Goals: (brief or bullet pointed list of topics to be learned)

* Why do we need the order of operations?
	+ What is the order of operations?

(Use Goals as a section header for the transition into each topic)

# Why do we need the order of operations?

Consider the problems:

$15÷5∙3=$

$2-1∙3^{2}=$

Does it seem reasonable that we could get more than one answer simply based on which operation we choose to do first?

Then what is “correct” is only a matter of choosing one set rules which designate a specific order to the operations in terms of preference in evaluating an expression.

I.E. we have to pick who goes first, then everyone has to follow that order, or else there will be multiple answers that are not the same (which is bad).

## The Order of Operations (look it up in any math book)

1. Parenthesis or grouping symbols
2. Exponents
3. Multiplication And Division in order of appearance from L$\rightarrow $R
4. Multiplication And Division in order of appearance from L$\rightarrow $R

Since any deviation or lack of understanding of the order of operations can lead to getting an incorrect answer, I will expect any student to be able to rigorously state the order of operation, noting the specific numerical order of preference, and if within one of these there are multiple operations, then state how to preference between these two (like in step 3 and step 4)

Division bars should be treated as a grouping symbol

Radicals should be treated as grouping symbols

Some tempting places to not follow the order of operations.

Ex: When division and multiplication are both in the expression. (especially if division comes first)

$$1+6÷3∙2$$

Ex: When the problem leads off or ends with a really easy operation (like adding or subtracting) and in the middle there is a harder looking set of operations:

$$3+4∙7^{2}÷4-1$$

The mistake is when you “just take care of the easy stuff first” instead of following the Order of Operations.

Ex: Exponents that have a negative near the base number but no parenthesis

$$1-3^{2}=$$

$$-3^{2}=$$

This comes down to this question, is the negative symbol part of your base number or is it just saying “subtract” $3^{2}$? We should be consistent in how we treat it.

Ex: If there are both adding and subtracting in your final steps, and the subtraction appears first from L$\rightarrow $R.

$$3-2+1$$

Can you think of any other places you often make mistakes using the order of operations?