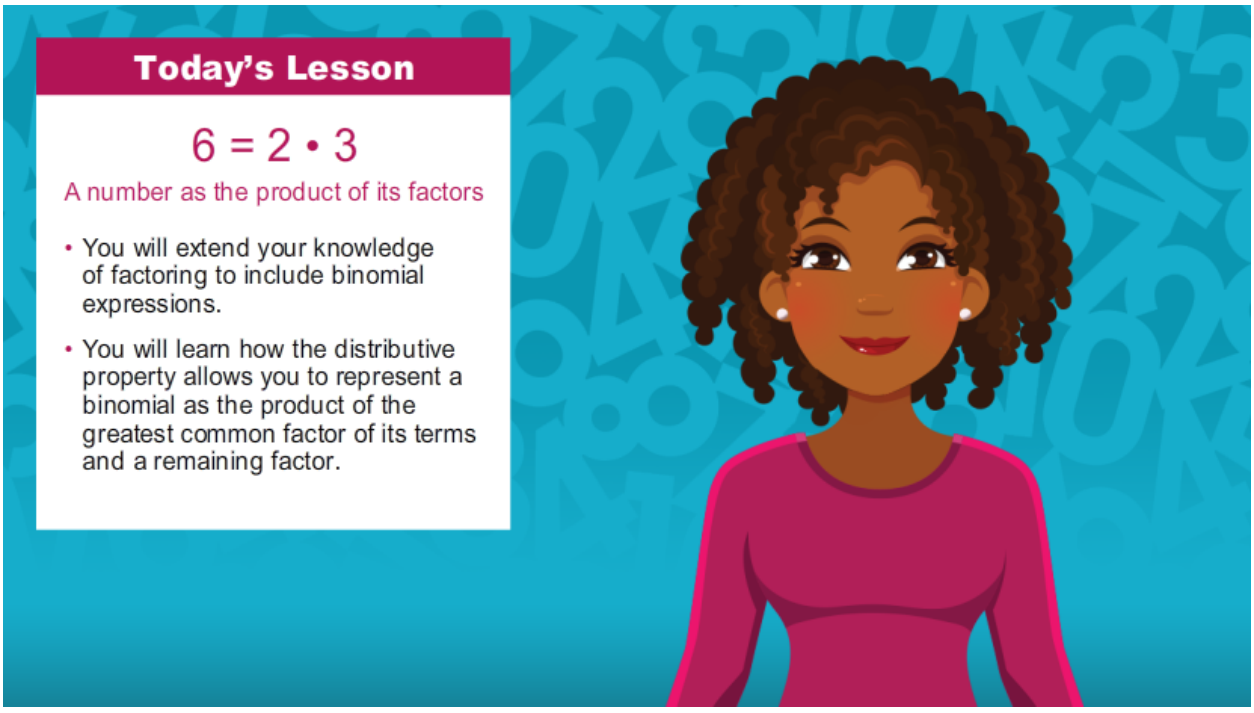
Module 3: Adding and Subtracting Polynomials

