

 **Key Idea**

Key Vocabulary 

factoring an expression, p. 140

Factoring an Expression

Words Writing a numerical expression or algebraic expression as a product of factors is called **factoring the expression**. You can use the Distributive Property to factor expressions.

Numbers $3 \cdot 7 + 3 \cdot 2 = 3(7 + 2)$ **Algebra** $ab + ac = a(b + c)$
 $3 \cdot 7 - 3 \cdot 2 = 3(7 - 2)$ $ab - ac = a(b - c)$

EXAMPLE 1 Factoring a Numerical Expression

Study Tip 

When you factor an expression, you can **factor out** any common factor.

Factor 20 – 12 using the GCF.

Find the GCF of 20 and 12 by listing their factors.

Factors of 20: ①, ②, ④, 5, 10, 20

Factors of 12: ①, ②, 3, ④, 6, 12

Circle the common factors.

The GCF of 20 and 12 is 4.

Write each term of the expression as a product of the GCF and the remaining factor. Then use the Distributive Property to factor the expression.

$$\begin{aligned} 20 - 12 &= 4(5) - 4(3) && \text{Rewrite using GCF.} \\ &= 4(5 - 3) && \text{Distributive Property} \end{aligned}$$

EXAMPLE 2 Identifying Equivalent Expressions

Which expression is not equivalent to $16x + 24$?

- (A) $2(8x + 12)$ (B) $4(4x + 6)$ (C) $6(3x + 4)$ (D) $(2x + 3)8$

Each choice is a product of two factors in which one is a whole number and the other is the sum of two terms. For an expression to be equivalent to $16x + 24$, its whole number factor must be a common factor of 16 and 24.

Factors of 16: ①, ②, ④, ⑧, 16

Factors of 24: ①, ②, 3, ④, 6, ⑧, 12, 24

Circle the common factors.

The common factors of 16 and 24 are 1, 2, 4, and 8. Because 6 is not a common factor of 16 and 24, Choice C cannot be equivalent to $16x + 24$.

Check: $6(3x + 4) = 6(3x) + 6(4) = 18x + 24 \neq 16x + 24$ **X**

∴ So, the correct answer is (C).

Equivalent Expressions

In this extension, you will

- use the Distributive Property to produce equivalent expressions.

EXAMPLE 3 Factoring an Algebraic Expression

You receive a discount on each book you buy for your electronic reader. The original price of each book is x dollars. You buy 5 books for a total of $(5x - 15)$ dollars. Factor the expression. What can you conclude about the discount?



Find the GCF of $5x$ and 15 by writing their prime factorizations.

$$5x = 5 \cdot x$$

$$15 = 5 \cdot 3$$

Circle the common prime factor.

So, the GCF of $5x$ and 15 is 5 . Use the GCF to factor the expression.

$$5x - 15 = 5(x) - 5(3)$$

Rewrite using GCF.

$$= 5(x - 3)$$

Distributive Property

The factor 5 represents the number of books purchased. The factor $(x - 3)$ represents the price of each book. This factor is a difference of two terms, showing that the price x of each book is decreased by $\$3$.

So, the factored expression shows a $\$3$ discount for every book you buy. The original expression shows a total savings of $\$15$.

Practice

Factor the expression using the GCF.

1. $7 + 14$

2. $44 - 11$

3. $18 - 12$

4. $70 + 95$

5. $60 - 36$

6. $100 - 80$

7. $84 + 28$

8. $48 + 80$

9. $2x + 10$

10. $15x + 6$

11. $26x - 13$

12. $50x - 60$

13. $36x + 9$

14. $14x - 98$

15. $10x - 25y$

16. $24y + 88x$

17. **REASONING** The whole numbers a and b are divisible by c . Is $a + b$ divisible by c ? Is $b - a$ divisible by c ? Explain your reasoning.

18. **OPEN-ENDED** Write five expressions that are equivalent to $8x + 16$.

19. **GEOMETRY** The area of the parallelogram is $(4x + 16)$ square feet. Write an expression for the base.



20. **STRUCTURE** You buy 37 concert tickets for $\$8$ each, and then sell all 37 tickets for $\$11$ each. The work below shows two ways you can determine your profit. Describe each solution method. Which do you prefer? Explain your reasoning.

$$\begin{aligned} \text{profit} &= 37(11) - (37)8 \\ &= 407 - 296 \\ &= \$111 \end{aligned}$$

$$\begin{aligned} \text{profit} &= 37(11) - (37)8 \\ &= 37(11 - 8) \\ &= 37(3) \\ &= \$111 \end{aligned}$$