

Bellwork:

Solve:

$$1) \frac{2x}{5} + \frac{3}{2} = 1 \quad 2) \frac{3x+1}{3} = \frac{-x+2}{4}$$

Solve the System by Substitution:

$$3) \begin{cases} x = 3y \\ 2x - y = 40 \end{cases} \quad 4) \begin{cases} 3x + y = 8 \\ -x + 5y = 8 \end{cases}$$

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Homework Questions???

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Chapter 5.3(a) Solving Systems by Elimination

Solve systems of linear equation in two variables by elimination.

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What are the two methods of solving a system of linear equations we have learned?

Graphing

Substitution

Today we are going to learn the last method for solving a system:

Elimination (sometimes called combination or addition)

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Elimination is a method that combines the systems leaving one equation with one variable (the second variable is eliminated).

$$\begin{cases} 3x + 2y = 7 \\ + \quad x - 2y = -11 \\ \hline 4x = -4 \end{cases}$$

$$x = -1$$

$$\begin{aligned} (-1) - 2y &= -11 \\ +1 & \quad +1 \\ -2y &= -10 \quad y = 5 \end{aligned}$$

Remember to keep the equations balanced.

Since 2y and -2y have opposite coefficients; y can be eliminated by adding the two equations.

$$(-1, 5)$$

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Solving Systems of Equations by Elimination

Step 1: Write both equations in standard form ($Ax + By = C$)**Step 2:** Eliminate one of the variables and solve.**Step 3:** Substitute the value of step 2 into one of the original equations and solve.**Step 4:** Write the answers as an ordered pair (x, y) and check your answer.

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Example 1: Solve by Elimination

$$\begin{cases} 3x - 4y = 10 \\ x + 4y = -2 \end{cases} \quad (2, -1)$$

$$\begin{array}{r} 3x - 4y = 10 \\ + \quad x + 4y = -2 \\ \hline 4x = 8 \\ x = 2 \end{array}$$

$$\begin{array}{r} 3x - 4y = 10 \\ -2 + 4y = -2 \\ \hline 4y = -4 \\ y = -1 \end{array}$$

Step 1: (Ax + By = C)

Step 2: Eliminate

Step 3: Substitute Value in Original

Step 4: (x, y) and check

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Example 2: Solve by Elimination

$$\begin{cases} 2x + y = -5 \\ 2x - 5y = 13 \end{cases} \quad (-1, -3)$$

$$\begin{array}{r} 2x + y = -5 \\ -2x - 5y = 13 \\ \hline -6y = 18 \\ y = -3 \end{array}$$

Step 1: (Ax + By = C)

Step 2: Eliminate Variable

Step 3: Substitute Value in Original

Step 4: (x, y) and check

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Example 3: Solve by Elimination

$$\begin{cases} x + 3y = 7 \\ x - 4y = 14 \end{cases} \quad (10, -1)$$

$$\begin{array}{r} x + 3y = 7 \\ -1(x - 4y = 14) \\ \hline 7y = -7 \\ y = -1 \end{array}$$

$$\begin{array}{r} x + 3y = 7 \\ x + 3(-1) = 7 \\ x - 3 = 7 \\ x = 10 \end{array}$$

$$\begin{array}{r} (10) + 3(-1) = 7 \\ 10 - 3 = 7 \\ 7 = 7 \end{array}$$

$$\begin{array}{r} (10) - 4(-1) = 14 \\ 10 + 4 = 14 \\ 14 = 14 \end{array}$$

Step 1: (Ax + By = C)

Step 2: Eliminate Variable

Step 3: Substitute Value in Original

Step 4: (x, y) and check

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Example 4: Solve by Elimination

$$\begin{cases} 2x + y = 25 \\ 3y = 2x - 13 \end{cases} \quad (11, 3)$$

$$\begin{array}{r} 2x + y = 25 \\ -2x + 3y = -13 \\ \hline 4y = 12 \\ y = 3 \end{array}$$

$$\begin{array}{r} 2x + y = 25 \\ 2x + 3 = 25 \\ 2x = 22 \\ x = 11 \end{array}$$

Step 1: (Ax + By = C)

