A Curriculum Project on Expressions and Equations in Mathematics 7 Aligned to the New York State Common Core and Learning Standards

Rebecca K. Logan

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A Curriculum Project on Expressions and Equations in Mathematics 7 Aligned to the New York State Common Core and Learning Standards

Rebecca K. Logan

A thesis project submitted to the Department of Education and Human Development of the State University of New York College at Brockport In partial fulfillment of the requirements for the degree of Master of Education – Adolescent Mathematics
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Chapter 1

Introduction

National Concerns in Education

The concern for mathematics education dates back to the 1980s; numerous documents expressed the concern that students in the United States were performing poorly. As the world became more technological, poor mathematics performance was alarming – a problem that needed to be addressed (Ellis and Berry, 2005). This concern in the nation’s education was confirmed, as stated by Alberti (2013), in the article “Making the Shifts”: “The Trends in International Math and Science Study (TIMSS) and other international studies have concluded that mathematics education in the United States is ‘a mile wide and an inch deep’” (p. 26). The current president of the United States, Barack Obama, has continued a reform in education, and has stated his strong commitment to academic standards as part of his educational reform agenda (Mathis, 2010). In the article, “The “Common Core” Standards Initiative: An Effective Reform Tool”, Mathis (2010) shares the White House Statement given by President Barack Obama on February 22, 2010:

Because economic progress and educational achievement go hand in hand, educating every American student to graduate prepared for college and success in a new work force is a national imperative. Meeting this challenge requires that state standards reflect a level of teaching and learning needed for students to graduate ready for success in college and careers. (p. 1).

The national government has held states accountable for making this educational change through adopting college and career ready standards in reading and mathematics (Mathis, 2010). Mathis (2010) stated: “The Obama administration called for federal Title I aid to be withheld from
states that do not adopt these or comparable standards” (p. 26). In addition to qualifying for Title I funding, developing and adopting a common set of standards is included in the rubric that the U.S. Department of Education (USDE) uses to grant awards in the Race to the Top competition (Porter, McMaken, Hwang & Yang, 2011).

**Pre-Algebra Studies**

As our nation is in a time of educational reform, a curriculum project on Expressions and Equations in the Mathematics 7 curriculum is appropriate. Algebra is considered by many to be a “gatekeeper” in school mathematics, critical to further study in mathematics as well as to future educational and employment opportunities (Ladson-Billings, 1998; National Research Council, 1998). The Expressions and Equations study in 7th grade mathematics is an introduction to a path that leads students to high school algebra. On page 11, McCallum (2012) illustrates the mandate to write standards that prepare students for college and career readiness through the flow chart in seen in Table 1.

**Table 1: Algebra Flow Chart**

![Diagram](image-url)
The need for students to successfully complete algebra has become increasingly apparent over the last decade (Witzel, Mercer & Miller, 2003). In the article, “Middle School Mathematics Teachers’ Knowledge of Students’ Understanding of Core Algebraic Concepts: Equal sign and Variable”, by Asquith, Stephens, Knuth, Alibali (2007) it is stated that:

By viewing algebra as a strand in the curriculum form pre-kindergarten on, teachers can help students build a solid foundation of understanding and experience as a preparation for more sophisticated work in algebra in the middle grades and high school”(Nation Council of Teachers of Mathematics [NCTM], 2000, p. 37).
Chapter 2
Survey of Literature

History of Mathematics Education in the United States

Change in mathematics education in the United States has taken place throughout the last century. In the article, “The Paradigm Shift in Mathematics Education: Explanations and Implications of Reforming Conceptions of Teaching and Learning”, Ellis and Better (2005) refer to the nation’s mathematics education as “a revolving door for revisions” that have “failed to change significantly the face of the mathematically successful student” (p. 8). Historically speaking, the federal government and its role in education has been limited. Each of the 50 States have been responsible for their individual educational standards (Mathis, 2010). Beginning in 1989, the National Council of Teachers of Mathematics (NCTM) realized that a varied curriculum among the nation’s 13,500 school districts needed to be moved towards a common understanding of what students should be learning in a mathematics classroom. In response to a lack of vision on how to educate today’s children, a set of standards were developed by the NCTM (McCallum, 2012). McCallum (2012) states that: “The NCTM standards were not themselves an act of government, but in response to them the governments of the 50 states started developing their own standards, bringing a measure of consistency to the mathematics curriculum within the states” (p. 1).

Development of the Common Core

Mathis (2010) shares that according to the Obama administration, common standards are necessary for the national economic competitiveness in a global economy and that expectations for our nation’s students must be raised in order to compete with other nations. This view was supported by Joan Richardson, editor of Phi Delta Kappan with the statement: “Standards are an
essential step toward ensuring equity and high-quality learning for all children everywhere” (p. 2). In the article, “Common Core Standards: The New U.S. Intended Curriculum”, Porter, McMaken, Hwang, and Yang (2011) share the history of the Common Core Standards:

Led jointly by the National Governors Association (NGA) Center for Best Practices and the Council of Chief State School Officers (CCSSO), The Common Core State Standards Initiative developed these standards as a state-led effort to establish consensus on expectations for student knowledge and skills that should be developed in Grades K-12 (p. 103)

This process of developing the Common Core Standards included representatives from 41 states along with the NGA and CCSSO beginning in April 2009. A little over a year later, the final recommendations for the Common Core Standards was released in June 2010 (Mathis, 2010). In the article: “The U.S. Common Core State Standards in Mathematics”, McCallum (2012) shares: “A recent analysis has shown that the standards are closely aligned with the standards of the A+ countries, a group of countries that formed a statistically significant group of top achievers on TIMSS 1995, and that state achievement in mathematics on the National Assessment of Education Progress is correlated with the closeness of previous state standards to the Common Core” (p. 2). These common standards are an answer to meet a challenge of a curriculum that is “a mile wide and an inch deep” (Porter, McMaken, Hwang & Yang, 2011).

A Shift in Mathematics Education

Current practice in mathematics education has been challenged by the Common Core State Standards. Porter, McMaken, Hwang and Yang (2011) state: “For mathematics, the Common Core standards represent a modest shift toward high levels of cognitive demand than are currently represented in state standards” (p. 106). There are three core shifts that are seen in
the new standards: greater focus on fewer topics, topics and thinking linked across grade levels, and rigorous pursuit of conceptual understanding, procedural skill, and application (Alberti, 2013). McCallum (2012) describes the format of the Common Core Standards:

The Standards are divided into Standards for Mathematical Content and Standards for Mathematical Practice. The content standards are further subdivided into K-8 standards and high school standards. The K-8 standards are specified by grade level and organized into domains, topics which follow a coherent progression over a certain grade span (p. 6).

When developing the Common Core Standards, one of the principles used in their design was focus. With a focus to each standard, teachers and students can spend more time on a topic, allowing for greater understanding. Another principle used is coherence – the idea that the structure of mathematics has natural pathways based on student development. The third principle used in the creation of the Common Core Standards is rigor. In this case, the word rigor means that there is a balance of student understanding, fluency, and mathematics is applied in meaningful situations (McCallum, 2012).

This Curriculum Project, a study of Expressions and Equations found in seventh grade mathematics, addresses the following New York State Standards from the Expressions and Equations Domain. The New York State Math Curriculum can be accessed through the Engage NY Website.

- 7.EE.1: Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- 7.EE.2: Understand that rewriting an expression in different forms in a problem context can shed light on the problem on how the quantities in it are related.
• 7.EE.3: Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

• 7.EE.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

A Modeling and ‘Hands-On’ Approach

As educators adopt the Common Core State Standards, new tools, ideas, and materials offer a choice in resources. Alberti (2003) suggests that:

In a time when the market is offering an enormous range of materials, educators need a secure understanding of the standards so that we can choose our resources wisely. As we put the standards into practice, it is important to focus on a few shifts that have the most significant effect on students (p. 24-25).

One technique to help students deepen their understanding of mathematics while learning about Equations in middle school is a ‘Hands-On’ approach. Raymond and Leinenbach (2000) investigate the outcomes of implementing a ‘Hands-On Equations’ approach to teaching algebra, seeking to answer three questions:

(a) How does the use of these mathematics manipulatives in an algebra class affect students’ confidence and interest in solving algebraic problems? (b) How does the use of these mathematics manipulatives in an algebra class affect students’ ability to correctly
solve algebraic equations and (c) Will the students’ retention of algebraic skills learning via manipulatives last beyond the eighth-grade experience? (p. 284)

This study concluded that when students are able to touch and manipulate mathematics, they learn best (Raymond & Leinenbach, 2000). In the article, “A Modeling Perspective on the Teaching and Learning of Mathematical Problem Solving”, Mousoulides, Cristou, and Sriraman (2008) state that: “modeling needs to be introduced early in the curriculum, particularly if we want to successfully implement modeling at all school levels” (p. 294). The authors indicate that not only is it important for students to know how to solve the problem, but also to explain and reason their solution. Communicating helped students to explain the solution of the problem, predict the behavior of similar problems, and to elaborate on and enrich their solution for more complex problems (Mousoulides, Cristou & Sriraman, 2008).

This Curriculum Project includes student learning objectives that demonstrate understanding of solving equations. The success of teaching equations with a ‘hands-on’ approach and modeling equations demonstrated in the studies mentioned earlier has helped to shape the lessons seen in this Curriculum Project.
Chapter 3

Curriculum Design

This Curriculum Project was created for mathematics students in seventh grade. The unit is intended for instruction towards the beginning of the school year, after students have studied and mastered the standards under The Number System domain as students will need an understanding of operations with rational numbers in order to be successful. As seen in Table 2, a Unit Overview is provided as well as a Unit Timeline for teachers to better manage their time. This suggested 9-day timeline is based on a class period of 45 minutes, and requires students to complete homework following each lesson in order to practice the new material. If a longer class time is available, the teacher can monitor and adjust the lesson to fit the needs of their students taking the amount of class time into consideration. For example, the teacher may want to use a homework assignment as an assignment to be done in class. This curriculum design was created to align to the necessary New York State Common Core Standards.

