8.5a Solving Systems by Elimination: Part I

Math 10

Solving Systems of Linear Equations Algebraically
Elimination Method: Part I

This lesson looks at the elimination method, another algebraic method which can be used to solve systems of linear equations. Using this method, one of the variables is eliminated in order to solve for the remaining variable. Consider the following system:

$$2x + 5y = -7$$
$$x + 5y = -4$$

The first step is to identify the variable which has the same coefficient in both equations.

The second step is to determine whether the equations should be added or subtracted. To figure this out, look at the sign in front of the term. If both signs are the same, subtract the equations. If the signs are different (one is positive, the other is negative) then add the equations. **If you have done this correctly, there will only be one variable in the equation.**

$$\begin{array}{rl} & 2x + 5y = -7 \\ \ominus & x + 5y = -4 \\ \hline & x \quad\quad = -3 \end{array}$$

The third step is to solve the equation.

In this case it has already been solved. We will see this step in the next examples.

The fourth step is to solve for the other variable.

Substitute $x=-3$ into either equation.

$$x + 5y = -4$$
$$-3 + 5y = -4$$
$$+3 \qquad +3$$
$$5y = -1$$
$$y = -\frac{1}{5}$$

Once you have determined the value of each variable, state the solution.

Solution: $(-3, -\frac{1}{5})$ or $x = -3, y = -\frac{1}{5}$

It is helpful to check you answer to ensure it is correct. This is done by substituting the value of each variable into each equation and verifying the left side is equal to the right side.

① LS = $2x + 5y$
= $2(-3) + 5(-\frac{1}{5})$
= $-6 + -1$
= -7
= RS ✓

② LS = $x + 5y$
= $-3 + 5(-\frac{1}{5})$
= $-3 + -1$
= -4
= RS ✓

Solve each system of linear equations by elimination. Verify your answer.

a) $3x - 2y = 5$
$x + 2y = 11$

$4x = 16$
$\div 4 \quad \div 4$
$x = 4$

$4 + 2y = 11$
$-4 \quad -4$
$2y = 7$
$y = \frac{7}{2}$

Solution: $(4, \frac{7}{2})$
or $x = 4, y = \frac{7}{2}$

check:

① $LS = 3x - 2y$
$= 3(4) - 2(\frac{7}{2})$
$= 12 - 7$
$= 5$
$= RS$ ✓

② $LS = x + 2y$
$= 4 + 2(\frac{7}{2})$
$= 4 + 7$
$= 11$
$= RS$ ✓

b) $2x + 4y = 10$
$y = 2x - 15$

$-2x + y = -15$
$2x + 4y = 10$

$5y = -5$
$y = -1$

$2x + 4(-1) = 10$
$2x - 4 = 10$
$2x = 14$
$x = 7$

Solution: $(7, -1)$
or $x = 7, y = -1$

check:

① $LS = 2x + 4y$
$= 2(7) + 4(-1)$
$= 14 - 4$
$= 10$
$= RS$ ✓

② $LS = y$
$= -1$

$RS = 2x - 15$
$= 2(7) - 15$
$= 14 - 15$
$= -1$
$= LS$ ✓

Assignment: handout