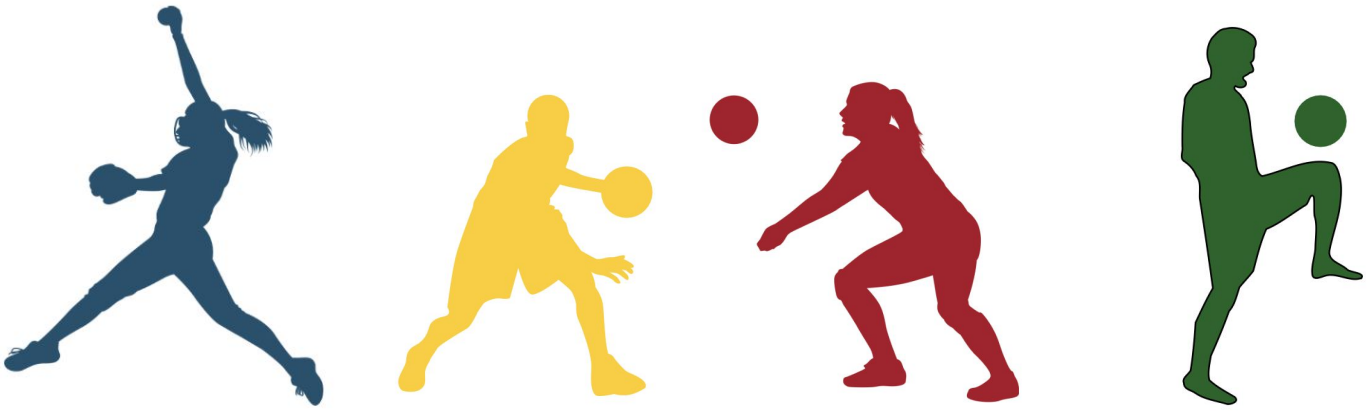
Discovering Pi - Sport Ball Exploration



Discovering Pi - Sport Ball Exploration

Students will discover the value of Pi by measuring a variety of sports balls and comparing the ratios of the circumference and diameter of each ball.

Standards

4.NBT.A.3 - Use place value understanding to round multi-digit whole numbers to any place

4.NF.C.7 - Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.

5.NBT.B.7 - Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

6.RP.A.2- Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.

7.G.B.4 - 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.

Timing
1- 60 Minute session

Materials Needed: Writing Utensil, Calculator, String, and Ruler.
Print each student the exploratory activity on page 2 and one worksheet page 3 - 5.
Answer key is pages 6 - 9.

Teachers Guide

Engage: Ask students if they have heard of "Pi Day". Do they know when it is and why it is that date.

Explore: Have students gather a variety of circular sports balls to measure. Explain to students that no matter how big or how small each ball is, they are going to find the one relationship that all of the sport balls share.

Explain: To students you are going to measure the circumference, the distance around each ball, and the diameter and the distance from one side of the ball to the other. Ask students to label these on their worksheet. Show students that measuring circular shapes is difficult because you can't just use the ruler and estimate. To ensure accuracy in measurement, model for students how to use a piece of string to measure the dimensions of the ball, and then how to measure the length of the string.
Teacher Note: Choose the units of measure you want your students to use.

Elaborate: In partners, ask students to measure each sports ball and record the results on the worksheet. What do the students notice about the relationship between circumference and diameter already?

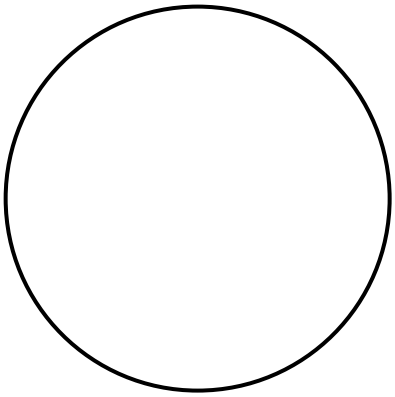
Evaluate: Ask students to analyze this relationship even further by finding the ratio of the circumference to the diameter of each ball. What ratio do they get for each ball? Ask them to find the average of these ratios.

If time allows,collect the class data for the ratio of circumference to diameter,and find the average of this data. Show students that the more data that is analyzed the closer the ratio is to the value of Pi.

Extend: Have students practice their skills by completing one of the worksheets provided (pages 3 - 5).

Discovering Pi - Sport Ball Exploration

Name:



Use the circle to draw your favorite sport ball.
Label the center, diameter, radius, and circumference.

Measure a variety of sport balls. Use the table to record the circumference and diameter.

What do you notice about the relationship between the circumference and diameter?

Sport Ball	Circumference	Diameter

Sport Ball	Ratio

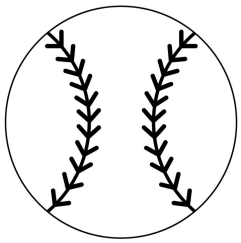
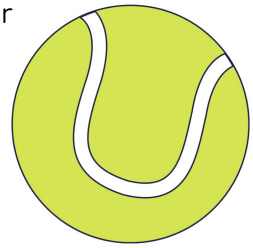
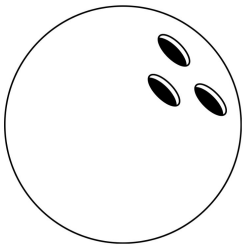
Further investigate this relationship by finding the exact ratio of the circumference to the diameter.

