Vision Empower & XRCVC Teacher Instruction KIT Simple Equations

Syllabus: Karnataka State Board Subject: Mathematics Grade: 7 Textbook Name: MATHEMATICS - Text cum Workbook (Revised) - Seventh Standard Chapter Number & Name: 4 Simple Equations

1. **OVERVIEW**

1.1 OBJECTIVE & PREREQUISITES

Objective

Students will be able to:

- set up equations.
- convert an equation into a statement.
- solve the equations by adding and subtracting terms on both sides.
- solve the equation using the transpose method.

Prerequisite Concept

• Algebra *TIK_MATH_G6_CH11_Algebra*

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*Kindly Note: Activities marked with * are mandatory*

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3. EXERCISES & REINFORCEMENT

Activity 1: Practice and Recall

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2. LEARN

2.1 KEY POINTS

- •
- In an equation, the value of RHS should be equal to the value of LHS.
- Use addition or subtraction to isolate the variables on one side of the equation.
- If we add/ subtract the same number to both sides of an equation, the value of both sides will remain equal.
- If we fail to do the same mathematical operation with the same number on both sides of an equality, then equality may not hold.
- Use multiplication or division to solve the variable.
- Before solving the equation, remove the parentheses or brackets by applying the distributive property.
- For a given solution, there will be N number of equations.
 - Transpose means moving a number from one side to the other, instead of adding/ subtracting the same number on both sides. While doing so, the sign of the number has to be changed.

2.2 LEARN MORE

3. ENGAGE

3.1 INTEREST GENERATION ACTIVITY

Puzzles

Activity 1: Puzzles Materials Required: None Prerequisites: TIK_MATH_G6_CH11_Algebra(Activity 1 and 2)

- pattern
- addition
- subtraction
- multiplication
- variables

Activity Flow:

- Divide the students into a group of 4
- Ask the following questions to the children. Let them discuss with the group to find the answers.

Questions are

1. What is the next number in the pattern?

a. 12, 16, 20, 24

The answer is 28.

Explanation: 12+ 4 = 16; 16 + 4 = 20; 20 + 4 = 24; 24 + 4 = 28.

- 2. Which is the next ordered pair in the pattern? (10, 5), (8, 4), (6, 3)
 - a. (2,4)
 - b. (4,2)
 - c. (5,2)

The answer is (4, 2).

Explanation: 10/2 *is* 5; 8/2 *is* 4; 6/2 *is* 3. *Similarly,* 4/2 *is* 2.

- 3. The first number in a pattern is 5. The pattern follows the rule "Add 3". What are the next 4 numbers in the pattern?
 - a. 1, 4, 7, 10
 - b. 5, 10, 15, 20
 - с. 8, 11, 14, 17
 - d. 3, 6, 9, 13
- 4. What is the rule for the following pattern? 10, 7, 4, 1
 - a. *add* 4
 - b. add 8
 - c. *multiply by 2*
 - d. *subtract 3*

The rule of the following pattern is to subtract 3.

- 5. *X*+10 = 12, what is the value of *X*? The value of *X* is 2.
- 6. Y-5=20? What is the value of Y? The value of Y is 25.
- 7. What is the sum of the first 5 consecutive numbers?
- 8. What is the sum of the first 30 consecutive numbers?

For the seventh question, you can easily add the first five consecutive numbers.

• *I.e.* 1 + 2 + 3 + 4 + 5 = 15

For the eighth question, adding the first thirty consecutive numbers is a time-consuming process. Instead of that, you can use the formula to find the answer.

• *I.e.*
$$\frac{n(n+1)}{2}$$

Algebra will allow writing the general rule by observing the pattern. It helps to solve problems easily. Using algebra we can find the unknown values by completing and balancing equations. In this class, they are going to learn about how to find the unknown values by solving an equation.

Note: Students have learned to write the general rule by observing patterns in class 6.

3.2 CONCEPT INTRODUCTION ACTIVITIES

Balancing the equation

Activity 1: Balancing the equation

Materials required: Shapes of semicircle and circle using cardboard, handmade balance scale. Prerequisites:

- addition
- subtraction

Activity Flow

An equation is a mathematical sentence that has two equal sides separated by an equality sign.

For example: X - 4 = 10

The value of RHS should be equal to the value of LHS.

An equation is similar to a balance scale. If we add/ remove weight from any one side of the balance scale then the other side will go either up/down. It will take the balance out between both sides. To maintain balance, both sides should have equal weight. In an equation, it's important to maintain the balance between both sides of an equality sign.

