

**Module 3: Adding and Subtracting Polynomials**  
**Topic 3 Content: Factoring Trinomials With a Leading Coefficient**  
**Not Equal to One**

**Introduction**



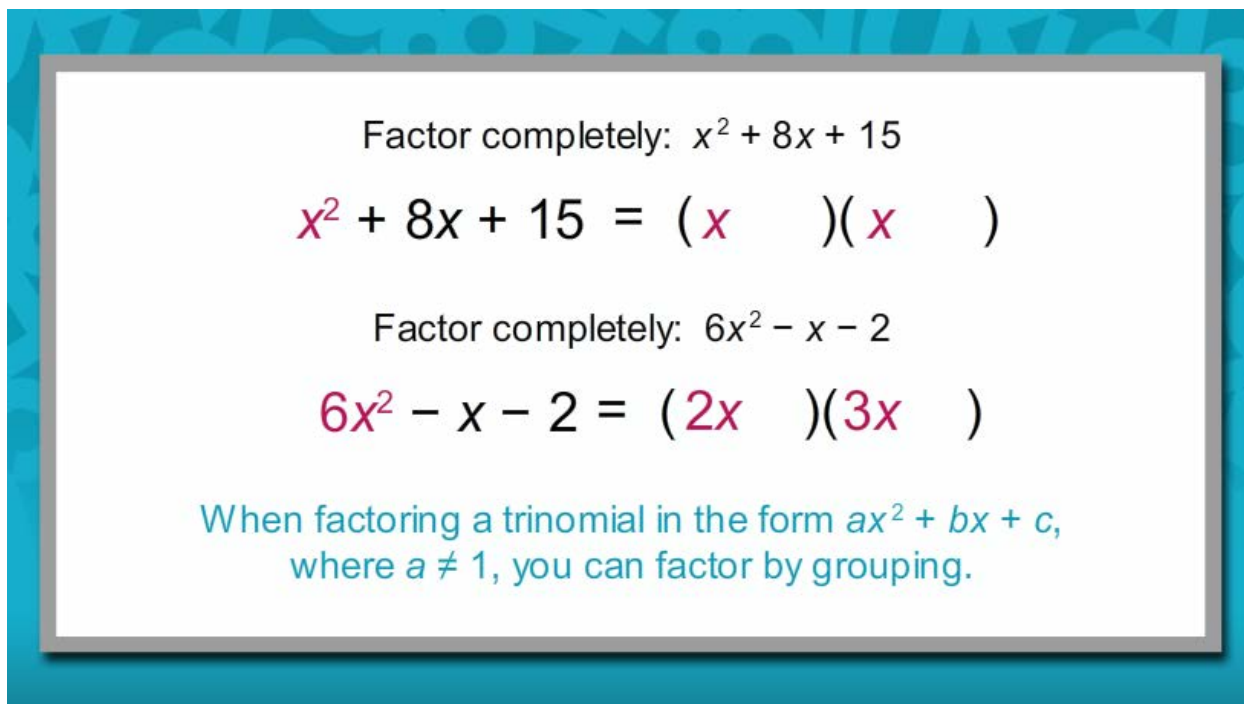
**Today's Lesson**

- You will extend your knowledge of factoring to include second-degree trinomials that have leading coefficient not equal to one.

Hello and welcome! I'm so glad to have you here for this lesson in Algebra I. In this lesson, you will extend your knowledge of factoring to include second-degree trinomials that have a leading coefficient not equal to one.

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Anticipatory Set



Factor completely:  $x^2 + 8x + 15$

$$x^2 + 8x + 15 = (x \quad)(x \quad)$$

Factor completely:  $6x^2 - x - 2$

$$6x^2 - x - 2 = (2x \quad)(3x \quad)$$

When factoring a trinomial in the form  $ax^2 + bx + c$ ,  
where  $a \neq 1$ , you can factor by grouping.

Take for example the given trinomial.

$$x^2 + 8x + 15$$

You know that it can be represented as the product of two binomials. The first term of the trinomial is  $x^2$ , so the first term of each of its factors must be  $x$  because  $x \cdot x = x^2$ .

What if you were asked to factor this trinomial?

$$6x^2 - x - 2$$

The three terms share no common factor other than 1. So, factoring out a greatest common factor wouldn't change much at all.

The first term of this trinomial is  $6x^2$ .

How could you determine what the first term of each of its binomial factors should be? Would they be  $x$  and  $6x$  because  $x \cdot 6x = 6x^2$ ? Or would they be  $2x$  and  $3x$  because  $2x \cdot 3x = 6x^2$ ?

To factor a trinomial in the form  $ax^2 + bx + c$ , where  $a \neq 1$ , you could guess and check different pairs of factors. Or, you could factor by grouping.

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**Factoring Trinomials With a Leading Coefficient Not Equal to One**

The image shows a digital interface for learning about factoring trinomials. At the top, a blue rounded rectangle contains the title "FACTORING TRINOMIALS WITH A LEADING COEFFICIENT NOT EQUAL TO ONE" 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" and "Example Two" are stacked vertically on the left, and "Self-Check" is on the right. The background is dark with faint white chalkboard markings and a 3D rendering of algebra tiles.

