# Steps Reasons and Rules for Algebraic Problems

All algebraic problems must be done in a vertical format (all the equal signs line up in one column.) Each line must have only one step EXCEPT that the arithmetic step and some notation steps can be combined with any other step. The reason must be given for each step and must be one from the following list.

| **Step** | **Abbreviation** | **Explanation and comments** |
|---|---|---|
| Arithmetic | Arith. | Doing any arithmetic step, (this is broadened to include taking powers, roots, or logarithms.) |
| Change of Notation | Not. | This step is shifting from one notation to another way of writing the same thing. In this class we will use this step in changing back and forth between:<br>1) Subtracting and 'adding the opposite.'<br>2) Dividing and 'multiplying by the reciprocal.'<br>3) Equation notation and function notation.<br>4) Log notation and exponential notation. |
| Distributive Property | Dist. | A common form of simplification. $a(b + c)$ becomes $ab + ac$. |
| Multiplying by one | Mult. by 1 | Used when changing denominators. This step is usually NOT used on equations. |
| Exponent Property<br>Root Property<br>Log Property<br>Quadratic Property | Prop | This general reason is used with one of the many properties that we cover in this course. |
| FOIL | FOIL | A more general use of the distributive property. Used when multiplying binomials together. |
| Substitution (evaluation) | Sub. | Exchanging a 'letter' for an expression that it equals. Used in evaluating expressions, solving systems of equations, and checking solutions. Also used when applying formulas. |
| Factoring | Fact. | Breaking an expression up into its factors. This is usually done in preparation for using the Zero Factor Property, or the Fundamental Property of Rational Numbers, or in getting common denominators in rational expressions. |
| Fundamental Principle of Rational Numbers | Reduce | This principle states that a number (not zero) divided by itself is one ($a/a = 1$, if $a$ is not zero.) |

| The following steps can ONLY be used on Equations. | | |
|---|---|---|
| Golden Rule | GRule | Add/Subtract/Multiply/Divide the same expression to both sides of an equation. |
| Zero Factor Property | 0-Fact. | This is a logic step. If ab = 0 then (⇒) a = 0 or b = 0. This is used when solving nonlinear functions. |
| Drop Absolute Value | Drop Abs | Used to eliminate the Absolute Value sign in equations by using the definition. |
| Power Rule | Power | Raising both sides of an equation to the same power. This process NOT the Golden Rule and can 'create' extraneous solutions that must be checked. |
| Square-Root Property | Sqrt. | Taking the square root of both sides of an equation. Like the Power Rule this step is not the Golden Rule; this step requires that you add a ± sign to one side. |
| Inverse | Inverse | The step used to create an inverse function from a given function. |
| One-to-One Property | One-to-One | The one-to-one property of exponential functions (and Log functions). Used to solve equations with exponentials (or logarithms) in them. Like the 0-Factor step, this is also a logic step. |

A sample problem using the required form:

$$\frac{1}{2} = x - 3(x+2)$$

$$\frac{1}{2} = x - 3x - 6 \quad \text{Dist.}$$

$$\frac{1}{2} + 6 = -2x - 6 + 6 \quad \text{G Rule}$$

$$\frac{1}{2} + 6\left(\frac{2}{2}\right) = -2x \quad \text{Mult by 1 and Arith.}$$

$$\frac{13}{2} = -2x \quad \text{Arith.}$$

$$\frac{13}{2}\frac{1}{-2} = -2x\frac{1}{-2} \quad \text{G Rule}$$

$$-\frac{13}{4} = x \quad \text{Arith.}$$