Workshop: Order of Operations

Problems that involve the order of operations can be tricky. Most people know the phrase associated with order of operations:

"**P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally"

or have just known the acronym **PEMDAS**. This leads to the following order of operations:

Parenthesis
Exponents
Multiplication
Division
Addition
Subtraction

This way of knowing the order of operations can be a little misleading because it leads you to believe that multiplication comes before division and addition comes before subtraction. **This is false!** The correct way to see the order of operations is like this:

Parenthesis
Exponents
Multiplication & Division
Addition & Subtraction

Multiplication and division have the same level and should be performed from left to right. The same goes for addition and subtraction. If you have the following:

$$45 \div 5 \cdot 3 - 5 + 16$$

The division should be performed **BEFORE** the multiplication and the subtraction **BEFORE** the addition.

$$\begin{aligned} & 45 \div 5 \cdot 3 - 5 + 16 \\ &= 9 \cdot 3 - 5 + 16 \\ &= 27 - 5 + 16 \\ &= 22 + 16 \\ &= 38 \end{aligned}$$

We then should remember that **LEFT to RIGHT** should be a part of our memorization device. So let's modify the above phrase:

Please **E**xcuse **M**y **D**ear, **L**ittle **R**elative, **A**unt **S**ally

Time to practice!

1. $-4(3)^2 - 2(-1)^3$

2. $3 - 2\left[\frac{8(-1)-7}{-3(2)-4}\right]$

3. $8[7 + 2(6 \cdot 9 - 14)]$

4. $(5 - 8)^2 - (4 - 8)^2$

5. $(6 - 9)[15 - 3(-4)]$

6. $3 - 2[4 - 4^2 \div 2 + (4 - 6)^3]$

7. $8 - (-7)\left[\frac{6-1(6-10)}{4-3(5-7)}\right]$

8. $-6^2 - (-6)^2$

9. $[(10 - 2)^2 + 3) + 3 + 8^2$

10. $[4^2 + (18 \div 3 + 3^2)] - 3^2$