

Geometry Sketching Activities for Young Children

Joseph M. Furner and Carol A. Marinas

Introduction

In this article we describe the use of geometry sketching software to teach geometric concepts to children in kindergarten through grade 4. When using *Geometer's Sketchpad* with middle and high school students, we noticed the ease with which of students followed directions on activity sheets and thought that such activities might be used at the K-4 grade levels as well. We share some activities that we used with second grade students, as well as rationales from research and state standards for using such software with young children.

Technology as a Principle for Teaching Mathematics

The importance of using technology in the teaching of mathematics has been advocated by the National Council of Teachers of Mathematics [NCTM] (1989, 2000). Computers are an integral part of life and students need to be prepared to use technology to solve problems and access information as young people and adults. As teachers, we are obliged to follow state standards, curriculum, and best practices in teaching mathematics. In the Florida Sunshine State Standards for Geometry and Spatial Sense (State of Florida DOE, 2000), students are expected to work with two- and three-dimensional shapes; combine and subdivide shapes; use coordinate geometry to locate objects; and describe objects algebraically. In the Measurement Standard, students explore and solve real-world problems by estimation and measurement techniques. These standards can easily be addressed using geometry sketching software.

Geometry Sketching Software

Geometer's Sketchpad (by Key Curriculum Press) is a dynamic construction and exploration tool that enables students to explore and understand mathematics in ways that are not possible with traditional tools. With *Geometer's Sketchpad* (GSP) students can construct an object and then explore its mathematical properties by dragging the object using the computer mouse. Another popular piece of software for learning geometry is *Cabri Geometry II* (Texas Instruments). Geometry sketching software brings dynamic power to the study of Euclidean and non-Euclidean geometries, algebra, trigonometry, precalculus, and calculus. This type of software can be adapted for use with young learners.

Geometry Sketching Software Research

Students today are motivated to learn when activities are presented in a dynamic, hands-on manner that is engaging. The *GSP* software is an interactive tool which allows

software. These pieces of software can serve as a bridge in the classroom for connecting concrete geometric ideas to abstract ideas in geometry as a child ages.

References

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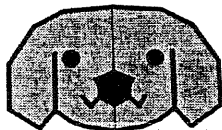
WEBSITES

- Key Curriculum Press** <http://www.keypress.com/sketchpad/>
- Math Forum** <http://mathforum.org/dynamic/classroom.html>
<http://mathforum.org/sketchpad/sketchpad.html>
- GSP Tutorial** <http://members.aol.com/markwestbr/GSPtutorial/home.html>
- Lesson Plans Using GSP** <http://www.math.byu.edu/~lfrancis/readings302/GSP/GSPLessonPl.html>
- Carol A. Marinas** <http://mcs-cmarinas.barry.edu/net/gsp/index.htm>
- State of Florida**
Sunshine State Standards <http://www.firn.edu/doe/curric/prek12/frame2.htm>
- Texas Instruments (TI)** http://education.ti.com/educationportal/sites/US/productDetail/us_cabri_geometry.html

Worksheet 3: Animal Faces

GSP Activity

1. Go to *Geometer's Sketchpad*.
2. Draw a vertical LINE (it goes up and down) through the center of the GSP screen.
3. On the left side of the vertical line, draw the left side of a puppy's face using the Segment Tool. Note the center features of the face will be on the vertical line.
4. You can now color your dog by coloring (DISPLAY/COLOR) the INTERIORS. Interiors are created by selecting the points in a clockwise or counterclockwise fashion and then choosing CONSTRUCT/INTERIORS. You can change the Interior's Color by using the DISPLAY/COLOR pull-down menu.
5. Double click on **just** the vertical line. This will **mark** the line.
6. Use the Selection Arrow Tool to draw a box around the left side of the dog.
7. Then go to TRANSFORM/REFLECT to see the right side of your dog.
8. Move some points on the left side and see what happens to the right side.
9. You can hide all the points and your vertical line to finish your puppy.

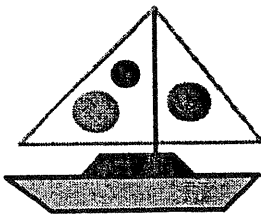


Worksheet 4 Sailboats

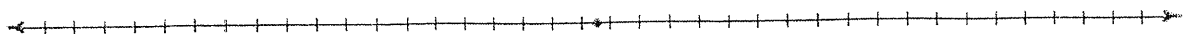
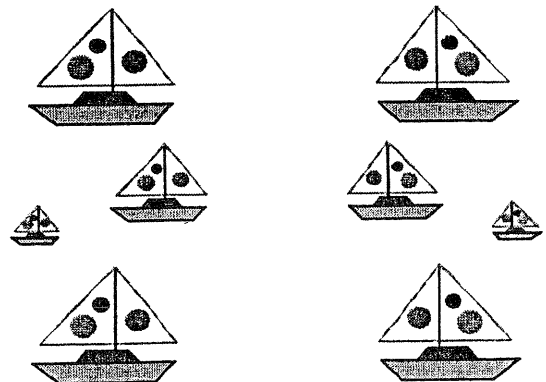
GSP Activity

