STEMscopes™
MATH

Take & Teach

Accelerate LEARNING
THE LEADER in STEM EDUCATION

What's Inside This Sample Lesson?

- A fully guided **Explore activity** written to meet rigorous state and national standards
- **Teacher Edition** pages, **Student Workbook** pages, and **other helpful resources** to fully experience a STEMscopes Math Explore activity
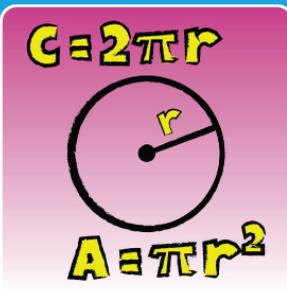
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Grade 7, Circles - Explore 1

Go Online!

Explore the digital resources for this lesson.

GRADE 7

CIRCLES

$C = 2\pi r$

$A = \pi r^2$

FOCUS STANDARDS

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between circumference and area of a circle.

ENGAGE ACTIVITIES

ACCESSING PRIOR KNOWLEDGE - FACT OR FICTION

Students engage in a dynamic exercise to differentiate between fact and fiction related to mathematical concepts, helping to identify and address misconceptions.

- Students listen to prompts and decide if they are fact or fiction by moving to designated sides of the classroom.
- The activity encourages peer discussion to explore and justify their reasoning.
- It is designed to uncover misconceptions, not as a summative assessment.
- Teachers can use this exercise to identify gaps in understanding and provide additional instruction if needed.

HOOK

Students explore the mathematical concepts of area and circumference by applying them to real-world scenarios involving pizzas.

- Students begin by observing a phenomenon and discussing the mathematical elements they notice.
- They are introduced to a scenario involving a pizza shop, where they must determine the amount of sauce and butter needed for pizzas of various sizes.
- Through guided questions and exploration, students use equations to calculate the area and circumference of circles, enhancing their understanding of these concepts.
- After completing related activities, students revisit the scenario to apply their new knowledge, discussing and justifying their calculations and potential pricing strategies.

EXPLORE ACTIVITIES

JUMP IN HERE

EXPLORE 1 - DISCOVERING CIRCUMFERENCE

Students explore the fundamental components of a circle and their relationships through hands-on group work.

- Students identify and label the radius, diameter, and circumference of a circle using definition cards and colored pencils.
- They measure and record the diameter and circumference of various-sized pizza models to discover the value of pi.
- Through guided questions and group discussions, students deepen their understanding of circle properties and the constant pi.
- The activity concludes with a Math Chat and an Exit Ticket to assess comprehension and facilitate reflection.

EXPLORE 2 - CIRCUMFERENCE

Students explore the concept of circumference using pi (π) to solve mathematical and real-world problems related to circles.

- Students work in groups to measure and calculate the circumference of a circle using string and a pizza cut-out.
- They explore the relationship between a circle's diameter and its circumference, discovering that it takes a little over three diameters to equal the circumference.
- Students apply their understanding by matching pizza images with circumference equations and calculating the circumference for each.
- The activity concludes with a Math Chat to discuss observations and strategies, followed by an Exit Ticket to assess understanding.

### EXPLORE 3 - AREA OF A CIRCLE

Students explore the concept of calculating the area of a circle through hands-on group work and real-world applications.

- Students decompose a circle into sectors to approximate the area formula by rearranging it into a parallelogram shape.
- They apply the area formula to solve practical problems, such as calculating the area needed for different sizes of pizzas.
- Group discussions and guided questions help reinforce understanding of the relationship between a circle's radius, diameter, and area.
- The activity concludes with a Math Chat and an Exit Ticket to assess students' comprehension and encourage reflection on their learning process.

EXPLORE 4 - AREA AND CIRCUMFERENCE PROBLEM SOLVING

Students explore the concepts of circumference and area of a circle through a real-world scenario involving pizza making.

- Students work in groups to determine when to calculate the circumference versus the area of a circle.
- They complete a Student Journal to document their understanding and reflections.
- A Math Chat allows students to discuss and compare strategies for using circumference and area formulas.
- The activity concludes with an Exit Ticket to assess students' grasp of the concepts.

