Grade/Subject	Grade 7/ Mathematics Grade 7/Accelerated Mathematics (Do extra challenging problems)
Unit Title	Unit 3: Algebraic Reasoning
Overview of Unit	Expressions and Equations • Use properties of operations to generate equivalent expressions. • Solve real-life and mathematical problems using numerical and algebraic expressions, equations and inequalities.
Pacing	Grade 7 Mathematics - 45 days (May take 52 days) Grade 7 Accelerated Mathematics – 37 days (May take 45 days)

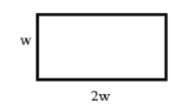
Background Information For The Teacher
It is expected that students will have prior knowledge/experience related to the concepts and skills such as number sense, computation with whole numbers and decimals (including application of order of operations), addition and subtraction of fractions with like and unlike denominators, and computation with all positive and negative rational numbers. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas. Although this unit emphasizes key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed on an ongoing basis. Ideas related to the eight practice standards should be addressed constantly as well. In this unit, students will use properties of operations to generate equivalent expressions. They will understand the connections between performing the inverse operation and undoing the operations. Students will show their steps in their work and explain their thinking using the correct terminology for the properties and operations. They will also build upon their understanding and application of writing and solving one-step equations from a problem situation in order to understand and solve multi-step equations from a problem situation. Students will solve

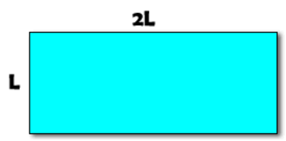
real-life and mathematical problems using numerical and algebraic equations and inequalities. They will work with multi-step problem situations that have multiple solutions and therefore can be represented by an inequality. Students will understand that values can satisfy an inequality but may not be appropriate for the situation, therefore limiting the solutions for that particular problem.

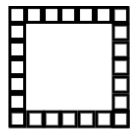
Essential Questions (and Corresponding Big Ideas)
How do you differentiate between a situation that can be represented with an equation and one that can be represented with an expression? • An equation is two equivalent expressions (similarity); an expression you simplify and an equation you solve (difference).) When would we use variables to represent real-world situations? • Variables are used to represent unknown values. How can we use inequalities to represent real-world situations? • Inequalities are used to represent solutions with more than one answer. Ex. Starting a business and determining when a profit will be made. Why are the properties of operations important? • Order of operations is important so everyone gets the same answer; rules for properties are important because they always holds true. How do you translate real-world problems to algebraic expressions? • Students should be able to read a word problem and be able to find necessary information to set up an equation and solve.

How do you differentiate between a situation that can be represented by an arithmetic solution and one that can be represented by an algebraic solution?

- Algebraic solutions include an unknown value, whereas all the values are provided for arithmetic solutions.

Core Content Standards	**Explanations and Examples**
7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients Apply previously learned properties of operations (distributive, commutative, associative, identify, and inverse properties of addition and multiplication) as strategies for adding, subtracting, factoring, and expanding linear expressions. Coefficients are limited to rational numbers that include integers, positive/negative fractions, and decimals. Use the properties to write equivalent expressions; for example 3(4a + 2) = 12a + 6 uses the distributive property. Substituting a numerical value for the variable and then evaluating the expressions to find the same solution is a tool to determine whether two expressions are equivalent. For example, 3(4a + 2) is equal to 12a + 6. Let a = 5 and substitute 5 for a in both expressions. 3(4a + 2) 12a + 6 3(4*5) (12*5) + 6 3(20 + 2) 60 + 6 3(22) 66 66 <u>What the Teacher Does:</u> • Present sets of expressions and ask which are equivalent. Allow time for students to reason using properties. For example, Maria thinks the two expressions 2(3a -2) + 4a and 10a - 2 are equivalent. Is he correct? Explain your reasoning. • Provide students with opportunities to explain their reasoning in writing about how they are creating an equivalent expression using precise mathematical	7.EE.1 Examples: • Write an equivalent expression for $3(x + 5) – 2$ • Suzanne thinks the two expressions $2(3a – 2)$ and $10a – 2$ are equivalent? Is she correct? Explain why or why not? • Write equivalent expressions for $3a + 12$. Possible solutions might include factoring as in $3(a + 4)$, or other expressions such as $a + 2a + 7 + 5$. • Solve $\frac{1}{2}x + 3 > 2$ and graph your solution on a number line. • A rectangle is twice as long as wide. One way to write an expression to find the perimeter would be $w + w + 2w + 2w$. Write the expression in two other ways. Solution: 6w OR $2(w) + 2(2w)$  • An equilateral triangle has a perimeter of $6x + 15$. What is the length of each of the sides of the triangle? Solution: $2(2x + 5)$, therefore each side is $2x + 5$ units long. <u>What the Students Do:</u> • Reason to identify sets of equivalent expressions. • Discover that there can be more than one expression equivalent to a given expression. • Change an expression into an equivalent expression using properties of operations and combining like terms and

