Algebra is one of the oldest mathematical studies in the course of human history. It was used by the ancient Egyptians and Babylonians to solve equations, approximate values, and explain geometric properties. From then on, algebra has become an indispensable tool in mathematics, physics, architecture, engineering, finance, and even social sciences.

Basically, algebra is all about representing numbers and quantities using symbols or letters. It is like a puzzle where you have to unravel the value being represented by a certain symbol.

In this reviewer, you will be introduced to the foundation of the study of algebra - algebraic expressions.

Variables and Constants.

Let us start with the most fundamental terms in the study of algebra - the variables and the constants.

1. Variables.

Let me present to you a simple puzzle. In this puzzle, your goal is to determine what is the number being represented by the triangle. *What do you think must be the number represented by the triangle?*

$$\triangle + 2 = 10$$

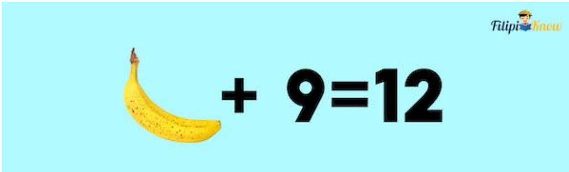
If you have answered 8, you got it right. The triangle represents the number 8 in the mathematical equation above.

The triangle used in our simple "puzzle" or equation above is an example of a variable.

A variable is a symbol that we use to represent a certain number. Again, in our equation above, the triangle is a variable since it represents the number 8. The variable is also called unknown since we have to solve the equation first so that we will be able to determine the value represented by the symbol.

Let us have another example:

Example 1: *What do you think is the value of the banana in the equation below?*



Solution: If your answer is three, then you got our puzzle right. Now, *can you determine what is the variable used in the equation above?*

Yes, the banana acts as a variable since it represents the number three in the equation.

Again, a variable can be any symbol as long as it represents an unknown quantity or number. It can be a triangle, banana, square, circle, and so on. However, the most convenient way to represent an unknown quantity in a mathematical expression is with the use of an alphabetical letter.

Let us take a look again at our example above but this time, let us use a letter as a variable instead of a banana.

$$x + 9 = 12$$

In this case, the letter *x* is a variable that represents the number 3.

Example 2: *Take a look at the expression x + y + z + 3. What are the variables in the expression?*

Solution: x, y, and z are the variables used in the expression *x* + *y* + *z*.

x, y, and z represent certain quantities or numbers.

Since a variable represents certain quantities or values, this means that the value of a variable is not fixed. For instance, in $x + y + z$, the values of x, y, and z can be any number.

In the study of algebra, English letters are the most commonly used variables. Thus, in this reviewer, we will use letters to denote a variable that represents a certain value.

2. Constants.

A constant is a quantity with a fixed value. This means that the value of a constant does not change in the expression. For example, 3 is a constant since its value is always equivalent to 3 and it never changes once you include it in a mathematical expression.

It is important to note that all numbers are constants.

For example, in the expression $x + 5$, 5 is a constant because its value is always 5 in that expression and it will never change. However, x is not a constant since its value is not fixed and specified and can be any number.

3. Coefficients.

If you multiply a variable by a certain number, the latter is called a numerical coefficient. Meanwhile, the variable becomes a literal coefficient.

Suppose we have a variable x which represents a certain quantity.

Now, our variable x is multiplied by 2. Thus, we have $2 \times x$.

In algebra, when we multiply a variable by a certain number, we refrain from using the arithmetic sign for multiplication (×). Instead, we just put the variable and the constant together.

Therefore, when we multiply x by 2, we write it as $2x$ instead of $2 \times x$.

Now, take a look at $2x$. 2 is a numerical coefficient since it is the number that is multiplied by a variable. Meanwhile, x is a literal coefficient since it is a variable multiplied by a number.

Example 1: *Determine the numerical coefficient and literal coefficient in ¼ y*.

Solution: The numerical coefficient is ¼ since it is the number multiplied by the variable y. Meanwhile, y is the literal coefficient since it is a variable multiplied by a number.

If a variable has no number written on its left, it means the numerical coefficient is 1. For instance, consider the variable *x*. Note that there is no number written on its left. This does not mean that it has no numerical coefficient. Instead, its numerical coefficient is 1. Thus, *x* can also be interpreted as 1*x* or "1 times *x*".

However, in algebra, if the numerical coefficient is 1, we do not write it because it is already understood that a certain variable has a numerical coefficient of 1.

