

Introduction

<div> <h3>Expressions and Equations</h3> </div> <div> <p>Physical and mathematical modeling – algebraic expressions</p> </div> <div> </div> <div> </div>	<p>Handouts:</p> <ul style="list-style-type: none"> • Set of paper algebra tiles, cut out (Positive-Blue, Green and Yellow; Negative-Red) • T-Chart template • Paper to write on
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<div> <h3>Learning Target –</h3> </div> <div> <p>I can model expressions using physical and mathematical models</p> </div> <div style="background-color: #e0f0e0; padding: 10px;"> <ul style="list-style-type: none"> • Identifying essential variables Determined value – 3, 28, $-12\frac{1}{2}$ Undetermined value – some, a few; (x, a, b,...) • Describing the relationships between the variables (and numbers) "I can eat twice as many as Jada can." → 2j • Performing the operations Expressions vs equations </div>	
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<div> <h3>Algebra Tiles</h3> </div> <div> <p>Linking the conceptual to the concrete</p> </div> <div> </div>	<p>Linking the conceptual to the concrete.</p>
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Review Prerequisite Skills for Students to Work with Algebraic Equations, Using Algebra Tiles

Terms in an expression

In elementary mathematics, a **term** is either a single number or variable, or the product of several numbers or variables. Terms are separated by a + or - sign in an overall **expression**.

Two terms:
 Positive 4 + 4 or just plain 4
 Negative 2 - 2

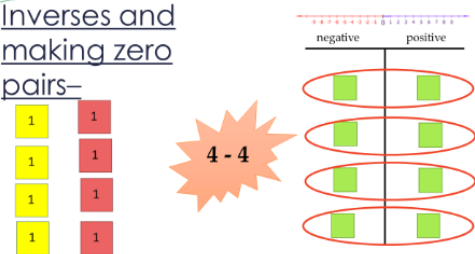
• How many terms are in this expression?
 • What are the terms?



First Prerequisite

- Term
- Expression = terms separated by a + or – sign
- Students need to determine:
 - How many terms are in an expression?
 - What are the terms?

Inverses and making zero pairs–



Terms, terms, terms...


Second Prerequisite

- Use the red tiles for the negative
- Inverse operations are opposite operations
- Zero Pair: use one-to-one correspondence to find pairs that equal zero. Take each zero pair off

Inverses and making zero pairs–

Scaffolding:
 4
 -(4)
 -(-4)
 -(-(-4))

Start at the center and work your way out



Third Prerequisite

- The relationship of negatives, parentheses and inverses
- The key is to work from the inside of the parentheses to the outside

ACTIVITY 1 - Understanding relationship of negatives, parentheses and inverses

4
 -(4)
 -(-4)
 -(-(-4))

The Tiles

Conceptualizing addition and subtraction of integers

	negative	positive
-2 + 4 - 1	1 1	1 1
3 - 5 + -2	1 1 1	1

Prerequisites:

- Separating terms within an expression
- Understanding of inverses

Use of tiles for operations of integers AKA making zero pairs

ACTIVITY 2 – Conceptualizing addition and subtraction of Integers

- Model the expression with the tiles
- Then use the t chart and the concept of zero pairs to demonstrate simplifying and creating an equivalent expression

(use the red tiles for negative)

The Tiles: Using Variables

The Tiles

What does an "x" look like?

1	1	<div style="border: 1px solid black; padding: 2px; font-size: 0.8em;"> 6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers </div> <div style="border: 1px solid black; padding: 2px; font-size: 0.8em; margin-top: 10px;"> 6.EE.4 Identify when two expressions are equivalent </div>
x	x	
x ²	x ²	

What does an "x" look like?

- Variables are formally introduced in Grade 6
- Standard 6.EE.2 – Write, read and evaluate expressions in which letters stand for numbers
- Standard 6.EE.4 – Identify when two expressions are equivalent

Algebra Tiles -

modeling operations with polynomials

x	1	1	1
x	1	x	1
x	1		1
x			

answer

ACTIVITY 3: Modeling operations and polynomials

- Participants lay out the same tiles as shown in the video
- Write the algebraic expression these represent using symbolic notation

Algebra Tiles -
combining like terms

$4x - 3 - x + 4$

ACTIVITY 4: Modeling operations and polynomials with a T-Chart

- Use the same tiles from Activity 3 and place them on a T-Chart
- Find and remove zero pairs to simplify

Physical modeling \rightarrow Mathematical modeling

answer

ACTIVITY 5: Physical Model to Mathematical Model

- Find the mathematical model based on the physical model on the video
- Is there a simplified form?

