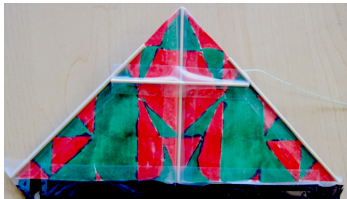


ARTS IMPACT—ARTS-INFUSED INSTITUTE LESSON PLAN (YR2-MAP)

SEVENTH GRADE—LESSON FIVE: Miniature Kites: Reducing Scale

Artist-Mentor – Meredith Essex

Grade Level: 7th



Enduring Understanding

Knowledge of ratio, scale factor and proportion can be used to accurately reduce the scale of shapes used in design and construction.

Math

Target: Reviews Delta kite parts and proportions.

Criteria: Lists sail, keel, spine, spar, spreader and 2:1 (b:h) ratio.

Target: Accurately scales down original kite dimensions.

Criteria: Draws 2:1 (b:h) isosceles triangle mini sail (8, 6 or 4 inch base) and right scalene triangle (30/60/90 degrees) mini-keel on grid paper.

Art

Target: Creates contrast and balance in design.

Criteria: Uses complementary colors in symmetrical polygon shapes.

Target: Uses craftsmanship in design.

Criteria: Draws with a ruler, cuts out sail and keel smoothly.

Art and Math

Target: Accurately calculates structural elements.

Criteria: Multiplies mini sail height by formula, measures, marks and/or cuts spine/spars/spreader attachment points.

Target: Adds structural elements with craftsmanship.

Criteria: Tapes spine/spars/spreaders/keel smoothly and symmetrically.

Extension:

Target: Scales up one design polygon.

Criteria: Multiplies mini-sail polygon by scale factor and draws similar figure on grid paper.

Session I

Materials

Pencils, colored pencils or markers in primary and secondary colors, vinyl erasers, 1-inch grid paper 8.5 x 11", rulers, scissors, individual color wheels

Learning Targets

- Reviews Delta kite parts and proportions.
- Accurately scales down original kite dimensions.
- Creates contrast and balance in design.
- Uses craftsmanship in design.

Do Now Label the Delta kite diagram. What is the ratio of base to height for the sail?

Activities/Prompts

- Review: What are the dimensions of your big kite sail? What is the ratio of base to height of sail/isosceles triangle b:h?
- Divide our big kites by a factor (of 3) and scale them down.

Sail dimensions:

Isosceles triangle

$4/3 = 8''$ base; $12/3 = 4''$ height (100%).

Keel Dimensions:

30/60/90 degree scalene triangle

hypotenuse/long side=3.16 inches (79%)

shortest side=1.32 inches (33%)

medium side=2.76 inches (69%)

Round measurements as a group, Post on board.

- Scale down and draw your mini kite on grid paper. Remember to dot vertices, count and number grid squares, and use your ruler.
- Add a sail design using symmetrical polygons.
- Review complementary color pairs combined for contrast: sports teams, art examples, kites. Use one pair in design. Add color and cut sail and keel out.



Big Math Ideas

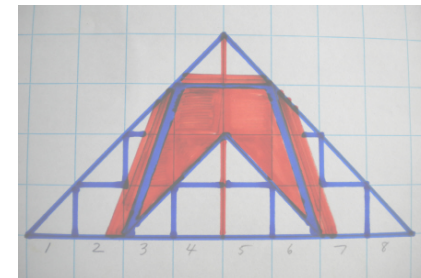
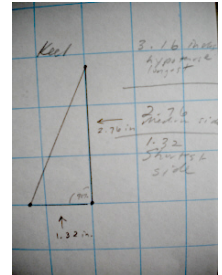
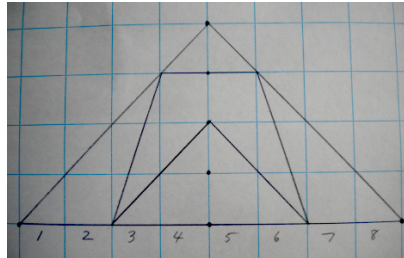
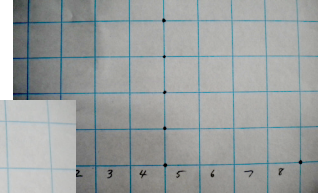
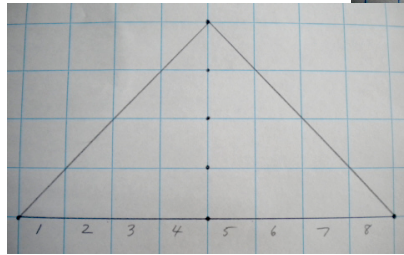
Ratio and proportion