Click the examples below to learn more.

- Example One
- Example Two
- Self-Check

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**Example 1**

The image shows a digital notebook interface with a blue border. The notebook page is lined and has two binder holes on the left. The text on the page is handwritten in black ink. At the top, it says "Factors of 18" with a horizontal line underneath. Below that, it says "List the factors of 18 on a sheet of notebook paper". Further down, it says "Click NEXT to verify your factors". On the left side of the notebook, there are some red text elements: "EX", "Factor co", "3x", and "3". On the right side, there is a pink button labeled "Next".

Factor completely:

$$3x^2 + 11x + 6.$$

To factor by grouping, begin by factoring out the greatest common factor.

The terms of this trinomial share no common factor other than 1, so you can move on to the next step of the process, which is to find the product of  $a$  and  $c$ .

$$3 \cdot 6 = 18$$

Now list the factors of 18.

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Example 1 (continued)

The image shows a piece of lined paper with handwritten notes. At the top, the title "Factors of 18" is written in large, bold letters and underlined. Below the title, a sentence reads "Your list of factors should resemble the following". Underneath this sentence, a list of factor pairs is written in two columns: 1 and 18, -1 and -18, 2 and 9, -2 and -9, 3 and 6, and -3 and -6. To the left of the paper, there are some red markings: "E)", "Factor co", "3)", and "3". To the right, there are some faint, partially visible words: "mon factor.", "and c,", and "ors.".

Your list of factors should resemble the following:

Factors of 18	
1	18
-1	-18
2	9
-2	-9
3	6
-3	-6

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Example 1 (continued)

The screenshot shows a digital workspace with a blue border. On the left, there is a vertical sidebar with a red 'E' and the text 'Factor co'. In the center, the title 'Factors of 18' is written in black cursive and underlined. Below the title, a question is written in black cursive: 'Which pair of factors has a sum equal to the coefficient of the middle term?'. A list of factor pairs is shown in black cursive: 1 18, -1 -18, 2 9, -2 -9, 3 6, and -3 -6. At the bottom, another instruction is written in black cursive: 'Click the pair of factors above that has a sum of 11'. On the right side, there is a vertical sidebar with the text 'mon factor.' and 'and c, ors.'.

Which pair of factors has a sum equal to the coefficient of the middle term?

Factors of 18	
1	18
-1	-18
2	9
-2	-9
3	6
-3	-6

Click the pair of factors above that has a sum of 11.

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Example 1 (continued)

**EX**  
Factor co

**3x**  
**3**

## Factors of 18

*Which pair of factors has a sum equal to the coefficient of the middle term?*

$1 + 18 = 19$   
 $-1 + (-18) = -19$   
 **$2 + 9 = 11$**   
 $-2 + (-9) = -11$   
 $3 + 6 = 9$   
 $-3 + (-6) = -9$

**$2 + 9 = 11$**   
*These are the necessary factors*

mon factor.  
and c,  
ors.

**Next**

The numbers 2 and 9 are the factors of 18 that have a sum of 11.

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Example 1 (continued)

<p style="text-align: center;"><b>EXAMPLE 1</b></p> <p>Factor completely: <math>3x^2 + 11x + 6</math></p> $3x^2 + 11x + 6$ $3x^2 + 2x + 9x + 6$ $(3x^2 + 2x) + (9x + 6)$ <p><input type="text"/> ( <input type="text"/> )</p> <p>Enter the correct values above and click <b>SUBMIT</b>. <input type="button" value="Submit"/></p>	<p style="text-align: center;"><b>STEP 1</b></p> <p>Factor out the greatest common factor.</p> <p style="text-align: center;"><b>STEP 2</b></p> <p>Find the product of <math>a</math> and <math>c</math>, and then list its factors.</p> <p style="text-align: center;"><b>STEP 3</b></p> <p>Rewrite the trinomial using the factors with a sum equal to the middle coefficient.</p> <p style="text-align: center;"><b>STEP 4</b></p> <p>Group the terms into two binomials.</p> <p style="text-align: center;"><b>STEP 5</b></p> <p>Factor both binomials completely.</p>
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Now rewrite the trinomial. This time, use the sum of the chosen factors to represent the coefficient of the middle term.

$$3x^2 + 11x + 6$$
$$3x^2 + 2x + 9x + 6$$

Although the polynomial appears to have changed, you haven't changed its value at all because  $2x + 9x = 11x$ .

