Bell Ringer

Jackson charges $30 to mow a lawn. Kory charges $25 to mow a lawn. Their total combined revenue one summer was $2020. Kory mowed 6 more lawns than Jackson. Write a system of equations to represent the situation, and then solve the system using substitution. Explain what the solution means.

$$30x + 25y = 2020$$

and

$$x + 6 = y \quad \text{or} \quad y - 6 = x$$

$$x = 34$$

$$y = 40$$

$$30x + 25(x + 6) = 2020$$
$$30x + 25x + 150 = 2020$$
$$55x = 1870$$
$$x = 34$$

Solving Linear Systems using Combinations

This method is also called the Elimination Method.

Key Point: you must determine a way to combine (add) both equations so that one variable is eliminated.

To do this, you may have to multiply one or both equations by an integer or integers.

The integers for each equation do not have to be the same.

Steps:
1. Arrange the equations with like terms in a column layout.
2. Determine a way to combine both equations using the key point mentioned above if necessary.
3. Combine (add) the equations from Step 2. This should eliminate one variable. Solve for the remaining variable.
4. Using either of the original equations, substitute and solve for the other variable.

Using linear combinations to solve the system.

1. $4x - 3 = 3y$ and $-5x + 3y = -6$

$$4x - 3y = 3$$
$$+ \quad -5x + 3y = -6$$
$$\overline{}$$
$$-1x = -3$$
$$x = 3$$

$(3, 3)$

$$4(3) - 3y = 3$$
$$12 - 3y = 3$$
$$-3y = -9$$
$$y = 3$$

Using linear combinations to solve the system.

2. $3x + 2y = 13$ and $2x + y = 7$

$$3x + 2y = 13$$
$$(2x + y = 7) \cdot -2$$

$$3x + 2y = 13$$
$$+ \quad -4x + -2y = -14$$
$$\overline{\quad -1x = -1 \quad}$$
$$x = 1$$

$$2(1) + y = 7$$
$$2 + y = 7$$
$$y = 5$$

$(1, 5)$

Using linear combinations to solve the system.

3. $3x + 5y = 6$ and $-4x + 2y = 5$

$$(3x + 5y = 6) \cdot 4 \qquad 12x + 20y = 24$$

$$(-4x + 2y = 5) \cdot 3 \quad + \quad -12x + 6y = 15$$

$$26y = 39$$

$$-4x + \frac{2}{1} \cdot \frac{3}{2} = 5 \qquad\qquad y = \frac{39}{26} = \frac{3}{2}$$

$$-4x + 3 = 5$$

$$-4x = 2 \qquad\qquad \left(-\frac{1}{2}, \frac{3}{2}\right)$$

$$x = -\frac{2}{4} = -\frac{1}{2}$$