Vision Empower & XRCVC

Teacher Instruction KIT

Algebra

Syllabus: Karnataka State Board
Subject: Mathematics
Grade: 6
Textbook Name: Math Text cum workbook
Chapter Number & Name: 11. Algebra

1. OVERVIEW

1.1 OBJECTIVES AND PREREQUISITES

Objective

Students will be able to

- Recognize the technical terms.
- Use variables to form an expression.
- To form an equation using a variable and constant.

Prerequisite Concept

- Patterns

TIK_MATH_G5_CH20_Patterns

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*Kindly Note: Activities marked with * are mandatory*

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Provide Homework

name: Algebra

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Description:

tags: grade 6, science, NCERT, CBSE, algebra, variables, expression with variables, use of expressions, equations

2. LEARN

2.1 KEY POINTS

Variable: A Variable is a symbol for a number we don't know yet. It is usually a letter like x or y. A number on its own is called a Constant. A variable takes on different values, its value is not fixed.

Expression: An algebraic expression is a mathematical expression that consists of variables, numbers and operations.

Equation: An equation is a mathematical statement that two things are equal. It consists of two expressions, one on each side of an equals sign.

2.2 LEARN MORE
None

3. ENGAGE

3.1 INTEREST GENERATION ACTIVITY

Interest generation activity

Activity 1: History of algebra

Materials Required: None
Prerequisites: None

Activity Flow

Ask them to read the history in the book and then add the information given below as an extra reading for the students.

Algebra is a mathematical system that is a generalization of arithmetic in symbolic form; it uses letters or symbols to represent numbers.

The word "algebra" comes from the Arabic word al-jabr which is a part of the title of al-Khwārizmī's treatise on algebraic methods which means "restoring," that is, the operation of adding a term to both sides of the equation.

Early works of algebra of ancient Babylonians and Egyptians lack the abstract notation that algebra has today. The Babylonians had methods of solving quadratic equations, while the Egyptians used the symbol heap for the unknown.

Algebra to the ancient Greeks is an unknown science except for the Greek mathematician Diophantus of Alexandria (3rd century BCE). His work Arithmetica contains the first

suggestions of algebraic notations and is probably the earliest treatise on algebra. He used algebraic equations and notations in presenting problems and solutions in Arithmetica.

The Islamic scholars made several contributions to algebra as well—most notable of them is al-Khwārizmī. He did not use algebraic notations in his treatise but employed rhetorical algebra. This is one reason why some consider Diophantus as the "Father of Algebra" rather than Al-Khwārizmī.

Activity 2: Variables
Materials Required: None
Prerequisites: None

Activity Flow

- *Ask the following questions to the students.*
  (a) $?+3=9$ *.Answer is 6*
  (b) $14-?=10$ *.Answer is 4*
- *For the above questions it's easy to find the answers. In Algebra, we don't use blank lines or boxes for the unknown values. We use a letter (usually x. y , x , but any letter is fine). We can write the above equations using the letters.*
- *For example*
  $x-2=4$
  The letter x means unknown value.

3.2 CONCEPT INTRODUCTION ACTIVITIES

The idea of a variable

Activity 3: The idea of a variable
Materials Required: Sticks
Prerequisites: None

Activity Flow

- *Ask the students how many toothpicks or small sticks they need to construct one square and also ask them to construct.*
- *Then ask them to construct one more square next to the first square such that the second square shares one side of the first square. This means the first square requires 4 sticks and the second requires 3 sticks. Similarly, for the next 4 consecutive squares.*

- *Now ask them how many sticks have been used to construct the first square? Similarly for second, third, fourth and fifth.*
- *First Square has 4 sticks, first two squares will have* $(4+3)$ *7 sticks, first three squares have 10 sticks, first four squares have 13 sticks and first five squares have 16 squares.*
- *Discuss with students that number of sticks required* $=3\times$ number of squares $+1$ *.*
- *Let n represent the number of squares. If one square is made, n = 1; if two squares are made, n = 2 and so on. Thus, n can be any natural number 1, 2, 3, 4, 5 and so on. We then write, number of sticks required* $=3\times n+1$ *. Instead of writing* $3\times n+1$*, we write* $3n+1$ *, because 3n means* $3\times n$ *. So here n is an example of a variable. Its value is not fixed, it can take any value 1, 2, 3, 4...*

