

USING ELIMINATION (ADDITION) TO FIND THE POINT OF INTERSECTION OF TWO LINES

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The **elimination** method can be used to solve a system of linear equations. By adding or subtracting the two linear equations in a way that eliminates one of the variables, a single variable equation is left.

Example 1

$$\text{Solve: } \begin{array}{l} x + 2y = 16 \\ x + y = 2 \end{array}$$

First decide whether to add or subtract the equations. Remember that the addition or subtraction should eliminate one variable. In the system above, the x in each equation is positive, so we need to subtract, that is, change all the signs of the terms in the second equation.

$$\begin{array}{l} x + 2y = 16 \\ -(x + y = 2) \end{array} \Rightarrow \begin{array}{l} x + 2y = 16 \\ -x - y = -2 \end{array} \Rightarrow y = 14$$

Substitute the solution for y into either of the original equations to solve for the other variable, x .

$$x + 2(14) = 16 \Rightarrow x = -12$$

Check your solution $(-12, 14)$ in the second equation. You could also use the first equation to check your solution.

$$-12 + 14 = 2 \Rightarrow 2 = 2 \checkmark$$

Example 2

$$\text{Solve: } \begin{array}{l} 2x + 3y = 10 \\ 3x - 4y = -2 \end{array}$$

Sometimes the equations need to be adjusted by multiplication before they can be added or subtracted to eliminate a variable. Multiply one or both equations to set them up for elimination.

$$\text{Multiply the first equation by 3:} \\ 3(2x + 3y) = 10(3) \Rightarrow 6x + 9y = 30$$

$$\text{Multiply the second equation by -2:} \\ -2(3x - 4y) = -2 \cdot (-2) \Rightarrow -6x + 8y = 4$$

Decide whether to add or subtract the equations to eliminate one variable. Since the x -terms are additive opposites, add these equations.

$$\begin{array}{r} 6x + 9y = 30 \\ -6x + 8y = 4 \\ \hline 17y = 34 \text{ so } y = 2. \end{array}$$

Substitute the solution for y into either of the original equations to solve for the other variable.

$$2x + 3(2) = 10 \Rightarrow 2x = 4 \Rightarrow x = 2 \checkmark$$

$$\text{Check the solution } (2, 2) \text{ in the second equation.} \\ 3(2) - 4(2) = -2 \Rightarrow 6 - 8 = -2 \Rightarrow -2 = -2$$

Solve each system of linear equations using the Elimination Method.

1. $x + y = -4$
 $-x + 2y = 13$

2. $3x - y = 1$
 $-2x + y = 2$

3. $2x + 5y = 1$
 $2x - y = 19$

4. $x + 3y = 1$
 $2x + 3y = -4$

5. $x - 5y = 1$
 $x - 4y = 2$

6. $3x - 2y = -2$
 $5x - 2y = 10$

7. $x + y = 10$
 $15x + 28y = 176$

8. $x + 2y = 21$
 $9x + 24y = 243$

9. $4x + 3y = 7$
 $2x - 9y = 35$

10. $2x + 3y = 0$
 $6x - 5y = -28$

11. $7x - 3y = 37$
 $2x - y = 12$

12. $5x - 4y = 10$
 $3x - 2y = 6$

13. $x - 7y = 4$
 $3x + y = -10$

14. $y = -4x + 3$
 $3x + 5y = -19$

15. $2x - 3y = 50$
 $7x + 8y = -10$

16. $5x + 6y = 16$
 $3x = 4y + 2$

17. $3x + 2y = 14$
 $3y = -2x + 1$

18. $2x + 3y = 10$
 $5x - 4y = 2$

19. $5x + 2y = 9$
 $2x + 3y = -3$

20. $10x + 3y = 15$
 $3x - 2y = -10$

Answers

1. $(-7, 3)$

2. $(3, 8)$

3. $(8, -3)$

4. $(-5, 2)$

5. $(6, 1)$

6. $(6, 10)$

7. $(8, 2)$

8. $(3, 9)$

9. $(4, -3)$

10. $(-3, 2)$

11. $(1, -10)$

12. $(2, 0)$

13. $(-3, -1)$

14. $(2, -5)$

15. $(10, -10)$

16. $(2, 1)$

17. $(8, -5)$

18. $(2, 2)$

19. $(3, -3)$

20. $(0, 5)$