Algebra I Notes #5 page 1 Other Useful Properties Unit 1

Multiplication by -1

$8 \cdot -1 = -8$ $3 \cdot -1 = -3$ $-1 \cdot 5 = -5$ $-1 \cdot 2 = -2$

Rule: $x \cdot -1 = -x$ and $-1 \cdot x = -x$.

-x is the opposite of x. Don't assume that -x is negative. If x represents a negative number, then -x is positive !! Consider these examples.

$-8 \cdot -1 = 8$ $-3 \cdot -1 = 3$ $-1 \cdot -5 = 5$ $-1 \cdot -2 = 2$

Consider the following examples.

$3 \cdot (4 + 2) = 3 \cdot 6 = 18$ and $3 \cdot 4 + 3 \cdot 2 = 12 + 6 = 18$

Therefore, $3 \cdot (4 + 2) = 3 \cdot 4 + 3 \cdot 2$

$5 \cdot (8 + 3) = 5 \cdot 11 = 55$ and $5 \cdot 8 + 5 \cdot 3 = 40 + 15 = 55$

Therefore, $5 \cdot (8 + 3) = 5 \cdot 8 + 5 \cdot 3$

$3 \cdot (4 - 2) = 3 \cdot 2 = 6$ and $3 \cdot 4 - 3 \cdot 2 = 12 - 6 = 6$

Therefore, $3 \cdot (4 - 2) = 3 \cdot 4 - 3 \cdot 2$

$5 \cdot (8 - 3) = 5 \cdot 5 = 25$ and $5 \cdot 8 - 5 \cdot 3 = 40 - 15 = 25$

Therefore, $5 \cdot (8 - 3) = 5 \cdot 8 - 5 \cdot 3$

Rule: $x(y + z) = xy + xz$ and $x(y - z) = xy - xz$

The first rule is The Distributive Law for Multiplication Over Addition.

The second rule is The Distributive Law for Multiplication Over Subtraction.

Consider the following examples.

$-(3 + 4) = -7$ and $-3 + -4 = -7$ Therefore, $-(3 + 4) = -3 + -4$

$-(2 + 9) = -11$ and $-2 + -9 = -11$ Therefore, $-(2 + 9) = -2 + -9$

Rule: $-(x + y) = -x + -y$ This is called The Opposite of a Sum Property.

Once again, don't assume that -x and -y represent negative numbers. Consider the following examples.

$-(8 + -3) = -5$ and $-8 + 3 = -5$ Therefore, $-(8 + -3) = -8 + 3$

$-(-7 + 10) = -3$ and $7 + -10 = -3$ Therefore, $-(-7 + 10) = 7 + -10$

The Opposite of a Sum Property: $-(x + y) = -x + -y$

Algebra I Notes #5 page 2 Simplifying Algebraic Expressions Unit 1

The properties we have learned can be used to simplify algebraic expressions. Consider the following examples.

Use the appropriate distributive law to write an equivalent expression without parentheses.

1. $3(x + 4) = 3 \cdot x + 3 \cdot 4 = 3x + 12$
2. $6(x - 5) = 6 \cdot x - 6 \cdot 5 = 6x - 30$
3. $5(2x + 7) = 5 \cdot 2x + 5 \cdot 7 = 10x + 35$
4. $7(3x - 4) = 7 \cdot 3x - 7 \cdot 4 = 21x - 28$
5. $-2(x + 5) = -2 \cdot x + -2 \cdot 5 = -2x + -10 = -2x - 10$
6. $-3(5x - 4) = -3 \cdot 5x - -3 \cdot 4 = -15x - -12 = -15x + 12$

Notice on problems 5 and 6 that a 'double sign' is not left in the final answer. The definition of subtraction is used to avoid this. Adding -10 is equivalent to subtracting 10. Subtracting -12 is equivalent to adding 12.

Use the appropriate distributive law to perform the indicated multiplication. Then combine like terms. Remember that the commutative and associative properties of addition allow you to change the order and the grouping of terms that are being added. When necessary, the definition of subtraction can be used to change subtraction to addition and to express the final answer without any 'double signs'.

7. $5(3x + 2y) + 2(x + 5y) =$
   $(15x + 10y) + (2x + 10y)$
   $(15x + 2x) + (10y + 10y) = 17x + 20y$

8. $3(2a - 7b) + 3(7a + 3b) =$
   $(6a - 21b) + (21a + 9b)$
   $(6a + -21b) + (21a + 9b)$
   $(6a + 21a) + (-21b + 9b) = 27a + -12b =$
   $27a - 12b$

Use the definition of subtraction to change the given subtraction problems to addition. Then use the opposite of a sum property. Finally, combine like terms.

9. $(5x + 7y) - (2x + 3y) =$
   $(5x + 7y) + -(2x + 3y) =$
   $(5x + 7y) + (-2x + -3y) =$
   $(5x + -2x) + (7y + -3y) = 3x + 4y$

10. $(2b + 9) - (5b - 2) =$
    $(2b + 9) + -(5b + -2) =$
    $(2b + 9) + (-5b + 2) =$
    $(2b + -5b) + (9 + 2) = -3b + 11$

11. $2(3x - 8) - 3(4x - 5) =$
    $2(3x + -8) + -3(4x + -5) =$
    $(6x + -16) + (-12x + 15) =$
    $(6x + -12x) + (-16 + 15) = -6x + -1 = -6x - 1$

12. $5(4x + 6) - 3(5x + 1) =$
    $5(4x + 6) + -3(5x + 1) =$
    $(20x + 30) + (-15x + -3) =$
    $(20x + -15x) + (30 + -3) = 5x + 27$