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

#14

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. Also see the textbook, pages 250, 252, 254, and 264.

Example 1

Solve: $\begin{aligned} x + 2y &= 16 \\ x + y &= 2 \end{aligned}$

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.

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

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.

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

Example 2

Solve: $\begin{aligned} 2x + 3y &= 10 \\ 3x - 4y &= -2 \end{aligned}$

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.

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

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.

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

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

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

Check the solution (2, 2) 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. $3x - y = 1$
   $-2x + y = 2$

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

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

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

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

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

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

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

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

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

CFS:
1. System is solved with elimination
2. All steps are shown
3. Solution is written as an order pair (x, y)
4. Solution is checked

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)