

**Mathematics Governor's Institute 2003
Problem-in-a-Bag Template**

Title of Project: Table For 2...4... or More?

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Grade Level and/or Course: Mathematics Grade 4

Concept(s) used: Finding Perimeter
Predicting and verifying patterns
Completing and using a chart

PA Standard(s) Addressed:

Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills to:

Mathematical Standards:

- 2.3.5A Select and use appropriate instruments and units for measuring quantities (e.g. perimeter, volume, area, weight, time, temperature).
- 2.5.5A Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense and explain how the problem was solved.
- 2.6.5A Organize and display data using pictures, tallies, tables, charts, bar graphs and circle graphs.
- 2.6.5E Instruct and defend simple conclusions based on data.
- 2.7.5F Determine patterns generated as a result of an experiment.
- 2.11.3D Continue a pattern of numbers or objects that could be extended infinitely.

Reading Standards:

- 1.1.5A Establish a purpose for reading a type of text (literature, information) before reading.
- 1.1.5F Identify understand the meaning of and use correctly key vocabulary from various subject areas.
- 1.6.5B Listen to a selection of literature (fiction and/or nonfiction).

NCTM Standard(s) Addressed:**Understanding patterns, relations, and functions**

- describe, extend, and make generalizations about geometric and numeric patterns
- represent and analyze patterns and functions, using words, tables, and graphs

Use mathematical models to represent and understand quantitative relationships

- model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions.

Analyze characteristics and properties of two-and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

- identify, compare, and analyze attributes of two-three-dimensional shapes and develop vocabulary to describe the attributes
- make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions

Use visualization, spatial reasoning, and geometric modeling to solve problems

- use geometric models to solve problems in other areas of mathematics, such as number and measurement
- recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.

Understand measurable attributes of objects and the units, systems, and processes of measurement

- explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them

- collect data using observations, surveys, and experiments
- represent data using tables and graphs such a line plots, bar graphs, and line graphs

Develop and evaluate inferences and predictions that are based on data

- propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions

Objectives/ applications:

- The student will apply prior knowledge to establish a relationship between mathematics and real life.
- The student will experiment with manipulatives to simulate possible solutions.
- The student will demonstrate an understanding of perimeter.
- The student will complete and use a chart to make and verify predictions about extended patterns.

Questions:

- **How can the arrangement of square dining tables determine the number of people that can be seated at any one time?**
- **How is perimeter affected as the number of squares placed in a straight line increases**

Resources and Materials (estimated cost):

- *Spaghetti and Meatballs for All! A Mathematical Story* by Marilyn Burns \$3.95 (Scholastic Inc.)
- Squares to represent tables (8 for each cooperative group)
- Counters to represent dinner guest (32 for each cooperative group)
- Graph paper
- Pencils
- Erasers
- Data Chart Activity Sheet (located at the end of this document)
- Recipes for Meatballs, Garlic Bread, and Salad with task cards (located at the end of the document)

Procedures & Activities:

This activity should be presented in 2-3 lessons

LESSON 1

1. **Activate prior knowledge:** Initiate a discussion on group and family gatherings in which a meal is shared. Focus on preparations, table arrangements, seating and menu.
2. **Distribute manipulatives** (2 squares and at least 8 counters per cooperative group) and allow time for investigating the following question: How can dinner guests be seated at these two tables? **Encourage students to explore.**
 - Use manipulatives to represent tables and dinner guests (square = table, counter = dinner guests)
 - Rules:
 - a. Only 1 counter may be placed on a side of a square.
 - b. A maximum of 4 counters may be used per square
 - Collect manipulatives

3. Listen to a selection of literature

- Read aloud the book *Spaghetti and Meatballs for All A Mathematical Story* by Marilyn Burns
- Use stop and think questioning to predict story events.