Next, group the terms into two binomials.

$$(3x^2 + 2x) + (9x + 6)$$

Now factor the first binomial completely.

$$3x^2 + 2x$$



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Example 1 (continued)

**EXAMPLE 1**

Factor completely:  $3x^2 + 11x + 6$

$$3x^2 + 11x + 6$$
$$3x^2 + 2x + 9x + 6$$
$$(3x^2 + 2x) + (9x + 6)$$
$$x(3x + 2)$$

Determine the greatest common factor by factoring each term completely.

$$3x^2 = 3 \cdot x \cdot x$$
$$2x = 2 \cdot x$$

The greatest common factor (GCF) is  $x$ . Now, factor the GCF out of the terms of the first binomial. To accomplish this, divide each of its terms by the GCF.

$$\frac{3x^2}{x} = 3x \quad \frac{2x}{x} = 2$$

So, when factored completely, the first binomial can be represented as

$$x(3x + 2).$$

**Next**

Determine the greatest common factor by factoring each term completely.

$$3x^2 = 3 \cdot x \cdot x$$
$$2x = 2 \cdot x$$

The greatest common factor is  $x$ .

Now that you have identified the greatest common factor, factor it out of the terms of the first binomial. To accomplish this, divide each of its terms by the greatest common factor.

$$\frac{3x^2}{x} = 3x$$

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

So when factored completely, the first binomial can be represented as

$$x(3x + 2).$$

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Example 1 (continued)

<p style="text-align: center;"><b>EXAMPLE 1</b></p> <p>Factor completely: <math>3x^2 + 11x + 6</math></p> $3x^2 + 11x + 6$ $3x^2 + 2x + 9x + 6$ $(3x^2 + 2x) + (9x + 6)$ $x(3x + 2) \quad \square \quad (\square)$ <p>Enter the correct values above and click <b>SUBMIT</b>. <input type="button" value="Submit"/></p>	<p style="text-align: center;"><b>STEP 1</b></p> <p>Factor out the greatest common factor.</p> <p style="text-align: center;"><b>STEP 2</b></p> <p>Find the product of <math>a</math> and <math>c</math>, and then list its factors.</p> <p style="text-align: center;"><b>STEP 3</b></p> <p>Rewrite the trinomial using the factors with a sum equal to the middle coefficient.</p> <p style="text-align: center;"><b>STEP 4</b></p> <p>Group the terms into two binomials.</p> <p style="text-align: center;"><b>STEP 5</b></p> <p>Factor both binomials completely.</p>
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Now factor the second binomial completely.

$$9x + 6$$

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Example 1 (continued)

**EXAMPLE 1**

Factor completely:  $3x^2 + 11x + 6$

$$3x^2 + 11x + 6$$
$$3x^2 + 2x + 9x + 6$$
$$(3x^2 + 2x) + (9x + 6)$$
$$x(3x + 2) + 3(3x + 2)$$

Determine the greatest common factor.

$$9x = 3 \cdot 3 \cdot x$$
$$6 = 2 \cdot 3$$

The greatest common factor (GCF) is 3.  
Now, divide each term by the GCF.

$$\frac{9x}{3} = 3x \quad \frac{6}{3} = 2$$

The second binomial factors completely to

$$3(3x + 2)$$

**Next**

Determine the greatest common factor.

$$9x = 3 \cdot 3 \cdot x$$
$$6 = 2 \cdot 3$$

The greatest common factor is 3.

Now divide each term by the greatest common factor.

$$\frac{9x}{3} = 3x$$

$$\frac{6}{3} = 2$$

The second binomial factors completely to  $3(3x + 2)$ .

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Example 1 (continued)

**EXAMPLE 1**  
Factor completely:  $3x^2 + 11x + 6$

$$3x^2 + 11x + 6$$
$$3x^2 + 2x + 9x + 6$$
$$(3x^2 + 2x) + (9x + 6)$$
$$x(3x + 2) + 3(3x + 2)$$
$$(3x + 2)(x + 3)$$

**STEP 1**  
Factor out the greatest common factor.

**STEP 2**  
Find the product of  $a$  and  $c$ , and then list its factors.

**STEP 3**  
Rewrite the trinomial using the factors with a sum equal to the middle coefficient.

**STEP 4**  
Group the terms into two binomials.

**STEP 5**  
Factor both binomials completely.

**STEP 6**  
Factor the shared binomial out of the expression.

[Menu](#)

Notice that the groups each have a binomial factor of  $(3x + 2)$ . Factor it out of the expression.

$$x(3x + 2) + 3(3x + 2)$$
$$(3x + 2)(x + 3)$$

Finally, you can represent the expression as the product of the binomials

$$(3x + 2)$$

and

$$(x + 3).$$

You have factored the given trinomial completely.

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**Example 2**

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$10x^2 - 2x - 8$

Do the terms share a greatest common factor other than 1?

**Yes**

**No**

Factor completely:

$$10x^2 - 2x - 8.$$

Begin by considering the terms of the trinomial. Do the terms share a greatest common factor other than 1?

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Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$

**STEP 1**

Factor out the greatest common factor.

Which of the following accurately represents the trinomial?

**$2(8x^2 - x - 6)$**

**$2(5x^2 - x - 4)$**

**$2(5x^2 + x + 4)$**

The answer is yes. The terms of the trinomial have a greatest common factor of 2.

Factor out the greatest common factor.

Which of the following accurately represents the trinomial?

