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Alg2a Solving Systems Graphically (non-linear)

Solving Systems of Equations Graphically

In the last packet we learned how to graph different types of functions. We're going to use what we learned in order to solve systems of equations graphically. When we solve a system of equations we graph the two equations on the same set of axis. The point or points where the two "curves" intersect will be our solution.

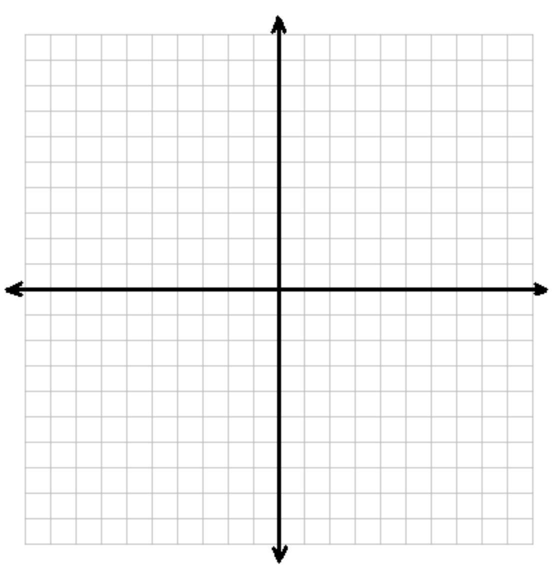
Before we get into solving these systems, we need to do a quick review of a type of function that you have done before but not this year. The function we are talking about is a *linear function* (x will be to the 1st power)

We can graph these linear equations by using the slope and the y-intercept. Or we can make a table like we did with the quadratic, absolute value, and exponential functions that we learned in the last packet.

Both ways are 100% acceptable as long as we show the proper work for each example.

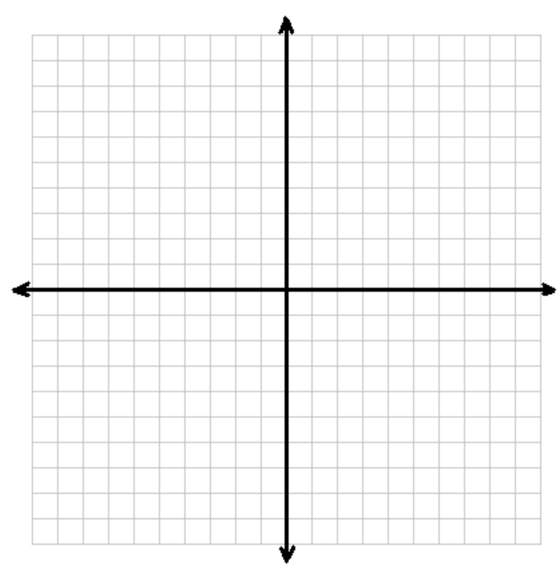
Example: a) graph $y = {}^{2}/_{3}\,x + 4$

Using the Slope and Y-Int



b) graph: $y = {}^{2}/_{3}\,x + 4$

Using the table of values



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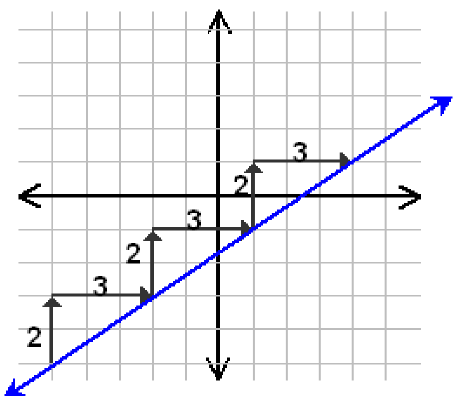
Slope Intercept Form

Before graphing linear equations, we need to be familiar with slope intercept form. To understand slope intercept form, we need to understand two major terms: The ***slope*** and the ***y-intercept***.

Slope (m):

$$m = \frac{\Delta y}{\Delta x}$$

The ***slope*** measures the steepness of a non-vertical line. It is sometimes referred to as the rise over run. It's how fast and in what direction y changes compared to x.



y-intercept:

The ***y-intercept*** is where a line passes through the y axis. It is always stated as an ordered pair (x,y). The x coordinate is always zero. The y coordinate can be found by plugging in 0 for the X in the equation or by finding exactly where the line crosses the y-axis.

What are the coordinates of the y-intercept line pictured in the diagram above? : ________

Some of you have worked with slope intercept form of a linear equation before. You may remember:

$$y = mx + b$$

Using y = mx + b, can you figure out the equation of the line pictured above?: ______________________

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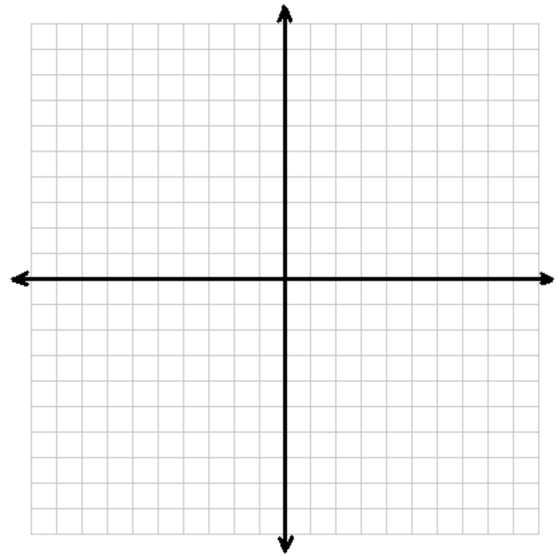
Graphing Linear Equations

Graphing The Linear Equation: **$y = 3x - 5$**

1) Find the slope: $m = 3 \rightarrow m = \frac{3}{1} = \frac{y}{x}$

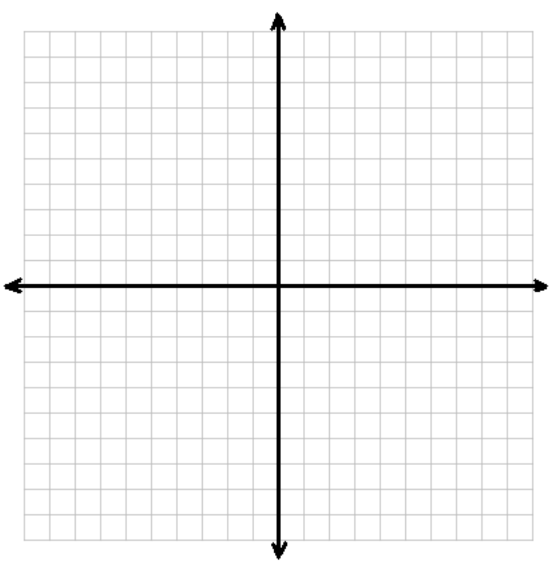


2) Find the y-intercept: $x = 0$, $b = -5 \rightarrow (0, -5)$
3) Plot the y-intercept
4) Use slope to find the next point: Start at (0,-5)

