

Chapter 2 Section 4 Lesson

Multiplying and Dividing Signed Numbers and Variables

Introduction

It is important to memorize the rules for multiplying and dividing signed numbers and variables.

Rules for Multiplication

Rule 1: Multiplying Numbers with the Same Sign

The product of two numbers with the same sign is positive.

Examples: $2 \times 7 = 14$
 $-2 \times (-7) = 14$

Rule 2: Multiplying Numbers with Different Signs

The product of two numbers with different signs is negative.

Examples: $2 \times (-7) = -14$
 $-2 \times 7 = -14$

Rule 3: Multiplying an Even Number of Negative Numbers

Multiplying an even number of negative numbers gives a positive product.

Example: $-2 \times (-4) \times (-3) \times (-1) \times 2 =$ (Four negative numbers)
 $8 \times (-3) \times (-1) \times 2 =$
 $-24 \times (-1) \times 2 =$
 $24 \times 2 = 48$

Rule 4: Multiplying an Odd Number of Negative Numbers

Multiplying an odd number of negative numbers gives a negative product.

Example: $-2 \times (-4) \times (-3) \times 1 \times 2 =$ (Three negative numbers)
 $8 \times (-3) \times 1 \times 2 =$
 $-24 \times 1 \times 2 =$
 $-24 \times 2 = -48$

Extended Example 1

$$(-3)(-6)(-3) = ?$$

Hint: First multiply $(-3)(-6)$. Remember the rule: The product of two numbers with the same sign is positive.

Step 1:
 $= 18(-3)$

Hint: Recall the rule: The product of two numbers with different signs is negative.

Answer:
 $= -54$

Rules for Division

The rules that apply to multiplying signed numbers also apply to dividing signed numbers.

Rule 5: Dividing Numbers with the Same Sign

When you divide two numbers with the same sign, the quotient is positive.

Example: $18 \div 3 = 6$
 $-18 \div (-3) = 6$

Rule 6: Dividing Numbers with Different Signs

When you divide two numbers with different signs, the quotient is negative.

Example: $18 \div (-3) = -6$
 $-18 \div 3 = -6$

Multiplying and Dividing with Variables

The rules for multiplying and dividing signed numbers also apply to variables. Note that it is important to remember that a variable representing a number does not indicate the number's sign. For example, $a(-b) = -ab$, but this product, $-ab$, could be positive, negative, or zero, depending upon whether a and b represent positive or negative numbers.

In algebra, we can indicate multiplication in a variety of ways:

| | | |
|--------------|-------------|--------|
| $a \times b$ | $a \cdot b$ | ab |
| $(a)(b)$ | $a(b)$ | $(a)b$ |

Note:

- $3 \times 5 = 15$ or $3 \cdot 5 = 15$ or $3(5) = 15$
- $4a = 4 \times a$ but $35 \neq 3 \times 5$

We know that $ab = ba$. The order of multiplied variables does not affect the product. But, it is standard practice to respect the order of the alphabet in most cases. You would rarely see the product ba in an answer. However, you might see it in the intermediate steps of solving an equation.

To simplify expressions with both numbers and variables, we handle them separately, starting with the numbers. The variables just "come along for the ride," so to speak.

For example, solve: $(-4t) \cdot (3s)$

First, multiply the numbers: $-4(3) = -12$

Now, include the variables: $-4t(3s) = -12ts = -12st$

Extended Example 2

$$(-2s)(-8t) = ?$$

Hint: Deal with the numbers and variables separately.

Step 1:

$$= (-2)(-8)st$$

Hint: Multiply the numbers. Remember, the product of two numbers with the same sign is positive.

Answer:

$$= 16st \quad \text{Don't forget the variables!}$$

End of Lesson