Example 2: *Determine the numerical coefficient of the following:*

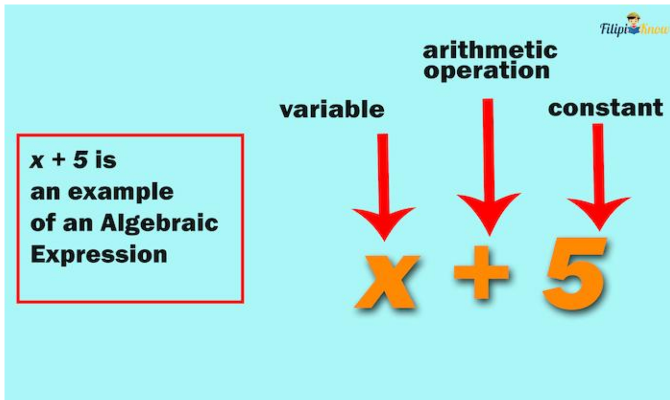
1. 3y
2. 0.23x
3. w

Solution: For item 1, the numerical coefficient is 3. For item 2, the numerical coefficient is 0.23. Lastly, for item 3, the numerical coefficient is 1.

Algebraic Expression.

An algebraic expression is a mathematical expression that involves constants, variables, and arithmetic operations (addition, subtraction, multiplication, or division).

For example, *x + 5* is an algebraic expression since it has a variable (which is *x*) that represents a certain quantity, a constant (which is 5), and an arithmetic operation (addition).



Another example, *3x - 9* is an algebraic expression where *x* is a variable, 9 is a constant, and the mathematical operations involved are multiplication (because of 3x that represents “3 times x”) and subtraction. Also, 3 is a numerical coefficient of x.

Example 1: *Determine the variables, constant, coefficient, and operations involved in 9 + 3xy - z.*

Solution: The variables are x, y, and z. The constant is 9. Meanwhile, the operations involved are addition, multiplication (*3xy* can be interpreted as 3 times *x* times *y*), and subtraction. Furthermore, 3 is a numerical coefficient of *xy*.

Example 2: *Determine the variables, constants, and operations involved in the algebraic expression x⁄y - 2.*

Solution: Before we answer this, take note that in algebra, we usually indicate division as the ratio or a fraction between two numbers. Therefore, if we want to write x ÷ y, we write it as x/y instead.

Therefore, in x/y - 2, the variables are *x* and *y*, the constant is 2, and the operations involved are division and subtraction.

Translating Verbal Expressions into Algebraic Expressions.

You have already learned what algebraic expressions are. In this section, you are going to learn how to write an algebraic expression from a given English sentence or phrase. This skill is crucial since you are going to solve some word problems in the succeeding chapters.

Let us start with this: Write "*7 plus 4 equals 11"* into a mathematical expression.

I know that you can translate that one with ease. The sentence *"7 plus 4 equals 11"* is simply: $7 + 4 = 11$.

This is exactly what we are going to do in this section: We will translate a sentence or phrase into a mathematical expression. But this time, we will be using variables and constants.

Having said that, let us try to translate this sentence into a mathematical expression:

"A number plus 4 equals 11"

The given sentence is actually the same as the previous example above except for one thing. Notice that instead of stating 7, we replace it with the words "*a number".* How can we translate the given sentence into a mathematical expression?

Let's find out the answer.

The word "*a number"* implies that we are not sure what exactly that number is. In other words, that number is unknown. For this reason, we need to use a variable that will represent this unknown number.

Recall that a variable is any symbol or letter that can represent an unknown number. Let us use the letter x to represent that unknown number in the given sentence.

Thus, we can translate the given sentence: *"A number plus 4 equals 11"* as:

$$x + 4 = 11$$

And we're done! We have already translated a verbal expression into an algebraic expression.

Example 1: *Translate this verbal expression into an algebraic expression: "18 minus a number equals 5".*

Solution: The phrase "*a number*" means that we are not sure what that number is. This means that we need to represent it using a letter or symbol. In other words, we need to use a variable to represent that unknown number.

Let us use the letter g to represent this unknown number. Thus, if we translate "*18 minus a number is 5*" into an algebraic expression, we will obtain:

$$18 - g = 5$$

Keep in mind that you can use any letter in the English alphabet as a variable to represent a certain number. However, the most commonly used letters are x and y. Furthermore, small letters are more commonly used than capital letters.

You now have an idea of how to use variables to translate a verbal expression into algebraic expressions. However, in your study of algebra, you will encounter complicated sentences that are quite challenging to convert into algebraic expressions. For this reason, you need the help of keywords.

Keywords for Mathematical Operations.

Keywords are certain words in a verbal expression that tells you what mathematical operations are involved in that sentence. They serve as your signals so that you can put the proper operations in the corresponding algebraic expression.

