

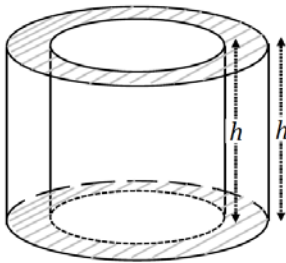
## Lesson 10: Unknown Length and Area Problems

### Classwork

#### Opening Exercise

In the following figure, a cylinder is carved out from within another cylinder of the same height; the bases of both cylinders share the same center.

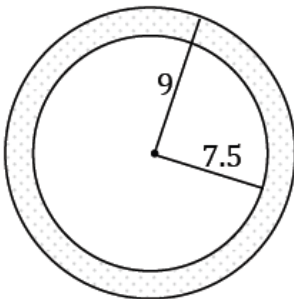
- Sketch a cross section of the figure parallel to the base.



- Mark and label the shorter of the two radii as  $r$  and the longer of the two radii  $s$ . Show how to calculate the area of the shaded region and explain the parts of the expression.

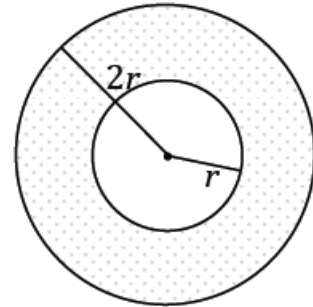
#### Exercises 1–13

- Find the area of the following annulus.



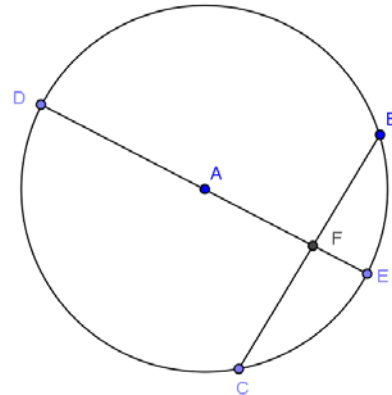
2. The larger circle of an annulus has a diameter of 10 cm, and the smaller circle has a diameter of 7.6 cm. What is the area of the annulus?

3. In the following annulus, the radius of the larger circle is twice the radius of the smaller circle. If the area of the following annulus is  $12\pi$  units<sup>2</sup>, what is the radius of the larger circle?



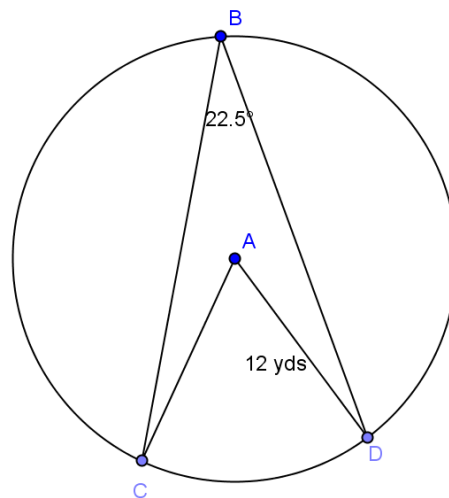
4. An ice cream shop wants to design a super straw to serve with their extra thick milkshakes that is double the width and thickness of a standard straw. A standard straw is 8 mm in diameter and 0.5 mm thick.
- What is the cross-sectional (parallel to the base) area of the new straw (round to the nearest hundredth)?
  - If the new straw is 23 mm long, what is the maximum volume of milkshake that can be in the straw at one time (round to the nearest hundredth)?
  - A large milkshake is 32 ounces (approximately 950 mL). If Corbin withdraws the full capacity of a straw 10 times a minute, what is the minimum amount of time that it will take him to drink the milkshake (round to the nearest minute)?

5. In the circle given,  $\overline{ED}$  is the diameter and is perpendicular to chord  $\overline{CB}$ .  $DF = 8$  cm and  $FE = 2$  cm. Find  $AC$ ,  $BC$ ,  $m\angle CAB$ , the arc length of  $\widehat{EB}$ , and the area of sector  $\widehat{CEB}$  (round to the nearest hundredth, if necessary).