Scale factor

Symmetry/reflection

Polygons/similar

Figures



Closure

Put all of your materials and notes in a zipper bag and seal.

Return tools as directed

Self assess using checklist. (7-33)

Assessment Criteria

- Lists sail, keel, spine, spar, spreader and 2:1 (b:h) ratio.
- Draws 2:1 (b:h) isosceles triangle mini-sail (8, 6 or 4 inch base) and right scalene triangle (30/60/90 degrees) mini-keel on grid paper.
- Uses complementary colors in symmetrical polygon shapes.
- Draws with a ruler, cuts out sail and keel smoothly.

Next Steps/Follow up Needs Pre cut 1.8 mm bamboo: one 4 inch spine, two 4-1/4 inch spars, and one approx 4" spreader (for students to trim to size). Pre-cut one 4x8 inch plastic tail shape per student.

Session II

Materials

pencils, colored pencils or markers, erasers, 1-inch grid paper 8.5 x 11" (pre-cut), 1.8 mm bamboo, 1/2 inch invisible magic tape, safety pins, rulers, old scissors, color wheels, pre-cut 4x8 inch plastic tail (one per student)

Learning Targets

- Accurately calculates (and cuts) structural elements.
- Adds structural elements with craftsmanship.
- Scales up one design polygon (extension).

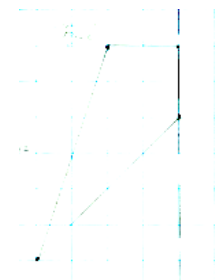
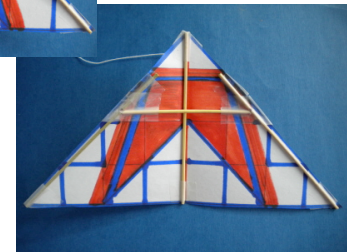
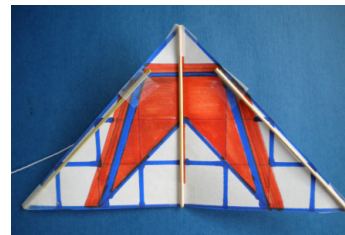
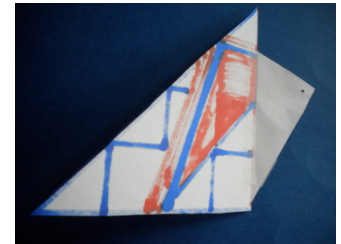
Do Now Calculate the length of the spine, spars, attachment point and keel size by dividing by factor of 3 or multiplying height of 4" by percentages in kite formula: spine height = 4 inches (100%); spar length = 4.36 inches (109%) spreader attachment point = 3.24 inches (81%) As a group, round off.

Activities/Prompt

- Fold mini-kite on line of symmetry. Wrap tape over to reinforce and poke hole in the keel angle that is a 90 degrees.
- Line up sail fold with hypotenuse of keel triangle touching sail base. Tape length of keel on both sides and trim.
- Check length of pre-cut spine and 2 spars against your calculations.
- Tape spine at bottom and top; wrap over spine tip. Spars touch base and are parallel with sides of sail. Tape top bottom and top of spars.
- Measure and mark spreader attachment points on upper spars. Lay bamboo between spreader attachment marks, cut, and fit in-between. Spine and spreader are perpendicular. Spreader is parallel with base. Wrap tape over spreader attachment.
- Add a tail by taping 4x8 inch plastic across base and adding parallel fringe.
- Extension: Enlarge one of the polygons in your kite design on grid paper. What is the scale factor in making this similar figure?

