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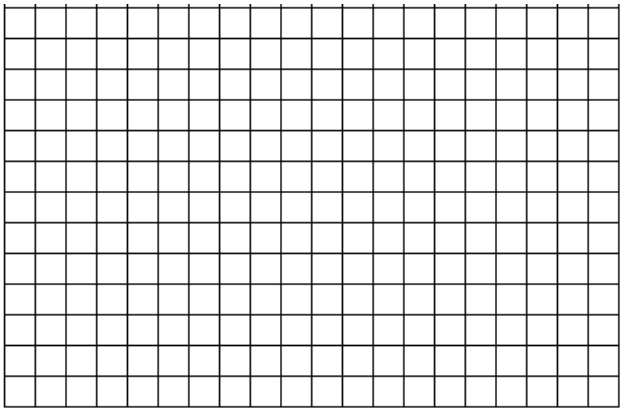
Algebra 1-2: 5-1a Stories from Graphs

I will interpret the meaning of the point of intersection of two graphs

1. Watch the video: http://youtu.be/X956EvmCevI showing a man and a girl walking on the same stairway.

   a. Graph the man's elevation on the stairway versus time in seconds.
   b. Add the girl's elevation to the same graph.
   c. How did you account for the fact that the two people did not start at the same time?

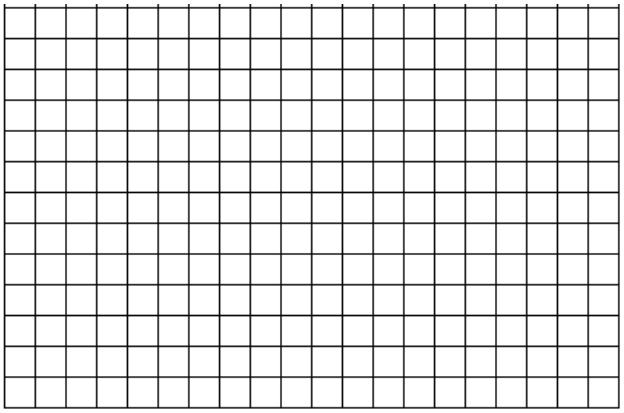


   d. Suppose the two graphs intersect at the point ***P*** (24, 4). What is the meaning of this point in this situation?

   e. Is it possible for two people, walking in stairwells, to produce the same graphs you have been using and NOT pass each other at time ***24*** seconds? Explain your reasoning.

2. Consider the story: *Duke starts at the base of a ramp and walks up it at a constant rate. His elevation increases by three feet every second. Just as Duke starts walking up the ramp, Shirley starts at the top of the same 25 foot high ramp and begins walking down the ramp at a constant rate. Her elevation decreases two feet every second.*

   a. Sketch two graphs on the same set of elevation-versus-time axes to represent Duke's and Shirley's motions
   b. What are the coordinates of the point of intersection of the two graphs?



   c. Interpret the meaning of this point of intersection.

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Algebra 1-2: 5-1b Solving Systems of Equations

I will solve a system of equations by graphing

Debbie's dog walking business charges $5.00 to walk the first dog and then $3.00 for every extra dog.

Suzie's dog walking business charges $7.00 to walk the first dog and then $2.00 for every extra dog.

What business is the better deal?

1) Make a table to represent each business.

Debbie's business					
Number of dogs (x)					
Cost to walk (y)					

Suzie's business					
Number of dogs (x)					
Cost to walk (y)					

2) At what point are the prices the same? _____dogs _____dollars

3) When is Debbie's business better?

4) When is Suzie's business better?

5) Write an equation to model each business where y = total cost and x = number of dogs walked.

Debbie's Equation Suzie's Equation

6) As you saw in yesterday's lesson, graphing is one method to identify points of intersection. Graph the equations for both Debbie and Suzie's businesses on the same grid at right.

a) At what point on the graph do the two lines intersect?

b) What is the solution to the system of equations represented by the dog walking?

