KEY

Lesson 7.4 ~ Using Substitution to Solve a System of Linear Equations

The second of three methods is substitution. We will solve for a variable in one equation, and then substitute it into the second equation.

Substitution Steps:

1. Solve for one variable from either equation (it is simplest to select the variable whose coefficient is one).
2. Substitute the result from step 1 into the other equation.
3. Solve for the remaining variable.
4. Substitute known value into either original equation and solve.
5. Verify the solution.

Example #1: Solve the linear system and verify the solution.

① $3x + y = 3$

② $7x - 2y = 20$

① $3x + y = 3$
$-3x \quad -3x$

$y = -3x + 3$ → ② $7x - 2(-3x + 3) = 20$

$7x + 6x - 6 = 20$
$+6 \quad +6$

$\frac{13x}{13} = \frac{26}{13}$

$\boxed{x = 2}$ ← $y = -3(2) + 3$

$y = -6 + 3$

$\boxed{y = -3}$

verify: ① $3(2) + (-3) = 3$
$6 - 3 = 3$
$3 = 3$ ✓

② $7(2) - 2(-3) = 20$
$14 + 6 = 20$
$20 = 20$ ✓

Example #2: Solve the linear system and verify the solution.

① $x-6y=4$

② $-2x+y=-8$

① $x-6y=4$
$+6y \quad +6y$
$x=6y+4$ → ② $-2(6y+4)+y=-8$
$-12y-8+y=-8$
$-11y=0$
$\boxed{y=0}$

$x=6(0)+4$
$\boxed{x=4}$

verify: ① $4-6(0)=4$
$4=4$ ✓

② $-2(4)+0=-8$
$-8=-8$ ✓

Example #3: Solve the linear system and verify the solution.

① $\left(\frac{1}{2}x-\frac{4}{5}y=-2\right)\times 10 \Rightarrow 5x-8y=-20$

② $\left(y=\frac{1}{4}x-\frac{3}{8}\right)\times 8 \Rightarrow 8y=2x-3$

① $5x-(2x-3)=-20$
$5x-2x+3=-20$
$-3 \quad -3$
$\frac{3x}{3}=\frac{-23}{3}$
$\boxed{x=-\frac{23}{3}}$

② $y=\frac{1}{4}\left(\frac{-23}{3}\right)-\frac{3}{8}$
$y=\frac{-23}{12}-\frac{3}{8}$
$y=\frac{-46}{24}-\frac{9}{24}$
$\boxed{y=\frac{-55}{24}}$

verify: ① $\frac{1}{2}\left(\frac{-23}{3}\right)-\frac{4}{5}\left(\frac{-55}{24}\right)=-2$ ✓

② $\frac{-55}{24}=\frac{1}{4}\left(\frac{-23}{3}\right)-\frac{3}{8}$ ✓