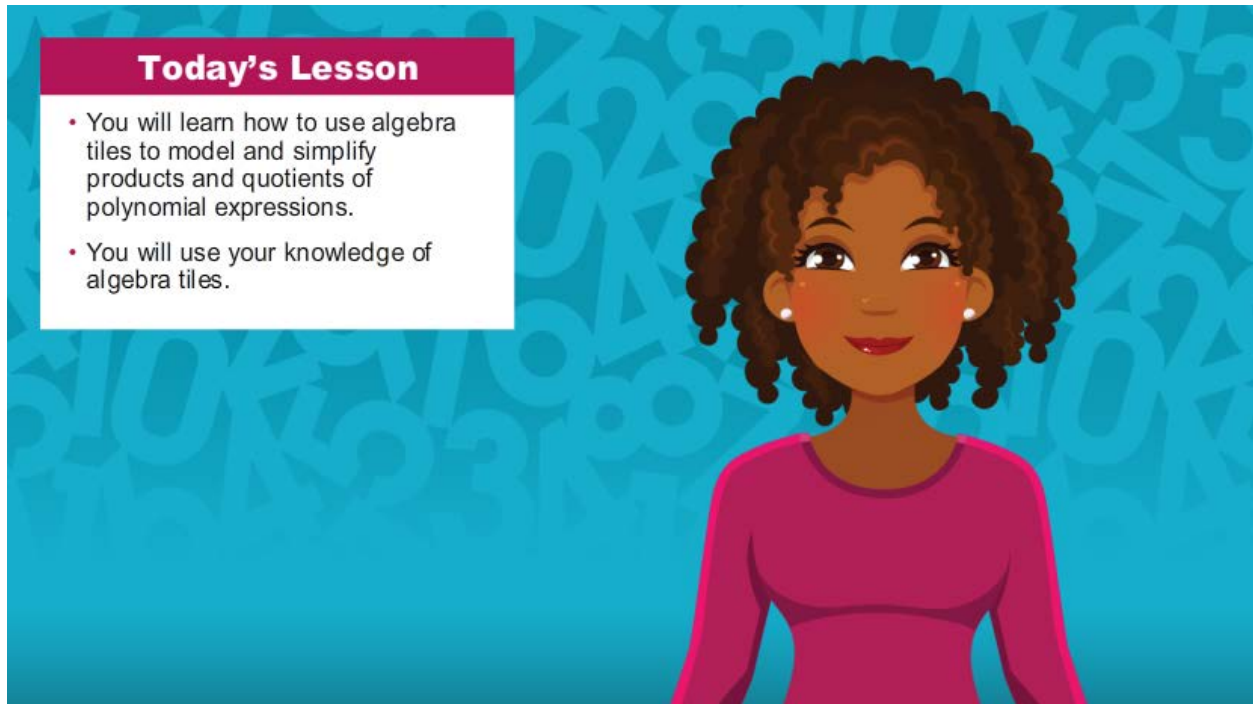


# Module 3: Adding and Subtracting Polynomials

## Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles

### Introduction



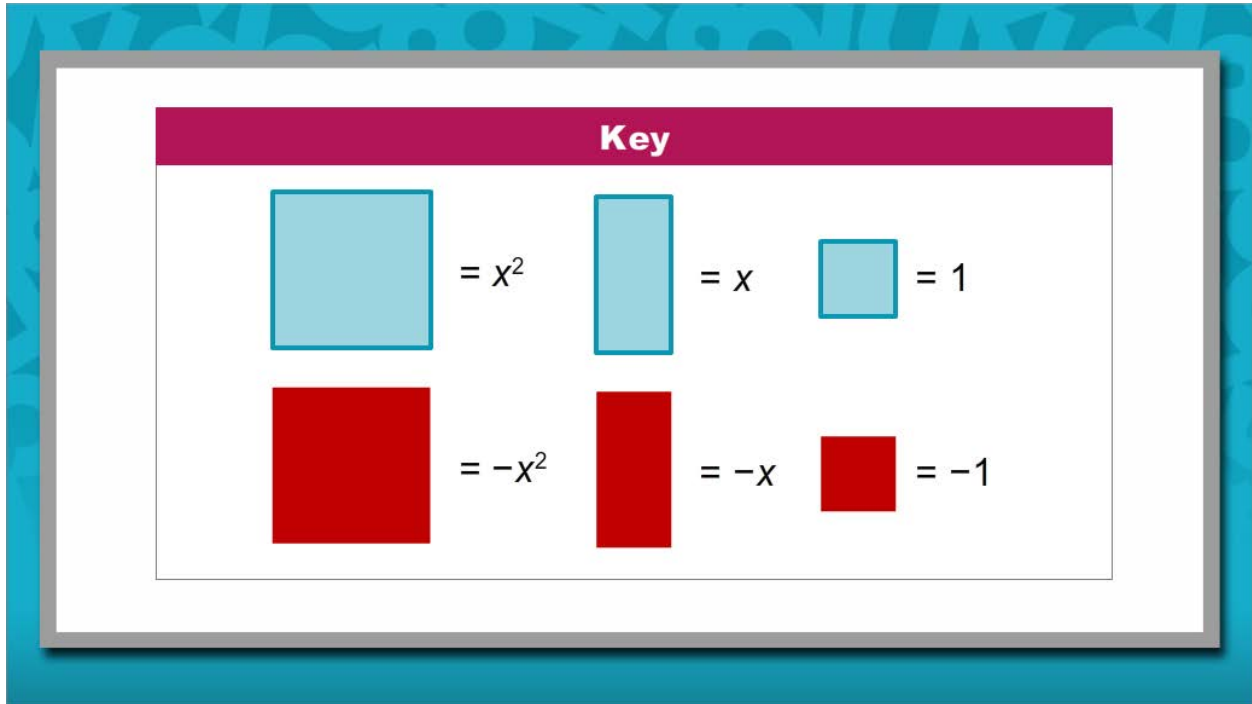
**Today's Lesson**

- You will learn how to use algebra tiles to model and simplify products and quotients of polynomial expressions.
- You will use your knowledge of algebra tiles.

Hello and welcome! I'm so glad to have you here for this lesson in Algebra I, where you will learn how to use algebra tiles to model and simplify products and quotients of polynomial expressions. Your knowledge of how to use algebra tiles to model integer operations will be a useful skill during this lesson.

**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

Anticipatory Set



Take a moment to review what each algebra tile represents.

**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

**Multiplying and Dividing Polynomials – Algebra Tiles**

The image shows a digital interface for learning about algebra tiles. At the top, a blue rounded rectangle contains the title "MULTIPLYING AND DIVIDING POLYNOMIALS - ALGEBRA TILES" in white, bold, uppercase letters. Below this, a yellow text prompt says "Click the Examples Below to Learn More". There are three pink rounded rectangular buttons: "Example One" on the top left, "Example Two" on the bottom left, and "Self-Check" on the top right. The background is a dark chalkboard with faint white mathematical symbols and arrows. In the bottom right corner, there is a photograph of physical white algebra tiles, including a large rectangular tile and a smaller square tile placed on top of it.

Click the examples below to learn more.

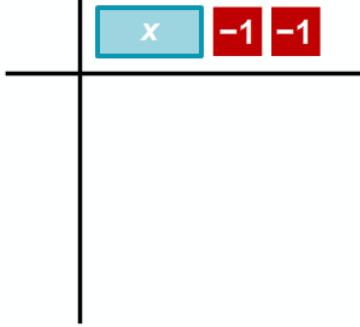
- Example One
- Example Two
- Self-Check

**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

**Example 1**

**EXAMPLE 1**

Use algebra tiles to model and simplify the expression below.

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


Use algebra tiles to model and simplify the expression below.