A table of contents is provided for easy access to each lesson plan, worksheets, and assessments needed for the 9-day unit. All the answer keys necessary are provided in Appendix B. In addition to the necessary worksheets and activities, each lesson plan includes the goal for the lesson, the instructional outcomes, and the New York State Common Core learning standards that are addressed. Table 3 gives an overview of the unit’s daily objectives.
### UNIT PLAN: EXPRESSIONS AND EQUATIONS

<table>
<thead>
<tr>
<th>UNIT OVERVIEW</th>
</tr>
</thead>
</table>
| **Subject Area**  
Seventh Grade Mathematics |
| **Approximate Time Needed**  
9 Days  
(Based on 45 minute Class Periods) |
| **New York State Standards Addressed** |
| •  **7.EE.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. |
| •  **7.EE.2** Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. |
| •  **7.EE.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. |
| •  **7.EE.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. |

<table>
<thead>
<tr>
<th>UNIT TIMELINE</th>
</tr>
</thead>
</table>
| **Day 1**  
Writing and Solving Expressions |
| **Day 2**  
Solving 1 Step Equations by Modeling |
| **Day 3**  
Solving 1 Step Equations by using the Inverse  
Solving Real World Scenarios with Equations  
Solving 2 Step Equations by Modeling  
Solving 2 Step Equations by using the Inverse |
| **Day 4**  
Review Activity: Equations Stations  
Assessment: Expressions and Equations Test  
(Start next Module) |

---

**Table 2: Unit Plan**

<table>
<thead>
<tr>
<th><strong>UNIT OVERVIEW</strong></th>
</tr>
</thead>
</table>
| **Subject Area**  
Seventh Grade Mathematics |
| **Approximate Time Needed**  
9 Days  
(Based on 45 minute Class Periods) |
| **New York State Standards Addressed** |
| •  **7.EE.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. |
| •  **7.EE.2** Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. |
| •  **7.EE.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. |
| •  **7.EE.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. |

<table>
<thead>
<tr>
<th><strong>UNIT TIMELINE</strong></th>
</tr>
</thead>
</table>
| **Day 1**  
Writing and Solving Expressions |
| **Day 2**  
Solving 1 Step Equations by Modeling |
| **Day 3**  
Solving 1 Step Equations by using the Inverse  
Solving Real World Scenarios with Equations  
Solving 2 Step Equations by Modeling  
Solving 2 Step Equations by using the Inverse |
| **Day 4**  
Review Activity: Equations Stations  
Assessment: Expressions and Equations Test  
(Start next Module) |
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Day 3: Solving 1 Step Equations by using the Inverse ....................................................................................33

Day 4: Solving Real World Scenarios with Equations ......................................................................................39

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<table>
<thead>
<tr>
<th>Day</th>
<th>Day 1: Writing and Solving Expressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Write and Evaluate Expressions</td>
</tr>
</tbody>
</table>
| Instructional Outcomes | 1. Given words, students will translate into a mathematical expression.  
2. Given an algebraic expression, students will evaluate based on provided variables. |
| NYS Learning Standards | 7.EE.1  
7.EE.2 |

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 2: Solving One Step Equations by Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Model and Solve One Step Equations</td>
</tr>
</tbody>
</table>
| Instructional Outcomes | 1. Students will model one step equations.  
2. Students will solve one step equations using what they know about the additive inverse property. |
| NYS Learning Standards | 7.EE.1  
7.EE.2 |

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 3: Solving Equations by Using the Inverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Solve Equations by using the Inverse</td>
</tr>
<tr>
<td>Instructional Outcomes</td>
<td>1. Students will solve one step equations by using inverse operations.</td>
</tr>
</tbody>
</table>
| NYS Learning Standards | 7.EE.1  
7.EE.2 |

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 4: Solving Real World Scenarios with Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Represent real world situations with tape diagrams to solve for an unknown</td>
</tr>
</tbody>
</table>
| Instructional Outcomes | 1. Students will model provided scenarios with a Tape Diagram.  
2. Students will use algebra to find the value of an unknown. |
| NYS Learning Standards | 7.NS.A.3 (students will need prior knowledge from the previous unit)  
7.EE.B.4a |

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 5: Solving Two Step Equations by Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Find the variable in two-step equations.</td>
</tr>
</tbody>
</table>
| Instructional Outcomes | 1. Students will use algebra tiles to represent equations.  
2. Given an algebraic equation containing addition or subtraction, and multiplication or division, students will be able to solve for the variable. |
| NYS Learning Standards | 7.EE.1  
7.EE.4 |
<table>
<thead>
<tr>
<th>Day</th>
<th>Day 6: Solving Equations with the Distributive Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Solve for the variable by using the Distributive Property</td>
</tr>
</tbody>
</table>
| Instructional Outcomes | 1. Students will use algebra tiles to model the distributive property.  
2. Students will solve equations by first using the distributive property. |
| NYS Learning Standards | 7.NS.A.3 (students will need prior knowledge from the previous unit)  
7.EE.B.4a |

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 7: Solving Equations with Variables on Both Sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Solve an equation with a variable on each side of the equal sign.</td>
</tr>
<tr>
<td>Instructional Outcomes</td>
<td>1. Students will solve an equation with a variable on both sides of the equal sign.</td>
</tr>
</tbody>
</table>
| NYS Learning Standards | 7.NS.A.3 (students will need prior knowledge from the previous unit)  
7.EE.B.4a |

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 8: Equations Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Review solving equations.</td>
</tr>
<tr>
<td>Instructional Outcomes</td>
<td>1. Students will review solving equations through a station activity.</td>
</tr>
<tr>
<td>NYS Learning Standards</td>
<td>Through this review activity, all the standards from this unit will be addressed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 9: Assessment: Expressions and Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Show me what you know about Expressions and Equations</td>
</tr>
<tr>
<td>Instructional Outcomes</td>
<td>1. Students will complete the Unit Assessment.</td>
</tr>
<tr>
<td>NYS Learning Standards</td>
<td>This assessment is aligned to all the unit standards.</td>
</tr>
</tbody>
</table>
Day 1
Expressions and Equations: Writing and Solving Expressions

**NYS Learning Standards:**

- 7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- 7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.

**Objective(s)/Goal(s):**

**Today’s Goal:** (Communicated to students on the front board)

Write and Evaluate Expressions

**Instructional Outcomes:**

1. Given words, students will translate into a mathematical expression.
2. Given an algebraic expression, students will evaluate based on provided variables

I plan to meet these instructional outcomes using a variety of learning strategies throughout the lesson. I will use guided practice, practice with partners, and individual practice. Student learning will be assessed in a variety of ways as well. I will know if my instructional outcomes are met by observing my students throughout the lesson, and collecting their homework the following day.

**Materials:**

- Smart Board
- Worksheets (see attached)
- Scientific Calculators
Anticipatory Set:

- Warm-Up (on Smart Board)
  - Write Homework in Planner
  - Have out Homework to Collect

Procedure:

1. Warm Up:

   Students will work on the warm-up activity before class begins.

2. Notes:

   Each student is given a copy of the skeleton notes that they are expected to follow along as the teacher works on the Smart Board.

3. Partner Practice: Writing and Evaluating Expressions

   Partners will be decided with their Clock Buddies Worksheet.

4. Exit Ticket: (leave five minutes at the end of class for this) – Students will complete the exit ticket on the Smart Board before leaving class. This will be a way to see if students met the goal for the day.

5. Homework: Evaluating Expressions with Exponents

   This independent practice will be an opportunity for students to practice what they learned today.
**Algebraic Expressions and Exponents**

Why learn this?
You can use algebraic expressions to help you make predictions based on patterns. If you know how far you can swim in one minute, you can estimate how far you can swim in 5 minutes.

**Variable:** a _______________ that represents a number.

Ex:

**Expression:** A mathematical phrase.

Ex:

Place each key word in the bank with the correct operation.

<table>
<thead>
<tr>
<th>Addition (+)</th>
<th>Subtraction (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiplication (*)</th>
<th>Division (÷)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Writing Algebraic Expressions

You will need to be able to translate words into math! Pick a variable that will represent “a number”.

<table>
<thead>
<tr>
<th>Word Phrase</th>
<th>Algebraic Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 more than a number</td>
<td></td>
</tr>
<tr>
<td>5 less than a number</td>
<td></td>
</tr>
<tr>
<td>The product of a number and 5</td>
<td></td>
</tr>
<tr>
<td>A number divided by 5</td>
<td></td>
</tr>
</tbody>
</table>

You try! Translate the following word phrases into an algebraic expression.

1. A temperature(t) decreased by seven
2. Ten times a number(n)
3. Sixteen more than five times a number(n)
4. One more than the quotient of x and four

Solving with Exponents

Exponent:

When a number is represented in the form $x^y$

**The exponent tells you the number of times the base is multiplied by _______________.**

Simplify by first writing each exponent in expanded form:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $5^2$ =</td>
<td>2. $3^4$ =</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. $1^8$ =</td>
<td>4. $2^5$ =</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


In your scientific calculator, there is a button that is used for exponents. When we have an exponent that is very large, instead of multiplying the base by itself over and over, you can use the exponent button. This button looks like an upside down “V” and we call this exponent button the “carrot”.

**Using your Calculator to Solve:**

\[
4^{11} = \\
\begin{array}{c}

4 \\
\wedge \\
1 \\
1 \\
= \\
4^{11} = \\
\end{array}
\]

If the base is negative, it is important to put parenthesis around your base and use the negative button (not the subtraction button).

\[
(-4)^{11} = \\
\begin{array}{c}

( \\
( \\
\wedge \\
1 \\
1 \\
= \\
(-4)^{11} = \\
\end{array}
\]

Solve the following by using your calculator.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>(10)^5</td>
<td>2.</td>
</tr>
<tr>
<td>4.</td>
<td>(-1)^4</td>
<td>5.</td>
</tr>
</tbody>
</table>
WRITING EXPRESSIONS

Directions: Write each phrase as an algebraic expression.