OR

- *If they find it difficult to arrange the sticks to get squares, ask them to draw squares as it explained above. So, in place of asking about the number of sticks, ask them to count the number of sides' first one square, first two squares altogether and so on.*
- *Give one more example to get an idea of the variable is the multiplication table. For example:*
  - *Take multiplication table 2.*
  - *I.e.*

    $2\times1=2,\ 2\times2=4,\ 2\times3=6,\ 2\times4=8,\ 2\times5=10,$

    $2\times6=12,\ 2\times7=14,\ 2\times8=16,\ 2\times9=18,\ 2\times10=20$
- *Here we can observe that the numbers on the left side of the equal sign there is number 2 which remains the same and there are numbers which varies 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10.*
- *So, we can write a general rule as 2 x y. Where y is a variable and takes values from 1 to 10.*
- *Similarly ask the students to do it for the multiplication table 3, 4 and 5. And whichever table they want to. Ask them to give the general rule.*

Use of variables in common rules

Activity 4: Use of variables in common rules

Materials Required: Sticks

Prerequisites: Perimeter. Refer to TIK_MATH_G6_CH10_Mensuration

Activity Flow

Rules from geometry

1. *Perimeter of a square:*

   We know that the perimeter of a square is the sum of the length of all four sides.

Hence, the perimeter of a square = 4 times the length of a side of the square $= 4 \times l = 4l$ *.*

Where l is a variable used to represent length and use of this variable will allow us to write the general rule in a way that is simple representation and easy to remember.

2. *Perimeter of a rectangle:*

We know that the perimeter of a rectangle is the sum of the length of two lengths and two breadths.
Hence, the perimeter of a rectangle = 2 times the length of sides + 2 times the breadths of sides $= 2 \times l + 2 \times b = 2l + 2b$ *.*
Where l and b are variables used to represent length and breadth of rectangle. The use of this variable will allow us to write the general rule in a way that is simple representation and easy to remember.

- *Ask the students to write the general rule for polygons having 5 sides and 6 sides which is pentagon and hexagon.*

Rules from arithmetic

Activity 5: Rules from arithmetic

Materials Required: None
Prerequisites: Distributive and commutative property

Activity Flow

Commutative of addition of two numbers

- *Interchanging the order of numbers in addition does not change the sum.*
  Example: $12 + 5 = 5 + 12 = 17$ *.*
  The use of variables allows us to express the generality of this property.
  Let a and b be two variables which can take any number. Then, $a + b = b + a$ *.*
- *Ask the students to write the general rule for commutative addition of three numbers.*

Commutative of multiplication of two numbers

- *Interchanging the order of numbers in multiplication does not change the product.*
  Example: $5 \times 6 = 6 \times 5 = 30$ *.*
  Using the variable a and b as in the case of addition, we can express the commutativity of multiplication of two numbers as $a \times b = b \times a$ *Where a and b can take any number.*
- *Ask the students to write the general rule for commutative multiplication of three numbers.*

Distributive property of numbers:

- *Ask the students to multiply 9 and 57. Also by applying the distributivity of multiplication over addition of numbers. I.e.* $9\times57=9\times(50+7)=9\times50+9\times7=450+63=513$.

