

# Combining Negations!

## Lesson for Grade 5-7

### Author's Note:

This is an introduction to negative numbers as zero pairs. It focuses only indirectly on the absolute value of the integers without going into direct instruction on absolute value for its own sake. The bonus problems at the end of the student handout can allow students who need enrichment to branch out into a more abstract concept of how we use the ideas in the lesson.

### Content Objectives:

- Develop a concrete model for the creation of zero pairs when combining negative and positive exponents.
- Understand subtraction as simply a model of negating positives
- Understanding positives as a way to negate negatives!
- Begin to introduce the idea that this works with variables (for more advanced students)

### Common Core Standards:

- CCSS.MATH.CONTENT.6.NS.C.6.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, e.g.,  $-(-3) = 3$ , and that 0 is its own opposite.

### Materials:

- Devices for students to access PhET simulation Expression Exchange
- Copies of the handout
- Warmup Document (to project or copy onto the board)
- Whiteboard/smartboard for teacher to demonstrate setup
- Student math notebooks or foldables

## 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>• Solicit student answers, encourage them to keep this number line in their minds as they begin the next exercise.</li></ul>	<ul style="list-style-type: none"><li>• Try the warm up</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>• Demonstrate how to set up the board:<ul style="list-style-type: none"><li>○ Go to the sim link: <a href="http://www.colorado.edu/physics/phet/dev/html/expression-exchange/1.0.0-dev.14/expression-exchange_en.html">http://www.colorado.edu/physics/phet/dev/html/expression-exchange/1.0.0-dev.14/expression-exchange_en.html</a></li><li>○ Click on the variables window</li><li>○ Minimize Total, Values, and My Collection windows (for now).</li><li>○ Drag 5 ones onto the right side of the work area.</li><li>○ Scroll to the right on the bottom until you find -1's and place 5 of them on the left side of your board.</li></ul></li><li>• Tell students that once they do that, they will have five minutes to play with the numbers. For now, don't touch the minimized windows. After five minutes, report what you learned.</li><li>• Keep students on track.</li><li>• Ask students what they learned.</li></ul>	<ul style="list-style-type: none"><li>• Set up the page as directed.</li><li>• Explore the sim within the given parameters and learn the different functions.</li><li>• Make some observations about what they found on their handout</li><li>• Respond to teacher questions and listen to their peers' responses</li></ul>

<p>Some responses may be:</p> <ul style="list-style-type: none"> <li>○ Observations about how the sim works. Highlight these in case anyone missed it.</li> <li>○ Observations about positives and negatives cancelling, and like types “adding”</li> <li>● Be prepared to work student observations into the lesson</li> </ul>	
<p>Directed Instruction: 10-15 minutes</p>	
<p>Teacher will...</p>	<p>Students will...</p>
<ul style="list-style-type: none"> <li>● Ask (If it has not already been discussed in the exploration): what happens when we drop a 1 onto a -1? <ul style="list-style-type: none"> <li>○ They cancel, they go away, etc.</li> </ul> </li> <li>● Why do you think this is? Hint: think of the warm up!</li> <li>● Introduce students to the term <b>zero pair</b>, and have students record it in their notebooks. A zero pair is when a positive number is added to its <b>negation</b>, -1, and VICE VERSA.</li> <li>● Define <b>negation</b> as “what we add to a number to get zero.” Sometimes, we add a negative, and sometimes we add a positive. It depends on what we start with! Students fill out box B.</li> <li>● Direct students to clear their boards. Then ask them to line up 4 positives and 6 negatives across from each other, in two lines.</li> <li>● Tell students we are about to combine these two numbers. (remind them if necessary that another name for 4 is 1+1+1+1) They are about to collide, like two opposing armies, and when they collide, each pair will annihilate the other, forming zeroes. Which side will win? <ul style="list-style-type: none"> <li>○ The negatives, -1’s, etc.</li> </ul> </li> <li>● By how much will they win? <ul style="list-style-type: none"> <li>○ By 2!</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Follow teacher directions</li> <li>● Complete handout as directed</li> <li>● Use the board appropriately</li> <li>● Challenge themselves on the end of the worksheet</li> </ul>

