Lesson 5-3 SOLVING SYSTEMS USING ELIMINATION BY ADDITION

KeyConcept Solving by Elimination

Step 1 Write the system so like terms with the same or opposite coefficients are aligned.

Step 2 Add or subtract the equations, eliminating one variable. Then solve the equation.

Step 3 Substitute the value from Step 2 into one of the equations and solve for the other variable. Write the solution as an ordered pair.

X's under X's
Y's under Y's
= under =

EXAMPLE 1: Use elimination to solve this system of equations.

$4x + 6y = 32$
$3x - 6y = 3$

Combine like terms vertically

$7x = 35$

$\frac{7x}{7} = \frac{35}{7}$

$x = 5$

find y in $4x+6y=32$:

$4(5)+6y=32$

$20+6y=32$

$-20 \quad -20$

$6y=12$

$\frac{6y}{6}=\frac{12}{6}$

$y=2$

Solution: (5, 2)

Check in $3x-6y=3$

$3(5)-6(2)=3$

$15-12=3$

$3=3$ ✓

EXERCISE 1A:

$-4x + 3y = -3$
$4x - 5y = 5$

$-2y = 2$

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

$y = -1$

find x in $4x-5y=5$:

$4x-5(-1)=5$

$4x+5=5$

$-5 \quad -5$

$4x = 0$

$\frac{4x}{4} = \frac{0}{4}$

$x = 0$

solution = (0, -1)

Check in $-4x+3y=-3$

$-4(0)+3(-1)=-3$

$0-3=-3$

$-3=-3$ ✓

EXERCISE 1B: HW

$4y + 3x = 22$
$3x - 4y = 14$

$3x+4y=22$
$3x-4y=14$

$6x = 36$

$\frac{6x}{6} = \frac{36}{6}$

$x = 6$

find y in $3x-4y=14$:

$3(6)-4y=14$

$18-4y=14$

$-18 \quad -18$

$-4y=-4$

$\frac{-4y}{-4} = \frac{-4}{-4}$

$y = 1$

solution (6, 1)

Check in $4y+3x=22$:

$4(1)+3(6)=22$

$4+18=22$

$22=22$ ✓

Example 2: Write and solve a system of equations

1st equation

Negative three times one number plus five times another number is -11. Three times the first number plus seven times the other number is -1. Find the numbers.

2nd equation

x = first number
y = other number

Negative three times one number	Plus	Five times another number	is	-11
$-3x$	+	$5y$	=	-11

Three times the first number	Plus	Seven times the other number	is	-1
$3x$	+	$7y$	=	-1

Add the system to eliminate a variable:

$$\begin{array}{r} -3x + 5y = -11 \\ (+)\quad 3x + 7y = -1 \\ \hline 12y = -12 \end{array} \quad \rightarrow \text{Solve for y}$$

$$\frac{12y}{12} = \frac{-12}{12}$$

$$y = -1$$

Are:
X's under X's?
Y's under Y's?
= under = ?
→ If yes to all 3, does anything cancel out?

Replace (-1) into an original equation for "y" and solve for "x"

Top equation

$-3x + 5y = -11$
$-3x + 5(-1) = -11$ → Solve for x
$-3x - 5 = -11$
$+5 \quad +5$

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

$$x = 2$$

check in the bottom equation: $3x+7y=-1$
$3(2)+7(-1)=-1$
$6-7=-1$
$-1=-1$ ✓

(X,Y)

Write your answer as an Ordered Pair (2, -1) What does your answer mean? The first number was 2 and the other number was −1.

EXERCISE 2:

1st equation 2nd equation

The sum of two numbers is – 10. Negative three times the first number minus the second number equals 2. Find the numbers. (Hint: let x = the 1st number and y = the 2nd number) Now write the system:

$1x+1y=-10$ 1st equation

$-3x-1y=2$ 2nd equation

$-2x=-8$ solve for x

$\frac{-2x}{-2}=\frac{-8}{-2}$

$x=4$

find y in $x+y=-10$:

$4+y=-10$

$-4 \quad -4$

$y=-14$

check in $-3x-y=2$:

$-3(4)-(-14)=2$

$-12+14=2$

$2=2$ ✓

Solution is (4,-14)
The first number was 4 and the second number was -14.

EXERCISE 3: Solve the system **algebraically** for x and y.

$3x+y=12$

$2x-y=3$

$5x=15$

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

$x=3$

find y in $3x+y=12$:

$3(3)+y=12$

$9+y=12$

$-9 \quad -9$

$y=3$

Solution (3,3).
The numbers are 3 and 3.

check in $2x-y=3$:

$2(3)-3=3$

$6-3=3$

$3=3$ ✓