vocabulary. • Use substitution as a method to determine if two expressions are equivalent. • Use equivalent expressions for real-world problems. For example: A rectangle is twice as wide as long. One expression to find the area is L*2L. Write the expression the other way. Solution is $2L^2$ 	substitution and solve them. • Communicate orally and/or in writing using precise mathematical vocabulary how an equivalent expression is created. • Defend why two expressions are or are not equivalent. <u>Misconceptions and Common Errors:</u> When students work with several steps in an expression sometimes they forget about the order of operations such as in the following example: 7 + 2(3x-5) + 2x. Students may want to add the 7 + 2 first or only multiply the 2 by the 3x and not the -5. A review of the order of operations can help. For students who need more assistance, have them create their own order of operations card with steps outlined to reference when needed to check their work. Students can also create their own pneumonic device to help them recall the steps.
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. *For example, $a + 0.05a = 1.05a$ means that “increase by 5 percent” is the same as “multiply by 1.05.”* Using equivalent expressions from the previous standard focus on how writing an equivalent statement can better show the relationship among the terms in the expressions. For example, 6x + 15 = 3(2x+5) means that three groups of 2x + 5 is the same as one group of 6x and 15.	7.EE.2 Examples: • Jamie and Ted both get paid an equal hourly wage of $9 per hour. This week, Ted made an additional $27 dollars in overtime. Write an expression that represents the weekly wages of both if J = the number of hours that Jamie worked this week and T = the number of hours Ted worked this week? Can you write the expression in another way? Students may create several different expressions depending upon how they group the quantities in the problem. One student might say: To find the total wage, I would first multiply the number of hours Jamie worked by 9. Then I would multiply the number of hours Ted worked by 9. I would add these two values with the $27 overtime to find the total wages for the week. The student would write the expression. $9J + 9T + 27$. Another student might say: To find the total wages, I would add the number of hours that Ted and Jamie worked. I would multiply the total number of hours worked by 9. I would then add the overtime to that value to get the total wages for the week. The student would write the expression $9(J + T) + 27$.

What the Teacher Does: • Present students with real world problems that can be modeled with more than one expression. For example: An item that is on sale for 20% off costs 80% of the original price. Write an expression by using x as the original price. Allow students to explain their expressions, decide if one another's expressions are equivalent, and explain how a particular expression relates the quantities in the problem. This can be done individually, in groups or as projects.	A third student might say: To find the total wages, I would need to figure out how much Jamie made and add that to how much Ted made for the week. To figure out Jamie's wages, I would multiply the number of hours she worked by 9. To figure out Ted's wages, I would multiply the number of hours he worked by 9 and then add the $27 he earned in overtime. My final step would be to add Jamie and Ted wages for the week to find their combined total wages. The student would write the expression (9*J*) + (9*T* + 27). • Given a square pool as shown in the picture, write four different expressions to find the total number of tiles in the border. Explain how each of the expressions relates to the diagram and demonstrate that the expressions are equivalent. Which expression do you think is most useful? Explain your thinking.  What the Students Do: • Model contextual problems with multiple variable expressions. • Explain orally and/or in writing, using precise mathematical vocabulary, how two equivalent expressions relate the quantities. Misconceptions and Common Errors: Many students have difficulty seeing that expressions are equivalent when the expressions are out of context. Use simple contexts so that students can reason with a context to explain why two expressions are equivalent. For example: Write two equivalents expressions for the following situation: All music downloads are 99 cents today. Maria wants to download 2 R&B hits, 1 rap hit and 3 hits by her favorite artist. Two equivalent expressions are 6 x .99 and (2 x .99) + (1 x .99) + (3 x .99). Focus student attention on how 6 hits for .99 cents each is the same as 2 hits and 1 hit and 3 hits for .99 each.
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. *For example: If a woman making $25 an hour gets a*	7.EE.3 Estimation strategies for calculations with fractions and decimals extend from students' work with whole number operations. Estimation strategies include, but are not limited to: • front-end estimation with adjusting (using the highest place value and estimating from the front end making adjustments to the estimate by taking into account the remaining amounts), • clustering around an average (when the values are close together an average value is selected and multiplied by the number of values to determine an estimate), • rounding and adjusting (students round down or round up and then adjust their estimate depending on how much the rounding affected the original values),