6. Given circle  $A$  with  $\angle BAC \cong \angle BAD$ , find the following (round to the nearest hundredth, if necessary):

- $m\widehat{CD}$
- $m\widehat{CBD}$
- $m\widehat{BCD}$
- Arc length  $\widehat{CD}$
- Arc length  $\widehat{CBD}$
- Arc length  $\widehat{BCD}$
- Area of sector  $\widehat{CD}$



h. Area of sector  $\widehat{CBD}$

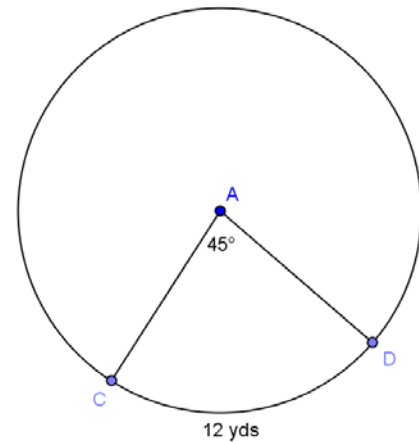
i. Area of sector  $\widehat{BCD}$

7. Given circle  $A$ , find the following (round to the nearest hundredth, if necessary):

a. Circumference of circle  $A$

b. Radius of circle  $A$

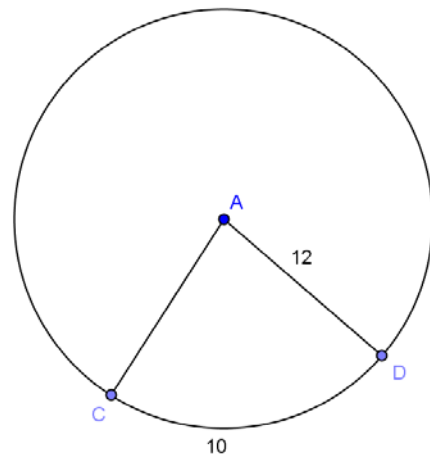
c. Area of sector  $\widehat{CD}$



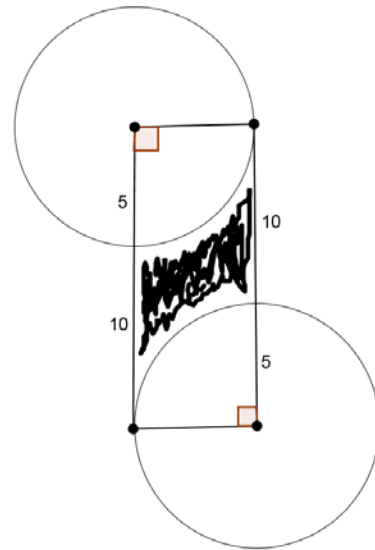
8. Given circle  $A$ , find the following (round to the nearest hundredth, if necessary):

a.  $m\angle CAD$

b. Area of sector  $\widehat{CD}$

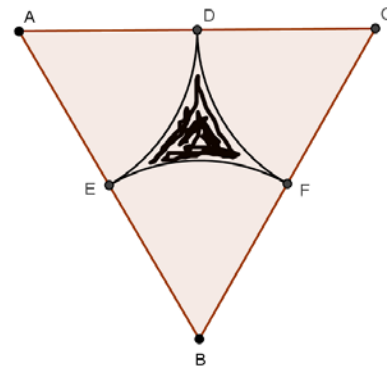


9. Find the area of the shaded region (round to the nearest hundredth).



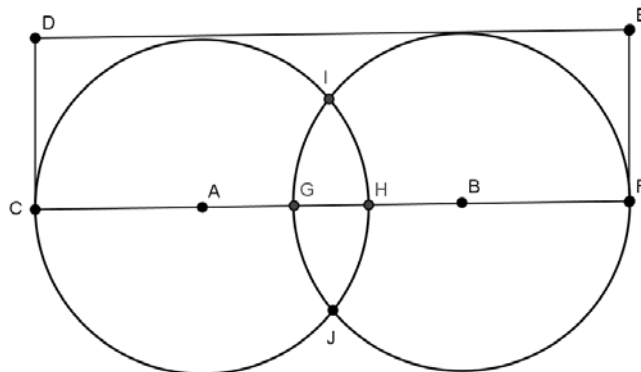
10. Many large cities are building or have built mega Ferris wheels. One is 600 feet in diameter and has 48 cars each seating up to 20 people. Each time the Ferris wheel turns  $\theta$  degrees, a car is in a position to load.
- How far does a car move with each rotation of  $\theta$  degrees (round to the nearest whole number)?
  - What is the value of  $\theta$  in degrees?