For example, X - 4 = 10, implies the value of (X - 4) is equal to 10.

Note: To maintain balance, if you add/subtract any value to one side of the equality sign then the same value should be added /subtracted on the other side to maintain the balance.

If possible, the teacher can bring a balance scale to the class. Let the children add/ remove weights on both sides of the pan to understand the concept of balancing. Ask the children to place one book on one side and some other items on the other side until the arm becomes horizontal. By touching the pans of the balance scale or by holding the balance scale helps to find out which one has more weight or vice versa because our hands will tilt to a heavier side. If the students add/remove the same weights to both pans then the arm remains horizontal.

- Divide the students into a group of three or four.
- *Give six pieces of each shape to all the groups.*
- Tell the children that one circle is equal to 2 semicircles.
- Ask them to arrange it in an equation form.

Example: placing one circle on the left-hand side of the equality sign and 2 semicircles on the right-hand side of the equality sign

- Ask them to use stylus/any other small materials as an equality sign
- After they set up an equation, ask the children to add one more circle on the righthand side
- Ask how many semicircles do we need to add on the other side to maintain the balance? They have to add two semicircles on the left-hand side.
- Then ask the children to add two semicircles on the right-hand side. Then ask them to maintain the balance on the other side by adding semicircles or circles.
- Now, ask them to bring the circles to one side and the semicircles to the other side without losing the balance. Always the equation should hold the balance between both sides. Let them try to bring the semicircles to one side and the circles to the other side by adding or removing the shapes on both sides. The teacher can help them to balance the equation.
 - For example: C circle; S semicircle
 - C = 2 S
 - C+C=S+S+C
 - C+C+C=S+S+S+C

Note: If they remove a circle on both sides then they will get semi-circles on one side and circles on the other side.

- On the RHS, remove the circle to have only semicircles (similar terms). Then remove one circle on the LHS to keep the equation balanced.
 - C+C=S+S+S+S
 - C+C=2S+2S
 - 2C = 4S

• Now LHS has only circles and the RHS has only semicircles. Learning to isolate similar terms to one side helps to solve the equation.

Set up an equation

Activity 2: Set up an equation

Materials required: None Prerequisites: TIK_MATH_G6_CH11_Algebra(Activity 1, 2, 3)

- concept of variables
- use of variables
- *expressions with variables*

Activity Flow

Algebra is used to find the value of the unknown.

Algebra Facts:

Early forms of algebra were developed by the Babylonians and the greek geometers such as the Hero of Alexandria. Algebra (from Arabic transliterated "al-jabr", meaning "reunion of broken parts"). It uses variables to represent a value of unknown. When an equals sign (=) is used, this is called an equation. A very simple equation using a variable is: 2+3 = x. In this example, x = 5, or it could also be said that "x equals five". This is called solving for x. The subject dates back over 4000 years to the ancient Babylonians.

• Explain the following example to the students.

For example:

A customer pays 100 rupees for a coffee maker after a discount of 20 rupees. What is the original price of the coffee maker?

We don't know the original price of the coffee maker.

• Consider it as "X" - unknown value.

After the discount of 20 rupees, the customer paid 100 rupees

- *I.e.* X 20 = 100
- X 20 = 100
- X 20 + 20 = 100 + 20 (by adding 20 to each side of the equation, you will find that X equals to 120).
- *X* =120

Things to remember to solve a problem:

- 1. understand a problem
- 2. list the given data
- 3. make an equation
- 4. solve the problem

Practice:

- Ask the children to form an equation for a set of statements.
- Divide the children into groups of four.
- Introduce the rules to the children.

The rules are:

- 1. Each group will get questions, they have to answer when their turn comes.
- 2. For each correct answer, they will get one point.
- 3. If the group fails to answer then the question will pass to another group. After each question, if the children were unable to solve, then the teacher should explain the solution to the problems.

Questions:

1. The sum of numbers x and 4 is 9. Form its equation?

- 2. 2 subtracted from y is 8.
- 3. Three-fourth of t is 15.
- 4. The number b divided by 5 gives 6.
- 5. Ten times a is 70.
- 6. If you take away 6 from 6 times y, you get 60.
- 7. If you add 3 to one-third of z, you get 30.
- 8. One-fourth of a number x minus 4 gives 4.
- 9. Irfan says that he has 7 marbles more than five times the marbles Parmit has. Irfan has 37 marbles. (Take m to be the number of Parmit's marbles.)