- A)  $2(8x^2 - x - 6)$
- B)  $2(5x^2 - x - 4)$
- C)  $2(5x^2 + x + 4)$

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Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$
$$2(5x^2 - x - 4)$$

**STEP 1**

Factor out the greatest common factor.

Divide each term of the trinomial by the greatest common factor of 2.

$$\frac{10x^2}{2} = 5x^2 \quad \frac{2x}{2} = x \quad \frac{8}{2} = 4$$

Now that the greatest common factor is factored out, the trinomial can be represented as:

$$2(5x^2 - x - 4)$$

Next

To determine the answer, divide each term of the trinomial by the greatest common factor of 2.

$$10x^2 - 2x - 8$$

$$\frac{10x^2}{2} = 5x^2$$

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

$$\frac{-8}{2} = -4$$

Now that the greatest common factor is factored out, the trinomial can be represented as

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

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Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$
$$2(5x^2 - x - 4)$$

**STEP 1**

Factor out the greatest common factor.

**STEP 2**

Find the product of  $a$  and  $c$ ,  
and then list its factors.

$$5 \cdot -4 = \boxed{\phantom{00}}$$

Enter your answer above  
and click **SUBMIT**.

Submit

For a moment, set aside the greatest common factor of 2 and focus your attention on the trinomial  $5x^2 - x - 4$ . You can factor this trinomial by grouping. Begin by finding the product of  $a$  and  $c$ .

What is the product of 5 and  $-4$ ?



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Example 2 (continued)

**EXAMPLE 2**  
Factor completely:  $10x^2 - 2x - 8$   
 $10x^2 - 2x - 8$   
 $2(5x^2 - x - 4)$

**STEP 1**  
Factor out the greatest common factor.

**STEP 2**  
Find the product of  $a$  and  $c$ ,  
and then list its factors.

$5 \cdot -4 = -20$

The product of 5 and  $-4$  is  $-20$ .  
Now, you should list the factors of  $-20$ .

**Next**

The correct answer is

$$5 \cdot -4 = -20.$$

Now list the factors of  $-20$  on a sheet of notebook paper.

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Example 2 (continued)

The screenshot shows a digital notebook interface with a blue border. The main content is on a white background with horizontal blue lines. At the top, the text "Factors of -20" is written in black and underlined. Below it, a handwritten note says "Your list of factors should resemble the following". A list of factor pairs is written in black ink:

1	-20
-1	20
2	-10
-2	10
4	-5
-4	5

On the left side of the notebook, there is a vertical sidebar with a red "EX" label and some partially visible text: "Factor co", "1)", and "2)". On the right side, there is a vertical sidebar with partially visible text: "mon factor.", "and c,", and "ors.". At the bottom right of the notebook, there is a red button with the word "Next" in white.

Your list of factors should resemble the following:

<u>Factors of -20</u>	
1	-20
-1	20
2	-10
-2	10
4	-5
-4	5

Identify the factors of  $-20$  that have a sum of  $-1$ .

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Example 2 (continued)

The image shows a digital workspace with a blue border. On the left, there is a vertical sidebar with a red 'EX' label and the text 'Factor co', '1)', and '2)'. The main area contains handwritten notes on lined paper. The title is 'Factors of -20' underlined. Below it is the question: 'Which pair of factors has a sum equal to the coefficient of the middle term?'. A list of factor pairs and their sums is shown:  $1 + (-20) = -19$ ,  $-1 + 20 = 19$ ,  $2 + (-10) = -8$ ,  $-2 + 10 = 8$ ,  $4 + (-5) = -1$ , and  $-4 + 5 = 1$ . The pair  $4 + (-5) = -1$  is highlighted in red. Below this, it says 'These are the necessary factors'. On the right side of the workspace, there is a vertical sidebar with the text 'mon factor.', 'and c,', and 'ors.'. At the bottom right, there is a red button labeled 'Next'.

Which two numbers will multiply to equal  $-20$  and add to equal  $-1$ ?

The numbers  $4$  and  $-5$  are the factors that have a sum of  $-1$ .

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Example 2 (continued)

<p style="text-align: center;"><b>EXAMPLE 2</b></p> <p>Factor completely: <math>10x^2 - 2x - 8</math></p> $10x^2 - 2x - 8$ $2(5x^2 - x - 4)$ <p><math>5x^2 - x - 4</math> can be rewritten as <math>5x^2 + 4x - 5x - 4</math>.</p> <p style="text-align: center;"><input type="button" value="True"/></p> <p style="text-align: center;"><input type="button" value="False"/></p>	<p style="text-align: center;"><b>STEP 1</b></p> <p>Factor out the greatest common factor.</p> <p style="text-align: center;"><b>STEP 2</b></p> <p>Find the product of <math>a</math> and <math>c</math>, and then list its factors.</p> <p style="text-align: center;"><b>STEP 3</b></p> <p>Rewrite the trinomial using the factors with a sum equal to the middle coefficient.</p>
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Now rewrite the trinomial using the sum of the chosen factors to represent the coefficient of the middle term.

