# MATH 6: EUCLIDEAN GEOMETRY 9

1. Graphs

In our work from last week, we discussed the definition of coordinate axes, the xy-plane, and graphs. There is a standard way to draw an xy-coordinate plane, and it's a picture that will likely be familiar to you as you see examples of graphs of functions elsewhere in your mathematical adventures. Today, we are going to draw some graphs!

We draw the x-coordinate horizontally, and the y-coordinate vertically. Then we mark distances along the axes at regular intervals. Here:
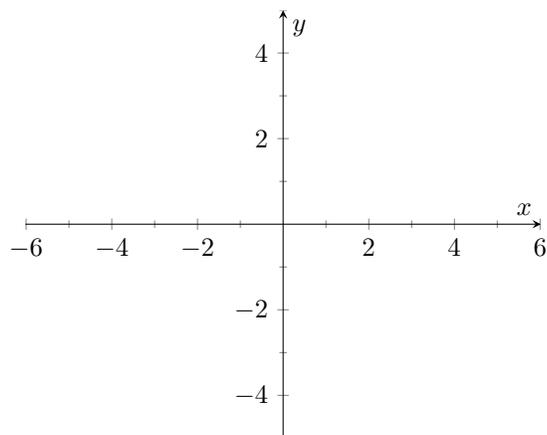
Let's graph two simple lines. These are graphs you should know how to draw.

$y = x$
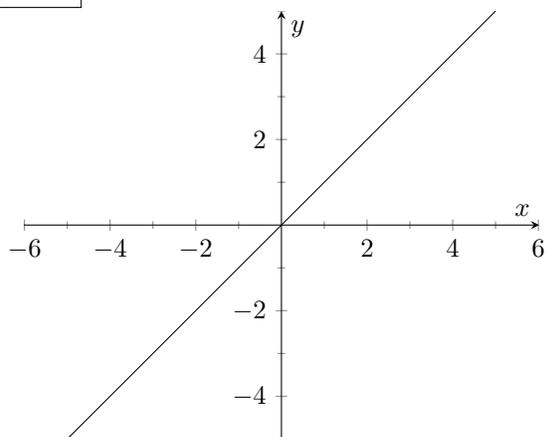
$y = -x$
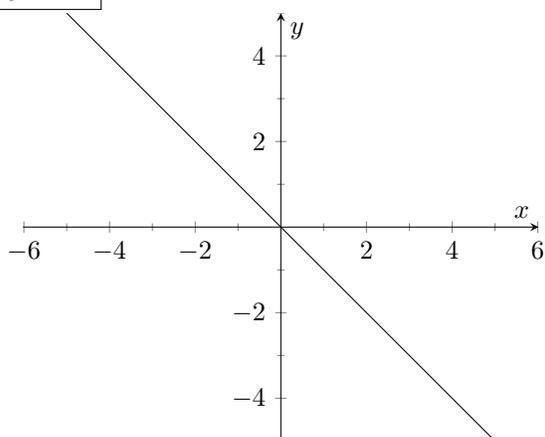
You may put more than one graph in the same drawing. Here are some examples.

$y = 2$

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

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

$y = -\frac{1}{2}x - 1$
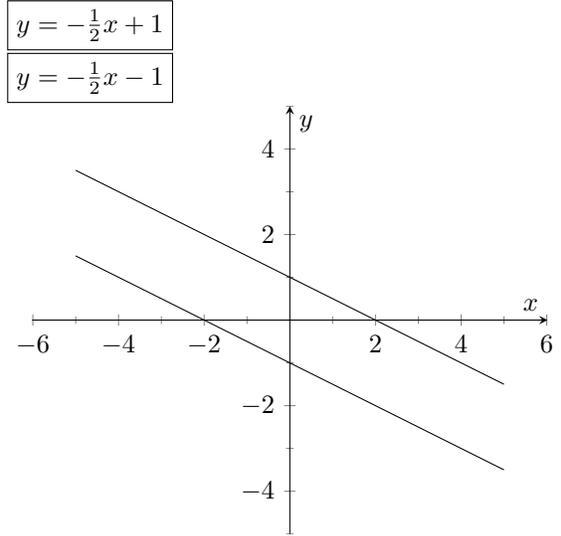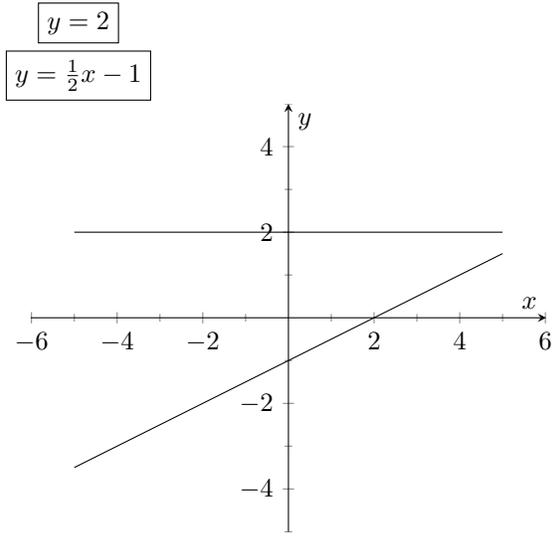
Here are some more graphs of functions that you should know how to draw.