1. A number (n) increased by five.

2. Four more than a number (x).

3. The product of a number (y) and ten.

4. Write an algebraic expression that represents the product of a number (x) and five, decreased by fifteen.

   Then, evaluate the expression when x = (-2)

   Answer: _____________________

5. Write an algebraic expression that represents the product of a number (x) and ten, increased by negative twenty.

   Then, evaluate the expression when x = (5)

   Answer: _____________________
## Evaluating Expressions

**Directions:** Evaluate each expression when $x = 2$, $y = -3$, and $z = 0$. Show all of your mathematical thinking.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>$(z + y) \times x$</td>
</tr>
<tr>
<td>8.</td>
<td>$xyz$</td>
</tr>
</tbody>
</table>
**Using Exponents to Solve**

When solving with exponents, remember the order of operations!! What is the order of operations?

**Directions:** Simply the following by using the order of operations.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $2^2 + 4^2 =$</td>
<td>2. $(-4)^3 - 5^2 =$</td>
</tr>
<tr>
<td>3. $4^2 + 1^3 - (-5)^3 =$</td>
<td>4. $(2^2)(1^3) =$</td>
</tr>
<tr>
<td>5. $\frac{(-4)^3}{-8} =$</td>
<td>6. $\frac{7^2 + 5}{9} =$</td>
</tr>
<tr>
<td>7. $3(2^2) =$</td>
<td>8. $2(4 - 2^1) =$</td>
</tr>
</tbody>
</table>
**Directions:** Evaluate each expression if \( m = 2, n = 6, \) and \( p = -4. \)

<table>
<thead>
<tr>
<th>Expression</th>
<th>Calculation/Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. ( 6p^3 )</td>
<td>( 6 (-4)^3 ) Sub in for the variable ( 6 (-64) ) Exponents First! -384 Multiply using your rules for integers</td>
</tr>
<tr>
<td>10. ( n^2 + 5 )</td>
<td></td>
</tr>
<tr>
<td>11. ( 3m + 4p )</td>
<td></td>
</tr>
<tr>
<td>12. ( 2m^2 )</td>
<td></td>
</tr>
<tr>
<td>13. ( 4n^2 )</td>
<td></td>
</tr>
<tr>
<td>14. ( 2p^3 )</td>
<td></td>
</tr>
</tbody>
</table>

15. The expression \( 4g + 5 \) can be used to find the total cost in dollars of bowling where \( g \) is the number of games bowled and 5 represents the cost of renting shoes.

a. How much will it cost Charlie to bowl 2 games?

b. How much will it cost Charlie to bowl 4 games?

c. How would the expression change if a shoe rental was $4 instead of $5?
Day 2
Expressions and Equations: Solving 1 Step Equations by Modeling

NYS Learning Standards:

- 7.EE 1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- 7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.

Objective(s)/Goal(s):

Today’s Goal: (Communicated to students on the front board)
Model and Solve One Step Equations

Instructional Outcomes:

1. Students will Model 1 Step Equations.
2. Students will Solve 1 Step Equations using what they know about the Additive Inverse Property

I plan to meet these instructional outcomes using a variety of learning strategies throughout the lesson. I will use guided practice, practice with partners, and individual practice. Student learning will be assessed in a variety of ways as well. I will know if my instructional outcomes are met by observing my students throughout the lesson, and collecting their homework the following day.
**Materials:**

- Smart Board
- Worksheets (see attached)

**Anticipatory Set:**

- Warm-Up (on Smart Board)
  - Write Homework in Planner
  - Have out Homework to Review

**Procedure:**

1. **Warm Up**:
   
   Students will work on the warm-up activity before class begins. We will then review their homework from the previous lesson.

2. **Notes: Modeling One Step Equations**
   
   Each student is given a copy of the skeleton notes that they are expected to follow along as the teacher works on the Smart Board.

3. **Partner Practice: Solving Equations by using the Inverse**
   
   Students will be permitted to pick their partners. The idea of using inverse operations to solve will be introduced. Students will be expected to finish this practice for homework.
4. **Exit Ticket**: (leave five minutes at the end of class for this) – Students will complete the exit ticket on the Smart Board before leaving class. This will be a way to see if students met the goal for the day.
**Modeling One Step Equations**

You can think of an equation as a balance scale. When you do something to one side of the equation, you must do the same thing to the other side of the equation to keep it balanced.

\[ 3 + x = 5 \]

**Modeling Equations:**

**Directions:** Model each equation using the terms given.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (4 + x = 5)</td>
<td>(x), (+1), (-1)</td>
</tr>
<tr>
<td>2. (x - 2 = 8)</td>
<td>(x), (-2), (+8)</td>
</tr>
<tr>
<td>3. (x + 5 = -6)</td>
<td>(x), (+5), (-6)</td>
</tr>
<tr>
<td>4. (-7 + x = -1)</td>
<td>(-7), (x), (+1)</td>
</tr>
</tbody>
</table>
Solving Equations:

To solve Equations, we will need to keep the scale balanced using Inverse operations.

**Inverse Operations**: operations that ________________ each other

ADDITION and __________________________ are Inverse Operations
MULTIPLICATION and _________________ are Inverse Operations

**Key Ideas:**

- The goal is to get the ______________ by itself (Use Inverse Operations)
- What you do one side, you must do to the __________ side (Balance)

5. \( x + 4 = 7 \)

Model the Equation
Make zero pairs
Isolate the x tiles
Find the value of x

Check your solution.

6. \(-3 + x = -5\)

Model the Equation
Make zero pairs
Isolate the x tiles
Find the value of x

Check your solution.
7. $x + (-2) = 10$

<table>
<thead>
<tr>
<th>Model the Equation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Make zero pairs</td>
<td></td>
</tr>
<tr>
<td>Isolate the x tiles</td>
<td></td>
</tr>
<tr>
<td>Find the value of $x$</td>
<td></td>
</tr>
</tbody>
</table>

Check your solution.

8. $x - 1 = 3$

<table>
<thead>
<tr>
<th>Model the Equation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Make zero pairs</td>
<td></td>
</tr>
<tr>
<td>Isolate the x tiles</td>
<td></td>
</tr>
<tr>
<td>Find the value of $x$</td>
<td></td>
</tr>
</tbody>
</table>

Check your solution.

9. $x + 10 = 0$

<table>
<thead>
<tr>
<th>Model the Equation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Make zero pairs</td>
<td></td>
</tr>
<tr>
<td>Isolate the x tiles</td>
<td></td>
</tr>
<tr>
<td>Find the value of $x$</td>
<td></td>
</tr>
</tbody>
</table>

Check your solution.
Solving Equations by Inverse Operations

You can model equations with pictures in order to see patterns. When you solve an equation, you are getting the variable by itself by doing the opposite to both sides.

Example:

\[ x + 2 = 5 \]

**Model the Equation**

<table>
<thead>
<tr>
<th>Make zero pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolate the x tiles</td>
</tr>
<tr>
<td>Find the value of x</td>
</tr>
</tbody>
</table>

*2 was being added to x, so you had to subtract 2 from both sides*

To solve Equations, we will need to keep the scale balanced using Inverse operations.

*Inverse Operations*: operations that ___________ each other

ADDITION and __________________________ are Inverse Operations

MULTIPLICATION and _________________ are Inverse Operations

Example

**Directions**: Solve the following equations. Check your answers!

1. \( x - 34 = -46 \)  
   \( \leftarrow \) Our goal is to get \( x \) by itself
   \( \leftarrow \) Undo subtraction with the inverse (addition)
   *Remember* What you do to one side, you MUST do to the other side!

**Check**: \( x - 34 = -46 \)  
(Start with your original problem)
**Directions:** Solve the following equations. Show all your work. Check your answer.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Solution</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. (x - 10 = 20)</td>
<td>(x = 30)</td>
<td>(x - 10 = 20) (30 - 10 = 20) (20 = 20) ✓</td>
</tr>
<tr>
<td>3. (n - 35 = 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. (z - 100 = 110)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. (x + 10 = 20)</td>
<td>(x = 10)</td>
<td>(x + 10 = 20) ((10) + 10 = 20) (20 = 20) ✓</td>
</tr>
<tr>
<td>6. (a + 57 = -10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. (r + 1 = 32)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now, undo addition with the inverse (subtraction)!
Day 3
Expressions and Equations: Solving Equations by using the Inverse

**NYS Learning Standards:**

- 7.EE 1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- 7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.

**Objective(s)/Goal(s):**

Today’s Goal: (Communicated to students on the front board)

Solve Equations by Using the Inverse

Instructional Outcomes:

1. Students will solve one step equations using inverse operations.

I plan to meet these instructional outcomes using a variety of learning strategies throughout the lesson. Students will be working with partners to sharpen their skills. Student learning will be assessed in a variety of ways as well. I will know if my instructional outcomes are met by observing my students throughout the class period, and checking their homework the following day.

**Materials:**

- Smart Board
- Worksheets (see attached)
**Anticipatory Set:**

- Warm-Up (on Smart Board)
  - Write Homework in Planner
  - Have out Homework to Collect

**Procedure:**

1. **Warm Up**:
   
   Students will work on the warm-up activity before class begins.

2. **Partner Practice**: Solving One Step Equations
   
   Partners will be decided based on picking 2 class sticks at a time.

3. **Homework**: Solving One Step Equations Extra Practice
   
   This independent practice will be an opportunity for students to practice what they learned today.
**Directions:** Solve each equation. Check your work!

