PEMDAS Solutions 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 $\frac{(5-2)^2+4}{2}-3=\frac{3^2+4}{2}-3=\frac{9+4}{2}-3=\frac{13}{2}-3=6.5-3=$ 3.5

*Simplify the stuff inside the **parentheses** first. Then evaluate the **exponent** on 3^2. We need to **add** 9 and 4 before we **divide** by 2. Then **subtract** 3.*

Simplify $(12+5)^2-3*5^2+20=17^2-3*5^2+20=289-3*25+20$
$=289-75+20=214+20=$ 234

*Simplify the stuff inside the **parentheses** first. Then evaluate the **exponents** on 17^2 and 5^2. We **multiply** 3 times 25 before we add and subtract. **Add and subtract** from left to right.*

Simplify $\dfrac{3(4-7)^2+7}{2} = \dfrac{3(-3)^2+7}{2} = \dfrac{3*9+7}{2} = \dfrac{27+7}{2} = \dfrac{34}{2} = 17$

*Simplify the stuff inside the **parentheses** first. Then evaluate the **exponent** by squaring the -3, which gives you positive 9. Then **multiply** on top before you **add** the 7. Then **divide** by 2.*

Simplify

$$(4x+2x)^2 - 5x^2 + 11x^2 - 1x^2 = (6x)^2 - 5x^2 + 11x^2 - 1x^2 = (6x)(6x) - 5x^2 + 11x^2 - 1x^2$$
$$= 36x^2 - 5x^2 + 11x^2 - 1x^2 = 31x^2 + 11x^2 - 1x^2 = 42x^2 - 1x^2 = 41x^2$$

*We'll deal with the **parentheses**, then the **exponent**. Then we'll **add** and **subtract**. It's easier if you see that "4x + 2x" is simply 6x. You can FOIL the parentheses out but it's less nasty if you write it as $(6x)^2$. To remember that the 6 and the x both get squared, I write it as (6x)(6x). Then we have an addition / subtraction problem. Go left to right. (P.S. – If you FOILed out $(4x + 2x)^2$, you should get $16x^2 + 8x^2 + 8x^2 + 4x^2$, which is $36x^2$.)*

Simplify $3(x+2)^2 - 5x + 4 = 3(x^2 + 4x + 4) - 5x + 4 = 3x^2 + 12x + 12 - 5x + 4$
$= 3x^2 + 7x + 16$

*We would do what's inside the **parentheses** first, but you cannot simplify "x + 2" anymore. So we evaluate the **exponent**, so square the "x + 2". We use FOIL to do this. Then **multiply** the 3 through. Then **go left to right**, combining like terms. We have "12x – 5x" which gives us 7x, and "12 + 4" which gives us 16.*

Simplify

$$2^3 * 4x - 5(x-3) + 6x = 8 * 4x - 5(x-3) + 6x = 32x - 5x + 15 + 6x = 27x + 15 + 6x = 33x + 15$$

*Evaluate the **exponent** on 2^3. Then we should see this as the sum or difference of three terms, "8*4x", "5(x - 3)", and "6x". **Multiply** the first two terms out before we add or subtract. Then **add** or **subtract** like terms from left to right. Be careful of the negative signs.*