Introduction to Algebra: Basic Operations and Equations

Student Name: _____

Class: _____

Due Date: _____

Introduction to Algebra

What is Algebra?

Algebra is a branch of mathematics that deals with variables and their relationships. It involves the use of symbols, equations, and functions to solve problems and model real-world situations.

Key Concepts:

- Variables: symbols that represent values that can change
- Constants: symbols that represent values that do not change
- Algebraic expressions: combinations of variables, constants, and mathematical operations
- Equations: statements that express the equality of two algebraic expressions

Basic Operations

Adding and Subtracting Algebraic Expressions

To add or subtract algebraic expressions, we need to combine like terms. Like terms are terms that have the same variable and coefficient.

Example:

$2x + 3 + 2x - 1 = ?$

Solution:

$2x + 2x = 4x$

$3 - 1 = 2$

So, $2x + 3 + 2x - 1 = 4x + 2$

Multiplying and Dividing Algebraic Expressions

To multiply or divide algebraic expressions, we need to follow the order of operations (PEMDAS).

Example:

$2(x + 3) = ?$

Solution:

$2(x + 3) = 2x + 6$

Solving Equations

Solve the following equations:

1. $2x + 3 = 7$

2. $x - 2 = 5$

3. $4y = 28$

4. $x/2 + 2 = 6$

Word Problems

Tom has £15 more than his sister. If his sister has £x, how much money does Tom have in total?

Solution:

Tom has £x + 15

A book costs £5 more than a pencil. If the pencil costs £x, how much does the book cost?

Solution:

The book costs £x + 5

Mixed Questions

Simplify the following expressions:

1. 2x + 3 + 2x - 1

2. 3y - 2 + 2y + 1

3. x + 1 - 2(x - 3)

Solve the following equations:

1. x + 2 = 9

2. 2x - 1 = 11

3. x/3 + 2 = 5

Extension Activities

Choose any combination:

1. Create and simplify your own algebraic expression using variables, constants, and basic operations

2. Solve the equation $2x + 5 = 3x - 2$ for the variable x

3. Create a word problem that involves algebraic operations and solve it

Algebraic Vocabulary

Algebraic Vocabulary:

- Variable: a symbol that represents a value that can change
- Constant: a symbol that represents a value that does not change
- Coefficient: a number that is multiplied by a variable
- Term: a part of an algebraic expression that is separated by a plus or minus sign

Common Algebraic Mistakes

Common Algebraic Mistakes:

- Forgetting to distribute: $2(x + 3) = 2x + 6$
- Not combining like terms: $2x + 3x = 5x$
- Not checking answers: $x + 2 = 9$, $x = 7$

Algebraic Games and Activities

Algebraic Bingo:

Create bingo cards with algebraic expressions and have students play a game of bingo

Algebraic Scavenger Hunt:

Create a scavenger hunt with algebraic expressions and have students find and simplify them

Graphing Linear Equations

Graphing Linear Equations:

A linear equation can be graphed on a coordinate plane using the slope-intercept form, $y = mx + b$, where m is the slope and b is the y-intercept.

Example:

Graph the equation $y = 2x + 1$

Solution:

First, plot the y-intercept (0, 1). Then, use the slope to find another point on the line. For every x unit, the line goes up 2 units.

Systems of Equations

Solving Systems of Equations:

A system of equations is a set of two or more equations that have the same variables. We can solve systems of equations using substitution or elimination.

Example:

Solve the system of equations:

$2x + 3y = 7$

$x - 2y = -3$

Solution:

We can solve this system using substitution or elimination. Let's use substitution.

Quadratic Equations

Quadratic Equations:

A quadratic equation is an equation in which the highest power of the variable is 2. Quadratic equations can be solved using factoring, the quadratic formula, or graphing.

Example:

Solve the equation $x^2 + 4x + 4 = 0$

Solution:

This equation can be factored as $(x + 2)(x + 2) = 0$. Therefore, $x = -2$.

Functions

Functions:

A function is a relation between a set of inputs (called the domain) and a set of possible outputs (called the range). Functions can be represented as graphs, tables, or equations.

Example:

Find the output of the function $f(x) = 2x + 1$ when the input is 3

Solution:

$f(3) = 2(3) + 1 = 7$

Inequalities

Inequalities:

An inequality is a statement that one expression is greater than, less than, greater than or equal to, or less than or equal to another expression. Inequalities can be solved using addition, subtraction, multiplication, and division.

Example:

Solve the inequality $2x + 3 > 5$

Solution:

Subtract 3 from both sides: $2x > 2$. Divide both sides by 2: $x > 1$.

Rational Expressions

Rational Expressions:

A rational expression is an expression that is the ratio of two polynomials. Rational expressions can be simplified by factoring and canceling common factors.

Example:

Simplify the rational expression (x^2 + 2x + 1) / (x + 1)

Solution:

Factor the numerator: (x + 1)(x + 1) / (x + 1). Cancel common factors: x + 1.

Review and Assessment

Review Questions:

1. Solve the equation $x + 2 = 7$

2. Graph the equation $y = 2x - 1$

3. Solve the system of equations:

   $2x + 3y = 7$

   $x - 2y = -3$

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Well done on completing your homework children!