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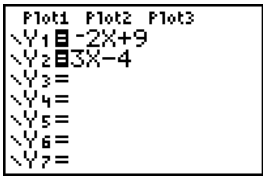
7) Compare the methods of finding the solution using a table vs. a graph. When would each method be preferable?

Using a graphing calculator to solve a system of equations

a. Equations must be in slope-intercept form to be entered in the calculator. If necessary, rewrite the equations in slope-intercept form first.

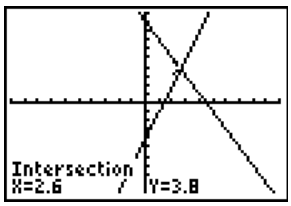
$4x+2y=18$ $9x-3y=12$

b. Enter the first equation into Y_1 and the second equation into Y_2 as shown at right.



c. Hit **GRAPH**. If the graph does not fit in the window, use **ZOOM** features.

d. Use the **INTERSECT** option to find where the two graphs intersect (the solution).
   - **2nd TRACE** (**CALC**) **# 5 Intersect**
   - Hit **ENTER** 3 times



Try it out!

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Algebra 1-2: 5-2a Solving Systems of Equations Using Substitution

I can solve a system of equations using substitution

1) On a rural highway a police officer sees a motorist run a red light at 50 miles per hour, and begins pursuit. At the instant the police officer passes through the intersection at 60 mph, the motorist is 0.2 miles down the road. When and where will the officer catch the motorist?

a. Model the motorist's cars distance, d , from the intersection in t hours from the instant the officer left the intersection.

b. Model the policeman's cars distance, d , from the intersection in t hours from the instant the officer left the intersection.

c. When the officer catches the motorist, both will be the same distance from the intersection. At this time, both equations will have the same d value. This means that we can replace d in one equation with an equivalent expression from the second equation, leaving us with a single equation to solve.

The Substitution Method
Provides exact solutions to systems of equations by substituting one equation into the other.

d. Part b gave one-half of the solution. To find the other half, substitute the value of t back into both equations. If you get the same answer, your solution is correct.

e. What does your solution mean in the context of the problem?

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Solving Systems of Equations by Substitution	
Step 1	Solve for one variable in one equation.
Step 2	Substitute the resulting expression into the other equation.
Step 3	Solve that equation to get the value of the other variable.
Step 4	Substitute that value into one of the original equations and solve.
Step 5	Write the values from Steps 3 and 4 in an ordered pair (x, y).
Step 6	Check the solution by substituting into both equations or by graphing.

2) $x = 17 - 4y$
$y + x = 2$

3) $4x - 7y = 10$
$y = x - 7$

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

Try it out!

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Algebra 1-2: 5-2b Modeling Systems – Substitution Practice

I can solve a real-life problem using a system of equations and substitution

Equation Bank

$\begin{cases} 5x+2y=48 \\ 3x+2y=32 \end{cases}$ $\begin{cases} 2x+4y=28 \\ 3x+5y=38 \end{cases}$ $\begin{cases} x+y=20 \\ 3x+11y=100 \end{cases}$ $\begin{cases} 3x+15y=30 \\ 2x+4y=11 \end{cases}$ $\begin{cases} x+y=12 \\ 6x+8y=86 \end{cases}$ $\begin{cases} x+y=100 \\ 4x+2y=360 \end{cases}$

Scenario	System of Equations
1) You bought supplies for a party. Three rolls of streamers and 15 party hats cost $30. Later, you bought 2 rolls of streamers and 4 party hats for $11. How much did each roll of streamers cost? How much did each party hat cost?	
2) You went to Taco Bell and got 2 enchiladas and 4 tacos and it cost $28.00. Your friends went the other day and got 3 enchiladas and 5 tacos and it cost them $38.00. How much did each item cost?	
3) Art students sold paintings at lunch. During 4th hour, 5 large paintings were sold and 2 small paintings totaling $48. During 5th hour, 3 large paintings were sold and 2 small paintings totaling $32. How much was each size painting sold for?	
4) 100 tickets were sold for a play. Adult tickets cost $4 and student tickets cost $2. The school made $360 on tickets. How many of each type of ticket were sold?	
5) A test has twenty questions worth 100 points. The test consists of True/False questions worth 3 points each and multiple choice questions worth 11 points each. How many multiple choice questions are on the test?	
6) Antonio saw 12 movies last month and spent $86. He goes to matinees that cost $6 and night shows that cost $8. How many of each type of movie did he attend?	

