



Name: _____

Date: _____

Student Exploration: Addition of Polynomials

Vocabulary: coefficient, constant, like terms, monomial, polynomial, zero pair

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. Mark has 2 dogs and 4 cats. Jane has 1 dog and 8 fish.

A. How many of each type of pet do they have, total? _____

B. Suppose d = number of dogs, c = number of cats, and f = number of fish. Fill in the blanks below to write an equation for this problem.

$$\underline{\quad} d + \underline{\quad} c + \underline{\quad} d + \underline{\quad} f = \underline{\quad} d + \underline{\quad} c + \underline{\quad} f$$

2. Fill in the blanks below to show the sum of $(2x^2 + 4x)$ and $(x^2 + 8)$.

$$(2x^2 + 4x) + (x^2 + 8) = \underline{\quad} x^2 + \underline{\quad} x + \underline{\quad}$$

Gizmo Overview

When you simplified the expression $(2x^2 + 4x) + (x^2 + 8)$ above, you added **like terms**, or **monomials** that contain the same variables raised to the same exponents. In the *Addition of Polynomials* Gizmo, you will use tiles to add like terms and find the sum of **polynomials** of the form $ax^2 + bx + c$.

Here's how the Gizmo works:

The sum for you to find is here.

Find the sum

$$(x^2 + 3x + 5) + (2x^2 - 4x - 1).$$

1.) Start by modeling the first polynomial. Drag tiles from the stacks on the right into the top box (or simply click them) to model:

$$x^2 + 3x + 5$$

2.) Click 'Continue' to proceed.

Feedback will appear here.

You will model the first polynomial by dragging or clicking to place the colored tiles here.




After you click **Continue**, model the second polynomial here.

Then you will combine the two groups of tiles to model the sum.

New

Continue



Activity A: Modeling polynomial addition	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> You should see $(x^2 + 3x + 5) + (2x^2 - 4x - 1)$ at the top of the Gizmo. If you do not, click Refresh in your browser. 	
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1. In this question, you will use tiles to model the sum $(x^2 + 3x + 5) + (2x^2 - 4x - 1)$.
- A. Model $x^2 + 3x + 5$ in the Gizmo by dragging or clicking blue x^2 -tiles, green x -tiles, and yellow 1-tiles into the top bin. How many of each type of tile did you use?

x^2 -tile(s) _____ x -tiles(s) _____ 1-tile(s) _____

- B. Click **Continue**. Model $2x^2 - 4x - 1$ by dragging or clicking blue x^2 -tiles, red $-x$ -tiles, and red -1 -tiles into the bottom bin. How many of each type of tile did you use?

x^2 -tile(s) _____ $-x$ -tiles(s) _____ -1 -tile(s) _____

- C. Click **Continue**. All of the tiles from both bins will be combined into a single bin to represent the sum of the two polynomials.

To simplify the sum, you need to remove all **zero pairs** of tiles like the pairs shown to the right. A zero pair is two quantities that add to zero.



How many of each type of zero pairs do you see in your model in the Gizmo?

x^2 and $-x^2$ _____ x and $-x$ _____ 1 and -1 _____

- D. Removing zero pairs simplifies the sum without changing its value. Why does removing zero pairs not change the value of the sum? _____

- E. To remove a zero pair, drag a box around the pair and click **Remove**. Remove all of the zero pairs. What is the sum in simplest form? _____

- F. You can add polynomials algebraically, without tiles. Add the numbers in front of the variables, called **coefficients**, of like terms. Then add the **constant** terms, 5 and 1.

Fill in the blanks below to find the sum $(x^2 + 3x + 5) + (2x^2 - 4x - 1)$.

(_____ + _____) x^2 + (_____ + _____) x + (_____ + _____) = _____

(Activity A continued on next page)

Activity A (continued from previous page)

2. Click **New**. You should see the sum $(-2x^2 - 3x + 2) + (2x^2 + x + 5)$.

A. Model the polynomials and find the sum. What is the sum? _____

B. Now use algebra to find the sum. Show your work below.

C. How can you tell by just looking at the coefficients of $-2x^2$ and $2x^2$ that the terms will add to zero? _____

3. Click **New**. Work through more problems in the Gizmo. After you have completed at least 5 problems, choose two sums from the Gizmo to find yourself.

First model the sum of the polynomials, crossing out any zero pairs. Then use algebra to find the sum. Show your work below. Check your answers in the Gizmo.

4. When two polynomials are added, what happens to any like terms that are opposites?



Activity B: Adding polynomials	<u>Get the Gizmo ready:</u>	<div style="display: inline-block; background-color: green; color: white; padding: 2px 5px;">x</div> <div style="display: inline-block; background-color: red; color: white; padding: 2px 5px;">-x</div>
	<ul style="list-style-type: none"> Click New if you need more practice adding polynomials similar to those in this activity. 	<div style="display: inline-block; background-color: green; color: white; padding: 2px 5px;">x</div> <div style="display: inline-block; background-color: red; color: white; padding: 2px 5px;">-x</div>
		<div style="display: inline-block; background-color: green; color: white; padding: 2px 5px;">x</div> <div style="display: inline-block; background-color: red; color: white; padding: 2px 5px;">-x</div>

Sketch a model to find each sum. Then use algebra to find the sum and check your work.

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

3. $(2x^2 - 4x - 5) + (3x^2 + 4x - 1)$

2. $(x^2 + 2x - 4) + (-x^2 - 6x + 3)$

4. $(-3x^2 + 5x - 4) + (2x^2 - x + 4)$

