WAMC Lab Template

Math Concept(s): Properties of Kites, Pythagorean Theorem, Triangle Congruence

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Short Description:

- This lab will allow students to apply their understanding of triangle congruence and the Pythagorean Theorem to investigate properties of kites. Students will build a kite using supplies in the classroom, using accurate calculations and measurement, then fly their kite outside.
  This lab will occur after lessons about general quadrilateral properties and a more specific class about properties of kites, allowing students to apply what they learned.

Lab Plan

Lab Title: Go Fly a Kite!

Prerequisite Skills:

- Using congruence criteria to determine side lengths and angle measures in triangles.
- Applying the Pythagorean Theorem to find missing side lengths in right triangles.
- Applying general properties of quadrilaterals (features of polygons, sum of interior angles, etc.)
- Applying properties of kites:
  - Two consecutive pairs of sides are congruent
  - One pair of opposite angles are congruent
  - One diagonal is a perpendicular bisector of the other

Lab Objective: In this lab, students will construct and fly a kite, documenting measurements of materials needed, the dimensions of the frame, and the dimensions of the sail.

Standards:

Mathematics K–12 Learning Standards:

- 8.G.B.7
  Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
- HSG.SRT.C.8
  Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- HSG.SRT.B.5
  Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Standards for Mathematical Practice:

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.

K-12 Learning Standards-ELA:

- ELA-LITERACY.SL.8.1
  Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

Engineering:

- MS-ETS1-4
  Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
☒ Think Creatively
☒ Work Creatively with Others
☐ Implement Innovations
Critical Thinking and Problem Solving
☒ Reason Effectively
☐ Use Systems Thinking
☒ Make Judgments and Decisions
☒ Solve Problems
Communication and Collaboration
☐ Communicate Clearly
☒ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
☒ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
☐ Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
☐ Adapt to Change
☒ Be Flexible
Initiative and Self-Direction
☒ Manage Goals and Time
☐ Work Independently
☒ Be Self-Directed Learners
Social and Cross-Cultural
☒ Interact Effectively with Others
☒ Work Effectively in Diverse Teams

Productivity and Accountability
☐ Manage Projects
☒ Produce Results
Leadership and Responsibility
☐ Guide and Lead Others
☐ Be Responsible to Others

Teacher Preparation:

Materials:

- Materials list in lab instructions
- Pencils
- Paper (preferably quad-ruled)
- Rulers or straight-edges
- Protractors

Set-Up Required:

- Arrange classroom furniture in a way where all students can walk around freely.
- Ensure that all students have a flat surface on which to construct their kites.
- Ensure that the weather for this lab is clear and windy when taking students outside to fly their kites.

Lab Organization Strategies:

Leadership:

- Students take on roles within their partner groups when constructing the kite. One student could focus on crafting with string to create the frame, while the other could do the cutting and measuring tasks.

Cooperative Learning:

- Students with construct their kites in pairs. Each student will be responsible for the construction and measurement of part of the kite.
- Each pair will engage in collaborative discussion and action to ensure the accuracy of measurement and stable construction of their kite.

Expectations:

- Students use time wisely and engage with materials and space appropriately.
- **Formative Assessment**: Teacher will walk around the classroom, monitoring students and asking questions to gauge student understanding. Students create a neat sketch of their kite, including all measurements (side lengths, interior segments, interior angles). Teacher will also ask students to self-assess on a 1-4 scale (1 = don't understand, 2 = somewhat understand, 3 = mostly understand, 4 = completely understand).

Timeline:

- Lab Launch/Expectation Review (5 minutes)
- Kite Construction and Measurement (35-40 minutes)
- Kite Flying (10 minutes)
- Self-Assessment (5 minutes)

Post Lab Follow-Up/Conclusions:

Discuss Real-World Application of Learning from Lab:

- Any scenario that requires one to follow simple instructions, collaborate effectively with others, and make precise measurements would be applicable. This encompasses most scenarios and learning opportunities.

Career Applications:

- Any career in which one must solve problems, build a product, work well with others, gather information, and use that information to support ideas and decision-making.

