Consider the system of linear equations

\[
\begin{align*}
x + y &= 11 \\
x - y &= -5
\end{align*}
\]

If we add the two expressions on the left side and we add the two expressions on the right side, will the new equality still be true? Yes! Additionally, doing this will eliminate the variable \(y\), allowing us to solve for \(x\) and then back substitute to solve for \(y\).

**Process 1. Solving Linear Systems by Addition**

1. If necessary, rewrite both equations in the form \(Ax + By = C\).
2. If necessary, multiply either equation or both equations by appropriate nonzero numbers so that the sum of the \(x\)-coefficients or the sum of the \(y\)-coefficients is zero.
3. Add the equations you obtained in Step 2. The sum will be an equation in one variable.
4. Solve the equation you obtained in Step 3.
5. Back substitute the value obtained in Step 4 into either of the original equations and solve for the other variable.
6. Check the solution in both of the original equations.
Example 1. Solve the system of linear equations using the addition method.

\[
\begin{align*}
\begin{cases}
2x + 3y &= 15 \\
-2x + 5y &= 9
\end{cases}
\end{align*}
\]

Example 2. Solve the system of linear equations using the addition method.

\[
\begin{align*}
\begin{cases}
x - 3y &= -5 \\
3x - 4y &= 5
\end{cases}
\end{align*}
\]
Example 3. Solve the system of linear equations using the addition method.

\[
\begin{align*}
2x + 5y &= 5 \\
3x - y &= -1
\end{align*}
\]
Example 4. Solve the system of linear equations using the addition method.

\[
\begin{align*}
2x - 3y &= 2 \\
3x + 4y &= 3
\end{align*}
\]
Group Work 1. Solve the systems of linear equations using the addition method.

a. \[
\begin{align*}
3x + 2y &= 12 \\
5x - 2y &= 4
\end{align*}
\]

b. \[
\begin{align*}
x - 2y &= 7 \\
-3x + 3y &= -6
\end{align*}
\]
c. \[
\begin{cases}
2x + 3y = 1 \\
2x - 4y = 8
\end{cases}
\]
d. \[
\begin{cases}
3x + 2y = 6 \\
2x - 4y = 12
\end{cases}
\]
Example 5. Solve the system of linear equations using the addition method.

\[
\begin{align*}
2x - 3y &= 5 \\
6x - 9y &= 8
\end{align*}
\]

Example 6. Solve the system of linear equations using the addition method.

\[
\begin{align*}
2x - 3y &= 5 \\
6x - 9y &= 15
\end{align*}
\]
Group Work 2. Solve the system of linear equations using the addition method.

\[
\begin{align*}
    x - 4y &= 5 \\
    2x - 8y &= 8
\end{align*}
\]

Group Work 3. Solve the system of linear equations using the addition method.

\[
\begin{align*}
    x - 4y &= 5 \\
    2x - 8y &= 10
\end{align*}
\]