Equations:

- 1. X + 4 = 9
- 2. Y 2 = 8
- 3. $\frac{3}{4}t = 15$
- 4. b/5 = 6
- 5. 10 * a = 70
- 6. 6Y 6 = 60
- 7. z/3 + 3 = 30
- 8. x/4-4=4
- 9. 5m + 7 = 37

Solving an equation

Activity 3: Solving an equation

Materials required: Marbles and toothpicks Prerequisites:

- addition
- subtraction
- multiplication
- division

Activity Flow

• Give the below equation to the children

$$X + 8 = 12$$

- Ask the RHS and LHS of the given equation.
- Again reinforce the concept of equality. The equals sign says that both sides are exactly equal, or of the same value.
 - For example
 - 4+2=6;

In the given example the value of LHS is 6 and the value of RHS is also 6; both the values are equal but not the numbers.

Note: In the above equation, X + 8 = 12*. It means the value of* X + 8 *is equal to 12.*

- Explain to the students, in an equation, there will be known values and unknown values.
 - For example 2X+8=12; Here X is an unknown value. 8 and 12 are known values.
- Tell them that before solving an equation, it's important to rearrange the equation by keeping the known values to one side and unknown values on the other side without losing the equality.

$$2X + 8 = 12$$

- In the above equation, to isolate 2X, subtract 8 from the LHS.
- To maintain equality, subtract the same number (8) from the RHS.

Note: If you add/subtract/multiply/ divide any value to one side of the equality sign then the same value should be added /subtracted/ multiplied/ divided on the other side to maintain the equality. If we fail to do the same mathematical operation with the same number on both sides of an equality, equality may not hold

- 2X+8-8=12-8; subtracting 8 from both the sides
- *I.e.* 2 X = 4
- (*New LHS*) 2*X* = 4 (*New RHS*);
- 2X / 2 = 4 / 2, divide both sides by 2 inorder to isolate X from 2,
 X = 2

To confirm whether the solution is right, put X = 2 in the original equation. We get LHS = 2X + 8 = 2(2) + 8 = 12, which is equal to the RHS as required.

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- Ask the children to consider the toothpicks as X; Marbles as units.
- Let them put any long scale in the centre, ask them to consider it as an equality sign
- *Give the following equation to solve*

2X + 4 = 8

- Ask the children, how many toothpicks and marbles do we have to place on the LHS of the scale and RHS of the scale.
- Inform them, the first step to solve an equation is to separate the unknown values and known values. (keeping like terms together)
- In the above equation, we have to bring the toothpicks to one side and the marbles to the other side of an equality sign.
- Remove (subtract) 4 marbles on the LHS so, we will get 2X on the LHS.
- To maintain the balance, remove (subtract) the same number of marbles on the RHS
- Ask the value of both RHS and LHS

- *i.e*, 2X(2 tooth sticks) = 4 marbles
- Tell the students that 2 toothpicks represent 4 marbles then ask them how many marbles represent 1 toothpick?
- To find that divide the two sticks into two groups and the 4 marbles into two groups. It represents that one stick is equal to two marbles.
 - To get X we have to divide the 2X by 2; i.e. 2X/2 = X
- To maintain the balance divide the same number on the RHS; I.e. 4/2 is 2
 - X/2 = 4/2;

• *X* = 2;

Transposing a number Activity 4: Transposing a number *Materials required: None Prerequisites:* • addition

- subtraction
- multiplication
- division

Activity Flow Solve 5P-10=4

Transpose: General meaning is to change a position or order. In Algebra, transpose means to bring a term from one side of the equation to the other, with a corresponding change of sign.

While solving the above equation, children will learn about transposing a number, i.e., moving a number from one side to the other. We can transpose a number instead of adding or subtracting it from both sides of the equation.

We can solve the above equation in two ways.

- The first way is
 - 5P 10 = 4;
 - 5P-10+10 = 4+10; adding 10 to both sides
 - 5P = 14;
 - 5P/5 = 14/5; divide both sides by 5;
 - P = 14/5;
- Another method is, moving a number from one side to the other. We can move a number instead of adding or subtracting it from both sides of the equation. While doing so, the sign of the number has to be changed.

- For example 5P 10 = 4;
- To separate the unknown values and known values, instead of adding 10 to both sides; we can move the number -10 from LHS to RHS.
 - 5P = 4+10; Transpose -10 from LHS to RHS; while transposing -10 becomes +10
 - 4P = 14;
 - 4P/4 = 14/4; to get p, divide both sides by 4;
 - P = 7 / 2;

Removing brackets

Activity 5: Removing brackets

Materials required: None Prerequisites: TIK_MATH_G6_CH11_Algebra(Activity 2,)

- distributive property
- multiplication

Activity Flow

- In grade 6th, students have studied the distributive property of numbers.
 - a(b+c) = ab+bc;
 - For example: 4(4+3) = 4*4+4*3;
 - 16+12=28;
 - 4(4+3) = 28;
- Ask the children to solve the below equation using the distributive property.
- By applying the distributive property, they can remove the given brackets.

