2-6 *Rules for Multiplication*

Objective: To multiply real numbers.

Properties	Examples

Identity Property of Multiplication
    The product of a number and 1 is identical
    to the number itself.
 	
    $a \cdot 1 = a$ and $1 \cdot a = a$
	$6 \cdot 1 = 6$ and $1 \cdot 6 = 6$

Multiplication Property of Zero
    When one of the factors of a product is zero,
    the product itself is zero.
 	
    $a \cdot 0 = 0$ and $0 \cdot a = 0$
	$6 \cdot 0 = 0$ and $0 \cdot 6 = 0$

Multiplication Property of -1
    For every real number a:
 	
    $a(-1) = -a$ and $(-1)a = -a$
	$6(-1) = -6$ and $(-1)6 = -6$
	$(-5)(-1) = -(-5) = 5$
	and $(-1)(-5) = -(-5) = 5$

Property of Opposites in Products
    For all real numbers a and b:
 	
    $(-a)(b) = -ab$
    $a(-b) = -ab$
    $(-a)(-b) = ab$
	$(-4)(5) = -20$
	$4(-5) = -20$
	$(-4)(-5) = 20$

Rules for Multiplication

1. If two numbers have the *same* sign, their product is positive.
   If two numbers have *opposite* signs, their product is negative.

2. The product of an *even* number of negative numbers is positive.
   The product of an *odd* number of negative numbers is negative.

Example 1   Multiply: **a.** $3(6)$ **b.** $(-3)(6)$ **c.** $3(-6)$ **d.** $(-3)(-6)$

Solution   **a.** $3(6) = 18$ (Both factors have the same sign.)

   b. $(-3)(6) = -18$ (The two factors have opposite signs.)

   c. $3(-6) = -18$ (The two factors have opposite signs.)

   d. $(-3)(-6) = 18$ (Both factors have the same sign.)

Example 2   **a.** $2(-3)(-4)(-5)$ is negative because it has 3 negative factors.

   b. $(-1)(-4)(-5)(6)(-7)$ is positive because it has 4 negative factors.

   c. $(-6)(7)(0)(-4)$ is zero because it has a zero factor.

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2–6 *Rules for Multiplication* (continued)

Multiply.

1. $(-12)(-3)$ 2. $18(-4)$ 3. $2(17)$ 4. $18(0)$

5. $(-2)(5)(-8)$ 6. $(4)(-7)(10)$ 7. $(-2)(-3)(-4)$ 8. $(-11)(-12)(0)$

9. $35(-26)(0)$ 10. $5(-2)(-8)(-5)$ 11. $(-7)(3)(-1)(2)$ 12. $(-8)(-5)(-1)(-3)$

Example 3   Simplify: **a.** $(-2x)(-6y)$ **b.** $3y + (-7y)$

Solution   **a.** $(-2x)(-6y) = (-2)x(-6)y$ **b.** $3y + (-7y) = [3 + (-7)]y$
                      $= (-2)(-6)xy$ $= (-4)y$
                      $= 12xy$ $= -4y$

Simplify.

13. $(-3a)(-4b)$ 14. $(5x)(6y)$ 15. $2p(-5q)$ 16. $(-4e)(7f)$ 17. $(-6a)(-5b)$

18. $-7a + (-8a)$ 19. $2x + (-5x)$ 20. $8x + (-3x)$ 21. $(-11y) + 3y$ 22. $-4n + 4n$

Example 4   Simplify: **a.** $-3(2x - y)$ **b.** $5x - 4(x - 1)$

Solution   **a.** $-3(2x - y) = -3(2x) - (-3)(y)$ **b.** $5x - 4(x - 1) = 5x - (4x - 4 \cdot 1)$
                      $= -6x - (-3y)$ $= 5x - (4x - 4)$
                      $= -6x + 3y$ $= 5x - 4x + 4$
                                                   $= x + 4$

Simplify.

23. $-6(x - 2y)$ 24. $-5(2c + d)$ 25. $-4(3m + 2n)$

26. $-7(-4y - 5)$ 27. $(3x - 5)(-6)$ 28. $(-3 + 5y)(-2)$

29. $4x - 3(x - 2)$ 30. $6x - 2(x + 3)$ 31. $3x - 5(x - 1)$

32. $(-1)(a - b + 2)$ 33. $(-1)(2x - y - 3)$ 34. $(-1)(x + y - z)$

35. $4x - 2x + 7 + x$ 36. $2y - 5 - 5y + 3$ 37. $11p - 6c - 7c + 9p$

Mixed Review Exercises

Translate each sentence into an equation.

1. Three times a number is 27.   2. The quotient of n and 4 is 15.

3. One half of a number is nine.   4. Six less than twice a number is 14.

Simplify.

5. $110 - (12 - 8)$ 6. $161 - (8 - 11)$ 7. $2 + (-5) + (-y) + 9$

8. $3(20 + 5)$ 9. $2n + (-5n)$ 10. $5(n + 1) + 7$