Essential Question: How can we solve a system of linear equations algebraically?

Do Now: Find the solution to the following system of linear equations.

Solve the following system of equations.

> Whether you use a table of values, intercept or slope-intercept method to graph the system of equations, be sure to show all work.

$y = 3x$ $2y + x = 14$

$m = \dfrac{3}{1}$ $2y = -x + 14$

$b = 0$ $y = -\dfrac{1}{2}x + 7$

$m = -\dfrac{1}{2}$

$b = 7$

Solution __(2, 6)__

Check: (2, 6)

$y = 3x$ $2y + x = 14$
$6 = 3(2)$ $2(6) + 2 = 14$
$6 = 6$ ✓ $12 + 2 = 14$
          $14 = 14$ ✓

Is there another way to solve this system?

$y = 3x$ $2y + x = 14$

↗ is the same as

          $2(3x) + x = 14$
          $6x + x = 14$
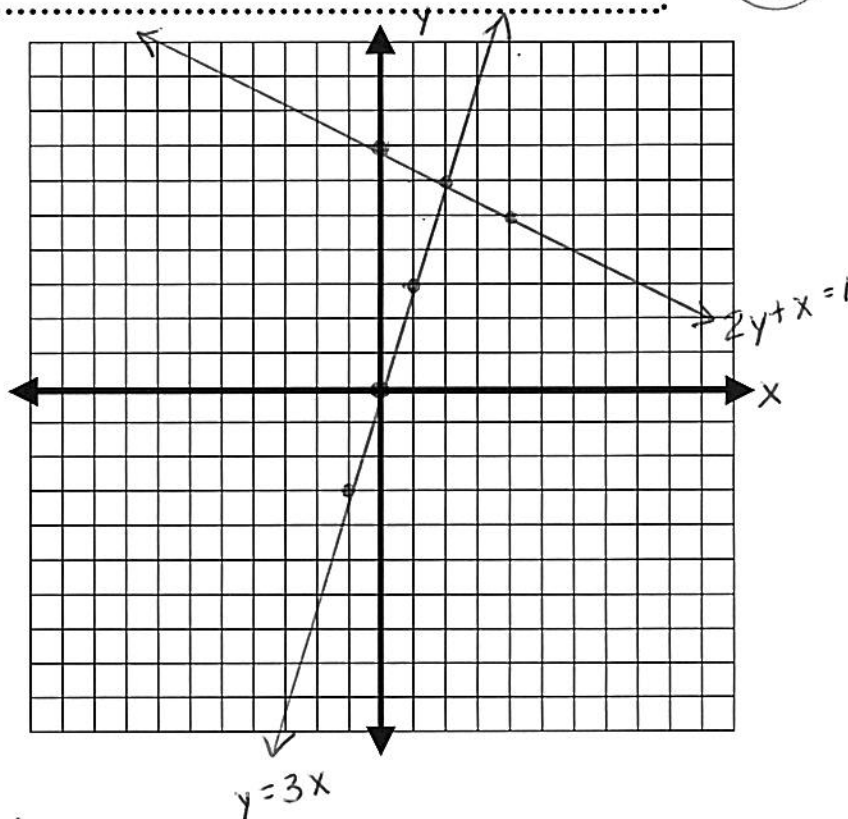 $7x = 14$
          $x = 2$

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

common solution
(2, 6)

Using the Substitution Method to solve Linear Systems

1) $x = y + 1$
$x + 2y = 10$

$(y+1) + 2y = 10$

$3y + 1 = 10$

$3y = 9$

$y = 3$

$x = y + 1$

$x = 3 + 1$

$x = 4$

$(4, 3)$
common solution

2) $x - 4y = -1$ $x = 4y - 1$
$2x + 2y = 3$

$2(4y - 1) + 2y = 3$

$8y - 2 + 2y = 3$

$10y - 2 = 3$

$10y = 5$

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

$x - 4y = -1$

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

$x - 2 = -1$

$x = 1$

$(1, \frac{1}{2})$ common solution

3) Members of the Cinema Arts Theater pay an annual membership fee of $15 and view movies for $2 each. Nonmembers pay $3 for each movie viewing.

a) Write an equation that represents the cost (C) of viewing m movies for members.

$C = 15 + 2m$

b) Write an equation that represents the cost (C) of viewing **m** movies for nonmembers.

$C = 3m$

c) Solve the system. What does the solution tell us in the context of the situation?

$3m = 15 + 2m$

$m = 15$

It costs the same for members and non-members when they view 15 movies.

d) When is it beneficial to become a member of the theater?

member $<$ non-members
$2m + 15 < 3m$
$15 < m$

It is beneficial to be a member when you view more than 15 movie

Solving Systems using the Substitution Method

1) Solve for ___X___ or ___Y___ in one of the equations.

2) ___Substitute___ the expression that represents x or y into the *other* equation and ___solve___ for the variable.

3) Solve for the *other* variable using either equation.

4) Always ___check___ your solution (x, y) with both equations.

Turn and Talk.

1. Given the following system:
$$2x = 8 - 5y$$
$$x + y = 1$$
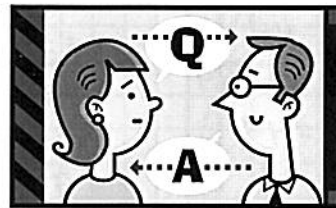
   Which equation would you choose to solve for a variable? What variable would you solve for? Why?

   I would choose $x + y = 1$ because each variable has a co-efficient of 1 (easy to isolate). I would probably solve for x since it would be easier to substitute in the other equation.

2. Given the system:
$$x + 2y = 4$$
$$y = 2x + 7$$

   Explain why it is OK to substitute $2x + 7$ for y in $x + 2y = 4$?

   The equation $y = 2x + 7$ tells you that "y" has the same value as $2x + 7$. wherever you see "y", you can replace it with "2x+7".

3. Examine the linear system graphed to the right. Why would you want to solve this system algebraically?

   The solution is not an integer and would be difficult to determine without tracing it on a calculator.