

TOPIC: SOLVING SYSTEMS OF LINEAR EQUATIONS BY ELIMINATION

Solving Systems of Linear Equations - Elimination

◆ Another way to solve systems of equations is by _____ the equations & _____ a variable.

► If not asked to use a specific method, use this when equations are in standard form or have large coefficients.
($Ax + By = C$)

Recall	Substitution	New	Elimination
	$y = 5x - 3$ $x = 2$		$x + y = 1$ $-x + y = 5$

EXAMPLE

Solve the system of equations using elimination.

$$3x + 2y = 1$$

$$-x + y = 3$$

HOW TO: Solve Systems of Equations - Elimination

- 1) Write BOTH equations in the form $Ax + By = C$, aligning coeff's vertically on top of each other
- 2) Multiply eq'n(s) by # (+ or -) so x or y coeff's are _____ with _____ signs
- 3) _____ equations vertically to eliminate one variable, then solve for other
- 4) Plug value from 3) back into *either* eq'n, then solve
- 5) Check answer by plugging values into both eqn's

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How to Multiply Equations in Elimination Method

◆ To determine what # to multiply by in Step 2), look at the coefficients of each equation.

Elimination Method - What to Multiply Equation(s) by to Eliminate Variable				
If coefficients of x or y are...	Equal with OPPOSITE sign	Equal with SAME sign	Factors of each other (Evenly divisible)	Anything Else
Multiply...	Nothing! Just add	Either eq'n by -1	Eq'n with smaller coeff's by quotient	Each eq'n by <i>other</i> coeff (+ or -)
EXAMPLE	$7x + 13y = 12$ $-7x + 2y = 18$	$5x + 7y = 17$ $6x + 7y = 12$	$12x - 5y = 24$ $3x - 2y = 6$	$6x + 2y = -10$ $-4x - 3y = 15$

HOW TO: Solve Systems of Equations - Elimination

- 1) Write BOTH equations in the form $Ax + By = C$, aligning coeff's vertically on top of each other
- 2) Multiply eq'n(s) by # (+ or -) so x or y coeff's are **EQUAL** with **OPPOSITE** signs
- 3) **ADD** equations vertically to eliminate one variable, then solve for other
- 4) Plug value from 3) back into *either* eq'n, then solve

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EXAMPLE

Without *fully* solving, multiple one or both equation(s) by an appropriate factor to cancel out a variable.

Elimination Method - What to Multiply Equation(s) by to Eliminate Variable				
If coefficients of x or y are...	Equal with OPPOSITE sign	Equal with SAME sign	Factors of each other (Evenly divisible)	Anything Else
Multiply...	Nothing! Just add	Either eq'n by -1	Eq'n with smaller coeff's by quotient	Each eq'n by <i>other</i> coeff (+ or -)

(A)

$$\begin{aligned}2x + 3y &= 1 \\ x - y &= 3\end{aligned}$$

(B)

$$\begin{aligned}5x + 3y &= 10 \\ -7x + 5y &= 15\end{aligned}$$

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PRACTICE

Use the elimination method to solve the following system of linear equations.

(A)

$$\begin{aligned}2x + y &= 1 \\3x - y &= 4\end{aligned}$$

HOW TO: Solve Systems of Equations - Elimination

- 1) Write BOTH equations in the form $Ax + By = C$, aligning coeff's vertically on top of each other
- 2) Multiply eq'n(s) by # (+ or -) so x or y coeff's are **EQUAL** with **OPPOSITE** signs
- 3) **ADD** equations vertically to eliminate one variable, then solve for other
- 4) Plug value from **3)** back into *either* eq'n, then solve
- 5) Check answer by plugging values into both eqn's

(B)

$$\begin{aligned}10x - 4y &= 5 \\5x - 4y &= 1\end{aligned}$$

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Choosing a Method to Solve a System

◆ While both algebraic methods for solving systems of equations work, one method is often easier than the other.

Method	Use when...	Example	
<i>Substitution</i>	<ul style="list-style-type: none">• x or y _____ ($x = ..$ OR $y = ..$)• x or y have coefficient of ____ or ____	$\begin{cases} 2x - 4y = 6 \\ x = 2y - 3 \end{cases}$	$\begin{cases} 2x - 4y = 6 \\ 3 - y = 3x \end{cases}$
<i>Elimination</i>	<ul style="list-style-type: none">• Both eqns in _____ form ($Ax + By = C$)• x or y coefficients are: _____, _____, _____	$\begin{cases} 6x - 8y = 26 \\ -6x + 5y = 1 \end{cases}$	$\begin{cases} 5x - 9y = -28 \\ 4x + 3y = -2 \end{cases}$

EXAMPLE

Without solving, determine which method is easiest to use to solve the system of linear equations.

(A)
$$\begin{cases} 3x + 4y = 10 \\ 5x + 2y = 6 \end{cases} \quad [\text{SUBSTITUTION} \mid \text{ELIMINATION}]$$

(B)
$$\begin{cases} y = 2x + 5 \\ 3x + y = 10 \end{cases} \quad [\text{SUBSTITUTION} \mid \text{ELIMINATION}]$$

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PRACTICE

Determine if substitution or elimination would be more convenient to use for the system below.

$$\begin{cases} 7x + 2y = 12 \\ 5x - 4y = 10 \end{cases}$$

- (A) Substitution
- (B) Elimination

PRACTICE

Determine if substitution or elimination would be more convenient to use for the system below.

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

- (A) Substitution
- (B) Elimination

EXAMPLE

Choose a method (substitution or elimination) to solve the system of equations, then solve.

$$\begin{cases} x = 4y - 2 \\ 4x - 2y = 6 \end{cases}$$

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EXAMPLE

Choose a method (substitution or elimination) to solve the system of equations, then solve.

$$\begin{cases} x + y = 7 \\ x - y = 3 \end{cases}$$