Pick any two of the systems from above to solve. Interpret your answer in the context of the problem.

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***Challenge*: The Mystery Dollar**

Angela was selling tickets to a dance. At the end of the night, she picked up the cash box and noticed a dollar lying on the floor next to it. She turned to her friend and said, "I wonder whether the dollar belongs inside the cash box or not." The price of tickets for the dance was 1 ticket for $6 (single ticket) or 2 tickets (couples tickets) for $8. She looked inside the cash box and found $214 and ticket stubs for the 47 students in attendance. Does the dollar belong inside the cash box or not?

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Algebra 1-2: 5-3a Solving Systems of Equations Using Elimination

I can solve a system of equations using elimination

The Elimination Method
Provides exact solutions to systems of equations by adding or subtracting equations to eliminate one of the variables.

Systems of equations can be solved by graphing, substitution, or by a third method, called **elimination.**

1) Look at the system of linear equations.

$$2x - 4y = -10$$
$$3x + 4y = 5$$

a) What do you notice about the coefficients of the y-terms?

b) What is the sum of -4y and 4y? How do you know?

c) Find the sum of the two equations by combining like terms.

d) Use the eqution from step c to find the value of x.

$$\begin{array}{rrcr} 2x & -4y & = & -10 \\ +3x & +4y & = & +5 \\ \hline \square & + \square & = & \square \end{array}$$

e) Use the value of x to find the value of y. What is the solution of the system?

Steps in the Elimination Method	
1.	Add or subtract the equations to eliminate one variable, and then solve for the other variable.
2.	Substitute the value into either original equation to find the value of the eliminated variable.
3.	Write the solution as an ordered pair.

Solve the linear system using elimination.

2) $x + 2y = 13$
$-x + y = 5$

3) $9x + y = 2$
$-4x - y = -17$

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4) $\begin{cases} -3x - y = 8 \\ 7x + y = -12 \end{cases}$

5) What's different about this one?

$$\begin{cases} x + y = 10 \\ x - 2y = 4 \end{cases}$$

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

7) $2x - y = 7$
$2x + 7y = 31$

8) J. P. is thinking of two numbers. He says the sum of the two numbers is 163 and their difference is 33. Find the two numbers.

Try it out!

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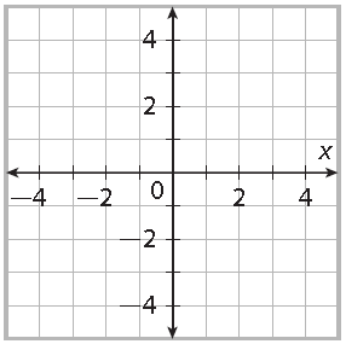
Algebra 1-2: 5-3b Solving Systems Using Multiplication and Elimination

You will solve a system of equations using multiplication and elimination

1. INVESTIGATION

A. Graph and label the following system of equations.

$$2x - y = 1$$
$$x + y = 2$$



B. The solution to the system is (_____,_____).

C. When both sides of an equation are multiplied by the same value, the equation [is / is not] still true.

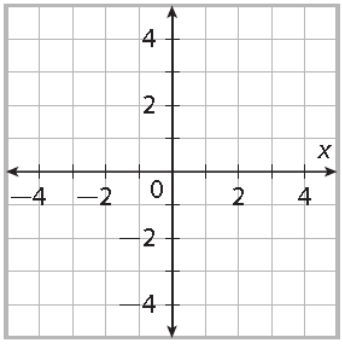
D. Multiply both sides of the second equation by 2.

