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LEARNING OBJECTIVE: We will solve systems of equations by substitution (G8M4L24)

CONCEPT DEVELOPMENT:

Substitution Method of Solving Systems of Linear Equations

If two expressions are equal to the same value, then they can be written as equal to each other.

Examples:

$$\begin{cases} y = 5x - 8 \\ y = 6x + 3 \end{cases}$$

$5x - 8 = 6x + 3$

$$\begin{cases} 3x = 4y + 2 \\ x = y + 5 \end{cases}$$

$3(y+5) = 4y + 2$

STRATEGY: When to use Substitution Method

1. When both equations are ALREADY in slope intercept form. (i.e. y-variable has been isolated) EXAMPLE 1 PRACTICE 1&2
2. When one equation is in slope-intercept form. (y-variable has been isolated) PRACTICE 3&4
3. When x-variable has been isolated in one equation. EXAMPLE 2, PRACTICE 5&6
4. When it takes one step to isolate a variable in one of the equations. PRACTICE 7&8

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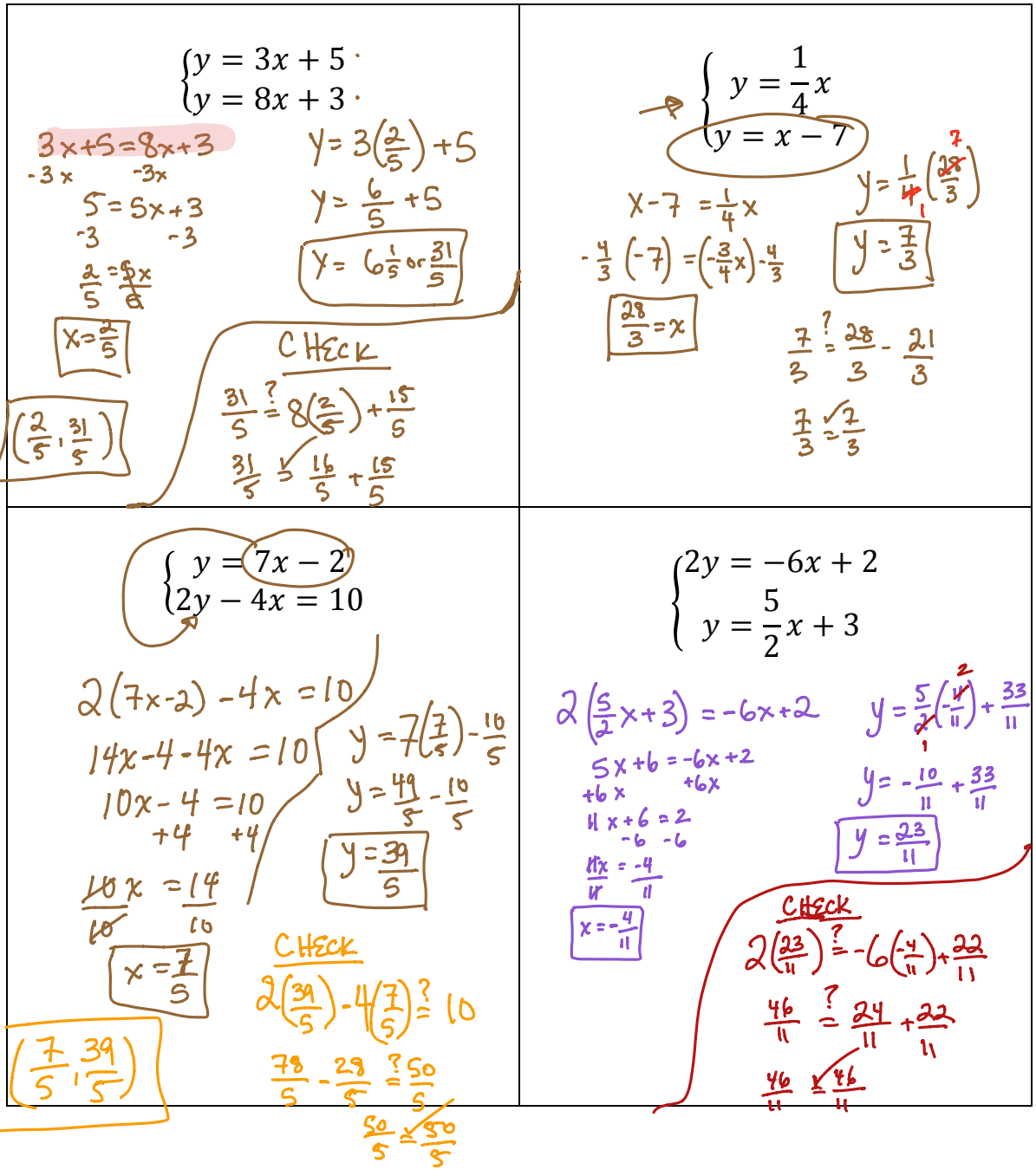
Guided Practice:

