



Order of Operations

When you are asked to add, multiply, subtract and divide it may not be clear which you should do first.

For example,

$$\text{Given: } 3 - 5*2^3 + 8 - 3*(5 + 1)$$

$$\text{Do you subtract first? } 3 - 5*2^3 + 8 - 3*(5 + 1)$$

$$\text{Do you multiply first? } 3 - 5*2^3 + 8 - 3*(5 + 1)$$

$$\text{Or do you do inside the parenthesis first? } 3 - 5*2^3 + 8 - 3*(5 + 1)$$

Over the years, mathematicians have agreed on the order of what should be done first. The procedures of adding, subtracting, multiplying, dividing and a few other forms of arithmetic are called "operations". When you *add* $5 + 3$, you *perform the operation of addition* to get the answer of 8.

The order of operations (the order in which you do arithmetic) are agreed to be:

First: Parentheses.

$$3 - 5*2^3 + 8 - 3*(5 + 1) = 3 - 5*2^3 + 8 - 3*(6)$$

Do anything you can do inside a set of parentheses. If there are parentheses within parentheses, then first do the inner-most parentheses and work your way out. It is like peeling an onion from the inside out. Keep working inside each peel until there is nothing left to do, then work inside the next peel, and the next, until there are no peels (parentheses) left.

Next: Exponents (powers attached to numbers)

$$3 - 5*2^3 + 8 - 3*(6) = 3 - 5*2*2*2 + 8 - 3*(6) = 3 - 5*8 + 8 - 3*(6)$$

After clearing parentheses, perform **all** exponential operations before proceeding in the problem.

Multiply and/or Divide (in order from left to right)

$$3 - 5*8 + 8 - 3*(6) = 3 - 40 + 8 - 3*(6) = 3 - 40 + 8 - 18$$

When reading from the left to the right, please notice that the **red product** is the first multiplication problem, so do it first. Skip to the next one, the **green one**, and do it second.

Finally,

Add and/or Subtract (in order from left to right).

$$3 - 40 + 8 - 18$$

$$= 3 - 40 + 8 - 18 = -37 + 8 - 18 = -37 + 8 - 18 = -29 - 18 = -29 - 18 = -47$$

Reading from the left to the right, 3 minus 40 is first. Get an answer and add it to 8. The latter result is then combined with -18 to produce the final answer of -47.

How to remember the order of operations:

Please (parentheses first) **Excuse** (exponents) **My Dear** (multiply and/or divide left to right) **Aunt Sally** (add and/or subtract left to right) --- *author unknown*.