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CIRCLES **GRADE 7**

SCOPE **BIG IDEAS**
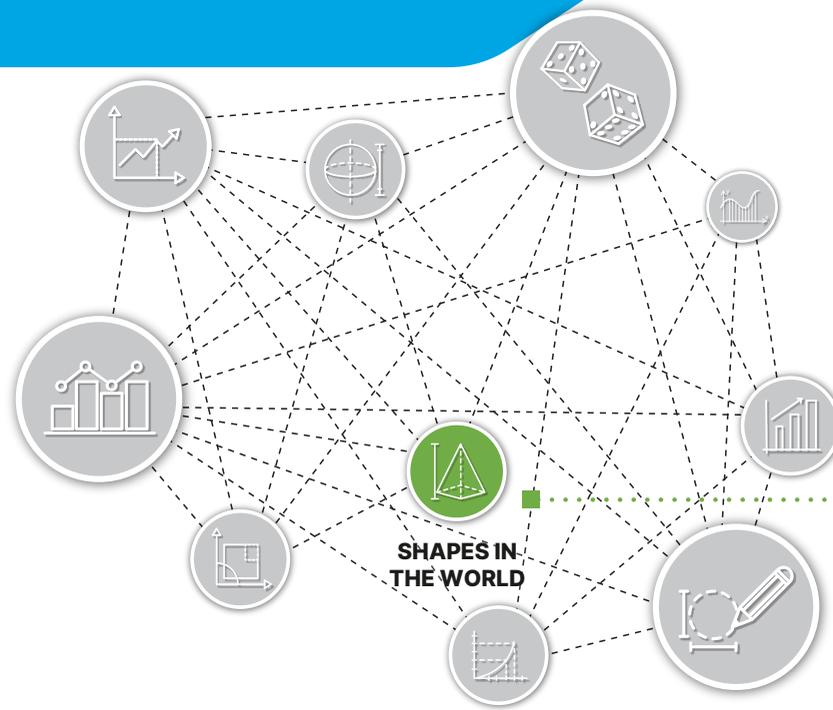
Students learn to identify and label the components of a circle, including the radius, diameter, and circumference. They explore how these components relate to each other and apply these concepts to solve real-world problems. For instance, students use the formula for circumference to determine the perimeter of circular objects like pizza pans, wheels, or garden beds. This foundational knowledge is applicable to real-world situations, such as calculating the required materials for circular objects or understanding the properties of circular designs.

SHAPES IN THE WORLD

KEY CONCEPTS

- I can discover and explain the formulas for area and circumference of a circle.
- I can use the formulas for area and circumference of a circle to solve real-world and mathematical problems.
- I can describe the relationship between circumference and area of a circle.
- I can describe the relationship between radius and diameter.
- I can describe the ratio of circumference and diameter.

FUNDAMENTAL QUESTIONS

- Define the formulas for circumference and area of a circle.
- Describe the relationship between area and circumference of a circle, including their similarities and differences.
- What is the ratio of circumference to diameter equal to?
- What is the relationship between radius and diameter?

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CIRCLES　**GRADE 7**

EXPLORE > EXPLORE 1

INSTRUCTIONAL LESSON

EXPLORE 1 - DISCOVERING CIRCUMFERENCE

Standard(s)

- **Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Big Ideas	Standards for Mathematical Practice	Content Connections	Drivers of Investigation
Shapes in the World	**MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	**CC3** Taking Wholes Apart, Putting Parts Together **CC4** Discovering Shape and Space	**DI1** Make Sense of the World (Understand and Explain)

DESCRIPTION

The students will identify and label the radius, diameter, and circumference of a circle and determine the relationships between them.

MATERIALS

PRINTED

- 1 Student Journal (per student)
- 1 Set of Definition Cards (per group)
- 1 Set of Pizza Cards (per group)
- 1 Exit Ticket (per student)

REUSABLE (PER GROUP)

- 1 Gallon-size resealable bag (per group)
- 1 Resealable bag (per group)
- 1 Piece of string (per group)
- 1 Ruler (per group)
- 1 Red colored pencil (per group)
- 1 Blue colored pencil (per group)
- 1 Green colored pencil (per group)

PREPARATION

- Plan to divide the class into groups of three or four to complete this activity.
- Print the Student Journal and Exit Ticket for each student.

PART I

- Label a resealable bag "Part 1" for each group.

- Print one set of the Definition Cards for each group. Cut out cards, and place each set in the resealable bag. If desired, print on card stock and laminate for future use.
- Gather enough red, blue, and green colored pencils for each group to use one of each color. Add each set of colored pencils to the resealable bag of Definition Cards.

PART II

- Label a gallon-sized resealable bag "Part 2" for each group.
- Print one set of the Pizza Cards for each group. Cut out the Pizza Cards along the dashed line. Place each set in the gallon-sized resealable bag labeled "Part 2." If desired, print on card stock and laminate for future use.
- Cut a piece of string at least the length of the circumference of the largest pizza. Optionally, cut strings the length of the circumference of each pizza. Place the string in the gallon-size resealable bag labeled "Part 2."
- Gather enough rulers for each group to have one.