Optional or Extension Activities:

- Further reflection questions could be asked about the construction of students' kites (how would changing the length of one diagonal of the kite affect its ability to fly?)
- Students could be invited to compare their products with others to investigate ratios in side lengths of right triangles (trigonometric application).
- One could modify this lab to create and measure kites with non-traditional shapes (other types of quadrilaterals, 3-dimensional models, etc.).

Go Fly a Kite!

Lab Instructions

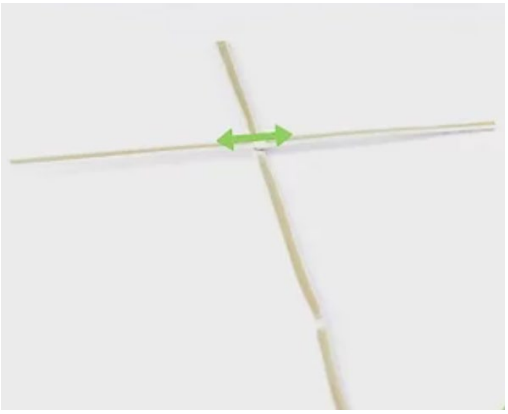
Reviewed by Amy Guerrero

Adapted from: https://www.wikihow.com/Make-a-Kite

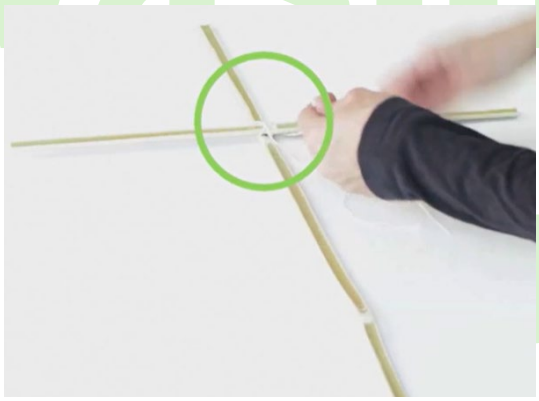
There is nothing quite like flying a kite outdoors on a sunny, breezy day. What's even better? Flying a kite you made yourself! Making a simple diamond kite is an easy project you can complete in one afternoon. We'll walk you through the process step-by-step and show you how to build the frame, fashion the sail, and put it all together. Then, you can enjoy watching your very own custom kite soar across the sky.

1. With your partner, gather the following materials to create your kite:
   - Pencil
   - Graph paper
   - Ruler
   - Tape measure (for larger kites)
   - Protractor
   - Colorful markers
   - (4) ¼-inch wooden dowels, or more for larger kites
   - String
   - Scissors
   - Hot glue or duct tape
   - White fabric
   - Kite flying line
   - Ribbons

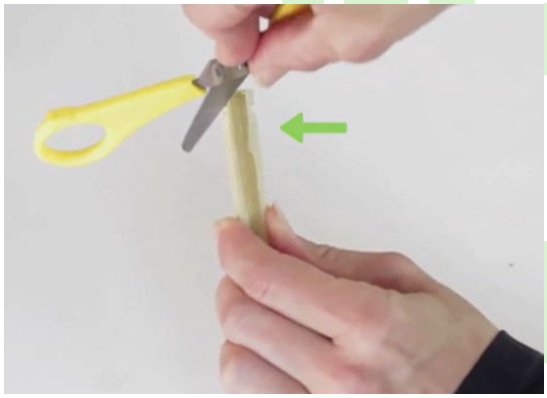
2. Make a lower-case "t"-shape with wooden dowels to make the frame of your kite. Make sure that the dowels intersect at a right angle, and that one of your dowels has been bisected by the other.
   If you would like to create a larger kite, use hot glue or duct tape to attach multiple dowels together.



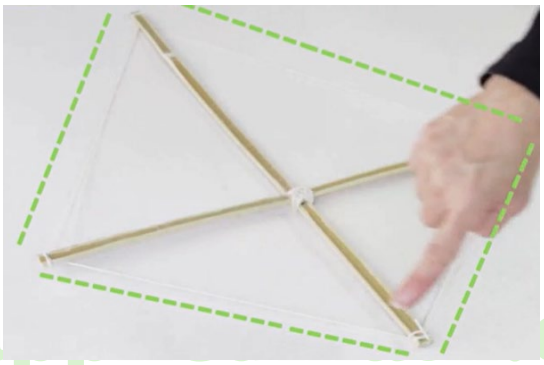
3. Attach the perpendicular dowels together with string and glue.
   Wrap string around the intersection of the dowels in “X” formations several times. Then, tie the string with a small knot and trim off the excess with scissors. Put a dab of hot glue on the knot and between the two dowels so the bond is extra secure.



4. Make a notch at the ends of each dowel, using scissors as a makeshift saw. Make the notches deep enough to fit the string you are going to use to attach the sail to the frame.

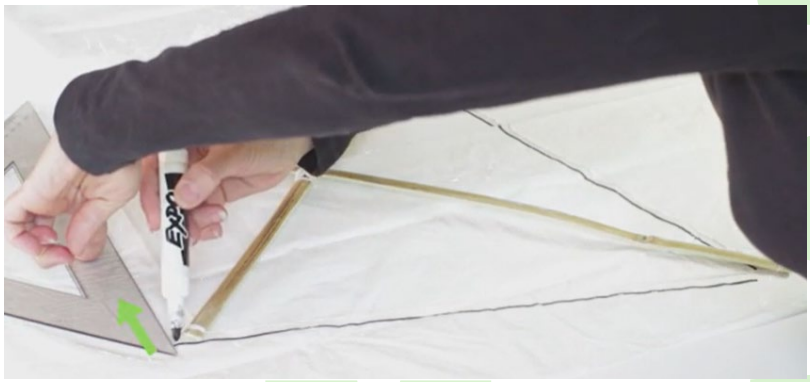


5. Stretch the string around the frame.
   Loop the string several times around one notch of the frame, then move either clockwise or counterclockwise repeating the process with the rest of the dowel notches. Once you have made your way back to the dowel you started with, wrap around this notch 1-2 more times. Keep the string taut; there should be no slack in the string, but the dowels should not bend or warp. You should see a clear kite shape once you have completed this process.



6. Cut the excess string used in the previous step and secure the shape with a knot in the string and a dab of hot glue.

7. Lay your kite frame on the fabric you will be using for the sail. Outline the frame with a ruler and a marker.



8. Measure, then cut the kite 2 inches wider than the outline you drew in the previous step. This extra space will allow you to wrap the sail to the frame easily. You should now have a nice, clean kite-shaped sail that can fit snugly over the frame.

9. Fold the edge of the sail over the frame, then glue it down. Once the glue has cooled slightly, press the fabric down firmly to keep the sail in place. The fabric should sit tightly over the frame with minimal give.

10. Tie a piece of string around the end of one dowel. Run the string along the front of your kite (the side that doesn't show the dowel frame) to the other end of the dowel, then tie it around the dowel and cut off the excess. Repeat this process with the other diagonal of the kite and another piece of string. The part you just constructed is called the kite's bridle.

11. Attach your flying line to the part of the bridle where the strings intersect. Use a secure knot and hot glue, if needed.

12. Make your kite your own! Use colorful fabric and/or ribbon to make a tail, and use paper or markers to decorate the front of the kite.

13. Test your kite outside to ensure that all parts are securely fastened to each other. Fly it!

14. Document all measurements of your kite on the lab follow-up.

Go Fly a Kite!

Lab Follow-Up and Student Self-Assessment (Formative)

Using a ruler and protractor, give a neat, smaller-scale sketch of your kite, including its diagonals (the frame made with dowels), in the space provided. Record the measurements of all segments and interior angles formed by the perimeter of the kite and its diagonals in your diagram.

After completing the lab, circle your level of understanding about properties of kites.

CATEGORY	4 EXCEEDS	3 MEETS	2 APPROACHING	1 DOESN'T MEET
Student Understanding	I completely understand this concept and could teach someone else.	I mostly understand this concept.	I somewhat understand this concept, but I need some help.	I don't understand this concept at all.