Math Objectives

- Students will identify and know the difference between central angles and inscribed angles of a circle.
- Students will identify the relationships between the measures of inscribed angles and the arcs they intercept.
- Students will identify and know the difference between major arcs and minor arcs.
- Students will identify and find the diameter, circumference, and area of a circle given the appropriate formulas.
- Students will see an example of how circles can be used in a real-world application.

Vocabulary

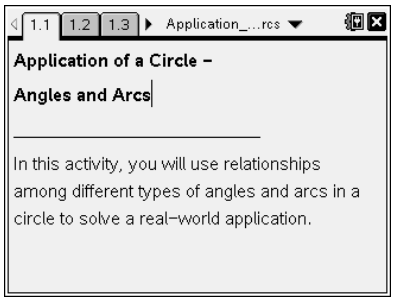
- central angle
- inscribed angle
- major arc
- minor arc
- diameter
- radius
- circumference
- area

About the Lesson

- This lesson is a follow-up lesson to the activity *Circles – Angles and Arcs*.
- This lesson involves using relationships among different types of angles and arcs in a circle to solve a real-world application involving the design of a courtyard.
- Students will use basic circle concepts, such as inscribed angles, to manipulate the design to desired specifications.
- Students will use other circle concepts, such as diameter, radius, circumference, and area, to determine basic information needed to construct the courtyard.

TI-Nspire™ Navigator™ System

- Use Teacher Edition computer software to review student documents.



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point
- Find the length of a segment
- Find the length of a circle
- Find the area of a circle
- Create a segment

Tech Tips:

- Make sure the font size on your TI-Nspire handhelds is set to Medium.

Lesson Materials:

Student Activity

Application_of_a_Circle_Angles_and_Arcs_Student.pdf

Application_of_a_Circle_Angles_and_Arcs_Student.doc

TI-Nspire document

Application_of_a_Circle_Angles_and_Arcs.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Tech Tip: If students experience difficulty dragging a point, check to make sure that they have moved the cursor until it becomes a hand (✋) getting ready to grab the point. Also, be sure that the word *point* appears, not the word *text*. Then press ctrl ✋ to grab the point and close the hand (✊).

Move to page 1.2.

Suppose you work for an architectural firm and a new business complex is in the process of being designed. The plans for the complex include a circular courtyard within a square area with side lengths of 8.4 yards. The courtyard will use 10-inch square pavers in different colors to create a design, as shown in the diagram on page 1.4. The points *A*, *B*, *C*, *D*, and *E* represent the points of the star design, and each of the points lies on the circle. Point *Q* represents the center of the circle.

You have been asked to supply the company constructing the courtyard some information that will help with creating the design and ordering supplies.

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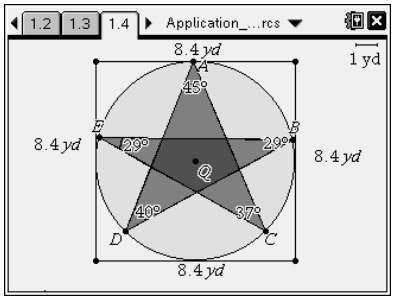


1. Would the angles *A*, *B*, *C*, *D*, and *E* be considered central angles or inscribed angles? Explain.

   Answer: The angles would be inscribed angles since the vertices are on the circle and the sides of the angles are chords of circle *Q*. The vertex of a central angle is at the center of the circle.

2. What is the relationship between the measures of the angles *A*, *B*, *C*, *D*, and *E* and the arcs they intercept? Explain.

   Answer: A central angle has the same degree measure as the arc it intercepts. An inscribed angle is half the degree measure of the central angle. Therefore, the degree measures of the inscribed angles of circle *Q* are half the measures of the arcs they intercept.

Teacher Tip: Students may need help coming to this conclusion. Providing a hint such as using the relationship between the measures of central angles and the arcs they intercept may be helpful.