• 2(x+6) = 10

• applying distributive property, 2 * X + 6 * 2 = 10; Now ask the children to use the 2X + 12 = 10

transpose method to find the value of X

- 2X + 12 = 10;
- 2X = 10 12; transposing the number;
- 2X = 2;
- 2X / 2 = 2 / 2; divide both sides by 2, to get X;
- X = 2;

Solution to the equation

Activity 6: Solution to the equation

Materials required: None

Prerequisites:

• addition

- subtraction
- multiplication
- division

Activity Flow

In the above activities, students have learned how to solve the unknown values from the given equation. Now they are going to form equations from a given solution.

Tell the students that they can form many equations to a given solution. Finding a solution from an equation is a normal path. If you find the equation from the solution is the reverse path.

For example, To solve an equation 3y-5=7add 5 to both sides, divide both sides by 3, y=4

If you follow the reverse path you will get the equation

Y = 4;multiply both sides by 3,3y = 4*3subtract 5 from both sides,3y - 5 = 12 - 53y - 5 = 7

For the solution (y = 4), we can also form different equations. y=4;

multiply both sides by 4, 4y = 16subtract 2 from both sides, 4y - 2 = 16 - 24y + 2 = 18

Tell the students that we have created two equations from the solution y = 4. Note: Any number can be subtracted equally from both sides of an equation.

- Give any solution to the children.
- Pair up the children, then ask them to form an equation together for the given solution.
- Ask each pair to say their equation aloud.
- Discuss how many equations they have formed for a given solution.

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

We use algebra every day of our lives. Examples of ways that we use algebra are finding the distance, the perimeter of an area, volume, determining the cost of something, renting something, time relationships, pricing options for something you want to buy, and more.

Algebra can be useful for solving problems in real life.

For example, suppose that Geetha has 50 rupees and she wants to buy a book that costs 125 rupees. To find out how much more money she needs, Geetha can use algebra. The problem can be written as 50 + x = 125 and can be read in English as " fifty-plus what number equals one hundred and twenty-five?" One of the rules of algebra says that any number can be subtracted equally from both sides of an equation. Therefore Geetha can solve her problem by starting with the original equation, 50 + x = 125, and subtracting 50 from both sides of the equation: 50 - 50 + x = 125 - 50, or x = 75. With algebra and basic arithmetic operations, it is possible to solve almost any equation that has a variable.

4. EXERCISES & REINFORCEMENT

4.1 EXERCISES & REINFORCEMENT

Practice and Recall

Activity 1: Practice and Recall

Materials Required: None

Prerequisites:

- solving an equation
- set up an equation
- *distributive property*
- transpose method

Activity Flow

- 1. Say, whether the equation is satisfied. (Yes/No)
 - a. x + 3 = 0; x = 3
 - b. x 7 = 1; x = 8
 - c. m/3 = 2; m = -6
 - d. 7n + 5 = 19; n = -2
- 2. Check whether the value given in the brackets is a solution to the given equation or not
 - a. 4p-3=13; (p=-4);
 - b. 4p-3=13; (p=0);
 - c. 4p-3=13; (p=1);
- 3. Set up an equation in the following cases:

- a. Laxmi's father is 49 years old. He is 4 years older than three times Laxmi's age. (Take Laxmi's age to be y years.)
- b. The teacher tells the class that the highest mark obtained by a student in her class is twice the lowest marks plus 7. The highest score is 87. (Take the lowest score to be l.)
- 4. Give first the step you will use to separate the variable and then solve the equation
 - a. x + 1 = 0
 - b. y + 4 = 4
 - c. 3l = 42
 - d. z/3 = 5/4
 - e. 3n 2 = 46
 - f. 10p + 10 = 100
 - g. 3s + 12 = 0
- 5. Solve the following equations: using the transpose method
 - a. 5t + 28 = 10
 - b. 2(x+4) = 12
 - c. 4(2-x) = 8
 - d. 4 = 5(p-2)
- 6. Construct 3 equations starting with x = 2

4.2 IMPORTANT GUIDELINES*

Exercise Reading

It is very important that the children practice their learning 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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