Worksheet 14c: Solving Linear Systems of Equations: \textbf{Addition (Elimination Method)}

\hspace{5mm} \textbf{Objective}: Use the \textit{elimination method} (addition \& multiplication) in order to solve the system of equations.

\begin{center}
\begin{tabular}{|c|c|c|}
\hline
\textbf{Elimination Method Using Addition and Subtraction:} & \\
\hline
\begin{align*}
\text{In systems of equations where the coefficient (the number in front of the variable) of the } & \text{x or } y \text{ terms are additive inverses, solve the system by adding the equations. Because one of the variables is eliminated, this method is called elimination.} \\
\text{Example 2:} & \\
\text{Use elimination to solve the system of equations } & \\
x - 3y = 7 \text{ and } 3x + 3y = 9. & \\
\end{align*}
\end{tabular}
\end{center}

\begin{center}
\begin{align*}
\text{Add the two equations.} & \rightarrow + 3x + 3y = 9 \\
& \begin{align*}
4x & = 16 \\
4 & = 4 \\
x & = 4
\end{align*} \\
\text{Substitute } 4 \text{ for } x \text{ in either} & \rightarrow \begin{align*}
x - 3y & = 7 \\
4 & = 7 \\
-3y & = 3 \\
3 & = 3 \\
y & = -1
\end{align*}
\end{center}

The solution of this system is \((4, -1)\).

Use elimination to solve each system of equations:

1. \begin{align*}
2x + 2y & = -2 \\
3x - 2y & = 12
\end{align*} \hspace{5mm} 2. \begin{align*}
4x - 2y & = -1 \\
-4x + 4y & = -2
\end{align*} \hspace{5mm} 3. \begin{align*}
x - y & = 2 \\
x + y & = -3
\end{align*}

\begin{align*}
(\hspace{2mm}, \hspace{2mm}) & \hspace{5mm} (\hspace{2mm}, \hspace{2mm}) & \hspace{5mm} (\hspace{2mm}, \hspace{2mm})
\end{align*}

4. \begin{align*}
6x + 5y & = 4 \\
6x - 7y & = -20
\end{align*} \hspace{5mm} 5. \begin{align*}
2x - 3y & = 12 \\
4x + 3y & = 24
\end{align*}

\begin{align*}
(\hspace{2mm}, \hspace{2mm}) & \hspace{5mm} (\hspace{2mm}, \hspace{2mm})
\end{align*}
Module #3: Solving Linear Systems of Equations: Addition (Elimination Method)

Elimination Method Using Multiplication:

Some systems of equations cannot be solved simply by adding or subtracting the equations. One or both equations must first be multiplied by a number before the system can be solved by elimination. Consider the following example:

Example 3: Use elimination to solve the system of equations $x + 10y = 3$ and $4x + 5y = 5$.

\[
\begin{align*}
\text{Multiply } x + 10y &= 3 \text{ by } -4. \\
\quad &\quad \Rightarrow -4x - 40y = -12 \\
\text{Then add the two equations.} &\quad \Rightarrow 4x + 5y = 5 \\
\quad &\quad -35y = -7 \\
\quad &\quad y = \frac{1}{5}
\end{align*}
\]

Substitute $\frac{1}{5}$ for $y$ into either original equation. Then solve for $y$.

\[
\begin{align*}
\Rightarrow x + 10\left(\frac{1}{5}\right) &= 3 \\
\Rightarrow x + 2 &= 3 \\
\Rightarrow x &= 1
\end{align*}
\]

The solution of this system is $(1, \frac{1}{5})$

Use elimination to solve each system of equations:

6. $3x + 2y = 0$  
   $x - 5y = 17$

7. $2x + 3y = 6$  
   $x + 2y = 5$

8. $3x - y = 2$  
   $x + 2y = 3$

9. $4x + 5y = 6$  
   $6x - 7y = -20$

10. $4x + 2y = 8$  
    $16x - y = 14$

Copyright© 2000. All rights reserved.