Solve Linear Systems by Elimination

- Elimination involves the <u>addition</u> or <u>subtraction</u> of the equations in order to <u>eliminate one variable</u>
- Once one variable is found, substitution is used to find the other.
- Multiplication can be used to rewrite an equation so that one variable may be eliminated.

Steps leading up to Elimination:

Recall,
$$
\begin{array}{r}
783 \\
-241 \\
\hline
542
\end{array}
\qquad\qquad
\begin{array}{r}
783 \\
+423 \\
\hline
1206
\end{array}
$$

For the following linear system, would you start by adding or subtracting? Explain your choice.

① $6x + 3y = -4$
② $5x + 3y = -9$
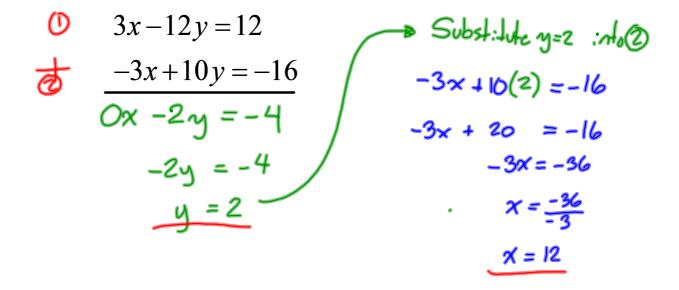
SUBTRACTION
to eliminate "y" terms

① $3x - 12y = 12$
② $-3x + 10y = -16$

ADDING to eliminate
the "x" terms.

Example 1
Solve the following systems of equations using the elimination method.

a) ① $3x - 12y = 12$ and ② $-3x + 10y = -16$

① $3x - 12y = 12$

② $-3x + 10y = -16$

$0x - 2y = -4$

$-2y = -4$

$y = 2$

Substitute $y=2$ into ②

$-3x + 10(2) = -16$

$-3x + 20 = -16$

$-3x = -36$

$x = \dfrac{-36}{-3}$

$x = 12$

Therefore, the solution is (12, 2)

Try this one…

b) $x + 2y = 0$ and $x - y = 3$

① $x + 2y = 0$ → Sub $y = -1$ into ②

② $\underline{x - y = 3}$

①–② $3y = -3$ $x - (-1) = 3$

$y = -1$ $x + 1 = 3$

         $x = 2$

Therefore, the solution is (-,1   )

Elimination with "No Match"

It is possible to use elimination when there are no matching variables.

By multiplying every term in one or both equations by any number that will create a match.

For the following linear system, show the multiplication step(s) that you must perform before you add or subtract.

a) eliminate x

① $8x - 5y = 6$

② $^4(2x - 3y) = (4)^4$

② $\underline{8x - 12y = 16}$

①-② $7y = -10$

$y = \dfrac{-10}{7}$

b) eliminate y

① $^3(8x - 5y) = (6)^3$

② $^5(2x - 3y) = (4)^5$

$24x - 15y = 18$

$\underline{10x - 15y = 20}$

Example 2

Solve the following systems of equations using the elimination method.

a) $x - 3y = 0$ and $3x - 2y = -7$

$$① \;{}^3(x - 3y) = (0)^3$$

$$② \;\; 3x - 2y = -7$$

$$① \;\; \underline{3x - 9y = 0}$$

$$7y = -7$$

$$y = -1$$

Sub $y = -1$ into ①

$$x - 3(-1) = 0$$

$$x = -3$$

Therefore the solution is $(-3, -1)$

Try this one…

$$2x - 3y = -19 \text{ and } \quad 4x + 6y = 28$$

Homework: TtBk: P. 216 #2a,b,c,d and 3