

Simplifying Variable Expressions Using Properties of Multiplication

When we need to multiply numbers and variables we are required to use one or more of the properties of multiplication. NOTE THE FOLLOWING THINGS:

- The Associative Property is used to change the grouping of the factors so that the numbers can be grouped together.
- The Commutative Property is used to change the order so that the numbers can be placed next to each other.
- The Multiplication Property of One is used to show that when you multiply a term by 1, the product is that term.
- The Inverse Property of Multiplication is used to show that when you multiply a number by its reciprocal, the product is always 1.

EXAMPLE: Simplify $(4x)3$

Note: 3 is not an exponent!

This means “the product of four and x times three.”

$$\begin{aligned}
 & (4x)3 \\
 = & 3(4x) && \text{Use the Commutative Property to change the order.} \\
 = & (3 \cdot 4)x && \text{Use the Associative Property to change the} \\
 & && \text{grouping.} \\
 = & 12x && \text{Multiply}
 \end{aligned}$$

EXAMPLE: Simplify $\left(\frac{4}{5}x\right)\left(\frac{5}{4}\right)$

This means “the product of four-fifths and x times five-fourths.”

$$\begin{aligned}
 & \left(\frac{4}{5}x\right)\left(\frac{5}{4}\right) \\
 = & \frac{5}{4} \cdot \left(\frac{4}{5}x\right) && \text{Use the Commutative Property to change order.}
 \end{aligned}$$

$$= \left(\frac{5}{4} \cdot \frac{4}{5} \right) x$$

Use the Associative Property to change the grouping.

$$= 1 \cdot x$$

Use the Inverse Property of Multiplication

$$= x$$

Use the Multiplication Property of One

EXERCISES

1. $5(2x)$

2. $(-3x)7$

3. $4(-x)$

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

5. $(2m)6$

6. $(-y)4$

7. $\left(\frac{3}{2}x\right)\left(\frac{2}{3}\right)$

8. $\frac{3}{4} \cdot 12a$

9. $\left(\frac{4}{3}x\right)\left(\frac{3}{4}\right)$

10. $(-3y)\left(\frac{5}{9}\right)$

11. $\left(\frac{2}{3}\right)\left(-\frac{3}{2}x\right)$

KEY:

1. $10x$

2. $-21x$

3. $-4x$

4. $8x$

5. $12m$

6. $-4y$

7. x

8. $9a$

9. x

10. $-\frac{5}{3}y$ or $-\frac{5y}{3}$

11. $-x$