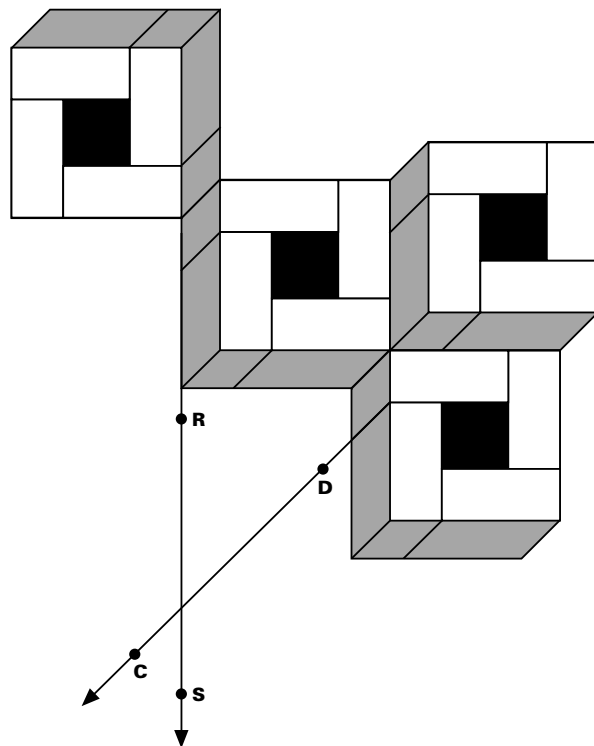


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GEOMETRY CHALLENGE



Creative Projects to Reinforce Geometry Concepts

WELCOME



Hours of Instruction: 16–24

Grades: 6–10

Overview: A series of challenges that require students to apply geometry concepts in unusual ways to complete diagrams and construct models.

Your students will:

- Stretch problem-solving skills
- Realize that there are many ways to approach and solve a problem
- Apply knowledge of geometry concepts
- Solve two-dimensional geometry challenges on rays, polygons, triangles, angles, rectangles and circles by making line constructions
- Solve three-dimensional challenges on planes, the letter “Y,” a rectangular prism, and a double pyramid
- Create a geometry challenge for others to experience

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ICONS KEY When you see these icons...



Answer Key

For student activities with specific objective responses, this icon directs you to the answer key.



Learning Tip

Found in the Student Guide. This directs your students to important procedures or directions.



Teaching Tip

In the margins of your Teacher Guide, these tips clarify materials or procedures.



Read or Tell

This is important information your students need for the activity. Be sure to read the passage or clearly instruct your students as stated in your Teacher Guide.



Grouping

This shows if your students work independently, in partners or in cooperative groups for each activity.



Reproducible

Find this icon in the upper outside corner of every master page needing duplication.



Timing

Many activities vary in length. Use this icon to help plan your teaching time.

GEOMETRY CHALLENGE

Creative Projects to Reinforce Geometry Concepts

NATE CATTELL graduated from Pennsylvania State University with a BA in graphic design. He later earned his Pennsylvania Elementary Teaching Certification and has taught sixth grade at the State College Area School District since 1971. In 1991, Nate was the Pennsylvania teacher chosen to receive the Presidential Award for Excellence in Mathematics Teaching. He delights in creating new challenge activities for his students. For Interact he wrote CHALLENGE MATH PROJECTS and devised a peace strand for GALAXY.

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The nationwide movement for high standards has not only determined what students should learn, but also has mandated that students demonstrate what they know. GEOMETRY CHALLENGE addresses numerous mathematics and geometry standards as established by the National Council of Teachers of Mathematics (NCTM), as well as cooperative and applied learning standards. These projects encompass aspects of the NCTM 2000 standards that may not be addressed sufficiently by traditional math texts or assignments.

Mathematics Standards

Number and Operations Standard

- Compute fluently and make reasonable estimates

Geometry Standard

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
- Use visualization, spatial reasoning, and geometric modeling to solve problems

Measurement Standard

- Understand measurable attributes of objects and the units, systems, and processes of measurement
- Apply appropriate techniques, tools, and formulas to determine measurements

Problem-Solving Standard

- Build new mathematical knowledge through problem solving
- Apply and adapt a variety of appropriate strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving

Reasoning and Proof Standard

- Recognize reasoning and proof as fundamental aspects of mathematics
- Make and investigate mathematical conjectures
- Develop and evaluate mathematical arguments and proofs
- Monitor and reflect on the process of mathematical problem solving

Communication Standard

- Organize and consolidate their mathematical thinking through communication
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
- Analyze and evaluate the mathematical thinking and strategies of others
- Use the language of mathematics to express mathematical ideas precisely

STANDARDS

STANDARDS

STANDARDS

Connections Standard

- Recognize and use connections among mathematical ideas
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole

Representation Standard

- Create and use representations to organize, record, and communicate mathematical ideas
- Select, apply, and translate among mathematical representations to solve problems

California Applied Learning Standards

Standard 1: Students will understand how to solve problems through a project design process. Students will design a product, service, or system to meet an identified need.

Standard 2: Students will understand how to solve problems through planning and organization.

Standard 4: Students will understand how to solve problems through meeting client needs. Students will conduct a commissioned project.

Standard 6: Students will understand how to apply communication skills and techniques. Students will demonstrate ability to communicate orally and in writing.

Standard 8: Students will understand the importance of teamwork. Students will work in teams to achieve objectives.