Find the average of these ratios.

What do you notice about the relationship between the ratio of the circumference to the diameter? Can you express this as an equation.

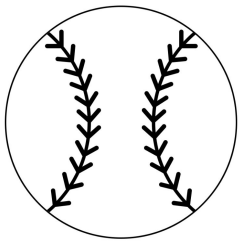
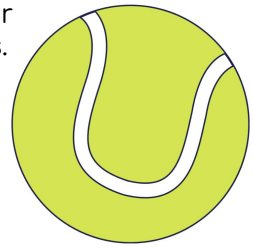
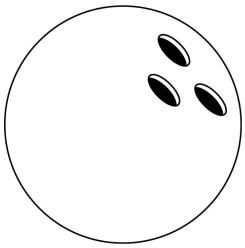
Name:

Find the circumference of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The diameter is 3 inches. 	The diameter is 2 inches. 	The diameter is 28 inches. 
The diameter is 8 inches. 	The diameter is 9 inches. 	The diameter is 10 inches. 
The radius is 3 inches. 	The radius is is 2 inches. 	The radius is 6 inches.

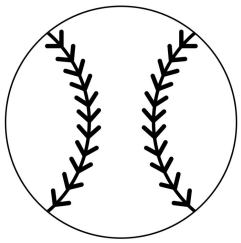
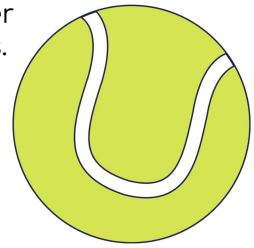
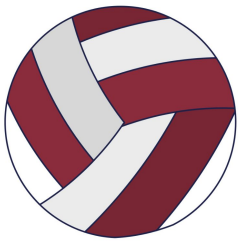
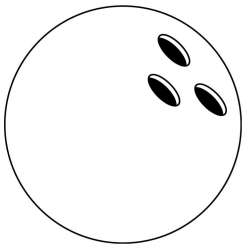
Name:

Find the circumference of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The diameter is 3 inches. 	The diameter is 2.5 inches. 	The diameter is 27 inches. 
The diameter is 7.5 inches. 	The diameter is 8 inches. 	The diameter is 9.5 inches. 
The radius is 2 inches. 	The radius is is 2.5 inches. 	The radius is 5 inches.

Name:

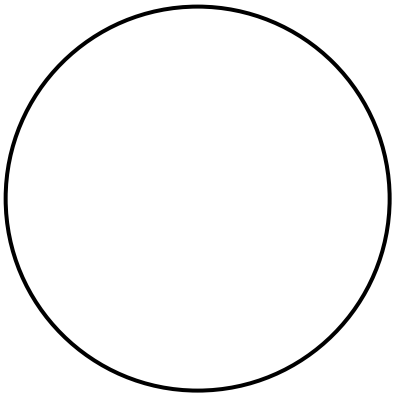
Find the circumference of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The diameter is 3 inches. 	The diameter is 2.6 inches. 	The diameter is 27.5 inches. 
The diameter is 8.2 inches. 	The diameter is 8.5 inches. 	The diameter is 9.5 inches. 

Find the diameter of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The circumference is 7 inches. 	The circumference is 5 inches. 	The circumference is 9.5 inches.

Name:



Use the circle to draw your favorite sport ball.
Label the center, diameter, radius, and circumference.
Center = Middle of the circle
Diameter = The line that goes from one side of the circle to the other, going through the center
Radius = The line that goes from one side of the circle to the center
Circumference = Distance around the circle

Measure a variety of sport balls. Use the table to record the circumference and diameter.

Sport Ball	Circumference	Diameter
Basketball	75 cm	24 cm
Volleyball	66 cm	21 cm
Softball	30.5 cm	9.75 cm
Baseball	23 cm	7.25 cm
Golf Ball	13.5 cm	4.3 cm
Tennis Ball	20.5 cm	6.5 cm
Lacrosse Ball	20 cm	6.4 cm
Soccer Ball	68 cm	21.6 cm
Pickleball	9.1 cm	2.9 cm
Bowling Ball	68.5 cm	21.5 cm

What do you notice about the relationship between the circumference and diameter?
The circumference is about 3 times bigger than the diameter.

Sport Ball	Ratio
Basketball	3.125 cm
Volleyball	3.143 cm
Softball	3.128 cm
Baseball	3.172 cm
Golf Ball	3.140 cm
Tennis Ball	3.154 cm
Lacrosse Ball	3.125 cm
Soccer Ball	3.148 cm
Pickleball	3.138 cm
Bowling Ball	3.186 cm

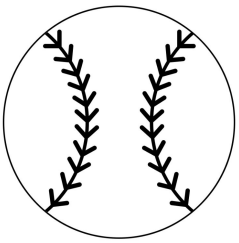
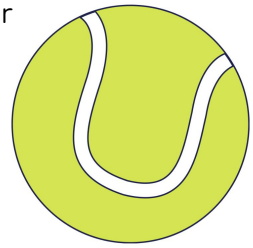
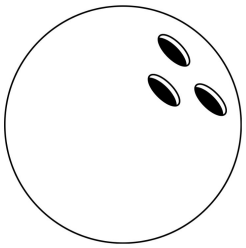
Further investigate this relationship by finding the exact ratio of the circumference to the diameter.

