8-6: Say It With Symbols

Unit Goals, Focus Questions, and Mathematical Reflections

Unit Goals

Equivalence Develop understanding of equivalent expressions and equations

- Model situations with symbolic statements
- Recognize when two or more symbolic statements represent the same context
- Use the properties of real numbers, such as the Distributive Property, to write equivalent expressions
- Determine if different symbolic expressions are mathematically equivalent
- Interpret the information that equivalent expressions represent in a given context
- Determine the equivalent expression or equation that is most helpful in answering a particular question about a relationship
- Use algebraic equations to describe the relationship among the volumes of cylinders, cones and spheres that have the same height and radius
- Solve linear equations involving parentheses
- Determine if a linear equation has a finite number of solutions, an infinite number of solutions, or no solution
- Develop understanding and some fluency with factoring quadratic expressions
- Solve quadratic equations by factoring
- Recognize how and when to use symbols, rather than tables or graphs, to display relationships, generalizations, and proofs

Functions Develop an understanding of specific functions such as linear, exponential and quadratic functions

- Develop proficiency in identifying and representing relationships expressed in problem contexts with appropriate functions and use these relationships to solve the problem
- Analyze equations to determine the patterns of change in the tables and graphs that the equations represent
- Relate parts of a symbolic statement or expression to the underlying properties of the relationship they represent and to the context of the problem
- Determine characteristics of a graph (intercepts, maxima and minima, shape, etc.) of an equation by looking at its symbolic representation

8-6 Say It With Symbols: Focus Questions (FQ) and Mathematical Reflections

Investigation 1 Making Sense of Symbols: Equivalent Expressions	**Investigation 2** Combining Expressions	**Investigation 3** Solving Equations	**Investigation 4** Looking Back at Functions	**Investigation 5** Reasoning with Symbols
Problem 1.1 **Tiling Pools: Writing Equivalent Expressions** FQ: What expression(s) represents the number of border tiles needed to surround a square pool with side length *s*? **Problem 1.2** **Thinking in Different Ways: Determining Equivalence** FQ: How can you determine if two or more expressions are equivalent? **Problem 1.3** **The Community Pool Problem: Interpreting Expressions** FQ: What information goes an expression represent in a given context? **Problem 1.4** **Diving In: Revisiting the Distributive Property** FQ: What information does an expression represent in a given context?	**Problem 2.1** **Walking Together: Adding Expressions** FQ: What are the advantages and disadvantages of using one equation rather than two or more equations to represent a situation? **Problem 2.2** **Predicting Profit: Substituting Expressions** FQ: What are some ways that you can combine one or more expressions (or equations) to create a new expression (or equation)? **Problem 2.3** **Making Candles: Volumes of Cylinders, Cones, and Spheres** FQ: What equations represent the relationships among the volumes of cylinders, cones, and spheres? **Problem 2.4** **Selling Ice Cream: Solving Volume Problems** FQ: What formulas are useful in solving problems involving volumes of cylinders, cones, and spheres?	**Problem 3.1** **Selling Greeting Cards: Solving Linear Equations** FQ: What strategies can you use to solve equations that contain parentheses? **Problem 3.2** **Comparing Costs: Solving More Linear Equations** FQ: What are strategies for finding a solution that is common to two-variable linear equations? **Problem 3.3** **Factoring Quadratic Equations** FQ: What are some strategies for factoring a quadratic expression? **Problem 3.4** **Solving Quadratic Equations** FQ: What are some strategies for solving quadratic equations?	**Problem 4.1** **Pumping Water: Looking at Patterns of Change** FQ: How can you use an equation to answer particular questions about a function and the situation it represents? **Problem 4.2** **Area and Profit – What's the Connection? Using Equations** FQ: How can two different contexts be represented by the same equation? **Problem 4.3** **Generating Patterns: Linear, Exponential, Quadratic** FQ: How can you determine the patterns of change of a function from a table of data for the function? **Problem 4.4** **What's the Function? Modeling With Functions** FQ: How can you determine which function to use to solve or represent a problem?	**Problem 5.1** **Using Algebra to Solve a Puzzle** FQ: How can you determine to use to solve or represent a problem? **Problem 5.2** **Odd and Even Revisited** FQ: How can you use algebra to represent and prove a conjecture about numbers? **Problem 5.3** **Squaring Odd Numbers** FQ: What are some strategies for making and proving a conjecture?
Mathematical Reflections 1. What does it mean to say that two expressions are equivalent? 2. Explain how you can use the Distributive Property to write equivalent expressions. 3. Explain how you can use the Distributive and Commutative properties to show that two or more expressions are equivalent.	**Mathematical Reflections** 1. Describe a situation in which it is helpful to add expressions to form a new expression. Explain how you can combine the expressions. 2. Describe a situation in which it is helpful to substitute an equivalent expression for a quantity in an equation. 3. What are the advantages and disadvantages of working with one equation rather than two or more equations in a given situation? 4. Write an expression that represents the volume of each three-dimensional figure. Explain your reasoning. 4a. cylinder 4b. cone 4c. sphere	**Mathematical Reflections** 1a. Describe some general strategies for solving linear equations, including those with parentheses. Give examples that illustrate your strategies. 1b. Describe how you can tell if a linear equation has a finite number of solutions, an infinite number of solutions, or no solutions. 2. Describe some strategies for solving quadratic equations of the form $ax^2 + bx + c = 0$. Give examples. 3. How are the solutions of linear and quadratic equations related to graphs of the equations?	**Mathematical Reflections** 1. Describe how you can tell whether an equation is a linear, an exponential, or a quadratic function. 2. Describe how you can determine specific features of the graph of a function from its equation. Include its shape, *x*- and *y*-intercepts, maximum and minimum points, and patterns of change. 3. Describe how you can recognize which function to use to solve an applied problem.	**Mathematical Reflections** 1. Describe how and why you could use symbolic statements to represent relationships and conjectures. 2. Describe how you can show that your conjectures are correct.