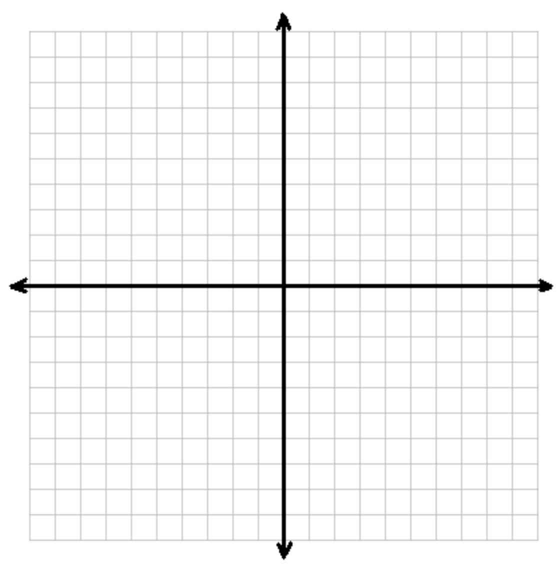
   $m = \frac{3}{1} = \frac{\blacktriangle y}{\blacktriangle x}$ → up 3 on the y-axis; → right 1 on the x-axis

   (1,-2) Repeat: (2,1) (3,4) (4,7)
5) To plot to the left side of the y-axis, go to y-int. and do the opposite. (Down 3 on the y, left 1 on the x) (-1,-8)
6) Connect the dots.

1) $y = 2x + 1$



2) $y = -4x + 5$



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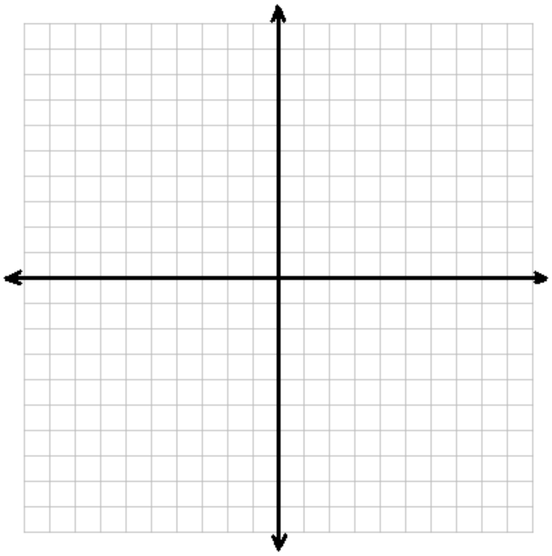
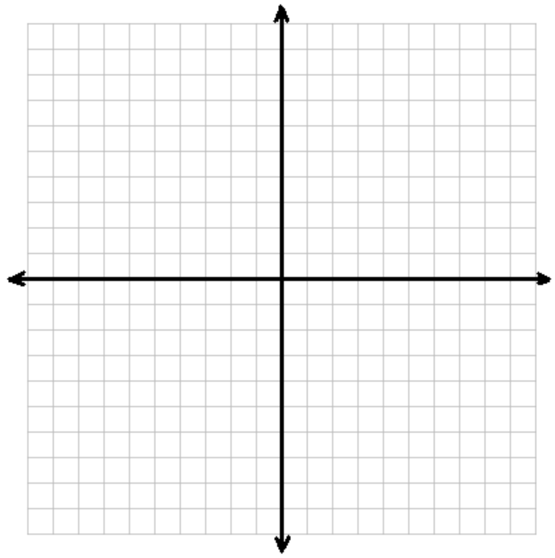
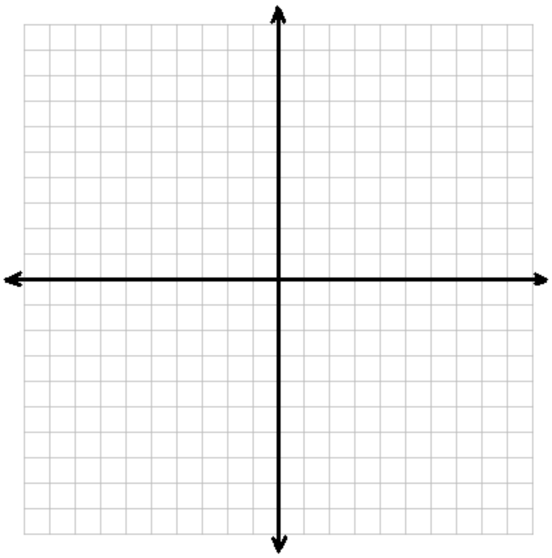
3) y = ½ x – 3



