Lesson 4-5 Factor Expressions

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I can... use common factors and the Distributive Property to factor expressions.

Explain It!

ACTIVITY

Tasha is packing gift bags that include the same items. She has 72 glow sticks, 36 markers, and 24 bottles of bubbles. Tasha believes that she can pack no more than 6 bags using all of her supplies.

Make Sense and Persevere How can you use what you know about common factors to solve the problem?

A. Critique Reasoning Do you agree with Tasha? Explain.

B. If Tasha creates the greatest number of gift bags, how many of each item is in each bag? Explain how you know.

Focus on math practices

Reasoning Tasha added more markers and now has a total of 48 markers. Does this change the possible number of gift bags? Explain.

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? Essential Question How does the Distributive Property relate to factoring expressions?

INTERACTIVE ANIMATION ASSESS

EXAMPLE 1 Factor Expressions

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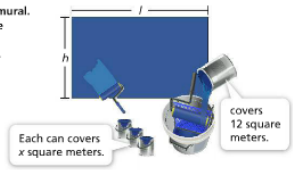
Kiana painted a rectangular wall blue to start an ocean mural. She used 3 cans of paint, each of which covered x square meters, and a different-sized can that covered 12 square meters. What are possible length and height dimensions of Kiana's mural?

Model with Math The expression $3x + 12$ represents the area of the mural.



ONE WAY Use an area model to represent the area of the mural, $3x + 12$.

So, one possible set of dimensions of the mural could be $x + 4$ meters long and 3 meters tall.

ANOTHER WAY Use a common factor and the Distributive Property to factor the expression $3x + 12$.

$3x + 12$

$3x + (3 \cdot 4)$ The GCF of $3x$ and 12 is 3.

$3(x + 4)$ This represents the area of the mural as a product of two factors.

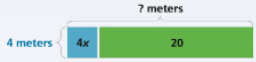
So, one possible set of dimensions of the mural could be 3 meters long and $x + 4$ meters tall.

Try It!

Use factoring to write an expression for the length of the pool with the given width.

$4x + 20 = \square(x + \square)$

So, the length of the pool is $\square$ meters.



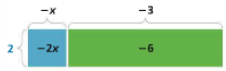
Convince Me! How can you use the Distributive Property to check the factored expression? Use the factored expression for Example 1 in your explanation.

EXAMPLE 2 Factor Expressions with Negative Coefficients

Rodrigo and Jordan each factor the expression $-2x - 6$. Who factored the expression correctly?

Rodrigo uses a positive common factor, 2, to factor the expression.

2 is a common factor of $-2x$ and -6.



$2(-x - 3) = -2x - 6$

Jordan uses a negative common factor , -2, to factor the expression.

-2 is a common factor of $-2x$ and -6.

$-2(x + 3) = -2x - 6$

$2(-x - 3)$ and $-2(x + 3)$ are equivalent expressions. So, both Rodrigo and Jordan are correct.

Try It!

Show two different ways to factor $-4x - 28$.

EXAMPLE 3 Factor Three-Term Expressions

Use the GCF to factor the expression $6x - 18 - 12y$.

STEP 1 Find the GCF of $6x$, -18, and $-12y$.

Factors of 6: 1, 2, 3, 6

Factors of 18: 1, 2, 3, 6, 9, 18

Factors of 12: 1, 2, 3, 4, 6, 12

The GCF is 6.

STEP 2 Use the GCF and the Distributive Property to factor the expression.

$6x - 18 - 12y$

$= (6)(x) - (6)(3) - (6)(2y)$

$= 6(x - 3 - 2y)$

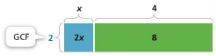
The factored expression of $6x - 18 - 12y$ is $6(x - 3 - 2y)$.

Try It!

Write an equivalent expression for the expression above using a negative factor.

KEY CONCEPT

The greatest common factor (GCF) can be used to factor expressions.



The Distributive Property can be applied to factor an expression. Factoring an expression creates an equivalent expression.

Do You Understand?

1. **Essential Question** How does the Distributive Property relate to factoring expressions?

2. Susan incorrectly factored the expression below.

$$12a - 15b + 6 = 3(4a + 5b + 3)$$

a. Explain any errors Susan may have made when factoring.

b. Factor the expression correctly.