1. Go to *Geometer's Sketchpad*.
2. Draw a sailboat using the SEGMENT and CIRCLE TOOLS.
3. You can now color your sailboat by coloring (DISPLAY/COLOR) the INTERIORS. Interiors are created by selecting the points in a clockwise or counterclockwise fashion and then choosing CONSTRUCT/INTERIORS.
4. Select your entire sailboat using the Select Arrow Tool and then TRANSFORM/TRANSLATE. Make the following changes:
 - * Translation Vector: Rectangular * Horizontal: Fixed Distance: 0 cm
 - * Vertical: Fixed Distance: - 8 cmYou should see a faint sailboat below your original sailboat. * Click on Translate. Your new sailboat will be the same size.
5. With your Point Tool, create a point between the two sailboats. Double click on your point with your Select Arrow Tool to mark it. Select your entire sailboat using the Select Arrow Tool and then TRANSFORM/DILATE.
 - * Change the Fixed Ratio to $\frac{1}{4}$ * Click on Dilate.You should see a third smaller sailboat between the two big ones.
6. You can add another sailboat between the two big ones using the Fixed Ratio of $\frac{1}{2}$.
7. You can change the colors of some of the sails.
8. Using the LINE Tool, draw a vertical line (Up and down) to the right of all the sailboats.
9. Double click on that line to **mark** it.
10. Use the Select Arrow Tool to select all your sailboats.
11. Next, TRANSFORM/REFLECT.
12. Move the line. Move points on the ORIGINAL Sailboat. Move points on any sailboat. What happens? Why?
13. Use the Select Arrow Tool and the DISPLAY/HIDE OBJECTS option. You can hide the points and the vertical line when your drawing is complete.

My Original Sailboat:



These are my sailboats in the water:



Teacher Notes:

Students might have problems in the following areas.

GENERAL

1. Students should save their image several times throughout each activity to ensure that they do not have to start over completely due to power outages or mistakes in construction. Example: Save them as bunny1, bunny3, ... bunnydone. This will alleviate frustration and stress.
2. Students need to be encouraged to do each step carefully before moving to the next step.

PAINT:

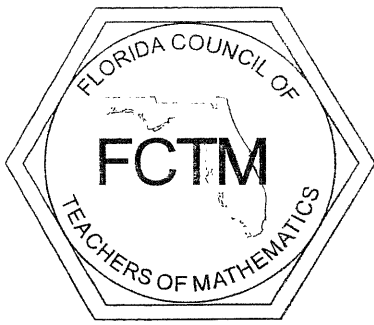
1. Students often get frustrated when making curved lines.
2. Students need to be shown how to use the Paint Bucket to FILL in the shapes with colors.

GSP:

1. Students might need help understanding the HIDE/SHOW tool.
2. Students will need practice when marking points of the figure in clockwise or counterclockwise fashion to select the INTERIORS for coloring in GSP.
3. Students need to know how to use the UNDO tool to correct mistakes.
4. Students need to recognize the image that occurs when MARKING a line for reflection.
5. Students need to use the TRANSFORM/TRANSLATE tool with precision to detail. Show students how to create smaller sailboats with a FIXED RATIO less than 1 or larger sailboat with a FIXED RATIO greater than 1.
6. Students need to SELECT entire objects using the SELECT ARROW TOOL.

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Carol A. Marinas has a Ph.D. in mathematics education with a concentration in educational technology from Florida State University. As a full professor of mathematics at Barry University for over 22 years, Dr. Marinas uses technology, manipulatives and real-world examples to create an excitement and a purpose to learning mathematical concepts.



Dimensions in Mathematics

Table of Contents

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President's Message Nancy Kinard, FCTM President	3
Lichtenberg Grant Awards for 2006 Rick Austin.....	4
Art, Area, and Assessment: Piet Mondrian Helps a Teacher Assess Measurement of Length Joanne J. LaFramenta.....	6
Equity for All: A Study of Mathematics Anxiety and Changes in At-Risk Students Gina Gresham.....	9
Diagnosing Understanding of Fundamental Mathematics Andy Reeves.....	15
Alternative Algorithms for Multiplication George Roy.....	24
Staggering Statistics: Descriptive Statistics in the Elementary Mathematics Classroom Taylar Clements.....	29
Geometry Sketching Activities for Young Children Joseph M. Furner and Carol A. Marinas.....	34
Teaching for Learning: Why Reading in Mathematics? Florida Online Reading Professional Development (FOR-PD) Share Strategies that Work Vicky Zygouris-Coe, Bonnie Swan, Lourdes H. Smith.....	41
Three Models of Fractions Gwen Johnson.....	46
Peanut M and M Color Distribution: A Chi-Square Experience David R. Duncan and Bonnie H. Litwiller.....	50

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