The polynomial  $5x^2 - x - 4$  can be rewritten as  $5x^2 + 4x - 5x - 4$ .

- A) True
- B) False

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Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$
$$2(5x^2 - x - 4)$$
$$2(5x^2 + 4x - 5x - 4)$$

In this expression,  $-x$  can be represented by  $4x - 5x$ .

**True**

**STEP 1**  
Factor out the greatest common factor.

**STEP 2**  
Find the product of  $a$  and  $c$ , and then list its factors.

**STEP 3**  
Rewrite the trinomial using the factors with a sum equal to the middle coefficient.

**Next**

In this expression,  $-x$  is represented by  $4x - 5x$ .

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Example 2 (continued)

<p style="text-align: center;"><b>EXAMPLE 2</b></p> <p>Factor completely: <math>10x^2 - 2x - 8</math></p> $10x^2 - 2x - 8$ $2(5x^2 - x - 4)$ $2(5x^2 + 4x - 5x - 4)$ $2((5x^2 + 4x) + (-5x - 4))$ $2(\square(\square) \quad )$ <p>Enter the correct values above and click <b>SUBMIT</b>. <span style="float: right;"><b>Submit</b></span></p>	<p style="text-align: center;"><b>STEP 1</b></p> <p>Factor out the greatest common factor.</p> <p style="text-align: center;"><b>STEP 2</b></p> <p>Find the product of <math>a</math> and <math>c</math>, and then list its factors.</p> <p style="text-align: center;"><b>STEP 3</b></p> <p>Rewrite the trinomial using the factors with a sum equal to the middle coefficient.</p> <p style="text-align: center;"><b>STEP 4</b></p> <p>Group the terms into two binomials.</p> <p style="text-align: center;"><b>STEP 5</b></p> <p>Factor both binomials completely.</p>
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Next, group the terms into two binomials.

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

Now factor the first binomial completely.

$$(5x^2 + 4x)$$

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Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$
$$2(5x^2 - x - 4)$$
$$2(5x^2 + 4x - 5x - 4)$$
$$2((5x^2 + 4x) + (-5x - 4))$$
$$2(x(5x + 4) \quad )$$

Find the greatest common factor by factoring each term completely.

$$5x^2 = 5 \cdot x \cdot x$$
$$4x = 2 \cdot 2 \cdot x$$

The greatest common factor (GCF) is  $x$ . Now that you have identified the GCF, you will need to factor it out of the terms of the first binomial.

$$\frac{5x^2}{x} = 5x \quad \frac{4x}{x} = 4$$

When factored completely, the first binomial can be represented as

$$x(5x + 4)$$

**Next**

First, find the greatest common factor of the terms of the first binomial.

$$5x^2 = 5 \cdot x \cdot x$$
$$4x = 2 \cdot 2 \cdot x$$

The greatest common factor is  $x$ .

Now that you have identified the greatest common factor, you will need to factor it out of the terms of the first binomial.

$$\frac{5x^2}{x} = 5x$$
$$\frac{4x}{x} = 4$$

So when factored completely, the first binomial can be represented as  $x(5x + 4)$ .

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Example 2 (continued)

<p style="text-align: center;"><b>EXAMPLE 2</b></p> <p>Factor completely: <math>10x^2 - 2x - 8</math></p> $10x^2 - 2x - 8$ $2(5x^2 - x - 4)$ $2(5x^2 + 4x - 5x - 4)$ $2((5x^2 + 4x) + (-5x - 4))$ $2( x (5x + 4) \input{text} (\input{text}) )$ <p>Enter the correct values above and click <b>SUBMIT</b>. <input type="button" value="Submit"/></p>	<p style="text-align: center;"><b>STEP 1</b></p> <p>Factor out the greatest common factor.</p> <p style="text-align: center;"><b>STEP 2</b></p> <p>Find the product of <math>a</math> and <math>c</math>, and then list its factors.</p> <p style="text-align: center;"><b>STEP 3</b></p> <p>Rewrite the trinomial using the factors with a sum equal to the middle coefficient.</p> <p style="text-align: center;"><b>STEP 4</b></p> <p>Group the terms into two binomials.</p> <p style="text-align: center;"><b>STEP 5</b></p> <p>Factor both binomials completely.</p>
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Now factor the second binomial completely.

$$(-5x - 4)$$



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Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$
$$2(5x^2 - x - 4)$$
$$2(5x^2 + 4x - 5x - 4)$$
$$2((5x^2 + 4x) + (-5x - 4))$$
$$2( x(5x + 4) - 1(5x + 4) )$$

Find the greatest common factor of the terms.

$$-5x^2 = -1 \cdot 5 \cdot x$$
$$-4 = -1 \cdot 2 \cdot 2$$

The greatest common factor (GCF) is  $-1$ .  
Now you will need to factor it out of the terms of the second binomial.

$$\frac{-5x}{-1} = 5x \quad \frac{-4x}{-1} = 4$$

When factored completely, the second binomial can be represented as

$$-1(5x + 4).$$

**Next**

Find the greatest common factor of the terms of the first binomial.

$$-5x = -1 \cdot 5 \cdot x$$
$$-4 = -1 \cdot 2 \cdot 2$$

The greatest common factor is  $-1$ .