E. Write the resulting system of equations:

$$\begin{cases} \square \\ 2x - y = 1 \end{cases}$$

F. Graph and label the new system of equations.

Solution: (_____,_____).



Discussion Questions:

1. How are the graphs of x + y = 2 and 2x + 2y = 4 related?

2. How are the equations x + y = 2 and 2x + 2y = 4 related?

G. Can the new system of equations from "E" be solved using elimination now that 2x appears in each equation? _____

H. Solve using elimination to verify your answer:

In some systems of linear equations, neither variable can be eliminated by adding or subtracting the equations directly. In these systems, you need to multiply one or both equations by a constant so that adding or subtracting the equations will eliminate one or more of the variables.

Steps for Solving a System of Equations by Multiplying First

1. Decide which variable to eliminate.
2. Multiply one or both equations by a constant so that adding or subtracting the equations will eliminate the variable.
3. Solve the system using the elimination method.

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2) Consider these equations:	$5x-8y=21$ $15x-4y=23$	$5x-4y=23$ $7x+8y=5$	$-3x+2y=4$ $12x-4y=-68$
Is there a number you can multiply one equation by to eliminate the x term?			
Is there a number you can multiply one equation by to eliminate the y term?			

3) Does it matter which variable we eliminate?

$$5x-8y=21$$
$$15x-4y=23$$

$$5x-8y=21$$
$$15x-4y=23$$

4) What's different about this one?

$$2x-3y=-5$$
$$5x+2y=16$$

5)

$$5x-2y=11$$
$$3x+5y=19$$

Try it out!

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Algebra 1-2-: 5-4 Choosing a Method to Solve Systems of Equations

I will determine which method to use to solve a system of equations

1) The School Fair

Joe is mixing jelly beans and skittles to sell at a school fair. He buys jelly beans in 4-pound bags and skittles in 1-pound bags. Let x = number of bags of jelly beans he buys and y = number of bags of skittles he buys.

a) The following equations are true. Explain in words the meaning of each equation.

$3x = y$ $4x + y = 70$

b) Review the student work samples and answer the following questions about each:

	Joe	Ethan	Nina
Method used			
Strengths			
Weaknesses			
When to use the method			

2) Which method would you choose to solve each system of equations? Justify your choice.

$y = 2x + 6$ $2x - 4y = 12$ $x + 3y = 4$

$y = x + 5$ $5x + 4y = 2$ $x = -y$

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PICK 3:

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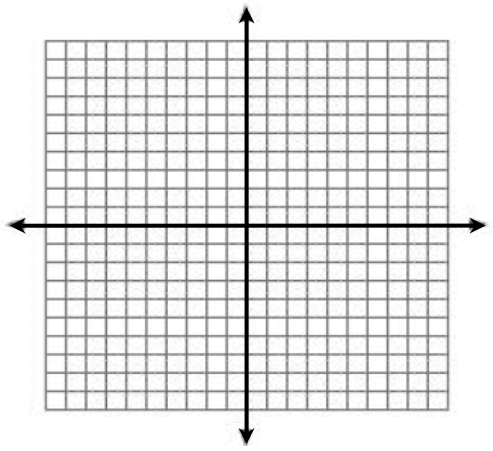
Algebra 1-2: 5-5a Graphing Linear Inequalities

I will represent inequalities graphically.



1) Investigation: Graphing Inequalities

a) Graph the line $y = x + 4$ on the grid at right.

b) Pick a point that lies above the graph of $y = x + 4$. (_____, _____)

Substitute the coordinates of this point in the inequality $y > x + 4$.

Is the result above a true statement? If so, mark the point on your graph.

c) Repeat the steps in part b for two additional points above the graph of $y = x + 4$

Point	Substitution	True?

d) To graph $y > x + 4$ would you choose points above or below $y = x + 4$? _____

e) Pick a point that lies below the graph of $y = x + 4$. (_____, _____) Substitute the coordinates of this point in the inequality $y < x + 4$.

