

Performance Based Learning and Assessment Task

Kite Project

I. ASSESSMENT TASK OVERVIEW & PURPOSE:

The students are instructed to: research the history, science, and design of kites; design a blueprint of their kite and find the measurements, scale factor, area, and perimeter of their blueprint; and construct and fly their kite.

II. UNIT AUTHOR:

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III. COURSE:

Geometry

IV. CONTENT STRAND:

Geometry, Measurement

V. OBJECTIVES:

Students will be able to

- Design a scale model of a kite
- Measure the dimensions and angles of the scale model
- Determine the scale factor of the scale model
- Compute the area and perimeter of the scale model
- Construct and fly a kite

VI. REFERENCE/RESOURCE MATERIALS:

For Research: computer access

For Scale Model Drawing: ruler, protractor, graph paper, calculator, Geometry SOL formula sheet

For Kites: tissue paper, plastic table cloths, small wooden dowels, straws, yarn, fishing wire, markers, scissors, tape, glue

VII. PRIMARY ASSESSMENT STRATEGIES:

The task includes an assessment component that performs two functions: (1) for the student it will be a checklist and provide a self-assessment and (2) for the teacher it will be used as a rubric. The attached assessment list will assess the research section, scale model drawing, and kite construction.

VIII. EVALUATION CRITERIA:

Assessment List, corresponding rubric.

IX. INSTRUCTIONAL TIME:

2 ninety minute class periods for research, scale model drawings, and kite construction.
1/2 ninety minute class period for flying kites.

Kite Project

Strand

Geometry, Measurement

Mathematical Objective(s)

Students will be able to:

- Design a scale model of a kite
- Find the measures of the sides and angles of the scale model
- Determine the scale factor of the scale model
- Compute the area and perimeter of the scale model

Related SOL

- G.12 The student will make a model of a three-dimensional figure from a two-dimensional drawing and make a two-dimensional representation of a three-dimensional object. Models and representations will include scale drawings, perspective drawings, blueprints, or computer simulations.
- G.8 The student will a) investigate and identify properties of quadrilaterals involving opposite sides and angles, consecutive sides and angles, and diagonals; and c) use properties of quadrilaterals to solve practical problems.

NCTM Standards

- Use visualization, spatial reasoning, and geometric modeling to solve problems: draw and construct representations of two- and three-dimensional geometric objects using a variety of tools
- Apply appropriate techniques, tools, and formulas to determine measurements: analyze precision, accuracy, and approximate error in measurement situations
- Apply appropriate techniques, tools, and formulas to determine measurements: understand and use formulas for the area, surface area, and volume of geometric figures.

Materials/Resources

- Kite Project Worksheet
- Class set of computers or iPads
- Class set of calculators
- Graph paper
- Protractors

- Rulers
- Geometry SOL Formula Sheet
- Kite supplies (i.e. Plastic table cloths, tissue paper, small wooden dowels, straws, yarn, fishing wire, scissors, glue, tape, markers)

Assumption of Prior Knowledge

- Students should have a basic knowledge of scale models, scale factors, and similar figures
- Students should have a basic knowledge of quadrilaterals and their properties
- Students should know how to measure sides and angles
- Students should know how to use formulas to calculate perimeter and area of basic 2-dimensional figures

Introduction: Setting Up the Mathematical Task

Using your knowledge of geometry and kites you will research, design, construct, and fly a kite with a group of 3-4 of your classmates. Your team will research the history, science, and designs of kites. Once you've completed your research, you will develop a blue print (scale model) on graph paper for your kite. On your scale model, you will measure the dimensions of and angles of your kite. You will also calculate the area and perimeter and determine the scale factor for your blue print to your actual kite. Once your blue print is complete, you will construct and of course fly your kite.

Planned Time Outline

Research

- Students should be divided into groups of 3 (a couple groups of 4 if necessary)
- Students should separate into research roles (1 person should research the history of kites, 1 should research the science of kites, and 1 (or 2 if a group of 4) should research possible designs of kites)
- Each student should have access to the internet (either on a computer, iPad, or Chromebook)
- Students can find internet links for their specific role on the back of the group worksheet.