LESSON 2

1. Establish a purpose for learning

- Discuss what students remember from the book *Spaghetti and Meatballs for All*. Focus on Mrs. Comfort's problem. Tell students they will help her solve the problem of seating her guests by using manipulatives and their knowledge of perimeter.
- Elicit from students a possible definition of perimeter.
- Distribute manipulatives (8 squares and 32 counters per cooperative group) for students to use as models of tables and dinner guests while teacher reads the book.

2. Demonstrate Problem Solving

- Read story to students, stopping to model each scenario. Allow time for cooperative groups to create each seating arrangement. Observe how the perimeter changes as the tables are arranged.
- Distribute Data charts to students. Each student will need several squares and counters to predict and verify answers they record on the chart.

3. Defend conclusions

- Students will orally share their results and justify their conclusions.

LESSON 3 – Optional Extensions

1. Using graph paper students find an arrangement in which 8 tables are connected by at least one side, exploring to see if the perimeter changes.
 - Sample questions: Which arrangement of the 8 connected tables has the largest perimeter...the smallest perimeter...the same perimeter? Is the perimeter always 12 units?
2. Use recipe masters to extend student problem solving skills.

Solution

$$\square = 4$$

$$\square \square = 6$$

$$\square \square \square = 8$$

$$\square \square \square \square = 10$$

$$\square \square \square \square \square = 12$$

$$\square \square \square \square \square \square = 14$$

$$\square \square \square \square \square \square \square = 16$$

$$\square \square \square \square \square \square \square \square = 18$$

Rubric:

- 4 – Student demonstrates a high degree of how table arrangement determines the number of people that can be seated. Student has no errors on data chart and has a strong explanation of solution.
- 3 – Student demonstrates a satisfactory understanding of how table arrangement determines the number of people that can be seated. Student may have minor calculation errors or only a basic explanation of the solution.
- 2 – Student demonstrates a partial understanding of how table arrangement determines the number of people that can be seated. The student may have minor calculation errors and a basic explanation.
- 1 – Student demonstrates minimal understanding of how table arrangement determines the number of people that can be seated. Some understanding is demonstrated through either chart completion or explanation.
- 0 – Student is off task, nothing correct, no attempt is made to solve the problem.

Accommodations:

Special Education

- Provide adapted data chart with graphic representations.
- Use larger or 3D manipulatives.

English as a Second Language

- Allow students access to the literature selection as needed.
- Have the book on tape for the student to listen to independently.
- Define unfamiliar vocabulary (Eg. family reunion, menu, banquet).

Enrichment: See Recipes with “Food for Thought” task cards as extension activities. These are located at the end of this document.



NAME _____

DIRECTIONS: Complete the chart below. Answer the questions that follow.

Table For One, Two, Three...Etc.

Number of Tables	Number of People Seated
1	4
2	
3	
4	
5	
6	

1. Predict what the perimeter would be if **12** tables were placed in a row. Explain your reasoning.

1. How is the perimeter affected as the number of squares placed in a straight line increases? Explain how you know.



Meatballs

- 1 Pound of ground meat
- 1 Egg
- ½ Small onion, grated
- 1 Cup of seasoned bread crumbs
- 1 Small clove garlic, crushed
- Milk as needed to moisten

Directions: Preheat oven to 350 degrees. Mix egg, ground meat, grated onion, and garlic. Add breadcrumbs. Mix thoroughly. Use milk to moisten as needed. Make into golf ball size meatballs. Place on cookie sheet. Bake in oven for 15 minutes. Place meatballs in spaghetti sauce previously made. Simmer for 2 hours. Makes 12 meatballs.



GARLIC BREAD



- 1 Loaf of Italian bread
- 1 Stick of softened butter or margarine
- Parsley
- Garlic salt

DIRECTIONS: Preheat oven to 350 degrees. Slice bread in half lengthwise. Spread each half with 1/2 stick of butter or margarine. Sprinkle with garlic salt according to taste. Sprinkle with parsley. Place in oven for 10 minutes. Turn oven to broil. Watch bread closely as it will burn on top quickly. When bread is browned, remove from oven. Cut into 12 slices. Place bread in basket. Serves 12.