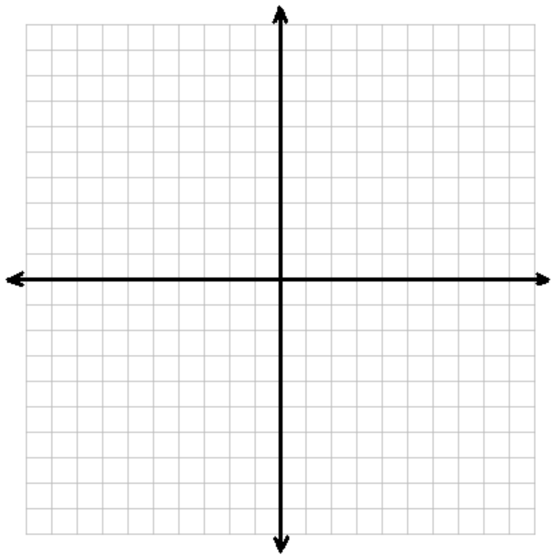
4) y= - ⅔x + 2



5) y = -x – 3



6) y= 5x



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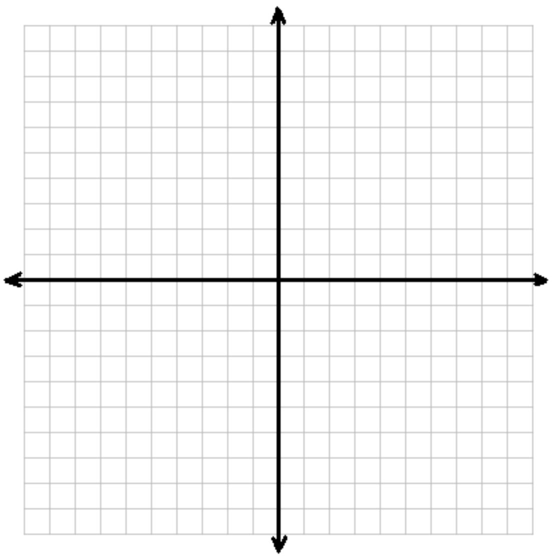
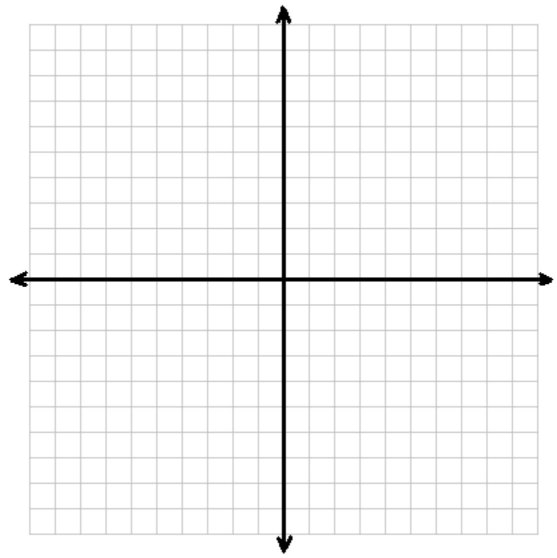
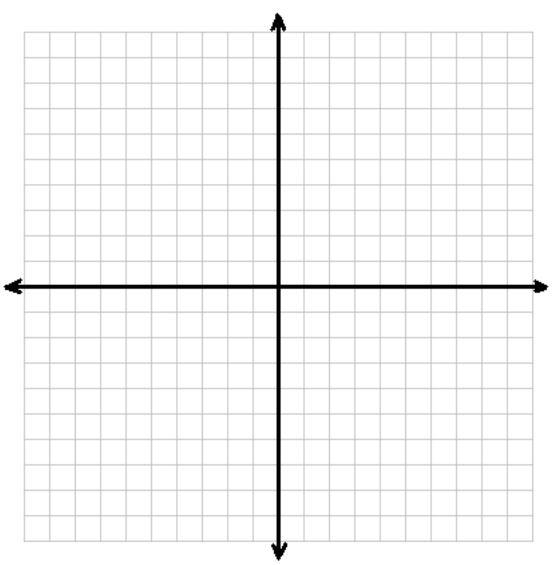
7) y = 5



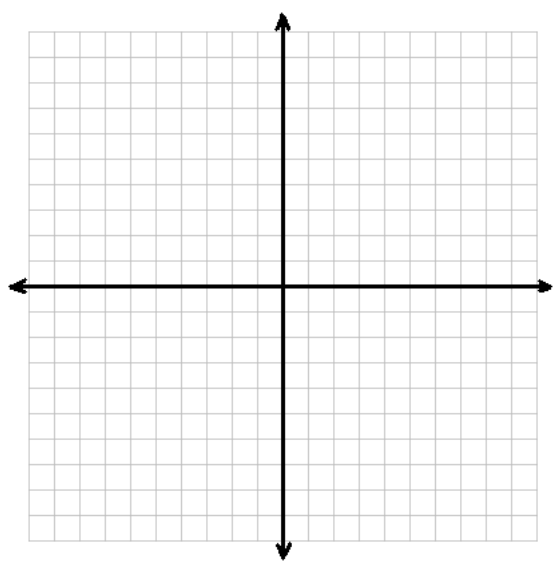
8) x = -4



5) y = -4



6) x = 8



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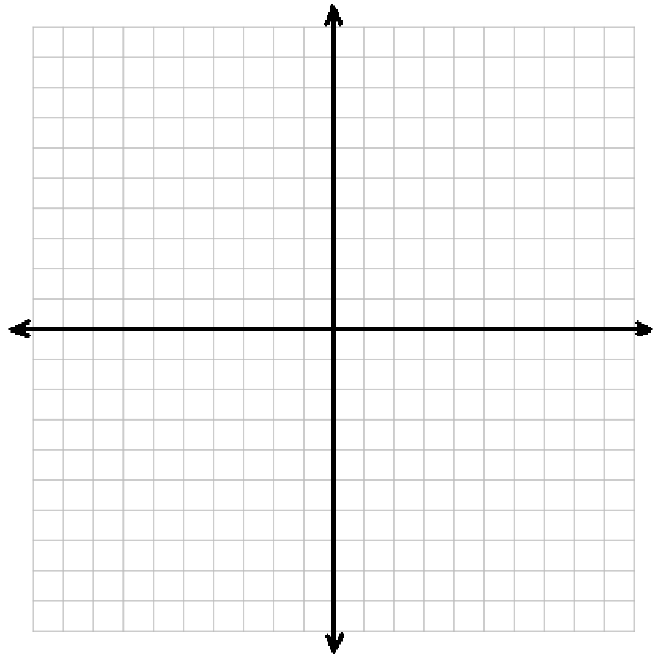
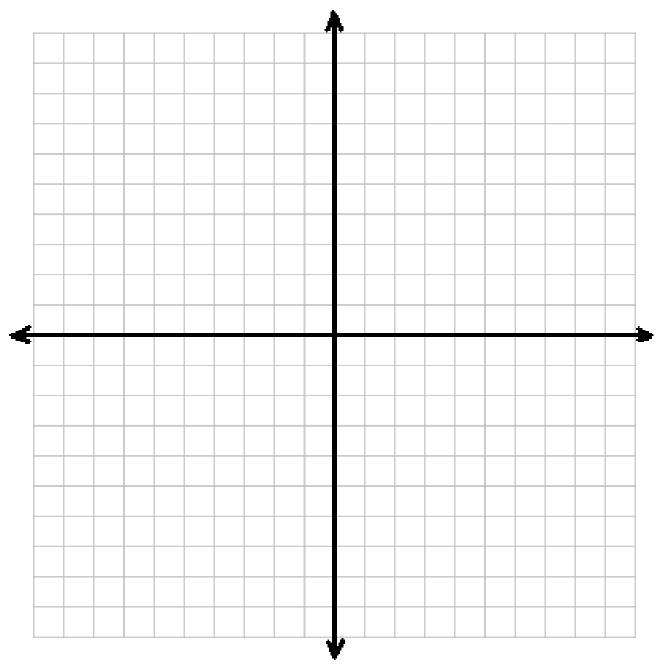
1) y - 2 = -3(x – 1)