10percent raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

Students solve multi-step real-world and mathematical problems. The problems should contain a combination of whole numbers, positive and negative integers, fractions, and decimals. Students will apply what they learned in previous standards about converting fractions, decimals, and percents and use properties of operations to find equivalent forms of expressions as needed. Students will be expected to check their work for reasonableness using estimation strategies.

What the Teacher Does:

- Pose a variety of multistep real-world and mathematical problems to solve, including integers, fractions, decimals, and percents. Students should convert fractions, decimals, and percents as in the example in the Standard where a 10% raise was interpreted as $\frac{1}{10}$ of the base salary.
- Encourage the use of rounding, compatible numbers, and benchmark numbers to check for reasonableness of results.
- Expect students to use a check for reasonableness on every problem. Have them explain orally and/or in writing their estimation strategies for some of the problems using journals or on exit slips.

- using friendly or compatible numbers such as factors (students seek to fit numbers together - i.e., rounding to factors and grouping numbers together that have round sums like 100 or 1000), and
- using benchmark numbers that are easy to compute (students select close whole numbers for fractions or decimals to determine an estimate).

Example:

- The youth group is going on a trip to the state fair. The trip costs $52. Included in that price is $11 for a concert ticket and the cost of 2 passes, one for the rides and one for the game booths. Each of the passes cost the same price. Write an equation representing the cost of the trip and determine the price of one pass.

x	x	11
52		

$2x + 11 = 52$
$2x = 41$
$x = \$20.5$

What the Students Do:

- Solve multi-step real-world and mathematical problems with precision.
- Select an appropriate estimation strategy and apply it to a problem. Values in problems lend themselves to different strategies.
- Justify the estimation process used by explaining, orally and/or in writing, how it proved their answer to be reasonable. If the estimate did not show an answer to be reasonable, explain how it helped lead to an accurate answer.

Misconceptions and Common Errors:

It is common for students to have difficulty with multi-step problems. Scaffold the problems by adding a question mid-way. Display the first step of the problem, allow students to find the answer, and then present the next part that relies on the first step. Gradually remove the middle question as students get used to finding a middle question and identifying it themselves. For example: Fred goes out to eat and buys a pizza that costs $12.75, including .50 tax. He wants to leave a tip based on the cost of the food. What must Fred do?

First present the following: Fred goes out to eat and buys a pizza that costs $12.75, including .50 tax. How much did the pizza cost? Solve this part of the problem. Then, using the answer from Part 1, introduce the second part of the problem. He wants to leave a tip based on the cost of the fold. What must Fred do?

Some students' work may indicate a weakness representing numbers in different forms such as 10% as $\frac{1}{10}$. These students need additional practice. Use number lines, visuals such as bars, and hands-on materials instead of memorizing rules.

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.

7.EE.4

Examples:

- Amie had $26 dollars to spend on school supplies. After buying 10 pens, she had $14.30 left. How much did each pen cost?
- The sum of three consecutive even numbers is 48. What is the smallest of these numbers?

- Solve word problems leading to equations of the form *px + q = r* and *p(x + q) = r*, where *p, q, and r* are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*

Students will become fluent in solving equations. Students use the arithmetic from the problem to generalize an algebraic solution. Use word problems that lend themselves to equations in the forms of px + q = r and p(x + q) = r. Two examples as follows:

- Three consecutive even numbers add up to 48. What is the lowest number of the three? x + x + 2 + x + 4 = 3x + 6 = 48 (px + q = r)
- Ms. Thomas had $25 to spend on party favors. She had $10.40 left after buying 10 balloons. How much did she spend on each balloon? 0.1(25-10.40) = r(p(x+q)=r)

Students should develop fluency solving word problems that can be modeled by linear equations in the form px + q = r. Integers, fractions, and decimals should be included as values in the word problems.

