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ALGEBRA IN MATHEMATICS

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ABSTRACT

In Mathematics, the main role of Algebra is to deal with the symbols and rules for the purpose of manipulations. Variables are used in the elementary algebra which are used to represent the quantities without fixed values. In algebra, equations are used to elaborate the relationships among the variables.

Also, the unification of the mathematical concepts can be done easily with the help of algebra and hence, it is known as an important part of Mathematics. In algebra, usually, there is an involvement of the numbers and operations in terms of geometry and data analysis. Hence, algebra can be regarded as a simple language which is used to solve those problems which are not solved with the help of numbers alone. Here modeling of the real-world problems is done with the help of the symbols like the alphabets x,y and z etc for the representation of the numbers. The current paper highlights the role of algebra in mathematics.

KEYWORDS: Algebra, Mathematics, Variables, Letters, Equation

INTRODUCTION

The main purpose of algebra is to establish a mathematical relationship with the help of the letters, numbers and operational symbols. This relationship is further used to represent the entities in the shorthand form. Then, values are substituted to solve the equations for the unidentified entities.

The usage of the algebra in the various fields of life like physics, mathematics, finance and other areas can be observed easily. For example, the mathematical terms are used to establish a relationship between force and acceleration and evaluation of the inches, distances and interest rates etc. These relationships are termed as the equations.

The languages related to algebra have shown variance in different prospects to inherit.

In algebra, a problem can be written as:

$x + y = 1{,}800$

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$\frac{2}{3} \cdot x - \frac{1}{2} \cdot y = 500$

where, x and y represent the area of the used field.

Here, the first equation depicts that there are two areas namely x & y and their summation leads to a result of 1800 square yards. On the other hand, the second equation seems to be complex than the previous. In this given equation, 'x' is the area of the first field having a yield of $2/3^{rd}$ of a gallon per square yard whereas the area of the second field has a yield of half of a gallon per square yard. Here, the subtraction of both the areas of the fields leads to an output of 500 which indicates that the first field generated 500 more gallons of the grain as compared to the second field.

Algebraic Expressions: These expressions are regarded as the phrase. Generally, in these kinds of expressions, the variables, constants and operating symbols such as '+' , '-' , '*' and '/' are used. Being a phrase, no symbol of equal to (=) is used for the algebraic expression. For example, 5x - 2y + 3yz + 10. The variables like x, y and z are defined with the aid of numbers and then, the expression is solved.

Variables: Variables are like alphabets or letters which are used to represent the numbers whose value is known in some cases and sometimes not. The examples of variables used in the algebra are x, y and z etc.

Coefficients: In a variable, generally, there are two important parts i.e. number and letter such as 5x. Here, the number part is known as coefficients where 5 can be termed as a coefficient in 5y. It should also be noted that in the terms like simple x, y and z, the coefficient is regarded as 1.

Constant: Constant is like a term used in the algebraic expression and only contains numbers. For example, 5y + 4 where 4 is a constant as this value can't be changed in this algebraic expression.

Real Numbers: These are a group of real world numbers like age, time, amount, distance etc. All the whole numbers, fractional and decimal numbers come under the category of the real numbers. Additionally, it can be said that real numbers are a set of rational and irrational numbers.

Rational Numbers: The term 'rational' is derived from the word 'ratio' where the numbers are represented as ratio like ½ which represents the ratio of 1 to 2.

Irrational Numbers: Those numbers having non-repeating and non-terminating decimal numbers and can't be expressed as a quotient of two integers. For example, Pi (22/7) whose value is evaluated to be non-repeating and non-terminating.

ALGEBRA IN MATHEMATICS

Algebra allows you to use letters of the alphabet to represent objects, numbers or expressions. Numbers can be constants or variables. The best way to explain how a relationship can be stated with letters is to provide some examples.

Gravity equation

In Physics, the gravity equation is:

F = m*g

where

- **F** is the force pulling an object toward the ground
- **m** is the mass of the object
- **g** is the acceleration due to gravity

g is a constant, since its value does not change, while **F** and **m** are variables.

The primary purpose of Algebra is to allow you to substitute letters for the names of items in a relationship, thus creating an equation. Then you can substitute in values to solve for an item. You can manipulate the equation to put it in terms of one of the variables.

It's easy to think of algebra as an abstract notion that has no use in real life. Understanding the history and the practical applications of algebra that are put into use every day might make you see it a little differently.

The main idea behind algebra is to replace numbers (or other specific objects) by symbols. This makes things a lot simpler: instead of saying "I'm looking for a number so that when I multiply it by 7 and add 3 I get 24", you simply write $7x+3=24$, where x is the unknown number.

