

Lesson 5-4: Elimination using multiplication

Verify that the solution to the equation  $2x + 5 = 11$  is  $x = 3$ .

$$\begin{aligned} 2(3) + 5 &= 11 \\ 6 + 5 &= 11 \\ 11 &= 11 \checkmark \text{ verified } \ddot{\text{u}} \end{aligned}$$

Recall that the Multiplication Property of Equality states that we can multiply the equation by any number (except 0) and the solution remains the same. Multiply the equation above by -4 and then verify the solution is still  $x = 3$

1<sup>st</sup>: Multiply by -4

2<sup>nd</sup>: Verify  $x = 3$

distribute  $x = 3$

$$\begin{aligned} -4(2x + 5 = 11) &\rightarrow -8x - 20 = -44 \\ -8(3) - 20 &= -44 \\ -24 - 20 &= -44 \\ -44 &= -44 \checkmark \text{ verified } \ddot{\text{u}} \end{aligned}$$

Example 1: Here is a system of two linear equations. Verify that the solution to this system is  $(3, 4)$ .

Equation 1:  $y = x + 1$

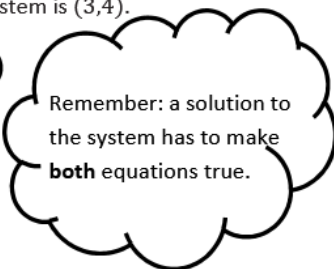
Equation 2:  $y = -2x + 10$

check  $(3, 4)$  in  $y = x + 1$ :

$$\begin{aligned} 4 &= 3 + 1 \\ 4 &= 4 \checkmark \\ \text{verified } \ddot{\text{u}} \end{aligned}$$

Check  $(3, 4)$  in  $y = -2x + 10$ :

$$\begin{aligned} 4 &= -2(3) + 10 \\ 4 &= -6 + 10 \\ 4 &= 4 \checkmark \text{ verified } \ddot{\text{u}} \end{aligned}$$



Now we are going to use the Multiplication Property of Equality... Pick a number and an equation from above. Multiply your number and your equation.

Multiply by Your number

Equation 1:  $y = x + 1$  "5"

$$\begin{aligned} 5(y = x + 1) \\ 5y = 5x + 5 \\ 5(4) = 5(3) + 5 \\ 20 = 15 + 5 \\ 20 = 20 \checkmark \end{aligned}$$

Verify the Solution is still  $(3, 4)$

Equation 2:  $y = -2x + 10$  "2"

$$\begin{aligned} 2(y = -2x + 10) \\ 2y = -4x + 20 \\ 2(4) = -4(3) + 20 \\ 8 = -12 + 20 \\ 8 = 8 \checkmark \end{aligned}$$

verified  $\ddot{\text{u}}$

The Multiplication Property doesn't change the solution. It only changes what the equation LOOKS LIKE.

Now watch the following video:

<http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=ate&wcsuffix=0703>

[Solving linear systems using elimination, multiplying first](#)

PLAY



VIDEO

## Solving Systems Using Elimination

Steps:

- 1) Multiply one equation (or both) by a constant so that one variable has coefficients that have a sum of zero.
- 2) Add the 2 equations (One variable should be eliminated)
- 3) Solve for the remaining variable, and then solve for the eliminated variable by using substitution.

$$\begin{array}{l} 5x - 3y = 9 \quad \rightarrow \quad 3(5x - 3y = 9) \rightarrow 15x - 9y = 27 \\ -3x + 4y = 10 \quad \rightarrow \quad 5(-3x + 4y = 10) \rightarrow -15x + 20y = 50 \end{array}$$

The goal is to create a zero pair therefore a variable will eliminate

Find  $x$  by substituting the  $y$ -value into an original equation and solve for  $x$ .

$(6, 7)$

$$5x - 3y = 9$$

check in  $-3x + 4y = 10$ :

$$-3(6) + 4(7) = 10$$

$$-18 + 28 = 10$$

$$10 = 10 \checkmark$$

Solve the systems algebraically & Verify your solution.

$$\begin{array}{l} 1: 3x + 6y = 6 \\ 2(2x - 3y = 4) \end{array} \rightarrow \begin{array}{r} 3x + 6y = 6 \\ 4x - 6y = 8 \\ \hline 7x = 14 \\ \hline x = 2 \end{array}$$

check in

$$\begin{array}{l} 2x - 3y = 4 \\ 2(2) - 3(0) = 4 \\ 4 - 0 = 4 \\ 4 = 4 \checkmark \end{array}$$

$x = 2$

$(2, 0)$

find y in  $3x + 6y = 6$ :

$$\begin{array}{r} 3(2) + 6y = 6 \\ -6 + 6y = 6 \\ \hline -6 \quad \downarrow \quad -6 \\ 6y = 0 \\ \hline y = 0 \end{array}$$

HW

$$\begin{array}{l} 2: 4x - y = 6 \\ 3x + 2y = 21 \end{array} \rightarrow 2(4x - y = 6) \rightarrow \begin{array}{r} 8x - 2y = 12 \\ 3x + 2y = 21 \\ \hline 11x = 33 \\ \hline x = 3 \end{array}$$

leave alone

find y in  $3x + 2y = 21$ :

$$\begin{array}{r} 3(3) + 2y = 21 \\ 9 + 2y = 21 \\ -9 \quad \downarrow \quad -9 \\ \hline 2y = 12 \\ \hline y = 6 \end{array}$$

$(3, 6)$

check in  $4x - y = 6$ :

$$\begin{array}{l} 4(3) - 6 = 6 \\ 12 - 6 = 6 \\ 6 = 6 \checkmark \end{array}$$

$$\begin{array}{l} 3: 2x + y = 25 \\ 4x + 3y = 9 \end{array} \rightarrow -3(2x + y = 25) \rightarrow \begin{array}{r} -6x - 3y = -75 \\ 4x + 3y = 9 \\ \hline -2x = -66 \\ \hline x = 33 \end{array}$$

find y in  $4x + 3y = 9$ :

$$\begin{array}{r} 4(33) + 3y = 9 \\ 132 + 3y = 9 \\ -132 \quad \downarrow \quad -132 \\ \hline 3y = -123 \\ \hline y = -41 \end{array}$$

$(33, -41)$

check in  $2x + y = 25$ :

$$\begin{array}{l} 2(33) + (-41) = 25 \\ 66 - 41 = 25 \\ 25 = 25 \checkmark \end{array}$$

## Attachments

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VIDEO