Name: Key Class: _____

M8-U5: Notes #4 - Solving by Substitution Date: _____

Warm-Up:
Solve this system of equations algebraically.

a. $\begin{cases} y = -2x - 7 \\ y = 2x + 17 \end{cases}$

$-2x - 7 = 2x + 17$
$+2x - 17 \quad +2x - 17$
$\frac{-24}{4} = \frac{4x}{4}$
$-6 = x$

P(-6,5)

$y = -2(-6) - 7$
$= 12 - 7$
$y = 5$

CK $y = 2(-6) + 17$
$= -12 + 17$
$= 5$ ✓

b. $\begin{cases} x = -4y + 1 \\ x = y - 4 \end{cases}$

$-4y + 1 = y - 4$
$+4y + 4 \quad +4y + 4$
$\frac{5}{5} = \frac{5y}{5}$
$1 = y$

P(-3,1)

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

CK $x = (1) - 4$
$= -3$ ✓

Substitution Method:
The substitution method is another method for solving systems of equations.

1. $\begin{cases} y = x - 2 \\ 2x + 2y = 4 \end{cases}$

$2x + 2(x - 2) = 4$
$2x + 2x - 4 = 4$
$4x - 4 = 4$
$+4 \quad +4$
$\frac{4x}{4} = \frac{8}{4}$
$x = 2$

P(2,0)

$y = (2) - 2$
$y = 0$

CK $2(2) + 2(0) \stackrel{?}{=} 4$
$4 + 0 \stackrel{?}{=} 4$
$4 = 4$ ✓

2. $\begin{cases} x = -4y - 4 \\ 3x + 5y = 2 \end{cases}$

$3(-4y - 4) + 5y = 2$
$-12y - 12 + 5y = 2$
$-7y - 12 = 2$
$+12 \quad +12$
$\frac{-7y}{-7} = \frac{14}{-7}$
$y = -2$

P(4,-2)

$x = -4(-2) - 4$
$x = 8 - 4$
$x = 4$

CK $3(4) + 5(-2) \stackrel{?}{=} 2$
$12 - 10 \stackrel{?}{=} 2$
$2 = 2$ ✓

Try It!

a. $\begin{cases} y = -2x - 1 \\ x - 2y = 12 \end{cases}$

$x - 2(-2x - 1) = 12$

$x + 4x + 2 = 12$

$-2 \quad -2$

$5x = 10$

$\frac{5x}{5} = \frac{10}{5}$

$x = 2$

$y = -2(2) - 1$

$= -4 - 1$

$y = -5$

$P(2, -5)$

CK

$(2) - 2(-5) \stackrel{?}{=} 12$

$2 + 10 \stackrel{?}{=} 12$

$12 = 12$ ✓

b. $\begin{cases} -3x - 7y = 1 \\ y = -2x + 3 \end{cases}$

$-3x - 7(-2x + 3) = 1$

$-3x + 14x - 21 = 1$

$+21 \quad +21$

$\frac{11x}{11} = \frac{22}{11}$

$x = 2$

$y = -2(2) + 3$

$= -4 + 3$

$y = -1$

$P(2, -1)$

CK

$-3(2) - 7(-1) \stackrel{?}{=} 1$

$-6 + 7 \stackrel{?}{=} 1$

$1 = 1$ ✓

Special Cases

3. $\begin{cases} y = -3x + 4 \\ 6x + 2y = 7 \end{cases}$

$6x + 2(-3x + 4) = 7$

$6x - 6x + 8 = 7$

$8 \neq 7$

No solution

No POI, parallel

4. $\begin{cases} y = 3x - 6 \\ -3x + y = -6 \end{cases}$

$-3x + (3x - 6) = -6$

$-6 = -6$

Identity,

Infinitely many solutions.

Same eqn.

Try It!

Solve the following system:

$$\begin{cases} y = 2x - 5 \\ -2x + y = 7 \end{cases}$$

$-2x + (2x - 5) = 7$

$-5 \neq 7$

No solution

parallel lines.

Practice: Solve the following systems.

1. $\begin{cases} 3x - y = 30 \\ y = -x + 14 \end{cases}$

$3x - (-x + 14) = 30$

$3x + x - 14 = 30$

$4x - 14 = 30$

$+14 \quad +14$

$\frac{4x}{4} = \frac{44}{4}$

$x = 11$

$y = -(11) + 14$

$y = 3$

$P(11, 3)$

CK

$3(11) - (3) \stackrel{?}{=} 30$

$33 - 3 \stackrel{?}{=} 30$

$30 = 30$ ✓

2. $\begin{cases} x = -6y + 15 \\ -x + 4y = 5 \end{cases}$

$-(-6y + 15) + 4y = 5$

$6y - 15 + 4y = 5$

$10y - 15 = 5$

$+15 \quad +15$

$\frac{10y}{10} = \frac{20}{10}$

$y = 2$

$x = -6(2) + 15$

$= -12 + 15$

$x = 3$

$P(3, 2)$

CK

$-(3) + 4(2) \stackrel{?}{=} 5$

$-3 + 8 \stackrel{?}{=} 5$

$5 = 5$ ✓

3. $\begin{cases} y = \frac{1}{2}x + 2 \\ x - 2y = -4 \end{cases}$

$x - 2(\frac{1}{2}x + 2) = -4$

$x - x - 4 = -4$

$-4 = -4$

identity; infinitely many solutions.