PROCEDURE AND FACILITATION POINTS

PART I: PARTS OF A CIRCLE

1. Read the following scenario to students: *Diego recently decided to open a pizzeria in his community. As the owner of the pizzeria, it is his responsibility to teach his employees how to make pizza. Diego's pizzeria is making pizzas shaped like circles and he needs your help to identify the parts of a circle and to understand the relationship between them so that each pizza is the perfect shape and size.*

GRADE 7 CIRCLES

EXPLORE > EXPLORE 1

2. Give 1 Set of Definition Cards to each group.

3. Give the Student Journal to each student.

4. Have students work in their groups to identify and label the parts of a circle based on the provided definitions. Then students will trace them on the circle using the colored pencils.

5. Monitor and talk with students as needed to check for understanding by using guiding questions.

   a. **DOK-1** What are the different parts of a circle? Responses will vary. The four parts of a circle are the center, radius, diameter, and circumference.

   b. **DOK-2** If the radius of a circle is 3 inches, what is the circle's diameter? Responses will vary. The diameter would be 6 inches, since the diameter is twice the length of the radius.

   c. **DOK-2** Why is the center a key feature of a circle? Responses will vary. One of the endpoints of the radius is the center, while the diameter must pass through the center.

6. Allow time for students to complete Part I of the Student Journal, including the reflection questions.

7. After Part I, invite the class to a Math Chat to share their observations and learning.

💡 **Explore**

Circles
Explore 1

Diego's Pizzeria
The pizza makers have learned how to make their first pizza and have recorded measurements for the pizza. The measurements are 14 inches, 44 inches, and 7 inches.
What parts of the circle could be represented by each measurement? Explain.
7 inches is the smallest measurement and is the radius.
14 inches is twice the size of the radius, so this is the diameter.
44 inches is the largest measurement and represents the circumference, the distance around the pizza.

Reflect

1. What is the relationship between the circle's radius and its diameter?

   The radius goes halfway across the circle. It starts at the center of the circle and goes to the edge of the circle. The diameter goes all the way across the circle. Both of its endpoints are on the edge of circle, and it goes through the center of the circle.

2. Do you think there is a relationship between the circle's diameter and its circumference?

   Answers will vary. Some students will say yes. Others will say no. This question will lead into Part 2 of this Explore.

2

💡 **Explore**

Circles
Explore 1

Name:_____ Date:_____

Opening a Pizzeria

Part I

Every pizza made and sold at the pizzeria will be in the shape of a circle. Use the definition cards to identify and label the center, radius, diameter, and circumference of the circle below.

circumference

diameter

center

radius

1

**STUDENT JOURNAL
ANSWER KEY**

💡 **Explore**

Circles
Explore 1

Part II

The pizzeria will make and sell 4 different-sized pizzas: a small pizza, a medium pizza, a large pizza, and a mega pizza. Use a ruler to measure the diameter, and use string to measure the circumference of each pizza on the pizza cards to the nearest inch. Use the measurements to complete the table below. Round your answer to the nearest hundredth.

Pizza Size	Diameter	Circumference	Circumference/Diameter	Decimal Form
Small	3 in.	9 in.	$\frac{9}{3}$	3
Medium	4 in.	13 in.	$\frac{13}{4}$	3.25
Large	5 in.	16 in.	$\frac{16}{5}$	3.20
Mega	7 in.	22 in.	$\frac{22}{7}$	3.14

Reflect

1. What do you notice about the information in the table?

   Answers may vary, but students should notice that the circumference-to-diameter ratios all represent about 3.14 even though each pizza has a different diameter and different circumference.

2. Do you think there is a relationship between a circle's diameter and its circumference? If so, what is it?

   Yes, when you divide the circumference by the diameter, it equals about 3.14. The circumference is about 3 times the length of the diameter.

**STUDENT JOURNAL
ANSWER KEY**

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Explore

Name:_____ Date:_____

Circles
Explore 1

Pepperoni Pizza
Exit Ticket

Diego is trying out a new size of pizza for his pizzeria. Label the parts of the pizza. Use a ruler to measure the diameter and use string to measure the circumference of the pizza to the nearest inch. Use the measurements to complete the table below. Round your answer to the nearest hundredth.

circumference

diameter

radius

Diameter	Circumference	Circumference / Diameter	Decimal Form
5 in.	16 in.	$\frac{16}{5}$	3.20 in.

