MATH 1314

Section 2.1

Solving Linear Equations

Definition: To solve an equation in the variable x using the **algebraic method** is to use the rules of algebra to isolate the unknown x on one side of the equation.

Definition: To solve an equation in the variable x using the **graphical method** is to move all terms to one side of the equation and set those terms equal to y. Sketch the graph to find the values of x where $y = 0$.

1. Isolate the variable on one side of the equal sign
2. Opposite operations (apply PEMDAS inverse order)
3. Simplify the left and right side of the equation
4. Variable on one side only
5. * Whatever you do on the left side, must be done on the right side.

Example 1: Solve the following equation **algebraically**.

$$5y + 6 = -18 - y$$

$+y \qquad +y$

$6y + 6 = -18$

$-6 \qquad -6$

$\frac{6y}{6} = \frac{-24}{6}$

$y = -4$

Check $(y = -4)$

$5(-4) + 6 = -18 - (-4)$

$-20 + 6 = -18 + 4$

$-14 = -14$ ✓

Example 2: Solve following equation **algebraically**.

$$7 + 2(3 - 8x) = 4 - 6(1 + 5x)$$

$7+6-16x=4-6-30x$

$13-16x=-2-30x$

$+30x \qquad +30x$

$13+14x=-2$

$-13 \qquad -13$

$14x=-15$

$\frac{14x}{14}=\frac{-15}{14}$

$x=-15/14$

Example 3: Solve following equation algebraically. Fraction = Fraction → Cross Multiply

$$\frac{2}{5}(x-1)=\frac{7}{3}$$

$$\frac{2(x-1)}{5}=\frac{7}{3}$$

$$3\cdot 2(x-1)=5\cdot 7$$

$$6(x-1)=35$$

$$6x-6=35$$

$$+6 \quad +6$$

$$6x=41$$

$$\frac{6x}{6}=\frac{41}{6}$$

$$x=\frac{41}{6}$$

Example 4: Solve following equation **algebraically**. LCD: $24x$

$$-\frac{3}{8x}+\frac{1}{12x}=\frac{2}{1}$$

$$\frac{-3}{8x}\cdot\frac{3}{3}+\frac{1}{12x}\cdot\frac{2}{2}=\frac{2}{1}\cdot\frac{24x}{24x}$$

$$\frac{-9}{24x}+\frac{2}{24x}=\frac{48x}{24x}$$

$$-9+2=48x$$

$$\frac{-7}{48}=\frac{48x}{48}$$

$$\boxed{x=\frac{-7}{48}}$$

(y = 0) (x = 0)

Example 5: Find the x-intercept and y-intercept of the following equation. Express the answers in coordinate point form.

a. $-7x + 8y - 63 = 0$

x-int:

$-7x + 8(0) - 63 = 0$

$-7x - 63 = 0$

$+63 \quad +63$

$-7x = 63$

$\frac{-7x}{-7} = \frac{63}{-7}$

$x = -9$

$(-9, 0)$

y-int:

$-7(0) + 8y - 63 = 0$

$8y - 63 = 0$

$+63 \quad +63$

$\frac{8y}{8} = \frac{63}{8}$

$y = 63/8$

$(0, 63/8)$

b. $x^2 - y - 16 = 0$

x-int:

$x^2 - 0 - 16 = 0$

$x^2 - 16 = 0$

$+16 \quad +16$

$x^2 = 16$

$\sqrt{x^2} = \pm\sqrt{16}$

$x = \pm 4$

$(4, 0)$ $(-4, 0)$ $(\pm 4, 0)$

y-int:

$0^2 - y - 16 = 0$ $(0, -16)$

$-y - 16 = 0$

$+16 \quad +16$

$\frac{-y}{-1} = \frac{16}{-1}$

$y = -16$

c. $4x^2 - y^2 - 81 = 0$

x-int:

$4x^2 - 0^2 - 81 = 0$

$4x^2 - 81 = 0$

$+81 \quad +81$

$\frac{4x^2}{4} = \frac{81}{4}$

$\sqrt{x^2} = \sqrt{\frac{81}{4}}$ $\left(\pm\frac{9}{2}, 0\right)$

$x = \pm\frac{9}{2}$

y-int:

$4(0)^2 - y^2 - 81 = 0$

$-y^2 - 81 = 0$

$+81 \quad +81$

$\frac{+y^2}{-1} = \frac{81}{-1}$

$\sqrt{y^2} = \sqrt{-81}$

$y = \pm\sqrt{-81}$ uh oh

No y-intercept.