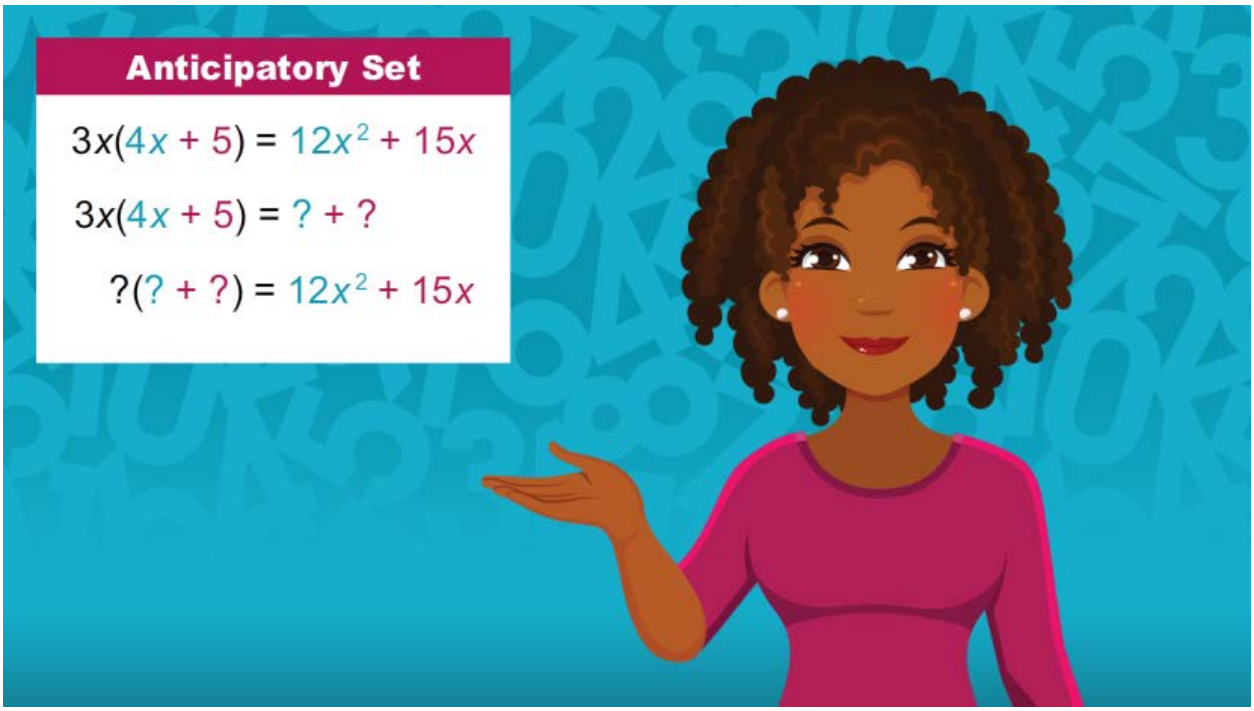
Topic 3 Content: Factoring Binomials

Introduction



Hello and welcome! You are probably fairly comfortable with how to represent a number as the product of its factors. In this lesson, you will extend your knowledge of factoring to include binomial expressions. You will learn how the distributive property allows you to represent a binomial as the product of the greatest common factor of its terms and a remaining factor.

Anticipatory Set



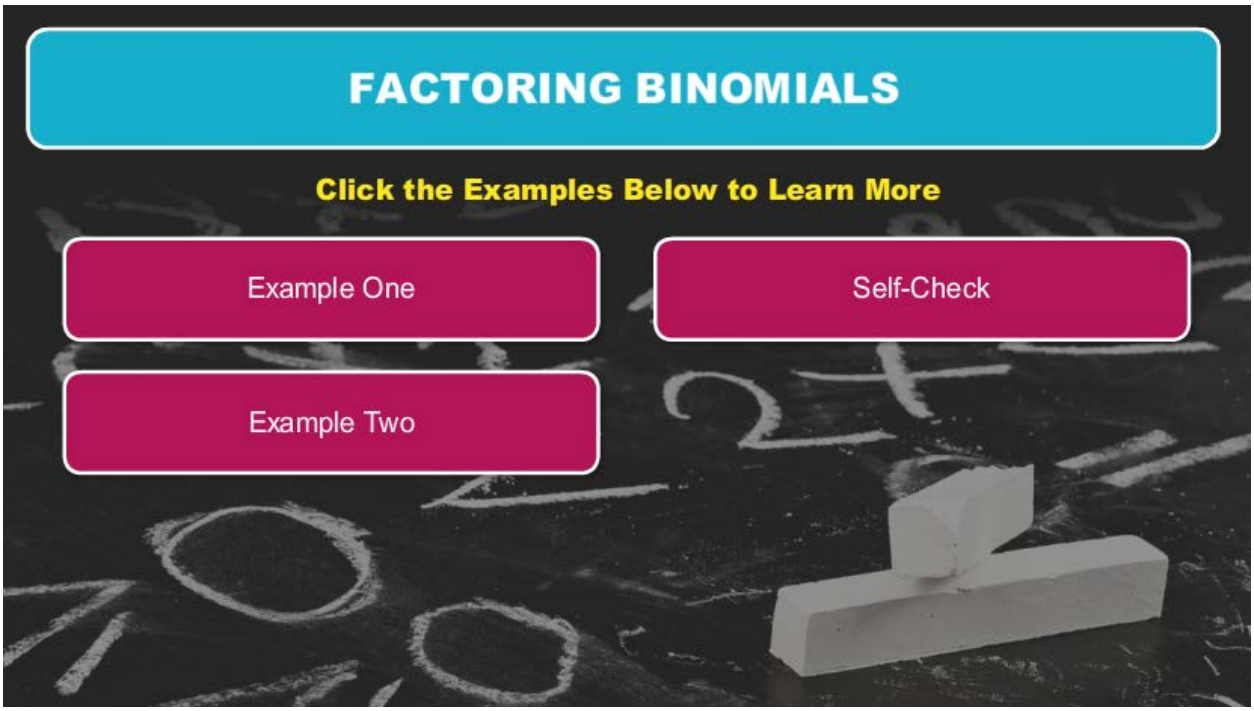
Take for example, the product of $3x$ and $(4x + 5)$. You have learned how to use the distributive property to evaluate products like this one.

$$3x(4x + 5) = 12x^2 + 15x$$

The terms $3x$ and $4x + 5$ are factors of the binomial $12x^2 + 15x$.

In this lesson, you will solve a problem similar to this but in reverse. Instead of being given factors and using the distributive property to determine the product, you will be given a product and must use the distributive property to determine the factors.