What the Teacher does:

- Select word problems for students that lend themselves to algebraic equations in the forms px + q = r and P(x + q) = r, such as:
- Diane had $30 to spend on party favors. She had $17.50 left after buying 10 balloons. How much did she spend on each balloon? 0.1(30 – 17.50) = r.
- Three consecutive even numbers add p to 48 what is the lowest number of the three?
  x + (x + 2) + (x + 4) = 48
  x + x + 2 + x + 4 = 48
  3x + 6 = 48
- Facilitate a classroom discussion about the importance of using the order of operations. Demonstrate with an incorrect sequence of operations to emphasize the point.
- Provide students with problems that can be solved

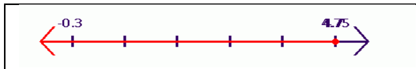
- Solve: $\frac{5}{4}n + 5 = 20$
- Florencia has at most $60 to spend on clothes. She wants to buy a pair of jeans for $22 dollars and spend the rest on t-shirts. Each t-shirt costs $8. Write an inequality for the number of t-shirts she can purchase.
- Steven has $25 dollars. He spent $10.81, including tax, to buy a new DVD. He needs to set aside $10.00 to pay for his lunch next week. If peanuts cost $0.38 per package including tax, what is the maximum number of packages that Steven can buy? Write an equation or inequality to model the situation. Explain how you determined whether to write an equation or inequality and the properties of the real number system that you used to find a solution.

What the students do:

- Model world problems with equations in the forms px + q and p(x + q) = r.
- Fluently solve equations of the forms px + q = r and p(x + q) = r.
- Compare algebraic equations with arithmetic solutions for the same problem using precise mathematical vocabulary.

Misconceptions and Common Errors:

arithmetically but also have an algebraic solution such as problems that apply formulas for area or perimeter as in the example in the Standard. b. Solve word problems leading to equations of the form *px + q > r or px + q < r*, where *p, q, and r* are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make and describe the solutions.* In this standard, students move from solving word problems with equations to word problems with inequalities. Inequalities follow a similar form to those of the equations, px + q > r. Students graph the solution set of the inequality on a number line and describe what it means in terms of the context of the word problem Be aware that sometimes the solution set to the inequality contains values that do not make sense as solutions for the word problem For example, in the word problem, Donna has at most $60 to spend on a shopping spree. She wants to buy a dress for $22 dollars and spend the rest on bracelets. Each bracelet costs $8. How many bracelets can she purchase? We see a solution of $60 - $22 = $38 $8x \leq 38$ $\frac{8x}{8} \leq \frac{38}{8}$ $x \leq 4.75$ The number of bracelets is less than or equal to 4.75. However, Donna cannot buy .75 of a bracelet, so when we graph the inequality as below:	Students who have difficulty becoming fluent in solving equations may need a hands-on approach. Manipulatives such as algebra blocks or tiles can be useful.



We see that the only viable solutions to the word problem are 4, 3, 2, 1, or no bracelets

<u>What the Teacher does:</u>

- Compare word problems that can be modeled with equations to those where an inequality is needed to find a solution set. Inequalities may have negative coefficients. Ask the students to compare how they are the same and how they are different.
- Model solving an inequality while
- facilitating a classroom discussion about how the procedure for solving inequalities is similar to that of equations.
- Present students with many examples of word problems that can be modeled by and solved with inequalities such as the following:
    - Erin has at most $73 to spend on jewelry. She wants to buy a watch for $25 and spend the rest on necklaces. Each necklace costs $8. Write an inequality for the number of necklaces she can purchase and solve it.
- Provide examples of inequalities with negatives so that students learn to reverse the direction of the inequality sign when multiplying or dividing by a negative.
- Encourage students to substitute the answer in the inequality to see if it makes the inequality true.
- Have students graph the solution sets of the inequalities on a number line and make sense of the solution set in context as opposed to whether it is a correct solution set to the mathematical inequality. Ask students to identify the maximum and minimum numbers that make sense swathing the context of the problem.