Now you will need to factor it out of the terms of the second binomial.

$$\frac{-5x}{-1} = 5x$$
$$\frac{-4}{-1} = 4$$

So when factored completely, the second binomial can be represented as  $-1(5x + 4)$ .

**Module 3: Adding and Subtracting Polynomials**  
**Topic 3 Content: Factoring Trinomials With a Leading Coefficient**  
**Not Equal to One**

Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$
$$2(5x^2 - x - 4)$$
$$2(5x^2 + 4x - 5x - 4)$$
$$2((5x^2 + 4x) + (-5x - 4))$$
$$2(x(5x + 4) - 1(5x + 4))$$

You can represent the polynomial as the product

$$(5x + 4)(x - 1)$$

**True**

**False**

Notice that the groups of the polynomial each have a common factor, the binomial  $5x + 4$ .

You can represent the polynomial as the product  $(5x + 4)(x - 1)$ .

- A) True
- B) False

**Module 3: Adding and Subtracting Polynomials**  
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**Not Equal to One**

Example 2 (continued)

**EXAMPLE 2**

Factor completely:  $10x^2 - 2x - 8$

$$10x^2 - 2x - 8$$
$$2(5x^2 - x - 4)$$
$$2(5x^2 + 4x - 5x - 4)$$
$$2((5x^2 + 4x) + (-5x - 4))$$
$$2(x(5x + 4) - 1(5x + 4))$$
$$2(5x + 4)(x - 1)$$

Once you have factored out  $(5x + 4)$ , the polynomial can be represented as

$$(5x + 4)(x - 1)$$

**True**

Once you have factored out  $(5x + 4)$ , the polynomial can be represented as  $(5x + 4)(x - 1)$ .

**Module 3: Adding and Subtracting Polynomials**  
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**Not Equal to One**

Example 2 (continued)

<p style="text-align: center;"><b>EXAMPLE 2</b></p> <p>Factor completely: <math>10x^2 - 2x - 8</math></p> $10x^2 - 2x - 8$ $2(5x^2 - x - 4)$ $2(5x^2 + 4x - 5x - 4)$ $2((5x^2 + 4x) + (-5x - 4))$ $2(x(5x + 4) - 1(5x + 4))$ <div style="border: 1px solid red; padding: 2px; display: inline-block;"><math>2(5x + 4)(x - 1)</math></div>	<p style="text-align: center;"><b>STEP 1</b></p> <p>Factor out the greatest common factor.</p> <p style="text-align: center;"><b>STEP 2</b></p> <p>Find the product of <math>a</math> and <math>c</math>, and then list its factors.</p> <p style="text-align: center;"><b>STEP 3</b></p> <p>Rewrite the trinomial using the factors with a sum equal to the middle coefficient.</p> <p style="text-align: center;"><b>STEP 4</b></p> <p>Group the terms into two binomials.</p> <p style="text-align: center;"><b>STEP 5</b></p> <p>Factor both binomials completely.</p> <p style="text-align: center;"><b>STEP 6</b></p> <p>Factor the shared binomial out of the expression.</p>
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Once you have factored out  $(5x + 4)$ , the polynomial can be represented as  $(5x + 4)(x - 1)$ .

Now recall the greatest common factor of 2 that was initially factored out of the given trinomial. When factored completely, the trinomial  $10x^2 - 2x - 8$  can be represented as

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

**Module 3: Adding and Subtracting Polynomials**  
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**Not Equal to One**

Self-Check 1



## Self-Check

Factor completely:  $2x^2 - 7x - 15$

$2x^2 - 7x - 15 = ( \quad ) ( \quad )$

Drag the correct expressions below to the appropriate spots above.

$2x + 8$	$2x + 3$	$x + 1$
$3x - 2$	$x - 1$	$x - 5$

SUBMIT

**Module 3: Adding and Subtracting Polynomials**  
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**Not Equal to One**

**Self-Check 1: Answer Step One**

### Self Check

**Correct**

That's correct!

$$2x^2 - 7x - 15$$

The terms share no common factor other than 1, so begin by finding the product of 2 and -15.

$$2 \cdot -15 = -30$$

Now, determine the factors of -30 that have a sum of -7. The necessary factors are 3 and -10.