Algebra is a huge area in mathematics, and there are many mathematicians who spend their time thinking about what you can do with collections of abstract symbols. In real life, however, algebra merges into all other areas as a tool.

Whenever life throws a maths problem at you, for example when you have to solve an equation or work out a geometrical problem, algebra is usually the best way to attack it. The equations you are learning about now are the ones that you're most likely to come across in everyday life. This means that knowing how to solve them is very useful. If you're planning to go into computer programming, however, the algebra you'll need is more complicated and now's the time to make sure you get the basics.

Two-dimensional shapes can be represented using a co-ordinate system. Saying that a point has the co-ordinates *(4,2)* for example, means that we get to that point by taking four steps into the horizontal direction and 2 in the vertical direction, starting from the point where the two axes meet.

Using algebra, we can represent a general point by the co-ordinates *(x,y)*. You may have already learnt that a straight line is represented by an equation that looks like $y=mx+b$, for some fixed numbers m and b. There are similar equations that describe circles and more complicated curves. Using these algebraic expressions, we can compute lots of things without ever having to draw the shapes. For example we can find out if and where a circle and a straight line meet, or whether one circle lies inside another one.

Writing and solving various types of equations is one of the key objectives of algebra. Many of the most widely useful applications pertaining to equations involve the transfer of money. Such problems are often of the type "You have x amount of money, how much of y product can you buy with it?" For instance, envision a scenario in which you're helping prepare for a party, and are sent to the store with rs.300 to buy as many liter bottles of soda as possible, as well as a package of plastic cups. Each liter of soda costs rs.180, and a package of cups costs rs.120. To quickly calculate how many sodas you can buy, you can write and solve an algebraic equation: 18x+45=300.

Interpreting and solving problems involving ratios, proportions and percents comprises another objective of algebra. Real-world scenarios in this genre can easily be created around the idea of store sales. Types of problems could include determining the percent off, percent saved, new cost or original cost. For example, suppose a shirt is priced at $22 and a sign says the price is 30 percent off. You want to know how much the shirt cost originally to see whether your savings would be significant. Thirty percent off equates to 70 percent of the original price, so, using the algebraic proportion formula to write a proportion: 22/x=70/100, and solve it by using cross-products.

DISCUSSION

Elementary algebra is the most basic form of algebra. It is taught to students who are presumed to have no knowledge of mathematics beyond the basic principles of arithmetic. In arithmetic, only numbers and their arithmetical operations (such as +, −, ×, ÷) occur. In algebra, numbers are often represented by symbols called variables (such as a, n, x, y or z). This is useful because:

- It allows the general formulation of arithmetical laws (such as $a + b = b + a$ for all a and b), and thus is the first step to a systematic exploration of the properties of the real number system.
- It allows the reference to "unknown" numbers, the formulation of equations and the study of how to solve these. (For instance, "Find a number x such that $3x + 1 = 10$" or going a bit further "Find a number x such that $ax + b = c$". This step leads to the conclusion that it is not the nature of the specific numbers that allows us to solve it, but that of the operations involved.)
- It allows the formulation of functional relationships. (For instance, "If you sell x tickets, then your profit will be $3x - 10$ dollars, or $f(x) = 3x - 10$, where f is the function, and x is the number to which the function is applied".)

A polynomial is an expression that is the sum of a finite number of non-zero terms, each term consisting of the product of a constant and a finite number of variables raised to whole number powers. For example, $x^2 + 2x - 3$ is a polynomial in the single variable x. A polynomial expression is an expression that may be rewritten as a polynomial, by using commutativity, associativity and distributivity of addition and multiplication. For example, $(x - 1)(x + 3)$ is a polynomial expression, that, properly speaking, is not a polynomial. A polynomial function is a function that is defined by a polynomial, or, equivalently, by a polynomial expression. The two preceding examples define the same polynomial function.

Two important and related problems in algebra are the factorization of polynomials, that is, expressing a given polynomial as a product of other polynomials that can not be factored any further, and the computation of polynomial greatest common divisors. The example polynomial above can be factored as $(x - 1)(x + 3)$. A related class of problems is finding algebraic expressions for the roots of a polynomial in a single variable.

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CONCLUSION

There are many additional real-life applications of algebra objectives. Exponential growth and decay functions connect to a wide variety of topics such as interest rates, population studies and bacteriology and medicine. Algebra objectives related to proportions may be used by cooks baking loaves of bread or dieters counting calories. Travelers use equations to convert between degrees Celsius and Fahrenheit in weather forecasts. In the realm of finance, algebra can be used to predict monthly payments or mortgage rates.

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