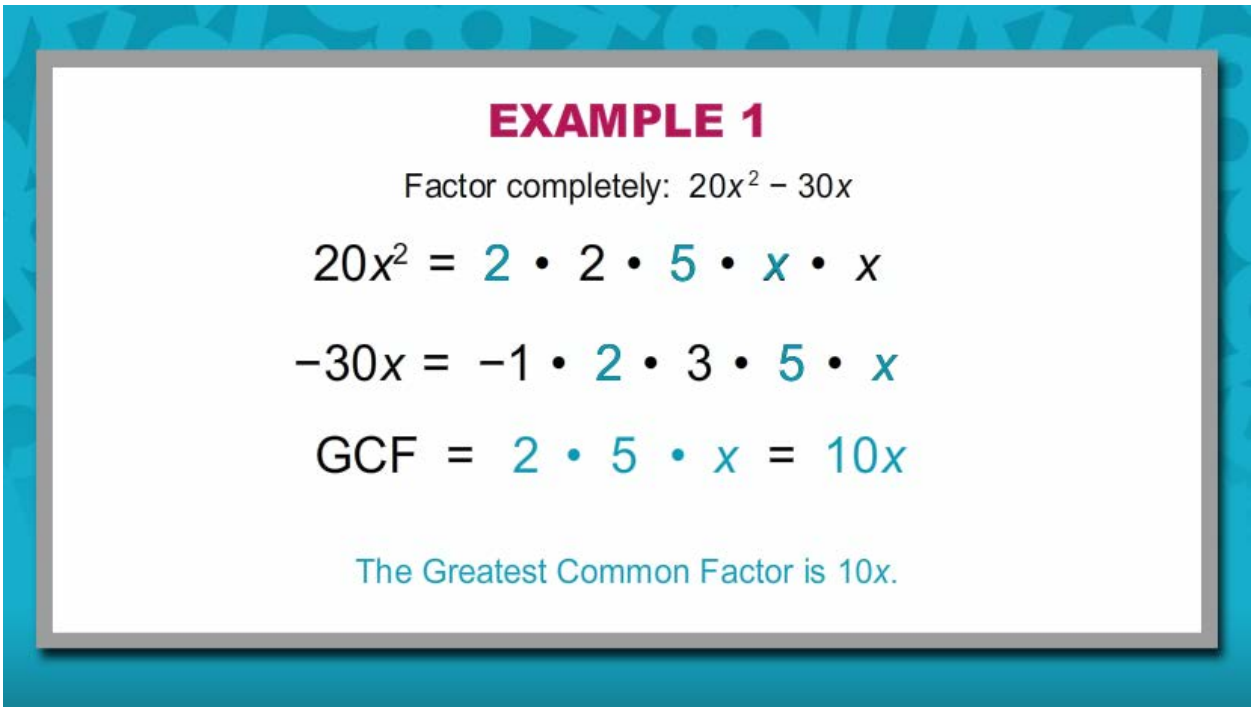
Factoring Binomials



Click the examples below to learn more.

- Example One
- Example Two
- Self-Check

Example 1



Factor completely:

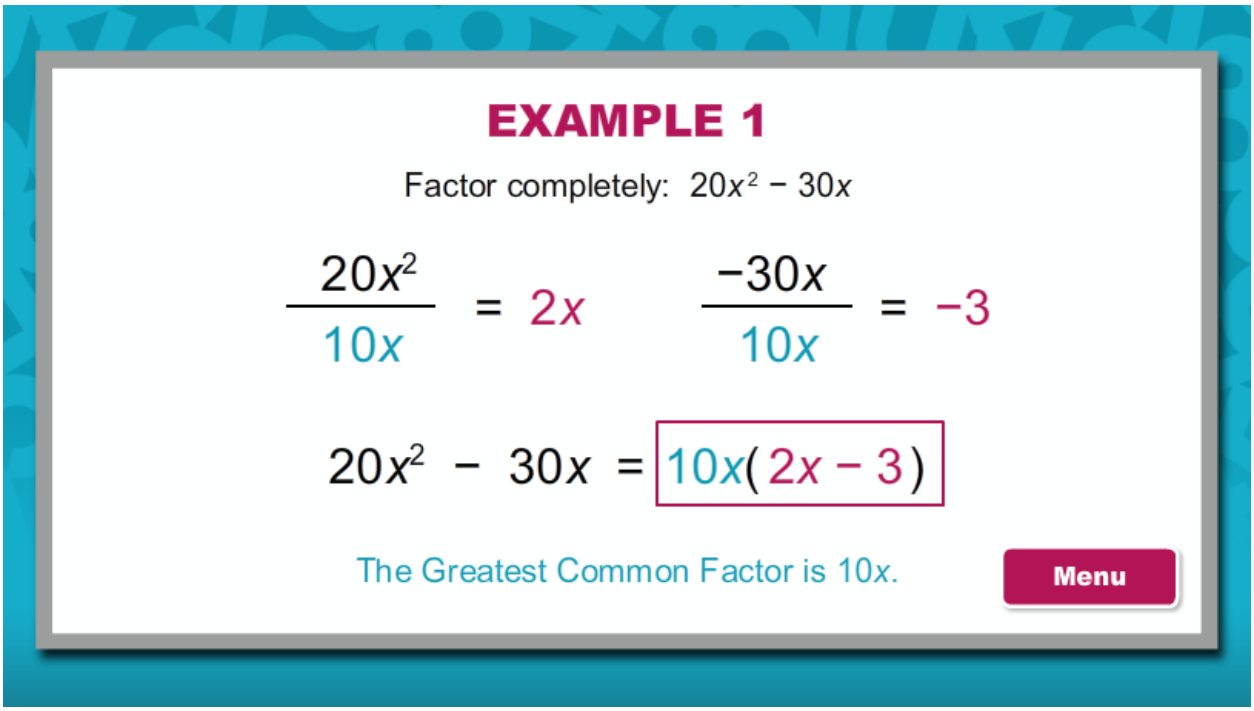
$$20x^2 - 30x$$

The first step to factoring the binomial completely is to determine the greatest common factor of its terms. You can achieve this by factoring each term completely.

$$20x^2 = 2 \cdot 2 \cdot 5 \cdot x \cdot x$$
$$-30x = -1 \cdot 2 \cdot 3 \cdot 5 \cdot x$$

The terms each have a factor of 2, a factor of 5, and a factor of x. Therefore, the greatest common factor is $10x$.

Example 1 (continued)



Now that you have identified the greatest common factor, you will need to factor it out of the original expression. To accomplish this, divide each term of the binomial by the greatest common factor.

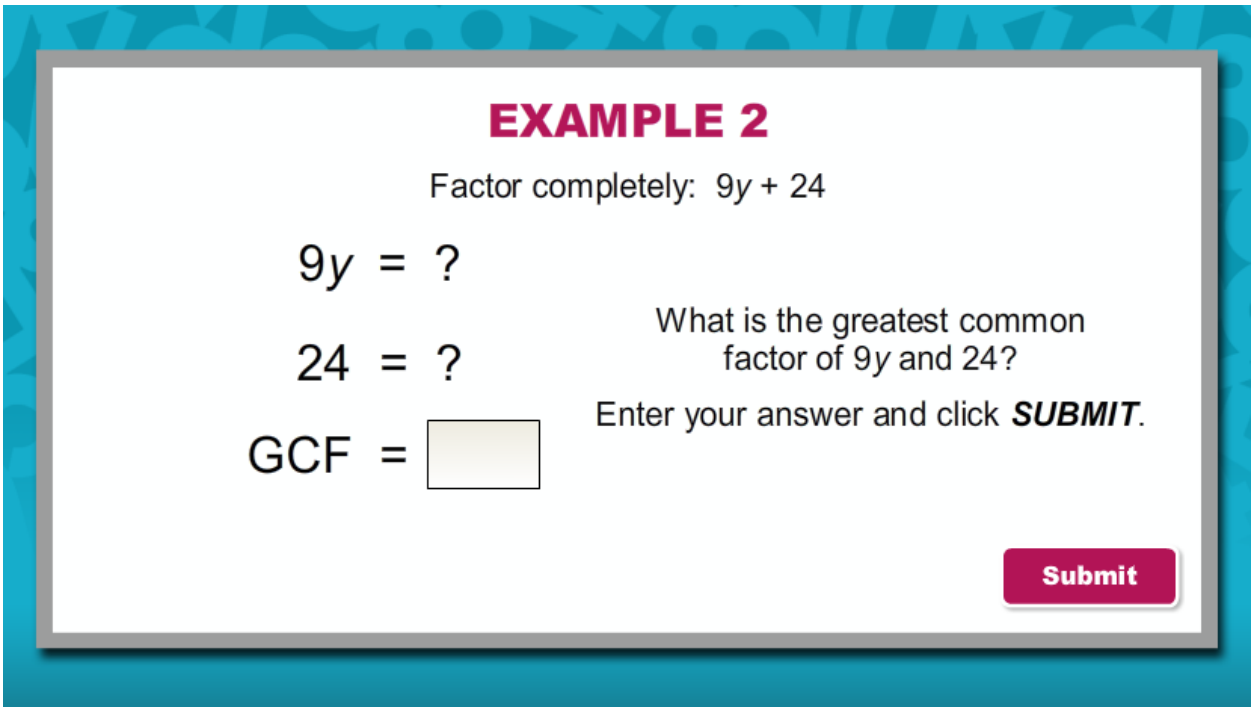
$\frac{20x^2}{10x} = 2x$; and

$\frac{-30x}{10x} = -3$

So, when factored completely,

$20x^2 - 30x = 10x(2x - 3)$.