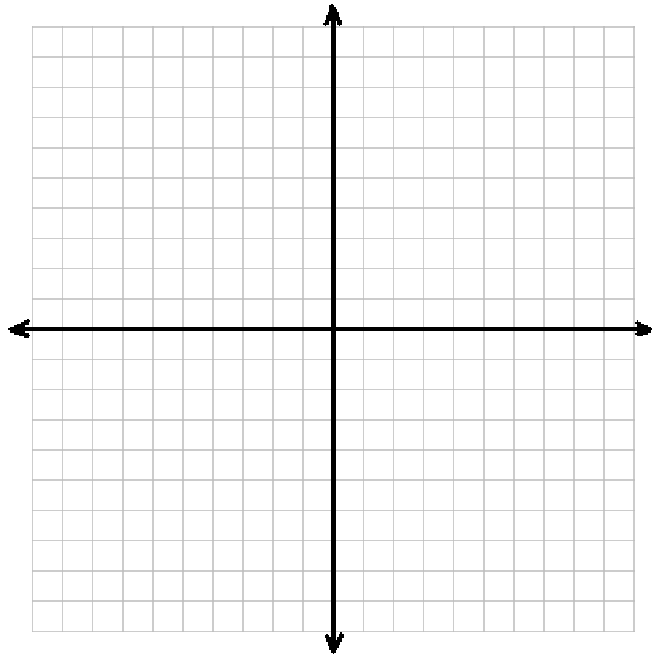


2) 14x + 21y = -84

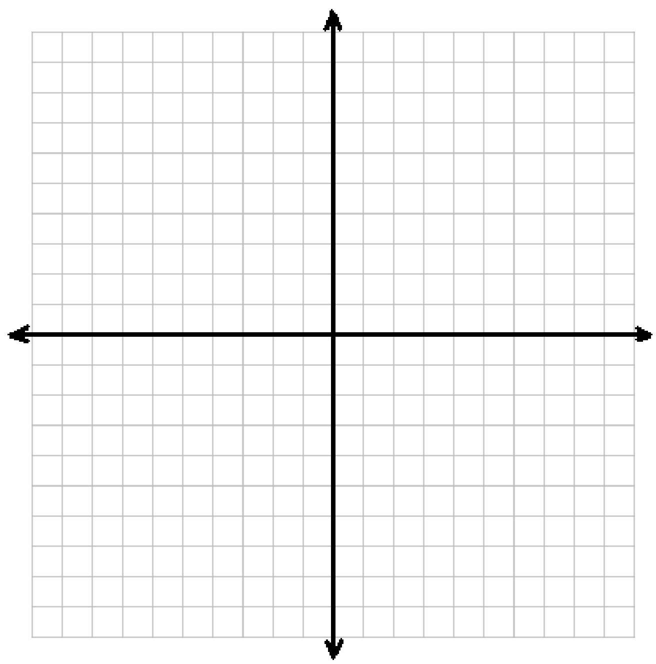


.

3) $y + 10 = 5(x + 2)$



4) $y - 7 = \frac{1}{4}(x - 20)$



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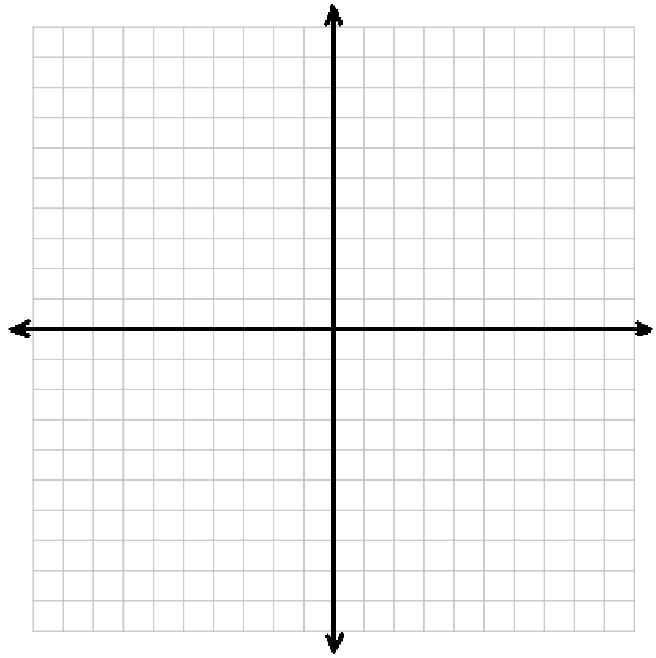
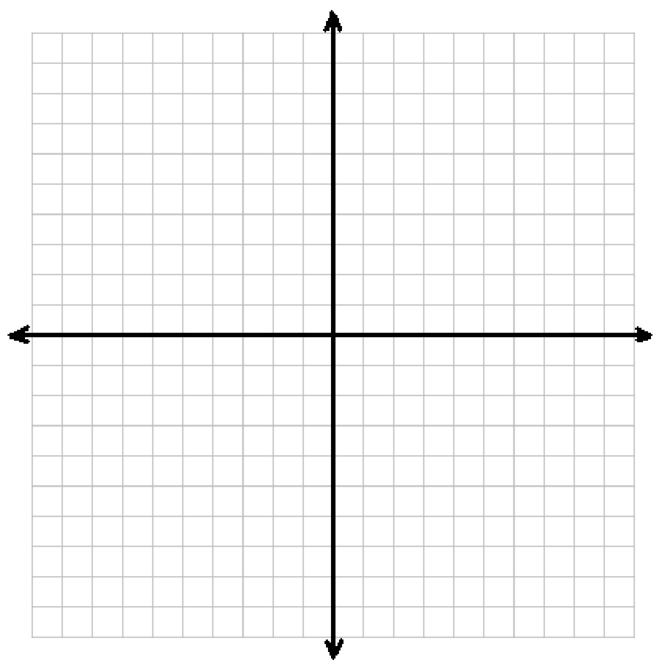
5) $8x - 8y = 56$