Next, rewrite the trinomial using the sum of the chosen factors to represent the coefficient of the middle term.

$$2x^2 - 7x - 15$$
$$2x^2 + 3x - 10x - 15$$

Now, factor the polynomial by grouping. Begin by grouping the terms.

$$2x^2 + 3x - 10x - 15$$
$$(2x^2 + 3x) + (-10x - 15)$$

Step One

Step Two

Continue

**SUBMIT**

**Module 3: Adding and Subtracting Polynomials**  
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**Not Equal to One**

**Self-Check 1: Answer Step Two**

**Correct**

Factor each group completely.

$$(2x^2 + 3x) + (-10x - 15)$$
$$x(2x + 3) - 5(2x + 3)$$

Factor out the common binomial expression.

$$x(2x + 3) - 5(2x + 3)$$
$$(2x + 3)(x - 5)$$

When factored completely,  $2x^2 - 7x - 15$  can be represented as

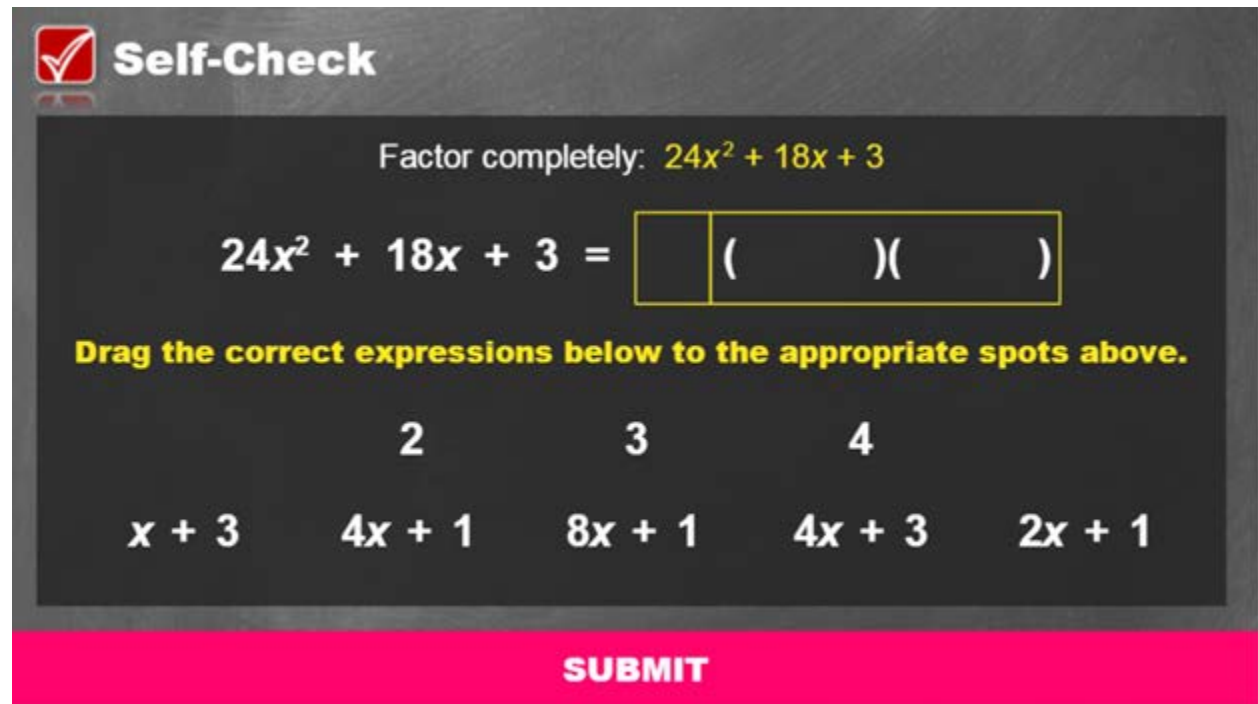
$$(2x + 3)(x - 5)$$

Step One   Step Two   Continue

**SUBMIT**

**Module 3: Adding and Subtracting Polynomials**  
**Topic 3 Content: Factoring Trinomials With a Leading Coefficient**  
**Not Equal to One**