SALAD



- 1 Head of lettuce
- 2 Tomatoes
- 1 Cucumber
- 1 Cup of croutons
- Sliced fresh onion rings if desired
- 1 Bottle of your favorite salad dressing

DIRECTIONS: Wash head of lettuce. Tear lettuce into small pieces and put into a large salad bowl. Wash and chop tomatoes. Put into salad bowl. Wash and slice cucumber. Place into salad bowl. Add onions and croutons if desired. Add dressing. Toss with salad tongs. Serves 8.



FOOD FOR THOUGHT

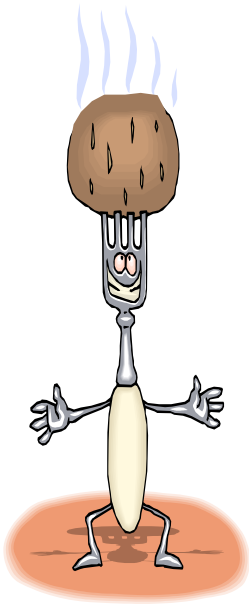
If the Comfort family were having 40 people for dinner, then how many batches of salad would they need to make?

List at least five other salad ingredients that you could add to the recipe.

Make a Venn diagram to show the ingredients that are green and the ingredients that you would like to eat. Are there any ingredients that are both green and that you like to eat?

FOOD FOR THOUGHT

Mrs. Comfort doubles the recipe for meatballs. How much of each ingredient does she need?



Everyone just loved Mrs. Comfort's meatballs, so she had to triple the recipe. Now how much of each ingredient does she need?



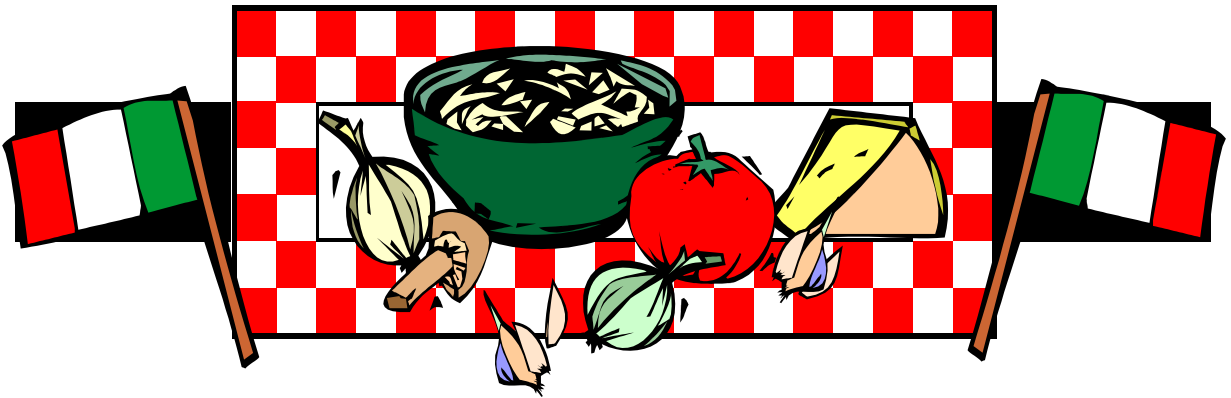
FOOD FOR THOUGHT

Margarine is sold in one-pound boxes. There are four sticks of margarine in one pound. How many recipes of garlic bread can we make with a pound of margarine?

The Comfort family loves garlic bread, so they cut each loaf into half the amount of pieces that the recipe suggested. How many pieces did they cut?

Draw a picture to show how the family cut the garlic bread.

Today's Menu



Spaghetti with Sauce
Meatballs
Mixed Garden Salad
Garlic Bread
Choice of Beverage