<table>
<thead>
<tr>
<th></th>
<th>Equation</th>
<th>CHECK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>( n - 30 = 100 )</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>( x + 34 = 7 )</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>( y - 7 = 3 )</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>( c + 100 = 250 )</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>( x - 45 = 10 )</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>( y + 5 = -6 )</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>( n - 13 = -10 )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equation</td>
<td>CHECK:</td>
</tr>
<tr>
<td>---</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>8.</td>
<td>$x + 10 = -2$</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>$y - 20 = -10$</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>$z + 34 = 34$</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>$r - 100 = 200$</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>$s + 42 = 21$</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>$t - 10 = -60$</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>$z + 80 = 3$</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>$m - 21 = 70$</td>
<td></td>
</tr>
</tbody>
</table>
### Directions:
Solve each equation. Show all your work. Check your answer.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$x - 6 = -55$</td>
<td>Check:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>$n - 255 = -455$</td>
<td>Check:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>$t - 32.8 = -27$</td>
<td>Check:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>$h - 37 = -42$</td>
<td>Check:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>$q - 16 = 40$</td>
<td>Check:</td>
</tr>
<tr>
<td></td>
<td>Equation</td>
<td>Check:</td>
</tr>
<tr>
<td>---</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>6.</td>
<td>$k + 17 = 29$</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>$d + 261.9 = -48$</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>$x + 34 = 212$</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>$253 + c = 725$</td>
<td></td>
</tr>
</tbody>
</table>

10. A student solved the equation. Determine if it is correct or incorrect. Give a reason why!

\[
\begin{align*}
x + 2 &= -12 \\
+2 &= +2 \\
x &= -10
\end{align*}
\]
Day 4
Expressions and Equations: Solving Real World Scenarios with Equations

**NYS Learning Standards:**

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers.
7.EE.B.4a Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about quantities.
   a. Solve world problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers.

**Objective(s)/Goal(s):**

Today’s Goal: (Communicated to students on front board)
Represent Real World situations with tape diagrams to solve for an unknown.

**Instructional Outcomes:**
1. Students will model provided scenarios with a Tape Diagram
2. Students will use algebra to find the value of an unknown value.

I plan to meet these instructional outcomes using a variety of learning strategies throughout the lesson. I will use group work and individual practice. Student learning will be assessed in a variety of ways. I will know if my Instructional Outcomes are met by observing my students throughout the lesson as well as a “ticket out the door” activity.

**Materials:**
- Smartboard
- Worksheets (see attached)

**Anticipatory Set:**
Warm-Up (written on front board)
- Write HW in your Agenda
- Have out last night’s HW
- Complete Worksheet
**Procedure:**

1. **Warm-Up:**
   Students will work on the warm-up activities as they enter the room. All students will be given a few minutes to work on the worksheet “Sarah’s Coins.” If their name is picked from the sticks, they have an opportunity to answer the question. Correct answers result in candy.

2. **Class Work: The Smith Family Vacation**
   Students will be presented with the Real World example of determining expenses from a family vacation. We will try two scenarios together to find a missing value using a Tape Diagram and then representing the situation with an algebraic equation.

3. **Group Work**
   Students will be placed in groups of 2 or 3 to model each scenario from the family vacation on a piece of poster paper. Students will be encouraged to work together and do their best work – they will be presenting their poster the following day to the class.

4. **Closure: Exit Ticket**
   This will be a way to see if students met the goal for the day.

5. **Homework:**
   The homework assignment will be an opportunity for students to use their knowledge of Tape Diagrams to model a problem and find a solution for an unknown number.
Warm Up

1. Sarah draws the following picture with a pouch and gold coins.

   ![Picture 1](image1)

   How many gold coins are in the pouch? Explain your reasoning.

2. Sarah draws another picture. Each pouch contains the same number of gold coins.

   ![Picture 2](image2)

   How many gold coins are in each pouch? Explain your reasoning.

3. Look back at the two problems you solved. Is there a way to write an Equation to represent each picture?
Solving Real World Problems with Equations
We can find solutions to word problems by working backwards and using tape diagrams to model the steps we use to arrive at the solution.

Today’s Goal:
Represent Real World Situations with Tape Diagrams to Solve for an unknown

Mr. and Mrs. Smith are looking at the expenses for themselves and their three children, Sam, Sophie, and Sydney from their family vacation to Myrtle Beach last spring. The table below shows the total cost of each expense from the trip:

<table>
<thead>
<tr>
<th>Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental Car &amp; Fees</td>
<td>$500</td>
</tr>
<tr>
<td>Airplane Tickets &amp; Fees</td>
<td>$875</td>
</tr>
<tr>
<td>Hotel &amp; Tax</td>
<td>$400</td>
</tr>
<tr>
<td>Baseball Game &amp; Souvenirs</td>
<td>$105</td>
</tr>
<tr>
<td>Movie Theater</td>
<td>$75</td>
</tr>
<tr>
<td>Pizza Parlor</td>
<td>$37.50</td>
</tr>
<tr>
<td>Sandals &amp; T-Shirts</td>
<td>$120</td>
</tr>
<tr>
<td>Aquarium &amp; Gift Shop</td>
<td>$105</td>
</tr>
<tr>
<td>Beach Day</td>
<td>$70</td>
</tr>
<tr>
<td>Bike Rentals</td>
<td>$180</td>
</tr>
</tbody>
</table>

As groups, we will take a look at each scenario from the Smith Family Vacation to determine the cost for different items purchased on the trip. Use a tape diagram to model the scenario to find the missing information.
**Scenario 1: Baseball Game**
One evening, Mr. Smith, Sam, and Sydney went to see the Myrtle Beach Pelicans’ Game. They each bought a ticket and a hat that cost $10 each. How much was each ticket to enter the ballpark?

**Scenario 2: Rental Car**
While on Vacation, the Smith family rented a car to get them to all the places they wanted to see for five days. The car costs a certain amount each day, plus a one-time insurance fee of $50. How much was the daily cost of the car (not including the insurance fees)?
Scenario 3: Movie Theater
One rainy day on the vacation, the entire Smith family went to watch a movie in the afternoon and then a movie in the evening at the local movie theater. The price for an afternoon movie is different than the price for an evening movie. The tickets for the afternoon movie cost $6.00 each. What was the cost for a ticket for the evening movie?

Scenario 4: Pizza Parlor
For dinner one night, the Smith Family went to the local pizza parlor. The cost of soda was $3. If each member of the family had a soda and one slice of pizza, how much did one slice of pizza cost?

Scenario 5: Shopping
Mrs. Smith and Sophie went shopping at the Beach Hut. They bought a t-shirt for each member of the family and bought two pairs of sandals that cost $10 each. If each t-shirt was the same price, how much was each t-shirt?

Scenario 6: Airfare
The Smith Family took an airplane to get to Myrtle Beach. Each person needed their own plane ticket, and pay $25 in fees per person. What was the cost of one plane ticket without fees?
Scenario 7: Hotel
The family stayed in a Hotel for 4 nights on their trip. The Hotel charged a fee each night, plus $60 for state tax. What is the nightly charge without the tax?

Scenario 8: Ripley’s Aquarium
The Smith family visited Ripley’s Aquarium one afternoon on vacation. The tickets for adults and children are the same price of $12 each. Sam, Sophie, and Sydney were each given an amount of money to spend at the aquarium gift shop. If each child received the same amount of money to spend, how much money did each child get to spend at the gift shop?

Scenario 9: Beach Day
One day, the family spent the day at the beach. They had to pay for parking, and rented a beach chair and umbrella for each person. If the parking fee was $10 for the day, how much was the rental cost for a beach chair and umbrella?

Scenario 10: Bike Rentals
One activity that the Smith’s did on vacation was to rent bikes to ride on the beach. The Bike shop charges a one-time fee of $20 in addition to the cost of each bike. What was the cost of each bike rental without the fee?
Show me that you met today’s goal!

Directions: Model the situation with a Tape Diagram in order to solve for the missing value.

1. Eric’s father works two jobs. He works one job in the morning and one job in the evening. He works a total of 40 hours in 5 days. If his schedule is the same each day, and he works 3 hours each morning, how many hours does Eric’s father work each afternoon?
Directions: For each of the problems below, model the situation with a tape diagram. Then solve for the unknown value.

1. A taxi cab in New York City charges $1 per person, plus $2 for every mile traveled. If a taxi cab ride for 2 people costs $12, how far did the taxi cab travel?

2. Heather works as a waitress at her family’s restaurant. She works 2 hours every morning during the breakfast shift and the same number of hours every evening for the dinner shift. In the last four days she worked 28 hours. How many hours did she work during each dinner shift?

3. Jillian exercises 5 times a week. She runs 3 miles each morning and bikes in the evening. If she exercises a total of 30 miles for the week, how many miles does she bike each evening?

4. Marc eats an egg sandwich for breakfast and a burger for lunch every day. The egg sandwich has 250 calories. If Marc has 5,250 calories for breakfast and lunch for the week in total, how many calories is one burger?
Day 5  
Expressions and Equations: Solving 2 Step Equations by Modeling

**NYS Learning Standards:**

- 7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- 7.EE.4 Use variable to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

**Objective(s)/Goal(s):**

Today's Goal: (Communicated to students through the manipulative and examples)  
Find the variable in two-step equations

**Instructional Outcomes:**

1. Students will use algebra tiles to represent equations.
2. Given an algebraic equation containing addition or subtraction and multiplication or division, students will be able to solve for the variable.

I plan to meet these instructional outcomes using a variety of learning strategies throughout the lesson. I will use guided practice, visual modeling, and individual practice. Student learning will be assessed in a variety of ways as well. I will know if my instructional outcomes are met by observing my students throughout the lesson.
**Materials:**

- Smart Board
- Worksheets (see attached)

**Anticipatory Set:**

- Warm-Up (on Smart Board)
  - Write Homework in Agenda
  - Have out Homework to Collect

**Procedure:**

1. **Warm Up**:
   Students will work on the warm-up activity before class begins. As students complete the warm-up, I will quickly check their homework from the previous day. This will be an informal way for me to see if they are solving one-step equations correctly.