1

EXIT TICKET
ANSWER KEY

MATH CHAT

- **DOK-1** In your own words, what are the different parts of a circle? The center is the most inside point of a circle. There is an equal distance from the center to any point on the circle. The radius is the length from the center to any point on the circle. The diameter is the distance from one point on the circle, through the center to the opposite side point.

- **DOK-2** If the length of a circle's radius is given, how can you determine the length of the diameter? We can multiply the length of the radius by 2 to get the length of the diameter.

- **DOK-2** What if the length of a circle's diameter is given, how can you determine the length of the radius? We can divide the length of the diameter by 2 to get the length of the radius.

- **DOK-3** Outside of the math classroom and not using the pizza example, where else might you see a diameter or radius? A real-life example of a radius would be a spoke on a bicycle tire or the distance from the center of a bicycle wheel to the tire. A real-life example of a diameter would be the distance from one Ferris wheel pod to the pod on the opposite side of the Ferris wheel.

PART II: DISCOVERING PI AS A CONSTANT

1. Read the following scenario to the students: *Diego's Pizzeria will make and sell 4 different-sized pizzas: small, medium, large, and the mega pizza. Help Diego and his pizza makers measure the diameter and circumference of each pizza to determine what size each pizza should be. Record the measurements, and complete the table in your Student Journal.*

2. Give a bag of Pizza Cards and string and a ruler to each group.

3. Have students work in their groups to measure and record the diameter of each pizza using the provided ruler. Students will use the provided string to measure the circumference of each circle by laying the string along the edge of each circle. Students will measure this distance around the circle using the ruler and record the length of the circumference. Students will record this data in their Student Journals. Students will then use the provided formula (circumference/diameter) to discover the value of pi (π).

4. Monitor and talk with students as needed to check for understanding by using guiding questions.

   a. **DOK-1** If pi is the ratio of the circumference to the diameter, what whole number is pi (π) closest to? Student responses will vary. Pi (π) is around 3.

   b. **DOK-2** Do you think the ratio of the circumference to its diameter would be the same as the other size pizzas, if there was a pizza with a diameter smaller than the small pizza? Responses will vary. Yes, I would expect to see the same value, around 3.14.

5. Allow time for students to complete part II of the Student Journal, including the reflection questions at the end of Part II.

6. After Part II, invite the class to a Math Chat to share their observations and learning.

MATH CHAT

- **DOK-1** Pi (π) is the ratio of a circle's circumference to its diameter. Using the last column in the table, what is the approximate value of pi? Depending how we round, the value is approximately 3.14 or a little over 3.

- **DOK-3** Outside of the math classroom, where else might you see an example of circumference in use? An example of everyday circumference is the distance a bicycle travels after one of the bicycle wheels makes one rotation.

7. When students are done, provide each student a ruler and piece of string, and have them complete the Exit Ticket to formatively assess their understanding of the concept.

GRADE 7 CIRCLES

EXPLORE > EXPLORE 1

ANCHOR CHART AND INTERACTIVE NOTEBOOK

Be sure to complete the Anchor Chart as a class. Once the class has completed the Anchor Chart, have students individually complete their Interactive Notebook.

INSTRUCTIONAL SUPPORTS

1. Some students may have difficulty reading a ruler in inches. As a pre-class activity, give each student a ruler, and project the image of a ruler on the board. Ask students to identify a specific location on the ruler such as 3.25 inches, and then show them on the board where it is located so that they can self-correct and ask questions.

2. Some students may have difficulty rounding to the nearest inch. As a pre-class activity, give each student a ruler, and project the image of a ruler on the board. Circle a number on the projected ruler such as 4.5, and discuss with the class what the nearest inch would be. Review the rules for rounding.

3. Some students may have difficulty seeing pi as a constant due to the variations in its estimates in the Explore. Have a discussion with the class about sources of error (especially due to rounding) that can contribute to the varying values of the ratio of circumference to diameter.

LANGUAGE ACQUISITION STRATEGY

The following Language Acquisition Strategy is supported in this Explore activity. See the strategies below for ways to support a student's language development.

Students will use learning techniques such as concept mapping, drawing, comparing, contrasting, memorizing, and reviewing to acquire basic and grade-level vocabulary.

Beginner: As a pre-lesson activity, provide students with manipulatives that are different shapes (i.e. circle, triangle, etc.). Each category of shape should have three sizes. Also provide labels that say: Small, Medium, Large. Ask students to categorize the shapes accordingly.

Intermediate: As a pre-lesson activity, give students three papers. On one paper they will write the word 'small' so that it is very tiny. Then they will write the word 'Large' to fill the paper. Last, they will write the word 'Medium' so that it is a size in between small and large on the third paper.

