

Interpretation of Equations

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Third Grade Lessons

1. **Recipes that Exchange** - The lesson focuses on a function that multiplies input by two but also changes the ingredient to another type of ingredient.
2. **Rules and Formulas** - Students are given a rule and a data table supposedly generated according to the rule. Students evaluate whether: (1) the proper rule has been applied and (2) the result is correct.
3. **Starting With A Rule** - Students focus on whether given outputs are consistent with a given rule.
4. **Times Two** - The lesson focuses on a function that multiplies the input by two. New notations are introduced.

Fourth Grade Lessons

1. **Comparing Strips of Unmeasured Lengths I** - The class is the first of a series that will focus directly upon the algebraic representation of measurements and their multiplicative relations. Children are asked to compare the lengths of strips, to describe the relationships between them in multiple ways, and to demonstrate that the relationships they represent are true.
2. **Comparing Strips of Unmeasured Lengths II** - The class is the second of the "Strips of Unmeasured Lengths" series that will focus directly upon the algebraic representation of measurements and their multiplicative relations. Children are asked to compare the lengths of strips, to use algebraic notation to describe the relationships between them, and to demonstrate that the relationships they represent are true.
3. **Comparing Strips of Unmeasured Lengths III** - This is the third lesson in the "Strips of Unmeasured Lengths" series that focuses directly upon the algebraic representation of measurements and their multiplicative relations. We will work with the relationship $B = 3S$, focusing on equations and their verbal descriptions and on true and false equations and statements.
4. **Fourth Grade Assessment I** - This is a written assessment where children will interpret and determine the truth or falsehood of equations and statements that describe comparisons between quantities.
5. **Fourth Grade Assessment I Review** - Children discuss responses to problems where they interpret and determine the truth or falsehood of equations and of statements that describe comparisons between quantities.
6. **Fourth Grade Assessment II** - This is a written assessment where children will interpret and determine the truth or falsehood of equations and of statements that describe comparisons between quantities.
7. **Fourth Grade Assessment III** - This is a written assessment where children will be asked to interpret graphs and to interpret and determine the truth or falsehood of equations and statements that describe comparisons between quantities.
8. **Three to One** - Children discuss and produce verbal and mathematical statements on the proportion, $S:L :: 1:3$, that is, on the function $f(x) = 3x$ and on its inverse $f^{-1}(x) = 1/3x$
9. **Two Phone Plans I** - Students compare two phone plans, one of which has a lower rate, but a monthly basic charge; the other has a higher rate but no basic charge.
10. **Two Phone Plans II** - Students will work on the comparison between two phone plans (also used in the lesson "Two Phone Plans I"), one of which has a lower rate, but a monthly basic charge, the other has a higher rate but no basic charge.
11. **Wallet Problem III** - Students will continue working with the wallet problem. They will be shown a graph for Mike's amounts and asked to (a) determine whether it represents Robin's or Mike's money and (b) to predict where the line for Mike would fall. Later they will plot Mike's amounts and will discuss why the lines cross.

Fifth Grade Lessons

1. **Enacting and Solving Equations** - Students enact and discuss a situation where two children have amounts of candies. Some of the candies are visible, others are inside opaque tubes or boxes. After considering multiple possibilities they are told that the children have the same amount of candies. The situation corresponds to the equation $3x + y + 6 = x + y + 20$, where x is the amount of candies per tube and y is the amount of candies per box. Students will be asked to discuss and to represent the situation, to solve the equation that corresponds to the situation, and to solve other written equations with similar structure.
2. **Equations in Groups** - Students first discuss equality situations and how equal changes on both sides of the equality do not change the equality or the solution to the equation. In a second activity, A pair of students begins with a solved equation (e.g. $N = 4$) and passes the equation to their neighbor; the neighbor operates equally on each side of the equation and passes the equations to the following neighbor. They continue this process until the series of equations return to the first two students who, then, check whether the solution still holds. They also check the logic and correctness of their colleagues operations on the initial equation.
3. **Equations in Groups II** - A student (or a pair of students) begins with a solved equation (e.g. $N = 4$) and pass(es) the equation to neighbor (or pair of neighbors); the neighbor(s) operate(s) equally on each side of the equation. And so on, around the table. There should be at least three students or pair of students at each table. When the series of equations returns to the first students, each student (or pair of students) check whether the solution still holds for the solution they had proposed at the beginning. They also check the logic and correctness of the changes implemented by their classmates.
4. **Fifth Grade Assessment I** - This assessment will focus on writing equations to solve verbal problems and on solving equations using syntactic rules. It is intended as a diagnostic tool to assist teachers in planning future activities.
5. **Fifth Grade Assessment I Review** - This lesson will focus on reviewing the recent in-class assessment, on writing equations for word problems, and on solving equations.
6. **Fifth Grade Assessment II** - This assessment will focus on writing equations to solve verbal problems and on solving equations using the syntactic rules of algebra.
7. **Fifth Grade Assessment III** - This assessment will focus on writing equations to solve verbal problems and on solving equations using the syntactic rules of algebra.
8. **Solving Equations I** - Students will be asked to use the syntactic rules of algebra to solve equations with variables on both sides of the equals sign.

Middle School Lessons

1. **Graphing Equations** - Students will practice moving between graphs and equations of functions, as well as identifying the y-intercept and slope.
2. **Relating Graphs and Equations - Linear and Quadratic Functions** - Students will generate graphs from given equations and equations from given graphs.
3. **What Will Happen** - Students will work with equations of functions (both linear and non-linear) to find the y-intercept without graphing.

4. **Who Shares My Function? - Linear with All Representations** - Students will work in groups after finding other students who have the same linear function represented by a story, a table, a graph, or an equation. They will attempt to explain and discuss why the different representations refer to the same function.
5. **Who Shares My Function? - Linear with Graphs, Tables, and Equations** - Students will make groups by finding other students who have the same linear function, as shown in representations of graphs, tables, or equations. They will then generate a story to go with the function.
6. **Who Shares My Function? - Linear with Negative and Fractional Slope** - Students will find other functions that are the same as theirs, starting from a table, a graph, or an equation. Once they have identified the same function represented in a different way, they will create a story that describes all of the different representations of the same function.
7. **Who Shares My Function? - Quadratics** - Students will make groups by finding other students who have the same quadratic or linear function in different representations.