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

To multiply the binomials  $(x + 1)$  and  $(x - 2)$ , you will need to set up the algebra tiles in a frame as follows. When you use algebra tiles to multiply first-degree polynomials, the result is a rectangle.

The length of this rectangle is  $x - 2$ , represented by the tiles outside the top of the frame. There is 1 blue rectangle to represent  $x$  and 2 red 1-unit squares to represent  $-2$ .

## Module 3: Adding and Subtracting Polynomials

### Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles

Example 1 (continued)

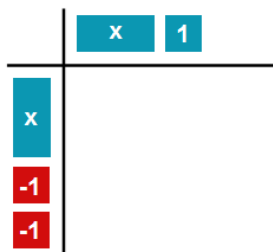
**EXAMPLE 1**

Use algebra tiles to model and simplify the expression below.

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

The width of this rectangle is  $x + 1$ , represented by the tiles outside the left of the frame. There is 1 blue rectangle and 1 blue 1-unit square to represent positive 1.

If you chose to represent the width as  $x - 2$  and the length as  $x + 1$ , that would be acceptable as well.



**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

**Example 1 (continued)**

**EXAMPLE 1**

Use algebra tiles to model and simplify the expression below.

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

The diagram shows a coordinate system with a vertical y-axis and a horizontal x-axis. The origin is at the intersection. To the right of the y-axis, there is a blue rectangular tile labeled 'x' and two red square tiles. To the left of the y-axis, there is one blue rectangular tile labeled 'x' and one blue square tile. To the right of the x-axis, there is one blue square tile labeled 'x<sup>2</sup>'.

Now to determine the product of the binomials, you will need to complete a few multiplication problems.

Begin by multiplying by the first tile of width by each tile of the length.

$$x \cdot x = x^2$$

A blue  $x^2$  tile in the area inside the frame represents this product.

**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

Example 1 (continued)

**EXAMPLE 1**

Use algebra tiles to model and simplify the expression below.

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

The diagram shows a large rectangle formed by algebra tiles. The top-left corner is a large light blue square labeled 'x'. To its right is a red vertical rectangle labeled '-x'. Below the 'x' tile is a smaller light blue square. To the right of the 'x' tile is a light blue horizontal rectangle. To the right of that horizontal rectangle are two red vertical rectangles, one labeled '-1' and one labeled '-x'.

$$x \cdot -1 = -x$$

A red rectangle in the area inside the frame represents this product. And once again:

$$x \cdot -1 = -x$$

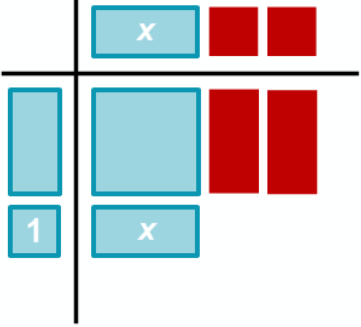
Another red rectangle in the area inside the frame represents this product.

**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

Example 1 (continued)

**EXAMPLE 1**

Use algebra tiles to model and simplify the expression below.

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


Now multiply the next tile of the width by each tile of the length.

$$1 \cdot x = x$$

A blue rectangle in the area inside the frame represents this product. Notice that this rectangle is laying horizontally. This shows that it is the result of multiplying a width of 1 by a length of  $x$ .



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Example 1 (continued)

**EXAMPLE 1**

Use algebra tiles to model and simplify the expression below.

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

$1 \cdot -1 = -1$

A red 1-unit square in the area inside the frame represents this product.

$$1 \cdot -1 = -1$$

Another red 1-unit square represents this product.

**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

Example 1 (continued)

**EXAMPLE 1**

Use algebra tiles to model and simplify the expression below.

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

$x^2$     $x$     $-1$   $-1$   
 $-x$   $-x$

$x^2 - x - 2$

Menu

Now it's time to simplify the product.

