Solving Linear Systems Algebraically

Two methods can be used to find solutions to systems of equations using algebraic methods: substitution or elimination.

Part 1: Solve systems using ________________

1. \( y = 3x + 2 \)
   \( y = -x - 6 \)

<table>
<thead>
<tr>
<th>Concrete (Algebra tiles)</th>
<th>Algebraic</th>
</tr>
</thead>
</table>
Solving Linear Systems Algebraically

Examples

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

a. Select one equation and solve for one of the variables, x or y.

b. Substitute this value into the other equation.

c. The result is an equation with only one variable. Solve this equation for the variable.

d. When the value of the variable is found, substitute it into one of the original equations and solve for the other variable. Write the solution in point form, (x, y).

3. \[
\begin{align*}
2x + 3y &= 6 \\
x - y &= 9
\end{align*}
\]
Solving Linear Systems Algebraically

Guided Practice:

1. \[ \begin{align*} x + 2y &= 2 \\ 5x - 3y &= -29 \end{align*} \]

2. \[ \begin{align*} x - 3y &= 13 \\ 5x + 3y &= 2 \end{align*} \]

Special Cases:

3. \[ \begin{align*} x - 2y &= 3 \\ 2x - 4y &= 6 \end{align*} \]

4. \[ \begin{align*} -x + 2y &= 3 \\ 2x - 4y &= 3 \end{align*} \]
Solving Linear Systems Algebraically

Practice Problems:

Solve the following using the substitution method.

1. \(2x - y = -3\)
   \(x + y = 9\)
2. \(7x - 3y = -23\)
   \(x + 5y = 32\)
3. \(x - y = 3\)
   \(2x - 2y = 6\)
4. \(7x + 2y = 24\)
   \(x + 2y = 0\)
5. \(2x - y = 5\)
   \(3x - 2y = 4\)
6. \(3x - 7y = -1\)
   \(2x + y = 5\)
7. \(3x - 5y = 61\)
   \(3x - y = 17\)
8. \(4x + y = 42\)
   \(6x - 5y = 50\)
9. \(x - 2y = .9\)
   \(4x - 3y = 13.1\)
Solving Linear Systems Algebraically

The second method algebraic method by which to find solutions to systems of equations is elimination.

Part II: Solve systems using ________________

1. \[ \begin{align*}
    2x + 3y &= 1 \\
    -x + 2y &= -4
\end{align*} \]

Concrete (Algebra tiles) | Algebraic
------------------------|------------------------
| y                      |
| x                      |
| u                      |
Solving Linear Systems Algebraically

Example

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

a. Line up like variables and constants.

b. If one of the variables will cancel out as written, draw a line and cancel out the variables.

c. If none of the variables cancel the way originally written, transform one or both equations by multiplying all parts by a factor that will cause one of the variables to cancel. Then draw a line under the equations and add the parts together.

d. The result is an equation with only one variable. Solve this equation for the variable.

e. When the value of the variable is found, substitute it into one of the original equations and solve for the other variable.

f. Write the solution in point form, \((x, y)\). Check solutions for reasonableness.
Solving Linear Systems Algebraically

Guided Practice:

1. \( y + 4x = 10 \)
   \( 6x - y = 20 \)

2. \( 5x - y = 22 \)
   \( 4y + 5x = -63 \)

3. \( 5x + 7y = 18.9 \)
   \( 2x - 3y = -8.1 \)

Special Cases:

4. \( x - 2y = 3 \)
   \( 2x - 4y = 6 \)

5. \( -x + 2y = 3 \)
   \( 2x - 4y = 3 \)
Solving Linear Systems Algebraically

Practice Problems:

1. \( x - 3y = 13 \)  
   \( 5x + 3y = 2 \)

2. \( x + 2y = 2 \)  
   \( 5x - 3y = -29 \)

3. \( 4x - 8y = 6 \)  
   \( 2x - 4y = 3 \)

4. \( x - 2y = -3 \)  
   \( 2x - 4y = 3 \)

5. \( 2x + 5y = 14 \)  
   \( 7x - 5y = -41 \)

6. \( 3x - 5y = 61 \)  
   \( 3x - y = 17 \)

7. \( 4x + y = 42 \)  
   \( 6x - 5y = 50 \)

8. \( 5x + 2y = 24 \)  
   \( 4x + 3y = 29 \)

9. \( 2x + 3y = 15 \)  
   \( 4x + 6y = 15 \)