- Students researching the history and science of kites should record 3 new things they learn about kites on the group worksheet.
- Students researching designs of kites should record 3 possible design options of kites for their group.
- During this time the teacher should help any students who are having technical issues, encourage students to be responsible for their portion of the research, and help groups along that are getting stuck.

Scale Model

- Before groups begin this section, the teacher should do a quick check to confirm that the research portion is complete.
- Once students have completed the research portion, the teacher should give the group a piece of graph paper, a ruler, a protractor, a geometry SOL formula sheet, and a calculator.
- The group should decide on a design for their kite and draw it on the graph paper.
- Once the group is happy with the blue print, they should measure all of the side lengths and all of the interior angles of their kite and record them on the blue print.
- The group should then calculate the area and perimeter of their kite and record their calculations on the blue print.
- Finally, the group should determine the scale factor of the blue print to their actual kite.
- During this section the teacher should observe group discussions of their problem solving of the calculations. If groups become stuck, the teacher should help them by asking guiding questions about area, perimeter, measurement, and scale factors.

Kite Construction

- Before groups begin this section, the teacher should do a quick check to confirm that the scale model portion is complete.
- Once students have completed their scale model of their kite, they should have access to the kite construction materials to build their kites.
- Construction materials could include: plastic table cloths, tissue paper, small wooden dowels, straws, yarn, fishing wire, markers, scissors, tape, glue, etc.
- During the section the teacher should circulate from group to group and ask guiding questions whenever groups get stuck. Try to be less involved in this process to allow students to problem solve and be creative.

Kite Flying

- Before the class begins this section, the teacher should do a quick check to confirm that groups have completed their constructions.

- Choose a day with good weather to take the class outside (low chance of rain, windy, comfortable temperature)
- Students should be given time to fly kites as a group.
- Demonstrate how to get a running start for your kite (some students probably have never flown a kite before)
- Bring a few supplies (scissors, string, tape, etc) for kites that may become damaged when flying and may need quick repairs

The research and scale model parts should take 45-60 minutes. The kite construction should take about 90-105 minutes divided up between 2 classes. The kite flying should take about 45 minutes.

Student Exploration

Individual Work

- Students are responsible for contributing to the success of the group kite. This is highlighted when students are given a specific role for researching kites. Each student should know what their role is for the research and should be responsible for sharing their findings with their entire group and writing them on the group worksheet.

Small Group Work

- Students will be working as a group for the whole activity to accomplish the goal. Students should work collaboratively and cooperatively by listening to one another's ideas and practice mathematical discourse to explain their own. One grade will be given to the entire group for this project.

Student/Teacher Actions

- Students should be working with their groups on each part of the activity to work together to build a kite that successfully flies.
- In order to facilitate math discourse, the teacher should work with groups by asking questions such as: Explain your process for calculating the area. Why did you choose your particular design? Are there other methods for calculating area and perimeter for your kite? etc.
- When groups become stuck because of differing ideas, ask group members to explain each other's construction ideas and ask the group if there is a way to compromise between the differing ideas.

Monitoring Student Responses

- students are to communicate their thinking and their new knowledge by communicating their ideas and mathematical reasoning verbally with math discourse to their group members
- students are to communicate with each other respectfully and supportively
- teacher should assist groups who have difficulties by asking guiding questions and asking students to compromise on their ideas
- teacher should summarize the activity by having groups discuss successes and weaknesses of different designs of kites after flying them and by asking groups what they could do differently to improve their designs



Team Names: _____

Let's Go Fly a Kite!

Objective:

The student will be able to use their knowledge of geometry and kites to construct and fly a kite.

Directions:

You will design, construct, and fly a kite with a group of 3-4 of your classmates. Your team will research kites, develop a blue print, calculate the dimensions of your kite, and of course fly your kite. This project will be counted as a **test grade**.

Research:

Use the given websites to fill in the chart with information you find on kites.

History of Kites

<http://www.skratch-pad.com/kites/where.html>

<http://www.gkites.com/howtofly/hist1.html>

Science of Kites

<http://www.grc.nasa.gov/WWW/k-12/airplane/bgk.html>

<http://www.gkites.com/howtofly/why.html>

<http://thephysicsofkites.homestead.com/index.html>

Design Ideas

<http://www.grc.nasa.gov/WWW/K-12/airplane/kiteprog.html>

<http://www.my-best-kite.com/how-to-make-a-kite.html>

<http://www.skratch-pad.com/kites/make.html>

<http://www.inquiry.net/OUTDOOR/spring/kites/>

Topic	Three things I discovered...
History of Kites	1. 2. 3.
Science of Kites	1. 2. 3.
Design Ideas	1. 2. 3.