2. **Class Work: Modeling Two Step Equations**
   Students will represent two step equations by using algebra tiles. This guided practice will reinforce the algebraic ideas we discussed in solving one step equations.

3. **Partner Practice**
   Students will choose a partner and practice solving two step equations by modeling. The teacher will walk around the room and address any questions/concerns as they arise.

4. **Homework**:
   The homework assignment will be an opportunity for students to use their knowledge of solving two step equations, without having to model the equation.
Modeling Two Step Equations

Terms

\[ \begin{array}{ccc}
  x & +1 & -1 \\
\end{array} \]

Key Ideas:

- The goal is to get the variable by itself (Use Inverse Operations)
- What you do one side, you must do to the other side (Balance)

1. \[ 2x + 3 = 7 \]

Model the Equation

Make zero pairs

Isolate the \( x \) tiles

Find the value of \( x \)

2. \[ 3x - 4 = 5 \]

Model the Equation

Make zero pairs

Isolate the \( x \) tiles

Find the Value of \( x \)
3. \[2x - 2 = -4\]

Model the Equation
Make zero pairs
Isolate the x tiles
Find the Value of x

4. \[4x + 1 = -7\]

Model the Equation
Make zero pairs
Isolate the x tiles
Find the Value of x

5. \[3x + 2 = 8\]

Model the Equation
Make zero pairs
Isolate the x tiles
Find the Value of x
Modeling Equations Practice

Directions: Solve the following equations by modeling. Show your work!

1. \(2x + 1 = -1\)
   - Model the Equation
   - Make zero pairs
   - Isolate the \(x\) tiles
   - Find the Value of \(x\)

2. \(3x - 2 = 4\)
   - Model the Equation
   - Make zero pairs
   - Isolate the \(x\) tiles
   - Find the Value of \(x\)

3. \(4x + 3 = -5\)
   - Model the Equation
   - Make zero pairs
   - Isolate the \(x\) tiles
   - Find the Value of \(x\)

4. On the back, check your work for #1, 2, and 3.
Check for #1:

Check for #2:

Check for #3:
## Two Step Equations Practice

**Directions:** Solve each equation. Check your answer.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $8r - 8 = -32$</td>
<td></td>
</tr>
<tr>
<td>2. $3w - 6 = 6$</td>
<td></td>
</tr>
<tr>
<td>3. $4g - 4 = 28$</td>
<td></td>
</tr>
<tr>
<td>4. $\frac{w}{5} + 3 = 6$</td>
<td></td>
</tr>
</tbody>
</table>

**Remember!**
1. Undo Addition/Subtraction
2. Undo Multiplication/Division
3. Solve
4. Check
<table>
<thead>
<tr>
<th></th>
<th>Equation</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>$\frac{n}{4} + 2 = 4$</td>
<td>Check:</td>
</tr>
<tr>
<td>6</td>
<td>$\frac{a}{7} + 10 = 17$</td>
<td>Check:</td>
</tr>
<tr>
<td>7</td>
<td>$3x + 4 = 19$</td>
<td>Check:</td>
</tr>
<tr>
<td>8</td>
<td>$\frac{t}{5} - 2 = 6$</td>
<td>Check:</td>
</tr>
</tbody>
</table>
Day 6
Expressions and Equations: Solving Equations with the Distributive Property

NYS Learning Standards:

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers.
7.EE.B.4a Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about quantities.
   a. Solve world problems leading to equations of the form \( px + q = r \) and \( p(x + q) = r \), where \( p, q, \) and \( r \) are specific rational numbers.

Objective(s)/Goal(s):

Today's Goal: (Communicated to students on front board)
Solve for the variable by using the Distributive Property

Instructional Outcomes:

1. Students will model the distributive property with algebra tiles.
2. Students will solve equations by first using the Distributive Property.
I plan to meet these instructional outcomes using a variety of learning strategies throughout the lesson. I will use group work and individual practice. Student learning will be assessed in a variety of ways. I will know if my Instructional Outcomes are met by observing my students throughout the lesson.

Materials:

- Smartboard
- Worksheets (see attached)

Anticipatory Set:

Warm-Up (written on front board)
- Write HW in your Agenda
- Have out last night’s HW
**Procedure:**

1. **Warm-Up:**
   Students will work on the warm-up activities as they enter the room.

2. **Go over Homework:**
   As a class, the homework from last night will be reviewed. It is crucial that students understand how to evaluate two step equations before the distributive property is added in.

3. **Class Work: The Distributive Property Notes**
   Students will evaluate expressions by modeling the distributive property with algebra tiles.

4. **Practice:**
   Students will complete a worksheet with the distributive property within solving equations. If time allows, students can begin this in class, and finish the assignment for homework.
EXPRESSIONS AND EQUATIONS

The Distributive Property
When we are solving equations, we might run into multiplication between one term and two terms that are inside parenthesis. See the example below:

\[ 3(x + 1) \]

The order of operations tells me to simplify parenthesis first, but I can’t add \( x \) and 1 together because they are NOT \( \text{__________} \)! In this situation, I need to use the Distributive Property.

We can show \( 3(x + 1) \) and the Distributive Property using algebra tiles:

<table>
<thead>
<tr>
<th>Key: ( \square = x )</th>
<th>( \square = 1 )</th>
</tr>
</thead>
</table>

\[ 3(x + 1) = 3x + 3 \]

You Try!
1. Distribute \( 2(x + 4) \) using algebra tiles

2. Distribute \( 2(x - 4) \) using algebra tiles
3. Distribute $3(x - 1)$ using algebra tiles

4. Distribute $2(2 + 2x)$ using algebra tiles

5. Distribute $4(x + 5)$ using algebra tiles
Example:

\[ 4(x + 5) \]

Directions: Use the distributive property to expand the expressions below.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>5(y + 3)</td>
</tr>
<tr>
<td>2.</td>
<td>4(x - 5)</td>
</tr>
<tr>
<td>3.</td>
<td>10(z + 4)</td>
</tr>
<tr>
<td>4.</td>
<td>32(y + 2)</td>
</tr>
<tr>
<td>5.</td>
<td>x(x + 1)</td>
</tr>
<tr>
<td>6.</td>
<td>2(r - 1)</td>
</tr>
<tr>
<td>7.</td>
<td>2x(4 + x)</td>
</tr>
<tr>
<td>8.</td>
<td>y(2y + 10)</td>
</tr>
</tbody>
</table>

What you’ll need to know:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 \times x = 2x</td>
<td>x \times x = x^2</td>
</tr>
<tr>
<td>A number times a variable, Smush together</td>
<td>A variable times a variable, Use an exponent</td>
</tr>
<tr>
<td>5y</td>
<td>z \times z =</td>
</tr>
<tr>
<td>3x \times 5 = 15x</td>
<td>3x \times x = 3x^2</td>
</tr>
<tr>
<td>Multiply the numbers, keep the variable</td>
<td>Multiply the variables, keep the number</td>
</tr>
<tr>
<td>4y \times 2 =</td>
<td>7y \times y =</td>
</tr>
</tbody>
</table>

Hint: Draw Arrows!
### Solving Equations with the Distributive Property

1. Distribute
2. Combine and Like Terms
3. Solve (One or Two Step)
4. Check

<table>
<thead>
<tr>
<th>Equation</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (3(x - 2) = 21)</td>
<td></td>
</tr>
<tr>
<td>2. (3(x - 2) + 5 = 17)</td>
<td></td>
</tr>
<tr>
<td>3. (2x - (x - 3) = 7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expression</td>
</tr>
<tr>
<td>---</td>
<td>------------</td>
</tr>
<tr>
<td>4.</td>
<td>$3x - 2(x - 3) = 9$</td>
</tr>
<tr>
<td>5.</td>
<td>$4x - 2(x + 3) = 8$</td>
</tr>
<tr>
<td>6.</td>
<td>$9 - (x - 4) = 5$</td>
</tr>
<tr>
<td>7.</td>
<td>$7 - 2(x - 9) = 3$</td>
</tr>
<tr>
<td>8.</td>
<td>$7x - 3(x + 2) = 10$</td>
</tr>
</tbody>
</table>
Day 7
Expressions and Equations: Solving Equations with Variables on Both Sides

**NYS Learning Standards:**

7.NS.A.3  Solve real-world and mathematical problems involving the four operations with rational numbers.
7.EE.B.4a  Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about quantities.
   a. Solve world problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where $p$, $q$, and $r$ are specific rational numbers.

**Objective(s)/Goal(s):**

**Today’s Goal:** (Communicated to students on front board)
Solve an equation with a variable on each side.

**Instructional Outcomes:**

1. Students will solve equations with a variable on both sides of an equal sign.

I plan to meet these instructional outcomes using a variety of learning strategies throughout the lesson. I will use group work and individual practice. Student learning will be assessed in a variety of ways. I will know if my Instructional Outcomes are met by observing my students throughout the lesson.

**Materials:**

- Smartboard
- Worksheets (see attached)

**Anticipatory Set:**

**Warm-Up** (written on front board)
- Write HW in your Agenda
- Have out last night’s HW
**Procedure:**

1. **Warm-Up:**
   
   Students will work on the warm-up activities as they enter the room.

2. **Collect Homework**

3. **Class Work: Variables on Both Sides**
   
   As a class, we will complete notes on what to do when there are variables on both sides of the equal sign.

4. **Partner Practice:**
   
   Students will choose (or be assigned) partners and complete the practice worksheet on solving equations with variables on both sides.
Variables Both Sides
If there is a variable on both sides of the equation, we must move all terms with variables to **ONE** side of the equation!

