Real-Life Math

GEOMETRY

SECOND EDITION

WALCH PUBLISHING

Table of Contents

(continued)

How to Use This Series

The *Real-Life Math* series is a collection of activities designed to put math into the context of real-world settings. This series contains math appropriate for pre-algebra students all the way up to pre-calculus students. Problems can be used as reminders of old skills in new contexts, as an opportunity to show how a particular skill is used, or as an enrichment activity for stronger students. Because this is a collection of reproducible activities, you may make as many copies of each activity as you wish.

Please be aware that this collection does not and cannot replace teacher supervision. Although formulas are often given on the student page, this does not replace teacher instruction on the subjects to be covered. Teaching notes include extension suggestions, some of which may involve the use of outside experts. If it is not possible to get these presenters to come to your classroom, it may be desirable to have individual students contact them.

We have found a significant number of real-world settings for this collection, but it is not a complete list. Let your imagination go, and use your own experience or the experience of your students to create similar opportunities for contextual study.

Introduction

Organization

This book is organized around six different contexts addressing geometry: Geometry Around Us; Construction and Landscaping; Design and Marketing; Art; Sports and Recreation; and Miscellaneous. For organizational purposes, the topics covered in each activity are listed on the teacher guide page for that activity.

Order of Activities

You'll find that the activities in this book parallel most topics taught in a typical geometry course. You can supplement or enrich a concept presented in your textbook with this resource or use the activities as an introduction to a new concept.

Level of Difficulty

Some activities use more difficult mathematical concepts than others. It should be noted that the less difficult lessons, mathematically speaking, still require higher-order thinking skills.

Time Considerations

Because students' ability levels and schools' schedules vary, time suggestions for the activities are not given. Before using an activity, review it and decide how much time would be appropriate for your students.

Calculators and Other Technology

A practical way of using calculators with the activities is to consider whether or not the situation described in the activity would warrant the use of a calculator in real life. If the situation does, then allow students to use calculators; if it doesn't, then don't allow them to use calculators. In some of the activities, students can use spreadsheet, word-processing, and desktop-publishing software.

Organizing the Classroom

The Teaching Notes sections include suggestions on how to arrange students for the activities. Some of the activities work best for individual student work, others are more appropriate for students working in pairs, and some work best for groups of students.

Evaluation and Assessment

Where appropriate, selected answers are given. However, because the lessons model real-life situations, exact answers cannot always be provided.

teacher's page

1. Talking Geometry

Context

geometry around us

Topic

geometric terms

Overview

In this activity, students build confidence about their prior knowledge of geometry by brainstorming about the geometric terms they already know. Then they use those words to create sentences showing how those geometric terms are used in everyday speech.

Objectives

Students will be able to:

- list common geometric terms used in everyday speech
- build confidence in their prior knowledge of geometry
- create sentences using common geometric terms

Materials

- one copy of the Activity 1 handout for each student
- dictionary (optional)

Teaching Notes

- Students should work in small groups for this activity.
- This activity is intended as an introductory activity to the class and works best at the beginning of the term. However, it can still be used after the course has started.
- After all the groups have generated lists of geometric terms, have them give you their lists so you can keep a master list with a frequency tally of terms on the board or overhead.
- Let students know that they don't have to be able to define each term; they'll do that in Activity 2.
- Once all the geometric terms have been posted, have students analyze the list and determine which terms appear most often. There might also be some debate about whether or not a term is actually related to geometry.
- If students are struggling with creating their sentences, share some sentences that other groups of students have written as they are working.
- Students do not have to use the classes' most common words when creating their sentences.
- When students are finished writing their sentences, post the most creative sentences around the room.

(continued)

Name ______________________________ Date ______________________

8. Hanging Drywall

Most interior walls in homes and offices are made of drywall. Drywall is made of gypsum and is less than half an inch thick. It is sold in sheets that measure 4 feet by 8 feet. A drywall hanger will put up entire sheets of drywall where possible, but then will have to fill in around it with smaller pieces cut from the larger sheets.

Once the sheets are hung, a paper "tape" and plaster "mud" are used to fill in the gaps between the sheets and between the sheets and the ceiling (but not the gaps between the sheets and the floor, which are covered by a baseboard). Filling the gaps makes the wall look continuous and smooth. The fewer taped and mudded joints, the less work the drywall hanger has.

Before a drywall hanger starts the job, he or she must decide how many 4-by-8-foot sheets are needed to complete the job. If a wall is 16 feet long and the ceiling is 8 feet high, four sheets of drywall can just be hung next to each other. Unfortunately, few walls or rooms are designed to make the drywall hanger's job that easy.

Read the problems below. In each case, find a way to complete the job using the fewest partial pieces of drywall and the least number of joints.

1. You need to hang drywall on a wall that is 20 feet long and 10 feet high. How should you position the 4-by-8-foot sheets to limit the number of joints and the number of sheets used? Describe your plan below. Be sure to list the number of sheets of drywall used and the total length of joints filled.

2. You need to hang drywall on a wall that is 13 feet long and 11 feet high. How should you position the sheets to limit the number of joints and the number of sheets used? Describe your plan. List the number of sheets of drywall used and the total length of joints filled. Then draw a scale model of your plan.

