**Theme:  The Number Concepts**          **Suggested Days of Instruction:  40 days**

## Ohio's Learning Standards

NUMBER SYSTEMS (NS)
*Apply and extend previous understandings of numbers to the system of rational numbers.*
6.NS 6.  Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself.
b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

EXPRESSION AND EQUATIONS (EE)
 *Apply and extend previous understandings of arithmetic to algebraic expressions.*
6.EE.1.  Write and evaluate numerical expressions involving whole-number exponents.
6.EE.2. Write, read, and evaluate expressions in which letters stand for numbers.
     a. Write expressions that record operations with numbers and with letters standing for numbers.
      For example, express the calculation "Subtract y from 5" as 5 – y."
     b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.
6.EE.3   Apply the properties of operations to generate equivalent expressions.
6.EE.4. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them)
6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
 *Reason about and solve one-variable equations and inequalities.*
6.EE.5. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
 6.EE.6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
6.EE.7.  Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers
6.EE.8. Write an inequality of the form x > c or x < c to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams.
*Represent and analyze quantitative relationships between dependent and independent variables*
6.EE.9. Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

**Commentary:**
At this level, the study of expressions and equations centers on the use of variables in mathematical expressions. Students write and evaluate numerical expressions and use expressions and formulas to solve problems. Students also solve simple one-step equations and use equations such as 3x=y to describe relationships between quantities.  The six-grade study of expressions and equations is foundational in the transition to algebraic representation and problem solving, which is extended and formalized in Grade 7.

**Resources:**
**SpringBoard:**  Unit 2 (Lessons 9.1-10.2) Unit 3(Lessons 11.1 -16.2)
**Manipulatives:** Fraction Strips, Number lines, Two-color counters, Cubes such as linking cubes, Unifix $cubes^{TM}$, $wooden\ cubes$, graph paper

**Formative Assessments**
SpringBoard Digital: Short-Cycle Assessment for each lesson

**Summative Assessments**
SpringBoard Digital:  End of Unit or Customized Assessment

**OST Released Items:**

**Embedded Assessments**
Unit 2
EA2: Coordinate Plane and Multiplying and Dividing Integers**, Scavenger Hunt**
·Use the Coordinate plane
· Multiply and Divide integers
Unit 3
EA1: Order of Operations and Expressions, **The Cost of After-School Activities**
· Read, write, and evaluate expressions
· Apply the order of operations
· Apply properties to generate equivalent expressions
· Use variables to represent numbers
· Solve real-world and mathematical problems by writing and solving equations
EA2: Expressions and Equations, **The School Book Fair**
· Solve real-world and mathematical problems by writing and solving equations and inequalities
· Graph an inequality
· Analyze the relationship between the dependent and independent variables

$3^2$

**Addressing Student Misconceptions and Common Errors**

*6.EE.1*

Some sixth graders may interpret $3^2$ as 3x2=6.  This is a common error. Use a number line representation to model the expression.  Also, writing the expanded notation of $3^2 = 3x3$ help students.

*6.EE. 2*

Some students misunderstand or incorrectly read expressions.  Students often confuse $x^3$ and 3x. To address this, students create a chart with the meaning of $x^3$ and 3x such as:

| $x^3$ means | 3x means |
|---|---|
| ✓ **x** times **x** times **x** <br> ✓ **x** to the third power | ✓  3 times **x** <br> ✓  **x+x+x** |

*6.EE. A.3*

When addressing the distributive property, some students may multiply the first term in the parentheses but forget to do the same to the second term.  To address this error, give students a plastic zip lock bag if approximately 25 counter in two different mixed colors in each bag.  Direct students to empty the bag and count the number of each color counter such as there are 14 yellows and 11 reds.  Ask students to use the distributive property to write an expression to show how many of each color would be in 4 bags.   Students write the expression 4(14y+11r).  Using the distributive property, the expression is 56y + 44r.  Interpret this as 56 yellows and 44 reds in 4 bags.  Provide other examples.

Give students error analysis problems such as the following: "Fred said 3(2+x) and 6 +x are equivalent expressions.  He was incorrect.  Tell Fred what he did incorrectly?"  One solution is to remind Fred that 3 must be distributed through both terms in the parenthesis.
Using manipulative such as Algeblocks$^{TM}$ or Algebra Tiles$^{TM}$ is also helpful in modeling the distributive property.

*6.EE. 4*

Some sixth graders do not recognize when letters are used to represent variables and when letters are used to represent units of measures such as, 4m and 4m as in meters or 3h and 3 h as in hours.  Use contextual examples to distinguish between the two.

Some students may continue to combine 4x and$4x^2$.  Use a manipulative such as square tiles to demonstrate the difference between the terms.

*6.EE. 5*

Many students have difficulty understanding that an inequality can have more than one solution.  The best way to work on this concept is to use real-world examples that are familiar to students. For example,, I have $25 and want to buy some bracelets.  The bracelets cost are $ each.  How many could I buy? This results in the inequality 8b ≤ 25 where b is the number of bracelets I can buy.  Since students are not solving inequalities in this standard, if you include a negative number in the set of possible solutions, have a discussion about how the negative value only works for the equation and not the real-world scenario.

**Addressing Student Misconceptions and Common Errors - Continued**

*6.EE.B.6*

Some students continually misrepresent real- world scenarios with expressions.  They each make a different errors. Do an error analysis on the work of the students who repeatedly make errors. Are they mistaking what the variable is?  Do they have trouble translating verbal expressions to variable expressions?  Write error analysis questions for the students to solve that use each of the common student errors being made in the class that you have identified. An example if such a problem is as follows:  Write Fred a note explaining his error.  Note: Do not use real student names. This meant to clarify misconceptions generally, not embarrass students who make the errors initially.

*6.EE.B.7*

Some students may need additional, on-going practice with writing and solving equations. Use advertisements in newspapers to generate real –world scenarios that may be used to write and solve the equations.

*6.EE.B.8*

Some students may need additional ongoing practice with writing inequalities to represent a real-world mathematics situation.  Use advertisements in newspapers to generate ideas of real-world scenarios that can be used to wrote an inequality to represent an amount. Ask students to talk about the problems and the number lines they create to show the inequalities.

*6.EE.C.9*
Some students may confuse what a graph represents. To help, have students explain in their own words what the graph means.

Source:  The Common Core Mathematics Companion:  The Standards Decoded (What They Say, What They Mean, How to Teach Them)
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