**Moving Variables to One Side**
1. Move all terms with variables to one side by adding or subtracting
   *Always move the smaller amount of x’s*
2. Combine Like Terms
3. Solve by getting the variable by itself
4. Check

**Example:**
3 + 7x = 4x + 24

**Directions:** Solve each equation by first moving the variable to one side!

<table>
<thead>
<tr>
<th>1. 4x + 3 = 5x + 7</th>
<th>Check:</th>
</tr>
</thead>
</table>

---

65
2. $18 + 2n = 4n - 10$
   
   **Check:**

3. $48 - 2x = 8x + 8$
   
   **Check:**

4. $3(x - 2) = 4x + 5$
   
   **Check:**

5. $3(2x - 1) = 9(x + 3)$
   
   **Check:**
Variables Both Sides Practice

Directions: Solve each equation. Show your work and check your answers.

Remember:
Move the variable to ONE SIDE first.
Get the variable by itself by doing the OPPOSITE to BOTH sides.

1. \(3a + 2 = a - 6\)  
   Check:

2. \(2x - 5 = x + 10\)  
   Check:

3. \(4(x - 10) = 2x + 20\)  
   Check:
<table>
<thead>
<tr>
<th></th>
<th>Expression</th>
<th>Check:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>$9 - 3y = -7 - 4y$</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>$k - 4 = 12 + 3k$</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>$3(x - 2) = 2(2x - 5)$</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>$5 + 4x = -7 - 2x$</td>
<td></td>
</tr>
</tbody>
</table>
Day 8

Expressions and Equations: Unit Review

**NYS Learning Standards:**

- **7.EE.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

- **7.EE.2** Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.

- **7.EE.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

**Objective(s)/Goal(s):**

**Today’s Goal:** (Communicated to students on front board)

Review Solving Equations

**Instructional Outcomes:**

1. Students will review solving equations.
I plan to meet this instructional outcome through a station activity.

**Materials:**

- Smartboard
- Worksheets (see attached)

**Anticipatory Set:**

Warm-Up (written on front board)

- Write HW in your Agenda
- Have out last night’s HW
Procedure:

1. **Warm-Up**:Students will work on the warm-up activities as they enter the room.

2. **Class Work: Equations Stations**
   Set up the room so that there are five different groups of desks. Assign students to a group based on their ability (mix strong students with weak students and keep in mind behavior combinations). At each station, students will be reviewing how to solve a certain type of equation. At each station, you will need to place the piece of paper that has the problems for that station (see attached). Students should be instructed to first copy down the problem, and then work as a team to solve.

   Set a timer to keep track of time (divide the class minutes remaining into 5).

3. **Homework:**
   Students will be expected to complete the Station Activity to review for their Unit Test tomorrow.
EQUATIONS STATIONS

Directions: As a team, you will be rotating around to five different stations. At each station, you will be solving different types of equations. When you get to the station, start by carefully copying down the problems. Then, solve each problem and show your work. Remember that you are working as a team.

STATION #1: Solving 2-Step Equations

Hint: Get the variable by itself by doing the OPPOSITE to BOTH sides of the equation

1. 

Check:

2. 

Check:
STATION #2: Solving Equations with the Distributive Property
Hint: Draw arrows from the term outside the parenthesis to each term in the parenthesis and multiply

1. 

Check:

STATION #3: Solving Equations by Combining Like Terms
Hint: Look for same last names to simplify

1. 

Check:

2. 

Check:
### STATION #4: Solving Equations with Variables on Both Sides
Hint: Get rid of the smaller variable by doing the opposite to both sides

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Check:</td>
</tr>
</tbody>
</table>

### STATION #5: Solving Equations with Fractions as Coefficients
Hint: Get rid of the Fraction in front of the variable by multiplying by the reciprocal (flip)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Check:</td>
</tr>
<tr>
<td>2.</td>
<td>Check:</td>
</tr>
</tbody>
</table>
STATION #1: Solving 2-Step Equations

Hint: Get the variable by itself by doing the OPPOSITE to BOTH sides of the equation

*Leave this paper at Station 1*

1. \( \frac{w}{5} + 3 = 6 \)

2. \( 8r - 8 = -32 \)
STATION #2:

Solving Equations with the Distributive Property

Hint: Draw arrows from the term outside the parenthesis to each term in the parenthesis and multiply

*Leave this paper at Station 2*

1. \(3x - 2(x - 3) = 9\)
STATION #3: Solving Equations by Combining Like Terms

Hint: Look for same last names to simplify

*Leave this paper at Station 3*

1. \[ 10x - 12x = -3 + -5 \]

2. \[ \frac{1}{2}y + \frac{1}{2}y + 5 = 7 \]
STATION #4: Solving Equations with Variables on Both Sides

Hint: Get rid of the smaller variable by doing the opposite to both sides

*Leave this paper at Station 4*

1. \[5 + 4x = -7 - 2x\]
STATION #5: Solving Equations with Fractions as Coefficients

Hint: Get rid of the Fraction in front of the variable by multiplying by the reciprocal (flip)

*Leave this paper at Station 5*

1. \( \frac{2}{5} x = 10 \)

2. \( \frac{6}{4} = \frac{3}{6} x \)
Day 9
Expressions and Equations: Module Assessment

NYS Learning Standards:

- **7.EE.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- **7.EE.2** Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.
- **7.EE.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

Objective(s)/Goal(s):

**Today's Goal:** (Communicated to students on front board)

Show me what you know about Expressions and Equations

Materials:

- Module Assessment (See attached)
- Scantron

Anticipatory Set:

- Warm-Up (written on front board)
  - Have out a Pencil

Procedure:

1. **Module Assessment**

   Students will be given the entire class time to complete the module assessment.
   Remind students to carefully transfer their answers to the scantron.
Directions: Answer each question to the best of your ability. Show your work on the test and transfer all your answers to the scantron. Good luck!

VOCABULARY

Directions: Match each definition or example with one vocabulary word from the word bank.

1. \(2x + 10\)
2. \(2x + 10 = 25\)
3. A letter that represents a number
4. The number in front of the variable
5. An expression with more than one term

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.   Expression</td>
</tr>
<tr>
<td>B.   Variable</td>
</tr>
<tr>
<td>C.   Equation</td>
</tr>
<tr>
<td>D.   Polynomial</td>
</tr>
<tr>
<td>E.   Coefficient</td>
</tr>
</tbody>
</table>

TRANSLATING WORDS INTO MATH

6. What expression represents 16 more than 5 times a number, \(n\)?

A. \(5n + 16\)
B. \(5n - 16\)
C. \(16n + 5\)
D. \(16n - 5\)

7. What equation represents three less than five times a number is twelve?

A. \(3 - 5x = 12\)
B. \(5x - 3 = 12\)
C. \(5(3 - x) = 12\)
D. \(5(x - 3) = 12\)
EVALUATING EXPRESSIONS

8. Evaluate the expression below when \( c = 5 \).
\[ 3c - 8 + 2c \]

A  -19  
B  20  
C  19  
D  17

9. Evaluate the expression below when \( x = 7 \).
\[ x^2 + x^2 \]

A  28  
B  14  
C  98  
D  0

10. Write “a number increased by seven” as an algebraic expression.
Then, evaluate when the value of the unknown number is 23.

A  30  
B  16  
C  7  
D  161
COMBINING LIKE TERMS

11. Simplify the expression below.
   \[ 2x + 5x \]

   A 10x  
   B 3x  
   C 7x  
   D 10x^2

12. Simplify the expression below.
   \[ n^2 + 3 - 2n^2 + 10 \]

   A \(-1n^2 + 13\)  
   B \(3n^2 + 13\)  
   C \(-12n^2\)  
   D \(n^2 + 13 - 2n^2\)

DISTRIBUTIVE PROPERTY

13. Simplify the expression below.
   \[ 6 (1 + 7n) \]

   A \(7 + 7n\)  
   B 14  
   C \(6 + 42n\)  
   D \(42n\)
\[ 10 - 5 (9n - 9) \]

A. \( -45n + 45 \)
B. \( 55 - 45n \)
C. \( 10 + 45n - 45 \)
D. \( -55 + 45n \)

15. Simplify.
\[ -4 + 7 (1 - 3m) \]

A. \( 3 + 21m \)
B. \( 11 + 21m \)
C. \( 24m \)
D. \( 3 - 21m \)
16. What is the value of \( n \) in the equation below?

\[
\frac{3}{4} n = 9
\]

\[
\begin{align*}
A & \quad 27 \\
B & \quad 11 \\
C & \quad 12 \\
D & \quad 6\frac{3}{4}
\end{align*}
\]

17. What value of \( x \) makes the equation below true?

\[
6x - 1 = 35
\]

\[
\begin{align*}
A & \quad 5 \\
B & \quad 6 \\
C & \quad 13 \\
D & \quad 24
\end{align*}
\]

18. What value of \( x \) makes the equation below true?

\[
3 (x - 2) = 21
\]

\[
\begin{align*}
A & \quad 10 \\
B & \quad -10 \\
C & \quad 9 \\
D & \quad -9
\end{align*}
\]
19. What value of x makes the equation below true?

\[ 7 - 2(x - 9) = 3 \]

A  11  
B  12  
C  2  
D  -11

20. Find the value of a in the equation below.

\[ 3a + 2 = a - 6 \]

A  4  
B  2  
C  -2  
D  -4
Chapter 4

Validity of Curriculum Project

The validity of this curriculum project was assessed by the author of the unit plan as the created lessons were implemented in the author’s classroom in October, 2014. This classroom was composed of a total of 84 seventh grade students in a rural school district – divided into four sections. In addition, the validity of the curriculum project was measured by a veteran teacher in a rural school district, and a veteran teacher in a city school district. The two cooperating teachers were asked to critique the unit plan and use their experience to reflect on the lessons created as they answered the questions provided in a questionnaire (found in Appendix A):

1. Compare the intended unit plan to how it would meet the needs of your students. Please comment on factors such as: time management, student engagement, and instructional learning outcomes.