Design:

Create a scale drawing of your kite using graph paper. You should label the scale factor of the drawing to the actual kite (ex. Scale Factor = ??).

Kite Measurements:

On your graph, you should label all side lengths and all angle measures. You should also calculate and record the perimeter and area of the blue print of your kite as well as figure out the area and perimeter of your actual kite.

Kite Flying:

Your project will be flown during class time. To classify as flying, the kite must be 10 feet off the ground and stay in the air for at least 10 seconds.

Assessment List and Rubric

Assessment List for Kite Project

Num	Element	Point Value	Earned Assessment	
			Self	Teacher
1	History of Kites chart completed	3		
2	Science of Kites chart completed	3		
3	Design Ideas chart completed	3		
4	Blueprint of kite designed on graph paper	5		
5	Scale Factor of scale model to actual kite displayed on blueprint	2		
6	Kite side lengths labeled on blueprint	3		
7	Kite angle measurements labeled on blueprint	3		
8	Kite perimeter of both blue print and actual correctly calculated and displayed on blueprint	5		
9	Kite area of both blue print and actual correctly calculated and displayed on blueprint	5		
10	Kite constructed according to blueprint	10		
11	Creativity/Neatness of construction	3		
12	Flight performance	5		
	Total	50		

Rubric for Kite Project

#	Element	0	1	2	3	4	5
1	History of Kites chart completed	0 pieces of historical information recorded	1 piece of historical information recorded	2 pieces of historical information recorded	3 pieces of historical information recorded	NA	NA
2	Science of Kites chart completed	0 pieces of historical information recorded	1 piece of historical information recorded	2 pieces of historical information recorded	3 pieces of historical information recorded	NA	NA
3	Design Ideas chart completed	0 pieces of historical information recorded	1 piece of historical information recorded	2 pieces of historical information recorded	3 pieces of historical information recorded	NA	NA
4	Blueprint of kite designed on graph paper	No blueprint of kite	A blueprint is drawn but is difficult to read and design contains significant flaws	A blueprint is drawn but is sloppy and design has some flaws	Blueprint is drawn neatly but the design has some flaws	Blueprint is drawn neatly with a thoughtful design but has a few inaccuracies	Blueprint is drawn neatly and precisely with a well thought-out design
5	Scale Factor of scale model to actual kite displayed on blueprint	No scale factor is displayed on blueprint	Scale factor is displayed but is unreasonable	Scale factor is displayed and is reasonable for the construction	NA	NA	NA
6	Kite side lengths labeled on blueprint	No side length measurements are labeled on blueprint	Some side length measurements are correct and labeled on blueprint	Most side length measurements are correct and labeled on blueprint	All side length measurements are correct and labeled on blueprint	NA	NA
7	Kite angle measurements labeled on blueprint	No angles measurements are labeled on blueprint	Some angle measurements are correct and labeled on blueprint	Most angle measurements are correct and labeled on blueprint	All angle measurements are correct and labeled on blueprint	NA	NA
8	Kite perimeter correctly calculated and	No perimeter was found for the kite.	An incorrect method was used to find the kite perimeter.	NA	A correct method was used to find the kite perimeter, but	NA	Kite perimeter of blue print and actual was correctly

	displayed on blueprint				was performed incorrectly.		calculated and labeled on blueprint.
9	Kite area correctly calculated and displayed on blueprint	No area was found for the kite.	An incorrect method was used to find the kite area.	NA	A correct method was used to find the kite area, but was performed incorrectly.	NA	Kite area of blue print and actual was correctly calculated and labeled on blueprint.
		0	2	4	6	8	10
10	Kite constructed according to blueprint	No kite is constructed	Kite is constructed but does not resemble blueprint design	Kite is similar to design on blueprint but measurements and the scale factor are wrong	Kite is similar to design on blueprint with several inaccuracies	Kite is constructed according to design on blueprint with some inaccuracies	Kite is constructed according to design on blueprint with accurate side lengths according to scale factor
		0	1	2	3	4	5
11	Creativity/ Neatness of construction	No kite is constructed	Kite is messy and uncreative	Kite is neat in construction	Kite is creative, neat in construction, and attractive	NA	NA
12	Flight performance	Kite does not fly	Kite flies as student runs while pulling the string for 3 seconds	Kite flies as student runs while pulling the string for 5 seconds	Kite flies at least 5 feet above the ground for at least 3 seconds	Kite flies at least 10 feet above the ground for at least 5 seconds	Kite flies at least 10 feet above the ground for at least 10 seconds