Example 2

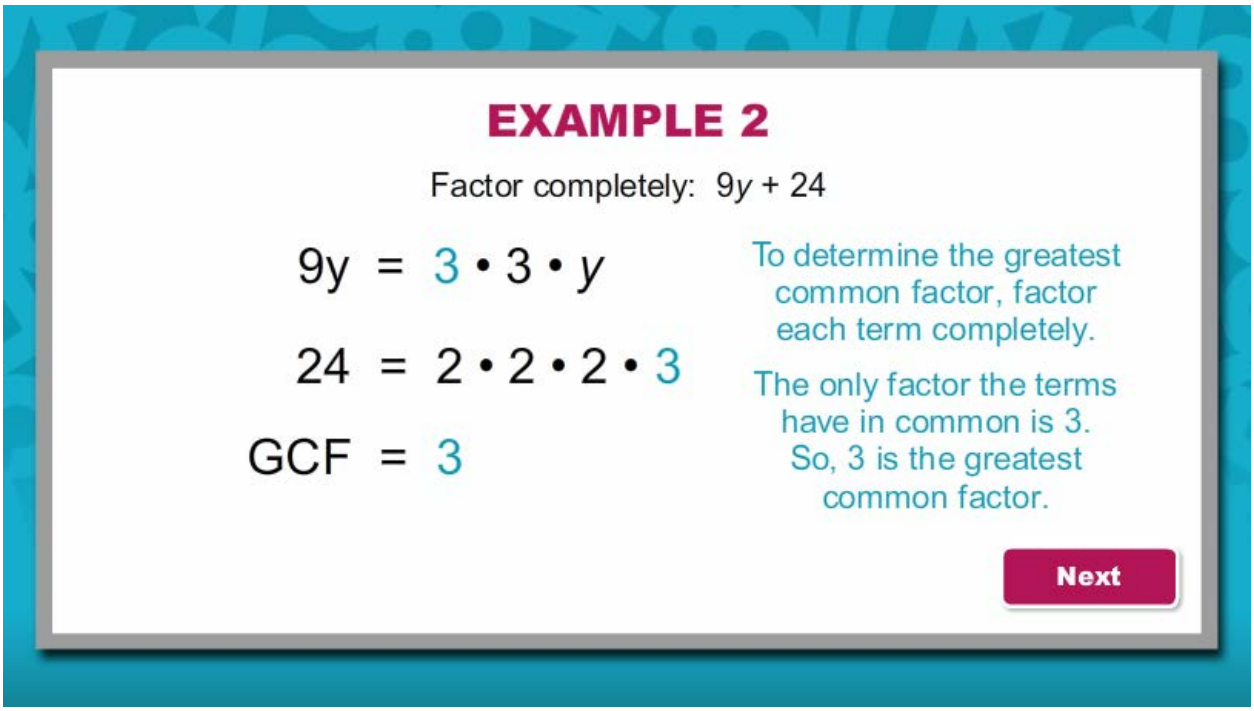


Factor completely: $9y + 24$

To factor the binomial completely, begin by determining the greatest common factor of $9y$ and 24.

What is the greatest common factor of $9y$ and 24?

Example 2 (continued)

