

# Like Terms and How to Combine Them

## Lesson for Grades 6-7 Pre-Algebra

### Author's Note:

I have found that my students struggle to make the transition from concrete models to algebraic expressions. This is a simple, 50 minute lesson to help students build understanding of what a coefficient means-- $5x$  is LITERALLY 5 of something.

### Content Objectives:

- Develop a concrete model for algebraic expressions, then move into abstract algebraic expressions
- Identify Like Terms and Coefficients as concepts and as vocabulary words
- Begin to create a set of rules for identifying and combining like terms with addition (and subtraction, time permitting. When I taught this lesson, both classes naturally went there.)

### Common Core 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. For example,  $a + 0.05a = 1.05a$  means that "increase by 5%" is the same as "multiply by 1.05."
- A-SSE.A1a Interpret parts of an expression, such as term, factors and coefficients

### Materials:

- Devices for students to access PhET simulation Expression Exchange
- Copies of the handout
- Warmup Document (to project or copy onto the board, or run off for students)
- Student notebooks (optional, depending on teacher, I included a definitions section at the bottom of the handout for folks who like binders and hole punching!)
- Whiteboard/smartboard for teacher to capture student feedback and allow students to demonstrate what they did for the whole class.

## Lesson Plan:

Warmup: 5 Minutes	
Teacher will...	Students will...
<ul style="list-style-type: none"><li>• Project the Warmup Document on the screen as the students enter.</li><li>• Answer questions, but encourage students to interpret the instructions in their own way. (The only wrong answer is not trying!)</li><li>• Ask a few students to explain how they represented each situation.</li><li>• Point out any that used symbols to stand for unknown numbers, or numbers next to a symbol that act as a coefficient (don't use that term yet if it has not been introduced, just point it out).</li><li>• If none of the students came up with a model that works, draw your own with help from students, and then discuss.</li></ul>	<ul style="list-style-type: none"><li>• Follow the directions to demonstrate their chosen scenario in their notebooks or on the board.</li><li>• Be ready to share and explain what they did.</li></ul>
Exploration: 15 Minutes	
Teacher will...	Students will...
<ul style="list-style-type: none"><li>• Ask students to explore the Basics Tab. Challenge them to find out what all the buttons do on the page, and be ready to use them.</li><li>• Ask students what they think this sim is for? (Converting Real Life into Algebra!)</li><li>• Ask students to share what things they learned about using the sim, and make sure all the major functions are covered, such as how to split up collections, how to add two things, and how to arrange them in rows to be added.</li><li>• Make sure to make a note that unlike coins cannot be piled.</li><li>• Also make sure that they know what the "total" box is showing them--the total value of their collection.</li></ul>	<ul style="list-style-type: none"><li>• Explore the page and learn the different functions.</li><li>• Respond to teacher questions and listen to their peers' responses.</li></ul>

Teach: 25 Minutes

Teacher will...

- Ask students to look at box A on their handout, and challenge them to record their solution in the box. Ask them to make sure that the two boxes on the side are unchecked.
- Ask students to share different ways.
- So, what is each coin worth? Could we tell what it was worth if we didn't have the coin box? (no) Why? (because it makes an equation--we can figure it out if we know what it adds each time.)
- Explain that this is all Algebra is--it is having an unknown or two, and using what we do know to solve for the unknowns.
- Ask students to fill out box B.
- So the number in front of the coins represent how many of that coin type there are? Awesome, we actually have a word for this in algebra. A number that goes before a symbol and says how many of them you have is called a COEFFICIENT.
- Ask students if they have seen any coefficients of 1. Why not (or where? If a student has clicked on the "show all coefficients" box.) Have all students do this. (you don't need to say there is one of something if it is obviously just one of something.)
- Ask students why they think two coins of a different type can't be "piled" upon each other. They should first write why they think that in box C on their sheet. (They are not the same thing, so you can't say there are 2 coppers if you stack a copper and a silver)
- Can you combine stacks? What kind of stacks? Record your response on the sheet in box D.
- Now flip the coin to x toggle. What do

Students will...

- Make a collection worth 56, and record and share how they did it.
- Students reflect in box B and record what a Coefficient is in their notes.
- Reflect upon why they can't combine a copper and silver coin, and share their thoughts with the class.
- Record their observations and thoughts about how the coins are similar to variables.
- Write a rule for combining variables with their coefficients.
- (Box G) Explore the "variables" tab and record what they found.
- (Box H) Revise their rule, or write about why their rule still works with what they observed.

<p>you notice? How are these two setups alike? How are they different?</p> <ul style="list-style-type: none"> <li>• Let students know that each “type” of variable with its coefficient is called a “TERM.” Record it in notebooks, and ask a few questions like, “can someone share what terms are displayed on their sims now?” If students try to say that their term is <math>4x+3y</math>, instruct them on how those are different terms. We know because why? (Because they can’t be combined) Refer back to warmup #2 and compare pickles to wigs--we can’t just say “how much” because they are DIFFERENT THINGS. No picklewigs!</li> <li>• Come up with a rule for adding variables with their coefficients and record it. Be ready to edit it!</li> <li>• Ask students to share their rules, and decide on a class rule.</li> <li>• Have students flip to the “variables” tab and answer the question in boxes G and H after they have played around and explored. They should be able to expand their definition to include subtraction, or adding negatives.</li> </ul>	
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Wrap-Up: 5 Minutes

Teacher will...	Students will...
<ul style="list-style-type: none"> <li>• Ask students if the overall class rule needs changing, and if so, why or why not?</li> <li>• Ask the class if they can come up with a definition of “like terms” by filling in the following format:</li> </ul> <p>Like terms are: Some examples are:</p> <p>Unlike terms are: Some examples are:</p>	<ul style="list-style-type: none"> <li>• Share their ideas/revisions with the teacher.</li> <li>• Record their definitions and examples in their notebooks.</li> </ul>

Write the student answers on the board.	
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### **Warm Up Instructions:**

Peel Back or puncture protective film over Brain. Insert into microwave for 30 seconds, or until ready for learning. Stir and think.

Consider the following scenarios, and choose one you think you could model with a picture, numbers, or a combination of the two. Draw that model in your notebook or on the whiteboard, and be ready to share how you modelled the situation with the class. They are ranked from easiest to most challenging.

1. Jenny, Benny, and Lenny each had different types of coins rattling around in their pockets. Jenny had three coins, Lenny had seven coins, and Benny had one coin. Jenny felt bad for Benny, so she gave him her three coins. Lenny only gave him two. What would the contents of each monkey's pocket look like now? (Hey, I never said they were human.)
2. I buy five pickles, nineteen wigs, and 31 pairs of tweezers. No, you don't need to know why, MIND YOUR OWN BUSINESS ALREADY. How much do I have altogether?
3. The principal of your school has a secret stash of candy. I don't know how much is left, but I have been "borrowing" five candies a day for the past three days.

# Like Terms and Coefficients

Name: \_\_\_\_\_ Date: \_\_\_\_\_

A) Can you make the total box read 56? Draw a picture of how you did that below:

B) What do you think the number in front of a stack of coins represents?

C) Why do you think the sim won't let you "pile" two different types of coins on top of each other?

D) Can you combine different stacked piles?

E) How is using variables ( $x$ ,  $y$ ,  $z$ ) like and unlike using coins?

F) Come up with a rule for combining like terms. Give an example.

G) On the "variables" tab--what are some things you could combine that you couldn't on the "explore" tab?

H) How does that fit in with your rule? Do we need to revise it? Why or why not?

Definitions:

Coefficients:

Ex:

Like Terms:

Ex:

Unlike Terms:

Ex: