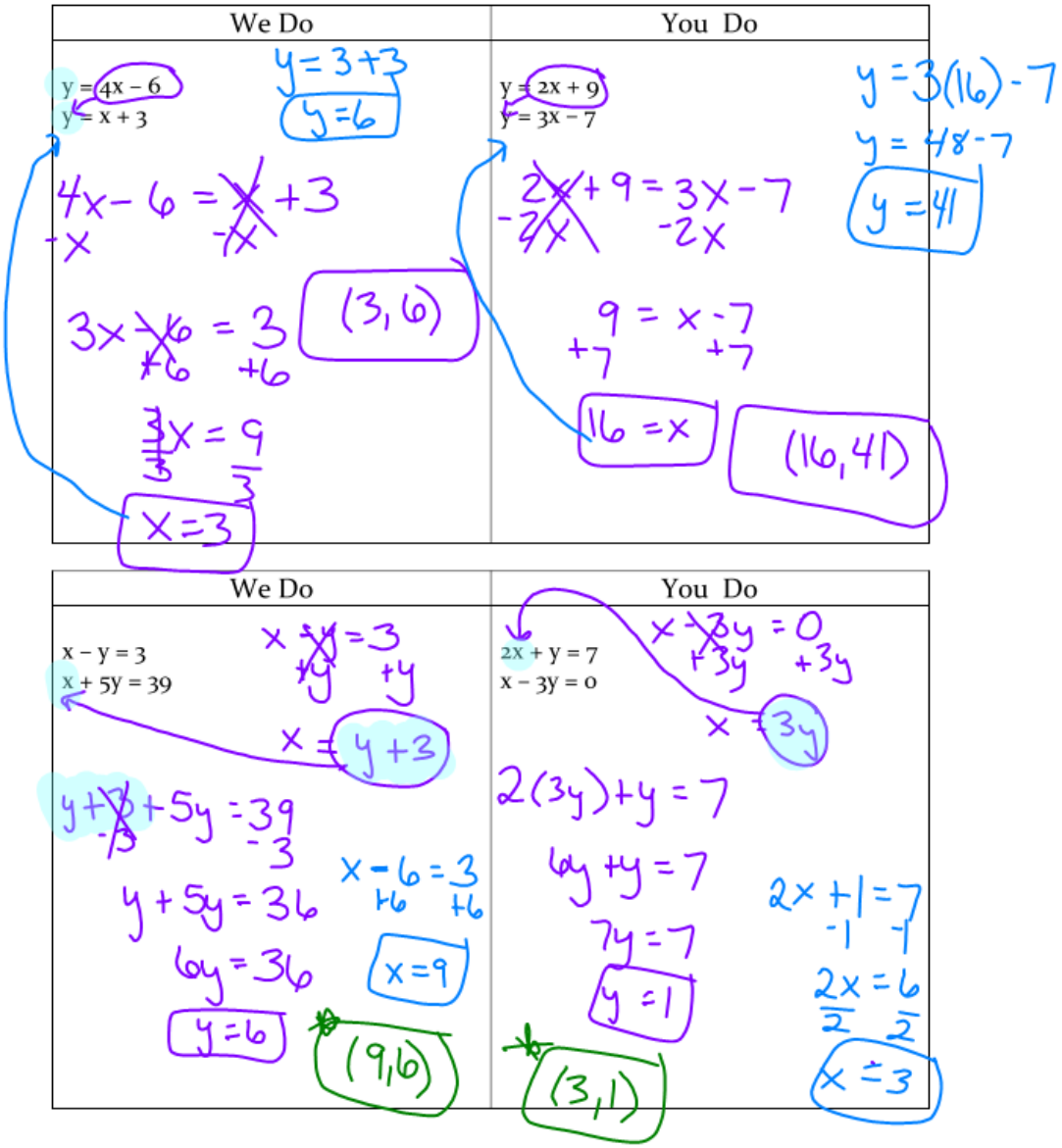
Solving Systems by Substitution

solution of a system of equations	Decode
Definition an ordered pair that makes BOTH equations true	Example (-2, 2) $y = x + 4$ $2 = -2 + 4$ $2 = 2$ ✓ $y = 2x + 6$ $2 = 2(-2) + 6$ $2 = -4 + 6$ $2 = 2$ ✓

Example 1: Solving Systems of Linear Equations

Solve the system of linear equations by substitution.

