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Worksheet 6-4: Solving Linear Systems by Substitution

Steps for Solving a System of Two Equations in x and y by Substitution:

Step 1: Using either equation, solve for one variable in terms of the other.
(Choose the equation that can be solved easier: where the coefficient of x or y is 1)

Step 2: Substitute the new expression for x or y into the remaining equation and solve.

Step 3: Substitute the value for x or y back into one of the original equations to determine the value of the other variable.

Practice:

1. **Solve x in terms of y.** (x, y)

(a) $x+4y=13$ (b) $2x-4y=12$ (c) $-2y+x=-5$

$-4y \quad -4y$

$x = 13-4y$

$+4y \quad +4y$

$\frac{2x}{2} = \frac{12+4y}{2}$

$x = 6+2y$

2. **Solve y in terms of x.**

(a) $y+8=3x$ (b) $x-y=-5$ (c) $3y-9x=18$

3. **Solve the following systems of equations by substitution.**

(a) $x-2y=7$ ①
$2x-3y=13$ ②

$(5)-2(-1)=?\ 7?$

$2(5)-3(-1)=?\ 13?$

From ①, $x-2y=7$

$+2y \quad +2y$

$x = 7+2y$ ③

Sub ③ into ②

$2x-3y=13$

$2(7+2y)-3y=13$

$14+4y-3y=13$

$(14)+y=13$

$-14 \quad -14$

$y=-1$

Sub $y=-1$ into ①

$x-2y=7$

$x-2(-1)=7$

$x+2=7$

$-2 \quad -2$

$x=5$

$(5,-1)$ is the solution.

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(b) $2x+y=2$ — ①
$-x+2y=-1$ — ②

(1,0)
$2(1)+0=?\ 2$
$-(1)+2(0)=?\ -1$

From ①, $2x+y=2$
$-2x \quad -2x$
$y=2-2x$ — ③

Sub. ③ into ②
$-x+2y=-1$
$-x+2(2-2x)=-1$
$-x+4-4x=-1$
$-5x+4=-1$
$-4 \quad -4$
$-5x=-5$

$\frac{-5x}{-5}=\frac{-5}{-5}$
$x=1$

Sub $x=1$ into ①
$2x+y=2$
$2(1)+y=2$
$2+y=2$
$-2 \quad -2$
$y=0$

The solution is (1,0).

(c) $3x-2y=6$
$x+y=-3$

Answers: **1.** (a) $x=13-4y$, (b) $x=6+2y$, (c) $x=-5+2y$ or $x=2y-5$;
2. (a) $y=3x-8$, (b) $y=-x+5$ or $y=5-x$, (c) $y=6+3x$;

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4. Solve the following systems of equations by substitution.

(a) $-4x + y = 6$
$-5x - y = 21$

(b) $-7x - 2y = -13$
$x - 2y = 11$

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(c) $\begin{cases} -2x - y = -9 \\ 5x - 2y = 18 \end{cases}$

(d) $\begin{cases} -3x + 3y = 4 \\ -x + y = 3 \end{cases}$

Answers: **3.** (a) The solution is $(5, -1)$, (b) The solution is $(1, 0)$, (c) The solution is $(0, -3)$;
4. (a) The solution is $(-3, -6)$, (b) The solution is $(3, -4)$, (c) The solution is $(4, 1)$, (d) no solution