Find the average of these ratios.
(3.125 + 3.143 + 3.128 + 3.172 + 3.140 + 3.095 + 3.125 + 3.148 + 3.138 + 3.186) / 10 = 3.14

What do you notice about the relationship between the ratio of the circumference to the diameter? Can you represent this as an equation?
It is Pi, the value 3.14. Regardless of the size of the circle, the ratio is always the same.
C = 3.14 * Diameter

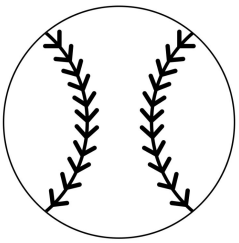
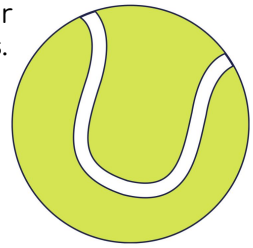
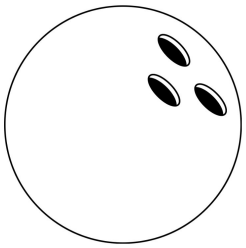
Name:

Find the circumference of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The diameter is 3 inches.  C = 3.14 x 3 C = 9.42 inches	The diameter is 2 inches.  C = 3.14 x 2 C = 6.28 inches	The diameter is 28 inches.  C = 3.14 x 28 C = 87.92 inches
The diameter is 8 inches.  C = 3.14 x 8 C = 25.12 inches	The diameter is 9 inches.  C = 3.14 x 9 C = 28.26 inches	The diameter is 10 inches.  C = 3.14 x 10 C = 31.4 inches
The radius is 3 inches.  D = 3 x 2 = 6 C = 3.14 x 6 C = 18.84 inches	The radius is 2 inches.  D = 2 x 2 = 4 C = 3.14 x 4 C = 12.56 inches	The radius is 6 inches. D = 6 x 2 = 12 C = 3.14 x 12 C = 37.68 inches

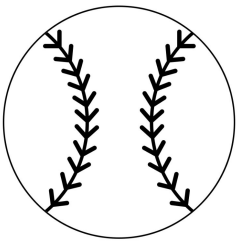
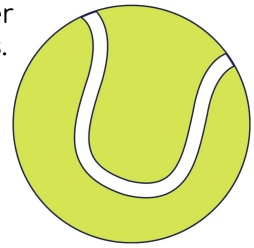
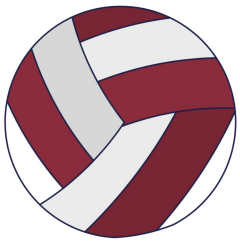
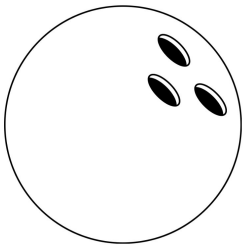
Name:

Find the circumference of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The diameter is 3 inches.  C = 3.14 x 3 C = 9.42 inches	The diameter is 2.5 inches.  C = 3.14 x 2.5 C = 7.85 inches	The diameter is 27 inches.  C = 3.14 x 27 C = 84.78 inches
The diameter is 7.5 inches.  C = 3.14 x 7.5 C = 23.55 inches	The diameter is 8 inches.  C = 3.14 x 8 C = 25.12 inches	The diameter is 9.5 inches.  C = 3.14 x 9.5 C = 29.83 inches
The radius is 2 inches.  D = 2 x 2 = 4 C = 3.14 x 4 C = 12.56 inches	The radius is is 2.5 inches.  D = 2.5 x 2 = 5 C = 3.14 x 5 C = 15.70 inches	The radius is 5 inches. D = 5 x 2 = 10 C = 3.14 x 10 C = 31.40 inches

Name:

Find the circumference of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The diameter is 3 inches.  C = 3.14 x 3 C = 9.42 inches	The diameter is 2.6 inches.  C = 3.14 x 2.6 C = 8.16 inches	The diameter is 27.5 inches.  C = 3.14 x 27.5 C = 86.35 inches
The diameter is 8.2 inches.  C = 3.14 x 8.2 C = 25.75 inches	The diameter is 8.5 inches.  C = 3.14 x 8.5 C = 26.69 inches	The diameter is 9.5 inches.  C = 3.14 x 9.5 C = 29.83 inches

Find the diameter of each sport ball. Use 3.14 for π.
Round to the nearest hundredths place.

The circumference is 7 inches.  7 = 3.14 x D D = 2.23 inches	The circumference is 5 inches.  5 = 3.14 x D D = 1.59 inches	The circumference is 9.5 inches. 9.5 = 3.14 x D D = 3.03 inches