Topic Essential Question

What are expressions and how can they be written and evaluated?

Vocabulary Review

Complete each definition with a vocabulary word.

Vocabulary

algebraic expression, coefficient, exponent, factor tree, like terms, variable

1. A(n) _____ tells the number of times the base is used as a factor.
2. A letter or symbol that represents an unknown quantity is a(n) _____.
3. A diagram that shows the prime factors of a composite number is a(n) _____.

Draw a line from each pair of numbers in Column A to the *least common multiple* (*LCM*) of the numbers in Column B.

Column A	Column B
4. 9, 6	36
5. 9, 12	56
6. 8, 7	18

7. Look at the variables in each expression below. Write **Y** if the terms of each expression are *like terms.* Write **N** if they are NOT *like terms.*

   a. $3a + 3z$ b. $\frac{x}{3} + \frac{x}{4}$ c. $4j - j + 3.8j$

Use Vocabulary in Writing

Explain one way to simplify the expression $4(3q - q)$. Use vocabulary words in your explanation.

Concepts and Skills Review

LESSON 3-1 Understand, Represent, and Evaluate Exponents

Quick Review

An exponent is a way to show repeated multiplication.

Example

Use an exponent to write the expression $6 \times 6 \times 6$. Then evaluate the expression.

6 is used as a factor 3 times.

6 is the base and 3 is the exponent.

$6 \times 6 \times 6 = 6^3 = 216$

Find 6^0.

A number with an exponent of 0 is always equal to 1.

$6^0 = 1$

Practice

Write each expression using an exponent.

1. $8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8$

2. 4

3. $-10 \times (-10) \times (-10) \times (-10)$

Evaluate each expression.

4. 9^2

5. 99^1

6. $3{,}105^0$

7. $(-22)^2$

8. $(-2)^7$

9. 3^4

LESSON 3-2 Find Greatest Common Factor and Least Common Multiple

Quick Review

You can use prime factorization to find the greatest common factor and the least common multiple of two numbers.

Example

Find the greatest common factor (GCF) and the least common multiple (LCM) of 12 and 6.

List the prime factors of both numbers.

12: $2 \times 2 \times 3$

6: 2×3

Identify the common factors, then multiply.

GCF: $2 \times 3 = 6$

12: $2 \times 2 \times 3$

6: 2×3

Identify the greatest number of times each factor appears, then multiply.

LCM: $2 \times 2 \times 3 = 12$

Practice

Find the GCF for each pair of numbers. Use the GCF and the Distributive Property to find the sum of each pair of numbers.

1. 30, 100

2. 8, 52

3. 28, 42

4. 37, 67

Use the GCF of the numerator and denominator to simplify each fraction.

5. $\frac{12}{24}$

6. $\frac{18}{112}$

Find the LCM for each pair of numbers.

7. 4, 9

8. 3, 6

9. 12, 5

10. 4, 11

LESSON 3-3 Write and Evaluate Numerical Expressions

Quick Review

Use the order of operations to evaluate numerical expressions.

Example

Find the value of the expression.
$3^2 + 2[(21 - 9) \div (-4)]$

$3^2 + 2[(21 - 9) \div (-4)]$ ..... Work inside the parentheses.

$= 3^2 + 2[12 \div (-4)]$ ..... Work inside the brackets.

$= 3^2 + 2 \times (-3)$ ..... Evaluate the power.

$= 9 + 2 \times (-3)$ ..... Multiply.

$= 9 - 6$ ..... Add.

$= 3$

The value of $3^2 + 2[(21 - 9) \div (-4)]$ is 3.

Practice

Find the value of each expression.

1. $-80 - 4^2 \div 8$

2. $92.3 - (3.2 \div 0.4) \times 2^3$

3. $\left[(2^3 \times 2.5) \div \frac{1}{2}\right] + 120$

4. $[20 + (2.5 \times 3)] - 3^3$

5. $\left[(2 \times 10^0) \div \frac{1}{3}\right] + 8$

LESSONS 3-4 AND 3-5 Write and Evaluate Algebraic Expressions

Quick Review

An algebraic expression can be written to represent a situation with an unknown quantity. Use a variable to represent the unknown quantity. An algebraic expression can be evaluated by substituting a value for the variable and performing the operations.

Example

Write an algebraic expression for 9 times the difference of 12 and *a* divided by 2. Then evaluate the expression for $a = 4$.

"9 times the difference of 12 and *a* divided by 2" is represented by $9 \times (12 - a) \div 2$.

Evaluate $9 \times (12 - a) \div 2$ when $a = 4$.

$9 \times (12 - a) \div 2$

$9 \times (12 - 4) \div 2$ — Use substitution to replace the variable with its value.

$= 9 \times 8 \div 2$

$= 72 \div 2$

$= 36$

Practice

Write an algebraic expression to represent each situation.

1. 22 less than 5 times a number *f*

2. 48 times a number of game markers, *g*

Write a situation for each algebraic expression.

3. $e \div 12$

4. $3(m + 7)$

Evaluate each expression for $n = 7$, $x = -4$, $y = 8$, and $z = 1$.

5. $12x - 7$

6. $x^2 \div y$

7. $5z + 3n - z^3$

8. $y^2 \div (2x) + (3n) - z$

LESSON 3-6 Apply Properties of Operations: Algebraic Expressions

Quick Review

Equivalent expressions are expressions that have the same value. The properties of operations and substitution can be used to write and identify equivalent expressions.

Example

Are the expressions $5x + 20$, $5(x + 4)$, and $x + 4$ equivalent?

For algebraic expressions to be equivalent, each expression must name the same value no matter what value is substituted for the variable.

x	$5x + 20$	$5(x + 4)$	$x + 4$
1	25	25	5
2	30	30	6
3	35	35	7

Use the Distributive Property to write $5x + 20$ as $5(x + 4)$.

$$5x + 20 = 5 \cdot x + 5 \cdot 4$$
$$= 5(x + 4)$$

Properties of operations cannot be used to write $5x + 20$ or $5(x + 4)$ as $x + 4$.

$5x + 20$ and $5(x + 4)$ are equivalent expressions.

Practice

Complete the table. Then circle the expressions that are equivalent.

1.

y	$5(2.2y + 1) - 3$	$11y + 5 - y$	$11y + 2$
1			
2			
3			

In 2–4, write Yes or No to indicate whether the expressions are equivalent.

2. $-10x - 3 + 2x - 5$ and $-4(3x - 2)$

3. $3y + 3$ and $9\left(y + \frac{1}{3}\right)$

4. $6(3x + 1)$ and $9x + 6 + 9x$

In 5–7, use properties of operations to complete the equivalent expressions.

5. $2(x + 4)$ and _____$x +$ _____

6. $5x - 45$ and $5($_____ $-$ _____$)$

7. $-3(x + 7)$ and _____$x +$ _____

LESSON 3-7 Simplify Algebraic Expressions

Quick Review

Combine like terms to simplify algebraic expressions.

Example

Simplify the expression $-3x + 7 + 6x$.

$-3x + 7 + 6x$ ..... Identify the like terms, $-3x$ and $6x$.

$= -3x + 6x + 7$ ..... Use the Commutative Property of Addition.

$= 3x + 7$ ..... Simplify.

The expression $3x + 7$ is equivalent to $-3x + 7 + 6x$.

Practice

Simplify each expression.

1. $9y + 4.1 - 6y$

2. $-3x + 5 + 7x$

3. $8x + 13 - 3x + 9\frac{1}{2}$

4. $y^2 + 3y^2$

5. $4x + 15 - 3x + 10$

6. $-10x + 2x + 8x$