Advanced: After the lesson, ask students to draw three circles of different sizes- one small, medium, and large. Then ask them to draw a radius for each and give the radius a number value.
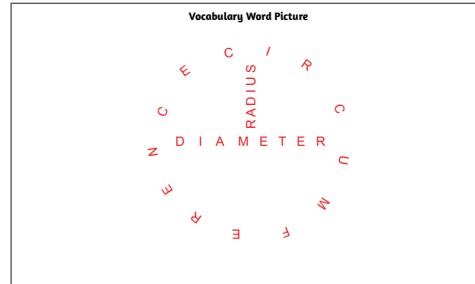
Show What You Know

Name: _____   Date: _____

Circles
Part 1

Discovering Circumference

Sara needs to create a picture of a circle by using the vocabulary words associated with circle parts. Use the words *circumference*, *diameter*, and *radius* to create that picture in the space below, and then answer the question that follows.

Vocabulary Word Picture

What is the relationship between the radius and the diameter of any circle?

Answers will vary, but should include one of the following:
1) The diameter is twice the length radius, or
2) The radius is half of the length of the diameter.

1

SHOW WHAT YOU KNOW - PART 1 ANSWER KEY
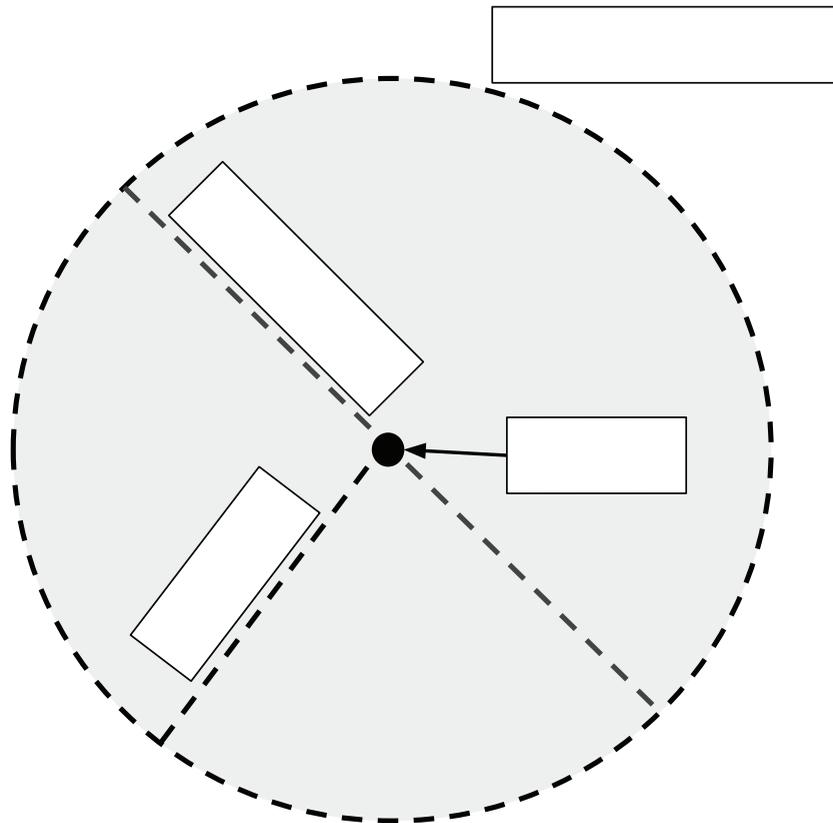
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Explore

Name:_____ Date:_____

Opening a Pizzeria

Part I

Every pizza made and sold at the pizzeria will be in the shape of a circle. Use the definition cards to identify and label the center, radius, diameter, and circumference of the circle below.

1

💡 Explore

Diego's Pizzeria
The pizza makers have learned how to make their first pizza and have recorded measurements for the pizza. The measurements are 14 inches, 44 inches, and 7 inches.
What parts of the circle could be represented by each measurement? Explain.

Reflect

1. What is the relationship between the circle's radius and its diameter?

2. Do you think there is a relationship between the circle's diameter and its circumference?

2

Explore

Part II

The pizzeria will make and sell 4 different-sized pizzas: a small pizza, a medium pizza, a large pizza, and a mega pizza. Use a ruler to measure the diameter, and use string to measure the circumference of each pizza on the pizza cards to the nearest inch. Use the measurements to complete the table below. Round your answer to the nearest hundredth.