For instance, in our earlier example, "*A number plus 4 equals 11*", the word "plus" is the keyword. It gives you a signal that you must use the addition sign (+) when you convert the given sentence into an algebraic expression.

We are going to tackle in this section some keywords that indicate the four fundamental mathematical operations.

1. Keywords for Addition.

Some common keywords for addition are *sum, plus, increased by, more than,* and *total*. Once you see these keywords, it means that addition will be involved when you translate the verbal expression into an algebraic expression.

The table below shows how these keywords are usually used in a sentence and how they can be translated into algebraic expressions.

Keyword	Example (Verbal Expression)	Algebraic Expression
sum	The sum of 8 and a number	$8 + x$
plus	-6 plus a number	$-6 + x$
increased by	A number increased by 7	$x + 7$
more than	3 more than a number	$x + 3$
total	The total of a number and -10	$x + (-10)$

The keywords *sum* and *total* are written before the given numbers. When you see these words, it means that the numbers are added. For example, the sentence "*The sum of 8 and a number*" implies that 8 and a certain number was added. Thus, the correct translation must be $8 + x$.

The keyword *increased by* means that a certain number was added to another number. For instance, the sentence "*A number increased by 7*" means that 7 was added to a certain number. Thus, the correct translation must be $x + 7$.

Meanwhile, the keyword *more than* means the first number stated is added to the second number. For instance, the sentence "*3 more than a number*" implies that 3 was added to a certain number. Thus, when we translate it into an algebraic expression, we write 3 as the second addend since it is being added to a certain number. The correct translation should be $x + 3$.

Example 1: *Translate "the sum of two numbers" into an algebraic expression.*

Solution: The given sentence doesn't explicitly state the values of two numbers. Thus, we need to use variables to represent them. Let us use the letters x and y to represent the numbers.

Since we have the keyword "sum", it means that the numbers must be added.

Thus, the sentence can be translated as $x + y$

The answer is $x + y$

Example 2: *Translate "a number more than 18 is equal to 25" into an algebraic expression.*

Solution: Let us assign k as the variable that represents the unknown number in the sentence.

It's stated that *"a number more than 18 is equal to 25"*. Since the keyword "more than" is used, it means the operation of addition is involved.

Again, the keyword "more than" implies that the first number mentioned in the sentence was added to the second number mentioned. This means that when we translate the sentence into an algebraic expression, we need to write the second number which is 18 as the first addend.

Thus, we can translate the sentence as $18 + k = 25$.

The answer is $18 + k = 25$.

2. Keywords for Subtraction.

Words such as *difference, subtracted by, subtracted from, deducted by, deducted from, decreased by,* and *minus* are some of the keywords used for subtraction.

Keyword	Example (Verbal Expression)	Algebraic Expression
difference	The difference between a number and 15	$x - 15$
subtracted by	9 subtracted by a number	$9 - x$
subtracted from	9 subtracted from a number	$x - 9$
deducted by	15 deducted by a number	$15 - x$
deducted from	15 deducted from a number	$x - 15$
decreased by	A number decreased by 6	$x - 6$

minus	11 minus a number	*11 - x*

The keyword *difference* is the subtraction counterpart of the keyword *sum*. It is written before two numbers and implies that the given numbers were subtracted. Thus, if you have a sentence such as *the difference between a number and 15*, it is just *x* - 15.

The keywords *subtracted by* and *subtracted from* are quite confusing and should not be used interchangeably.

If the keyword *subtracted by* is used, it means the second number mentioned is the one being subtracted. For example, the given sentence *9 subtracted by a number* means the unknown number was taken from 9. Thus, the correct translation is *9 - x.*

On the other hand, the word *subtracted from* means the first number mentioned is the one being subtracted. For example, *9 subtracted from a number* means that 9 was taken from the unknown number. Thus, the correct translation is *x* - 9.

You can use this simple pattern if you still find it difficult to differentiate *subtracted by* and *subtracted from:*

Verbal Expression	**Algebraic Expression**
<First Number> *subtracted by* <Second Number>	<First Number> - <Second Number>
<First Number> *subtracted from* <Second Number>	<Second Number> - <First Number>

The words *deducted by* and *deducted from* work in the same way as the words *subtracted by* and *subtracted from*. Thus, you can use the table below (which is just the same as above) for the words *deducted by* and *deducted from*.

Verbal Expression	**Algebraic Expression**
<First Number> *deducted by* <Second Number>	<First Number> - <Second Number>

<First Number> *deducted from* <Second Number>	<Second Number> - <First Number>

Lastly, *decreased by* implies that the second number was subtracted from the first number. Hence, if the given sentence "*6 decreased by a number*" is translated into an algebraic expression, we will obtain $6 - x$.

