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LEARNING OBJECTIVE: We will solve systems of equations by **elimination.** (G8M4L25)

ACTIVATING PRIOR KNOWLEDGE:
We can add.

$2 + 5 = 7$ $+\ 6 + 9 = 15$ $8 + 14 = 22$	$-3 + 11 = 8$ $+\ 3 + 2 = 5$ $0 + 13 = 13$

CONCEPT DEVELOPMENT:
You can solve systems of equations by **elimination** by **adding** equations together to eliminate a variable.

Example:

$$\begin{cases} 6x - 5y = 21 \\ 2x + 5y = -5 \end{cases}$$

$+$

$8x + 0y = 16$

$6x + (-5y) + 2x + 5y = 21 + (-5)$

What happens to y-variable? It gets eliminated!

Y variables cancel out

STANDARD FORM!!

STRATEGY: When to use Elimination Method

1. When the two coefficients of one of the variables are opposites. EXAMPLE ABOVE
2. When you can multiply one equation by an integer number to create a system where two coefficients of one of the variables are opposites.

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GUIDED PRACTICE:

Steps for Solving Equations Using Elimination

1. Multiply one entire equation by an integer to create **opposite** coefficients for one of the variables (if necessary).
2. **Add** an entire equation in order to eliminate one variable.
3. Solve for your remaining variable.
4. Substitute your answer into one of the original equations and solve for the variable you eliminated originally.
5. Check your work by substituting your answers into the original equations.

$\begin{cases} 2x + y = 14 \\ 3x - y = 4 \end{cases}$ $2x+y+3x+(-y)=14+4$ $\frac{5x}{5}=\frac{18}{5}$ $\boxed{x=\frac{18}{5}}$ $2\left(\frac{18}{5}\right)+y=\frac{70}{5}$ $\frac{36}{5}+y=\frac{70}{5}$ $-\frac{36}{5} \quad -\frac{36}{5}$ $\boxed{y=\frac{34}{5}}$ CHECK $3\left(\frac{18}{5}\right)-\frac{34}{5} \stackrel{?}{=} \frac{20}{5}$ $\frac{54}{5}-\frac{34}{5} \stackrel{?}{=} \frac{20}{5}$ $\frac{20}{5} = \frac{20}{5}$ ✓ $\boxed{\left(\frac{18}{5}, \frac{34}{5}\right)}$	$\begin{cases} 2x + 3y = 11 \\ -2x + 9y = 4 \end{cases}$ $\cancel{2x}+3y+(\cancel{-2x})+9y=11+4$ $\frac{12y}{12}=\frac{15}{12}$ $\boxed{y=\frac{5}{4}}$ $2x+3\left(\frac{5}{4}\right)=11$ $2x+\frac{15}{4}=\frac{44}{4}$ $\frac{1}{2}(2x)=\left(\frac{29}{4}\right)\frac{1}{2}$ $\boxed{x=\frac{29}{8}}$ CHECK $-2\left(\frac{29}{8}\right)+9\left(\frac{5}{4}\right)\stackrel{?}{=}4$ $-\frac{58}{8}+\frac{45}{4}\stackrel{?}{=}4$ $-\frac{58}{8}+\frac{90}{8}\stackrel{?}{=}\frac{32}{8}$ $\frac{32}{8}=\frac{32}{8}$ ✓ $\boxed{\left(\frac{29}{8}, \frac{5}{4}\right)}$
$\begin{cases} 2x - 3y = 21 ✓ \\ 2x - y = 13 ✓ \end{cases}$ $-$ $0x \; \frac{-2y}{-2}=\frac{8}{-2}$ $\boxed{y=-4}$ $2x-3(-4)=21$ $2x+12=21$ $-12 \; -12$ $\frac{2x}{2}=\frac{9}{2}$ $\boxed{x=\frac{9}{2}}$ CHECK $2\left(\frac{9}{2}\right)-(-4)\stackrel{?}{=}13$ $9+4\stackrel{?}{=}13$ $13 = 13$ ✓ $\left(\frac{9}{2}, -4\right)$	$\begin{cases} 5x + 18y = -27 \\ 2x + 18y = -9 \end{cases}$ $-$ $\frac{3x}{3}=\frac{-18}{3}$ $\boxed{x=-6}$ $2(-6)+18y=-9$ $-12+18y=-9$ $\frac{18y}{18}=\frac{3}{18}$ $\boxed{y=\frac{1}{6}}$ CHECK $5(-6)+18\left(\frac{1}{6}\right)\stackrel{?}{=}-27$ $-30+3\stackrel{?}{=}-27$ $-27 = -27$ ✓