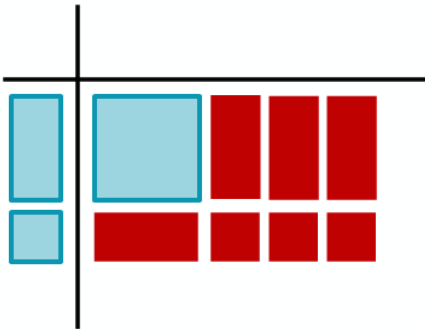
Group the like tiles together. After eliminating the zero pair, you find that the product simplifies to  $x^2 - x - 2$ .

**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

**Example 2**

**EXAMPLE 2**

What is the solution to the quotient represented in the model below?



$$\frac{x^2 - 4x - 3}{x + 1}$$

What is the solution to the quotient represented in the model below?

$$\frac{x^2 - 4x - 3}{x + 1}$$

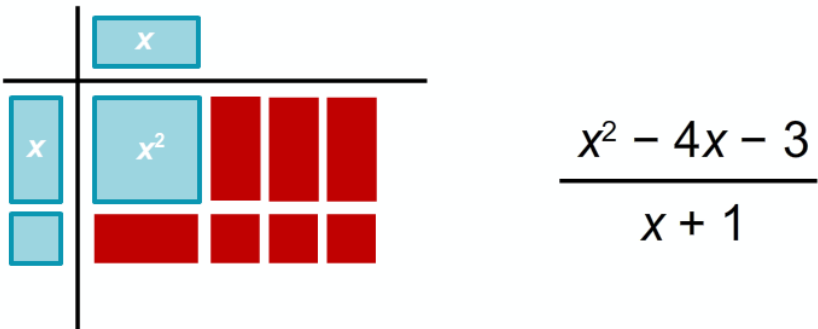
The algebra tiles model the quotient of two polynomials. The tiles in the area inside the frame represent the trinomial,  $x^2 - 4x - 3$ . Along the width of the frame, the tiles represent the binomial,  $x + 1$ . You'll notice the tiles along the length of the frame are missing. Once you determine the quotient of the polynomials, you will determine the missing length.

**Module 3: Adding and Subtracting Polynomials**  
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Example 2 (continued)

**EXAMPLE 2**

What is the solution to the quotient represented in the model below?



$$\frac{x^2 - 4x - 3}{x + 1}$$

Recall that the first row of algebra tiles inside the frame is generated by multiplying the first tile of the width by each tile of the length.

Remember that division is the inverse of multiplication. So, to determine the tiles needed for the length, you must divide each of the tiles in the first row inside the frame by the first tile of the width.

The first tile in the inside area is  $x^2$ .

$$\frac{x^2}{x} = x$$

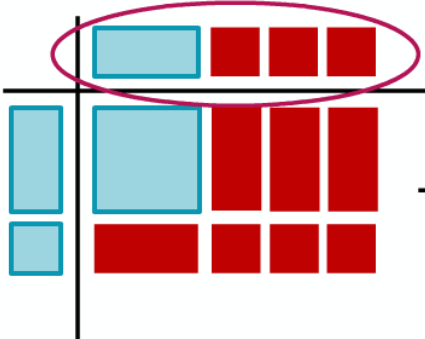
So, the first tile of the length is  $x$ .

**Module 3: Adding and Subtracting Polynomials**  
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Example 2 (continued)

**EXAMPLE 2**

What is the solution to the quotient represented in the model below?



$$\frac{x^2 - 4x - 3}{x + 1} = \boxed{x - 3}$$

**Menu**

Now move on to the second tile in the first row inside the frame,  $-x$ .

$$\frac{-x}{x} = -1$$

So, the second tile of the length is  $-1$ . The third tile in the inside area is also  $-x$ .

$$\frac{-x}{x} = -1$$

The third tile of the length is  $-1$ . The fourth tile in the inside area is also  $-x$ .


$$\frac{-x}{x} = -1$$

The fourth tile of the length is also  $-1$ . You have determined the tiles needed for the unknown length. They represent the binomial  $x - 3$ .