Big Math Ideas

Ratio and proportion
Scale factor
Symmetry/reflection
Similar figures
Measurement



Closure

Put all of your materials and notes in a zipper bag and seal.

Return tools as directed

Self assess using checklist. (7-33)

Assessment Criteria

- Multiplies mini-sail height by formula, measures, marks and/or cuts spine/spars/spreader attachment points.
- Tapes spine/spars/spreaders/keel smoothly and symmetrically.
- Multiplies mini-sail polygon by scale factor and draws similar figure on grid paper (extension).

Next Steps/Follow up Needs Tie approximately 30 inches of sewing thread or light finishing line to keel, tie off other end of line on pen or stick flying wand, and carefully wind up. Send home kite.

Session I

Teaching and Learning Strategies

DO NOW WARM-UP

Label the kite parts on the Delta kite diagram. What is the ratio of base to height for the sail?

1. Asks students review the kite making process by labeling parts of kites (worksheet provided with this lesson) and then leads students through making calculations for a mini-kite with an 8 inch base. *Prompts: What are the dimensions of your big kite sail? What is the ratio of base to height of sail/isosceles triangle $b:h$? Share the name for the kite parts that you were able to label in your Do Now. We are going to reduce our big kite size using a factor of 3. Divide the big kite dimensions by three: What is the height, what is the base of our sail?* Guides calculating dimensions, rounds off measurements, converts to inches as a group, and posts on board.

Sail dimensions:

Isosceles triangle

$4/3 = 8''$ base; $12/3 = 4''$ height (100%).

Keel Dimensions:

30/60/90 degree scalene triangle

hypotenuse/long side=3.16 inches (79%)

shortest side=1.32 inches (33%)

medium side=2.76 inches (69%)

Student: Participates in discussion by reviewing kite parts and ratios. Uses kite diagram/worksheet to label parts and enter calculations.

2. Demonstrates drawing mini-kite sail and keel using calculations on 1-inch grid paper (the paper becomes the actual small kite—the design is not transferred to Tyvek) *Prompts: Scale down and draw your mini-kite on grid paper. Remember to dot vertices, count and number grid squares, and use your ruler.*

Student: Draws mini-kite sail and keel on grid paper.

Embedded Assessment: Criteria-based teacher checklist

3. Demonstrates adding a design to sail using symmetrical polygons. *Prompts: Be sure that you use a ruler to create simple symmetrical polygons: straight-sided shapes. Use grid lines and vertices to guide you.*

Student: Adds geometric design in symmetry to kite.

Embedded Assessment: Criteria-based teacher checklist

4. Reviews complementary color pairs combined for contrast. Guides students in adding color to and cutting out sail and keel. *Prompts: Where do we find complementary colors on a color wheel? Where do we see complementary colors combined in the world around us? Sports teams, art examples, advertisements, kites? Be sure to use one pair in your design. Now add symmetrical complementary color to your sail and keel designs.*

Student: Adds complementary color pair in symmetry to kite.

Embedded Assessment: Criteria-based teacher checklist

Session II

Teaching and Learning Strategies

DO NOW WARM-UP

Calculate the length of the spine, spars, attachment point and keel size by dividing by factor of 3 or multiplying height on the kite diagram of 4" by percentages in kite formula: spine height = 4 inches (100%) spar length = 4.36 inches (109%) Spreader attachment point = 3.24 inches (81%) As a group, round off.

1. Demonstrates attaching the keel to the sail. *Prompts: Fold mini-kite on line of symmetry. Wrap tape over to reinforce and poke hole (using a pushpin or large safety pin) in the keel angle that is a 90 degrees. Line up sail fold with hypotenuse of keel triangle touching sail base. Tape length of keel on both sides and trim.*

Student: Attaches the keel to the sail.

Embedded Assessment: Criteria-based teacher checklist

2. Demonstrates attaching spine and spars. *Prompts: Check length of pre-cut spine and 2 spars against your calculations. Tape spine at bottom and top; wrap over spine tip. Spars touch base and are parallel with sides of sail; tape bottom and top of spars. On the mini-kites, we don't need tape running all the way up the spine and spars—it makes it heavy.*

Student: Attaches spine and spars.