<u>What the students do:</u>

- Recognize whether a word problem can be represented with an equation or in inequality.
- Create inequalities of the forms $px + q > r$ and $px + q < r$.
- Solve inequalities that contain the symbols $<$, $>$, $\leq$, $\geq$.
- Check answers with substitution.
- Graph solutions to inequalities on number lines and discuss whether all of the answers in the solution set make sense in the context of the problem.

<u>Misconceptions and Common Errors:</u>

Students may forget to switch the inequality sign when multiplying or dividing by a negative. Help students by asking them to check answers in their solution sets in the original inequality to see if they satisfy the inequality. For other students who consistently make errors, check their number line graphs. Some seventh graders may have difficulty drawing the graphs accurately. For example, some students will reverse the location of negative and positive integers. For theses students, supply them with graph paper or simply a sheet of pre-drawn number lines for them to fill out.

Accelerated Only 8.EE.7b Solve linear equations in one variable. **a.** Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form *x* = *a*, *a* = *a*, or *a* = *b* results (where *a* and *b* are different numbers). **b.** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	8.EE.7b As students transform linear equations in one variable into simpler forms, they discover the equations can have one solution, infinitely many solutions, or no solutions. When the equation has one solution, the variable has one value that makes the equation true as in 12 - 4*y* =16. The only value for y that makes this equation true is -1. When the equation has infinitely many solutions, the equation is true for all real numbers as in 7*x* + 14 = 7(*x*+2). As this equation is simplified, the variable terms cancel leaving 14 = 14 or 0 = 0. Since the expressions are equivalent, the value for the two sides of the equation will be the same regardless which real number is used for the substitution. When an equation has no solutions it is also called an inconsistent equation. This is the case when the two expressions are not equivalent as in 5*x* - 2 = 5(*x*+1). When simplifying this equation, students will find that the solution appears to be two numbers that are not equal or -2 = 1. In this case, regardless which real number is used for the substitution, the equation is not true and therefore has no solution.
Standards for Mathematical Practice	**Explanations and Examples**
Use properties of operations to generate equivalent expressions.	

7.EE.1, 7.EE2 Students apply properties of operations previously learned as strategies to add, subtract factor and expand linear equations that have rational coefficients. This skill leads to students being able to rewrite expressions in different forms so they can solve contextual problems and understand how the quantities in the problem are related. **MP2. Reason abstractly and quantitatively.** **MP4. Model with mathematics.** **MP6. Attend to precision.**	Students write expressions in different forms to understand how quantities in an equation are related. Students write expressions and equations to model contextual problems. Students communicate their reasoning using precise mathematical vocabulary.
Solve real-life and mathematical problems using numerical and algebraic expressions and equations. **7.EE.3, 7.EE4** Students focus on solving real-world problems and learn to use equations and inequalities to solve the problems by reasoning about quantities. Students learn to solve equations in the form $px + q = r$ and $p(x + q) = r$ fluently through practice. They compare algebraic solutions to arithmetic ones to demonstrate that they understand the sequence of operations in each approach and how they are the same and different. For inequalities, students graph solutions and then describe the solutions in terms of the context of the problem. **MP1. Make sense of problems and persevere in solving them.** **MP2. Reason abstractly.** **MP4. Model with mathematics.** **MP6. Attend to precision.**	Students solve multi-step real-world mathematical problems. Students use equations and inequalities to solve problems. Students solve problems by reasoning about quantities. Students write equations to model contextual problems. Students estimate answers to problems as a check to accurate solutions.

K-U-D	
KNOW	**DO**

Facts, formulas, information, vocabulary	*Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)*

• Variables can be used to represent numbers whose exact values are not yet specified.
 	
• Expressions can be manipulated to generate equivalent expressions to simplify the problem.
 	
• Expressions can be decomposed and recomposed in different ways to generate equivalent forms.
 	
• Flexibility with the equivalent forms of an expression (expanded form, factored form, etc) allows for efficient problem solving.
 	
• Properties of Operations and Order of Operations are used to simplify, evaluate, or find equivalent expressions.
 	
The equal sign demonstrates equivalence.
Ex: 2x + x = 3x (equivalent expressions)
2x + x and 3x + 4 are not equivalent expressions
 	
• Rational numbers can be represented in equivalent forms to solve problems efficiently (25% can be represented as 1/4 or 0.25).
 	