By using variables, we can write this property of numbers in general form.
Let a, b and c are three variables, each of which can take any number.
Then $a\times(b+c)=a\times b+a\times c$

Expressions with variables

Activity 6: Expressions with variables

Materials Required: None
Prerequisites: Variables

Activity Flow

- *Ask the following questions to the students,*
  - *Teacher called one of the students from the class and gave 3 pens twice and 5 pens. And asked the student to count the number of pens that he has with him.*
  - *Answer:* $3\times2+5=6+5=11$.
    Or
  - $3+3+5=11$
- *Two friends bought one full packet of chocolates. And they wanted to divide it equally. One of them started grouping it into 5 chocolates and made 10 groups and there were 4 extra chocolates. Then how many does each will get and what is the number of chocolates in total.*
  - *Answer: Each of them will get 5 groups of 5 chocolates plus 2.*
  - *The total number of chocolates they had was* $5\times10+4=54$
- *Above examples introduce the concept of expression. Also this is an example for expression without variables.*
- *The following examples are expressions with variables.*
  $7y+6$
  $2m-8$
  $-4x+13$

Use of expressions

Activity 7: Use of expressions.

Materials Required: None
Prerequisites: Variables and expressions

Activity Flow

- *Explain to them the following examples to show that these are the expressions used practically.*
  For example:
- *Prajwal has 7 more sheets than Surya. Since we do not know how many sheets Surya has we will call that unknown variable x. Then the number sheets prajwal has will be* $(x+7)$ *. Where* $(x+7)$ *is the expression for the given statement.*
- *The price of hair oil per litre is rupees 30 less than the price of cooking oil. Let us denote the unknown, which is the price of cooking oil per kg, by a variable p. The statement can be written in a simple way in the form of expression,* $(p-30)$*. Hence,* $(p-30)$ *will be the price of hair oil per litre.*
- *Also explain the examples given in the textbook and use of variables and after that ask students to give their examples for using expressions practically.*

Equation

Activity 8: Equation

Materials Required: None

Prerequisites: Variables and Expressions.

Activity Flow

- *Ask the following questions to the students and ask how they are going to find the answers.*
- *Arun bought biscuits and sugar for 25 rupees and if biscuit costs 10 then what is the cost of sugar?*
  Solution: $Biscuit + Sugar = 25$
  $10 + Sugar = 25$
  Cost of sugar = 15.
- *Explain to them how to find the cost. We need to form an equation to solve the problem.*
- *Here instead of writing the word sugar and Biscuit, we can replace with a variable s and b respectively.*
  Therefore, the equation becomes $b + s = 25$
  $10 + s = 25$
  S = 15
- *Pallavi bought 4 pens which cost 5 rupees each and what is the total amount paid for 4 pens.*

Solution: Cost of one pen = 5 rupees
Therefore cost of 4 pens $= 5+5+5+5 = 20$
Or
The cost of 4 pens $= 5 \times 4 = 20$

- *Here the same question can be framed in such a way that the word pen is replaced with a variable p.*
  Hence, we can write it as the cost of 4 pens = 4p = 20
- *These are the simple examples to introduce the concept of equations. Ask the students to give examples for the equation.*
- *Ask them the difference between the examples of equations and examples expressions.*
- *As the word itself describes that an equation has an equal sign between its two sides which is the left hand side and right hand side. If Both LHS and RHS are not equal then we do not get an equation. Whereas expressions will not have equal signs.*
  Example:
  $125 - 9 = 116$ *is an example of an equation.*
  $79 > 78$ *is not an equation.*
- *Ask the students to write examples for equations and expressions and also solve the exercises in the book.*

Solution of an equation

Activity 9: Solution of an equation

Materials Required: None
Prerequisites: None

Activity Flow

- *Explain, to solve an equation.*
  For example: $X - 3 = 11$
  This equation is satisfied by x = 14.
  If you put x = 14, the LHS of the equation $= 14 - 3 = 11 =$ *RHS.*
  If you put 12, the LHS of the equation $= 12 - 3 = 9$ *, which is not equal to RHS.*
  If you put 15, the LHS of the equation $= 15 - 3 = 12$ *, which is not equal to RHS.*
  Thus, x = 14 is a solution to the equation $x - 3 = 11$.
- *The value of the variable in an equation which satisfies the equation is called a solution*
  to the equation.
- *Ask the students to solve and get the value for the unknown.*
  - $p + 3 = 9$ *, the value of p =?*
  - $2x - 7 = 11$ *, value of x =?*

- $y \div (3+5) = 6$, *value of y =?*
- $5l + 10 = 0$, *value of l =?*

- *Also ask them how they are going to solve and which method they would try.*
- *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* $+, -, \times, \div$*) 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.)*

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

We use algebra quite frequently in our everyday lives, and without even realizing it! We not only use algebra, we actually need algebra to solve most of our problems that involve calculations.