2. Based on your understanding of the Common Core Learning Standards, is this unit plan aligned to those standards?

3. What are the strengths of this unit plan?

4. What changes, if any, would you make to this unit plan?

The author of the curriculum project used the answers that the cooperating teachers provided to measure the validity of the curriculum project, as well as the author’s own experience with the unit plan, discussed in the final chapter.
Chapter 5

Summary

New Opportunities with the Common Core

The paradigm shift from the NCTM standards to the Common Core State Standards provides opportunities for educators to re-design their teaching in the classroom; this curriculum project on Expressions and Equations is created to be a resource to aid in this shift. Implementing the CCSS provides a promise to teachers as described by McCallum (2012), “The promise of the Common Core is having a shared text that, whatever its virtues and flaws, provides the basis of disciplined innovation in curriculum and shared tools for teaching” (p. 13). Porter, McMaken, Hwang, and Yang (2011) share several benefits that a national curriculum would offer, including: shared expectations, focus, efficiency, and quality of assessments. As teachers are developing curriculum, the opportunity of consistent standards across states creates a focus instead of various demands put in place by state standards. Also, a shared set of standards allows for opportunities for educators across the country to work together and share tools for implementation based on common standards (McCallum, 2012). Mathis (2010) shares: “In this view, “common core” standards will allow broad-based sharing of what works within and across schools, districts and states. Thus, efficiency will be increased. Further, with a common curriculum, children will be able to move from school to school across the nation and basically not have the continuity of their studies interrupted” (p. 2). The possibility for an increase in the quality of assessments is described by Porter, McMaken, Hwang, and Yang (2011): “With the set of Common Core standards and one or two aligned assessments, it might be possible to (a) deliver assessments electronically and (b) make them computer adaptive.
Electronically delivered assessments could be more animated and engaging; computer adaptive testing would produce fewer floor and ceiling effects” (p. 103).

**Curriculum Project Implementation and Questionnaire Findings**

Two veteran teachers agreed to complete the questionnaire (found in Appendix A) after analyzing the unit plan. Teacher A is a seventh grade mathematics teacher in a rural school district with 67 students, and Teacher B is a seventh grade mathematics teacher in a city charter school with 52 students, both schools are located in upstate New York.

After reviewing the comments provided from completion of the questionnaire, it is clear that both teachers agree that the unit plan is an effective teaching tool that they would use in their classrooms. Teacher A was especially impressed with how modeling was used to help give students a visual aid in solving all types of equations. Teacher B stated: “In the past, many of my students have struggled to understand the Distributive Property. Previously, I have explained the Distributive Property as multiplication by everything within a set of parenthesis, and my students draw arrows to show this multiplication. Instead, using the algebra tiles, as shared in Day 6 of this unit plan would be beneficial for students to gain a deeper understanding of this mathematical concept. I believe that using modeling to introduce and practice properties is a main focus of the Common Core”.

Both Teacher A and Teacher B shared that their favorite lesson within the unit was on Day 4: Solving Real World Scenarios with Equations. Teacher A said: “The real world example of a family vacation is a great way to “hook” my students and get them engaged in learning. I can’t tell you how many times my students ask when they will use the skills they learn in math class”. Teacher B commented: “My students would be excited about the different vacation scenarios that include the pictures – a great addition to capture a seventh grade student”.
Some great feedback was given on how this Unit Plan could be improved. Teacher A suggested that an additional day should be added for students to complete an “Equations Re-Cap” where they practice solving equations of varying degrees, for example, one step, two step, solving by distributing, and solving with variables on both sides. This re-cap would not only serve as an additional practice for the students, but the teacher could use this as an informal assessment before the unit test.

The author of this Unit Plan was able to use the lessons that were created in their own seventh grade classroom. As a reflection, the four questions from the questionnaire were answered below:

1. Compare the intended unit plan to how it would meet the needs of your students. Please comment on factors such as: time management, student engagement, and instructional learning outcomes.

*Time Management*: Overall, the lesson plans provided in this Unit Plan were suitable for the 45 minute class periods. There were some lessons that took longer than expected and adjustments needed to be made. For example, there were some practice worksheets where students did not finish in the allotted time, and finished the problems for homework. For the station activity on Day 8, I found that some of my more advanced students were finishing the problems at the station with extra time. This allowed them to be a peer tutor for others in their groups.

*Student Engagement*: The students enjoyed the activities where real-world examples were given as they saw the importance of how it related to their life. They enjoyed the activities that included work with a partner, especially when they got to choose their own partner.

*Instructional Learning Outcomes*: The goals and outcomes for each day were assessed in a variety of ways including: cold call, picking name sticks, thumbs up or down, tickets out the
door, and ultimately the unit assessment on Day 9. The averages on the unit assessment for the four classes were: 81, 83, 89, and 93. The fourth class mentioned is an accelerated class of seventh grade students.

2. Based on your understanding of the Common Core Learning Standards, is this unit plan aligned to those standards?

The Unit Plan was aligned to the CCLS as the students displayed a deeper understanding of Expressions and Equations. Students were able to not only solve for a variable, but draw a model of the Equation and use inverse operations to isolate the variable. This understanding is a key component of the new curriculum.

3. What are the strengths of this unit plan?

This Unit Plan takes into consideration how to engage a middle school student while also addressing the standards. The most popular activity among the students was “The Smith Family Vacation”. There were several students who had been to Myrtle Beach on a family vacation and were excited to work with partners on each of the scenarios.

4. What changes, if any, would you make to this unit plan?

The idea of having an extra day for students to practice the different types of equations as suggested by Teacher A is a great idea. Many of the students would benefit from this review and would probably perform higher on the unit assessment.

Final Thoughts

In conclusion, the goal of this curriculum project on Expressions and Equations was to design a unit plan for Mathematics 7 suitable for an effective resource as our nation’s classrooms experience an instructional shift to the Common Core Learning Standards. The constructive criticism received from the cooperating teachers that analyzed this curriculum, as well as the
author’s successful implementation in the classroom reveal that the goal of this curriculum project was achieved.
References


CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS


Appendix A

Teacher Questionnaire

The following questionnaire was given to the two cooperating teachers that reviewed the curriculum project.

Directions: After your examination of the Unit Plan on Expressions and Equations in Mathematics 7 Aligned to the New York State Common Core and Learning Standards by Rebecca K. Logan, please offer your feedback by answering the following questions:

1. Compare the intended unit plan to how it would meet the needs of your students. Please comment on factors such as: time management, student engagement, and instructional learning outcomes.

2. Based on your understanding of the Common Core Learning Standards, is this unit plan aligned to those standards?

3. What are the strengths of this unit plan?

4. What changes, if any, would you make to this unit plan?

Thank you for your evaluation. Your input is valued as validity of this unit plan is assessed.
Appendix B

Unit Plan Answer Keys

The answer keys needed for all worksheets and activities are provided.
CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS

1. Check the following by using your calculator.

<table>
<thead>
<tr>
<th>x</th>
<th>100 2</th>
<th>2 100 2</th>
<th>3 100 2</th>
<th>4 100 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>x₀</td>
<td>3 100 2</td>
<td>2 100 2</td>
<td>3 100 2</td>
<td>4 100 2</td>
</tr>
<tr>
<td>x₁</td>
<td>3 100 2</td>
<td>2 100 2</td>
<td>3 100 2</td>
<td>4 100 2</td>
</tr>
</tbody>
</table>

2. Solve the following problem:

If there is a variable, it is important to work out your problem slowly and look at the negative or positive sign. If there is no variable, it is important to work out your problem slowly and look at the number which is the same as the negative or positive sign.

3. Using the calculator, perform the following calculation:

\[ (-11)^2 = \]

4. Write an algebraic expression that represents the product of a number and five.

\[ 5x - 15 \]

5. Write an algebraic expression that represents the product of a number and five, then evaluate the expression when \( x = 10 \).

\[ 5(10) = 50 \]

6. Write an algebraic expression that represents the product of a number and five, then evaluate the expression when \( x = 15 \).

\[ 5(15) = 75 \]

7. Write an algebraic expression that represents the product of a number and five, then evaluate the expression when \( x = -10 \).

\[ 5(-10) = -50 \]

8. Write an algebraic expression that represents the product of a number and five, then evaluate the expression when \( x = -15 \).

\[ 5(-15) = -75 \]
EVALUATING EXPRESSIONS

Evaluate the following expressions where x = 2 and y = 3. Show your work.

1. \( \frac{x}{y} \)
2. \( x^2 - y^2 \)
3. \( 2x + 3y \)
4. \( x^3 - y^3 \)

**Directions:** Simplify the expression by using the order of operations.

**Order of Operations:**

1. Parentheses
2. Exponents
3. Multiplication and Division (left to right)
4. Addition and Subtraction (left to right)

**Teacher's Notes:**

- Ensure students understand the order of operations.
- Encourage students to show their work.

**Name:**

**Score:** 100%
### Expression and Equations

#### Example 1:

- **Expression:** $3 + x = 7$
- **Solution:** $x = 4$

#### Example 2:

<table>
<thead>
<tr>
<th>Expression</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x + 2 = 5$</td>
<td>$x = 3$</td>
</tr>
<tr>
<td>$2x - 3 = 7$</td>
<td>$x = 5$</td>
</tr>
</tbody>
</table>

#### Example 3:

- **Equation:** $2 + y = 8$
- **Solution:** $y = 6$
CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS

1. \( \frac{a}{b} = \frac{c}{d} \)
   \[ a \times d = b \times c \]

2. \( \frac{a}{b} + \frac{c}{d} \)
   \[ \frac{a \times d + b \times c}{b \times d} \]

3. \( \frac{a}{b} - \frac{c}{d} \)
   \[ \frac{a \times d - b \times c}{b \times d} \]

4. \( \frac{a}{b} \times \frac{c}{d} \)
   \[ \frac{a \times c}{b \times d} \]

5. \( \frac{a}{b} \div \frac{c}{d} \)
   \[ \frac{a \times d}{b \times c} \]

Example:

Find the value of \( x \):

\[ x + 3 = 7 \]

Solve for \( x \):

\[ x = 7 - 3 \]

Check the answer:

\[ 7 - 3 = 4 \]

Solution to another problem:

\[ \frac{2}{3} \times \frac{4}{5} = \frac{8}{15} \]
CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS

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[Image of handwritten text and equations]
For guided practice, try the first two as a class.