Is the result above a true statement? If so, mark the point on your graph.

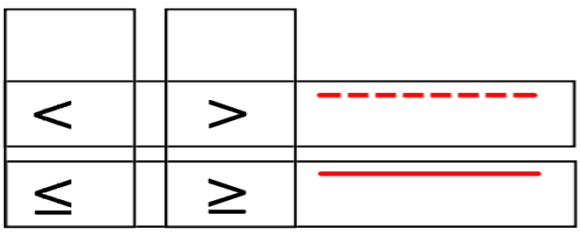
f) Repeat the steps in part b for two additional points below the graph of $y = x + 4$

Point	Substitution	True?

g) To graph $y < x + 4$ would you choose points above or below $y = x + 4$? _____

Linear Inequality: _____ on plane

Solutions: Make the inequality _____ (Shaded area)



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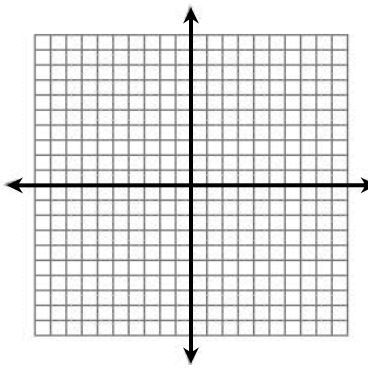
Graphing Linear Inequalities

1. Rewrite the equation in slope intercept form – remember to flip the direction of the inequality when multiplying or dividing by a negative number.
2. Use the y-intercept and slope to mark two points on the line.
3. Make boundary line:
   - Dashed: < or > • Solid: ≤ or ≥
4. Shade one side:
   - Below: < or ≤ • Above: > or ≥

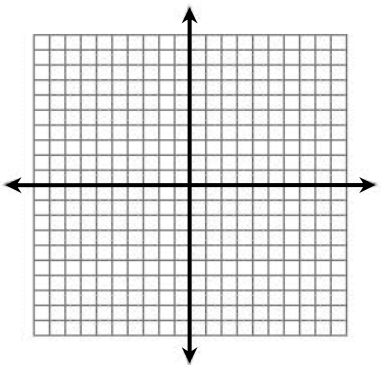
1) $y > 2x + 1$



Solution Test:
(_____, _____)

Non-Solution Test:
(_____, _____)

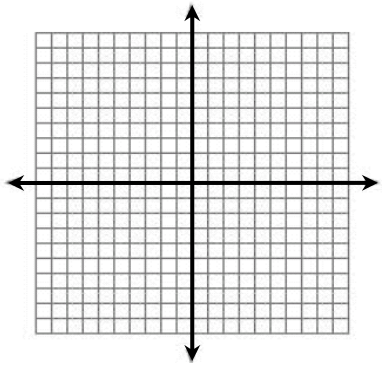
2) $y \leq -\frac{2}{3}x - 2$



Solution Test:
(_____, _____)

Non-Solution Test:
(_____, _____)

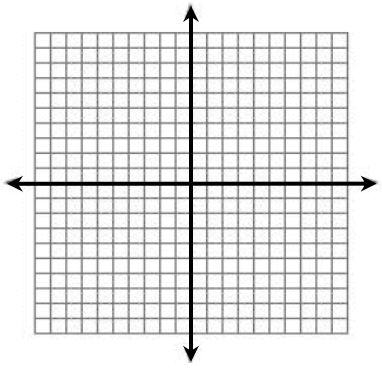
3) $2x - 3y > 6$



Solution Test:
(_____, _____)

Non-Solution Test:
(_____, _____)

Try it out: $3x + 7y \leq -21$



Solution Test:
(_____, _____)

Non-Solution Test:
(_____, _____)

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Algebra 1-2: 5-5b Graphing Systems of Linear Inequalities

I will represent systems of inequalities graphically.

