Sec. 3.2 Solving Systems Algebraically

Equivalent systems: have the same solutions. We can multiply each side of one or both equations by the same number.

Problem 1: Solve using substitution.

a. $5x - 3y = -1$ ✓
$x + y = 3$ ✓

$-x \quad -x$

① $y = 3 - x = 3 - 1 = 2$ ④

② $5x - 3(3 - x) = -1$

③ $5x - 9 + 3x = -1$

$8x - 9 = -1$

$+9 \quad +9$

$\frac{8x}{8} = \frac{8}{8}$

③ $x = 1$

$(1, 2)$

① Solve for x or y in one equation.

② Plug that value into the OTHER equation

③ Solve for one variable

④ Plug that variable into an equation and solve for other variable.

⑤ Write the solution as an ordered pair.

⑥ Check in BOTH equations.

b. $x + 3y = 5$ ✓

$-2x - 4y = -5$ ✓

$-2(5-3y) - 4y = -5$

$-10 + 6y - 4y = -5$

$-10 + 2y = -5$

$+10 \quad +10$

$\frac{2y}{2} = \frac{5}{2}$

$y = \frac{5}{2}$ ✓ $\left(-\frac{5}{2}, \frac{5}{2}\right)$

$x + 3y = 5$

$-3y \quad -3y$

$x = 5 - 3y$ ✓

$x = 5 - 3 \cdot \frac{5}{2}$

$x = 5 - \frac{15}{2}$

$x = \frac{10}{2} - \frac{15}{2}$

$x = -\frac{5}{2}$

$(-2.5, 2.5)$

b. $3x + 5y = 13$

$2x + y = 4$

$-2x \quad -2x$

$y = 4 - 2x$

$4 - 2 \cdot 1$

$4 - 2$

2

$(1, 2)$

$3x + 5(4 - 2x) = 13$

$3x + 20 - 10x = 13$

$-7x + 20 = 13$

$-20 \quad -20$

$\frac{-7x}{-7} = \frac{-7}{-7}$

$x = 1$

Problem 2: Solve by elimination.

a. $2x - 3y = 14$
$4x + 3y = 46$

$6x = 60$
$\frac{6x}{6} = \frac{60}{6}$
$x = 10$

$4 \cdot 10 + 3y = 46$
$40 + 3y = 46$
$-40 \quad -40$
$3y = 6$
$\frac{3y}{3} = \frac{6}{3}$
$y = 2$

$(10, 2)$

b. $9(7x + 5y = 2) \rightarrow 63x + 45y = 18$
$5(8x - 9y = 17) \rightarrow 40x - 45y = 85$

$103x = 103$
$x = 1$

$8 \cdot 1 - 9y = 17$
$8 - 9y = 17$
$-8 \quad -8$
$-9y = 9$
$y = -1$

$(1, -1)$

Problem 3 :4

a. $\begin{cases} 6x + 4y = 2 \\ -2(3x + 2y = -1) \end{cases}$ → $6x + 4y = 2$

$-6x - 4y = 2$

$0 \neq 4$

False

no solution

inconsistent

b. $8(6x - 3y = 15)$ → $48x - 24y = 120$

$6(-8x + 4y = -20)$ → $-48x + 24y = -120$

$0 = 0$

True

infinitely many solutions

consistent

dependent