Name _____ Period_____ Date_____

Solving Systems of Linear Equations by Substitution (page 1)

When solving by graphing, you estimate the solution and then check that it works. **Substitution** is an algebraic way that we can use to find the exact solution for a system of linear equations. When both equations are written in slope-intercept form, you can set the equations equal to each other since both are equal to *y*. To use substitution (both equations in slope-intercept form:

1) If necessary, rewrite both equations in slope-intercept form.
2) Substitute *y* in one equation with the expression from the other equation. In other words, set the two *x* equations equal to each other.
3) Solve for *x*.
4) Replace *x* in one of the equations with the value found in Step 3 and solve for *y*.
5) Substitute the values for both variables into both equations to show they are correct.

Example: **Solve the system algebraically using the substitution method.** $\begin{cases} y = x - 3 \\ y = 2x \end{cases}$

Solution: Step 1) Both equations are written in slope-intercept form.
Step 2) Substitute 2x for y in the first equation.
Step 3) Solve for x.
Step 4) Since $x = -3$, then

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

Solution is $(-3, -6)$

$$y = x - 3$$
$$2x = x - 3$$
$$-x = -x$$
$$x = -3$$

Step 5) Check:

$y = x - 3$ | $y = 2x$
$(-6) = (-3) - 3$ | $(-6) = 2(-3)$
$-6 = -6$ ✓ | $-6 = -6$ ✓

Example: **Solve the system algebraically using the substitution method.** $\begin{cases} y = 2x + 3 \\ y = 6x - 5 \end{cases}$

Solution: 1) Both equations are in slope-intercept form.
2) Substitute $6x - 5$ for *y* in the first equation.
3) Solve for *x*.

$$y = 2x + 3$$
$$6x - 5 = 2x + 3$$
$$-2x = -2x$$
$$4x - 5 = 3$$
$$+5 = +5$$
$$4x = 8$$
$$\frac{4x}{4} = \frac{8}{4}$$
$$x = 2$$

4) Since $x = 2$, then

$$y = 2x + 3$$
$$y = 2(2) + 3$$
$$y = 7$$

Solution: $(2, 7)$

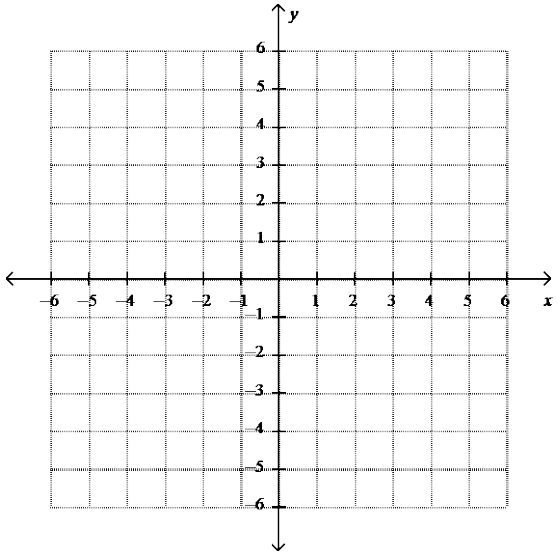
5) Check:

$y = 2x + 3$ | $y = 6x - 5$
$7 = 2(2) + 3$ | $7 = 6(2) - 5$
$7 = 7$ ✓ | $7 = 7$ ✓

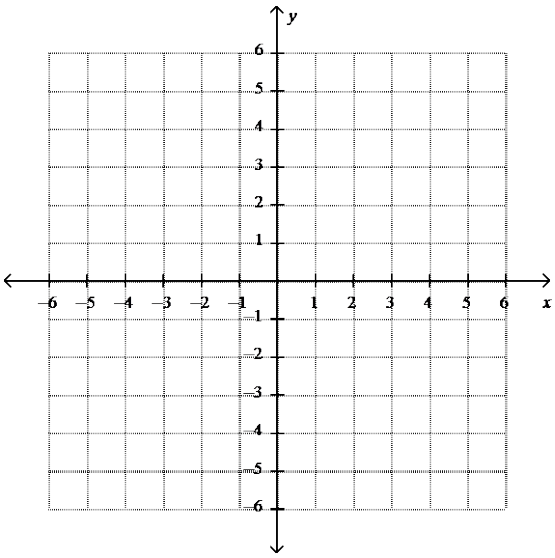
Solving Systems of Linear Equations by Substitution (page 2)

Solve the systems by graphing. Check by solving using substitution (see below).

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



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



Solve the same systems (as above) by substitution.

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

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

Solve the systems by substitution.

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

4. $\begin{cases} y = 7x + 4 \\ y = 9x - 6 \end{cases}$