15.2: Appendix B- Order of Operations

Some formulas require many operators (i.e. symbols that denote a mathematic procedure is to be performed). Mathematicians, statisticians, and scientists use agreed upon rules that govern how they should proceed in their work. These explicit rules reduce confusion and miscommunication among members of the fields. One such important rule is referred to as the Order of Operations. *The Order of Operations* refers to the order in which parts (i.e. steps) of equations must be carried out. The acronym PEMDAS is often used as a short-hand for the steps in their proper order: Parenthesis, Exponents, Multiplication and/or Division and/or, and finally Adding and/or Subtraction. Not following this order can cause an individual to yield a wrong answer.

When following the Order of Operations, you should conduct four steps:

1. First, complete all operations within parenthesis or brackets.
2. Second, calculate all the exponents.
3. Third, complete all multiplications and/or divisions in order from left to right.
4. Fourth, complete all addition and/or subtraction in order from left to right.

Note

Sometimes there are multiple steps within parentheses. When this is the case, you perform The Order of Operations **within** the parenthesis as step one.

This section will walk you through a few examples using The Order of Operations, starting with simpler equations and progressing to more complex equations.

Example 15.2.1

$70 – 6 \times 5$

Solution

There are only two operations to do: subtract and multiply. The Order of Operations tells us the complete all multiplication before subtraction. Therefore, the solution is 40 and is found as follows:

$70 – 6 \times 5 = 70 – 30 = 40$

Example 15.2.2

$4 \times 5^2 – 15$

Solution

There are three operations to do:, multiplication, squaring, and subtraction. The Order of Operations tells us to complete exponents before multiplication and then subtraction. Therefore, the solution is 85 and is found as follows:

$4 \times 5^2 – 15 = 4 \times 25 – 15 = 100 – 15 = 85$

Example 15.2.3

$36 \div 12 + (8 \div 2)$

Solution

There are three operations to do: divide, add, and divide within a parenthesis. The Order of Operations tells us to complete the division within parenthesis, then the division outside the parenthesis, and then the addition. Therefore, the solution is 7 and is found as follows:

$36 \div 12 + (8 \div 2) = 36 \div 12 + 4 = 3 + 4 = 7$