Solving Equations Part II

Example 1:

$$\mathbf{3x + 6 = 18}$$

Since this equation is a bit more difficult to solve by inspection, we'll solve it **algebraically.**

$$\begin{aligned} &\mathbf{3x + 6 = 18} \\ &\underline{\quad -6 \quad -6} \quad \longleftarrow \text{subtract } 6 \text{ from both sides.} \\ &\frac{\mathbf{3x}}{3} = \frac{\mathbf{12}}{3} \quad \longleftarrow \text{divide both sides by } 3. \\ &\mathbf{x = 4} \end{aligned}$$

> **<u>NOTE</u>:** The addition property of equality must be performed **BEFORE** the multiplication property of equality.

Example 2:

$$\mathbf{7 - 2x = 19}$$

$$\begin{aligned} &\mathbf{7 - 2x = 19} \\ &\underline{-7 \qquad -7} \quad \longleftarrow \text{Subtract } 7 \text{ from both sides.} \\ &\frac{\mathbf{-2x}}{-2} = \frac{\mathbf{12}}{-2} \quad \longleftarrow \text{Divide both sides by } -2. \\ &\mathbf{x =} \underline{\qquad} \end{aligned}$$

> <u>Recall:</u> Equations involving fractions
>
> $$\frac{4}{3} \cdot \frac{3}{4} = \underline{\qquad}$$
>
> $$\left(-\frac{3}{2}\right) \cdot \left(-\frac{2}{3}\right) = \underline{\qquad}$$

Example 3:

$$\frac{3}{4}x = \frac{1}{5}$$

The **reciprocal approach:**

To isolate the variable we need to **divide** both sides by $\frac{3}{4}$. Since dividing by a fraction is the same as multiplying by its **reciprocal**, we can **multiply** both sides by $\frac{4}{3}$.

$$\left(\frac{4}{3}\right)\frac{3}{4}x = \frac{1}{5}\left(\frac{4}{3}\right)$$

$$x = \frac{4}{15}$$

This method is called the **reciprocal approach**, but only works for **simple** equations.

Example 4:

$$\frac{3}{4}x = \frac{1}{2} + \frac{1}{3}$$

If we were to use the reciprocal approach, we would multiply both sides by $\frac{4}{3}$ in order to isolate the variable. We would then be forced to distribute $\frac{4}{3}$ on the right hand side. To avoid this extra work we can use a method called **clearing the fractions.**

To **clear the fractions** we must first identify the lowest common denominator or the **LCD** for short.

The **LCD** for the equation in example 4 is **12**, since 12 is the **smallest** number that **ALL** the denominators divide evenly into.

$$12\left[\frac{3}{4}x\right] = \left[\frac{1}{2} + \frac{1}{3}\right]12$$

Now that we've identified the **LCD**, we multiply **both sides** of the equation bu the **LCD.**

$$9x = 12\left(\frac{1}{2}\right) + 12\left(\frac{1}{3}\right)$$

Reduce.

$$9x = 6 + 4$$

Notice that we eliminated **ALL** the fractions!

$$\frac{\not{9}x}{\not{9}} = \frac{10}{9}$$

$$x = \frac{10}{9}$$

Example 5:

$$-0.5x - 0.13 = 3.07$$

> **Recall**: A decimal is simply a fraction whose denominator is a power of 10. The number 0.13 is said," thirteen hundredths" and as a fraction, is written $\frac{13}{100}$.

Rewriting the equation as fractions instead of decimals, we get:

$$-\frac{5}{10}x - \frac{13}{100} = \frac{307}{100}$$

Now we can clear the fractions. LCD$=100$

$$100\left(-\frac{5}{10}x - \frac{13}{100}\right) = \left(\frac{307}{100}\right)100$$

$$100\left(-\frac{5}{10}x\right) - 100\left(\frac{13}{100}\right) = \left(\frac{307}{100}\right)100$$

$$-50x - 13 = 307$$

Now we have NO fractions in the equation!

$$\begin{array}{rcl} -50x - 13 & = & 307 \\ +13 & & +13 \\ \hline -50x & = & 320 \\ \overline{-50} & & \overline{-50} \end{array}$$

$$x = -\frac{320}{50}$$

Now we must reduce.

$$x = -\frac{320}{50} = -\frac{32}{5}$$

Solving Equations Part II

Practice Problems

Solve each equation:

1. $\mathbf{5x + 13 = 58}$

2. $\mathbf{8 - 3x = -2}$

3. $\mathbf{\frac{5}{8}x = \frac{1}{3}}$

4. $\mathbf{\frac{9}{2}x = \frac{5}{3} + \frac{1}{6}}$

5. $\mathbf{-0.2 + 0.05x = 9.8}$