Lesson 9: Arc Length and Areas of Sectors

Classwork

**Example 1**

1. What is the length of the arc of degree measure in a circle of radius cm?



1. Given the concentric circles with center and with , calculate the arc length intercepted by on each circle. The inner circle has a radius of and each circle has a radius units greater than the previous circle.
2. An arc, again of degree measure , has an arc length of cm. What is the radius of the circle on which the arc sits?
3. Give a general formula for the length of an arc of degree measure on a circle of radius .
4. Is the length of an arc intercepted by an angle proportional to the radius? Explain.

Exercise 1

1. The radius of the following circle is cm, and the .
	1. What is the arc length of ?
	2. What is the radian measure of the central angle?

**Sector**: Let be an arc of a circle with center and radius . The union of all segments , where is any point of , is called a *sector*.

**Example 2**

* 1. Circle has a radius ofcm. What is the area of the circle? Write the formula.
	2. What is the area of half of the circle? Write and explain the formula.
	3. What is the area of a quarter of the circle? Write and explain the formula.
	4. Make a conjecture about how to determine the area of a sector defined by an arc measuring degrees.
	5. Circle has a minor arc with an angle measure of . Sector has an area of . What is the radius of circle ?
	6. Give a general formula for the area of a sector defined by arc of angle measure on a circle of radius ?

Exercises 2–3

1. The area of sector in the following image is . Find the measurement of the central angle labeled .
2. ****In the following figure, circle has a radius of cm, and cm. Find:
	1.
	2.
	3. Area of sector

Lesson Summary

**Relevant Vocabulary**

* **Arc**:An *arc* is any of the following three figures—a minor arc, a major arc, or a semicircle.
* **Length of an arc**:The *length of an arc* is the circular distance around the arc.
* **Minor and major arc**:In a circle with center , let and be different points that lie on the circle but are not the endpoints of a diameter. The *minor arc* between and is the set containing , , and all points of the circle that are in the interior of . The *major arc* is the set containing , , and all points of the circle that lie in the exterior of .
* **Radian**: A *radian* is the measure of the central angle of a sector of a circle with arc length of one radius length.
* **Sector**: Let arc be an arc of a circle with center and radius . The union of the segments , where is any point on the arc , is called a *sector.* The arc is called the arc of the sector, and is called its radius.
* **Semicircle**:In a circle, let and be the endpoints of a diameter. A *semicircle* is the set containing , , and all points of the circle that lie in a given half-plane of the line determined by the diameter.

Problem Set

1.  and are points on the circle of radius cm and the measure of arc is . Find, to one decimal place each of the following:
	1. The length of arc
	2. Find the ratio of the arc length to the radius of the circle.
	3. The length of chord
	4. The distance of the chord from the center of the circle.
	5. The perimeter of sector .
	6. The area of the wedge between the chord and the arc
	7. The perimeter of this wedge.
2. What is the radius of a circle if the length of a arc is ?
3. Arcs and both have an angle measure of , but their arc lengths are not the same. and .
	1. What are the arc lengths of arcs and ?
	2. What is the ratio of the arc length to the radius for all of these arcs? Explain.
	3. What are the areas of the sectors and ?
4. In the circles shown, find the value of .

The circles shown have central angles that are equal in measure.

 a. b.



c. d.



1. The concentric circles all have center . The measure of the central angle is . The arc lengths are given.
	1. Find the radius of each circle.
	2. Determine the ratio of the arc length to the radius of each circle, and interpret its meaning.
2. In the figure, if cm, find the length of arc ?
3. Find, to one decimal place, the areas of the shaded regions.



* 1. The following circle has a radius of.



* 1. 