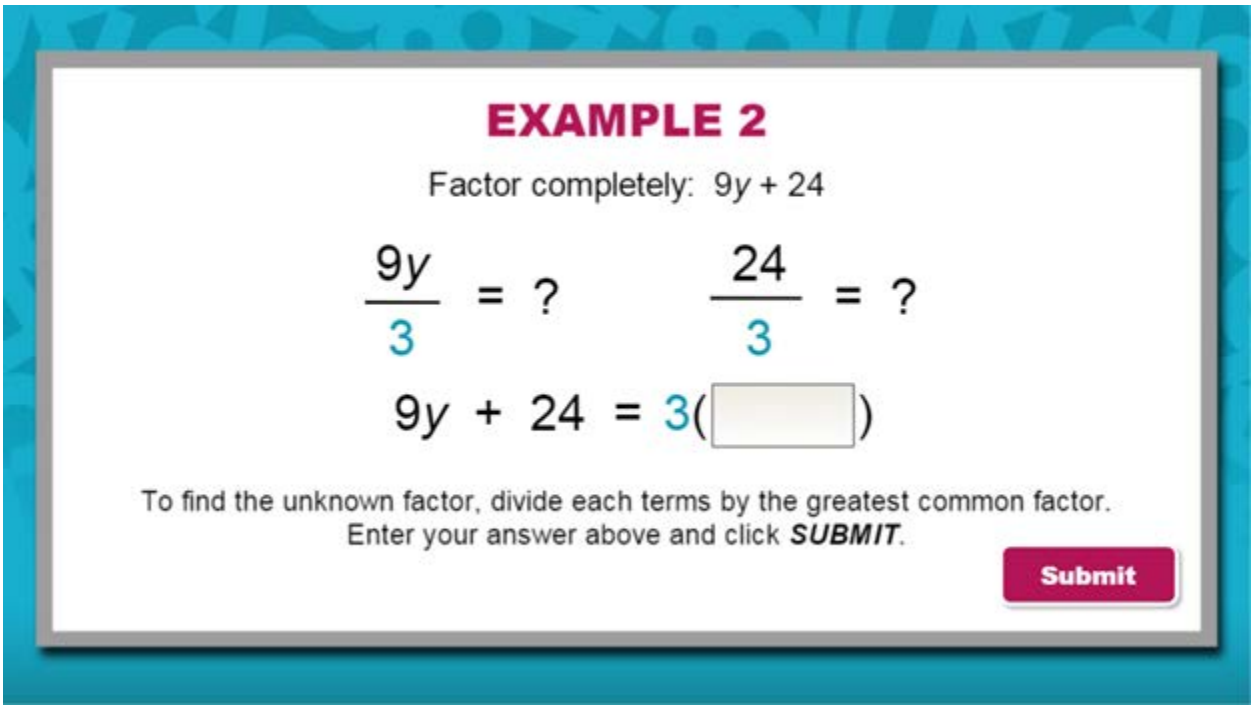


To determine the greatest common factor, factor each term completely.

$$9y = 3 \cdot 3 \cdot y$$
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$

The only factor the terms have in common is 3. So, 3 is the greatest common factor.

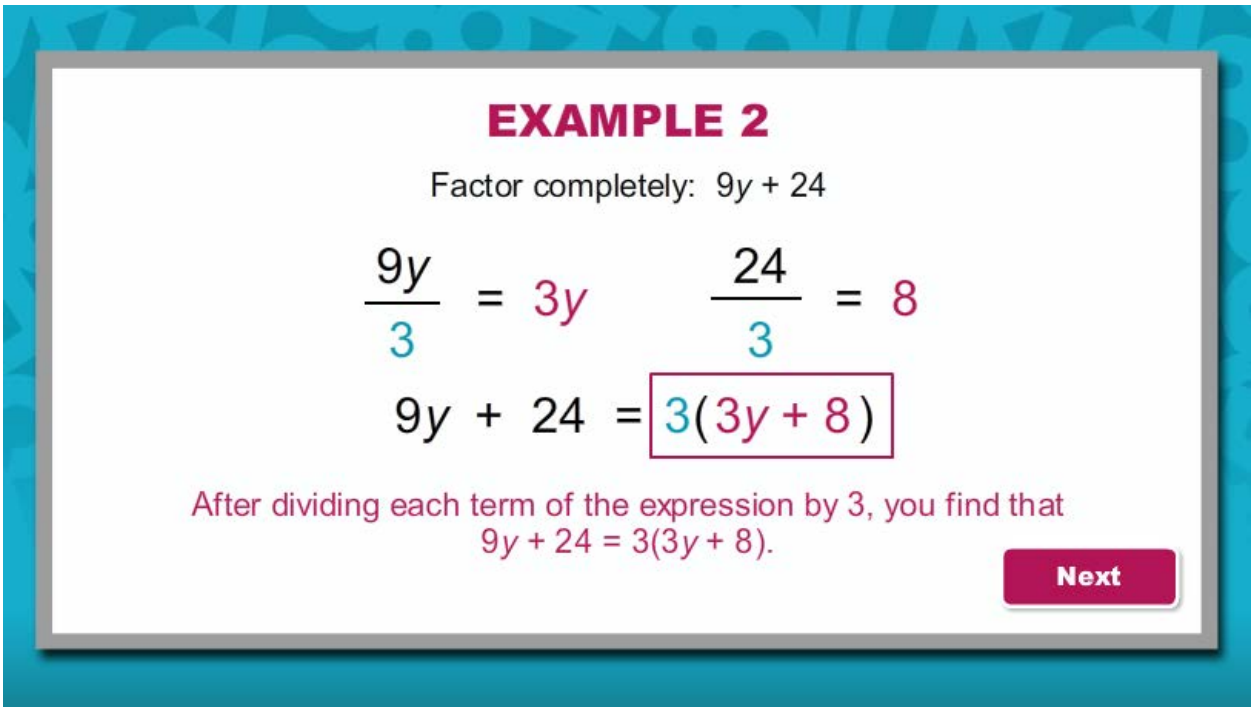
Example 2 (continued)



Now that you have identified the greatest common factor, you will need to factor it out of the original expression. To accomplish this, divide each term of the binomial by the greatest common factor.

When factored completely, $9y + 24 = 3(?)$.