Embedded Assessment: Criteria-based teacher checklist

3. Demonstrates attaching spreader. *Prompts: Measure and mark spreader attachment points on upper spars. Lay bamboo between spreader attachment marks, cut, and fit in-between. Spine and spreader are perpendicular. Spreader is parallel with base. Wrap tape over spreader attachment point; you do not need any tape on the intersection of spreader and spine—again, it makes the kite too heavy.*

Student: Measures, cuts and attaches spreader.

Embedded Assessment: Criteria-based teacher checklist

4. Demonstrates attaching spreader. *Prompts: Add a tail by taping 4x8 inch plastic across base. Cut parallel fringe.*

Student: Attaches and fringes tail.

Extension:

Prompts: Enlarge one of the polygons in your kite design on grid paper. What is the scale factor in making this similar figure?

Student Self Assessment Checklist

Mini Kites: Review Session I

- Lists sail, keel, spine, spar, spreader and 2:1 (b:h) ratio.
- Draws 2:1 (b:h) isosceles triangle mini sail (8, 6 or 4 inch base) and right scalene triangle (30/60/90 degrees) mini keel on grid paper.
- Uses complementary colors in symmetrical polygon shapes.
- Draws with a ruler, cuts out sail and keel smoothly.

Mini Kites: Review Session II

- Multiplies mini-sail height by formula; measures, marks and/or cuts spine/spars/spreader attachment points.
- Tapes spine/spars/spreaders/keel smoothly and symmetrically.
- Multiplies mini sail polygon by scale factor and draws similar figure on grid paper.