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$$\begin{cases} 12x - y = 26 \\ 6x - 3y = -36 \end{cases} \cdot -2$$

$$\begin{cases} -12x + 6y = 72 \\ 12x - 1y = 26 \end{cases}$$

$5y = 98$

$\boxed{y = \frac{98}{5}}$

$12x - \left(\frac{98}{5}\right) = 26$

$12x - \frac{98}{5} = \frac{130}{5}$

$12x = \frac{228}{5}$

$\boxed{x = \frac{228}{60} = \frac{19}{5}}$

$\boxed{\left(\frac{19}{5}, \frac{98}{5}\right)}$

CHECK

$6\left(\frac{19}{5}\right) - 3\left(\frac{98}{5}\right) \stackrel{?}{=} -36$

$\frac{114}{5} - \frac{294}{5} \stackrel{?}{=} -\frac{180}{5}$

$-\frac{180}{5} = -\frac{180}{5}$ ✓

$$\begin{cases} 3x - 10y = -30 \\ 2x + 20y = 10 \end{cases} \cdot 2$$

$6x - 20y = -60$

$2x + 20y = 10$

$8x = -50$

$\boxed{x = -\frac{25}{4}}$

$2\left(-\frac{25}{4}\right) + 20y = 10$

$-\frac{25}{2} + 20y = \frac{20}{2}$

$20y = \frac{45}{2}$

$y = \frac{45}{40}$

$\left(-\frac{25}{4}, \frac{9}{8}\right)$

$$\begin{cases} 2x + 5y = -10 \\ -5x + 4y = 4 \end{cases} \begin{matrix} \cdot 5 \\ \cdot 2 \end{matrix}$$

$\cancel{10x} + 25y = -50$

$+ \; \cancel{-10x} + 8y = 8$

$33y = -42$

$\boxed{y = -\frac{14}{11}}$

$2x + 5\left(-\frac{14}{11}\right) = -\frac{110}{11}$

$2x - \frac{70}{11} = -\frac{110}{11}$

$\frac{1}{2}(2x) = \left(-\frac{40}{11}\right)\frac{1}{2}$

$\boxed{x = -\frac{20}{11}}$

$\boxed{\left(-\frac{20}{11}, -\frac{14}{11}\right)}$

CHECK

$-5\left(-\frac{20}{11}\right) + 4\left(-\frac{14}{11}\right) \stackrel{?}{=} \frac{44}{11}$

$\frac{100}{11} - \frac{56}{11} \stackrel{?}{=} \frac{44}{11}$

$\frac{44}{11} = \frac{44}{11}$ ✓

$$\begin{cases} 7x - 4y = 13 \\ 6x + 3y = 11 \end{cases}$$

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Independent Practice:

$\begin{cases} 7x + 4y = 13 \\ 6x + 3y = 11 \end{cases}$	$\begin{cases} 3x - y = 21 \\ 10x - 3y = 11 \end{cases}$
$\begin{cases} 2x + y = 8 \\ x + y = 10 \end{cases}$	$\begin{cases} 8x - 5y = 10 \\ 3x + 5y = 12 \end{cases}$

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CLOSURE:

Choose the most efficient method of solving each system: Substitution or Elimination and be ready to explain your decision. NO need to solve each system!

A. $\begin{cases} -3x + y = 13 \\ 2x - 3y = 16 \end{cases}$	Substitution or Elimination? S or E
B. $\begin{cases} x = 4y + 12 \\ y = -5x + 81 \end{cases}$	Substitution or Elimination? S
C. $\begin{cases} 16x + 13y = 134 \\ (-4x - 12y = 2)4 \end{cases}$	Substitution or Elimination? E

TEACHER NOTES:

Maps to lesson 28 from Module 4. HW could be handout (or Khan).