Example 2 (continued)



After dividing each term of the expression by 3, you find that

$$\frac{9y}{3} = 3y,$$

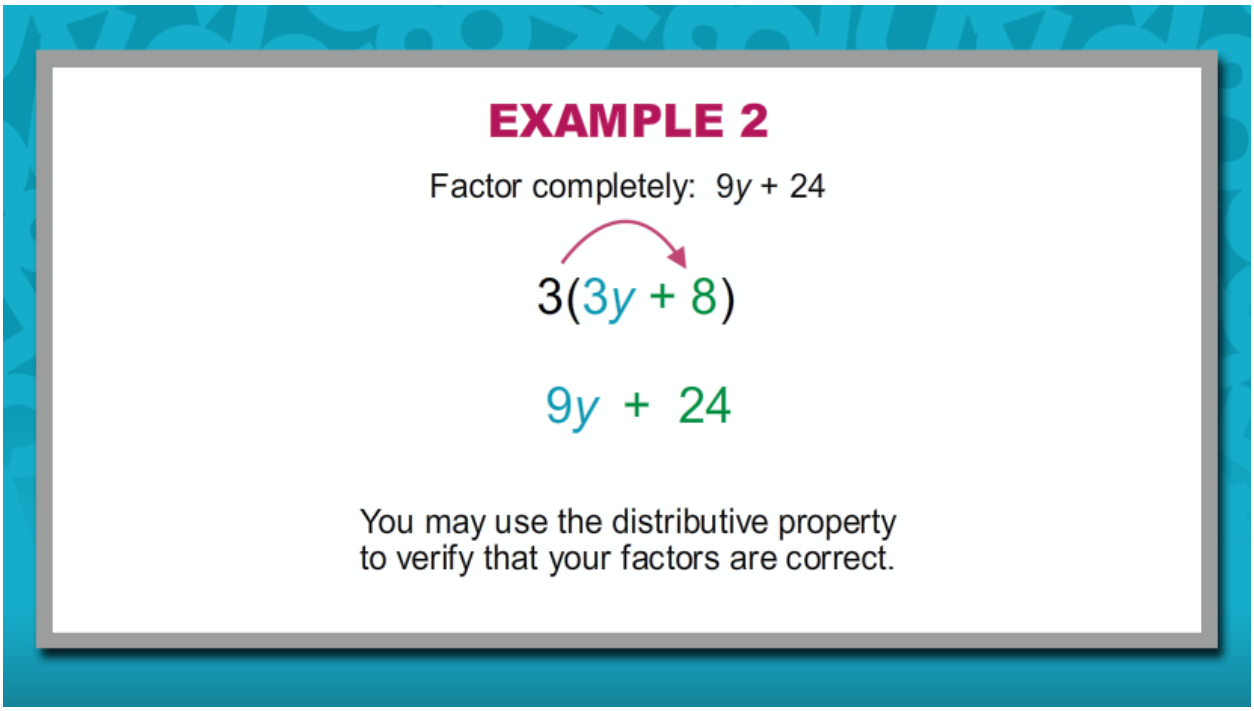
and

$$\frac{24}{3} = 8.$$

Therefore, when factored completely,

$$9y + 24 = 3(3y + 8).$$

Example 2 (continued)



It is important to mention that you are also able to use the distributive property to verify that your factors are correct. Multiply your factors and verify that the result is the original binomial expression.