Example 1: *Translate "A number subtracted from - 19 is equal to 5" into an algebraic expression.*

Solution: Let us use the letter p as the variable that represents the unknown number.

Recall that to translate a sentence with the keyword *subtracted from* into an algebraic expression, we are going to write it in the form <second number> - <first number>.

Hence, the correct translation must be: $-19 - p = 5$.

Example 2: *Translate "54 decreased by a number" into an algebraic expression.*

Solution: Let us use the letter q to represent the unknown number.

The keyword "*decreased by*" implies that a number was subtracted from 54.

Thus, the correct translation should be $54 - q$

3. Keywords for Multiplication.

Some of the keywords that indicate multiplication are: *product, multiplied by, twice, triple, of,* and *times*.

Keyword	Example (Verbal Expression)	Algebraic Expression
product	The product of a number and 5	$5x$
multiplied by	-3 multiplied by a number	$-3x$
twice	Twice of a number	$2x$

thrice	Thrice of a number	$3x$
of	½ of a number	$\frac{1}{2}x$
times	7 times a number	$7x$

As a reminder, when we are expressing the multiplication of a variable and a constant, we are not using the sign anymore. Instead, we just write the letter and the number together. For instance, if we want to write "8 times x" we simply write it as $8x$ instead of 8 x.

The keyword "product" works in the same way as the keywords "sum" and "difference". It is written before the given numbers and indicates that those numbers were multiplied together. For instance, if you want to translate *"the product of 5 and a number*" into an algebraic expression, the answer is simply $5x$.

The keyword "multiplied by" tells you that the first number was multiplied by the second number. For instance, if you want to translate "*- 3 multiplied by a number",* the answer is simply $-3x$.

The keyword "twice" means that the given number was multiplied by 2. For example, *"twice of a number"* means that a certain number was multiplied by 2. Hence, the answer is $2x$.

The keyword "thrice" means that the given number was multiplied by 3. For example, *"thrice of a number"* means that a certain number was multiplied by 3. Hence, the answer is $3x$.

The keyword "of" is usually used to indicate that a number was multiplied to a fraction, a decimal, or a percent. For instance, "½ of a number" means that a number is multiplied by ½. Thus, the correct translation is $\frac{1}{2}x$.

The keyword "times" tells you that the first number is multiplied by the second number in the sentence. For instance, the translation of "*7 times a number*: is simply $7x$.

Example 1: *Translate "20% of a number is equal to 50"* into an algebraic expression.

Solution: The keyword "of" indicates multiplication. Thus, the correct translation is $20\%x = 50$. You can also express the given percent into decimal. This means that $0.20x = 50$ is also a translation for the given sentence.

Example 2: *Translate "The product of two numbers is equal to twice of another number" into an algebraic expression.*

Solution: We have three unknown numbers involved. Thus, we need to use three letters as variables. Let us use the letters *x, y,* and *z.*

The product of two numbers can be translated as xy. Meanwhile, since the keyword *twice* indicates that a number is being doubled or multiplied by 2, then *twice of another number* can be translated as $2z$. Hence, the correct translation of the given sentence should be $xy = 2z$.

4. Keywords for Division.

Some of the keywords that indicate division are quotient, divided by, *the ratio of, split equally,* and *average*.

Keyword	Example (Verbal Expression)	Algebraic Expression
quotient	The quotient of 8 and a number	$8 \div x$ or $8/x$
divided by	A number divided by 4	$x \div 4$ or $x/4$
ratio of	The ratio of a number and 2	$x \div 2$ or $x/2$
split equally	A number is split equally into 3	$x \div 3$ or $x/3$

Recall that we can express the division of two numbers in fraction form. For example, we can rewrite $8 \div x$ as $8/x$. The fractional form of the division of two numbers is usually used since it is more convenient and less tedious to write when other operations are involved.

The keyword *quotient* is written before the given numbers and indicates that the operation of division is involved. For instance, the translation of *"The quotient of 8 and a number"* is $8 \div x$ or $8/x$.

The keyword *divided by* implies that the first number mentioned in the sentence is the dividend while the second number is the divisor. For example, if you want to translate *"A number divided by 4",* the correct answer would be $x \div 4$ or $x/4$.

The keyword *ratio of* works the same way as the keyword *quotient*. It is written before the given numbers and indicates that the operation of division is involved. For example, the correct translation of *"The ratio of a number and 2"* is $x \div 2$ or $x/2$.

The keyword *split equally* works the same way as the keyword *divided by*. Thus, if we want to translate *"A number is split equally into three",* the correct translation is $x \div 3$ or $x/3$.

