



Circles and Ratio

Topic 1 Overview



How is *Circles and Ratio* organized?

In this topic, students develop formulas for the circumference and area of circles and use those formulas to solve mathematical and real-world problems. Students begin the topic reviewing terminology of circles and creating ratios of the measures of the distance around and across different circles. After noting that this ratio is always the same, the value of the ratio, pi (π), is introduced. Students develop an understanding of the irrational number pi (π) as the ratio of a circle's circumference to its diameter. They then work backwards to write an equation for the circumference of a circle. Next, students decompose a circle and rearrange the pieces to form a familiar shape to derive the formula for the area of a circle. Throughout the topic, students practice applying the formulas for the circumference and area of a circle, including selecting the appropriate formula, to solve mathematical and real-world problems.

What is the entry point for students?

Throughout elementary school, students used and labeled circles and determined the perimeters of shapes formed with straight lines. In grade 6, students worked extensively with ratio and ratio reasoning.

To begin this topic, students draw on these experiences as they use physical tools to investigate a constant ratio, pi. They form ratios of the distance around circles to the distance across circles. As they engage in this investigation, students review basic ideas of ratios and proportional relationships.



How does a student demonstrate understanding?

Students will demonstrate understanding of the standards in this topic if they can:

- Describe pi (π) as the ratio of the circumference to the diameter of a circle.
- Use models to derive and explain the relationship between circumference and area of a circle.
- Justify the formulas for area and circumference of a circle and how they relate to pi (π).
- Apply the circumference and area formulas to solve mathematical and real-world problems.

Why is *Circles and Ratio* important?

This topic provides a solid bridge between the mathematical work with ratio, equations, and area from grade 6 with related work around proportional reasoning and the area and circumference of circles in grade 7. This

early review of and experience with ratios prepares students for the remainder of the module. Students move from concrete representations and reasoning about ratios and proportions to more abstract and symbolic work with solving and representing proportional relationships. Pi, although not named as an irrational number in this topic, is the first irrational number students encounter. In future grades, students will use the circumference and area formulas of circles to calculate surface areas and volumes of cylinders and composite three-dimensional shapes that include circles.



How do the activities in *Circles and Ratio* promote student expertise in the mathematical process standards?

All Carnegie Learning topics are written with the goal of creating mathematical thinkers who are active participants in class discourse, so the mathematical process standards should be evident in all lessons. Students are expected to make sense of problems and work towards solutions, reason using concrete and abstract ideas, and communicate their thinking while

providing a critical ear to the thinking of others.

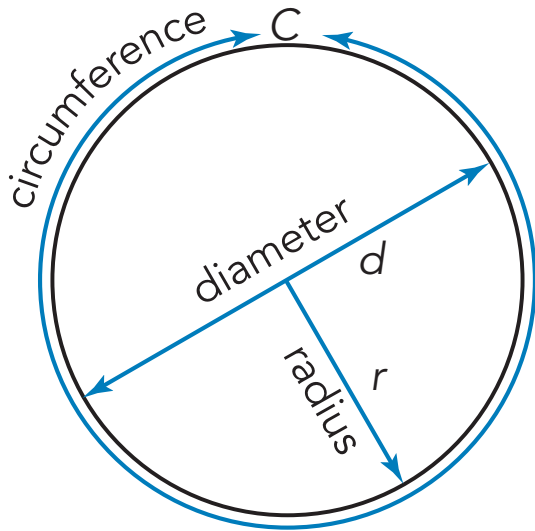
Composing and decomposing circles and composite figures with circular parts is a theme in this topic. Students are expected to recognize that objects and expressions can be decomposed and composed to reveal new details. For instance, cutting a circle into wedges and rearranging them to form a pseudo-parallelogram leads to a strategy for determining the area of a circle. Also, rearranging the proportion that includes the ratios of distances around and across circles yields the formula for the circumference of a circle. Students are also expected to reason about the ratio relationship, the relationship between circumference and area, and the relationships among the shapes in composite figures as they calculate areas of the figures.

