

## PEMDAS

NAME:

This worksheet discusses order of operations. PEMDAS is an acronym that helps me remember the order of operations. And keep in mind, these rules are essentially arbitrary, they are the way they are because long-dead men decided it to be so. Keeping them straight (like the difference between  $(3+4)/2$  and  $3+4/2$ ) helps us communicate. Because one guy thinks he's talking about 3.5 and another guy thinks he's talking about 5. When that happens, bridges collapse and people die, do you want that??

The order of operations is

- 1.) **P**arentheses
- 2.) **E**xponents
- 3.) **M**ultiply and **D**ivide
- 4.) **A**dd and **S**ubtract

Also, we must remember to do multiply/divide or add/subtract operations from left to right. But always divide or multiply any terms before adding or subtracting.

PS—Do not use your calculator. It will help you internalize what's going on. Write out the steps explicitly as demonstrated.

We'll do a few examples.

Simplify  $\frac{(3+2)^2 - 6^2}{7}$ .

First, we deal with the stuff inside the **Parentheses**. This gets us  $\frac{5^2 - 6^2}{7}$ . Then we evaluate the **Exponents** to get  $\frac{25 - 36}{7}$ . Notice this means the difference  $25 - 36$  divided by 7. So we need to subtract first to get  $\frac{-11}{7}$ . (It's like we had **Parentheses** around the  $25 - 36$ .) We then **Divide** to find this number is  $-1.57$ .

Simplify  $(3^2 - 4)^2 + 4 - 6 - 2 + 10$ .

This is tricky. Let's deal with the **Parentheses** first, or the  $(3^2 - 4)$  part. Inside the parentheses we have  $(3^2 - 4) = (9 - 4) = 5$ . (Notice here we evaluated the **Exponent** then **Subtracted**.) So our expression is now  $5^2 + 4 - 6 - 2 + 10$ . Evaluate the **Exponent** to get  $25 + 4 - 6 - 2 + 10$ . The rest is just remembering to go from left to right... 25 plus 4 is 29... minus 6 is 23... minus 2 is 21... plus 10 is 31.

Simplify  $\frac{3(6-2)^2 - 10}{19}$ .

Evaluate the **Parentheses**  $6-2=4$ , so we have  $\frac{3*4^2 - 10}{19}$ . Then do the **Exponent** or  $4^2 = 16$  so you have  $\frac{3*16 - 10}{19}$ . **Multiply** to get  $\frac{48 - 10}{19}$ , then **Subtract** on top to get  $\frac{38}{19}$  which is 2.

A way to remember stuff like what we did with the  $3*4^2$  is imagine it as  $3*4*4$  or 48. (Because of what it means to square the 4.) If we multiply the 3 and 4 before squaring, it would be like  $(3*4)^2$  or  $3*4*3*4$  which is 144.

Simplify  $3(x-3)^2 + 4x - 5$ .

Just like before, we would evaluate the **Parentheses** but  $x-3$  is in simplified form already, so we just need to evaluate the **Exponent** and get  $3(x^2 - 6x + 9) + 4x - 5$ .

**Multiplying** the 3 into  $x^2 - 6x + 9$  gives us  $3x^2 - 18x + 27 + 4x - 5$ . Adding left to right we have three terms, they are  $3x^2$ ,  $-14x$ , and 22. So we have  $3x^2 - 14x + 22$ .

### Practice

Simplify  $\frac{(5-2)^2 + 4}{2} - 3$ .

Simplify  $(12+5)^2 - 3*5^2 + 20$ .

Simplify  $\frac{3(4-7)^2 + 7}{2}$ .

Simplify  $(4x + 2x)^2 - 5x^2 + 11x^2 - 1x^2$ .

Simplify  $3(x + 2)^2 - 5x + 4$ .

Simplify  $2^3 * 4x - 5(x - 3) + 6x$ .