$y = |x|$

$x^2 + y^2 = 1$
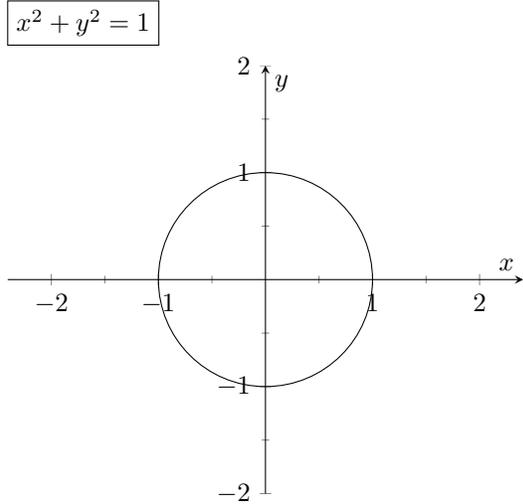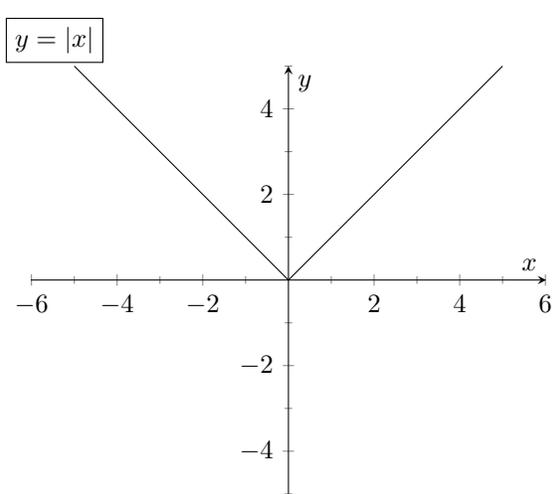
Here is a concept you should know about: when you add a constant to x or y, the graph will shift in the opposite direction by that amount. So, for example, $y = |x+1|$ should look the same as the graph of $y = |x|$ except shifted one unit in the *negative x* direction.

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

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

$y = |x+3|$

$y = -|x-1|$

$(x+2)^2 + (y-1)^2 = 9$

$(-2, 1)$
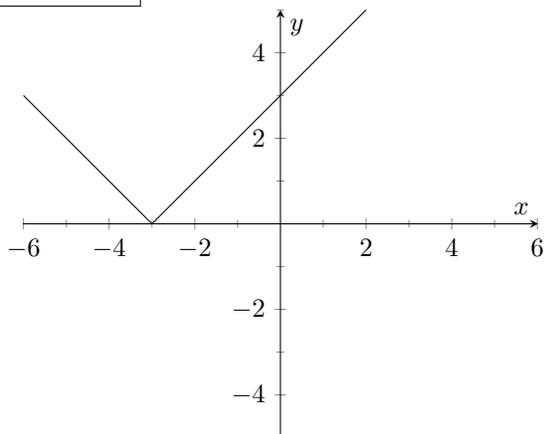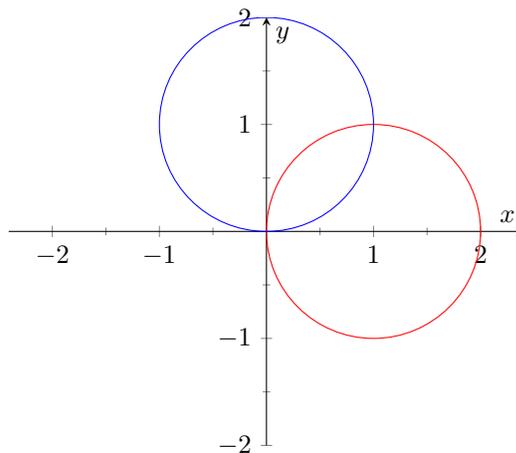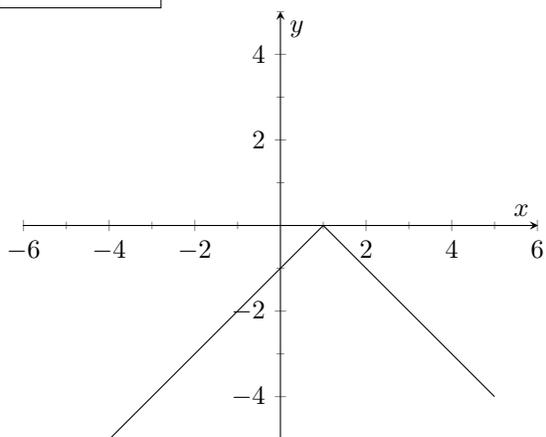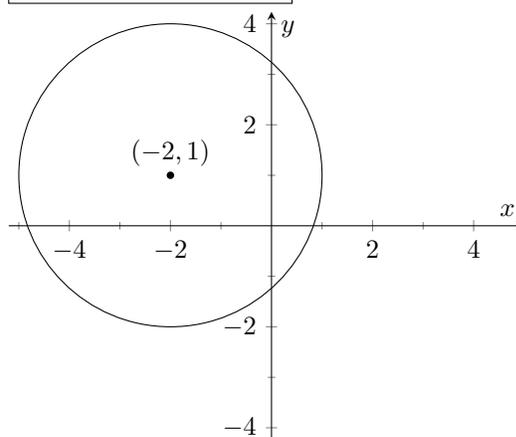
And that's it!