• Estimation as a means for predicting & assessing the reasonableness of a solution. Fluency with mental math and estimation facilitates efficient problem solving.
 	
• Inverse operations are used to solve equations and inequalities.
 	
• Solutions to an equation/ inequality are the values of the variables that make the equation/ inequality true.
 	
• There are some inequalities that have infinitely many solutions (those in the form of x>c or x<c).
 	
• Solutions to an inequality are represented symbolically or using
	• USE variables.
	• REPRESENT quantities in/out of context.
	• CONSTRUCT simple equations and inequalities.
	• SOLVE problems in context.
	    ○ Simple equations
	    ○ Simple inequalities
	• REASON about quantities.
	• COMPARE algebraic and arithmetic solutions.
	• IDENTIFY sequence of operations.
	• GRAPH inequality.
	• INTERPRET graphed inequality using context.
	• APPLY properties of operations.
	• FACTOR linear expressions with rational coefficients.
	• EXPAND linear expressions with rational coefficients.
	• WRITE an expression in different forms.
	• INTERPRET and REPRESENT expressions in different forms to make meaning of context.

a number line.	

UNDERSTAND *Big ideas, generalizations, principles, concepts, ideas that transfer across situations*
Expressions can be manipulated to suit a particular purpose and solving problems efficiently. Mathematical expressions, equations, and inequalities are used to represent and solve real-world and mathematical problems.

Common Student Misconceptions for this Unit
• Variables can be used to represent numbers in any type mathematical problem. • Understand the difference in an expression and an equation. • Expressions you simplify and equations you solve for the variable's value. • Write and solve multi-step equations including all rational numbers. • Some equations may have more than one solution and understand inequalities. • Students confuse 3x and x^3. • When simplifying, students confuse x + x and x * x. • Students forget to change the inequality sign when multiplying or dividing by a negative number.

Unit Assessment/Performance Task	**DOK**

• Unit 3 Test • Unit 3 Performance Task “Planning a Climb”	

Vocabulary
Algebraic expression Coefficient Constant Dependent Variable Distributive Property Equation Equivalent Evaluate Expanded Form Expression Factored Form Inequality Linear Numerical expression Term Variable

Key Learning Activities/Possible Lesson Focuses (order may vary)
These are ideas for lessons. **Pre-assessment (Recall prior knowledge) and Pre-requisite skills review (if needed)**

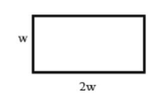
Lesson 1: Expressions

Given understanding of the Distributive Property, simplifying expressions will be expanded upon in Lesson 1 with students using different strategies and properties to decompose and recompose expressions

a) Working cooperatively, students will be given expression, which they will model with algebra tiles and then rearrange the tiles to write equivalent expressions. (Examples: Write an equivalent expression for $3(x + 5) – 2$ and Write equivalent expressions for $3a + 12$. Possible solutions might include factoring as in $3(a + 4)$, or other expressions such as $a + 2a + 7 + 5$.)

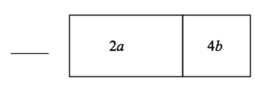
b) Students will be asked to prove or disprove if expressions are equivalent. (Example: Suzanne thinks the two expressions $2(3a – 2)$ and $10a – 2$ are equivalent? Is she correct? Explain why or why not?)

c) Students will be asked to find the perimeter of polygons given their variable dimensions. (Example: A rectangle is twice as long as wide. One way to write an expression to find the perimeter would be $w + w + 2w + 2w$. Write the expression in two other ways.
Solution: 6w OR $2(w) + 2(2w)$



d) Given the perimeter of regular polygons, students will be asked to find the length of each side.
Example: An equilateral triangle has a perimeter of $6x + 15$.
What is the length of each of the sides of the triangle?
Solution: $2(2x + 5)$, therefore each side is $2x + 5$ units long.

e) Given the area of a rectangle, in terms of a variable, students will be asked to find the length and width.
Example: What is the length and width of the rectangle below?



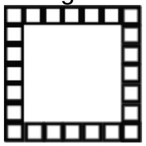
Lesson 2: Using Expressions

a) Give students a situation and ask them to write an expression that would represent it. Ask if there can be more than one expression to represent a situation.

