

Algebra 1: 5.3 Solving Systems by Elimination

Main Idea:

Add the equations together in order to eliminate one of the variables.

If you cannot eliminate a variable right away, multiply the equation(s) by a number to make it cancel.

$$\begin{array}{r} \text{Ex:} \quad 2x - 3y = -9 \\ + \quad 5x + 3y = 30 \\ \hline 7x + 0 = 21 \end{array}$$

Notice how if you Add down, the $-3y$ and $+3y$ will cancel.

$$\frac{7x}{7} = \frac{21}{7}$$

$$x = 3$$

plug $x=3$ into the x on Equation 1.

$$2x - 3y = -9$$

$$2(3) - 3y = -9$$

$$\begin{array}{r} 6 - 3y = -9 \\ -6 \quad \quad -6 \end{array}$$

$$\frac{-3y}{-3} = \frac{-15}{-3}$$

$$y = 5$$

y was cancelled

Step 1: Eliminate a variable by adding down.

Step 2: Solve for the remaining variable.

Step 3: Plug that value in to an equation and solve for the other variable.

Answer :

$(3, 5)$

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Ex:

$$\begin{array}{r} x + 4y = 2 \\ -x - 5y = -3 \\ \hline 0 - 1y = -1 \end{array}$$

$$\frac{-1y}{-1} = \frac{-1}{-1}$$

$$y = 1$$

Now plug this into one of the Equations.

$$x + 4y = 2$$

$$x + 4(1) = 2$$

$$\begin{array}{r} x + 4 = 2 \\ -4 \quad -4 \end{array}$$

$$x = -2$$

What do you notice if you added down now?

the x's will cancel.

$$1x - 1x = 0$$

Answer:
 $(-2, 1)$

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You MUST make sure the equations are in the same format before you attempt to eliminate!

Format Goal

x 's y 's = #

$$\begin{array}{l} 2y - 4 = -3x \\ 3x - 2y = -4 \end{array}$$

Work to get it in the correct format.

$$\begin{array}{r} 2y - 4 = -3x \\ +3x \qquad +3x \end{array}$$

$$\begin{array}{r} 3x + 2y - 4 = 0 \\ +4 \qquad +4 \end{array}$$

$$3x + 2y = 4$$

Correct Format!

rewrite Problem.

$$\begin{array}{r} 3x + 2y = 4 \\ + \quad 3x - 2y = -4 \\ \hline 6x + 0 = 0 \end{array}$$

You don't need to keep writing this 0.

$$\frac{6x = 0}{6} \quad \frac{0}{6}$$

$$x = 0$$

plug it in Anywhere to find y.

$$3x - 2y = -4$$

$$3(0) - 2y = -4$$

$$\begin{array}{r} -2y = -4 \\ \hline -2 \qquad -2 \end{array}$$

$$y = 2$$

Answer:
 $(0, 2)$

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Prerequisite skill: Finding the Least Common Multiple

Vocabulary.

Multiple: multiples of 3 are: 3, 6, 9, 12, 15, ...
multiples of 5 are: 5, 10, 15, 20, ...

Least Common Multiple: The LCM of 3 & 5 is 15.

Find the least common multiple for the following numbers. Then state what you'd have to multiply each number by to get that LCM:

Ex.1	Ex.2	Ex.3
-1 & 5	-6 & 24	4 & 5
6 ·	4 ·	5 · · 4
LCM: 5	LCM: 24	LCM: 20

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Ex:

$$\begin{array}{l} 3 \cdot (2x - 5y = 15) \\ -2 \cdot (3x + 7y = 8) \end{array}$$

distribute

Goal: Try to cancel x's

LCM: 6

$$\begin{array}{l} 6x - 15y = 45 \\ -6x - 14y = -16 \end{array}$$

Now we can add down.

$$\begin{array}{r} -29y = 29 \\ \hline -29 \quad -29 \end{array}$$

$$y = -1$$

Answer:
(5, -1)

Notice how nothing eliminates if you add down now.

Remember the goal is to eliminate either the x or the y. So look at the numbers you have for x and y and see which would be easier to find a LCM for.

plug -1 in for y
on Any Equation

$$2x - 5y = 15$$

$$2x - 5(-1) = 15$$

$$2x + 5 = 15$$

-5 -5

$$\begin{array}{r} 2x = 10 \\ \hline 2 \quad 2 \end{array}$$

$$x = 5$$

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Ex: # 13 on HW

$$\begin{aligned} & \cdot 11x - 20y = 28 \\ & \cdot 5 \cdot (3x + 4y = 36) \end{aligned}$$

$$\begin{aligned} & 11x - 20y = 28 \\ & 15x + 20y = 180 \end{aligned}$$

$$\frac{26x}{26} = \frac{208}{26}$$

$$x = 8$$

Now the
y's cancel

LCM for x's

$$\begin{array}{c} 11 \div 2 \\ 3 \cdot 11 \div 2 \\ \hline 33 \end{array}$$

LCM for y's

$$\begin{array}{c} 20 \div 4 \\ * 20 \div 4 \cdot 5 \\ \hline 20 \end{array}$$

plug in to $3x + 4y = 36$

$$3(8) + 4y = 36$$

$$\begin{array}{r} 24 + 4y = 36 \\ -24 \quad -24 \end{array}$$

$$\frac{4y}{4} = \frac{12}{4}$$

$$y = 3$$

Answer
(8, 3)

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Homework:

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