Steps for Solving Systems of Equations by Substitution

1. (If necessary) Manipulate one of the equations to isolate a variable (**if you're isolating the *y*-variable, you will be converting your equation to slope-intercept form).
2. Rewrite the equation substituting the equivalent values, containing only one variable.
3. Solve for the one remaining variable in your equation.
4. Solve for the second variable by replacing your solution from step 3 above into your original equation.
5. Express your answer in terms of an ordered pair.



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$$\begin{cases} x = -2y + 11 \\ 4y = 5x - 1 \end{cases}$$

$4y = 5(-2y+11) - 1$

$4y = -10y + 55 - 1$

$+10y \quad +10y$

$\frac{14y}{14} = \frac{54}{14}$

$y = \frac{27}{7}$

$x = -2\left(\frac{27}{7}\right) + 11$

$x = -\frac{54}{7} + \frac{77}{7}$

$x = \frac{23}{7}$

CHECK

$4\left(\frac{27}{7}\right) \stackrel{?}{=} 5\left(\frac{23}{7}\right) - \frac{7}{7}$

$\frac{108}{7} \stackrel{?}{=} \frac{115}{7} - \frac{7}{7}$

$\frac{108}{7} \stackrel{\checkmark}{=} \frac{108}{7}$

$$\begin{cases} x = 3y + 4 \\ 3x - y = 8 \end{cases}$$

$3(3y+4) - y = 8$

$9y + 12 - y = 8$

$8y + 12 = 8$

$-12 \quad -12$

$\frac{8y}{8} = \frac{-4}{8}$

$y = -\frac{1}{2}$

$x = 3\left(-\frac{1}{2}\right) + \frac{8}{2}$

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

$x = \frac{5}{2}$

CHECK

$3\left(\frac{5}{2}\right) - \left(-\frac{1}{2}\right) \stackrel{?}{=} \frac{16}{2}$

$\frac{15}{2} + \frac{1}{2} \stackrel{?}{=} \frac{16}{2}$

$\frac{16}{2} \stackrel{\checkmark}{=} \frac{16}{2}$

$\left(\frac{5}{2}, -\frac{1}{2}\right)$

$$\begin{cases} 2x = 3y + 9 \\ x - 4y = 10 \end{cases}$$

① ② ③ ④

$x = 4y + 10$

$$\begin{cases} 3y = 4x - 5 \\ 3x + y = 4 \end{cases}$$

$y = -3x + 4$

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Independent Practice:

Solve each system of equations using substitution.

$\begin{cases} y = 3x - 5 \\ y = 6x + 8 \end{cases}$	$\begin{cases} y = -3x + 1 \\ -2y = 5x + 2 \end{cases}$
$\begin{cases} x = 4y + 9 \\ 3x = 2y - 17 \end{cases}$	$\begin{cases} y = -6x + 32 \\ 3x - 5y = 30 \end{cases}$
$\begin{cases} y = \frac{3}{2}x - 1 \\ 3y = x + 2 \end{cases}$	$\begin{cases} 7x - 8y = 112 \\ y = -2x + 9 \end{cases}$

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Activating Prior Knowledge:

We can tell how many solutions a system has by looking at the slope:

$\begin{cases} y = \frac{3}{4}x - 5 \\ 3x - 4y = 20 \end{cases}$	$\begin{cases} x - y = 12 \\ y = x - 7 \end{cases}$

Closure:

Write a system of equations with $(4, -5)$ as its solution.

Teacher Notes:

This is the second half of Lesson 27
HW is Khan: Systems of Equations with Substitution