

8.2 Getting Centered

A Solidify Understanding Task

Malik's family has decided to put in a new sprinkling system in their yard. Malik has volunteered to lay the system out. Sprinklers are available at the hardware store in the following sizes:

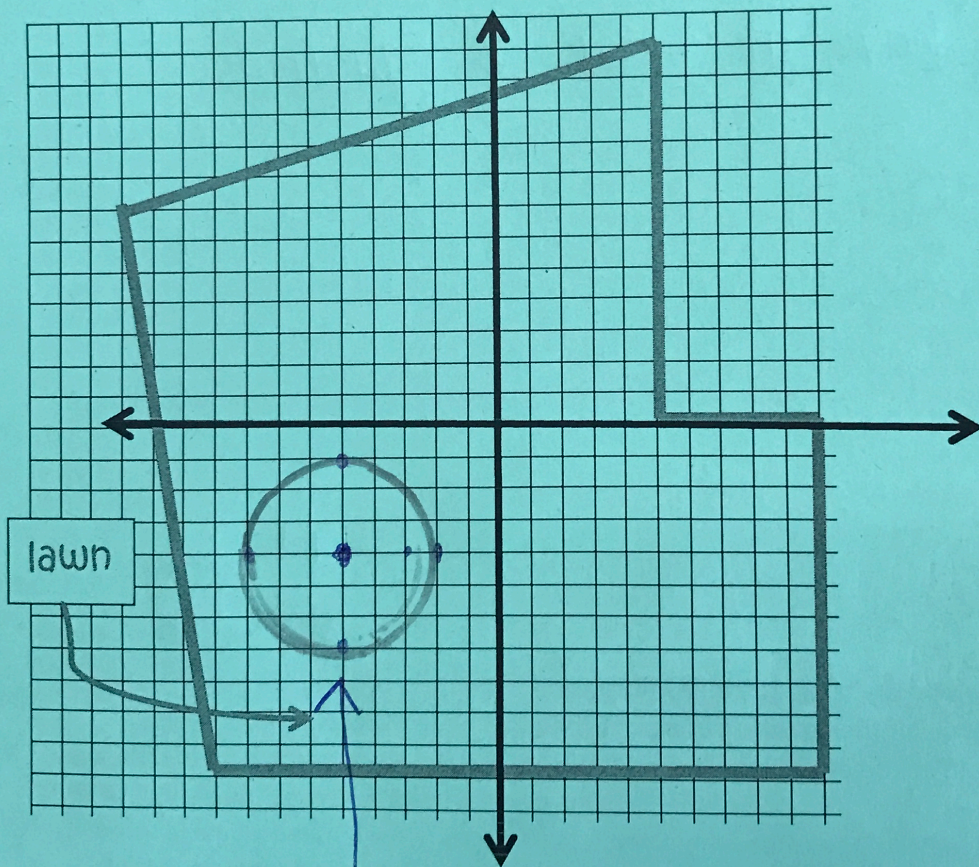
- Full circle, maximum 15' radius
- Half circle, maximum 15' radius
- Quarter circle, maximum 15' radius



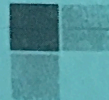
www.flickr.com/photos/paynomind/148476571

7

All of the sprinklers can be adjusted so that they spray a smaller radius. Malik needs to be sure that the entire yard gets watered, which he knows will require that some of the circular water patterns will overlap. He gets out a piece of graph paper and begins with a scale diagram of the yard. In this diagram, the length of the side of each square represents 5 feet.



This circle has
to be used



1. As he begins to think about locating sprinklers on the lawn, his parents tell him to try to cover the whole lawn with the fewest number of sprinklers possible so that they can save some money. The equation of the first circle that Malik draws to represent the area watered by the sprinkler is:

$$(x + 25)^2 + (y + 20)^2 = 225$$

Draw this circle on the diagram using a compass.

Drawn on the front page

2. Lay out a possible configuration for the sprinkling system that includes the first sprinkler pattern that you drew in #1.

~~Answers~~ Answers will vary. Try to cover as much space as possible using the fewest amount of

3. Find the equation of each of the full circles that you have drawn.

sprinklers.

Should have at least 8 equations here.

Malik wrote the equation of one of the circles and just because he likes messing with the algebra, he did this:

Original equation: $(x - 3)^2 + (y + 2)^2 = 225$

$$x^2 - 6x + 9 + y^2 + 4y + 4 = 225 \quad \text{1st step}$$

$$x^2 + y^2 - 6x + 4y - 212 = 0 \quad \text{2nd step}$$

Malik thought, "That's pretty cool. It's like a different form of the equation. I guess that there could be different forms of the equation of a circle like there are different forms of the equation of a parabola or the equation of a line." He showed his equation to his sister, Sapana, and she thought he was nuts. Sapana, said, "That's a crazy equation. I can't even tell where the center is or the length of the radius anymore." Malik said, "Now it's like a puzzle for you. I'll give you an equation in the new form. I'll bet you can't figure out where the center is."

Sapana said, "Of course, I can. I'll just do the same thing you did, but work backwards."

4. Malik gave Sapana this equation of a circle:

$$x^2 + y^2 - 4x + 10y + 20 = 0$$

$$x^2 - 4x + y^2 + 10y + 20 = 0$$

Since we need
a total of 29
We have to add 9
to each side.

Help Sapana find the center and the length of the radius of the circle.

complete the square - $x^2 - 4x + \underline{4} + y^2 + 10y + \underline{25} = 0$
+9

$$(x-2)^2 + (y+5)^2 = 9$$

center: (2, -5)

radius: 3

5. Sapana said, "Ok. I made one for you. What's the center and length of the radius for this circle?"

$$x^2 + y^2 + 6x - 14y - 42 = 0$$

$$(x+3)^2 + (y-7)^2 = 100$$

center: (-3, 7)

radius: 10

6. Sapana said, "I still don't know why this form of the equation might be useful. When we had different forms for other equations like lines and parabolas, each of the various forms highlighted different features of the relationship." Why might this form of the equation of a circle be useful?

~~$$x^2 + y^2 + Ax + By + C = 0$$~~

Ignore this problem. Just write out the steps you have to take to solve #4 & #5