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STRENGTHS
CHALLENGES
CONCEPTS

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Students appreciate a good challenge. They gain self-esteem and confidence as they tackle difficult tasks and succeed. GEOMETRY CHALLENGE projects encourage students to employ logical thinking and common sense as they solve the varied and difficult problems. Each activity is designed to extend the student's problem-solving ability.

Completion of a GEOMETRY CHALLENGE task demonstrates thorough knowledge of specific geometry terms and concepts. Students apply basic geometry concepts to create a final product, either a model, a diagram, or a drawing. Mirror images, reversed drawings, and creative folding solutions emphasize clearly that many math problems have multiple solutions/interpretations.

GEOMETRY CHALLENGE is an excellent supplement to any math program. Students will strengthen their geometry understanding while increasing skill, confidence, and creativity. Specifically your students will gain the following:

Knowledge

- Understand that some problem may have more than one solution
- Apply geometry concepts in a broader context
- Solve related types of problems
- Devise creative and innovative two- and three-dimensional diagrams and models

Skills

- Apply visualization, measurement, and estimation to construct a model
- Attack a wide variety of projects while applying geometry knowledge
- Create challenging materials for use by others
- Learn to apply concepts to new problems
- Tackle a problem in a variety of ways
- Work cooperatively with other students to develop problem-solving strategies

Attitudes

- Confidence to use his/her own approach to create a solution
- Appreciation of the value of collaborative working relationships
- Willingness to take risks based on knowledge, estimation, math concepts, and visualization
- Gain an appreciation for alternate math solutions
- Delight in seeing how others have solved a problem
- Increased knowledge and confidence as they share insights and methods with others

PURPOSE

OVERVIEW

OVERVIEW

GEOMETRY CHALLENGE is not a traditional simulation or interaction unit. Each project is discrete and independent. As students progress in their geometry understanding the teacher can select more difficult tasks that extend or reinforce concepts learned.

Students work alone, with a partner, and, on occasion, in teams. They use basic materials for all of the challenges and they finish the projects outside of class. The activities are designed to stretch your students' problem-solving skills. Many of the challenges have more than one correct solution. Solutions will differ because of each individual's interpretations as well as his/her approach to solving the problem. Students thus gain an appreciation for alternate math solutions and realize that there are many ways to approach and solve a problem.

The format of each challenge forces students to read directions and information carefully and then apply those facts appropriately to create a model or diagram. The students solve two-dimensional challenges on rays, polygons, triangles, angles, rectangles, and circles by making line constructions. They also solve three-dimensional challenges on planes, the letter "Y," a rectangular prism, and a double pyramid.

Differentiation

Like all Interact units, GEOMETRY CHALLENGE provides differentiated instruction through its various learning opportunities. Students learn and experience the knowledge, skills, and attitudes through all domains of language (reading, writing, speaking, and listening). Adjust the level of difficulty as best fits your students. Assist special needs students in selecting activities that utilize their strengths and allow them to succeed. Work together with the Resource Specialist teacher, Gifted and Talented teacher, or other specialist to coordinate instruction. Every activity causes students to use higher level thinking skills. Knowledge, application, analysis, evaluation, and synthesis are all needed to work through these challenges. The unit incorporates Howard Gardner's

Multiple Intelligences:

Visual-Spatial — drawing and creating verbal/physical imagery

Bodily-Kinesthetic — hands-on creations

Interpersonal — interacting and planning with others

Intrapersonal — setting own goals, independent study, introspection, and use of creative materials

Linguistic — using words effectively in writing instructions and evaluations

Logical-Mathematical — reasoning, calculating, thinking conceptually and abstractly, and seeing and exploring patterns and relationships

SETUP DIRECTIONS

1. Before you Begin

Read this entire Teacher Guide. Decide how you will use GEOMETRY CHALLENGE in your classroom. (See **Setup Directions #4, Lesson Planning Guide** for ideas and an explanation of the Challenge procedures.) Throughout the Teacher Guide, Interact employs certain editorial conventions to identify materials.

- In preparing materials, *Class set* means *one per student*.
- All transparency masters and student handouts are listed by name using ALL CAPITAL LETTERS.
- Teacher reference pages are named in **Bold**.

2. Timing Options

Decide how you will use the projects—either weekly, throughout the term, throughout the school year, or after lessons on specific geometric concepts.

- The time required for each challenge varies from a normal *class period* (45 minutes to one hour) up to *two hours*.
- Time suggested is listed on each challenge.

3. Grouping Students

Decide ahead of time if the challenge will be an individual, partner, or team task.

- Some challenges indicate the type of student grouping; you decide the grouping for unmarked challenges.
- Partner projects allow for student interaction, **but each student is responsible for his/her own finished project.**

4. Lesson Planning Guide

GEOMETRY CHALLENGE is useful in a variety of classroom situations. Some challenges include extension activities.

- Experience the activities. Work through each challenge yourself to be better able to respond to any questions your students may ask.
- Select the activities most appropriate for your students.
- Modify any activity to meet the needs of your students.

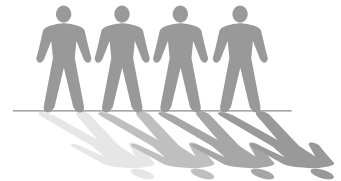
Teaching Directions Pages

The *Teaching Directions* pages include the following:

- Suggestions for student grouping
- Step-by-step procedures for introducing and managing the Challenge
- Information needed to answer many student questions that might arise
- Areas where students might experience trouble



45 minutes–2 hours
per challenge



Individual, Partner, or
Cooperative Groups