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Core Concepts

Solving a System of Linear Equations by Elimination

Step 1 Multiply, if necessary, one or both equations by a constant so at least one pair of like terms has the same or opposite coefficients.

Step 2 Add or subtract the equations to eliminate one of the variables.

Step 3 Solve the resulting equation.

Step 4 Substitute the value from Step 3 into one of the original equations and solve for the other variable.

Notes:

Worked-Out Examples

Example #1

Solve the system of linear equations by elimination. Check your solution.

$5x + 6y = 50$

$x - 6y = -26$

Step 2

$$5x + 6y = 50$$
$$\underline{x - 6y = -26}$$
$$6x + 0 = 24$$

Step 3 $6x = 24$

$$\frac{6x}{6} = \frac{24}{6}$$
$$x = 4$$

Step 4

$$x - 6y = -26$$
$$4 - 6y = -26$$
$$\underline{-4 \qquad\quad -4}$$
$$-6y = -30$$
$$\frac{-6y}{-6} = \frac{-30}{-6}$$
$$y = 5$$

Check $5x + 6y = 50$ $x - 6y = -26$

$$5(4) + 6(5) \overset{?}{=} 50 \qquad 4 - 6(5) \overset{?}{=} -26$$
$$20 + 30 \overset{?}{=} 50 \qquad\quad 4 - 30 \overset{?}{=} -26$$
$$50 = 50 \checkmark \qquad\qquad -26 = -26 \checkmark$$

The solution is (4, 5).

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Example #2

Solve the system of linear equations by elimination. Check your solution.

$10x - 9y = 46$

$-2x + 3y = 10$

Step 1

$10x - 9y = 46$

$-2x + 3y = 10$ | Multiply by 5. →

Step 2

$10x - 9y = 46$

$\underline{-10x + 15y = 50}$

$0 + 6y = 96$

Step 3 $\quad 6y = 96$

$\dfrac{6y}{6} = \dfrac{96}{6}$

$y = 16$

Step 4

$-2x + 3y = 10$

$-2x + 3(16) = 10$

$-2x + 48 = 10$

$\dfrac{-48 \quad -48}{-2x = -38}$

$\dfrac{-2x}{-2} = \dfrac{-38}{-2}$

$x = 19$

Check $\qquad 10x - 9y = 46 \qquad\qquad -2x + 3y = 10$

$10(19) - 9(16) \overset{?}{=} 46 \qquad -2(19) + 3(16) \overset{?}{=} 10$

$190 - 144 \overset{?}{=} 46 \qquad\qquad -38 + 48 \overset{?}{=} 10$

$46 = 46 \checkmark \qquad\qquad\qquad 10 = 10 \checkmark$

The solution is (19, 16).

Practice A

In Exercises 1–18, solve the system of linear equations by elimination. Check your solution.

1. $x + 3y = 17$

$-x + 2y = 8$

2. $2x - y = 5$

$5x + y = 16$

3. $2x + 3y = 10$

$-2x - y = -2$

4. $4x + 3y = 6$

$-x - 3y = 3$

5. $5x + 2y = -28$

$-5x + 3y = 8$

6. $2x - 5y = 8$

$3x + 5y = -13$

7. $2x + y = 12$

$3x - 18 = y$

8. $4x + 3y = 14$

$2y = 6 + 4x$

9. $-4x = -2 + 4y$

$-4y = 1 - 4x$

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10. $x + 2y = 20$
$2x + y = 19$

11. $3x - 2y = -2$
$4x - 3y = -4$

12. $9x + 4y = 11$
$3x - 10y = -2$

13. $4x + 3y = 21$
$5x + 2y = 21$

14. $-3x - 5y = -7$
$-4x - 3y = -2$

15. $8x + 4y = 12$
$7x + 3y = 10$

16. $4x + 3y = -7$
$-2x - 5y = 7$

17. $8x - 3y = -9$
$5x + 4y = 12$

18. $-3x + 5y = -2$
$2x - 2y = 1$

19. The sum of two numbers is 22. The difference is 6. What are the two numbers?