Spark Your Learning • Student Samples

During the *Spark Your Learning***, listen and watch for strategies students use. See samples of student work on this page.**

Reason with Circumference and Density   Strategy 1

For any row, the length is given by πr because each row is a semicircle. I can then find the total length of all the rows and divide that into seats of equal size to determine the number of people that can be seated in the amphitheater because there can be 1 person for every 2 feet. The number of people that can be seated in the amphitheater is approximately 4650 people.

If students . . . reason with circumference and density, they are demonstrating an understanding of population density from Lesson 1.4.

Have these students . . . explain how they chose to consider the length of a semicircular row and how they determined the density. **Ask:**

Q How did you know to use the circumference formula to help you find the length of each row?

Q What was your reasoning to determine the density of people per length of row?

Reason with a Scale Drawing   Strategy 2

I would create a scale drawing of the middle row where 1 foot is represented by 2 millimeters. Then mark off every 2 feet to determine the number of people in the middle row and use that to find the total for all 30 rows. The number of people that can be seated in the amphitheater is approximately 4650 people.

If students . . . reason with a scale drawing, they are demonstrating that they understand how a length can be divided into congruent segments, but they may not realize that their process is inefficient.

Activate prior knowledge . . . by having students determine the length of a semicircular row before drawing it. **Ask:**

Q How can you determine the length of a semicircular row before you draw it?

Q How can you determine how many seats would fit along that row if you know the total length of the row and the length of each seat?

COMMON ERROR: Uses Circumference

The circumference of each row is given by 2πr so I can use that to determine the total length of the rows. The number of people that can be seated in the amphitheater is approximately 4650 people.

If students . . . use the circumference formula, they may not understand that the formula needs to be modified for this situation.

Then intervene . . . by pointing out that each row is a semicircle so the length is only half of the circumference of a corresponding circle. **Ask:**

Q How can you describe the relationship between the length of each semicircular row and the circumference of a corresponding circle?

Q How do you think that the formula for circumference should be modified to obtain a formula for the length of a semicircular row?

HMH

Central Angles and Inscribed Angles

(I Can) determine the measures of central angles, inscribed angles, and arcs of a circle.

Spark Your Learning

An outdoor amphitheater has semicircular rows of seating around a semicircular stage. The tickets for the next performance have been sold out.

Complete Part A as a whole class. Then complete Parts B–C in small groups.

A. What is a mathematical question you can ask about this situation? What information would you need to know to answer your question?

B. To answer your question, what strategy and tool would you use along with all the information you have? What answer do you get?
See Strategies 1 and 2 on the facing page.

C. Does your answer make sense in the context of the situation? How do you know? **yes; on average, each row can seat approximately 155 people and there are 30 rows.**

A. **How many people can be seated in the amphitheater?; the number of rows, how the rows increase in length, how much space should be allowed per person.**

Turn and Talk How much space would each attendee have if only $\frac{3}{4}$ of all tickets are sold? Explain. **See margin.**

(EL) SUPPORT SENSE-MAKING • Three Reads

Tell students to read the information in the photo three times and prompt them with a different question each time.

1 What is the situation about? The situation is about determining the number people that can be seated in the amphitheater.

2 What are the quantities in this situation? How are those quantities related? The quantities are the radius of each row, the distance between each row, the length of each row, the distance between each seat, and the number of people that can be seated in the amphitheater. Because each row is a semicircle, the length of each row can be found by determining the circumference of each circular row and then dividing it in half. The number of people that can be seated in the amphitheater can be found by determining the total length of all rows and then dividing it into seats of equal sizes.

3 What are possible questions you could ask about this situation? Are all the rows and seats equally spaced? What is the distance between each seat? Can people be seated in areas that are not shown in the photo? How big are the aisles? What is the length of each row? How many people can sit in each row?

---

① Spark Your Learning

▶ MOTIVATE

- Have students look at the photo in their books and read the information contained in the photo. Then complete Part A as a whole-class discussion.
- Give the class the additional information they need to solve the problem. This information is available online as a printable and projectable page in the Teacher Resources.
- Have students work in small groups to complete Parts B and C.

▶ PERSEVERE

If students need support, guide them by asking:

Q Advancing • Use Tools Which tool could you use to solve the problem? Why choose that tool and not some other? Students' choices of tools and reasons for choosing them will vary.

Q Assessing How much space will be between people sitting in the same row and between people sitting in adjacent rows? The distance between people sitting in adjacent rows is 3 feet. It is reasonable to assume that each person would also take up approximately 2 feet along the row that they are sitting in.

Q Assessing As you move from row to row, how does the length of each row change? The radius of each semicircular row increases by 3 feet from the previous row. Then, the length of each successive row increases by 6π feet.

Q Advancing How you can you determine the number of people in the nth row? The radius of the nth row is given by $r_n = 60 + 3(n - 1)$. The number of people in the nth row is then approximately $\frac{2\pi[60 + (3n - 1)]}{3}$.

Turn and Talk Ask students to start by estimating how the amount of space for each attendee would change. If less tickets were sold, would each attendee have more space or less space? If only $\frac{3}{4}$ of the tickets were sold, how would each attendee's amount of space change? They would have more space. The amount of space would increase by 25%.

▶ BUILD SHARED UNDERSTANDING

Select groups of students who used various strategies and tools to share with the class how they solved the problem. As they present their solutions, have each group discuss why they chose a specific strategy and tool.

HMH