7.5 Solving Systems of Equations by Elimination

When we solve a linear system by graphing, it is not always possible to get exact values. We will look at another algebraic method that can be used to find these exact values.

Elimination Steps:

1. Choose which variable to eliminate first (x or y). Choose the variable that has the same coefficient in each equation. If they don't, find the lowest common multiple between the coefficients. Multiply one or both equations by a number that makes the coefficients equal.
2. Add or subtract the equations to eliminate the chosen variable.
   a. Add equations if the chosen variable has opposite signs in each equation (one positive, one negative).
   b. Subtraction equations if the chosen variables has the same sign in equation (both positive or both negative).
3. Solve the resulting equation in step 2 for the variable.
4. Substitute known value (found in step 3) into either original equation and solve for the other variable.
5. Check your answer using both equations.

Examples: Solve by Elimination

a) ① $2x + y = -7$
② $x + y = -4$

the "y" coefficients are the same so we'll subtract equations.

every term in equation ② is subtracted

① $2x + y = -7$
$-$ (② $x + y = -4$)

$x + 0 = -3$

$x = -3$

Now solve for "y"

② $x + y = -4$

$-3 + y = -4$

b) ① $3x + 2y = 9$
② $-3x - 5y = -15$

the "x" coefficients are equal and opposite signs so we'll add equations

① $3x + 2y = 9$
② $+(-3x - 5y = -15)$

$0 - 3y = -6$

$\frac{-3y}{-3} = \frac{-6}{-3}$

$y = 2$

verify:

① $2(-3) + (-1) \stackrel{?}{=} -7$

$-6 - 1 = -7$ ✓

② $-3 + (-1) \stackrel{?}{=} -4$

$-3 - 1 = -4$ ✓

① $3x + 2y = 9$

$3x + 2(2) = 9$

$3x + 4 = 9$

$-4 \quad -4$

$\frac{3x}{3} = \frac{5}{3}$

$x = \frac{5}{3}$

c)
① $2x-3y=15$
② $5x-2y=10$

Neither variable has matching coefficients.
Choose to eliminate "x" first.
Find lowest common multiple between 2 and 5 (it's 10).
Multiply equation ① by 5
Multiply equation ② by 2

① $5(2x-3y=15) = 10x-15y=75$

② $2(5x-2y=10) = 10x-4y=20$

① $10x-15y=75$

② $-(10x-4y=20)$

$0-11y=55$

$\frac{-11y}{-11}=\frac{55}{-11}$

$y=-5$

① $2x-3y=15$

$2x-3(-5)=15$

$2x+15=15$

$-15 \quad -15$

$\frac{2x}{2}=\frac{0}{2}$

$x=0$

d) $\frac{2}{3}x-\frac{1}{2}y=4$

$\frac{1}{2}x+\frac{1}{4}y=\frac{5}{2}$

Practice: p.437 #6, 7, 12ab
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