Pre-AP Algebra II
Notes Day #2
Order of Operations, Combining Like Terms

In mathematics, the order of operations are the rules for which procedures to perform first in evaluating a mathematical expression.

Evaluate - Finding the specific value of a numerical or algebraic expression. You may think of evaluating as trying to find a single number from the original expression.

Order of Operations	
( ) , [ ] , { }	Parentheses, Brackets, Braces
x^a , $\sqrt{}$	Exponents, radicals
× , ÷	Multiplication, Division
+ , −	Addition, Subtraction

Evaluate ↓ Solving ↑

- **In evaluating expressions, we proceed down the order of operations in the usual manner (PEMDAS).**
- **For solving equations however, we proceed up the order of operations , doing the order in reverse (SADMEP).**

Directions: **Evaluate example 1 and solve example 2.**

Ex. 1: $2(3) + 1$

$6 + 1$

$\boxed{7}$

Ex. 2: $2x + 1 = 5$

$-1 \quad -1$

$\frac{2x}{2} = \frac{4}{2}$

$\boxed{x = 2}$

Directions: Solve the following equation.

Ex. 3: $\frac{2x+4}{3} - 7 = -\frac{7}{3}$

$$\frac{2x+4}{3} - 7 = -\frac{7}{3}$$
$$\underline{\quad +7 \quad +7}$$
$$\frac{2x+4}{3} = -\frac{7}{3} + \frac{7}{1}$$
$$\frac{2x+4}{3} = -\frac{7}{3} + \frac{7}{1}\left(\frac{3}{3}\right)$$
$$\frac{2x+4}{3} = -\frac{7}{3} + \frac{21}{3}$$
$$\cancel{3}\left(\frac{2x+4}{\cancel{3}}\right) = \left(\frac{14}{\cancel{3}}\right)\cancel{3}$$
$$2x + 4 = 14$$
$$\underline{\quad -4 \quad -4}$$
$$\frac{2x}{2} = \frac{10}{2}$$
$$\boxed{x = 5}$$

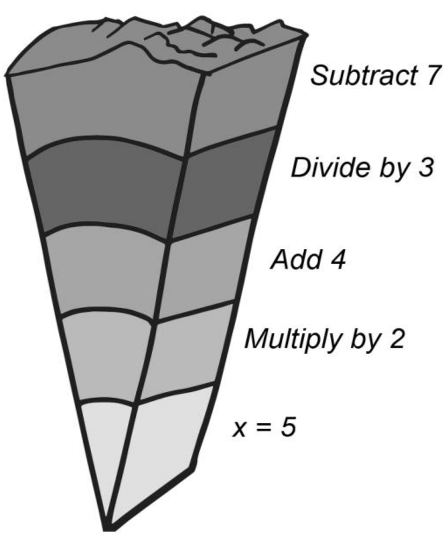
- **Why is it we work backwards to solve equations?**

Solving equations can be thought of like an archaeologist digging up a fossil. The newest layers of the Earth's crust are on top and represent the last step used to build the equation in this analogy.

Equations are constructed from the order of operations and each operation acts like one of the layers of dirt and rock between an archaeologist and their fossil. The further down we travel, the older the rock layers are as we return to the original step in the equation.

Each layer is undone by its opposite operation, or inverse**. After doing this for all the steps in the equation we obtain our goal, the solution of the equation (or the fossil for the archaeologist).**

Directions: Construct the equation in Example 3 from the steps in the picture below.



Ex. 4: $x = 5$ **[Original Problem]**

$2x = 10$ **[** Multiply by 2 **]**

$2x + 4 = 14$ **[** Add 4 **]**

$\frac{2x+4}{3} = \frac{14}{3}$ **[** Divide by 3 **]**

$\frac{2x+4}{3} - 7 = -\frac{7}{3}$ **[** Subtract 7 **]**

Remember that variables are representations of an abstract idea. *x* and *y* are commonly used to represent the independent and dependent variable respectively, but this still works even using other symbols to represent the variables. Other fields of study have their own symbols to represent specific variables and you should get used to solving equations that have other symbols.

Directions: **Solve the following equations.**

Ex. 5: $7\varphi+3-4\varphi=6\varphi+1$

$3\psi+3=6\psi+1$
$-3\psi \quad -3\psi$

$3=3\psi+1$
$-1 \quad -1$

$\frac{2}{3}=\frac{3\psi}{3}$

$\boxed{\psi=\frac{2}{3}}$

Ex. 6: $3\delta^2-5\delta+1=3\delta^2+7\delta-5$

$-3\delta^2 \quad -3\delta^2$

$-5\delta+1=7\delta-5$
$+5\delta \quad +5\delta$

$1=12\delta-5$
$+5 \quad +5$

$\frac{6}{12}=\frac{12\delta}{12}$

$\frac{6}{12}=\delta$

$\boxed{\delta=\frac{1}{2}}$

Combining Like Terms

A phrase you may have encountered several times before is to "combine like terms". Before we can do that however, we will need to have a precise classification of what it means to be an algebraic term. Terms in algebra all have three distinct parts.

$\boldsymbol{ax^n}$

coefficient

exponent

base

***Note: Both the** coefficient **and** exponent **are assumed to have a value of 1 if their value is not given.**

Often when working with polynomials (meaning "many terms"), certain terms may be combined in a way that simplifies the expression.

Properties for combining terms:

Addition Property

1) $\boldsymbol{ax^n+bx^n=(a+b)x^n}$

Add coefficients

Ex. 7:

$\boldsymbol{2x^4+3x^3+1x^4=}$ $(2+1)x^4+3x^3$

$\boxed{3x^4+3x^3}$

Multiplication Property

2) $ax^m \bullet bx^n = (a \bullet b)x^{m+n}$

multiply coefficients, Add exponents

or

$ax^m \bullet by^n = (a \bullet b)x^m y^n$

multiply coefficients

Ex. 8:

$2x^4 \bullet 3x^3 = (2 \cdot 3)x^{4+3}$

$= \boxed{6x^7}$

$2x^4 \bullet 3y^3 = (2 \cdot 3)x^4 y^3$

$= \boxed{6x^4y^3}$

Notice in property 1 that <u>the bases for both terms must be exactly the same and the exponents for both terms must be exactly the same</u>. This is the only way that terms may be added together for our purposes. It is important to note that only the __coefficients__ ever change when adding terms together. This property is generally what we mean by "__combining like terms__".

For property 2 however, none of the term components have to match. Notice in the end result the <u>coefficients are multiplied together</u> and the <u>exponents are added together</u> if the bases match. In the second case of the property the coefficients are multiplied together while the bases *and* exponents remain the same.

Directions: Simplify the following expressions.

Ex. 9: $\lambda^7 + \lambda^4 + 3\lambda^7 + 2\lambda^4 + 1$

$\boxed{4\lambda^7 + 3\lambda^4 + 1}$

Ex. 10: $-3\theta + 5 - 2\theta + 3\theta^2 - 7\theta + 2$

$3\theta^2 - 5\theta - 7\theta + 7$

$\boxed{3\theta^2 - 12\theta + 7}$

Ex. 11: $3x^3 \bullet 4x^2y \bullet 2$

$12x^5y \cdot 2$

$\boxed{24x^5y}$

Ex. 12: $4\delta^2 \bullet 3\delta^5 y \bullet 3xy^2$

$(12\delta^7 y) \cdot (3xy^2)$

$\boxed{36\delta^7 y^3}$