6) $y + 6 = -1(x - 3)$



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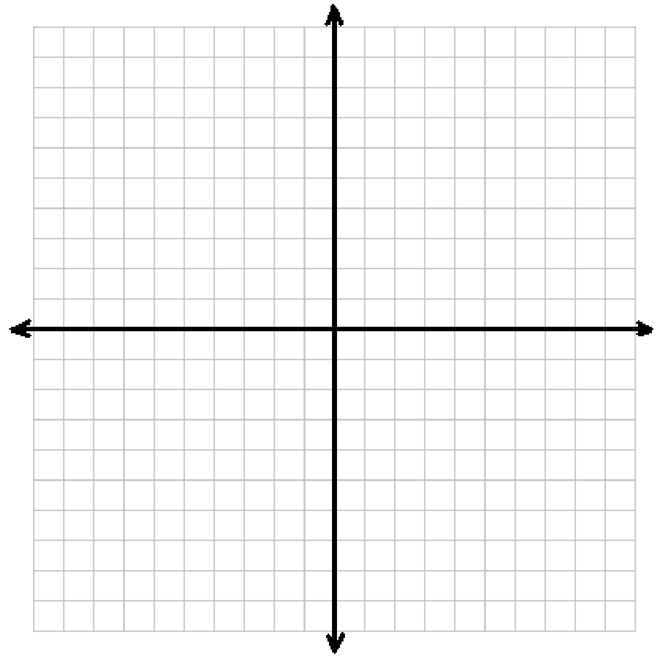
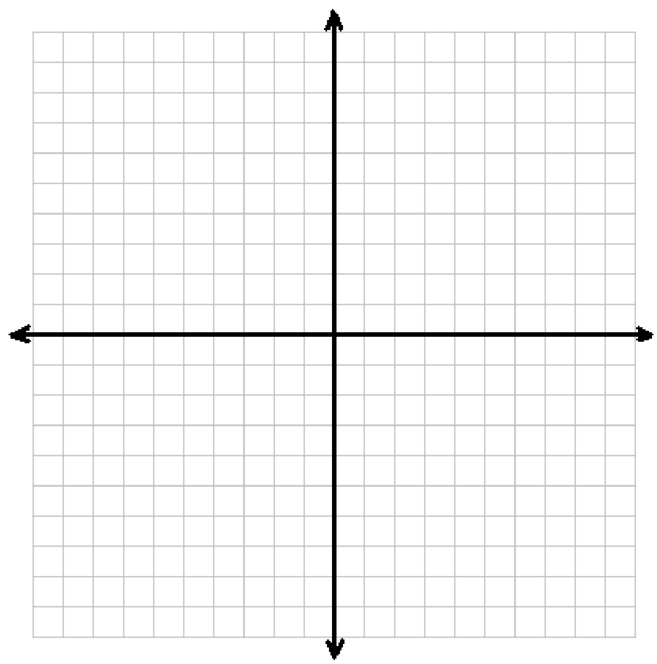
7) 18x – 12y = -12



8) y – 15 = (-5/3)(x + 9)



Answers:* *1) y = -3x + 5 ***2) y = - ⅔ x - 4*** ***3) y = 5x*** ***4) y = ¼ x + 2***

5) y = x - 7 ***6) y = - x – 3*** ***7) y = (3/2)x + 1*** ***8) y = -(5/3)x***

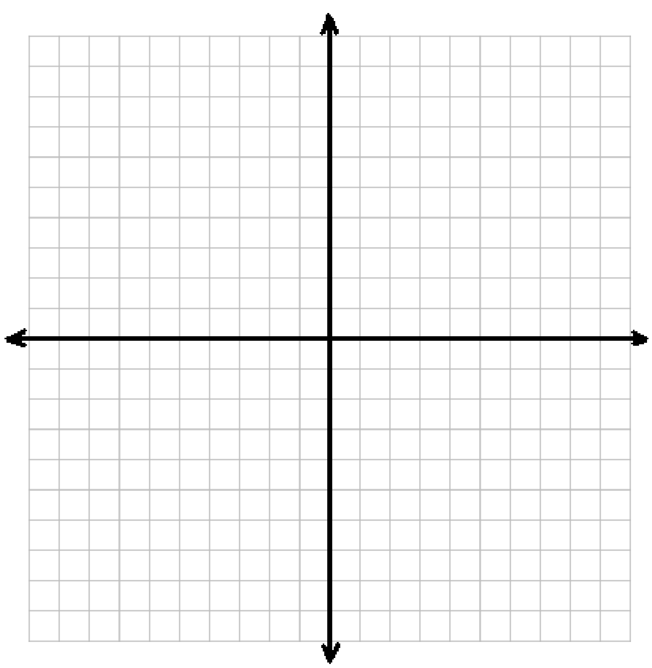
Solving Systems of Equations Graphically

A system of equations is a collection of two or more equations with a same set of unknowns. In solving a system of equations, we try to find values for each of the unknowns that will satisfy every equation in the system. When solving a system containing two linear equations there will be **one ordered pair (x,y)** that will work in both equations.

To solve such a system graphically, we will graph both lines on the same set of axis and look for the **point of intersection.** The point of intersection will be the one ordered pair that works in both equations. We must then **CHECK** the solution by substituting the x and y coordinates in **BOTH ORIGINAL EQUATIONS**.

1) Solve the following system graphically:

$y = 2x - 5$
$y = -\frac{1}{3}x + 2$



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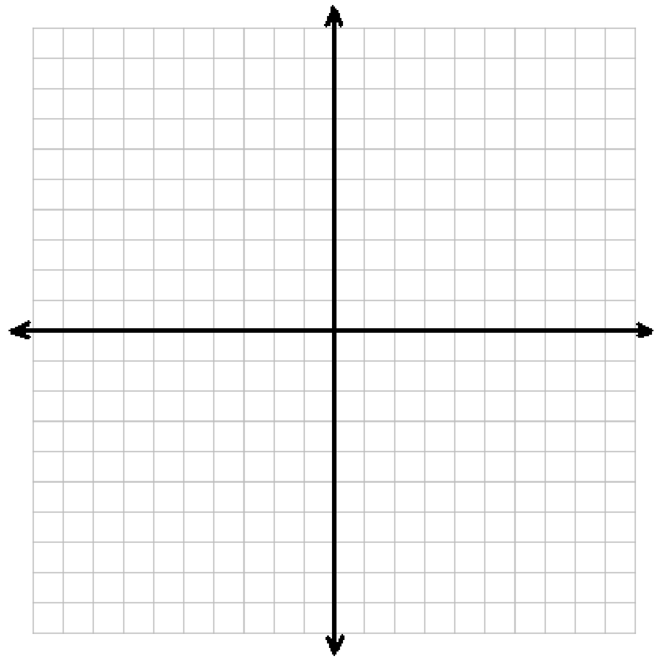
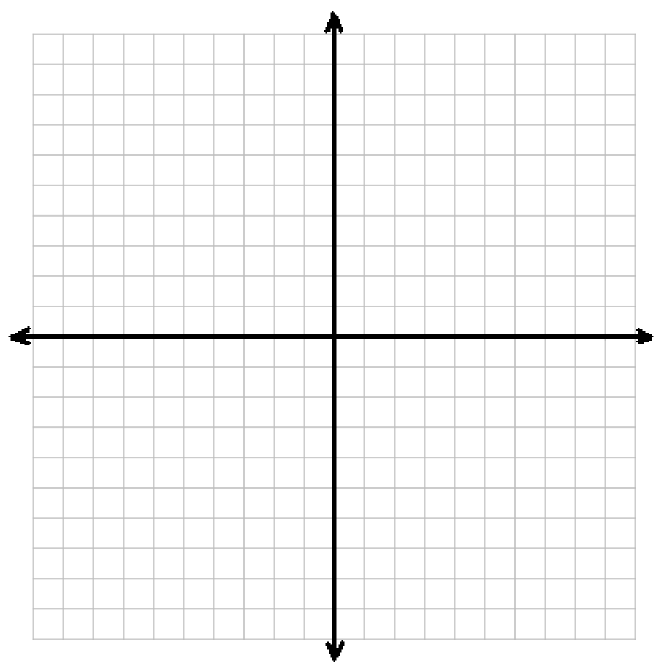
Solving Systems Graphically (non-linear)