Shown below is a summary of the keywords that are usually used for the four [fundamental operations of mathematics]:

Keywords usually used for the Four Fundamental Operations in Mathematics

ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
SUM	DIFFERENCE	PRODUCT	QUOTIENT
PLUS	SUBTRACTED BY	MULTIPLIED BY	DIVIDED BY
INCREASED BY	SUBTRACTED FROM	TWICE	RATIO OF
MORE THAN	DEDUCTED BY	THRICE	SPLIT EQUALLY
TOTAL	DEDUCTED FROM	OF	
	MINUS	TIMES	

Translating Verbal Expressions Into Algebraic Expressions with Multiple Operations Involved.

We have translated various sentences or phrases into algebraic expressions. However, we have only translated those with only one mathematical operation involved. In this section, we are going to translate those that involve multiple operations.

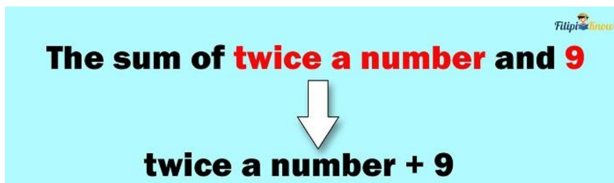
Make sure that you still have the keywords in your mind because they are really helpful in this section.

Example 1: *What is "The sum of twice a number and 9" as an algebraic expression?*

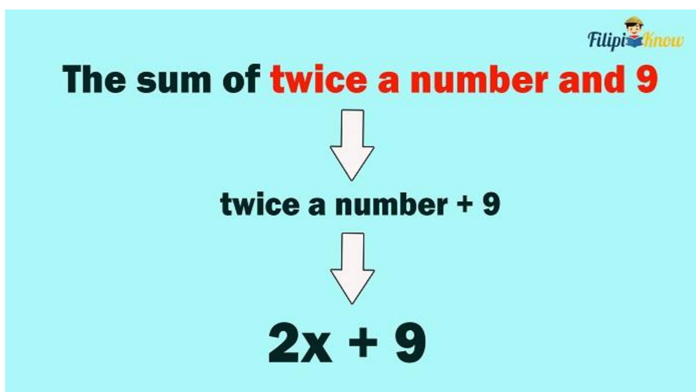
Solution: Let us start with the first keyword mentioned in the problem which is the *sum*. Recall that if the keyword *sum* is used in a sentence, it implies that there are numbers being added. The question now is: *What are the numbers that are being added according to the given verbal expression?*

Let us read again the given verbal expression: *The sum of twice a number and 9*. It is clearly stated that there are two quantities that will be added--the quantity *twice a number* and 9.

We can now express our translation in this form for a while: *twice a number + 9*



Now, let us translate *twice a number* into an algebraic expression. Again, the word *twice* implies that a certain number is being doubled or multiplied by 2. Let us use x to represent the unknown number. Thus, twice of x is simply, $2x$.



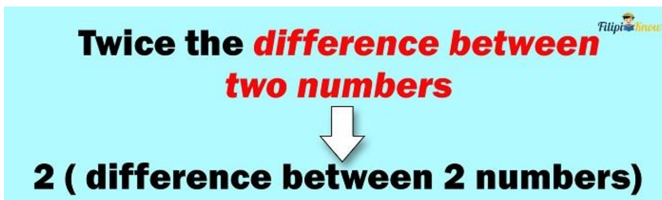
Therefore, our final translation for *The sum of twice a number and 9* is $2x + 9$.

Example 2: *Translate "Twice the difference between two numbers" into an algebraic expression.*

Solution: Let us start with the keyword *twice*. This keyword implies that a certain quantity or number will be multiplied by 2. *What is this quantity that will be multiplied by 2 according to the given verbal expression?*

Let us read the given problem again: *Twice the difference between two numbers*. The statement tells us the difference between the two numbers is what will be multiplied by 2.

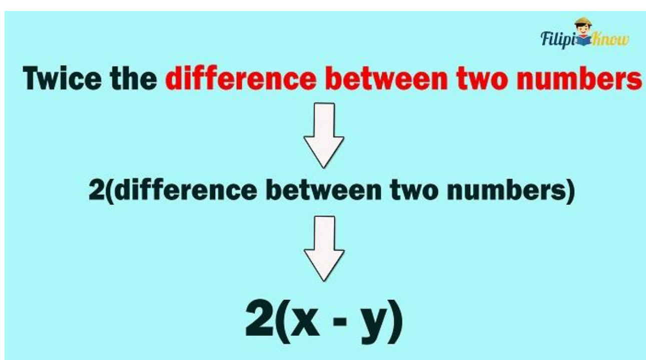
Hence, we can translate it this way: 2(*difference between two numbers)*. We use parenthesis to indicate multiplication.



