

Solving Systems Algebraically

Example 1... Solve each system of equations with substitution.

a. $y = (x+3)$
 $5x + y = 9$
 $5x + (x+3) = 9$
 $6x + 3 = 9$
 $\quad -3 \quad -3$
 $\frac{6x}{6} = \frac{6}{6} \quad x = 1$
 $y = 1 + 3$
 $y = 4$
(1, 4)

b. $2x + y = -1 \rightarrow y = (-2x - 1)$
 $6x - 3y = -33$
 $6x - 3(-2x - 1) = -33$
 $6x + 6x + 3 = -33$
 $\quad -3 \quad -3$
 $\frac{12x}{12} = \frac{-36}{12}$
 $x = -3$
 $y = -2(-3) - 1$
 $y = 6 - 1 = 5$
(-3, 5)

c. $2x - 3y = 6$
 $x + y = -12$
 $x = (-y - 12)$
 $2(-y - 12) - 3y = 6$
 $-2y - 24 - 3y = 6$
 $\quad +24 \quad +24$
 $\frac{-5y}{-5} = \frac{30}{-5}$
 $x = (6 - 12)$
 $x = -6 \quad y = -6$
(-6, -6)

Example 2... Solve each system of equations with elimination.

a. $3x + y = -9$
 $+ \quad -x - 2y = 12$
 $\quad -y = 3$
 $\quad -1 \quad -1$
 $y = -3$
 $3x + \quad -y = -9$
 $\quad +3 \quad +3$
 $\frac{3x}{3} = \frac{-6}{3}$
 $x = -2$
(-2, -3)

b. $2(4x + 3y = -6)$
 $5x - 6y = -27$
 $+ \quad 8x + 6y = -12$
 $\frac{13x}{13} = \frac{-39}{13}$
 $x = -3$
 $5(-3) - 6y = -27$
 $-15 - 6y = -27$
 $\quad +15 \quad +15$
 $\frac{-6y}{-6} = \frac{-12}{-6}$
 $y = 2$
(-3, 2)

c. $5(3x + 7y = 15)$
 $-3(5x + 2y = -4)$
 $15x + 35y = 75$
 $-15x - 6y = 12$
 $\frac{29y}{29} = \frac{87}{29}$
 $y = 3$
 $3x + 7(3) = 15$
 $3x + 21 = 15$
 $\quad -21 \quad -21$
 $\frac{3x}{3} = \frac{-6}{3}$
 $x = -2$
(-2, 3)

Example 3... Suppose your drama club is planning a production that will cost \$525 for the set and \$150 per performance. A sold-out performance will bring in \$325. Write an equation for the cost C and an equation for the income I for p sold-out performances. Find how many sold-out performances will make the cost equal to the income. 3 sold-out

$C = 525 + 150p$
 $I = 325p$
 $C = I$

$525 + 150p = 325p$
 $\quad -150p \quad -150p$
 $\frac{525}{175} = \frac{175p}{175}$
 $3 = p$