Day 5 – Equations with Fractions

When solving equations with fractions, you want to find a way to eliminate the fraction.

> **Ways to Eliminate Fractions**
> - Multiply by the Reciprocal
> - Multiply by a Common Denominators – always works!
> - Cross Multiply

When You Could Multiply by the Reciprocal (One Fraction Attached to the Variable):

1.
$$-\frac{3}{4} \cdot \frac{-4}{3}m = 10 \cdot -\frac{3}{2}$$
$$m = \frac{(10 \cdot -3)}{2}$$
$$m = -\frac{30}{2}$$
$$\boxed{m = -15}$$

2.
$$\frac{2m}{3} + 5 = 12$$
$$ -5 -5$$
$$\frac{3}{2} \cdot \frac{2m}{3} = 7 \cdot \frac{3}{2}$$
$$\boxed{m = \frac{21}{2}}$$

$$\frac{6}{6} \frac{4}{4}$$
$$\boxed{12} \frac{8}{12}$$
$$\boxed{12}$$

When You Should Multiply by a Common Denominator (Two Fractions)

1.
$$7 \cdot \left(w + \frac{1}{7}\right) = \left(\frac{6w}{7} - 1\right) \cdot 7$$
$$(7)(w) + (7)\left(\frac{1}{7}\right) = (7)\left(\frac{6w}{7}\right) - (7)(1)$$
$$7w + \frac{7}{7} = \frac{42w}{7} - 7$$
$$7w + 1 = 6w - 7$$
$$-6w -6w$$
$$1w + 1 = -7$$
$$-1 -1 \quad \boxed{w = -8}$$

2.
$$6 \cdot \left(\frac{x}{6} + \frac{2x}{3}\right) = 5 \cdot 6$$
$$(6)\left(\frac{x}{6}\right) + (6)\left(\frac{2x}{3}\right) = 30$$
$$\frac{6x}{6} + \frac{12x}{3} = 30$$
$$1x + 4x = 30$$
$$\frac{5x}{5} = \frac{30}{5}$$
$$\boxed{x = 6}$$

3.
$$12 \cdot \left(\frac{x-5}{6}\right) = \left(\frac{x}{4} - 1\right) \cdot 12$$
$$(12)\left(\frac{x-5}{6}\right) = (12)\left(\frac{x}{4}\right) - (12)(1)$$
$$\frac{12x-60}{6} = \frac{12x}{4} - 12$$
$$2x - 10 = 3x - 12$$
$$-2x -2x$$
$$-10 = 1x - 12$$
$$+12 +12 \quad \boxed{2 = x}$$

When You Could Cross Multiply (Can also be solved by multiplying by a common denominator):

1.
$$\frac{4}{x} \times \frac{2}{x-2}$$
$$(4)(x-2) = (x)(2)$$
$$4x - 8 = 2x$$
$$-4x -4x$$
$$\frac{-8}{-2} = \frac{-2x}{-2}$$
$$\boxed{4 = x}$$

2.
$$\frac{x+9}{5} \times \frac{x-7}{10}$$
$$(10)(x+9) = (5)(x-7)$$
$$10x + 90 = 5x - 35$$
$$-5x -5x$$
$$5x + 90 = -35$$
$$-90 -90$$
$$\frac{5x}{5} = \frac{-125}{5}$$
$$\boxed{x = -25}$$

3.
$$\frac{2x-18}{4} \times \frac{3x+1}{2}$$
$$(2)(2x-18) = (4)(3x+1)$$
$$4x - 36 = 12x + 4$$
$$-4x -4x$$
$$-36 = 8x + 4$$
$$-4 -4$$
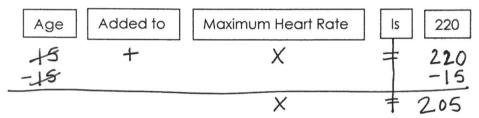$$\frac{-40}{8} = \frac{8x}{8}$$
$$\boxed{-5 = x}$$

9

Day 5 – Creating Equations from a Context

Earlier in our unit, you learned to write expressions involving mathematical operations. We are going to use those same key words along with words that indicate an expression will become part of an equation or inequality.

Addition	Subtraction	Multiplication	Division	Equals
Sum	Difference	Of	Quotient	Is
Increased by	Decreased by	Product	Ratio of	Equals
More than	Minus	Times	Percent	Will be
Combined	Less	Multiplied by	Fraction of	Gives
Together	Less than	Double	Out of	Yields
Total of	Fewer than	Twice	Per	Costs
Added to	Withdraws	Triple	Divided by	
Gained				
Raised				
Plus				

When taking a word problem and translating it to an equation or inequality, it is important to **"talk to the text"** or underline/highlight key phrases or words. By doing this it helps you see what is occurring in the problem.

A person's maximum heart rate is the highest rate, in beats per minute, that the person's heart should reach. One method to estimate the maximum heart rate states your age added to your maximum heart rate is 220. Using this method, write and solve an equation to find the maximum heart rate of a 15 year old.

$$\begin{array}{ccccc} \boxed{\text{Age}} & \boxed{\text{Added to}} & \boxed{\text{Maximum Heart Rate}} & \boxed{\text{Is}} & \boxed{220} \\ \underset{-15}{\cancel{15}} & + & X & = & \begin{matrix}220 \\ -15\end{matrix} \\ & & X & = & 205 \end{array}$$

In the equation above, we did not know one of the quantities. When we do not know one of the quantities, we use a **variable** to represent the unknown quantity. When creating equations, it is important that whatever variable you use to represent the unknown quantity, you define or state what the variable represents.

Practice Examples: *In the examples below, "talk to the text" as you translate your word problems into equations. Define a variable to represent an unknown quantity, create your equation, and then solve your equation.*

$(-)\qquad (\times)\qquad (=)$

1. Six less than four times a number is 18. What is the number?

Variable: $n = number$

Equation:
$$\begin{array}{rcl} 4n - 6 &=& 18 \\ +6 & & +6 \\ \hline \frac{4n}{4} &=& \frac{24}{4} \qquad n = 6 \end{array}$$

2. On her iPod, Mia has rock songs and dance songs. She currently has 14 rock songs. She has 48 songs in all. How many dance songs does she have? $(+)$

Variables: $d = dance\ songs$

$r + d = \cancel{total} \qquad \cancel{total}$

Equation:
$$\begin{array}{rcl} \cancel{14} + d &=& 48 \\ -14 & & -14 \\ \hline d &=& 34\ dance\ songs \end{array}$$