$$\frac{x^2 - 4x - 3}{x + 1} = x - 3$$







**Module 3: Adding and Subtracting Polynomials**  
**Topic 2 Content: Multiplying and Dividing Polynomials – Algebra Tiles**

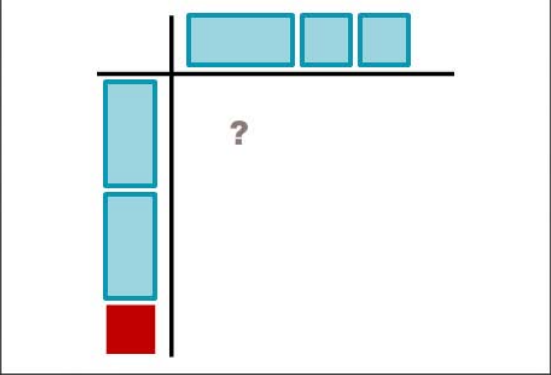
Self-Check 1

 **Self-Check**

Use algebra tiles to model the product of  $(2x - 1)(x + 2)$ .

**Key**

		
$x^2$	$x$	$1$
		
$-x^2$	$-x$	$-1$



**Drag the correct tile from the key and drop it on the question mark.**

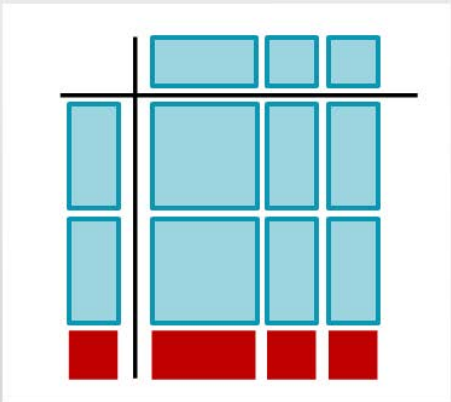
Solve the problem in the image above to check your understanding of the content.

**Module 3: Adding and Subtracting Polynomials**  
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**Self-Check 1: Answer**

**Correct**

That's correct! The algebra tiles on the right correctly model the product of  $(2x - 1)(x + 2)$ .




Continue

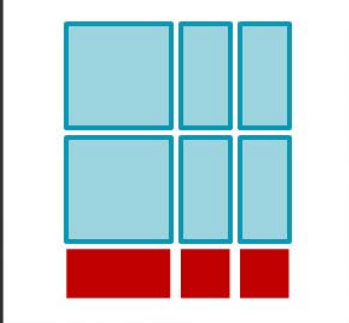
For your reference, the image above shows the correct solution to the self-check problem.

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Self-Check 2

 **Self-Check**

Now simplify the product of  $(2x - 1)(x + 2)$ . Group the like tiles together and simplify.