A System of Linear Inequalities

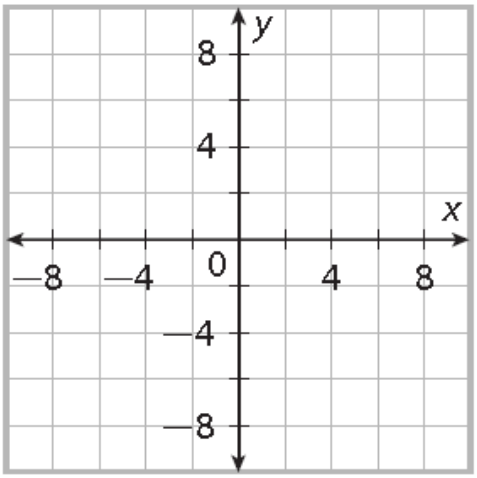
consists of _____ linear inequalities that have the same _____. The solutions of a system of linear inequalities are all the ordered pairs that make all the inequalities in the system _____.

A) Solve the following system by graphing:

$$\begin{cases} x + 3y > 3 \\ -x + y \leq 6 \end{cases}$$

Graphing Linear Inequalities

1. Rewrite the equation in slope intercept form – remember to flip the direction of the inequality when multiplying or dividing by a negative number.
2. Use the y-intercept and slope to mark two points on the line.
3. Make boundary line:
   - Dashed: < or > • Solid: ≤ or ≥
4. Shade one side:
   - Below: < or ≤ • Above: > or ≥



Identify the solutions. They are represented by _____the shaded regions. Check your answer by using a point in each region. Complete the table.

Ordered Pair	Satisfies $x + 3y > 3$?	Satisfies $-x + y \leq 6$?	In the overlapping shaded regions?
(0, 0)			
(2, 3)			
(−8, 2)			
(−4, 6)			

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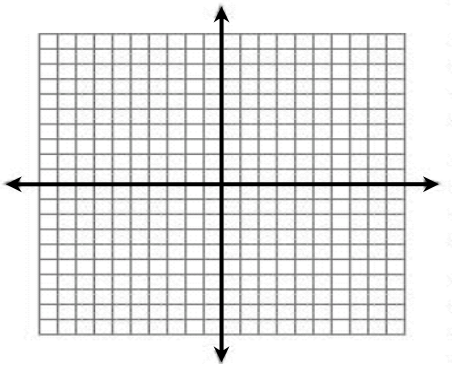
Solve each of the systems by graphing. Give two ordered pairs that are solutions and two that are not solutions.

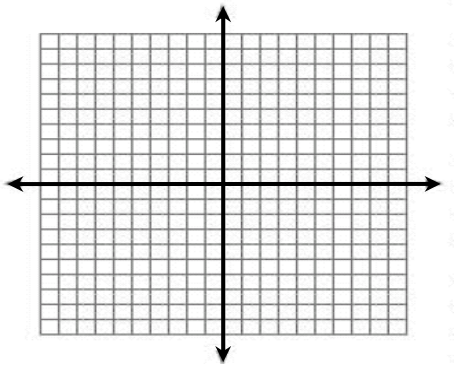
1) $y > 2x - 5$
$y < -\frac{3}{4}x + 3$



Solutions: (_____, _____), (_____, _____)

Non- Solutions: (_____, _____), (_____, _____)

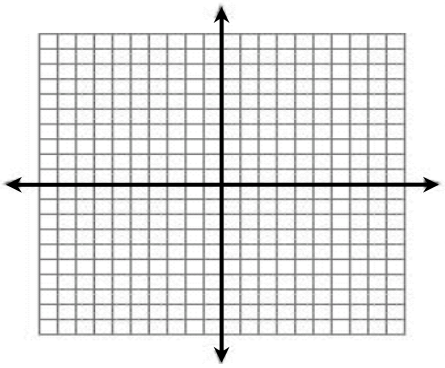
2) $y \geq x - 2$
$y \leq -\frac{1}{3}x + 3$



Solutions: (_____, _____), (_____, _____)

Non- Solutions: (_____, _____), (_____, _____)

