Theme 2: Expressions and Equations   **Suggested Days of Instruction: 35 days**

Ohio's Learning Standards
<u>EXPRESSIONAS AND EQUATIONS</u>
Use properties to generate equivalent expressions. Solve real life and mathematical problems and numerical and algebraic expressions and equations.
7.EE.A.1
Apply properties of operations of strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.A.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantifies in it are related.
For example,
7. EE.B.3 Solve multi –step real life and mathematical problems posed with positive and negative numbers in any form (whole numbers, fractions, and decimals.) Apply properties of operations to calculate with numbers in any ; convert between forms as appropriate; and assess the reasonableness if answers using mental computation and estimation strategies, For example: If a woman making $25 an hour gets a 10% raise, she will make an additional $\frac{1}{10}$ of her salary an hour, or $2.50 for a new salary of $27.50. If you want to place a towel bar $9\frac{3}{4}$ inches long in the center of a door that is $27\frac{1}{2}$ inches wide, you will need to place the bar about 9 inches from each edge; this estimation can be used check on the exact computation.

7.EE.B.4 Use variables to represent quantiles in a real-world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities.
   a.   Solve word problems leading to equations of the form px + q = r and p(x+q) = r, and where *p, q,* and *r* are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution, identifying the sequence if 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?

   b.   Solve word problems leading to inequalities 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 if sales you need to make, and describe the solution.

Commentary:
In this unit 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 quantities in the problem are related.

Students will focus on solving real-world problems and learn to use equations and inequalities to solve the problems by reasoning about the quantities. Students learn to solve equations in the forms *px +q = r* and *p(x+q)=r* fluently through practice. They compare algebraic solutions to arithmetic ones to demonstrated 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 if the context of the problem.

Resources:
SpringBoard: Unit 2
Tools: Number line, Two-Color counters, Algebra Tiles

Embedded Assessments
Unit 1
 EA1: Writing and Solving Equations, **Fund Raising**

EA2: Solving Inequalities**, *A Gold Medal Appetite***

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

Summative Assessments
SpringBoard Digital: End of Unit or Customized Assessment
OST Released Items:

Addressing Student Misconceptions and Common Errors
7.EE.A.1
When students work with several steps om an expression, sometimes they forget about the order of the operations such as in the following example:
7+2 first or only multiply the 2 by the 3x, and not the -5.
A review of the order of the 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.A.2
Many students have difficulty seeing that expressions are equivalent when the expressions are out of context. Use simple content so that students can reason with a context to explain why two expressions are equivalent. For example: Write two equivalent expressions for the following situation _
All music down loads are $ 0 .99 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 $0.99 and (2x $0.99) + (1 x $0 .99).   "Focus student attention on how 6 hits for $0.99 each is the same as 2 hits and 1 hit and 3 hits for $0.99 each.

Addressing Student Misconceptions and Common Errors - Continued

7.EE.B.3

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 in the problem, allow students to find the answer, and then present the next part that relies on the first step. Gradually remove the middle questions as students get used to finding a middle question and identifying themselves, For example "Fred goes out to eat and buys a pizza that cost $12.75, including $0.50 tax. He wants to leave a tip based on the cost of the food. What does Fred do?

First, present the following: "Fred goes out to eat and buys a pizza that cost $12.75, including tax $0.50 tax. He wants to leave a tip based on the cost of the food. What must Fred do?

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

7.EE.B.4

Students who have difficulty becoming fluent in solving equations may need a hands-on approach. Manipulatives such as $Algeblocks^{TM}, Hands-On\ Equations\ ,^{TM}$ and Algebra Tiles$^{TM}\ can\ be\ useful$.

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. 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 these students, supply them with graph paper or simply a sheet of pre-drawn number lines for them to fill out.

Source: The Common Core Mathematics Companion: The Standards Decoded (What They Say, What They Mean, How to Teach Them)
      Authors: Ruth Harbin Miles and Lois A. Williams, 2016 NCTM

Theme 2: Expressions and Equations   **Suggested Days of Instruction: 15 days**

Ohio's Learning Standards

EXPRESSIONS AND EQUATIONS (EE)
Use properties of operations to generate equivalent expressions.
7.EE.1   Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
7.EE.2   In a problem context, understand that rewriting an expression in an equivalent form can reveal and explain properties of the quantities represented by the expression and can reveal how those quantities are related.
Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
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 estimations strategies.
7.EE.4   Use variables to represent quantities in real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
   a.   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.
   b.   Solve word problems leading to inequalities 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.

Commentary:
Seventh graders use properties of operations to generate equivalent expressions. They use the arithmetic of rational numbers to formulate expressions and equation in one variable and use these equations to solve problems. The seventh-grade focus of solving real-world and mathematical problems using numerical and algebraic expressions and equations provides the foundation for equation work for writing equivalent nonlinear expressions in later grades.

Resources:
SpringBoard: Unit 2 (Lessons 5-1 to 7 - 2)
Tools: Color Tiles, Graph Paper

Embedded Assessments
Unit 1
 EA1: Writing and Solving Equations, *Fundraising Fun*
EA2: Solving Inequalities, *A Gold Medal Appetite*

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

Summative Assessments
SpringBoard Digital: End of Unit or Customized Assessment

OST Released Items:

Addressing Student Misconceptions and Common Errors
7.EE.1
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
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 equivalent expressions for the following situation – All music downloads are 99 cents today. Maria wants to download *2 R&B hits, I rap hit, and 3 hits by her favorite artist*. Two equivalent expressions are 6 x 0.99 and (2 x 0.99) + (1 x 0.99) + (3 x 0.99)." Focus student attention on how 6 hits for 0.99 each is the same as 2 hits and 1 hit and 3

Addressing Student Misconceptions and Common Errors – Cont.

7.EE.3

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 food.   What 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 hand-on materials instead of memorizing rules.

7.EE.4

Students who have difficulty becoming fluent in solving equations may need a hands-on approach. Manipulatives such as Algeblocks,^{TM}, Hands-On Equations ^{TM} and Algebra Tiles,^{TM} can be useful.

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 these students, supply them with graph paper or simply a sheet of pre-drawn number lines for them to fill out.

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