11.  $\triangle ABC$  is an equilateral triangle with edge length 20 cm.  $D$ ,  $E$ , and  $F$  are midpoints of the sides. The vertices of the triangle are the centers of the circles creating the arcs shown. Find the following (round to the nearest hundredth):
- The area of the sector with center  $A$ .

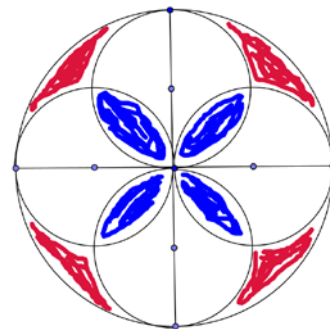


- b. The area of triangle  $ABC$ .
- c. The area of the shaded region.
- d. The perimeter of the shaded region.

12. In the figure shown,  $AC = BF = 5$  cm,  $GH = 2$  cm, and  $m\angle HBI = 30^\circ$ . Find the area in the rectangle, but outside of the circles (round to the nearest hundredth).

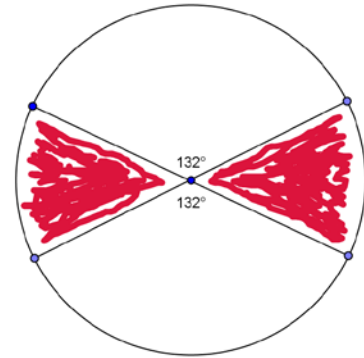


13. This is a picture of a piece of a mosaic tile. If the radius of each smaller circle is 1 inch, find the area of red section, the white section, and the blue section (round to the nearest hundredth).

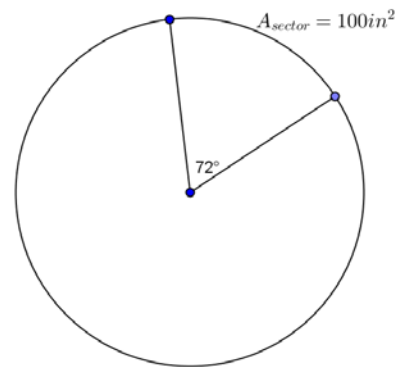


Problem Set

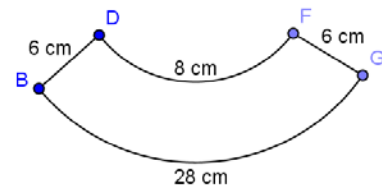
- Find the area of the shaded region if the diameter is 32 inches (round to the nearest hundredth).



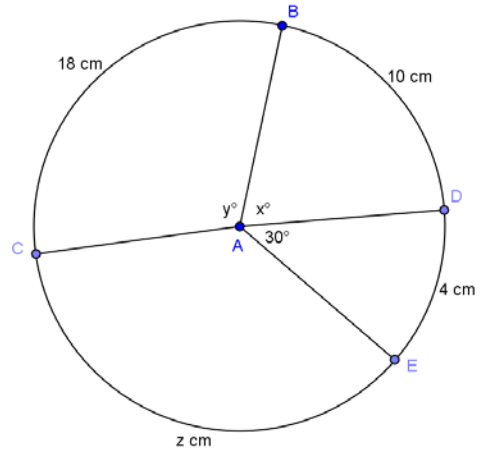
- Find the area of the entire circle given the area of the sector.



- $\widehat{DF}$  and  $\widehat{BG}$  are arcs of concentric circles with  $\overline{BD}$  and  $\overline{FG}$  lying on the radii of the larger circle. Find the area of the region (round to the nearest hundredth).



4. Find the radius of the circle,  $x$ ,  $y$ , and  $z$  (round to the nearest hundredth).



5. In the figure, the radii of two concentric circles are 24 cm and 12 cm.  $m\widehat{DAE} = 120^\circ$ . If a chord  $\overline{DE}$  of the larger circle intersects the smaller circle only at  $C$ , find the area of the shaded region in terms of  $\pi$ .

