Lesson 12

Foundations of College Algebra

Commutative and Associative Properties

Definition - Commutative Property

- If a, b are real numbers, then $a + b = b + a$.
- If a, b are real numbers, then $a \cdot b = b \cdot a$.

Definition - Associative Property

- If a, b, c are real numbers, then $(a + b) + c = a + (b + c)$.
- If a, b, c are real numbers, then $(a \cdot b) \cdot c = a \cdot (b \cdot c)$.

Examples

Use a commutative property to finish each statement.

1. $4 + x =$

2. $-3 \cdot d =$

Use the associative property to simplify.

1. $\left(\frac{5}{6} + \frac{8}{15}\right) + \frac{7}{15}$

2. $3(4x)$

3. $(y + 12) + 28$

Distributive Property

Definition - Distributive Property

If a, b, c are real numbers, then $a(b + c) = a \cdot b + a \cdot c$ and $a(b - c) - a \cdot b - a \cdot c$.

Examples

Simplify using the distributive property.

1. $6\,(c - 13)$

2. $\frac{1}{4}\,(3q + 12)$

3. $12\left(\frac{1}{6} + \frac{3}{4}s\right)$

Use the distributive property to write each addition as a multiplication.

1. $5 \cdot x - 5 \cdot 12$

2. $15x + 15y$

Identity and Inverse Properties

Definition - Identity Property

For any real number a, $a+0=a$ and $a\cdot 1=a$.

Definition - Inverse Property

- For any real number a, $a+(-a)=0$.
- For any real number a except 0, $a\cdot\frac{1}{a}=1$.

Examples

Simplify.

1. $\frac{1}{2}+\frac{7}{8}+\left(-\frac{1}{2}\right)$

2. $\frac{3}{20}\cdot\frac{49}{11}\cdot\frac{20}{3}$

Terms

Definition - Terms and Coefficients

A **term** is a constant, or the product of a constant and one or more variables.

Some terms are: 7, y, $5x^2$, $9a$,and b^5.

The constant that multiplies the variable is called the **coefficient**.

Note

- The coefficient of x is 1.
- The coefficient of $-x$ is -1.

Definition - Like Terms

Terms that are either constants or have the same variables raised to the same powers are called **like terms**.

Example

Identify the like terms in the following.

1. $6z$, $3w^2$, 1, $6z^2$, $4z$, w^2

Combine Like Terms

How To - Combine Like Terms

1. Identify like terms.
2. Rearrange the expression so like terms are together.
3. Add or subtract the coefficients and keep the same variable for each group of like terms.

Examples

Simplify the expressions by combining like terms.

1. $10x + 3x$

2. $4c + 2c + c$

3. $7u + 2 + 3u + 1$

4. $10a + 7 + 5a - 2 + 7a - 4$

5. $3x^2 + 12x + 11 + 14x^2 + 8x + 5$

Simplify Expressions with Parentheses

Examples

Simplify using the distributive property.

1. $16-3(y+8)$

2. $18-4(x+2)$

3. $(5m-3)-(m+7)$

4. $(4y-1)-(y-2)$

5. $5(2n+9)+12(n-3)$

6. $6(7y+8)-(30y-15)$

Write Word Phrases and Algebraic Expressions

Examples

Write each phrase in algebra. Use x for the unknown number. Simplify the expression if possible.

1. The difference of a number and three, divided by two

2. Four times the sum of a number and twelve.