Example: All varieties of a certain brand of cookies are $3.50. A person buys peanut butter cookies and chocolate chip cookies. Write an expression that represents the total cost, *T*, of the cookies if *p* represents the number of peanut butter cookies and *c* represents the number of chocolate chip cookies.

Solution: Students could find the cost of each variety of cookies and then add to find the total. $T = 3.50p + 3.50c$. Or students could recognize that multiplying 3.50 by the total number of boxes (regardless of variety) will give the same total. $T = 3.50(p + c)$.

Given a square pool as shown in the picture, write four different expressions to find the total number of tiles in the border. Explain how each of the expressions relates to the diagram and demonstrate that the expressions are equivalent. Which expression do you think is most useful? Explain your thinking.



b) Students understand the reason for rewriting an expression in terms of a contextual situation. For example, students understand that a 20% discount is the same as finding 80% of the cost, *c* (0.80*c*).

Lesson 3: Real-world Equations

a) Students should be given real-life situations/scenarios in which they can write and solve one-step equations. (This is a review from 6th grade.) The scenarios should be extended to require two-step equations for a solution. (Solving two-step and multi-step equations is new to 7th grade.)

b) Equations with two variables should be introduced (with a relation to real-world situations).

Example: Johnny opened a bike repair shop. His start up costs are $800 for supplies, tools, etc. He decides to charge $60 per tune up. How many tune ups will he have to do to pay for his initial expenses? (P = 60t – 800) Evaluating the equation for several values can improve the students overall understanding of the problem. If he does ___ (20, 24, 30 …) tune ups, how much of a profit will he make? What if Johnny found a way to decrease his startup costs by $300, how would that change the equation? What if he increased the tune up fees by $20, how would that change the equations?

Activity/Formative Assessment:

How Old Are They http://map.mathshell.org.uk/materials/tasks.php?taskid=371&subpage=apprentice

Lesson 4: Real-world Inequalities

a) Students should be given real-life situations/scenarios in which they can write and solve one- two- and multi -step inequalities. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make and describe the solutions.* $50 + 3s \geq 100$
b) In addition to solving the above inequality, ask students to substitute several values for the number of sales (s) and then graph the solution set of the inequality and interpret it in the context of the problem.
c) Students should be able to graph solutions to inequalities on a number line.

Supplemental Materials and Resources

Online Lessons

- Linear Inequalities
  http://www.wtamu.edu/academic/anns/mps/math/mathlab/int_algebra/int_alg_tut10_linineq.htm
- Properties
  http://www.montereyinstitute.org/courses/Algebra1/U02L1T1_RESOURCE/topicText.html

Worksheets

- A variety of worksheets for algebra
  http://www.kutasoftware.com/free.html

Videos

- Expressions and Equations in the Real World
  https://www.teachingchannel.org/videos/teaching-algebra
- Solving Equations
  http://www.montereyinstitute.org/courses/Algebra1/U02L1T1_RESOURCE/index_tabless.html?tabless

SMART Board Lessons

- Search smartexchange for a variety of SMART lessons
  http://exchange.smarttech.com/

Online Interactive Activities & Games

- Linear Function Machine http://www.shodor.org/interactivate/activities/LinearFunctMachine/
- For students having difficulty translating word problems into expressions, see http://www.algebralab.org/lessons/lesson.aspx?file=Algebra_OneVariableWritingEquations.xml

Literature connections:

Math Doesn't Suck: How to Survive Middle School Math Without Losing Your Mind or Breaking a Nail by Danica McKellar

Kiss My Math: Showing Pre-Algebra Who's Boss by Danica McKellar

Hot X: Algebra Exposed by Danica McKellar

Interdisciplinary connections:

Science:

- Finding velocity
- Solving equations (d=rt)

Tools/Manipulatives
Algebra tiles Graph paper or coordinate grid whiteboards Square tiles (paper or commercially produced)

Differentiation and Accommodations

- Provide graphic organizers
- Provide tutoring opportunities
- Provide retesting opportunities after remediation (up to teacher and district discretion)
- Teach for mastery not test
- Teaching concepts in different modalities
- Adjust homework assignments

Suggested Formative Assessment Practices/Processes
• Problem of the Day • Lesson Quizzes • Entrance and Exit Slips • Anecdotal Records (Topic Observation Checklist)