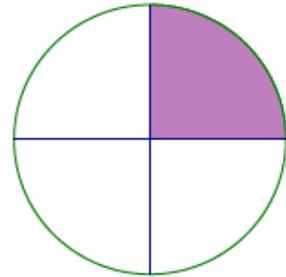


## Lesson 22: Area Problems with Circular Regions

### Classwork

#### Example 1

- a. The circle to the right has a diameter of  $\frac{1}{2}$  cm. Calculate the area of the shaded region.



- b. Sasha, Barry, and Kyra wrote three different expressions for the area of the shaded region. Describe what each student was thinking about the problem based on their expression.

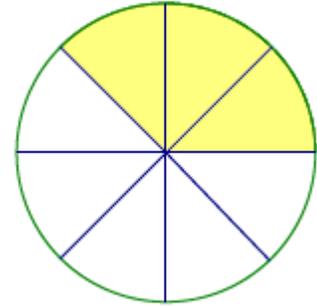
Sasha's expression:  $\frac{1}{8}$

Barry's expression:  $\frac{1}{8}$

Kyra's expression:  $\frac{1}{8}$

**Exercise 1**

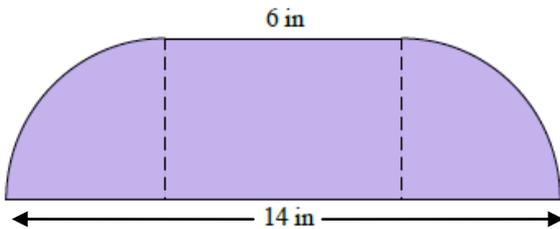
a. Find the area of the shaded region of the circle to the right.



b. Explain how the expression you used represents the area of the shaded region.

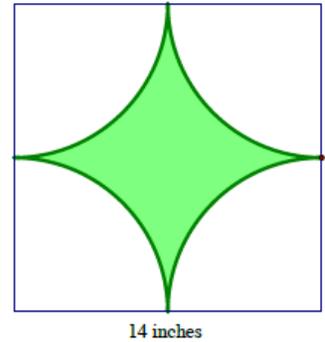
**Exercise 2**

Calculate the area of the figure below that consists of a rectangle and two quarter circles, each with the same radius. Leave your answer in terms of pi.



**Example 2**

The square in this figure has a side length of  $s$  inches. The radius of the quarter circle is  $\frac{s}{2}$  inches.



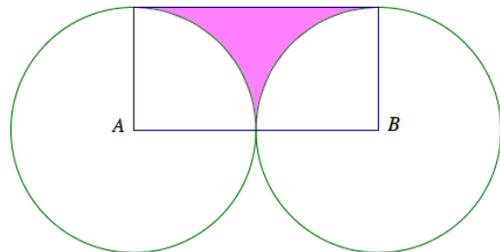
14 inches

- a. Estimate the shaded area.
  
- b. What is the exact area of the shaded region?
  
- c. What is the approximate area using  $\pi \approx 3.14$ ?

**Exercise 3**

The vertices  $A$  and  $B$  of rectangle  $ABCD$  are centers of circles each with a radius of  $r$  inches.

- a. Find the exact area of the shaded region.

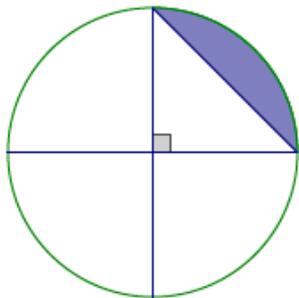


b. Find the approximate area using  $\pi$ .

c. Find the area to the nearest hundredth using your  $\pi$  key on your calculator.

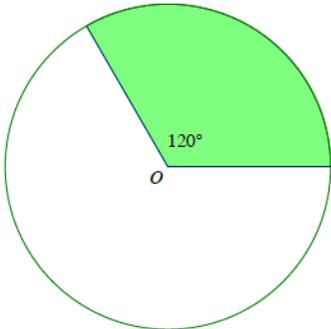
#### Exercise 4

The diameter of the circle is 4 in. Write and explain a numerical expression that represents the area.



**Problem Set**

1. A circle with center  $O$  has an area of  $48\pi$  in<sup>2</sup>. Find the area of the shaded region.



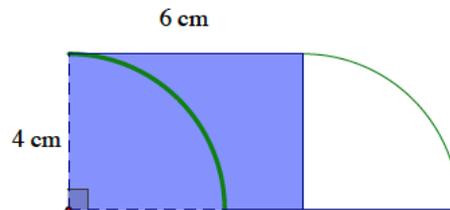
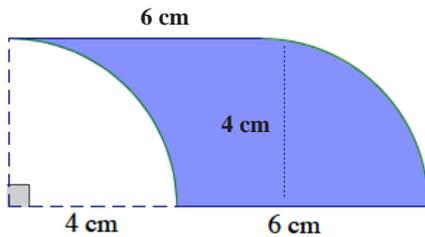
Peyton's Solution

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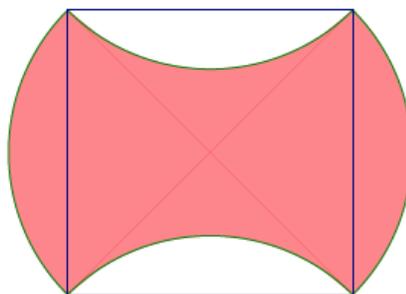
Monte's Solution

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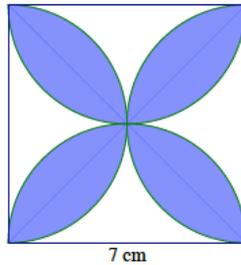
2. The following region is bounded by the arcs of two quarter circles each with a radius of 4 cm and by line segments 6 cm in length. The region on the right shows a rectangle with dimensions 4 cm by 6 cm. Show that both shaded regions have equal areas.



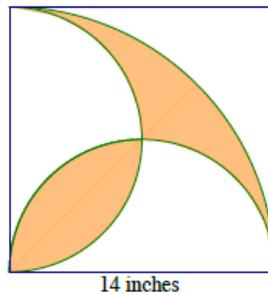
3. A square is inscribed in a paper disc (i.e., a circular piece of paper) with a radius of 5 cm. The paper disc is red on the front and white on the back. Two edges of the square are folded over. Write and explain a numerical expression that represents the area of the figure. Then find the area of the figure.



4. The diameters of four half circles are sides of a square with a side length of 7 cm.



- Find the exact area of the shaded region.
  - Find the approximate area using  $\pi \approx 3.14$ .
  - Find the area using the  $\pi$  button on your calculator and rounding to the nearest thousandth.
5. A square with a side length of 14 inches is shown below, along with a quarter circle (with a side of the square as its radius) and two half circles (with diameters that are sides of the square). Write and explain a numerical expression that represents the area of the figure.



6. Three circles have centers on segment  $\overline{AC}$ . The diameters of the circles are in the ratio 1:2:1. If the area of the largest circle is  $4\pi$  ft<sup>2</sup>, find the area inside the largest circle but outside the smaller two circles.
7. A square with a side length of 4 ft. is shown, along with a diagonal, a quarter circle (with a side of the square as its radius), and a half-circle (with a side of the square as its diameter). Find the exact, combined area of regions I and II.