Pizza Size	Diameter	Circumference	Circumference Diameter	Decimal Form
Small				
Medium				
Large				
Mega				

Reflect

1. What do you notice about the information in the table?

2. Do you think there is a relationship between a circle's diameter and its circumference? If so, what is it?

Explore

Name:_____ Date:_____

Pepperoni Pizza
Exit Ticket

Diego is trying out a new size of pizza for his pizzeria. Label the parts of the pizza. Use a ruler to measure the diameter and use string to measure the circumference of the pizza to the nearest inch. Use the measurements to complete the table below. Round your answer to the nearest hundredth.

Diameter	Circumference	$\dfrac{\text{Circumference}}{\text{Diameter}}$	Decimal Form

1
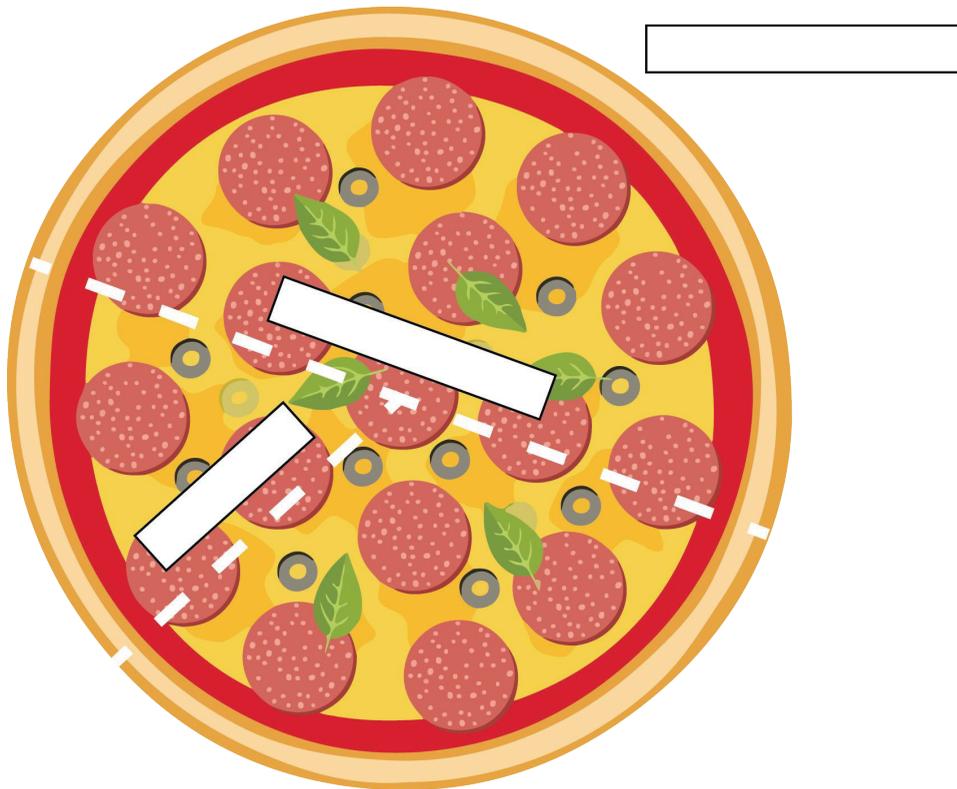
💡 **Explore**

Definition Cards

Circle

A closed round figure in which every point on the boundary is equidistant from the center

Circumference

The distance around a circle

Trace the circumference of your circle in green.

Diameter

Any straight line segment that passes through the center of the circle and has endpoints that lie on the circle

Trace the diameter of your circle in blue.

Radius

The distance from the center of a circle to any point that lies on the circle

Trace the radius of your circle in red.