A useful tip for helping plot functions, when you don't know where to start, is to plug in some x values and calculate the y values, and then plot those points.

2. Homework

There are seven homework problems, some of which ask you to graph equations, and some of which ask you to find equations of graphs. Problem 7 is starred, so it is optional.

1. Graph the following equations in separate drawings.
  (a) $y = -2x + 1$
  (b) $y = \frac{1}{3}x + 1$
  (c) $y = -|x|$
  (d) $(x-1)^2 + (y-1)^2 = 4$

2. Graph the following equations in separate drawings.
  You might need to apply some algebra to simplify these equations (except for the last one, which will require a little bit of creative thinking).
  (a) $(y+1) + 2(x+1) = 1$
 (b) $\frac{1}{2}(y-2) + 2(x - \frac{1}{2}) = 0$
  (c) $(x+y)^2 + (x-y)^2 = 1$
  (d) $|y| = x$

3. Graph the following equations in separate drawings.
  (a) $y = |x+1| + |x-1|$
     (Hint: draw a graph of $y = |x| + |x|$. For which values of x will $|x+1| = |x-1|$? What happens to the original equation when x is in these values?)
 (b) $|y| = |x|$
     (Hint: if y is positive, then $|y|$ is simply y; if y is negative, then $|y|$ is $-y$. Try graphing each of $y = |x|$ and $-y = |x|$)
  (c) $(x-1)(y-1) = 0$
     (Hint: try drawing the graphs of $x - 1 = 0$ and $y - 1 = 0$, then test points on each of these graphs to see if they are on the graph of $(x-1)(y-1) = 0$)
  (d) $|x+y| = |x-y|$

**4.** What is the equation of the line in the following graph?
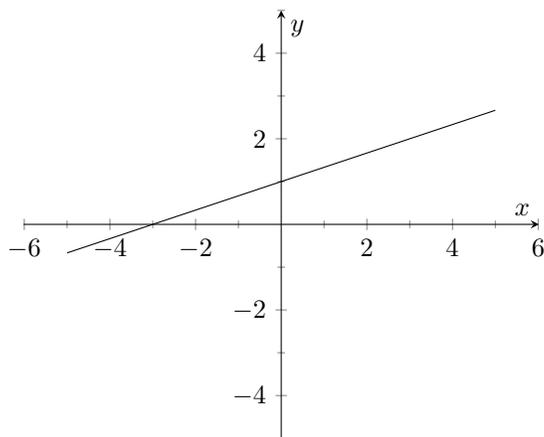
5. In the following graph, the median from A to $\overline{BC}$ in triangle $\triangle ABC$ is drawn. What is the equation of this line?
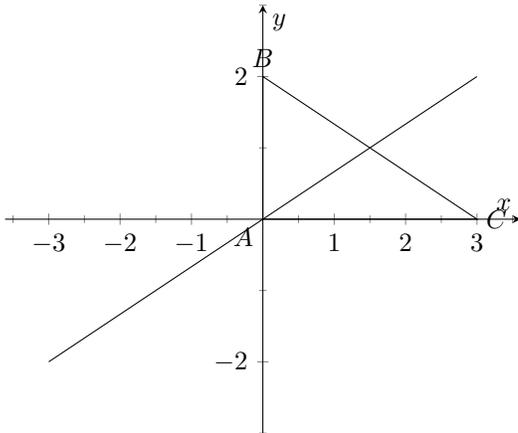
6. In the following graph, line m has slope 1. What is the equation of line m?
(Hint: let M be the point of intersection of m with the circle, and O be the center of the circle. Then the tangent line m is perpendicular to $\overleftrightarrow{OM}$. Using Coordinate Theorem 7, can you figure out the slope of $\overleftrightarrow{OM}$?)
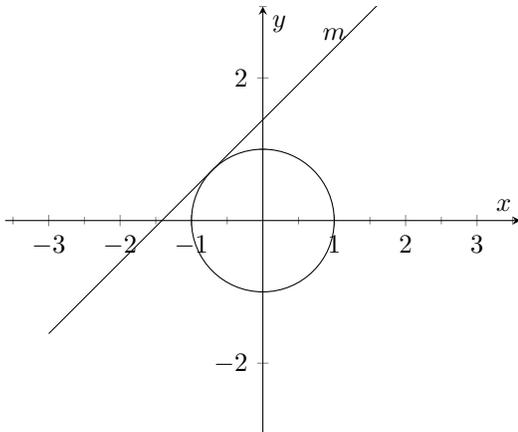
*7. Graph the following equations in separate drawings.
(a) $(y + 2x)(y - \frac{1}{2}x) = 0$
(b) $|x + y - 2| = |x - y|$