ADDING AND SUBTRACTING ALGEBRAIC EXPRESSIONS

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PRE-PLANNING

LEARNING GOALS

- Use the Commutative, Associative, and Distributive Properties to add and subtract algebraic expressions
- Simplify algebraic expressions by combining like terms
- Define and use the vocabulary words term, constant, and coefficient
- Solve real-world problems involving algebraic expressions
- Rewrite a difference of expressions as a sum.

STANDARDS ADDRESSED

- CCSS.Math.Content.7.EE.A.1
  Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- CCSS.Math.Content.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 quantities in it are related.

CURRICULUM ALIGNMENT

Digits Grade 7, Lesson 7-3 and 7-4

PRIOR KNOWLEDGE

- Write algebraic expressions to represent the information in a verbal expression.
- Use the distributive property to expand an expression
- Use the commutative property to simplify an expression

MATERIALS

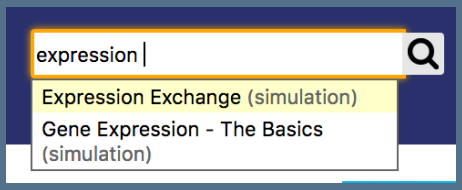
- Technology: 2:1 or 1:1 laptop, chromebook, or iPad
- PhET sim: Expression Exchange
- Activity sheet

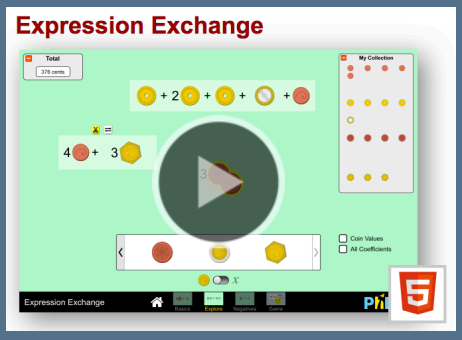
LESSON PLAN (45 MINUTES)

WARM-UP

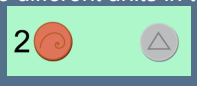
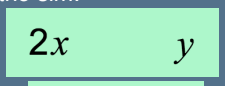
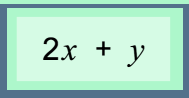
8
MINUTES

Instruct students to go to phet.colorado.edu and search for Expression Exchange, click on the play icon to open the sim, and play with it for 5 minutes.





After students have played for a while, facilitate a whole-class discussion where students can share out features that they found.

- Use the vocabulary “term” and “expression” to differentiate between these different units in the sim.
  - Terms:  
  - Expressions:  
- What does the  button allow you to do?
- What does the  button do?

- Be sure students notice the toggle at the bottom of the screen:
  - What does this toggle do? 
- What does My Collection show?
- Can you change the value of the coins? Can you change the value of the variables? Why do you think you can change the value of a variable but not the value of a coin?

SIM-BASED LESSON

10 MINUTES

Instruct students to work on #2-4 to focus on specific interactions in the sim relating to "overlapping" terms and expressions.

Facilitate a whole-class discussion where you bring students together to share responses to #2-4. Call on students to share their responses, and ask for multiple students to share what they answered (even if answers are similar). Be sure to highlight important vocabulary that comes up during student share-out: **term, coefficient, variable, constant,** and **expression.**

10 MINUTES

Instruct students to work on #5. Take note of partner discussions.

If students are stuck, ask the following pushing questions:

- Did you try building the expression?
- How can you take away those terms from the expression?
- Do you remember what those yellow and white buttons above an expression do? Try using the yellow break-apart button to break your expression down into all of the individual terms.

Facilitate a whole-class discussion.

- What mathematical operation is the same as "taking away"?
- How can we write this situation as a math problem? If we started with one expression and took away terms..
- $(3x + 2y + 5x^2 + 8) - (2x^2 + x + 5)$
- Which expression means the same thing?
  - $3x + 2y + 5x^2 + 8 - 2x^2 + x + 5$
  - $3x + 2y + 5x^2 + 8 - 2x^2 - x - 5$

	○ How do you know? Which one matches the action we took in the sim when trying to take away the terms? • So when you are subtraction an expression, don't forget to **subtract every term**!
10 MINUTES	Allow students to continue working on #6 and the application question at their own pace, checking in with individuals to assess their progress. If there is time, have different students share their work for the application questions on the board.

SUMMARY

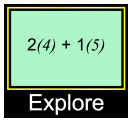
5 MINUTES	Have students answer the following question on an exit ticket: **How are adding expressions and subtracting expressions similar?**

Name: _____ Date: _____ Class: _____

ADDING AND SUBTRACTING EXPRESSIONS

💬 = turn and talk. Stop and share your responses with your partner. If you have different responses, try to come to a consensus.

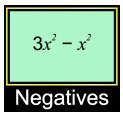
1. Play with the sim for 5 minutes. Write down three questions or observations that you have.



2. When you overlap two terms, sometimes the sim shows a yellow glow and sometimes you *can't* get a yellow glow.
   a. What is happening when you see the yellow glow?

   b. What is happening when you don't see a yellow glow?

3. When you overlap two expressions, what happens?



4. Build three different expressions (with 3-4 terms) and record them under Expression #1. Copy your partners expressions under Expression #2. Use the sim to add the two expressions and simplify so they have as few terms as possible.

Expression #1	**Expression #2 (partners)**	**#1 + #2 (simplified!)** 💬

Commented [Office1]: After 5 minutes, ask students to pause what they are doing on their laptops/tablets and share out what they found. You can model this on the projected sim or have students come up to show the class- whatever is easier.

Commented [AM2]: The expressions get added together.

Commented [AM3]: Pause here for a whole-class discussion to go over #2-4. (2) When you overlap and get a yellow glow, you must have two of the same type of term (e.g., 2x and x become 3x) and the coefficient will increase. (3) When you overlap and get a transparent box, you might have two of any types of terms and an expression is forming (e.g., 2x + x or 2x + y). (4) When you overlap two expressions, they get added together. In this sim, **overlapping = adding.**

Commented [AM4]: If students have trouble here, point out the two buttons above every expression and ask "what do these buttons do?" or point them back to #2 above and ask "what happened when two coins/terms made a yellow glow?"

5. I built this expression in the sim: $3x + 2y + 5x^2 + 8$

   a. My partner borrowed my computer and took away $2x^2$, x, and 5! What was left on my screen when I got my computer back?

   b. How did you figure this out?

   c. Could my partner have taken away $-x$? How would they do that, and what would the expression on the screen look like?

Commented [AM5]: Encourage students to continue using the sim (especially the Negatives screen) to answer these questions.

Commented [AM6]: Pause after this question to discuss what is happening in #6. In part a, we are starting with an expression and **subtracting** another expression. Show students that this problem is the same as (3x + 2y + 5x^2 + 8) – (2x^2 + x + 5). In part c, this situation can be written as (3x + 2y + 5x^2 + 8) – (-x).

6. Work on levels 7-8 in the game. Write down your results below:

	Level 7	Level 8
target		
your expression		
target		
your expression		
target		
your expression		

APPLY WHAT YOU LEARNED!

Which expressions are equivalent to $-6 + 5t$?

a. $(8t + 13) + -3t + 7$

b. $(6t + 3) - (t + 9)$

c. $-3 + 6t - 3 + t - 2t$

d. $(t + 9) + (4t - 15)$

e. $5(-2 + t) + 4$

f. $2(t + 5) - (3t - 4)$

g. $-1 + (2t + 3) + 2(t - 3)$

h. $4t - 4(t + 2) + (5t + 2)$