Solve each of the systems of equations graphically:

2) y + 1 = -3(x – 1)
7x + 7y = 42



3) y – 9 = ¾ (x – 12)
6x + 12y = -60



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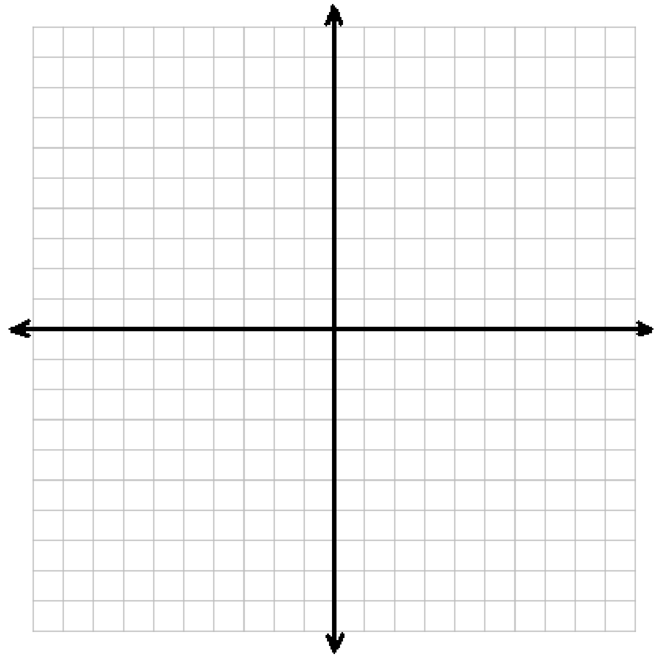
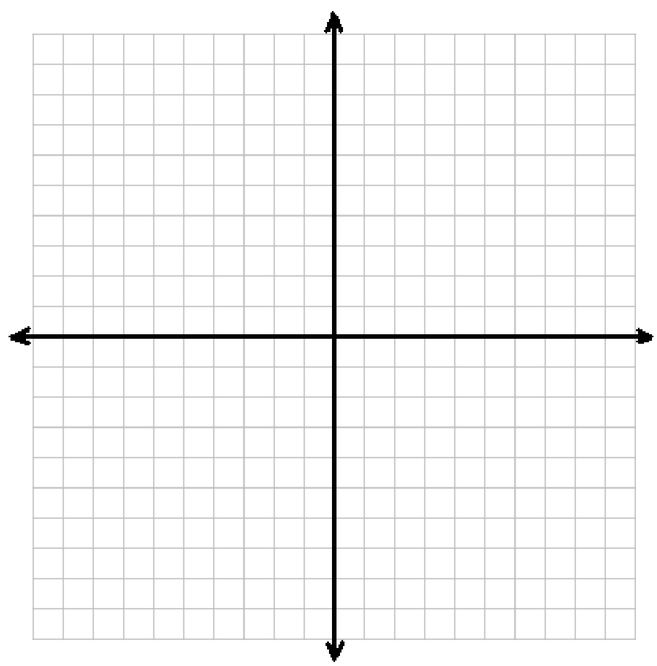
4) $12x - 8y = 48$
$y - 4 = -2(x - 2)$



5) $y + 5 = 2(x + 4)$
$y - 10 = -\frac{1}{2}(x + 4)$



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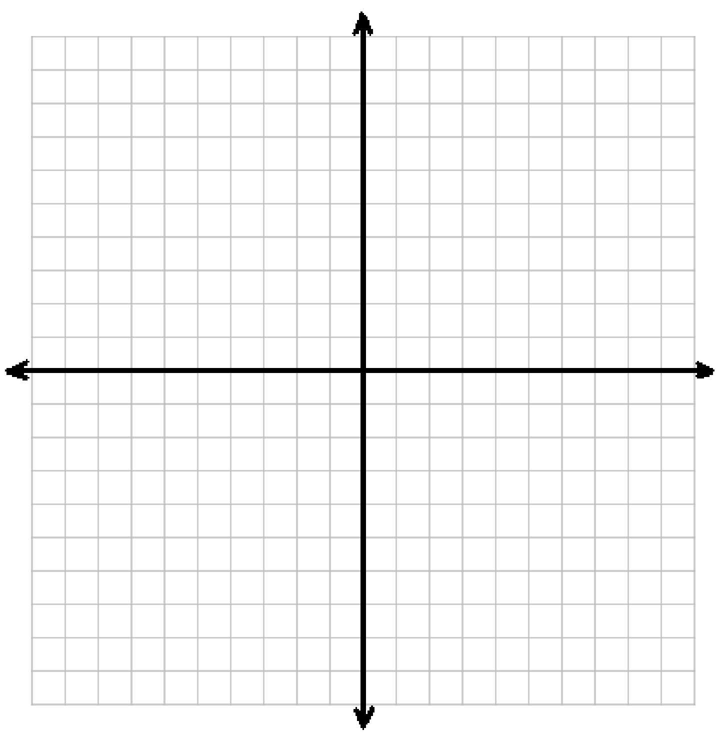
So far in all these systems, both equations were linear equations. We just graphed both lines and found the point of intersection. The point of intersection was the lone solution to the system. Now one or both of the equations will be non-linear. They will be the types of equations we learned how to graph in the last packet; quadratic, exponential, and absolute value equations.

Our strategy will still be the same. We will graph both equations and find the point OR POINTS of intersection. You read that correctly. You can now have more than 1 point of intersection.

This (C) will be the first system we solve graphically. There will be a youtube link on the Algebra 2a page with me doing the problem.