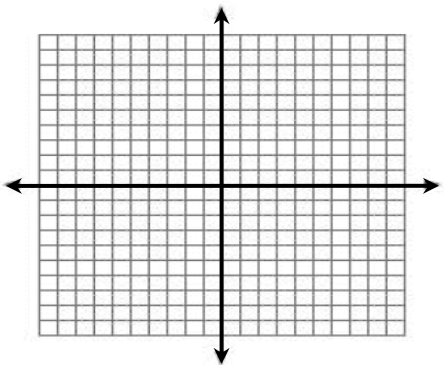
3) $y \geq -x + 2$
$2x + 4y < 4$



Solutions: (_____, _____), (_____, _____)

Non- Solutions: (_____, _____), (_____, _____)

4) $x + y < 3$
$y \geq \frac{1}{2}x$



Solutions: (_____, _____), (_____, _____)

Non- Solutions: (_____, _____), (_____, _____)

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Algebra 1-2: 5-6 Modeling Systems of Linear Equations and Inequalities

I will model real-world scenarios using systems of equations and inequalities

1) Jacob's family bought 4 adult tickets and 2 children's tickets to the school play for $64. Tatianna's family bought 3 adult tickets and 3 children's tickets for $60.

   a. ***Define your variables***

      Choose variables. Use a for _____ and c for _____.

   b. Write two linear equations as a system to represent this information:

   c. Solve the system of equations

   d. Interpret the meaning of your answer:

2) Jamian bought a total of 40 bagels and donuts for a morning meeting. He paid a total of $33.50. Each donut cost $0.65 and each bagel cost $1.15.

   a. Define your variables

   b. Write two linear equations as a system to represent this information

   c. Solve the system of equations

   d. Interpret the meaning of your answer:

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NOW LET'S TRY A SYSTEM OF INEQUALITIES:

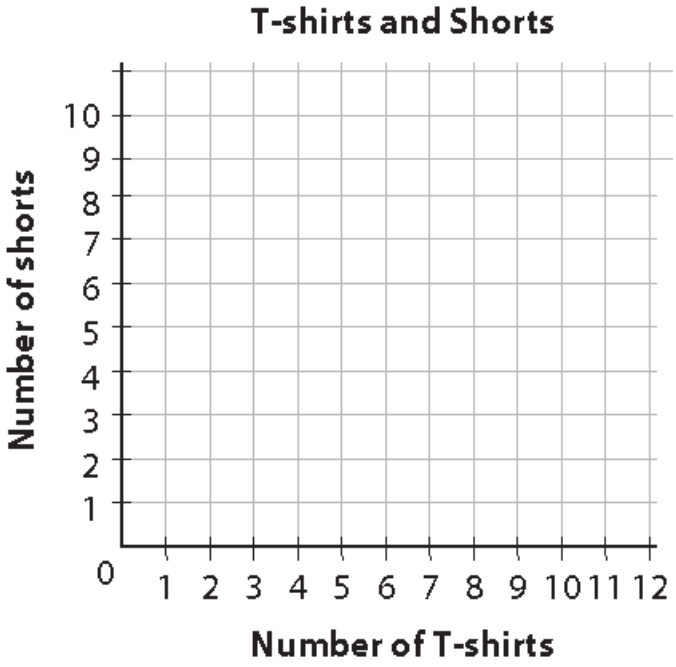
3) Sue is buying T-shirts and shorts. T-shirts cost $14 and shorts cost $21. She plans on spending no more than $147 and buy at least 5 items. Show and describe all combinations of the number of T-shirts and shorts she could buy.

a. Let x represent the number of T-shirts, and let y represent the number of shorts.

- Write an inequality representing the number of items Sue will purchase: _____
- Write an inequality representing Sue's budget: _____

b. Write these inequalities as a system:

c. Graph the inequalities.



d. Give one possible combination of T-shirts and shorts that Sue can purchase. Substitute the value into the inequalities to make sure it is a valid solution.