Drag Box	$x^2$ tiles	$x$ tiles	1-unit tiles
	Drop Area	Drop Area	Drop Area

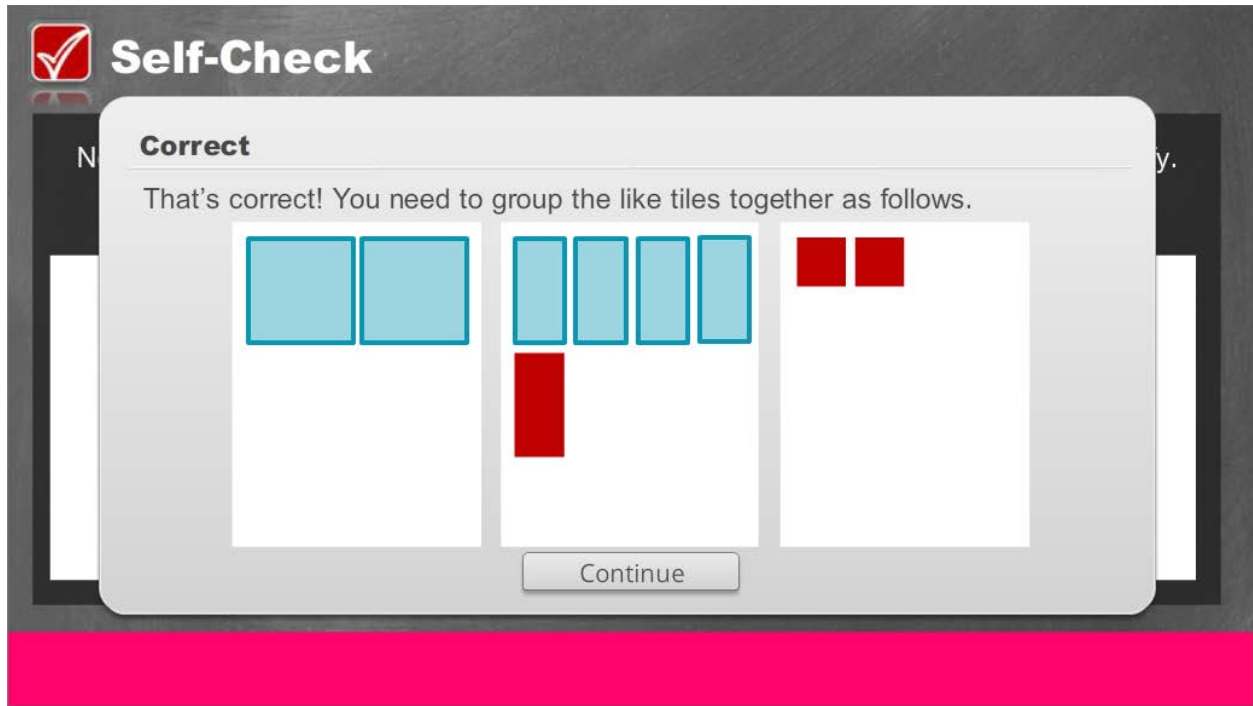
**Group the like tiles together by dragging them to the areas on the right.**

Solve the problem in the image above to check your understanding of the content.



**Module 3: Adding and Subtracting Polynomials**  
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**Self-Check 2: Answer**



For your reference, the image above shows the correct solution to the self-check problem.

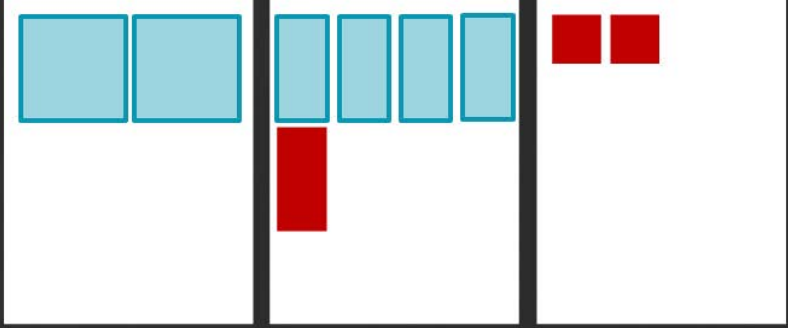
**Module 3: Adding and Subtracting Polynomials**  
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**Self-Check 3**

 **Self-Check**

Finally, simplify the result. Eliminate zero pairs, if necessary.  
Which of the following represents the product of the polynomials?

- $2x^2 + 5x - 1$
- $x^2 + 3x - 1$
- $x^2 + 5x - 2$
- $2x^2 + 3x - 2$



**SUBMIT**

Solve the problem in the image above to check your understanding of the content.

**Module 3: Adding and Subtracting Polynomials**  
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**Self-Check 3: Answer**

**Self-Check**

**Correct**

That's correct! After eliminating zero pairs, the remaining algebra tiles represent the following polynomial.