Benchmark for Kite Project



Team Names: Student Benchmark

Let's Go Fly a Kite!

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<http://www.gkites.com/howtofly/why.html>

<http://thephysicsofkites.homestead.com/index.html>




Design Ideas

<http://www.grc.nasa.gov/WWW/K-12/airplane/kiteprog.html>

<http://www.my-best-kite.com/how-to-make-a-kite.html>

<http://www.skratch-pad.com/kites/make.html>

<http://www.inquiry.net/OUTDOOR/spring/kites/>

Topic	Three things I discovered...
History of Kites	<ol style="list-style-type: none"> 1. Kites were once used in the South Sea Islands to catch fish. 2. It is believed Kites were flown in China more than 2000 years ago. 3. In the 18th and 19th centuries Kites were used as vehicles and tools for scientific research.
Science of Kites	<ol style="list-style-type: none"> 1. A kite is flown by the lift created by air in motion over its wings. 2. Drag is created by wind resistance on the kite's surface and tail. 3. A tail on a kite adds stability and balance.
Design Ideas	<ol style="list-style-type: none"> 1. Diamond Kite  2. Box Kite, square  3. Eddy 

Design:

Create a scale drawing of your kite using graph paper. You should label the scale factor of the drawing to the actual kite (ex. Scale Factor = ??).

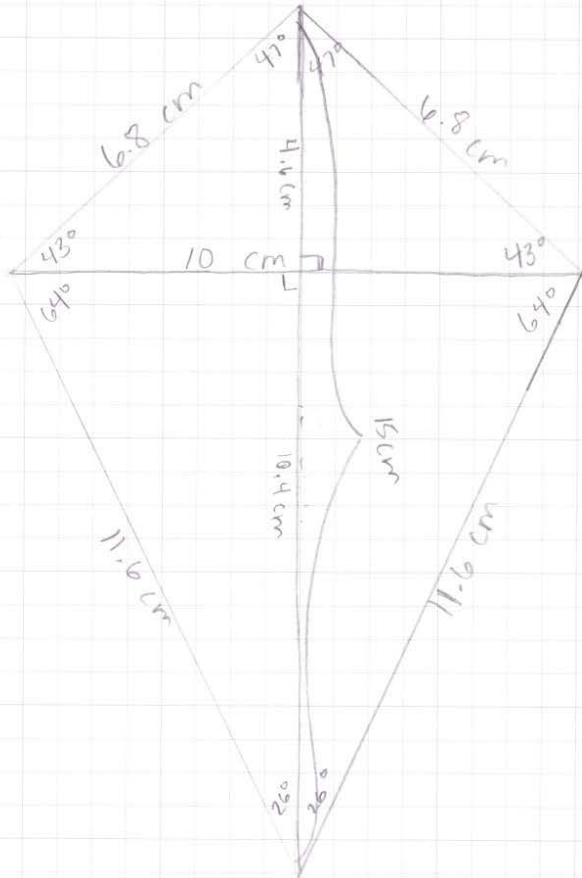
Kite Measurements:

On your graph, you should label all side lengths and all angle measures. You should also calculate and record the perimeter and area of your kite.

Kite Flying:

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Student Benchmark



$$\text{Perimeter} = 11.6 + 11.6 + 6.8 + 6.8 = \boxed{36.8 \text{ cm}}$$

$$\text{Area} = \frac{1}{2}(10)(4.6) + \frac{1}{2}(10)(10.4)$$

$$= 23 + 52$$

$$= \boxed{75 \text{ cm}^2}$$

$$\text{Scale Factor blue print to actual Kite} = \boxed{1 : 4}$$

Examples of students' final kite constructions and flying attempt:

