Order of Operations Rules Name ________________________________

As problems become longer and contain multiple steps, it is critical that you develop good organizational skills to keep track of your work. This becomes even more critical as the problems involve fractions. Here are two whole number order of operation problems, worked using a slightly different method. Pay attention that in both cases, every step of the problem represent the value of the original problem.

Method 1:

	$12 \div 3 + 5 \cdot 6 - 4(2+1)$	
Following order of operations, the first step is to add the 2 + 1 in the PARENTHESES.	$12 \div 3 + 5 \cdot 6 - 4 \cdot 3$	Notice that everything else from the original problem is re-written, so that the original problem remains intact, except the one computation that is done first.
Since there are no more parentheses and there aren't any exponents, the next step is to do the division. Remember that the rules say to do multiplication or division AS THEY APPEAR IN THE PROBLEM FROM LEFT TO RIGHT.	$4 + 5 \cdot 6 - 4 \cdot 3$	Notce that as the problem is done, it is easy to see what has changed (that is what order the computations were done in) and it is easy to track the problem from start to finish.
The next step would be to do the first multiplication $5 \cdot 6$	$4 + 30 - 4 \cdot 3$	
Next comes the other multiplication.	$4 + 30 - 12$	
Next the addition.	$34 - 12$	This method works great, but some people find it long and drawn out. It really wasn't too bad. 6 steps from start to finish.
Then the subtraction.	22	

Method 2:

Now let's look at the same problem done a slightly different way.

In order for this next method to work, you need to be able to split a problem into multiple terms. You learned about factors earlier in this module. Factors are separated by multiplication (or division, since division is just multiplying by a reciprocal), so in the problem $4 \cdot 3$, 4 and 3 are both factors. Terms are separated by addition or subtraction, to $4 + 3$ is made up of two terms; 4 and 3 are both terms.

In the problem $12 \div 3 + 5 \cdot 6 - 4(2+1)$ there is one + and one -, so the problem can be thought of as having 3 terms. Note that the + in 2 + 1 doesn't make another term, because it is inside a set of parentheses.

$$\underset{\text{this is the first term}}{12 \div 3} \qquad \underset{\text{this is the second term}}{+5 \cdot 6} \qquad \underbrace{-4(2+1)}_{\text{this is the third term}}$$

Since the last step when you follow the rules for the order of operations is to add or subtract (in the order they appear in the problem from left to right), the three terms would not interact with each other until the last step, so you can work the problem like three separate smaller problems at the same time.

If you are going to do this, it is still important to keep the problem intact and only do one step at a time in each term.

This is how this looks thinking about the problem as three terms, compared to the method above.

$$\begin{array}{c} {\color{red}12 \div 3} {\color{blue}+5 \cdot 6} {\color{green}-4(2+1)} \\ {\color{red}4} {\color{blue}+30} {\color{green}-4 \cdot 3} \\ {\color{red}4} {\color{blue}+30} {\color{green}-12} \\ 34-12 \\ 22 \end{array} \qquad \begin{array}{c} 12 \div 3+5 \cdot 6-4(2+1) \\ 12 \div 3+5 \cdot 6-4 \cdot 3 \\ 4+5 \cdot 6-4 \cdot 3 \\ 4+30-4 \cdot 3 \\ 4+30-12 \\ 34-12 \\ 22 \end{array}$$

WARNING… Avoid the temptation to shorten the process by trying to skip steps or do parts in your head. It may work now, but there is a really good chance it won't work when you are doing similar problems containing fractions.

Here are a few order of operation problems containing just whole numbers for you to try. You will want to make certain that you aren't having problems with order of operations before you do order of operation problems involving fractions.

$4 \cdot 10-3^2 \cdot 2 \div 6+3(4-1)$ $\qquad$ $3\left(12 \div 3 \cdot 2^2\right)+4 \div 2$ $\qquad$ $2\left(5^2+12 \div (4 \div 2)-2\right)$