$2x^2 + 3x - 2$

$2x^2$        $3x$        $-2$

Continue


**SUBMIT**

The image shows a digital interface for a self-check. At the top left is a red checkmark icon. Below it, the text 'Self-Check' is displayed. A central white box contains the word 'Correct' and a message: 'That's correct! After eliminating zero pairs, the remaining algebra tiles represent the following polynomial.' To the left of this box is the polynomial  $2x^2 + 3x - 2$ . To the right, three columns of algebra tiles are shown. The first column, labeled  $2x^2$ , has two light blue squares. The second column, labeled  $3x$ , has three light blue rectangles and one red rectangle below them, with a diagonal line through the top-left corner of the red rectangle. The third column, labeled  $-2$ , has two red squares. Below the tiles is a 'Continue' button. At the bottom of the interface is a large pink bar with the word 'SUBMIT' in white capital letters.







For your reference, the image above shows the correct solution to the self-check problem.

Module 3: Adding and Subtracting Polynomials  
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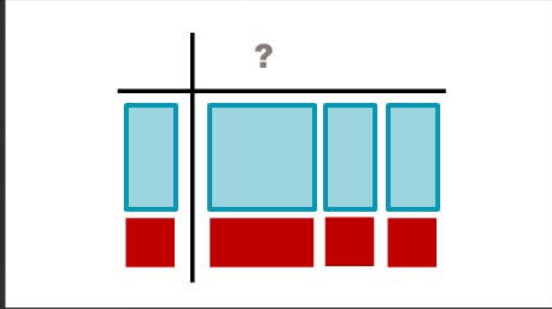
Self-Check 4

 **Self-Check**

**Key**

		
$x^2$	$x$	$1$
		
$-x^2$	$-x$	$-1$

Use algebra tiles to model the quotient of  $\frac{x^2 + x - 2}{x - 1}$



**Drag the correct tile from the key and drop it on the question mark.**

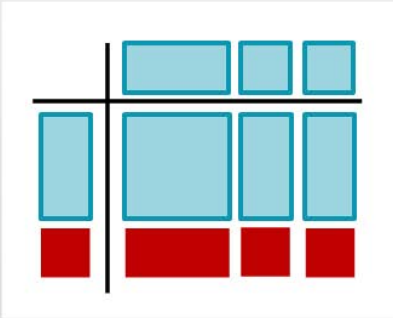
Solve the problem in the image above to check your understanding of the content.

**Module 3: Adding and Subtracting Polynomials**  
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**Self-Check 4: Answer**

**Correct**

That's correct! These algebra tiles correctly model the quotient of  $\frac{x^2 + x - 2}{x - 1}$ .




Continue

For your reference, the image above shows the correct solution to the self-check problem.

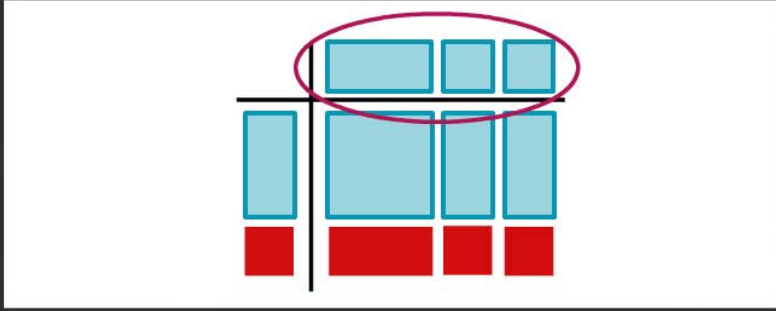
**Module 3: Adding and Subtracting Polynomials**  
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Self-Check 5

 **Self-Check**

Based on the algebra tile model below, what is the quotient of  $\frac{x^2 + x - 2}{x - 1}$  ?

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



**SUBMIT**

Solve the problem in the image above to check your understanding of the content.

**Module 3: Adding and Subtracting Polynomials**  
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**Self-Check 5: Answer**

**Self-Check**

**Correct**

That's correct!

