Created by Lilli Fullmer

## Warmup $12 /(\mathbf{1 1} \times \mathbf{1})$

***Make sure you have a whiteboard, marker, and eraser inside your desk***

1. Today's warmup will be a check for understanding on a separate sheet of paper. Just write "CFU" on your warmup.

CFU \#1 (Elimination)

$$
\text { 1) }\left\{\begin{aligned}
& 4 x+3 y=-1 \\
&-4 x+6 y=46 \\
& \frac{9 y}{9}=\frac{45}{9} \\
& y=5
\end{aligned} \quad \begin{array}{rl}
4 x+3(5) & =-1 \\
4 x+15 & =-1.1 \\
\frac{4 x}{4} & =\frac{-16}{4}
\end{array}\right.
$$

CFU \#2 (Substitution)

$$
\begin{aligned}
& \text { 2) }\{ \\
& \text { 2) }\left\{\begin{array}{c}
4 x+2 y_{\pi}=36 \\
y=(x-6)
\end{array}\right. \\
& 4 x+2(x-6)=36 \\
& y=8-6 \\
& y=2 \\
& 4 x+2 x-12=36 \\
& \begin{array}{c}
6 x-1 / 2=36 \\
1 / 12+12
\end{array} \\
& (8,2)
\end{aligned}
$$

## CFU \#3 (Graphing)

3) $\left\{\begin{array}{c}2 x+6 y=18 \\ y=\frac{2}{3} x-3\end{array}\right.$

$$
\begin{array}{l|l}
x & y \\
\hline 9 & 0 \\
0 & 3 \\
3 & 2 \\
6 & 1
\end{array}
$$




## MAIN STRATEGIES:

- Graphing: Graph both equations and see where they intersect!
- Substitution: If (y = stuff), plug in the "stuff" for the $y$ and go from there
- Elimination: Make sure you have opposite coefficients on a variable, then add the equations together

Ok...when would adding equations together help me???
$9 a+10 b=16$
$+4 a-6 b=28$
$13 a+4 b=44$

$$
\begin{array}{r}
x+y=20 \\
+2 x+2 y=40 \\
\hline \mathbf{3 x}+\mathbf{3 y}=\mathbf{6 0}
\end{array}
$$

$$
\begin{gathered}
\mathbf{p}+\mathbf{q}=4 \\
+\quad \mathbf{p}-\mathbf{q}=-27 \\
\hline
\end{gathered}
$$

$$
-4 m+2 n=5
$$

$$
2 \mathbf{p}=-23 \quad \$-4=11
$$

$$
+?+7=12
$$

$$
\overline{\$+?+3=23}
$$

$5 n=15$
$5 x+6 y=37$

$$
\begin{array}{r}
5 x+2 y=29 \\
\hline 10 x+8 y=66
\end{array}
$$

What do you do when you CAN'T Eliminate right away???

- You need opposite coefficients, such as:

$$
\begin{aligned}
& -5 x \text { and } 5 x \\
& \mathbf{3 y} \text { and }-\mathbf{3 y} \\
& -x \text { and } x \\
& \text { Etc... }
\end{aligned}
$$

## Obvious question:

- What happens if you don't have opposite coefficients???

$$
\begin{array}{r}
x+y=20 \\
+2 x+2 y=40 \\
\hline
\end{array}
$$

$9 a+10 b=16$
$+4 a-6 b=28$

$$
\begin{array}{r}
5 x+6 y=37 \\
+\quad 5 x+2 y=29 \\
\hline
\end{array}
$$

## Another legal math move...

- You are allowed to multiply an entire equation by any number.

$$
\begin{aligned}
& 2 x=10 \\
& 3(2 x=10) \\
& 6 x=30 \\
& \frac{1}{5} x+3=\frac{2}{5} x-4
\end{aligned}
$$

## What could I multiply here?

$$
\begin{array}{r}
5 x+6 y=37 \\
+\quad 10 x-2 y=29 \\
\hline
\end{array}
$$

To eliminate " $x$ ", you could multiply the first equation by -2

- You would have -10x and 10x


## OR

To eliminate " $y$ ", you could multiply the second equation by 3

- You would have $6 y$ and -6y

Quick Number Exercise: "Make them opposites"

- I am going to show you two numbers. Tell me how you could multiply one or both of them to make them opposites!

What would you multiply them by to make them opposites???

$$
\begin{array}{r}
3 \text { and }-1 \\
\hline 3 \text { and }-3
\end{array}
$$

What would you multiply them by to make them opposites???


What would you multiply them by to make them opposites???

$$
\begin{aligned}
& \frac{1}{1} \text { and }-5 \\
& \frac{5}{5} \text { and }-5
\end{aligned}
$$

What would you multiply them by to make them opposites???

3 and $\mathbf{3}$

$$
\bullet-1
$$

3 and -3

What would you multiply them by to make them opposites???

2 and 6

$$
\frac{-3}{-6 \text { and } 6}
$$

What would you multiply them by to make them opposites???

$$
\begin{aligned}
& -5 \text { and } \mathbf{- 1 0} \\
& 0-2 \\
& 10 \text { and }-10
\end{aligned}
$$

What would you multiply them by to make them opposites???


What would you multiply them by to make them opposites???

$$
\begin{aligned}
& -4 \text { and } 6 \\
& \stackrel{-3}{12} \text { and }-12
\end{aligned}
$$

## Don't write, just watch:

$6 \mathbf{a}+\mathbf{b}=\mathbf{1 5} \longrightarrow 6 a+b=15$
$2(-3 \mathbf{a}+4 \mathbf{b}=6) \longrightarrow \frac{-6 a+8 b=12}{9 b=27}$
and the rest is the same...

## Example: Multiplying One Equation

$-2 x+4 y=8 \longrightarrow-2 x+4 y=8$

$$
4(3 x-y=3) \longrightarrow \frac{12 x-4 y=12}{10 x}=20
$$

$$
(2,3)
$$

$$
\begin{array}{r}
x=2 \\
\text { Find y: }-2 x+4 y=8 \\
-2(2)+4 y=8 \\
-4+4 y=8 \\
4 y=12 \\
y=3
\end{array}
$$

## Try it! (Notes or whiteboard)

$$
\begin{gathered}
x+\mathbf{4 y}=\mathbf{5} \\
-(\mathbf{x}+\mathbf{2 y}=\mathbf{1}) \rightarrow \begin{array}{r}
x+4 y=5 \\
-x-2 y=-1 \\
2 y \\
y=4 \\
y=2 \\
x+2(2)=1 \\
x+4=1 \\
-4-4 \\
x=-3
\end{array} \quad((-3,2)]
\end{gathered}
$$

## Example: Multiplying BOTH Equations

$3(-5 x+3 y=2) \longrightarrow-15 x+9 y=6$ $5(3 x-2 y=-2) \longrightarrow \frac{15 x-10 y=-10}{-1 y=-4}$
$y=4$

$$
\text { Find } x: 3 x-2 y=-2
$$

$$
\begin{aligned}
3 x-2(4) & =-2 \\
3 x-8 & =-2 \\
3 x & =6 \\
x & =2
\end{aligned}
$$

## Try these...

No Multiplying
$\left\{\begin{array}{c}x+y=8 \\ -x+5 y=-20\end{array}\left\{\begin{array}{c}3 x+y=3 \\ -4 x-4 y=12\end{array}\right.\right.$
(10, -2)
$(3,-6)$
$(1,4)$

## Homework

Worksheet from yesterday

