Your SAGE Review packet is due today, get that out and ready to be checked off.

Apr 8-8:30 AM

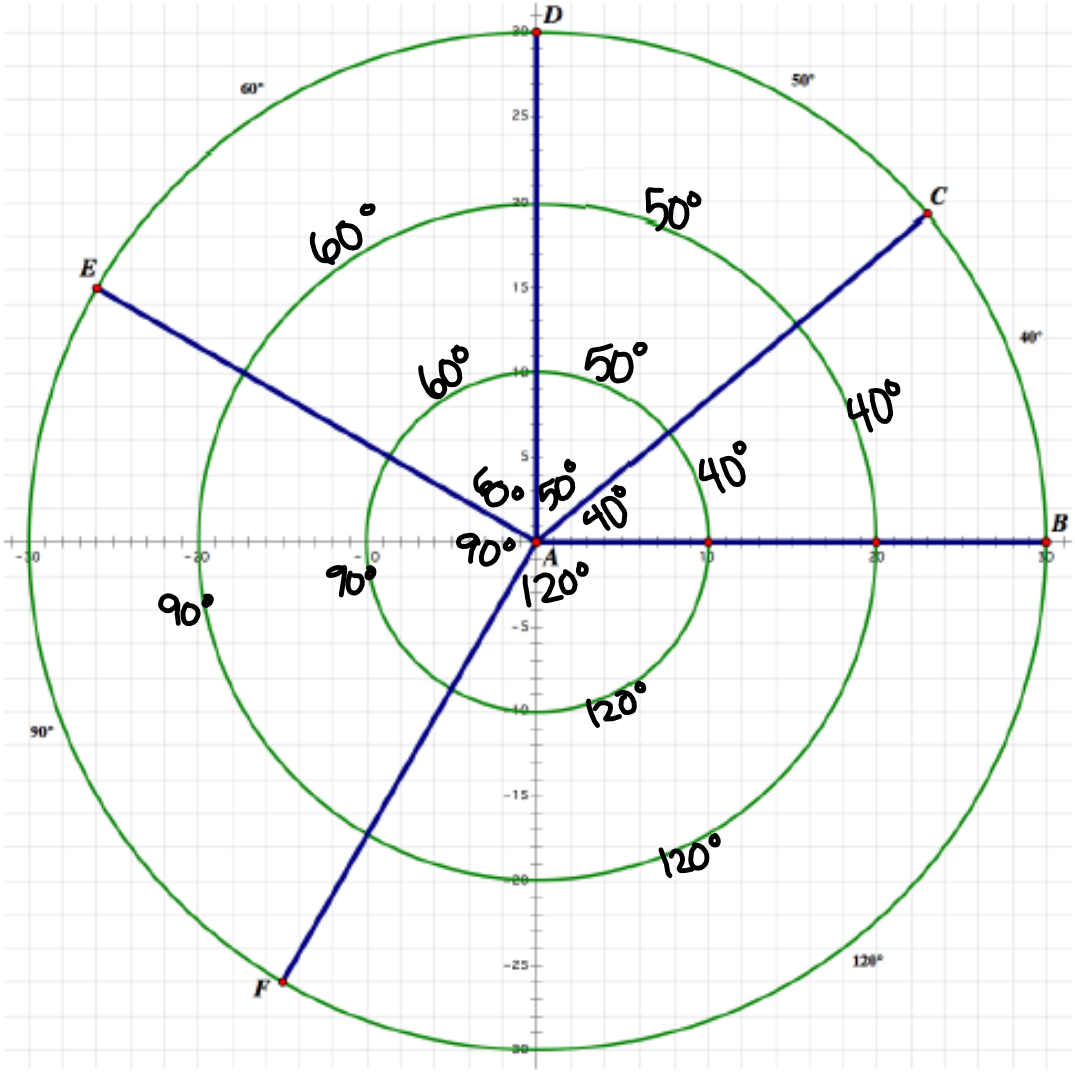
7.8 Madison's Round Garden

A Practice and Develop Understanding Task

Last year Madison won the city's "Most Outstanding Garden" Award for her square garden. This year she plans to top that with her design for a beautiful round garden.