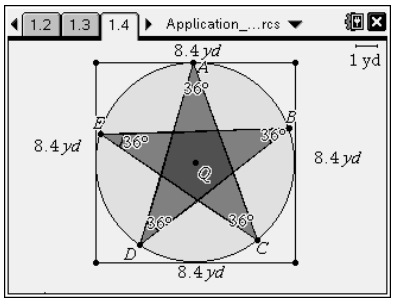
3. Would the arcs intercepted by each of the angles *A*, *B*, *C*, *D*, and *E* be considered major arcs or minor arcs? Explain.

   Answer: A major arc is a part of a circle that measures between 180 and 360 degrees. A minor arc measures less than 180 degrees. Therefore, the arcs intercepted by each of the angles would be minor arcs.

4. In order for the star pattern to be uniform, each of the angles should have the same degree measure. What should be the degree measure of each of the angles *A*, *B*, *C*, *D*, and *E*? Explain your reasoning.

   Answer: Since 360 degrees represents the circle and there are 5 angles, divide 360 by 5 to get 72 degrees. An inscribed angle is half the measure of the intercepted arc. Divide 72 by 2 to get 36 degrees. Each of the angles should measure 36 degrees.

5. Grab and move points *A*, *B*, *C*, *D*, and *E* around the circle until all angle measures are the same. What is the degree measure? Is this what you expected? Explain.



   Sample Answer: The degree measure of each of the five angles is 36 degrees. This result will correspond with the answer to Question 4, if students answered correctly.

6. What is the diameter of circle *Q*? Explain your reasoning.

   Answer: By looking at the diagram and visualizing a diameter of circle *Q* that is parallel with two sides of the square, it appears as though the diameter will be the same as the length of the sides of the square in which it is inscribed.

Check your answer to Question 6 by using the **Segment** tool (**MENU > Points & Lines > Segment**) to create a segment that represents the diameter of circle *Q*. Use the **Length** tool (**MENU > Measurement > Length**) to find the length of the segment. Change the **Attributes** (**MENU > Actions > Attributes**) of the measurement to one decimal place.

7. Given that the circumference of a circle can be found by using the formula $C = 2\pi r$, where r is the radius, find the circumference of circle Q to the nearest yard. Show your work below.

Answer: $C = 2\pi r = 2 \cdot \pi \cdot 4.2 = 26.389 = 26$ yd

Check your answer to Question 7 by using the **Length** tool to find the length of circle Q. Change the **Attributes** of the measurement to display zero decimals.

8. Given that the area of a circle can be found by using the formula $A = \pi r^2$, where r is the radius, find the area of circle Q to the nearest yard. Show your work below.

Answer: $A = \pi r^2 = \pi \cdot 4.22 = 55.418 = 55$ yd^2

Check your answer to Question 8 by using the **Area** tool **(MENU > Measurement > Area)** to find the area of circle Q. Change the **Attributes** of the measurement to display zero decimals.

9. Given that the pavers being used to construct the courtyard are squares with side lengths of 10 inches, how many pavers will need to be ordered to construct the courtyard? (1 yd^2 = 1,296 in.^{2})

Answer: First, convert the area of the circle to inches, since the pavers are given in units of inches, and then divide by 100 since the pavers are 10-inch squares. At least 713 pavers would need to be ordered to construct the courtyard.

$$\frac{1{,}296 \text{ in.}^2}{1 \text{ yd}^2} \cdot 55 \text{ yd}^2 = 71{,}280 \text{ in.}^2 \div 100 \text{ in.}^2 = 712.8$$

Wrap Up

Upon completion of the discussion, the teacher should ensure that students understand:

- The difference between central angles and inscribed angles of a circle.
- The relationship between the measure of inscribed angles and the arcs they intercept.
- The difference between a major arc and a minor arc.
- How to identify the diameter of a circle.
- The relationship between the diameter and radius of a circle.
- How to find the circumference and area of a circle.

Assessment

Complete a similar problem by changing the dimensions of the square in which the circle is inscribed, or have students design their own courtyard using both inscribed and central angles.