8 Algebra CC

8-4

Essential Question: Are there other methods we can use to solve linear systems algebraically?

Do Now: Use the substitution method to solve the following linear system. *Don't forget to check your solution in both equations!*

$4x + 3y = 16$
$2x - 3y = 8$

$2x = -3y + 8$
$x = -\frac{3}{2}y + 4$

$4x + 3y = 16$
$4(-\frac{3}{2}y + 4) + 3y = 16$
$-6y + 16 + 3y = 16$
$-3y + 16 = 16$
$-3y = 0$
$y = 0$

$2x - 3y = 8$
$2x - 3(0) = 8$
$2x = 8$
$x = 4$

common solution
$(4,0)$

check (4,0
$4x + 3y = 16$
$4(4) + 3(0) =$
$16 + 0 = 16$
$16 = 16$ ✓

$2x - 3y =$
$2(4) - 3(0)$
$8 - 0 = 8$
$8 = 8$ ✓

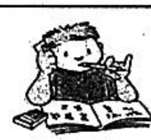
Is there an easier way to solve the system from the Do Now?

Yes! create (or look for) a zero pair

$$\begin{array}{rl} & 4x + 3y = 16 \\ + & 2x - 3y = 8 \\ \hline & 6x = 24 \\ & x = 4 \end{array}$$

$2x - 3y = 8$
$2(4) - 3y = 8$
$8 - 3y = 8$
$-3y = 0$
$y = 0$

Solving Linear Systems using Elimination



1. Line up variable terms and constants.
2. Decide which variable term ("x" or "y") will be easier to **eliminate.** In order to eliminate a variable term, the coefficients must be **additive inverses** (*same number, opposite signs*).
3. **Add** each column to **eliminate** the desired variable (*addition property of equality*).
4. The resulting equation should have only **one variable.** Solve this simple equation.
5. Substitute the value of the variable into either of the **original** equations to get the value of the other variable.
6. Check your solution!

Examples:

1)
$$\begin{array}{rl} & 3x - 5y = -16 \\ + & 2x + 5y = 31 \\ \hline & 5x = 15 \\ & x = 3 \end{array}$$

$2x + 5y = 31$
$2(3) + 5y = 31$
$6 + 5y = 31$
$5y = 25$
$y = 5$

check (3,5)

$3x - 5y = -16$
$3(3) - 5(5) = -16$
$9 - 25 = -16$
$-16 = -16$ ✓

$2x + 5y = 31$
$2(3) + 5(5) = 31$
$6 + 25 = 31$
$31 = 31$ ✓

2) $4x + y = 7 \rightarrow 4x + y = 7$

$-1(4x - 2y = -2) \rightarrow -4x + 2y = 2$

$3y = 9$

$\boxed{y = 3}$

$4x + y = 7$

$4x + 3 = 7$

$4x = 4$

$\boxed{x = 1}$

common solution $(1,3)$

3) $-3(x + y = 10) \rightarrow -3x - 3y = -30$

$2x + 3y = 8 \rightarrow 2x + 3y = 8$

$-x = -22$

$\boxed{x = 22}$

$x + y = 10$

$22 + y = 10$

$\boxed{y = -12}$

common solution $(22,-12)$

4) $4(2x - 6y = -6) \rightarrow 8x - 24y = -24$

$-3(7x - 8y = 5) \rightarrow -21x + 24y = -15$

$-13x = -39$

$\boxed{x = 3}$

$2x - 6y = -6$

$2(3) - 6y = -6$

$6 - 6y = -6$

$-6y = -12$

$\boxed{y = 2}$

common solution $(3,2)$

check $(3,2)$

1st original equation

$2x - 6y = -6$

$2(3) - 6(2) = -6$

$6 - 12 = -6$

$-6 = -6$ ✓

2nd original equation

$7x - 8y = 5$

$7(3) - 8(2) = 5$

$21 - 16 = 5$

$5 = 5$ ✓

The TAKE AWAY

When using the **Elimination Method**, sometimes we need to multiply one or both equations by a number in order to create a pair of variable terms that are additive inverses (zero pair).

opposites