Solving Systems of Linear Equations by Substitution

Solving a system by graphing is very difficult, especially without graph paper! Thus, we prefer algebraic methods for solving systems of linear equations. There are two such algebraic methods:

1. Substitution
2. Elimination

We look at the method of substitution in this section.

Example 1: Solve the system by the substitution method.

\[
\begin{align*}
2x + 7y &= -12 \\
x &= -2y
\end{align*}
\]

**Step 1** Solve one equation for either variable.

**Step 2** Substitute for that variable in the other equation.

**Step 3** Solve the equation from Step 2.

**Step 4** Substitute the result from Step 3 into the equation from Step 1 to find the value of the other variable.

**Step 5** Check the solution in both of the original equations.
Solving a Linear System of Substitution

**Step 1**  Solve one equation for either variable.
**Step 2**  Substitute for that variable in the other equation.
**Step 3**  Solve the equation from Step 2.
**Step 4**  Substitute the result from Step 3 into the equation from Step 1 to find the value of the other variable.
**Step 5**  Check the solution in both of the original equations.

**Example 2:** Solve the system by the substitution method.

\[
x + 1 = -4y \\
2x - 5y = 11
\]

**Example 3:** Solve the system by the substitution method.

\[
y = 8x + 4 \\
16x - 2y = 8
\]
**Example 4:** Solve the system by the substitution method.

\[
\begin{align*}
2x + 3y &= -7 \\
4x + 12y &= -28
\end{align*}
\]

**Example 5:** Solve the system by the substitution method.

\[
\begin{align*}
\frac{1}{2}x + \frac{1}{3}y &= -\frac{1}{3} \\
\frac{1}{2}x + 2y &= -2
\end{align*}
\]

(Clear fractions first!!)