1

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Explore

Pizza Card – Small Pizza
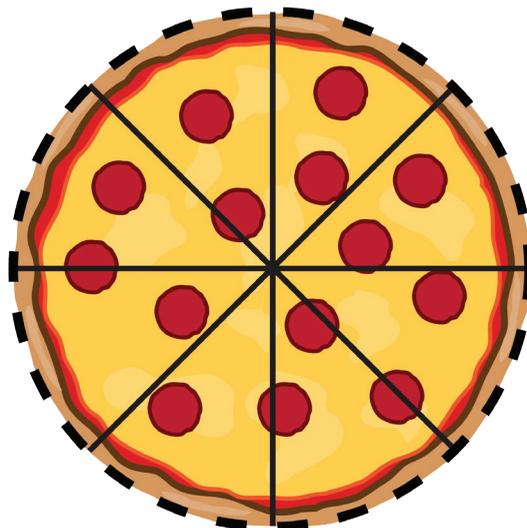
Explore

Pizza Card – Medium Pizza
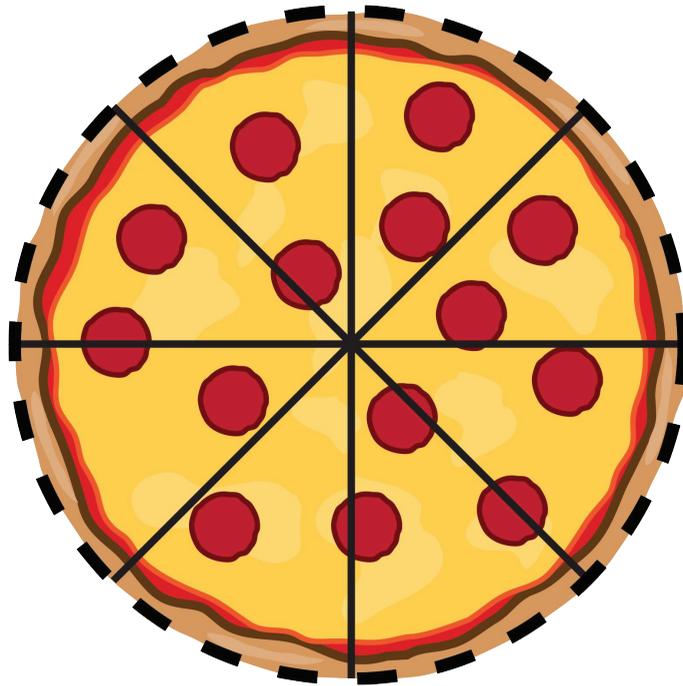
Explore

Pizza Card – Large Pizza

3
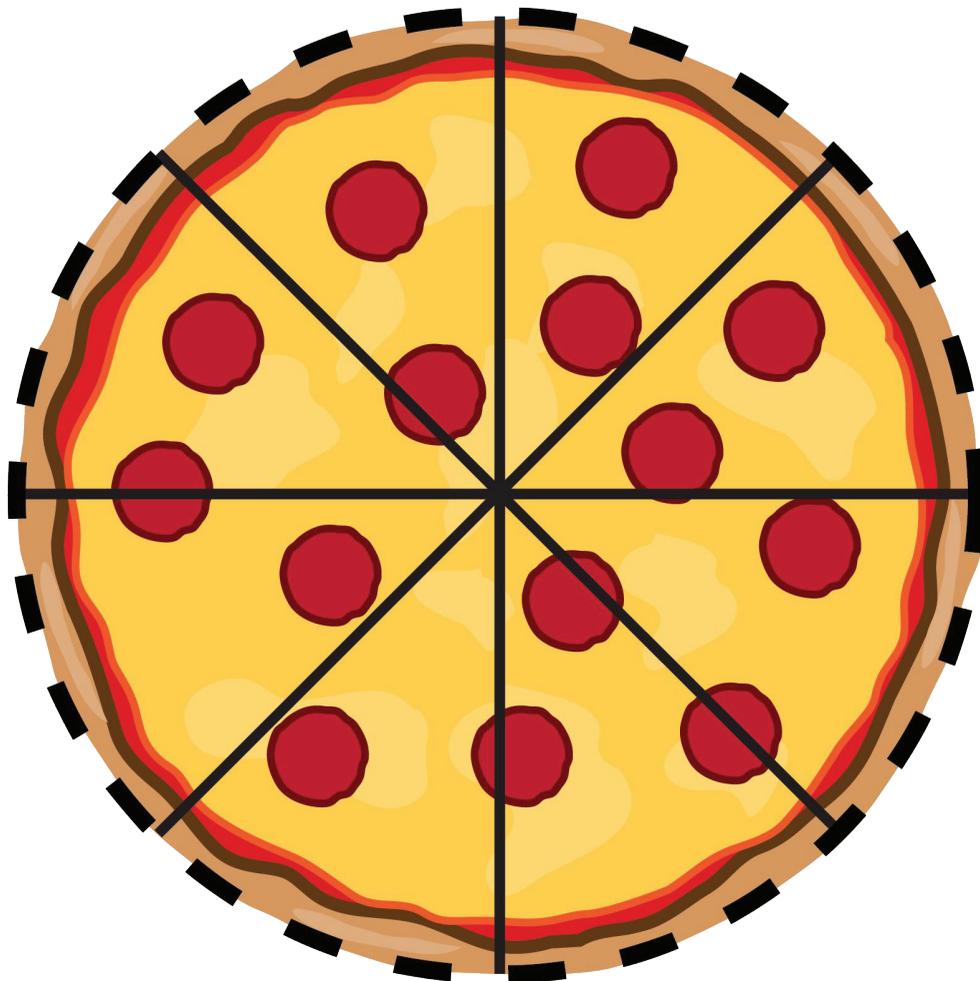
Explore

Pizza Card – Mega Pizza

4
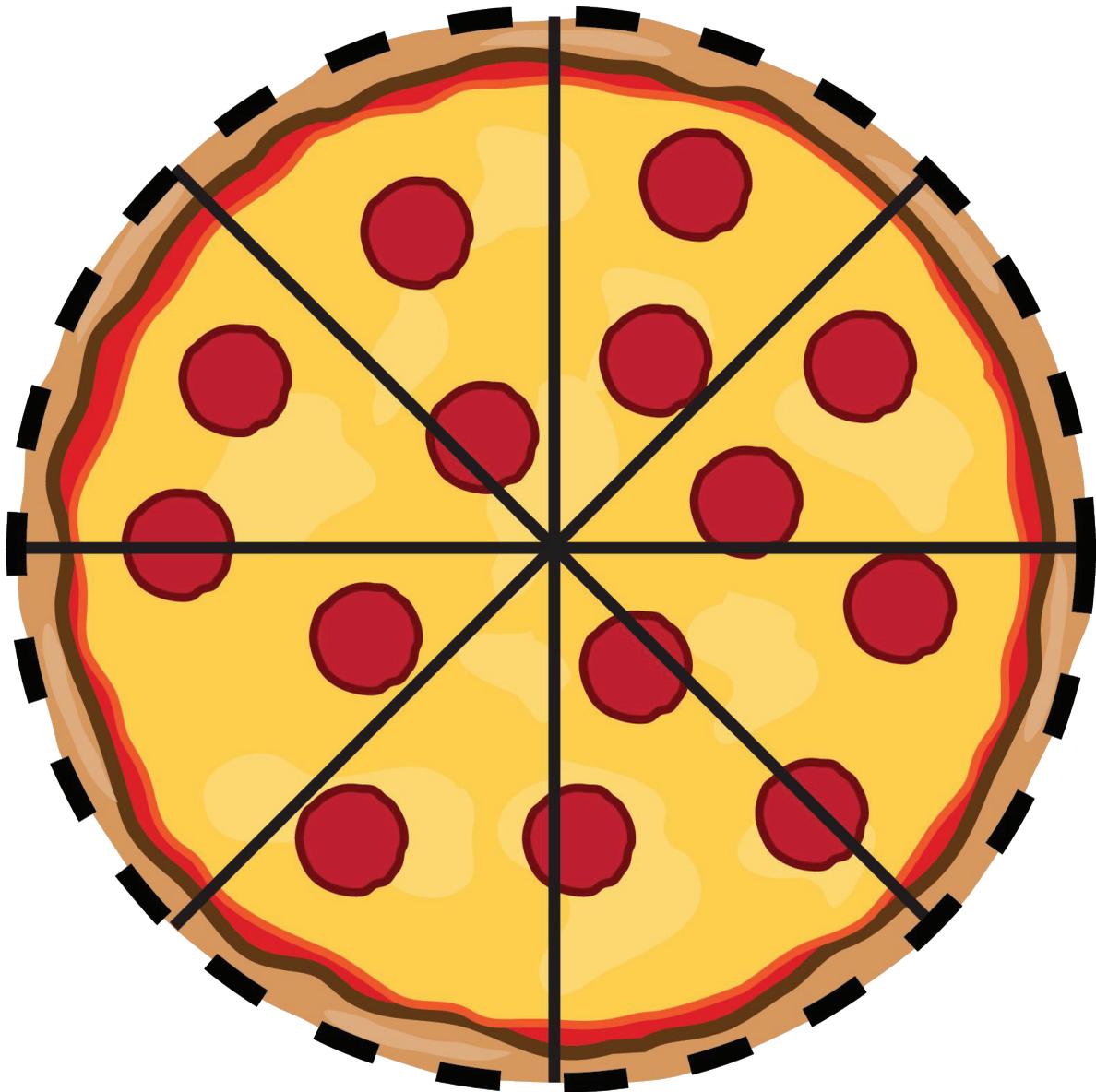
Show What You Know

Name:_____ Date:_____

Discovering Circumference

Sara needs to create a picture of a circle by using the vocabulary words associated with circle parts. Use the words *circumference*, *diameter*, and *radius* to create that picture in the space below, and then answer the question that follows.

Vocabulary Word Picture

What is the relationship between the radius and the diameter of any circle?

1

Notes

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Notes

Notes

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Scan here!

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