I Do
$y = x + 3$ $y = 2x + 5$ $x + 3 = 2x + 5$ $-x \quad -x$ $3 = x + 5$ $-5 \quad -5$ $-2 = x$ $y = -2 + 3$ $y = 1$ $(-2, 1)$


We Do
You Do
y = 4x − 6
y = x + 3
y = 3 + 3
y = 6
4x − 6 = x + 3
−x −x
3x − 6 = 3
+6 +6
3x = 9
3 3
x = 3
(3, 6)
y = 2x + 9
y = 3x − 7
y = 3(16) − 7
y = 48 − 7
y = 41
2x + 9 = 3x − 7
−2x −2x
9 = x − 7
+7 +7
16 = x
(16, 41)
We Do
You Do
x − y = 3
x + 5y = 39
x − y = 3
+y +y
x = y + 3
y + 3 + 5y = 39
−3 −3
y + 5y = 36
6y = 36
y = 6
(9, 6)
x − 6 = 3
+6 +6
x = 9
2x + y = 7
x − 3y = 0
x − 3y = 0
+3y +3y
x = 3y
2(3y) + y = 7
6y + y = 7
7y = 7
y = 1
(3, 1)
2x + 1 = 7
−1 −1
2x = 6
2 2
x = 3

$-3(2\frac{1}{2}y+\frac{1}{2})+4y=2$

$-7\frac{1}{2}y-1\frac{1}{2}+4y=2$

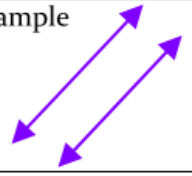
$-3\frac{1}{2}y-1\frac{1}{2}=2$

$+1\frac{1}{2}\quad+1\frac{1}{2}$

$-3\frac{1}{2}y=3\frac{1}{2}$

$y=-1$

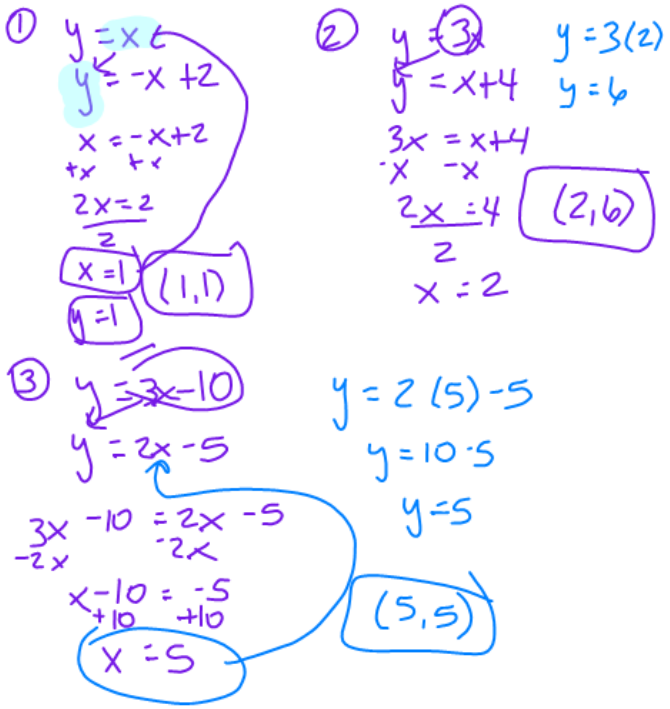
You Do	You Do
$2x-5y=1$ $-3x+4y=2$ $2x-5y=1+5y$ $+5y\quad+5y$ $\frac{2x}{2}=\frac{5y+1}{2}$ $x=2\frac{1}{2}y+\frac{1}{2}$ $2x-5(-1)=1$ $2x+5=1$ $-5\quad-5$ $2x=-4$ $x=-2$ $(-2,-1)$	$2x+y=1$ $x-2y=8$ $8x+y=1-2x$ $-2x$ $y=1-2x$ $x-2(1-2x)=8$ $x-2+4x=8$ $5x-2=8$ $+2\quad+2$ $5x=10$ $x=2$ $2(2)+y=1$ $4+y=1$ $-4\quad-4$ $y=-3$ $(2,-3)$

no solution	Decode
Definition NO ordered pair satisfies both equations	Example 

infinitely many solutions	Decode
Definition ALL ordered pairs on the line satisfy both equations	Example 

We Do	We Do
$3x + y = 8$ $6x + 2y = 16$ $3x + y = 8$ $-3x \quad -3x$ $y = -3x + 8$ $6x + 2(-3x + 8) = 16$ $6x - 6x + 16 = 16$ $16 = 16$ infinitely many solutions	$y = 2x + 9$ $y = -8 + 2x$ $2x + 9 = -8 + 2x$ $-2x \quad -2x$ $9 \neq -8$ No solution

You Do	You Do
$-2x + 10y = -8$ $x - 5y = 4$ $x - 5y = 4$ $+5y \quad +5y$ $x = 5y + 4$ $-2(5y + 4) + 10y = -8$ $-10y - 8 + 10y = -8$ $-8 = -8$ infinitely many solutions	$y = 3x + 5$ $-3x + y = -10$ $-3x + 3x + 5 = -10$ $5 \neq -10$ No solution


①
y = x
y = -x + 2
x = -x + 2
+x +x
2x = 2
2
x = 1
y = 1
(1,1)

②
y = 3x
y = x + 4
3x = x + 4
-x -x
2x = 4
2
x = 2
y = 3(2)
y = 6
(2,6)

③
y = 3x - 10
y = 2x - 5
3x -10 = 2x - 5
-2x -2x
x - 10 = -5
+10 +10
x = 5

y = 2(5) - 5
y = 10 - 5
y = 5
(5,5)