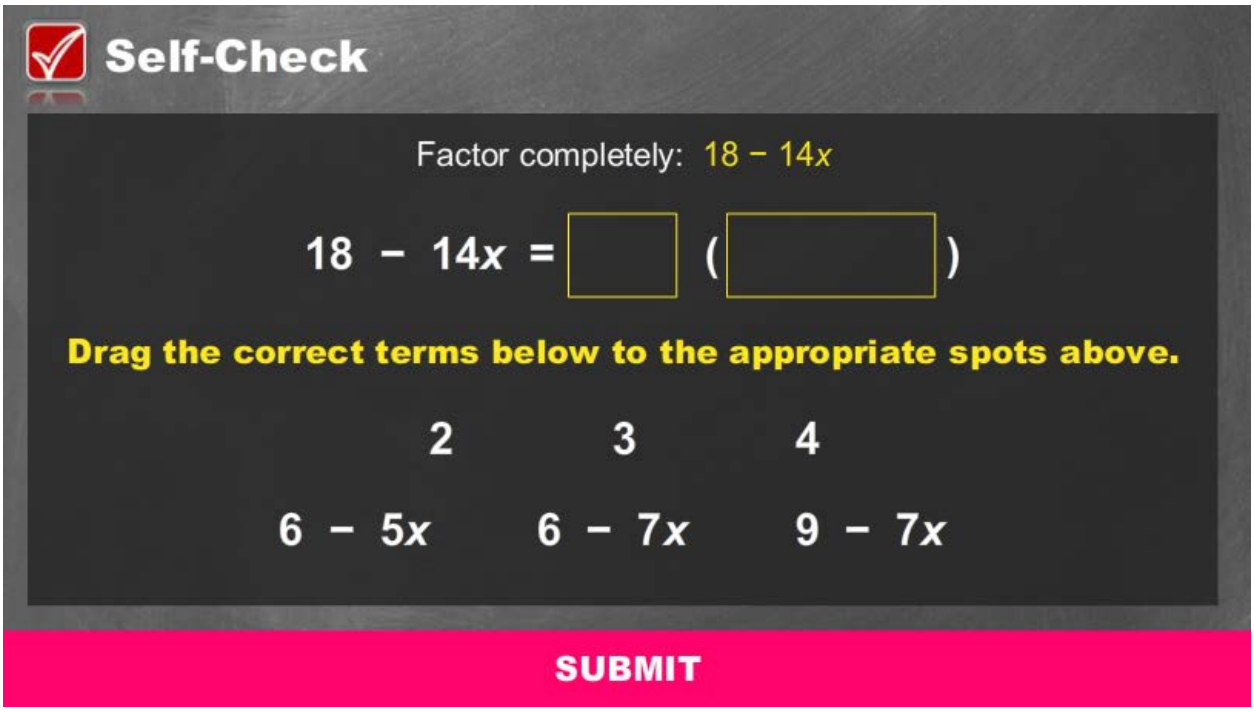
$3 \cdot 3y = 9y$
$3 \cdot 8 = 24$

Therefore,

$3(3y + 8) = 9y + 24$.

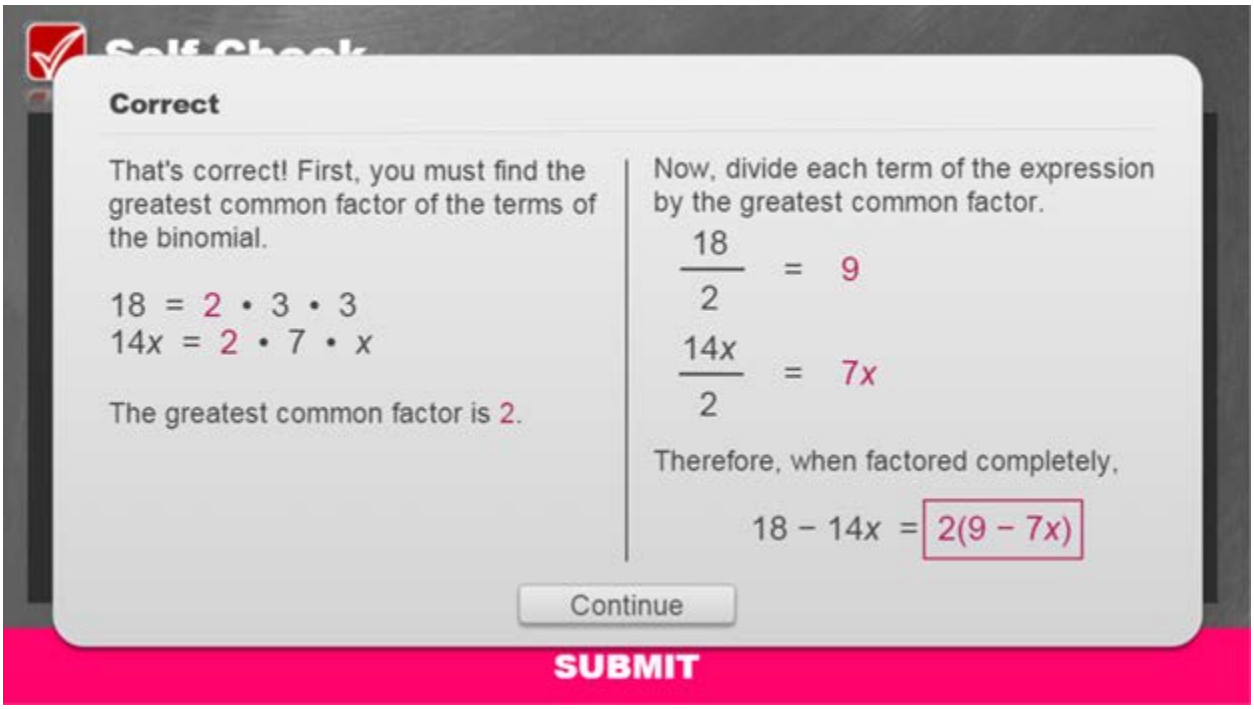
The product is equivalent to the original expression. So, your factors are correct.

Self-Check 1



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

Self-Check 1: Answer



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

Conclusion

Congratulations! You have reached the conclusion of this lesson in Algebra I. In this lesson, you learned how to use the distributive property to factor binomials completely.