Do You Know How?

3. Sahil is putting together supply kits and has 36 packs of x pencils, 12 packs of y crayons, and 24 erasers.

a. Write an expression to show the total number of items. $36x + 12y + 24$

b. Use factoring to show many kits Sahil can make while putting every type of item in each kit.

c. Use the factored expression to find th number of each item in each kit.

4. Show two different ways to factor $-12x + 24 - 18y$.

5. How can you use the Distributive Property to factor the expression $6x + 15$?

$36x + 12y + 24$

$18x + 6y + 12$

$9x + 3y + 6$

$3x + 1y + 2$

$(3x + 1y + 2)$

$12(3x + 1y + 2)$

GCF: $3 \mid 6x + 15$

$1 \mid 2x + 5$

$3(2x + 5)$

$3(2x+5)$

We factor out a 3, which is the reverse of the distributive property.

2 | 16A+10
8A+5
2(8A+5)

Name:

Practice & Problem Solving

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Leveled Practice In 6–9, factor the expression.

6. 16a + 10.

The GCF of 16a and 10 is 2.

2 × 8A = 16a 2 × 5 = 10

The factored expression is 2(8A+5)

7. −9y − 3.

The positive GCF of −9y and −3 is 3.

3 × ___ = −9y 3 × ___ = −3

The factored expression is ___.

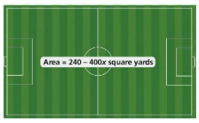
8. 14x + 49

9. 12y − 16

10. This model shows the area of a garden. Write two expressions that represent the area.

11. Use the GCF to write the factored form of the expression 18x + 24y.

12. Find the dimensions of the sports field at the right if the width is at least 60 yards.



13. Your friend incorrectly factors the expression 15x − 20xy as 5x(3 − 4xy).

a. Explain your friend's mistake.

b. Factor the expression correctly.

5x(3+-4y)

Our friend likely forgot to factor out the x from the 2nd term -4xy.

14. You are given the expression 12x + 18y + 26.

a. **Make Sense and Persevere** What is the first step in factoring the expression?

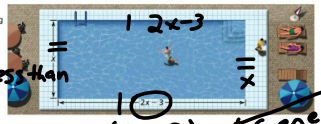
b. Factor the expression.

5 | 15x+-20xy
3x+-4xy
3x+-4xy
3+-4y
(3+-4y)

5x(3+-4y)

$P_{\square} = x + (2x-3) + x + (2x-3)$

15. **Higher Order Thinking** A hotel manager is adding a tile border around the hotel's rectangular pool. Let x represent the width of the pool, in feet. The length is 3 more than 2 times the width, as shown. Write two expressions that give the perimeter of the pool.



less than

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$P_{\square} = 2x + 2(2x-3)$ see notes

General formula $P_{\square} = 2l + 2w$

16. Use the expressions below.

$14m + mn$	$2y + 2x + 4$
$-\frac{3}{4}m + 8m + m$	$4 - 3p$
$5.75t + 7.75t - t$	$8xy - 6xy$

a. Circle the expressions that have like terms.

b. Explain why the other expressions do not have like terms.

17. **Construct Arguments** Ryan says the expression $3 + 5y$ cannot be factored using a GCF. Is he correct? Explain why or why not.

GCF → 1 | 3+5y
1(3+5y)

Ryan is correct in the sense that 1 is the GCF.

Assessment Practice

18. Which of the following expressions is equivalent to 12 + 30y? Select all that apply.

- ☐ 3(4 + 10y)
- ☐ 4(3 + 10y)
- ☐ 6(2 + 5y)
- ☐ 2(6 + 30y)
- ☐ 6(3 + 10y)

19. Write an expression that is the product of two factors and is equivalent to −2x − 10.

2 | -2x+-10
-1x+-5
2(-1x+-5)

2 | -2x+-10
-1 | -1x+-5
2(1x+5)

2(-1x+-5) or -2(1x+5)

15) $P_{\square} = 2x + 2(2x + 3)$

$P_{\square} = 2x + 2(2x) + 2(-3)$

$P_{\square} = 2x + (2 \cdot 2)x + -6$

$P_{\square} = 2x + 4x + -6$

$P_{\square} = (6x + -6)$ feet