Self-Check 2



**Self-Check**

Factor completely:  $24x^2 + 18x + 3$

$24x^2 + 18x + 3 =$

**Drag the correct expressions below to the appropriate spots above.**

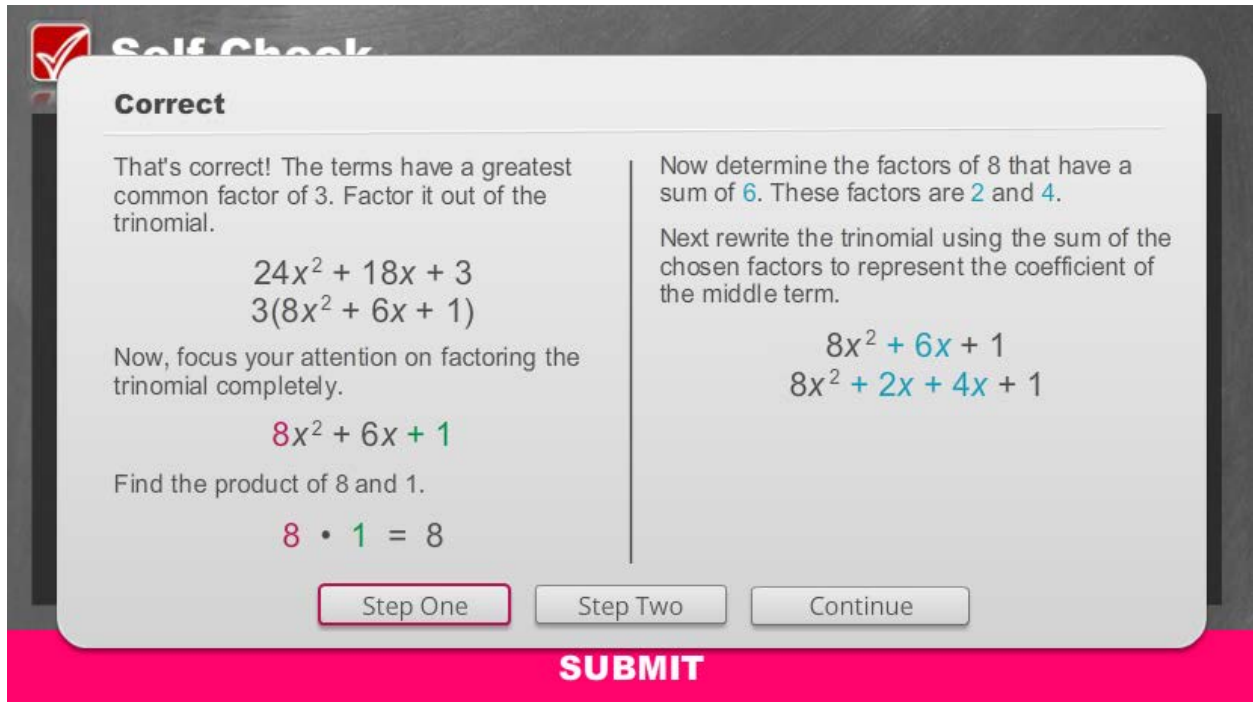
	2	3	4	
$x + 3$	$4x + 1$	$8x + 1$	$4x + 3$	$2x + 1$

**SUBMIT**



**Module 3: Adding and Subtracting Polynomials**  
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**Not Equal to One**

**Self-Check 2: Answer Step One**



The image shows a digital interface for a self-check. At the top left, there is a red checkmark icon and the text "Self Check". Below this, the word "Correct" is displayed in bold. The interface is divided into two columns. The left column contains the text "That's correct! The terms have a greatest common factor of 3. Factor it out of the trinomial." followed by the equations  $24x^2 + 18x + 3$  and  $3(8x^2 + 6x + 1)$ . Below this, it says "Now, focus your attention on factoring the trinomial completely." followed by the equation  $8x^2 + 6x + 1$ . Then, it asks "Find the product of 8 and 1." followed by the equation  $8 \cdot 1 = 8$ . The right column contains the text "Now determine the factors of 8 that have a sum of 6. These factors are 2 and 4." followed by "Next rewrite the trinomial using the sum of the chosen factors to represent the coefficient of the middle term." followed by the equations  $8x^2 + 6x + 1$  and  $8x^2 + 2x + 4x + 1$ . At the bottom of the interface, there are three buttons: "Step One" (highlighted with a red border), "Step Two", and "Continue". Below these buttons, the word "SUBMIT" is written in large, bold, white letters on a red background.

**Correct**

That's correct! The terms have a greatest common factor of 3. Factor it out of the trinomial.

$$24x^2 + 18x + 3$$
$$3(8x^2 + 6x + 1)$$

Now, focus your attention on factoring the trinomial completely.

$$8x^2 + 6x + 1$$

Find the product of 8 and 1.

$$8 \cdot 1 = 8$$

Now determine the factors of 8 that have a sum of 6. These factors are 2 and 4.

Next rewrite the trinomial using the sum of the chosen factors to represent the coefficient of the middle term.

$$8x^2 + 6x + 1$$
$$8x^2 + 2x + 4x + 1$$

Step One Step Two Continue

**SUBMIT**

**Module 3: Adding and Subtracting Polynomials**  
**Topic 3 Content: Factoring Trinomials With a Leading Coefficient**  
**Not Equal to One**

**Self-Check 2: Answer Step Two**

**Correct**

Now, factor the polynomial by grouping.  
Begin by grouping the terms.

$$8x^2 + 2x + 4x + 1$$
$$(8x^2 + 2x) + (4x + 1)$$

Factor each group completely.

$$(8x^2 + 2x) + (4x + 1)$$
$$2x(4x + 1) + 1(4x + 1)$$

Factor out the common binomial expression.

$$2x(4x + 1) + 1(4x + 1)$$
$$(4x + 1)(2x + 1)$$

Recall the greatest common factor of 3 that was initially factored out of the trinomial.

When factored completely, the trinomial  $24x^2 + 18x + 3$  can be represented as

$$3(4x + 1)(2x + 1)$$

Step One   Step Two   Continue

**SUBMIT**

**Module 3: Adding and Subtracting Polynomials**  
**Topic 3 Content: Factoring Trinomials With a Leading Coefficient**  
**Not Equal to One**

**Conclusion**



Congratulations! You have reached the conclusion of this lesson, where you learned how to factor second-degree trinomials by grouping.