

# Order of Operations

When you have a math problem that involves more than one operation—for example, addition and subtraction, or subtraction and multiplication - what do you do first?

Example 1:  $6 - 3 \times 2 = ?$

*Do you do the subtraction first ( $6 - 3 = 3$ ) and then the multiplication ( $3 \times 2 = 6$ )?  
Or do you start with the multiplication ( $3 \times 2 = 6$ ) and then subtract ( $6 - 6 = 0$ )?*

## PEMDAS

In cases like these, we follow the order of operations. The order in which operations should be done is abbreviated as PEMDAS:

1. Parentheses
2. Exponents
3. Multiplication and Division (from left to right)
4. Addition and Subtraction (from left to right)

(One-Way to memorize this is to think of the phrase Please Excuse My Dear Aunt Sally.)

Example 1 Again:  $6 - 3 \times 2 = ?$

In this example,

- *We are dealing with multiplication and subtraction.*
- *Multiplication comes a step before Subtraction,*
- *So first we multiply  $3 \times 2$ , and then subtract the sum from 6, leaving 0.*

Example #2:  $30 \div 5 \times 2 + 1 = ?$

### Correct Approach:

- *There are no Parentheses.*
- *There are no Exponents.*
- *We start with the Multiplication and Division, working from left to right.*  
*NOTE: Even though Multiplication comes before Division in PEMDAS, the two are done in the same step, from left to right. Addition and Subtraction are also done in the same step.*
- *$30 \div 5 = 6$ , leaving us with  $6 \times 2 + 1 = ?$*
- *$6 \times 2 = 12$ , leaving us with  $12 + 1 = ?$*
- *We then do the Addition:  $12 + 1 = 13$*

### Wrong Approach:

If we do the multiplication before the division, we end up with the wrong answer:

- $5 \times 2 = 10$ , leaving  $30 \div 10 + 1 = ?$
- $30 \div 10 = 3$ , leaving  $3 + 1 = ?$
- $3 + 1 = 4$  (off by 9!)

Example #3:  $5 + (4 - 2)2 \times 3 \div 6 - 1 = ?$

- *Start with the Parentheses:*  $4 - 2 = 2$ . (Even though subtraction is usually done in the last step, because it's in parentheses, we do this first.) That leaves  $5 + 22 \times 3 \div 6 - 1 = ?$
- *Then Exponents:*  $2^2 = 4$ . We now have  $5 + 4 \times 3 \div 6 - 1 = ?$
- *Then Multiplication and Division, starting from the left:*  $4 \times 3 = 12$ , leaving us with  $5 + 12 \div 6 - 1 = ?$
- *Then moving to the right:*  $12 \div 6 = 2$ , making the problem  $5 + 2 - 1 = ?$
- *Then Addition and Subtraction, starting from the left:*  $5 + 2 = 7$ , leaving  $7 - 1 = ?$
- *Finally, moving to the right:*  $7 - 1 = 6$