- Algebra helps to calculate the grocery expenses. For example, You have to buy two dozen eggs priced at 10, three breads (each bread is 5 rupees), and five bottles of juice (each bottle is 8 rupees). How much money will you need to take to the grocery store?

  We will use algebra to solve the problem easily and quickly.
  The prices are
  a = Price of two dozen eggs = 10 rupees
  b = Price of one bread = 5 rupees
  c = Price of one bottle of juice= 8 rupees
  Money needed $= a + 3b + 5c$
  Money needed $= 10 + 3(5) + 5(8) = 10 + 15 + 40 = 65$ rupees

- Algebra can help you to measure your living room dimensions and determine the size of an electronic item like TV or refrigerator that'll fit comfortably in the space.

- Algebraic notations and symbols are crucial for deciphering and understanding musical notes, forces of gravity, behavior of solids, liquids, and gases. The myriad branches of science that have helped us comprehend and appreciate everyday natural phenomenon, use algebra extensively.

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Reinforcement

Activity 10: Practice and Recall

Materials Required: None

Prerequisites: None

Activity Flow

1. *The teacher distributes 5 pencils per student. Can you tell how many pencils are needed, given the number of students? (Use s for the number of students.)*
2. *A bird flies 1 kilometer in one minute. Can you express the distance covered by the bird in terms of its flying time in minutes? (Use t for flying time in minutes.)*
3. *The side of an equilateral triangle is shown by l. Express the perimeter of the equilateral triangle using l.*
4. *Which out of the following are expressions with numbers only?*
   - *a)* $y+3$
   - *b)* $(7\times 20)-8z$
   - *c)* $5(21-7)+7\times 2$
   - *d)* 5
   - *e)* $3x$
   - *f)* $5-5n$
   - *g)* $(7\times 20)-(5\times 10)-45+p$
5. *Give expressions for the following cases.*
   - *(a) 7 added to p*
   - *(b) 7 subtracted from p*
   - *(c) p multiplied by 7*
   - *(d) p divided by 7*
   - *(e)* 7 subtracted from $-\ m$
   - *(f)* $-\ p$ multiplied by 5

(g) p multiplied by -5

6. *State which of the following are equations (with a variable). Give reason for your answer. Identify the variable from the equations with a variable.*

   a) $17 = x + 7$

   b) $4 \div 2 = 2$

   c) $(7 \times 3) - 19 = 8$

   d) $x - 2 = 0$

   e) $2m < 30$

   f) $2n + 1 = 11$

   g) $7 = (11 \times 5) - (12 \times 4)$

   h) $7 = (11 \times 2) + p(k)\,20 = 5y(l)$

   Pick out the solution from the values given in the bracket next to each equation. Show that the other values do not satisfy the equation.

   (a) $5m = 60$ $(10, 5, 12, 15)$

   (b) $n + 12 = 20$ $(12, 8, 20, 0)$

   (c) $p - 5 = 5$ $(0, 10, 5 - 5)$

4.2 IMPORTANT GUIDELINES*

Exercise Reading

It is very important that the children practice their learnings as well as their Reading. Hence have the children read out the newly learned concepts from their textbooks or other available resources.

Perform Textbook Activity

It is good practice to have the children perform the textbook activities. Your textbook activities might not be accessible hence go through this resource to learn how to make textbook content accessible

Provide Homework

To evaluate their understanding and to help the student revise and implement the new learnt concept ensure to provide them with homework. Students should perform one or two of the questions mentioned above or from the textbook exercises with the teacher in Class and the remaining may be given for homework. Also, ensure that the student knows their special skills linked to independently using their accessible books as it will be critical to doing homework independently

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