Step 2: Eliminate Variable

Step 3: Substitute Value in Original

Step 4: (x, y) and check

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Example 5: Solve by Elimination

$$\begin{cases} x + 2y = 11 \\ -3x + y = -5 \end{cases} \quad (3, 4)$$

$$\begin{array}{r} x + 2y = 11 \\ -3x + y = -5 \\ \hline 7y = 28 \\ y = 4 \end{array}$$

$$\begin{array}{r} x + 2y = 11 \\ x + 2(4) = 11 \\ x + 8 = 11 \\ x = 3 \end{array}$$

Step 1: (Ax + By = C)

Step 2: Eliminate Variable

Step 3: Substitute Value in Original

Step 4: (x, y) and check

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Example 6: Solve by Elimination

$$\begin{cases} -2x + y = 9 \\ 3x + 2y = 12 \end{cases}$$

$$\begin{array}{r} -2x + y = 9 \\ 4x - 2y = -18 \\ \hline 3x + 2y = 12 \end{array}$$

Step 1: (Ax + By = C)

Step 2: Eliminate Variable

Step 3: Substitute Value in Original

Step 4: (x, y) and check

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What kind of coefficients are needed before
you can eliminate a variable?

Opposites

$$-3 \text{ \& } 3$$

$$-5 \text{ \& } 5$$

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Homework

P. 347-348 #1-6, 11-16, 22 (all)

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2) $\begin{cases} x+y=12 \\ x-y=2 \end{cases}$
 $\begin{array}{r} 7+y=12 \\ -7 \quad -7 \\ \hline y=5 \end{array}$
 $7-5=2$
 $2=2 \checkmark$
 $\begin{array}{r} 2x+0=14 \\ x=7 \end{array}$
 $(7, 5)$

4) $\begin{cases} (x-10y=60)-1 \\ x+14y=12 \end{cases}$
 $\begin{array}{r} -x+10y=-60 \\ x+14y=12 \\ \hline 0+24y=-48 \\ y=-2 \end{array}$
 $40+14(-2)=12$
 $40-28=12$
 $12=12 \checkmark$
 $(40, -2)$

6) $\begin{cases} (-5x+7y=11)-1 \\ -5x+3y=19 \end{cases}$
 $\begin{array}{r} -5x+7y=11 \\ -5x+3y=19 \\ \hline 0-4y=-8 \\ -4 \quad -4 \\ \hline y=2 \end{array}$
 $-5(-5)+7(2)=11$
 $25+14=11$
 $11=11 \checkmark$
 $(-5, 2)$

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12) $\begin{cases} -2x+y=-20 \\ 2x+y=48 \end{cases}$
 $\begin{array}{r} -2x+y=-20 \\ 2x+y=48 \\ \hline 0+2y=28 \\ y=14 \end{array}$
 $-2x+(14)=-20$
 $-2x=-34$
 $x=17$
 $2(17)+(14)=48$
 $34+14=48$
 $48=48 \checkmark$
 $(17, 14)$

14) $\begin{cases} (x-y=4)-1 \rightarrow -x+y=-4 \\ x-2y=10 \end{cases}$
 $\begin{array}{r} -x+y=-4 \\ x-2y=10 \\ \hline 0-y=-6 \\ -1 \quad -1 \\ \hline y=6 \end{array}$
 $x-(6)=4$
 $x+6=4$
 $x=-2$
 $(-2, 6)$

16) $\begin{cases} (3x-2y=-1)-1 \rightarrow -3x+2y=1 \\ 3x-4y=9 \end{cases}$
 $\begin{array}{r} -3x+2y=1 \\ 3x-4y=9 \\ \hline 0-2y=10 \\ -2 \quad -2 \\ \hline y=-5 \end{array}$
 $3(-\frac{11}{3})-4(-5)=9$
 $-11+20=9$
 $9=9 \checkmark$
 $(-\frac{11}{3}, -5)$

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22)

A) $\begin{cases} x+y=-3 \\ 3x+y=3 \end{cases}$
 $\begin{array}{r} x+y=-3 \\ -(3x+y=3) \\ \hline -2x=0 \\ x=0 \end{array}$
 $x+y=-3$
 $0+y=-3$
 $y=-3$

B) $\begin{cases} x+y=3 \\ 3x+y=3 \end{cases}$
 $\begin{array}{r} x+y=3 \\ -(3x+y=3) \\ \hline -2x=0 \\ x=0 \end{array}$
 $x+y=3$
 $0+y=3$
 $y=3$

The correct answer is B; you have to multiply everything by negative 1!

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