Linear Equations

An equation consists of two expressions set equal to each other. To solve an equation means to find the number that makes the equation a true statement.
The set of all solutions for an equation makes up its **solution set**.

There are three types of equations:

1) **Identity Equations:** An equation is classified as an identity when it is true for ALL real numbers for which both sides of the equation are defined.
   Example: $2x - 1 = -1 + 2x$

2) **Conditional Equations**: A conditional equation is an equation that is not an identity, but has at least one real number solution.
   Example: $3x + 5 = x - 7$

3) **Inconsistent Equations**: An inconsistent equation is an equation with one variable that has no solution.
   Example: $2x + 5 - x = x + 7$

Any two equations with the same domain and the same solution set are **equivalent equations**.

Equations are classified according to the degree of the variables

Linear Equation: An equation that can be written in the form of *ax + b = 0*
where a and b are constants
Note that the exponent on the variable of a linear equation is always 1.

To solve linear equations you can use multiplication and addition properties of equality.

GUIDELINE:

1) Simplify any grouping symbols.
2) If you would like to eliminate fractions, then multiply each term by the LCD.
2) Combine like terms.
3) Bring variables to one side of equal symbol.
4) Apply the addition property.
5) Apply the multiplication/division property.
6) Check your solution in the original equation.

Example 1: Solve 3(2x - 1) = 4(x + 5).
6x - 3 = 4x + 20   simplify by distributing
2x - 3 = 20   subtract 4x on both sides
2x = 23   add 3 on both sides
x = 23/2 or 11.5 is the solution.   divide both sides by 2

Example 2: Solve 3[2m - (7 - 3m)] = m - 21.
3[2m - 7 + 3m] = m - 21   simplify grouping symbols
3[5m - 7] = m - 21
15m - 21 = m - 21
14m - 21 = -21   subtract m on both sides
14m = 0   add 21 on both sides
m = 0 is the solution.   divide both sides by 14

Example 3: Solve $\dfrac{2}{3}\left(3x - \dfrac{1}{4}\right) = \dfrac{3}{4}(5 - x) - \dfrac{1}{2}(3x - 7)$

$12 \bullet \dfrac{2}{3}\left(3x - \dfrac{1}{4}\right) = 12 \bullet \dfrac{3}{4}(5 - x) - 12 \bullet \dfrac{1}{2}(3x - 7)$ Multiply each term by LCD of 12

$8\left(3x - \dfrac{1}{4}\right) = 9(5 - x) - 6(3x - 7)$

24x - 2 = 45 - 9x - 18x + 42   simplify grouping symbols
24x - 2 = 87 - 27x   collect like terms
51x - 2 = 87   add 27x on both sides
51x = 89   add 2 on both sides
x = 89/51 is the solution.   divide both sides by 51