Circles and Ratio
Topic 1 Overview

8 Days

How is *Circles and Ratio* organized?

In *Circles and Ratio*, 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 *Circles and Ratio*, 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 *Circles and Ratio* if they can:
- Explain pi (π) as the ratio of the circumference and diameter of a circle.
- 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?

As the first topic in Course 2, *Circles and Ratio* 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 as 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 numbers students encounter. The distinction between rational and irrational numbers will be further addressed in Module 2, Topic 2 *Multiplying and Dividing Rational Numbers*. 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 practice standards?

All Carnegie Learning topics are written with the goal of creating mathematical thinkers who are active participants in class discourse, so elements of the habits of mind 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 shapes, numbers, and expressions continues to be a theme throughout this course. 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

Digital Access

For all digital files aligned to this topic, login at www.carnegielearning.com/c2.

Learning Together: 5 Days

| Lesson	Lesson Name	Standards	Days	Highlights	Spaced Review
1.1	Pi: The Ultimate Ratio Exploring the Ratio of Circle Circumference to Diameter	7.G.4	2	Students explore the relationships between the distance around a circle and the distance across the circle. They notice that the ratio is always constant, leading to the formula $C = \pi d$.	6.RP.3b 6.RP.3d 6.SP.5c
1.2	That's a Spicy Pizza! Area of Circles	7.G.4	2	Students explore the area of a circle in terms of its circumference. They derive the area for a circle and then solve problems using the formulas for the circumference and area formulas for circles	6.RP.2 7.G.4
1.3	Circular Reasoning Solving Area and Circumference Problems	7.G.4	2	Students use the area of a circle formula and the circumference formula to solve for unknown measurements in problem situations.	6.RP.2 7.G.4

Visual Representations Used

Labeled Circle
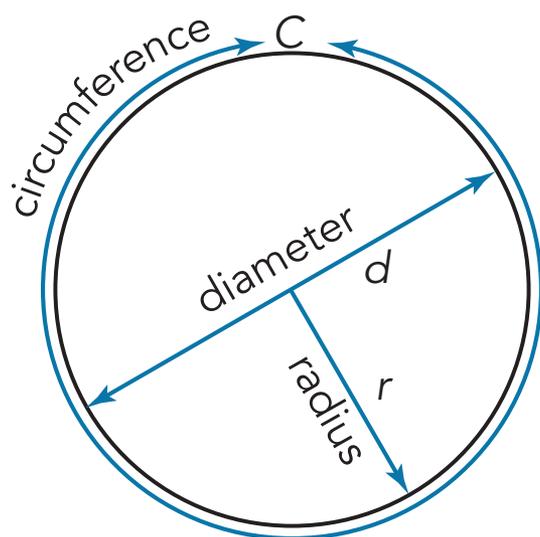
Relationship between Circumference and Area
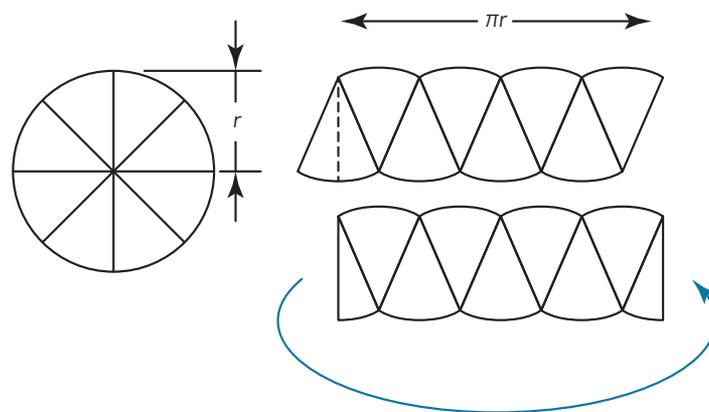
Learning Individually with MATHia: Approximately 2 Days

In the MATHia software, students practice solving problems involving area and circumference of circles.

At Carnegie Learning, we believe it is our responsibility to continuously enhance MATHia to better support your students' learning needs. We leverage the learning data in MATHia to regularly improve both the learning experience and content. To get the latest MATHia content alignment map, please go to: www.carnegielearning.com/c2/mag.

Learning Individually with Skills Practice: Approximately 2 Days

Problem Set	Overview
Identifying Parts of a Circle and Congruent Circles	Students identify parts of the circles and determine if circles are congruent.
Calculating Circumference and Area of Circles	Students determine the circumference and area of circles. They use the formulas for circumference and area to solve a variety of problems.

Assessments

There are six assessments aligned to this topic: a Pre-test, a Post-test, End of Topic Test (Form A and Form B), Standardized Test Practice, and a Performance Task.

Log into your account at CarnegieLearning.com to access Edulastic, an online assessment tool, and Lessoneer.com, an online implementation platform.