Solve each system GRAPHICALLY:

C) $y = x^2 - 6x + 2$
$18x - 9y = 45$



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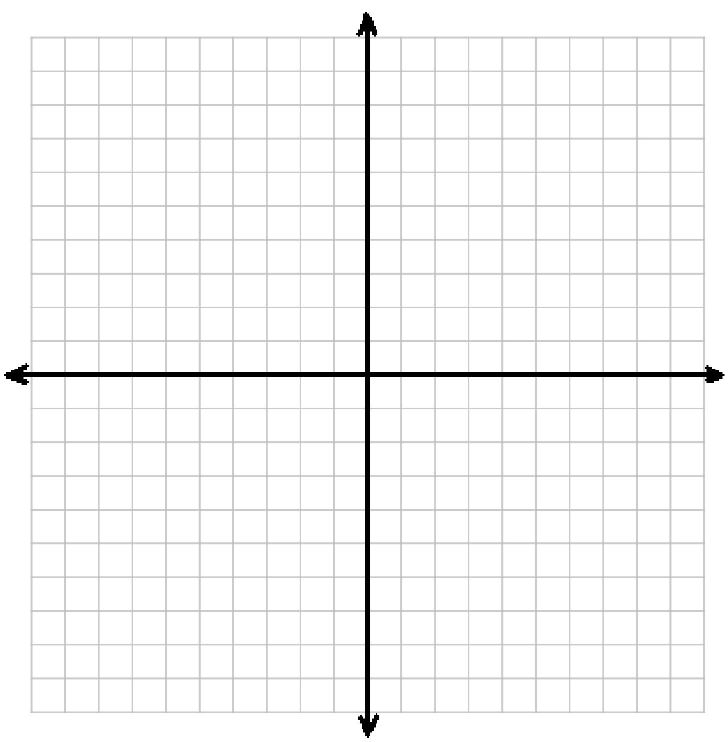
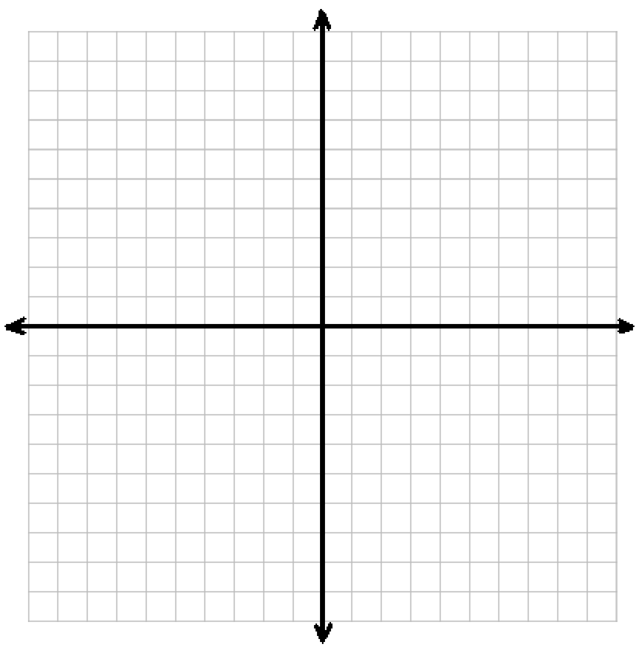
Alg2a Solving Systems Graphically (non-linear)

Solve each system graphically and check (using the calculator);

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



2) $y = -x^2 + 6x - 3$
$15x + 15y = -45$



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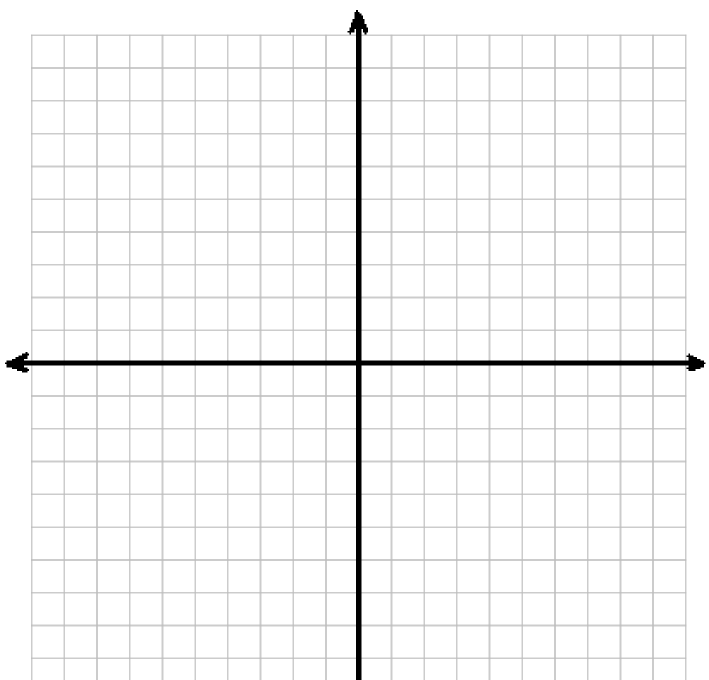
3) $y = -3x^2 + 8$
$y = 5$



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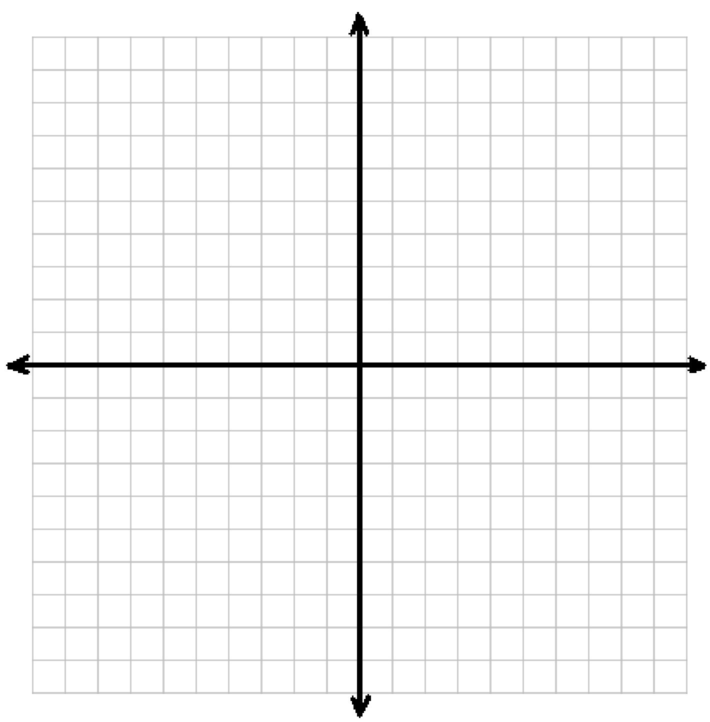
4) $y = 3^x - 5$
$12x - 3y = 12$



