

# Properties of Numbers

1. **Commutative Property:** changing positions (“commuting”)
  - a.  $a + b = b + a$   
 $ab = ba$
  - b. **Note:** only for addition and multiplication!
  
2. **Associative Property:** regrouping (grouping things differently)
  - a.  $a + (b + c) = (a + b) + c$   
 $a(bc) = (ab)c$
  - b. Again, only for addition and multiplication!
  - c. This property is really useful in making some problems easier.
    1. **Example 1:**  $146 + 38 + 4$  Use commutative property to switch two numbers (such as the 38 and 4) to make  $146 + 4 + 38$ . Now group the first two numbers ( $146 + 4$ ), which is easy to add to 150. The resulting expression is easy:  $150 + 38 = 188$ . If you try to add the 146 and the 38 first, you can certainly get the correct answer, but it’s much easier and faster if you move numbers when you can.
    2. **Example 2:**  $(25)(73)(4) = (25)(4)(73) = (100)(73) = 7300$ . In this example, you recognize that 25 times 4 is 100, and that makes this an easy mental-math problem, rather than laboriously writing out 25 times 73, and then multiplying the result with 4.
  
3. **Identity Property:**
  - a. The main concept for this property is that you want to keep your original number.
  - b. For addition and subtraction, use zero. Add or subtract zero to a number, and the number stays the same.
  - c. For multiplication and division, use one. Multiply or divide one to a number, and the number stays the same. This property is the reason you can change fractions denominators and numerators.
  
4. **Distributive Property:** multiply each term within parentheses by the number outside.
  - a.  $a(b + c) = ab + ac$
  - b.  $3(x - 5) = 3x - 15$
  - c.  $-3(x - 5) = -3x + 15$
  - d.  $3(2x - 5) = 6x - 15$
  - e.  $3(2x - 5 + 8y) = 6x - 15 + 24y$