**-75**
10 +(– 3x)	**7**	**-5**	**-20**	**-50**	**-65**
10 – 3x	**7**	**-5**	**-20**	**-50**	**-65**
10-(-3x)	**13**	**25**	**40**	**70**	**85**

Activity 3:

x	1	2	3	4	-4	-3	-2
$10x - 1\,000$	**-990**	**-980**	**-970**	**-960**	**-1 040**	**-1 030**	**-1 020**
$1\,000 - (-10x)$	**1 010**	**1 020**	**1 030**	**1 040**	**960**	**970**	**980**
$1\,000 - 10x$	**990**	**980**	**970**	**960**	**1 040**	**1 030**	**1 020**
$(-10x) + 1\,000$	**990**	**980**	**970**	**960**	**1 040**	**1 030**	**1 020**
$10x - (+1\,000)$	**1 010**	**1 020**	**1 030**	**1 040**	**960**	**970**	**980**