<p><u>Arts Infused:</u> Balance Enlarge Geometric shape Horizontal Parallel Perpendicular Proportion Reduce Scale Symmetry Vertical <u>Math:</u> Base Height Isosceles Ratio Rectangle Reflection Right scalene triangle Scale factor Similar figures Triangle Vertex <u>Art</u> Complementary Color Contrast Craftsmanship <u>Kite</u> Base Keel Sail Spars Spine Spreader Attachment point Tail</p>	<p>Museum Artworks</p> <p>Additional Resources: <i>Guide to Building Miniature Kites</i> by Glenn Davison, 2004</p> <p>Individual Color wheels & color wheel poster.</p> <p>Art Materials: One inch grid copy paper 8.5 x11 inches Pencils Vinyl erasers Small rulers Primary and secondary colored pencils or markers</p> <p>1.8 mm bamboo (from www.drachen.org):</p> <ul style="list-style-type: none"> • one spine per student: cut to 4 inches • two spars per student: cut to 4 ¼ inches • one spreader: 4 inches approximately custom trimmed to fit each kite by students <p>½ inch invisible scotch tape Safety pins to punch hole in keel Colorful recycled plastic bags for tails Thread or light fishing line Old scissors</p>	<p>Arts State Grade Level Expectations AEL 1.1 concepts <i>Geometric shape, Scale</i> AEL 1.1.2 composition <i>Proportion, Symmetry/balance</i></p> <p>AEL 1.2 skills and techniques <i>Measuring</i> <i>Drawing</i> <i>Reducing scale</i> <i>Taping</i></p> <p>AEL 4:2 connections between the arts and other content areas <i>Explains relationships between the arts and other content areas</i></p> <p>Math State Grade Level Expectations 7.2.A proportionality and similarity <i>Mentally adds, subtracts, multiplies, and divides simple fractions, decimals, and percents</i> 7.2.B proportionality and similarity <i>Solves single- and multi-step problems involving proportional relationships and verifies the solutions</i> 7.2.C proportionality and similarity <i>Describes proportional relationships in similar figures and solves problems involving similar figures</i> 7.2.D proportionality and similarity <i>Makes scale drawings and solves problems related to scale</i> 7.2.H proportionality and similarity <i>Determines whether or not a relationship is proportional and explains reasoning</i> 7.2.I proportionality and similarity <i>Solves single- and multi-step problems involving conversions within or between measurement systems and verifies the solutions</i> 7.3.C surface area and volume <i>Describes the effect that a change in scale factor on one attribute of a two- or three-dimensional figure has on other attributes of the figure, such as the side or edge length, perimeter, area, surface area, or volume of a geometric figure</i></p>
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Vocabulary	Materials and Community Resources	WA Essential Learnings & Frameworks
<p><u>Arts Infused:</u> Balance Enlarge Geometric shape Horizontal Parallel Perpendicular Proportion Reduce Scale Symmetry Vertical <u>Math:</u> Base Height Isosceles Ratio Rectangle Reflection Right scalene triangle Scale factor Similar figures Triangle Vertex <u>Art</u> Complementary Color Contrast Craftsmanship <u>Kite</u> Base Keel Sail Spars Spine Spreader Attachment point Tail</p>	<p>Museum Artworks</p> <p>Additional Resources: <i>Guide to Building Miniature Kites</i> by Glenn Davison, 2004</p> <p>Individual Color wheels & color wheel poster.</p> <p>Art Materials: 1-inch grid copy paper 8.5 x 11" Pencils Vinyl erasers Small rulers Primary and secondary colored pencils or markers</p> <p>1.8 mm bamboo (www.drachen.org):</p> <ul style="list-style-type: none"> • one spine per student: cut to 4 inches • two spars per student: cut to 4 ¼ inches • one spreader: 4 inches approximately custom trimmed to fit each kite by students <p>½ inch invisible scotch tape Safety pins to punch hole in keel Colorful recycled plastic bags for tails Thread or light fishing line Old scissors</p>	<p>Arts State Grade Level Expectations AEL 1.1 concepts <i>Geometric shape, Scale</i> AEL 1.1.2 composition <i>Proportion, Symmetry/balance</i></p> <p>AEL 1.2 skills and techniques <i>Measuring</i> <i>Drawing</i> <i>Reducing scale</i> <i>Taping</i></p> <p>AEL 4.2 connections between the arts and other content areas <i>Explains relationships between the arts and other content areas</i></p> <p>Math State Grade Level Expectations 7.2.A proportionality and similarity <i>Mentally adds, subtracts, multiplies, and divides simple fractions, decimals, and percents</i> 7.2.B proportionality and similarity <i>Solves single- and multi-step problems involving proportional relationships and verifies the solutions</i> 7.2.C proportionality and similarity <i>Describes proportional relationships in similar figures and solves problems involving similar figures</i> 7.2.D proportionality and similarity <i>Makes scale drawings and solves problems related to scale</i> 7.2.H proportionality and similarity <i>Determines whether or not a relationship is proportional and explains reasoning</i> 7.2.I proportionality and similarity <i>Solves single- and multi-step problems involving conversions within or between measurement systems and verifies the solutions</i> 7.3.C surface area and volume <i>Describes the effect that a change in scale factor on one attribute of a two- or three-dimensional figure has on other attributes of the figure, such as the side or edge length, perimeter, area, surface area, or volume of a geometric figure</i></p>

ARTS IMPACT—ARTS-INFUSED INSTITUTE LESSON PLAN (YR2-MAP)
SEVENTH GRADE—LESSON FIVE: Miniature Kites: Reducing Scale
ASSESSMENT WORKSHEET

Disciplines Concept	MATH		ART		ART AND MATH		MATH	Total 7 Points
	Kite Parts and Ratio		Craftsmanship	Contrast and Balance	Construction, Craftsmanship		Similar Figures	
Students	Lists sail, keel, spine, spar, spreader and 2:1 (b:h) ratio	Draws 2:1 (b:h) isosceles triangle mini sail (8, 6 or 4 inch base) and right scalene triangle (30/60/90 degrees) mini keel on grid paper	Draws with a ruler, cuts out sail and keel smoothly	Uses complementary colors in symmetrical polygon shapes	Multiplies mini-sail height by formula, measures, marks and/or cuts spine/spars/spreader attachment points	Tapes spine/spars/spreaders/keel smoothly and symmetrically	Multiplies mini-sail polygon by scale factor and draws similar figure on grid paper	
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24.								
25.								
26.								
Total								
Percentage								

Criteria-based Reflection Questions: (Note examples of student reflections on back.)

