Conics Homework – All the Points Equidistant from a Given Point*

Kenny M. Felder

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Abstract

This module provides a worksheet introducing circles.

Exercise 1

Draw as many points as you can which are exactly 5 units away from (0,0) and fill in the shape. What shape is it?

Exercise 2

Now, let's see if we can find the **equation** for that shape. How do we do that? Well, for any point (x,y) to be on the shape, it must be exactly five units away from the origin. So we have to take the sentence:

The point (x,y) is exactly five units away from the origin

and translate it into math. Then we will have an equation that describes **every point on our shape**, and no other points. (Stop for a second and discuss this point, make sure it makes sense.)

OK, but how do we do **that?**

a. To the right is a drawing of our point (x,y), 5 units away from the origin. On the drawing, I have made a little triangle as usual. How long is the vertical line on the right side of the triangle? Label it in the picture.

b. How long is the horizontal line at the bottom of the triangle? Label it in the picture.

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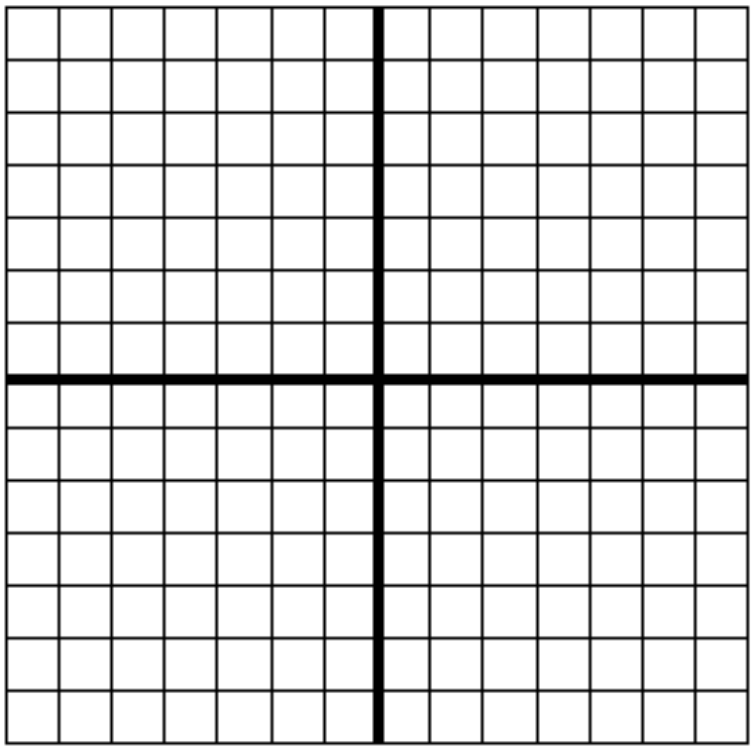

c. Now, all three sides are labeled. Just write down the Pythagorean Theorem for this triangle, and you have the equation for our shape!

d. Now, let's see if it worked. A few points that are **obviously** part of our shape—that is, they are obviously 5 units away from the origin—are the points (5,0) and (4,–3). Plug them both into your equation from the last part and see if they work.

e. A few points that are clearly **not** part of our shape are (1,4) and (–2,7). Plug them both into your equation for the shape to make sure they don't work!

Exercise 3

OK, that was all the points that were 5 units away from the origin. Now we're going to find an equation for the shape that represents all points that are exactly 3 units away from the point (4,–1). Go through all the same steps we went through above—draw the point (4,–1) and an arbitrary point (x,y), draw a little triangle between them, label the distance from (x,y) to (4,–1) as being 3, and write out the Pythagorean Theorem. Don't forget to test a few points!

Exercise 4

By now you probably get the idea. So—**without** going through all that work—write down the equation for all the points that are exactly 7 units away from the point (–5,3).

Exercise 5

And finally, the generalization as always: write down the equation for all the points that are exactly r units away from the point (h,k).