$3x - 2x^2 - 1 - 3x + 2x^2$

answer

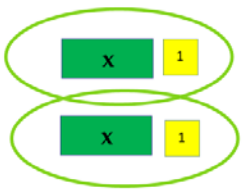
ACTIVITY 6: Mathematical Model to Physical Model

- Use tiles to build a physical model of the mathematical expression


$3x - 2x^2 - 1 - 3x + 2x^2$

The Distributive Property

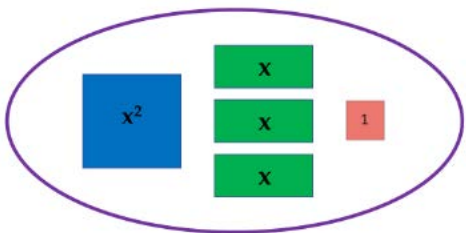

The Distributive Property-
modeling the multiplication of quantities



$2(x + 1)$



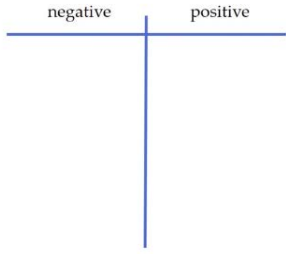
$3(x^2 + 3x - 1)$

ACTIVITY 7 – Modeling the multiplication of quantities

- Model the expression with tiles
 - The video shows the tiles needed to represent the quantity inside the parentheses
- Write the simplified expression

$4x - 3 - x + 9$



DEMONSTRATION – Using T-Charts to build relational understanding

$4(2x - 3)$

↑ Number of groups
↑ Number in each group

negative	positive
3	2x
3	2x
3	2x
3	2x
- 12 + 8x	
8x - 12	

DEMONSTRATION – Using T-Charts with the Distributive Property

4 (2x – 3)

Number of groups: (4)

Number in each group: (2x – 3)

Inverses and Subtracting Quantities

Inverses and subtracting quantities-

inverse \rightarrow $-(2x - 3)$

x

x

1

1

1

\rightarrow

\rightarrow

$-2x + 3$

Process (just using tiles)

- Model the quantity inside the parentheses (2x - 3)
- Distribute the “-“/inverse by using the tiles to model the quantities changing from negative to positive; or from positive to negative; by changing the colors of the tiles.
- (2) green x’s change to (2) red x’s
- (3) red 1’s change to (3) yellow 1’s
- $-(2x - 3)$ simplifies to $-2x + 3$

negative	positive	negative	positive
1	x	x	1
1	x	x	1
1			1

$-(2x - 3)$

Process (using tiles and a t-chart)

- Model the quantity inside the parentheses (2x-3)
- Distribute the “-“/inverse by modeling how the tile colors change and MOVE from negative side to the positive side; or from the positive side to the negative side of the T-chart

Summary and Closing

<p>$4(2x - 3) - (x + 6)$</p>	<table style="margin: auto;"> <tr> <th style="border-bottom: 1px solid black;">negative</th> <th style="border-bottom: 1px solid black;">positive</th> </tr> <tr> <td>3</td> <td>2x</td> </tr> <tr> <td>3</td> <td>2x</td> </tr> <tr> <td>3</td> <td>2x</td> </tr> <tr> <td>3</td> <td>2x</td> </tr> <tr> <td style="color: red;">x</td> <td></td> </tr> <tr> <td style="color: red;">6</td> <td></td> </tr> </table>	negative	positive	3	2x	3	2x	3	2x	3	2x	x		6		<p>Demonstration – Putting it all together</p>
negative	positive															
3	2x															
3	2x															
3	2x															
3	2x															
x																
6																

<p style="text-align: center;">Try Me!!</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>$5x - (3x - 4)$</p> </div> <div style="text-align: center;"> <p>$(5x - 1) - (3x - 4)$</p> </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;"> <div style="text-align: center;"> <p>$2 + x - (x - 3)$</p> </div> <div style="text-align: center;"> <p>$2x - (3x + 4)$</p> </div> </div>	<p>Activity 8 (optional) Using T-charts to simplify algebraic expressions</p> <p style="text-align: center; margin-top: 20px;">$5x - (3x - 4)$</p> <p style="text-align: center; margin-top: 10px;">$(5x - 1) - (3x - 4)$</p> <p style="text-align: center; margin-top: 10px;">$2 + x - (x - 3)$</p> <p style="text-align: center; margin-top: 10px;">$2x - (3x + 4)$</p>
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<p>Tutorials and Virtual Tiles</p> <p>Algebra for All – Algebra Tile Applet http://a4a.learnport.org/page/algebra-tiles</p> <ul style="list-style-type: none"> • Users can download this Algebra Tile Applet, save to a flash drive to use off-line <p>Math Bits – Working with Algebra Tiles https://mathbits.com/MathBits/AlgebraTiles/AlgebraTiles/AlgebraTiles.html</p>