Materials Needed

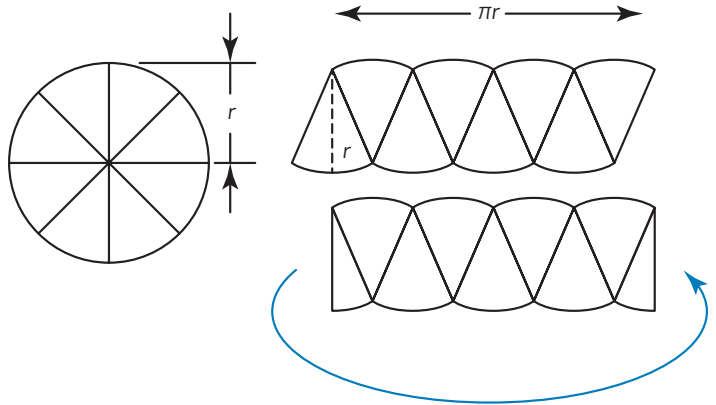
- Centimeter rulers
- String
- Compasses
- Scissors
- Calculator with π key

Visual Representations Used

Labeled Circle



Relationship between Circumference and Area







Learning Together

ELPS: 1.A, 1.C, 1.E, 1.F, 1.G, 2.C, 2.E, 2.I, 3.D, 3.E, 4.B, 4.C, 4.D, 4.J, 5.B, 5.F, 5.G

Lesson	Lesson Name	TEKS	Days	Highlights
1	Pi: The Ultimate Ratio: Exploring the Ratio of Circle Circumference to Diameter	7.5B 7.8C 7.9B	2	Students explore the relationship between the distance around a circle and the distance across a circle. They learn the terms <i>circumference</i> , <i>diameter</i> , and <i>radius</i> . Students use hands-on tools to measure the distances and compare the ratio of the circumference to the length of the diameter. They then use a compass to create their own circles and realize that for every circle the ratio of circumference to diameter is pi. Students practice solving for the diameter or the circumference in problems.
2	That's a Spicy Pizza: Area of Circles	7.4B 7.8C 7.9B	2	Students explore the area of a circle in terms of its circumference. They cut a circle into sectors and fit the sectors together to form a parallelogram. The parallelogram helps students see the area of a circle in relation to its circumference: Students derive the area for a circle and then solve problems using the formulas for the circumference and area of circles.
3	Circular Reasoning: Solving Area and Circumference Problems	7.9B 7.9C	2	Students use the area of a circle formula and the circumference formula to solve for unknown measurements in problem situations. Some of the situations are problems composed of more than one figure, and some of the situations include shaded and non-shaded regions. Students then determine whether to use the circumference or area formula to solve problems involving circles.

Suggested Topic Plan

*1 Day Pacing = 45 min. Session

Day 1	Day 2	Day 3	Day 4	Day 5
<p>TEKS: 7.5B, 7.8C, 7.9B</p> <p>LESSON 1 Pi: The Ultimate Ratio GETTING STARTED ACTIVITY 1 ACTIVITY 2</p>	<p>LESSON 1 continued ACTIVITY 3 TALK THE TALK</p>	<p>TEKS: 7.4B, 7.8C, 7.9B</p> <p>LESSON 2 That's a Spicy Pizza! GETTING STARTED ACTIVITY 1</p>	<p>LESSON 2 continued ACTIVITY 2 ACTIVITY 3 TALK THE TALK</p>	 <p>MATHia[®] Use LiveLab and Reports to monitor students' progress</p>
Day 6	Day 7	Day 8	Day 9	
<p>TEKS: 7.9B, 7.9C</p> <p>LESSON 3 Circular Reasoning GETTING STARTED ACTIVITY 1 ACTIVITY 2</p>	<p>LESSON 3 continued ACTIVITY 3 TALK THE TALK</p>	 <p>MATHia[®] Use LiveLab and Reports to monitor students' progress</p>	<p>END OF TOPIC ASSESSMENT</p>	

Assessments

There is one assessment aligned to this topic: End of Topic Assessment.