

9PR2.6 Model, record and explain the operations of addition and subtraction of polynomial expressions, concretely, pictorially and symbolically (limited to polynomials of degree less than or equal to 2).

Adding and Subtracting Polynomials

It can be helpful to use algebra tiles to add or subtract polynomials. Once you understand how to add or subtract the terms, it is easy to perform the operations with the numbers and variables only.

Adding and Subtracting Polynomials Pictorially

Algebra tiles can help you understand the addition and subtraction of polynomials. Follow these steps when adding polynomials using algebra tiles:

1. Model the polynomials with tiles
2. Simplify the equation by cancelling negative and positive tiles of the same size.
3. Determine the solution by counting up the remaining tiles.

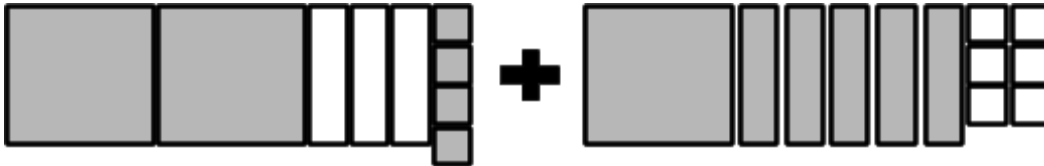
Example

Simplify the polynomial $(2x^2 - 3x + 4) + (x^2 + 5x - 6)$ using algebra tiles.

Solution

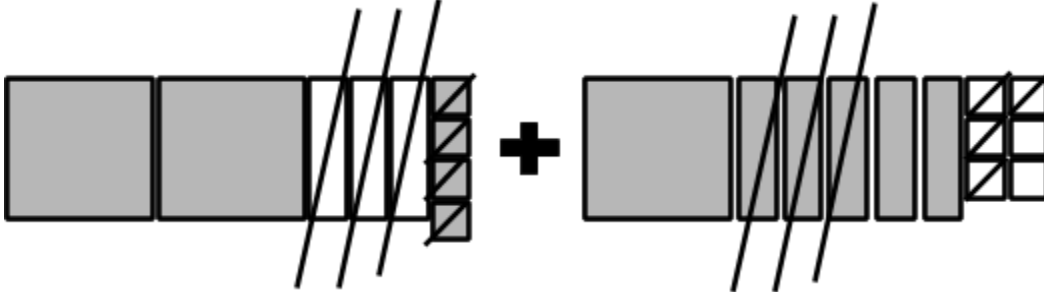
Step 1

Model the polynomials with tiles.



Step 2

Simplify the equation by cancelling negative and positive tiles of the same size.



Step 3

Write the remaining tiles as the solution.



The answer is $3x^2 + 2x - 2$

Follow these steps when subtracting polynomials:

1. Model the polynomials with tiles.
2. Change the tiles of the second polynomial to the opposite colour (its **additive inverse**).
3. Simplify the equation by cancelling negative and positive tiles of the same size.
4. Determine the solution by counting up the remaining tiles.

Example

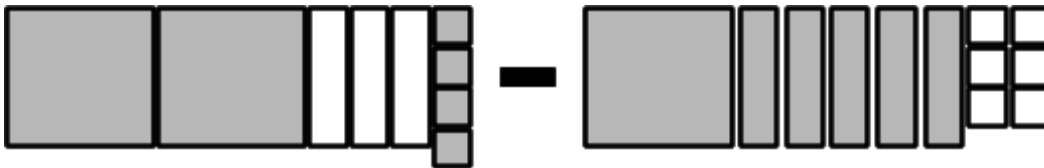
Simplify the polynomial

$(2x^2 - 3x + 4) - (x^2 + 5x - 6)$ using algebra tiles.

Solution

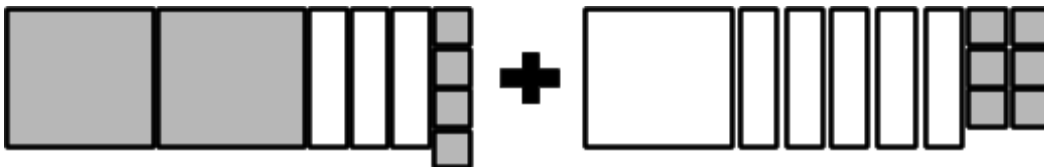
Step 1

Model the polynomials with tiles.



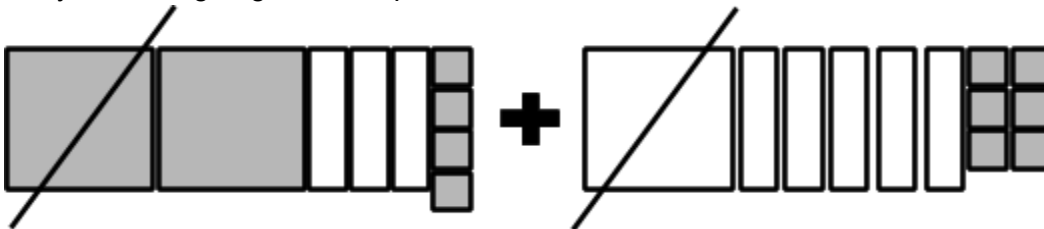
Step 2

Add the opposite with subtracting polynomials. To do this, change the tiles of the second polynomial to the opposite colour.



Step 3

Simplify the equation by cancelling negative and positive tiles of the same size.



Step 4

Determine the solution by counting up the remaining tiles.



The answer is $x^2 - 8x + 10$

Adding and Subtracting Polynomials Algebraically

To add polynomials algebraically, remove the brackets, gather terms in descending order of degree, and combine like terms.

Example

Add the polynomials

$$(-x^2 - 7x - 4) + (5x^2 + 8x - 1)$$

Solution

Step 1

Remove the brackets.

$$-x^2 - 7x - 4 + 5x^2 + 8x - 1$$

Step 2

Organize the terms by writing them in descending order by degree, with the constants as the last term. The degree of a term is the sum of the exponents of all its variables. Recall that if there is no exponent on the variable, it has the degree of 1.

$$-x^2 + 5x^2 - 7x + 8x - 4 - 1$$

Step 3

Combine like terms. Add or subtract the coefficients of like terms while keeping the variable the same. Like terms have the same variable and exponent.

$$4x^2 + x - 5$$

When subtracting polynomials, change the subtraction sign between the polynomials to an addition sign. Then, change each of the terms after the addition sign to its **additive inverse**. Finally, simplify the expression.

Example

Simplify the polynomial

$$(2x^2 - 4x + 6) - (4x^2 - 4x + 1)$$

Solution

Step 1

Change the subtraction sign to an addition sign. Switch the signs of the terms located in the second set of brackets to their opposites.

$$(2x^2 - 4x + 6) + (-4x^2 + 4x - 1)$$

Step 2

Remove the brackets.

$$2x^2 - 4x + 6 - 4x^2 + 4x - 1$$

Step 3

Organize the terms by writing them in descending order by degree, with the constants coming last

The degree of a term is the sum of the exponents of all its variables. Recall that if there is no exponent on the variable, it has a degree of 1.

$$2x^2 - 4x^2 - 4x + 4x + 6 - 1$$

Step 4

Combine like terms.

Add or subtract the coefficients of like terms while keeping the variable the same. Like terms have the same variable and exponent.

$$-2x^2 + 5$$