Madison's design starts with a sprinkler in the center, and concentric rings of colorful flowers surrounding the central sprinkler. Pavers will create both circular pathways and pathways that look like spokes on a wheel between the flowers. The sprinkler can be adjusted so it waters just the inner circle of flowers, or it can be adjusted so it waters the entire round garden. Consequently, flowers that need to be watered more frequently will be placed near the center of the garden, and those that need the least amount of water will be placed farthest from the center. The sectors of the garden will not all be the same size, since they need to accommodate different types of plants.

Here is Madison's design for her garden. The number of degrees in each sector has been marked.



Apr 26-8:56 AM

1. Madison has only marked the degree measure on the arcs of the outermost ring of the garden. Determine the angle measure for the arcs on the inner and middle rings of the garden.

The arcs are the same, no matter what ring they're on.

2. Madison needs to orders pavers for the garden. She plans to vary the size and colors of the pavers in different parts of the garden. Consequently, she needs to know the lengths of different portions of the paths. Help her complete this table by calculating the missing arc lengths.

radius $S = \frac{\theta}{360}(2\pi r)$

	Distance from Center	Arc Length				
		40° Sector	50° Sector	60° Sector	90° Sector	120° Sector
Inner Circle of Pavers	10 feet	$\frac{40}{360}(2\pi 10) = 6.98$	$\frac{50}{360}(2\pi 10) = 8.73$	$\frac{60}{360}(2\pi 10) = 10.47$	15.71	20.94
Middle Circle of Pavers	20 feet	$\frac{40}{360}(2\pi 20) = 13.96$	17.45	20.94	31.42	41.89
Outer Circle of Pavers	30 feet	$\frac{40}{360}(2\pi 30) = 20.94$	26.18	31.42	47.12	62.83

3. As Madison filled out the table she began to notice some interesting things. What did you notice?

4. One thing Madison noticed involved the ratio of the arc length to the radius of the circle. Complete this version of the table and state what you think Madison noticed.

radius

	Distance from Center	Arc length / Radius				
		40° Sector	50° Sector	60° Sector	90° Sector	120° Sector
Inner Circle of Pavers	10 feet	$\frac{6.98}{10} = 0.698$	$\frac{8.73}{10} = 0.873$	$\frac{10.47}{10} = 1.047$	$\frac{15.71}{10} = 1.571$	$\frac{20.94}{10} = 2.094$
Middle Circle of Pavers	20 feet	$\frac{13.96}{20} = 0.698$	$\frac{17.45}{20} = 0.873$	1.047	1.571	2.094
Outer Circle of Pavers	30 feet	$\frac{20.94}{30} = 0.698$	$\frac{26.18}{30} = 0.873$	1.047	1.571	2.094

$$\frac{\text{Arc length}}{\text{radius}} = \frac{\frac{\theta}{360}(2\pi r)}{r} = \frac{\theta}{360}(2\pi) = \frac{\frac{\theta}{360}(2\pi)}{1} = \frac{\theta}{360}(2\pi)$$

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As Madison examined these numbers, she realized that they behave the same way that degree measurements behave—all arcs in the same sector have the same degree measurement, and all arcs in the same sector have the same value for the ratio of arc length to radius. This made her wonder if these new numbers could be used as a way of measuring angles just as degrees are used.

Later that evening Madison shared her discovery with her older sister Katelyn who is taking calculus at a local university. Katelyn told Madison that her new numbers for measuring angles in terms of the ratio of the arc length to the radius are know as *radians* and that they make the rules of calculus much easier than if angles are measured in degrees.

Madison learned so much from examining the arc length of the sectors of her garden that she decides to examine the areas of the sectors also.

5. Complete this table for Madison by calculating the areas of the sectors for the different rings of the garden.

radius

$\frac{\theta}{360}(\pi r^2)$

	Distance from Center	Area of Sector				
		40° Sector	50° Sector	60° Sector	90° Sector	120° Sector
Inner Circle of Pavers	10 feet	$\frac{40}{360}(\pi 10^2) \approx 34.91$	$\frac{50}{360}(\pi 10^2) \approx 43.63$	52.36	78.54	104.72
Middle Circle of Pavers	20 feet	$\frac{40}{360}(\pi 20^2) \approx 139.63$	174.53	209.44	314.16	418.88
Outer Circle of Pavers	30 feet	$\frac{40}{360}(\pi 30^2) \approx 314.16$	392.70	471.24	706.86	942.48

6. Do you notice anything interesting in this table?

Homework

Finish 7.8 "Ready, Set, Go"

Mar 28-9:36 AM