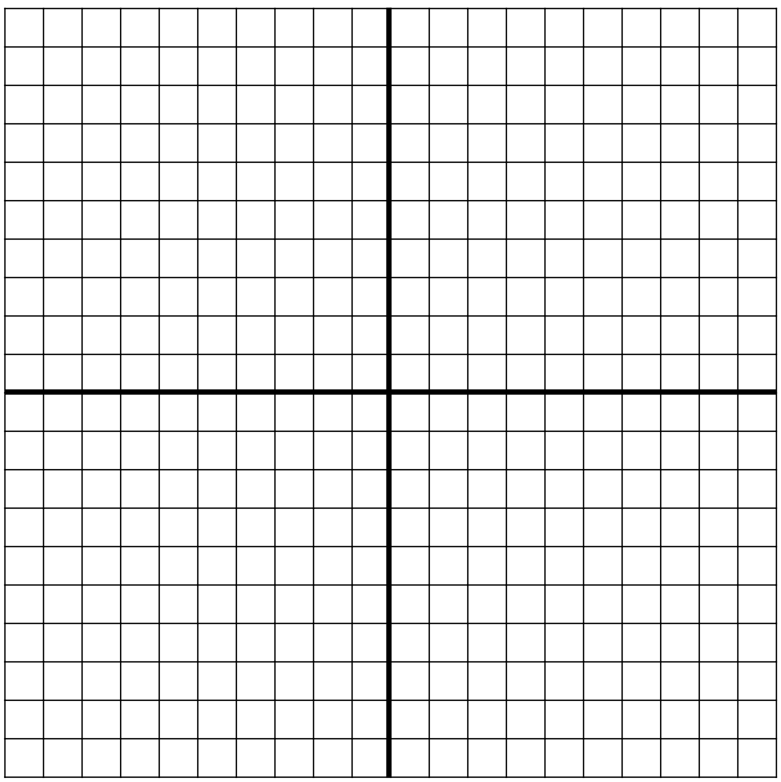
Name ______________________________ Date ____________________

12. Quilts

Quilts are a traditional American form of art that have been around for centuries. Quilts are typically constructed by designing a block pattern or template on a grid. Each individual block is then joined with other blocks to form the overall pattern. Follow the steps below to create your own quilt design.

Use the books your teacher provides or search the Internet for a web site that shows quilt designs. While you are looking over the designs, consider how the patterns work. Pay particular attention to the symmetry, rotation, reflection, or translations that might be present in the design. Choose one quilt pattern to study in greater detail.

Using the quilt pattern you chose, describe its pattern in terms of symmetry, rotation, reflection, or translations. Then draw the basic design in the grid that follows.



(continued)

Name ______________________________ Date ____________________

12. Quilts

Grid Design

Now it is your turn to come up with a design of your own.

Step 1: On a sheet of grid paper, outline a square. The square will form the foundation of your quilt design.

Step 2: Make a pattern inside the square. For now, keep the design simple. For example, you may want to create a design using symmetrical triangles.

Step 3: Draw the reflection of your design.

Step 4: Make six to eight copies of the design and its reflection.

Step 5: Using the squares you made, create different designs using rotations, reflections, and translations. When you are satisfied with a pattern, tape or glue it onto a piece of poster board.

Write a brief description of how your design works.

Problem Solving with Your Design

1. Suppose you wanted to make your quilt fit on a queen-size bed. How much material of each color would you need? A standard-sized queen mattress measures 80×60 inches.

2. Suppose you wanted to make your quilt fit on a king-size bed. How much material of each color would you need? A standard-size king mattress measures 84×72 inches.

Name ______________________________ Date ____________________

16. Air Supply I

Divers have to plan for many different things before they actually get in the water. One of the most important things they have to plan for is how much air they will need for a scuba dive. As such, dive supervisors learn how such things as changes in pressure, temperature, and breathing rates affect the available volume of air.

Imagine you are a dive supervisor planning a scuba dive. First, you will explore the relationship between volume and pressure, as described by Boyle's law. Second, you will apply what you have learned to determine the duration of the air supply for a scuba dive.

Boyle's Law

One of the first gas laws that divers learn about is Boyle's law. Boyle's law explains the relationship between pressure and volume: At constant temperature, the absolute pressure and the volume of a given mass of gas are inversely proportional. As you go deeper in the water, the pressure increases, and the volume of gas decreases; or you could say the opposite—as the pressure decreases, the volume increases. Understanding this relationship is important because as a diver goes deeper, less air is available. For example, suppose you had a 1-gallon milk container at the surface of the water. This milk container is under 1 atmosphere (atm) of pressure. 1 atm is equal to 14.7 pounds per square inch, or psi. If you inverted the milk container and took it to a depth of 33 feet, it would be under 2 atm of pressure (29.4 psi). Every 33 feet of water is equal to 1 atm of pressure. Because there is now twice the absolute pressure on the container, the volume is decreased to one-half gallon. If you took the container to a depth of 66 feet, then the pressure would be equal to 3 atm and would compress the volume to one-third gallon.

Boyle's law can be expressed as:

Boyle's law

$$P_1V_1 = P_2V_2$$

where

P_1 = initial pressure

V_1 = initial volume

P_2 = final pressure

V_2 = final volume

(continued)