The quotient of  $\frac{x^2 + x - 2}{x - 1}$  is

$x + 2$

Continue

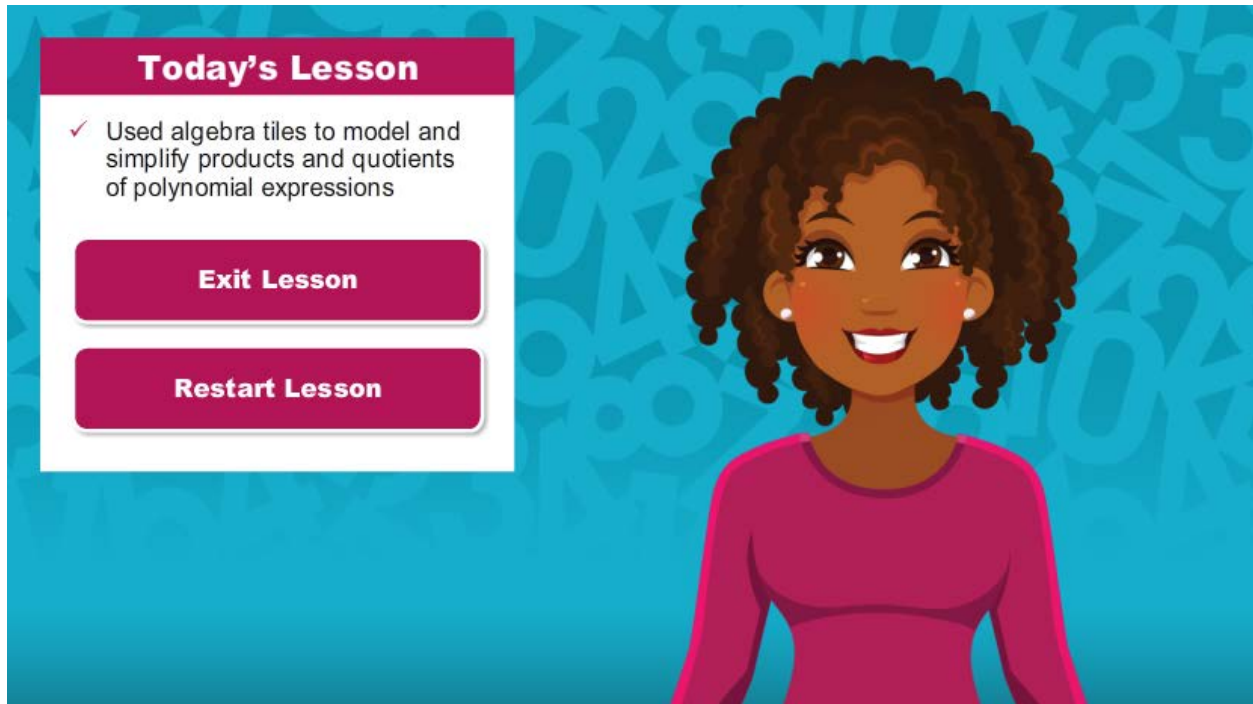
**SUBMIT**

The diagram shows algebra tiles representing the division of  $x^2 + x - 2$  by  $x - 1$ . The dividend is represented by a large blue square (x<sup>2</sup>), a vertical blue rectangle (x), and two small red squares (-2). The divisor is represented by a vertical blue rectangle (x) and a small red square (-1). The quotient is shown as a horizontal row of three tiles: a vertical blue rectangle (x), a small blue square (1), and another small blue square (1). These three tiles are circled in red. The remainder is zero.

For your reference, the image above shows the correct solution to the self-check problem.

**Module 3: Adding and Subtracting Polynomials**  
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**Conclusion**



Congratulations! You have reached the conclusion of this lesson in Algebra I. In this lesson, you were able to apply your knowledge of algebra tiles to model and simplify products and quotients of polynomial expressions.