**COLLEGE PREP**

**SECTION 1.1 - LINEAR EQUATIONS**

**Objectives:**

* Determine if a number is a solution to an equation.
* Solve Linear Equations
* Determine whether an Equation is a Conditional Equation (1 solution), a Contradiction (no solutions), or an Identity (infinite solutions)

**DEFINITIONS:**

**Linear equation** is an equation that has one variable which is written to the first power. ax + b =0 (a and b are real numbers and a$\ne $0.

A **Solution** is any value of the variable that results in a true statement. The value *satisfies* the equation.

***DETERMINING IF A NUMBER IS A SOLUTION:*** Substitute the value of the variable into the equation and simplify. If both sides are =, the value is a solution.

**Example:** Determine if x = 5, and x= 3 are solutions to 3(x-1)=-2x+12.

 Try x = 5: Try x = 3:

 3(5-1) = -2(5) + 12 3(3-1)= -2(3) + 12

 3(4) = -10 + 12 3(2) = -6 + 12

 12 $\ne $ 2 So x=5 is not a solution. 6 = 6, so x = 3 is a solution.

***SOLVING LINEAR EQUATIONS*** means to find all of the solutions of the equation. (Find the *Solution Set*). If two or more equations have the same solution set, they are called *equivalent equations*.

***Tools for Solving:***

* **ADDITION PROPERTY OF EQUALITY:** Says that we can add the same number to both sides of the equation and it will remain equal. This covers subtraction, too, because subtracting is just adding a negative number.
* **MULTIPLICATION PROPERTY OF EQUALITY:** Says that you can multiply (or divide) both sides of the equation by the same value and it remains equal. NOTE: when you utilize the multiplication property, you must be sure to multiply every term on each side of the equation.
* **DISTRIBUTIVE PROPERTY:** Helps you remove parentheses at the beginning (before you use the addition or multiplication properties).

***SUMMARY OF STEPS FOR SOLVING:***

 1. Remove any parentheses using the distributive property.

 2. Combine like terms on each side of the equation (simplify each side).

 3. Use the Addition Property to move all the variables to one side and all the constants to the other.

 4. Use the Multiplication Property to get the coefficient of the variable to equal 1.

 5. CHECK YOUR SOLUTION!!!!

**Examples:**

**A)** Solve 2(x+4) = x – 4(x – 5)

 2x + 8 = x – 4x + 20 Distribute.

 2x + 8 = -3x + 20 Combine like terms.

 +3x -8 +3x - 8 Addition Property

 5x = 12 Multiplication Property

 x = 12/5

**EX B)** Solve $\frac{x+5}{2}-4=\frac{2x-1}{3}$

 $6\left(\frac{x+5}{2}-4\right)=6\left(\frac{2x-1}{3}\right)$ Multiply by the LCD (6)

 3(x+5) – 24 = 2(2x – 1) Simplify with the Distributive property

 3x + 15 – 24 = 4x – 2 Distribute again.

 3x – 9 = 4x -2 Combine like terms

 -3x +2 -3x +2 Addition Prop

 -7 = x Solution Set is {7} Don’t forget to check!

***CATEGORIZING LINEAR EQUATIONS:***

**Conditional:** Means it’s true for some values of x but not all (usually 1 solution) Example: x + 7 = 10 is only true for x = 3.

**Contradiction:** The equation is false for all values (no solutions or $∅$). Example: 3x + 8 = 3x + 6. If you subtract 3x from both sides you get 8= 6, which doesn’t work.

**Identity:** The equation is true for every possible values (all real numbers or $R$) Example: 3x + 11 = 3x + 11. When you simplify, you end up with the exact same thing on both sides of the equations.

**Example C)** 5(2x+1) – x = 4(2 – x) + 13x Distribute

 10x + 5 – x = 8 – 4x + 13x Combine like terms

 9x + 5 = 8 + 9x Subtract 9x from both sides

 5 $\ne $ 8

 So { } or $∅$ *This is a Contradiction.*

**Example D)** 2(3x – 2) – (x – 6) = -3(6 – x) + 2 (x + 10) Distribute

 6x – 4 – x + 6 = -18 + 3x + 2x + 20 Combine Like Terms

 5x + 2 = 5x + 2

 Exactly the same so {x|x is all real numbers } or $R$ *This is an Identity*.

Homework: page 60 – 62, # 15-37 odds