Now, let us translate the *difference between two numbers* into an algebraic expression. We have two unknown numbers so let us use x and y to represent them. Thus, we can translate the *difference between two numbers* as *x - y.*

We replace the expression *difference between two numbers* in 2(*difference between two numbers)* with *x - y*.

Hence, *Twice the difference between two numbers* is 2*(x - y).*



Example 3: *Write "the ratio of two numbers increased by 5" as an algebraic expression.*

Solution: Let us start with the keyword *ratio*. The phrase *the ratio of two numbers* tells us that two numbers are involved in a division process. Let *x* and *y* be these two numbers. Hence, we can translate *the ratio of two numbers* as $x \div y$ or x/y. For this problem, let us use x/y.

The next keyword *increased by* in *the ratio of two numbers increased by 5* tells us that the number 5 will be added to x/y. This means that we need to add 5 to our translation. Thus,

$$x/y + 5$$

Therefore, if *the ratio of two numbers increased by 5* will be written as an algebraic expression, you will have $x/y + 5$

Other Important Keywords.

There are more keywords that are used in translating verbal expressions into algebraic expressions. Some of them involve exponents, radicals, equality, or inequality signs.

Here are other keywords commonly used that do not indicate any of the four fundamental operations:

1. Keywords for Radicals.

Keywords for Radicals	Example (Verbal Expression)	Algebraic Expression
square root	The square root of a number	$\sqrt{x}$
cube root	Cube root of a number	$\sqrt[3]{x}$

2. Keywords for Exponents.

Keywords for Exponents	Example (Verbal Expression)	Algebraic Expression
raised to	A number raised to 5	x^5
square of	Square of a number	x^2
cube of	Cube of a number	x^3

The keyword *raised to* tells us that a number has a certain exponent. The keyword *square of* means that a number is raised to the power of 2. Meanwhile, the keyword *cube of* means that a number is raised to the power of 3.

3. Keywords for Equality.

Keywords for Equality	Example (Verbal Expression)	Algebraic Expression
equal to	4 is equal to a number	$4 = x$
yields	3 plus a number yields 9	$3 + x = 9$
is	7 minus a number is 0	$7 - x = 0$

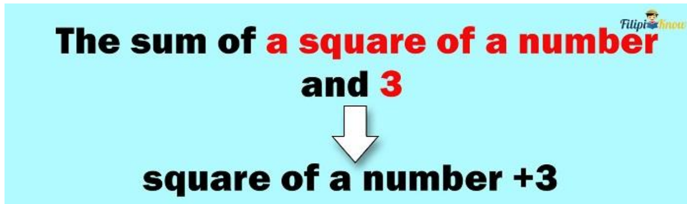
4. Keywords for Inequality.

Keywords for Inequality	Example (Verbal Expression)	Algebraic Expression
Not equal to	5 is not equal to a number	$4 = x$
Greater than	7 is greater than a number	$3 + x = 9$
Less than	7 is less than a number	$7 - x = 0$
Greater than or equal to	0 is greater than or equal to a number	$0 \geq x$
Less than or equal to	0 is less than or equal to a number	$0 \leq x$
At least	5 plus a number is at least 9	$5 + x \geq 9$
At most	3 minus a number is at most 2	$3 - x \leq 2$

The keywords *greater than or equal to* is synonymous with *at least*. Meanwhile, the keywords *less than or equal to* is synonymous with *at most*.

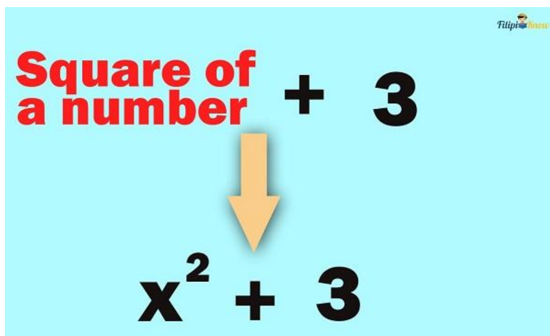
Example 1: *Write "the sum of the square of a number and 3 is at least 9" as an algebraic expression.*

Solution: The keyword *sum* tells us that certain quantities will be added. These quantities are the square of a number and 3.