<table>
<thead>
<tr>
<th>Item</th>
<th>2.5</th>
<th>5.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td></td>
<td></td>
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<tr>
<td>7.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Find the exact number of dots in the image on the right.
2. Write the expression to show the total number of dots.
3. Solve the expression to find the exact number of dots.

Expression: 2 \times x + 3 = 5

Solution:
1. Distribute the 2 to both terms on the left.
2. Add 3 to both sides to isolate the variable.
3. Divide both sides by 2 to solve for x.

Expression: \frac{x}{2} = \frac{3}{2}

Solution:
1. Multiply both sides by 2 to solve for x.
2. Simplify the expression to find the value of x.
1. A taxi cab in New York City charges $1 per person, plus $2 for every mile traveled. If a taxi cab ride for 2 people costs $12, how far did the taxi cab travel?

   
   \[
   \begin{align*}
   \text{Total Cost} &= 12 \\
   \text{People} &= 2 \\
   \text{Rate} &= 1 \times \text{People} + 2 \\
   \text{Distance} &= \frac{12 - 2 \times 2}{1} = 8 \text{ miles}
   \end{align*}
   \]

2. Heather works as a waitress at her family’s restaurant. She works 2 hours every morning during the breakfast shift and the same number of hours every evening for the dinner shift. In the last four days she worked 28 hours. How many hours did she work during each dinner shift?

   
   \[
   \begin{align*}
   \text{Total hours} &= 28 \\
   \text{Breakfast hours} &= 2 \\
   \text{Dinner hours} &= \frac{28 - 2}{2} = 13 \text{ hours}
   \end{align*}
   \]

3. Jillian exercises 5 times a week. She runs 3 miles each morning and bikes in the evening. If she exercises a total of 30 miles for the week, how many miles does she bike each evening?

   
   \[
   \begin{align*}
   \text{Total miles} &= 30 \\
   \text{Morning miles} &= 3 \times 5 = 15 \\
   \text{Evening miles} &= \frac{30 - 15}{5} = 3 \text{ miles}
   \end{align*}
   \]

4. Marc eats an egg sandwich for breakfast and a burger for lunch every day. The egg sandwich has 250 calories. If Marc has 5,200 calories for breakfast and lunch for the week in total, how many calories is one burger?

   
   \[
   \begin{align*}
   \text{Total Calories} &= 5,200 \\
   \text{Breakfast} &= 1,750 \\
   \text{Lunch} &= \frac{5,200 - 1,750}{5} = 640 \text{ calories per burger}
   \end{align*}
   \]

Key Ideas:

- The goal is to get the variable by itself (Use Inverse Operations)
- What you do to one side, you must do to the other side (Balance)

1. \(2x + 3 = 7\)

   \[
   \begin{array}{c|c|c|c|c}
   \text{Model the Equation} & x & + & 3 & = 7 \\
   \text{Make zero pairs} & 2 \times 3 & & & \\
   \text{Isolate the x tiles} & x & = 4 \\
   \text{Find the value of x} & & & 4
   \end{array}
   \]

2. \(2x - 4 = 6\)

   \[
   \begin{array}{c|c|c|c|c}
   \text{Model the Equation} & x & + & -4 & = 6 \\
   \text{Make zero pairs} & 2 \times 4 & & & \\
   \text{Isolate the x tiles} & x & = 10 \\
   \text{Find the Value of x} & & & 10
   \end{array}
   \]
### CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS

#### Table 1

<table>
<thead>
<tr>
<th>Expression</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x = 2x - 8</td>
<td>x = 4</td>
</tr>
<tr>
<td>3x + 7 = 10</td>
<td>x = 1</td>
</tr>
<tr>
<td>5x - 3 = 17</td>
<td>x = 4</td>
</tr>
</tbody>
</table>

#### Table 2

<table>
<thead>
<tr>
<th>Expression</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x + 3 = 7</td>
<td>x = 2</td>
</tr>
<tr>
<td>4x - 9 = 11</td>
<td>x = 4</td>
</tr>
<tr>
<td>6x + 2 = 14</td>
<td>x = 2</td>
</tr>
</tbody>
</table>

#### Table 3

<table>
<thead>
<tr>
<th>Expression</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>x + 5 = 10</td>
<td>x = 5</td>
</tr>
<tr>
<td>2x - 1 = 7</td>
<td>x = 4</td>
</tr>
<tr>
<td>3x + 2 = 11</td>
<td>x = 3</td>
</tr>
</tbody>
</table>

#### Table 4

<table>
<thead>
<tr>
<th>Expression</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>4x - 7 = 11</td>
<td>x = 4</td>
</tr>
<tr>
<td>5x + 3 = 17</td>
<td>x = 3</td>
</tr>
<tr>
<td>6x - 1 = 5</td>
<td>x = 1</td>
</tr>
</tbody>
</table>

**Check Your Work:**

1. Check your work for all tables.
2. Review your answers for any errors.
3. Modify your work as needed.
4. Ensure all calculations are correct.

---

**Reminders:**

- Use clear and legible handwriting.
- Show all work and steps.
- Check your answers for accuracy.
CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS

Expression and Equations

\[ 2x - 8 = 0 \]
\[ 2x = 8 \]
\[ x = 4 \]

\[ \text{Check:} \quad 2(4) - 8 = 0 \]

\[ s = 2 - \frac{3}{4} \]
\[ s = \frac{5}{4} \]
\[ \text{Check:} \quad 2 - \frac{3}{4} = \frac{5}{4} \]

\[ \frac{3}{4} \cdot 8 = \frac{6}{2} \]
\[ \frac{3}{4} \cdot 8 = \frac{6}{2} \]

\[ s = \frac{5}{4} \]
\[ s \cdot \frac{5}{4} = \frac{5}{4} \cdot \frac{5}{4} \]
\[ \text{Check:} \quad s \cdot \frac{5}{4} = \frac{5}{4} \cdot \frac{5}{4} \]

\[ \frac{S}{1} \cdot \frac{X}{1} = \frac{S}{1} \cdot \frac{X}{1} \]
\[ \frac{S}{1} \cdot \frac{X}{1} = \frac{S}{1} \cdot \frac{X}{1} \]

\[ t_1 = t_1 \]
\[ t_1 = 0 + t_1 \]
\[ t_1 = 0 + \frac{t_1}{t_1} \]
\[ t_1 = 0 + \frac{t_1}{t_1} \]

\[ h = h \]
\[ h = 2 + \frac{2}{1} \]
\[ h = 2 + \frac{2}{1} \]
\[ h = 2 + \frac{2}{1} \]

\[ \text{Check:} \quad h = 2 + \frac{2}{1} \]

\[ \text{Check:} \quad h = 2 + \frac{2}{1} \]

\[ \text{Check:} \quad h = 2 + \frac{2}{1} \]

\[ \text{Check:} \quad h = 2 + \frac{2}{1} \]
### DISTRIBUTIVE PROPERTY

<table>
<thead>
<tr>
<th>Expression</th>
<th>Simplified</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(x - 2)</td>
<td>3x - 6</td>
</tr>
<tr>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>5(3x) - 5</td>
<td>15x - 5</td>
</tr>
<tr>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>4(x - 3)</td>
<td>4x - 12</td>
</tr>
<tr>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>

**Steps:**
1. Combine like terms.
2. Solve the equations.

**Answers:**
1. $x = 2$
2. $x = 5$
3. $x = 2$
4. $x = 3$

**Additional Examples:**

- **Example 1:**
  - Expression: $3(x - 2)$
  - Simplified: $3x - 6$
  - Solution: $x = 2$

- **Example 2:**
  - Expression: $5(3x) - 5$
  - Simplified: $15x - 5$
  - Solution: $x = 5$

- **Example 3:**
  - Expression: $4(x - 3)$
  - Simplified: $4x - 12$
  - Solution: $x = 3$
CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS

Example:

\( \frac{3x + 2}{x - 1} = \frac{5}{2} \)

1. Multiply both sides by \( x - 1 \):
   \( 3x + 2 = \frac{5(x - 1)}{2} \)

2. Distribute the \( x - 1 \):
   \( 3x + 2 = \frac{5x - 5}{2} \)

3. Multiply both sides by 2:
   \( 6x + 4 = 5x - 5 \)

4. Solve for \( x \):
   \( x = -9 \)
CURRICULUM PROJECT ON EXPRESSIONS AND EQUATIONS

TRANSLATING WORDS INTO MATH

1. A subtraction word problem is given, and an equation is formed.

2. An equation word problem is given, and a subtraction equation is written.

3. Translate the following expression into an equation: 3x + 2 = 11

4. Translate the following equation into a subtraction word problem: 5x - 7 = 8

VOCABULARY

Expression: A mathematical phrase that combines numbers, variables, and operations.

Equation: A statement that two expressions are equal.

Operations: The mathematical operations of addition, subtraction, multiplication, and division.

Translation: The process of converting a word problem into a mathematical equation or expression.

Example: Translate the following word problem into an equation: "If the sum of a number and 5 is 12, what is the number?"
Solution: x + 5 = 12

Example: Translate the following equation into a word problem: 2x - 3 = 7
Solution: "If twice a number minus 3 equals 7, what is the number?"
Simplifying expressions:

1. Simplify the expression below: $2x + 3 - 2x + 10$

2. Simplify the expression below: $-x^2 + 3x - 2x + 10$

3. Simplify the expression below: $5x + 2x - 5$