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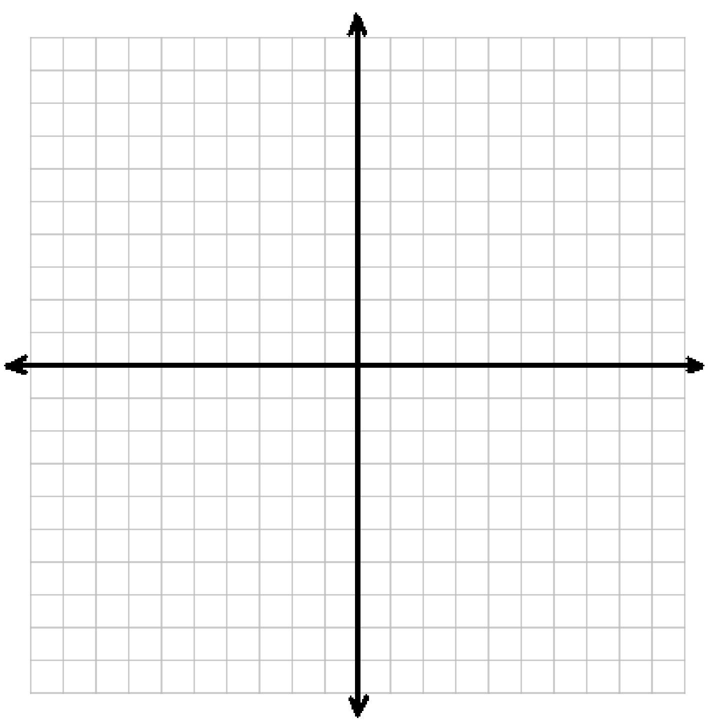
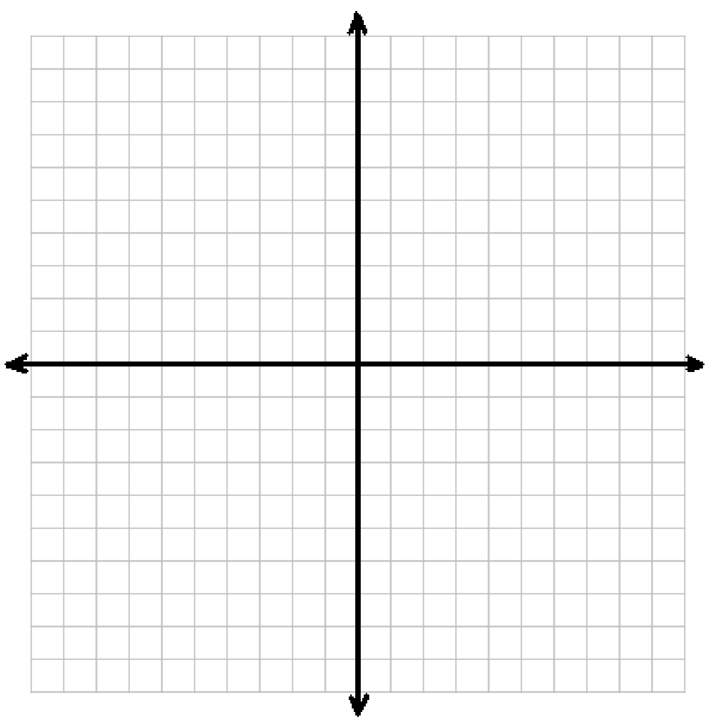
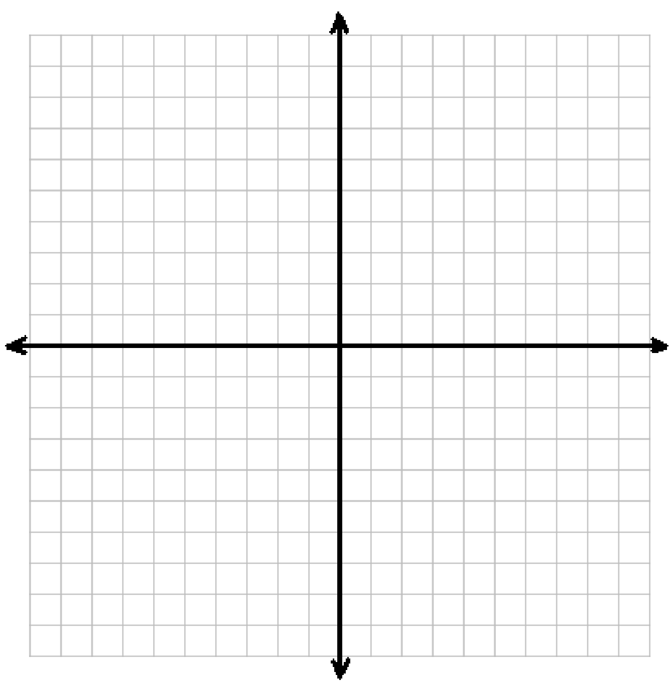
5) $y = ½^{x} + 2$
$y – 4 = -3(x + 1)$



6) $y = |3x - 3| - 4$
$8x + 8y = 40$



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



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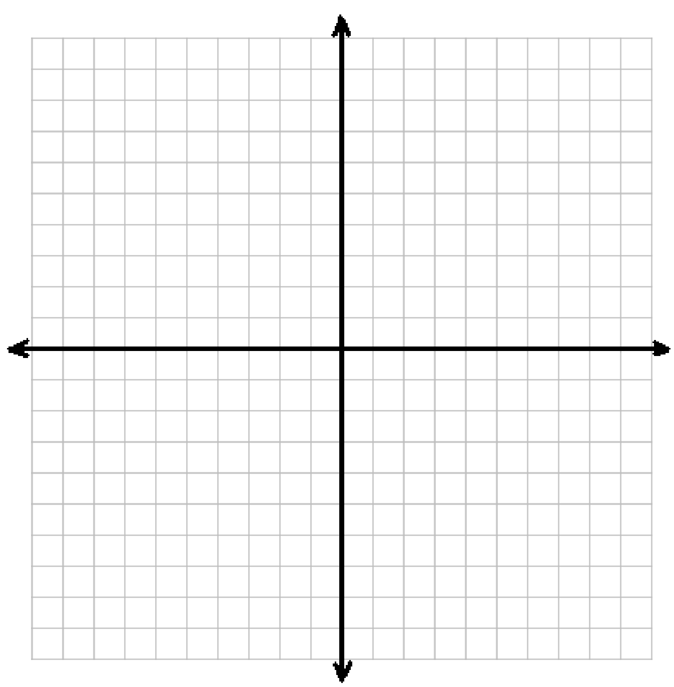
8) $y = 2^x - 7$

$48x + 16 = -32$



Answer Key:
1) (-3,-4)(2,6)
2) (0,-3)(7,-10)
3) (-1,5)(1,5)
4) (0,-4)(2,4)
5) (-3,10)(-1,4)
6) (-3,8)(3,2)
7) (-8,-3)(2,-3)
8) (1,-5) (They only intersected at one point.)