<ul style="list-style-type: none"> <li>● How do you know? <ul style="list-style-type: none"> <li>○ Because there are two more of them; they don't have negations to make them go away, etc.</li> </ul> </li> <li>● Direct students to open up their Total tab to see if they were correct. Tell them that the total tab will always keep track of what is on the board--since there are four zeroes and two negative ones, the total is -2. (This may provoke some, "Four zeroes?!" comments, explain that four of the -1's were negated by forming zero pairs. Better yet, have another student explain this.)</li> <li>● Ask them to write a number model for what they just did: <ul style="list-style-type: none"> <li>○ <math>4 + -6 = -2</math></li> </ul> </li> <li>● Explain that we usually put parentheses between double signs, and demonstrate this.</li> <li>● Tell students that they will have their own epic battles now. Sound effects are encouraged. They can create a few scenarios of their choosing on the board, and show their number models in box C of their handout..</li> <li>● Continue to use the vocabulary <b>negation</b> and <b>zero pair</b> frequently in assisting students.</li> <li>● Share some of the epic battles with the class.</li> </ul>	
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Wrap Up: 10 minutes

Teacher will...	Students will...
<ul style="list-style-type: none"> <li>● Gather students' attention and ask them to think about what they learned from the set of "epic battles" written in mathematical form on the board. Tell them we are going to come up with some rules for what to do when we combine negations.</li> <li>● Take down student suggestions as the class agrees on a set of rules for</li> </ul>	<ul style="list-style-type: none"> <li>● Offer up their ideas for rules</li> <li>● Listen to each other and add on to others' suggestions.</li> <li>● Record the rules they developed in their math notebooks</li> </ul>

adding positives and negatives.

- Explain that it can be helpful to think of “combining” rather than adding and subtracting. It turns out that all that time in elementary school when you were “subtracting” you were really just combining groups of ones with their negations!
- We can note, for those who crave some algebra, that  $x+(-x)=0$  if you want to be fancy!

## Negations!

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

- 1) Google search PhET Simulations. When the results return, click on Math.
- 2) Scroll through the sims until you find **Expression Exchange**. Start this sim.
- 3) Select Variables.
- 4) Set up this board as demonstrated by your teacher.
- 5) Explore!

**A: LIST ONE THING YOU NOTICED FROM PLAYING AROUND WITH THE NUMBERS:**

**B: WHAT HAPPENS WHEN YOU COMBINE A 1 AND A -1?**

**WHY DO YOU THINK THIS HAPPENS? (THINK OF THE WARM UP!)**

**WHAT IS THE NEGATION OF 1? \_\_\_\_\_**

**WHAT IS THE NEGATION OF -1? \_\_\_\_\_**

**C: CLEAR THE BOARD, THEN SET UP YOUR OWN "EPIC BATTLE." DRAW IT HERE. WHICH SIDE WINS?**

\_\_\_\_\_

SHOW THIS AS A NUMBER MODEL: \_\_\_\_\_

D: DRAW A PICTURE TO SHOW HOW A FRIEND ARRANGED THEIR BOARD FOR THEIR "BATTLE."

WHAT WOULD THE NUMBER MODEL BE?

E: SOLVE THE FOLLOWING ADDITION PROBLEMS. YOU MAY USE YOUR BOARD IF YOU WISH.

1)  $6 + (-5) =$

2)  $-9 + 17 =$

3)  $7 + (-9) =$

F: WHAT IS THE NEGATION OF 13? \_\_\_\_\_ WHY?

WHAT IS THE NEGATION OF -55? \_\_\_\_\_ WHY?

**BONUS!**

FILL IN THE BLANKS! IF YOU WANT, YOU CAN USE YOUR BOARD TO HELP YOU!

$-92 + \underline{\hspace{2cm}} = 0$

$-13 + \underline{\hspace{2cm}} = 2$

$82 + \underline{\hspace{2cm}} = 0$

$-21 + \underline{\hspace{2cm}} = -6$

$x + \underline{\hspace{2cm}} = 0$

$5x + \underline{\hspace{2cm}} = 0$

$-2x + \underline{\hspace{2cm}} = 0$

## Warm Up

Fill in the blanks on the number line below:

\_\_\_\_\_ -4 \_\_\_\_\_ \_\_\_\_\_ -1 0 1 2 3 \_\_\_\_\_ \_\_\_\_\_

How far away from 0 is -3?

Make a guess: what is the opposite of 5?