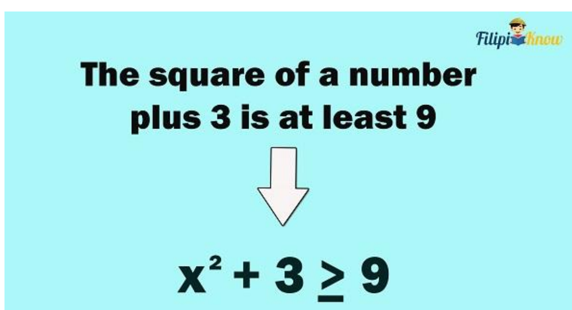


Let us use x to represent the unknown number. Its square can be represented as x^2.

Thus, the quantities that will be added are x^2 and 3.



The sum of the square of a number and 3 is at least 9. This means that x^2 + 3 is greater than or equal to 9.



Hence, the correct translation is $x^2 + 3 \geq 9$

Translating Verbal Expressions Into Algebraic Expressions in Real-Life Scenarios.

We have now arrived at the most exciting part of this reviewer. We will apply what we have learned in translating verbal expressions into algebraic expressions in various real-life scenarios.

Example 1: *Lea has 150 books that she collected during her college years. She decided to give some of her books to her friends. After giving some to her friends, 40 books were left to Lea. Write an algebraic expression that will illustrate Lea's scenario.*

Solution: It's stated in the given scenario that Lea has 150 books. She gave some of her books to her friends. 40 books were left to Lea after giving some of them. This can be interpreted as 150 books minus the number of books given equals 40.

Let us use b to represent the number of books Lea gave to her friends.

Thus, we have this algebraic expression: $150 - b = 40$

Example 2: *A burger costs Php 32 each while a can of pineapple juice costs Php 25 each. Dario bought some burgers and cans of pineapple juice. Write an algebraic expression that shows how much Dario will pay for the burgers and cans of pineapple juice he bought.*

Solution: It's not specifically stated in the given scenario how many burgers and cans of pineapple juice Dario bought. Thus, we can use variables to represent the number of burgers and cans of pineapple juice he bought.

Let b represent the number of burgers that Dario bought. Meanwhile, let p represent the number of cans of pineapple juice that Dario bought.

Each burger costs Php 32. Thus, the total amount that Dario will pay for the burgers can be represented as $32b$.

Meanwhile, each can of pineapple juice costs Php 25. Thus, the total amount that Dario will pay for the cans of pineapple juice can be represented as $25p$.

Combining the total amount he will pay for the burgers and cans of pineapple juice: $32b + 25p$.

Thus, the answer is $32b + 25p$.

Translating Algebraic Expressions into Verbal Expressions.

You have learned how to translate a given sentence or phrase into algebraic expressions. This time, let us discuss how we can translate a given algebraic expression into words or verbal expressions.

There is no general process to translate an algebraic expression into a sentence or phrase. However, using the proper keywords is really helpful in performing the translation.

Example 1: *Write* $x + 2$ *as a verbal expression.*

Solution: The algebraic expression involves the operation of addition. Thus, you can use the keywords for addition in translating $x + 2$. Moreover, just use the words "*a number*" to translate the variable.

Let's use the keyword *sum*. We know that *sum* is written before the quantities that are added. Thus, one possible translation could be "*the sum of a number and 2*"

Another possible translation is using the keyword "*increased by*". You can translate $x + 2$ as *"A number increased by 2".*

Example 2: *Translate* $4z + 5$ *into a verbal expression.*

Solution: $4z$ indicates multiplication. Hence, you can use any keyword for multiplication. Let us use the keyword "product". One possible translation for $4z$ is "*the product of 4 and a number".*

Now, we just incorporate the plus 5 in $4z + 5$ to complete our translation. Hence, one possible translation is "*the product of 4 and a number plus 5*" Another possible translation could be "*four times a number increased by 5".*

Example 3: *Translate* $y^2 \leq 2$ *into a verbal expression.*

Solution: y represents a certain number. Thus, we can translate it as "*a number*". Meanwhile, y^2 means that we squared that number. Hence, y^2 can be translated as "*the square of a number".*

The symbol ≤ means less than or equal. We can use the phrase *less than or equal* for this symbol or the phrase *at most*. In this problem, let us use the phrase *at most*.

Therefore, one possible translation for $y^2 \leq 2$ could be *the square of a number is at most 2*.

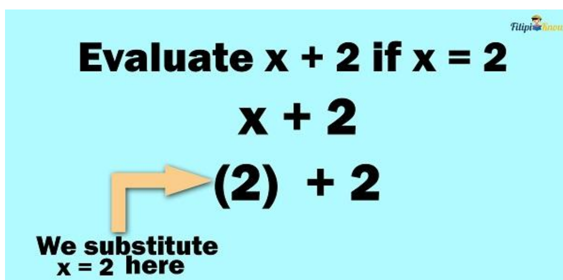
Evaluating Algebraic Expressions.

We have mentioned that variables in an algebraic expression represent a certain number or quantity. What if the values that these variables represent are specified? Can we compute the value of the algebraic expression?

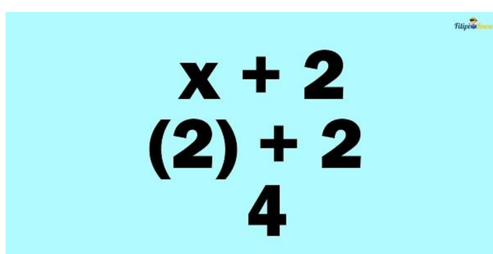
Evaluating an algebraic expression means determining its value according to the values assigned to its variables. To further understand how this works, let us have some examples.

Example 1: *Evaluate* $x + 2$ *if* $x = 2$

Solution: The variable in $x + 2$ is x. In this example, we have assigned a value to x which is $x = 2$. This means that we need to substitute or replace x with 2.



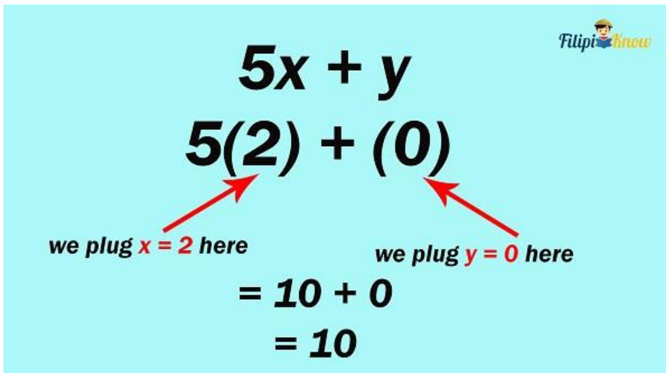
Afterward, we perform the calculation to find the value of the algebraic expression when $x = 2$.



Thus, $x + 2 = 4$ if $x = 2$.

Example 2: *Evaluate 5x + y if x = 2 and y = 0*

Solution: We just substitute *2* for *x* and *0* for *y* in *5x + y.* Take note that 5*x* is multiplication between 5 and *x*. Thus, once you substitute 2 for *x*, you will have 5(2) which implies "5 times 2".

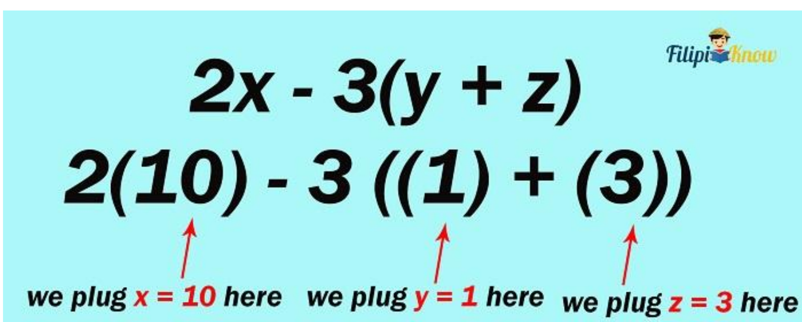


Hence, the answer is 10.

There are instances that when you are evaluating an algebraic expression, there is more than one mathematical operation involved. In this case, to be able to perform the computation, apply the order of operations or PEMDAS.

Example 3: *Evaluate 2x - 3(y + z) if x = 10, y = 1, and z = 3*

Solution: Plug in the assigned values for *x, y, and z* in the given algebraic expression:



Since, there are multiple operations involved, let use apply PEMDAS:

$$\begin{gathered}2(10) - 3(1+3)\\ 20 - 3(1+3)\\ 20 - 3(4)\\ 20 - 12\\ 8\end{gathered}$$

Therefore, the answer is 8.

Also, there are instances where the assigned values to the variables are any real numbers and not just whole numbers. Thus, it is important that you still remember how to perform operations with integers, fractions, or decimals since variables can represent these numbers.

Example 4: *Evaluate 8a - 3b if a = ½ and b = - 2*

Solution: Let us plug in the values of *a* and *b* to the given algebraic expression.

$$\begin{gathered}8a - 3b\\ 8\left(\tfrac{1}{2}\right) - 3(-2)\end{gathered}$$

we plug a = 1/2 here

we plug b = - 2 here

Performing the operations involved:

$$\begin{gathered}8\left(\tfrac{1}{2}\right) - 3(-2)\\ 4 - 3(-2)\\ 4 + 6\\ 10\end{gathered}$$

Thus, the answer is 10.