

Lab Plan: *Where's my Π ?*

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Unit number and title: Unit #9 *Using Ratios and Proportions*

Short Description: This is a hands-on activity using ordinary household items to 1) demonstrate how to find the radius of an object using a ratio, and 2) demonstrate for any circle that the ratio of the circumference to the diameter is Π .

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TEACHER: Teacher Prep/ Lesson Plan

- **Lab Objective**

- Use of common measurements in the English system
- Ability to read measurements taken with common measuring tools
- Students will use tools to measure quantities and solve problems that involve the measurements made
- Reinforce problem solving skills by requiring students to determine the circumference by using the following formula: $C = \Pi \times \text{Diameter}$
- Demonstrate that no matter what the circumference is of an object that dividing circumference by the diameter always equals Π (3.14...)

- **Statement of pre-requisite skills needed** (i.e., vocabulary, measurement techniques, formulas, etc.)

- Ability to use calculator
- Ability to follow lab procedure directions
- Ability to take measurements with a ruler or tape measure
- Students need to be able to cooperate with another as they rotate through workstations
- Familiarity with the terms: circumference, diameter, radius, and Π
- Familiarity with appropriate formulas and ability to perform necessary calculations required in lab activity

- **Vocabulary**

No new vocabulary for this lab (new vocabulary for this Unit would have already been covered at this point). However, key terms for this lab with their definitions will be available on a Lab Resource Sheet handout.

- **Materials List: Provide the enough of the following items to set up 6 workstations.**

- Dinner plate
- Saucer
- Can of Tuna
- Can of Campbell's Soup
- Can of Progresso Soup
- Can of Spaghettios
- Bottle of Salad Elegance
- Tape Measures
- Chart to record data and calculation results

- **GLEs (State Standards) addressed**

Math:

1.1.8: Apply estimation strategies in situations involving multi-step computations of rational numbers using addition, subtraction, multiplication, division, powers, and square roots to predict or determine reasonableness of answers.

1.2: Understanding and apply concepts and procedures from measurements

1.2.3: Apply unit conversions within measurement systems, U.S. or metric, to maintain an appropriate level of precision.

2.1.1: Formulate questions to be answered to solve a problem

2.2.2: Apply mathematical concepts and procedures from number sense, measurement, geometric sense, probability and statistics, and/or algebraic sense to construct solutions

3.1.1: Analyze, compare, and integrate mathematical information from multiple sources

- **Leadership Skills**

- Set an example of appropriate behavior
- Strive to do the best job possible
- Work cooperatively with others
- Be an active participant
- Participate in all aspects of the lab including clean-up

- **SCAN Skills/Workplace Skills**

- Works with Diversity—works well with men and women from diverse backgrounds
- Participates as a Member of a Team—contributes to group effort
- Performs basic computations
- Demonstrates understanding, friendliness, adaptability, empathy, and politeness in a new and on-going group settings
- Displays high standards of attendance, punctuality, enthusiasm, vitality, and optimism in approaching and completing tasks.
- Discovers a rule or principle underlying the relationship between two or more objects that applies it in solving a problem

- **Set-up information**

- Establish 7 “work” areas (one for the dinner plate, saucer, etc...)
- Print out Data Chart to record data and calculation results
- Provide a lab procedure sheet outlining expectations (i.e. stay with lab partner/no wandering around the classroom)
- Put assigned lab partners on Smart Board
- Partners will trade off at each work station who measures and who records data (they will have the option to check each other’s measurements in the interest of accuracy)
- Start lab with one set of lab partners at each station and allow students to choose which station they will go to next

- **Lab organization**

- Break class into groups of 2 students each (partners assigned by teacher)
- Provide Lab Resource Sheet
- Provide Data Chart
- Provide peer evaluation forms to students

- **Teacher Assessment of student learning** (scoring guide, rubric)

- Grade lab partner's papers against answer key
- Have students evaluate each other with evaluation form

- **Summary of learning** (to be finished after student completes lab)

- Students fill out peer evaluation forms
- Evaluate lab by initiating class discussion on likes/dislikes of lab and how to improve it
- Ask students: what did they get out of it
- Ask students: did anyone get anything other than 3.14... when you divide circumference by the diameter
- Restate factoid: For any circle, the ratio of the circumference to the diameter is pi.
- What type of jobs could you apply these skills (after response share career applications)

- **Optional activities**

Students who are absent will be required to make up during Tutorial.

- **Career Applications**

Cook	Machinist
Chemist	Pest Exterminator
Farmer	Accident Investigator
Detective	Educator
Biologist	Engineer
Carpenter	Barista

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LAB TITLE: *Where's my π ?*

STUDENT INSTRUCTIONS:

- **Statement of problem addressed by lab**
 - What is unique when you divide circumference by diameter on any object?
- **Grouping instructions and roles**
 - Break class into groups of 2 students each
 - Partners will trade off at each work station who measures and who records data (students will have the option to check each other's measurements in the interest of accuracy)
 - Start lab with one set of lab partners at each station and allow students to choose which station they will go to next
 - Students are to stay with their assigned lab partner/no wandering around the classroom
- **Procedures** – steps to follow/instructions
 - Start lab with one set of lab partners at each station
 - Students choose which station they will go to next
 - Partners will trade off at each work station who measures and who records data
 - Students will measure each object at each work station for the diameter
 - After students have been at each workstation perform calculations required on the chart. Respond in complete sentences to the question at the bottom of the chart.
 - After turning in the charts by each team complete the peer evaluation
- **Outcome instructions**
 - What did you learn or observe from this lab?
 - Did anyone get anything other than 3.14... when you divide circumference by the diameter?
 - What type of jobs could you apply these skills?
- **Assessment instructions** (peer-teacher)
 - Teacher will grade lab partner's papers against answer key
 - Students will evaluate each other with the evaluation form (instructor will review peer evaluations and compare with instructor's observations)

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Lab Partners: _____

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Lab: Where's My π ?

Complete the following chart by measuring the diameter of each object at each "work station". Use the *formulas* we have studied in Unit 9 to determine the circumference. Next, determine the radius by the formula: Diameter/2. In the last column use the formula in the column heading and compare the answer you get for each item.

In the space provided below write what rule or constant you see when you divide circumference by the diameter of an object?

Item	Circumference	Diameter	Radius	Circumference \div Diameter
Plate				
Saucer				
Tuna				
Campbell's				
Progresso				
Spaghettios				
Salad Elegance				

For **any circle** what does the **ratio** of circumference \div diameter equal?

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Where's my Π ?
Resource Sheet

Circle: is a continuous line, or it is a plane (flat) surface bounded by the line.

Circumference (c): is both the boundary of a circle and the measurement of the distance around a circle.

Radius (r): is the distance from the center to the circumference of a circle.

Diameter (d): is the distance from one side of a circle to the other, measured through the center. The diameter is twice as long as the radius.

Critical formulas for completing the Lab Chart:

$$\text{Circumference} = \Pi \times \text{Diameter} \text{ or } c = 3.1416 \times d$$

$$\text{Radius} = \text{Diameter} \div 2 \text{ or } r = d/2$$

Footnote: **d/2** is a ratio

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