Thoughts about Learning: Which prompts best communicated concepts? Which lesson dynamics helped or hindered learning?

Lesson Logistics: Which classroom management techniques supported learning?

Teacher: _____

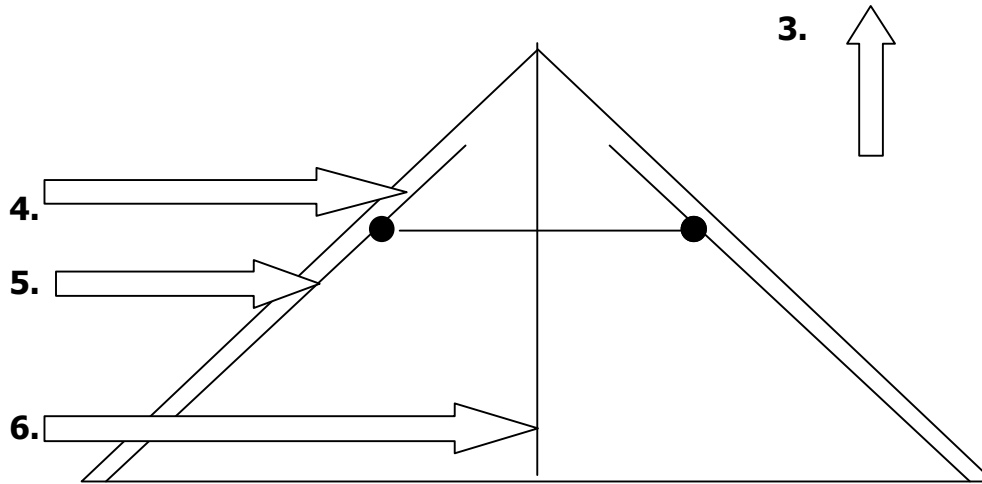
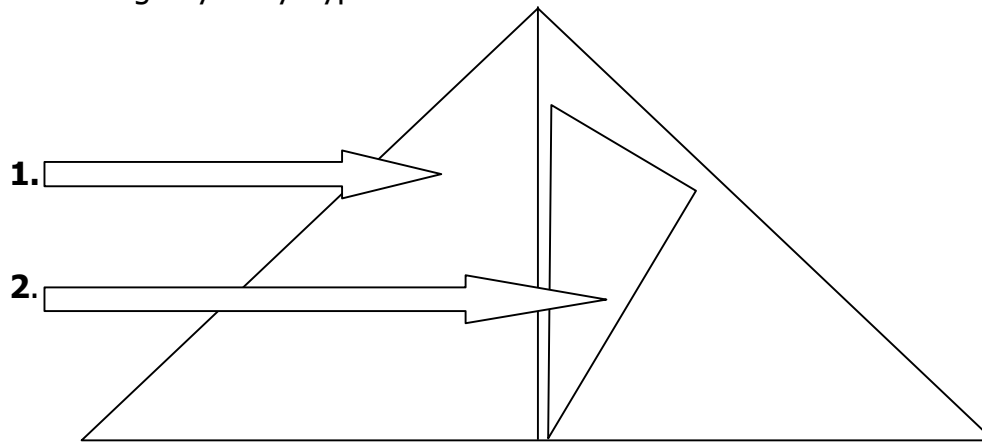
Date: _____

Name: _____

Period: _____

Delta Kite Diagram: Label Each Part of the Kite

Kite Design by Tony Cyphert



7. ● =

8. Ratio of Base to Height =

1. _____

2. _____

3. _____

4. _____

5. _____

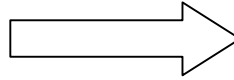
6. _____

7. _____

8. _____

**Math Formulas and Calculations for Kite:
Reducing size or scaling down....**

LARGE KITE



SMALL KITE

$\frac{b}{h}$

$\frac{24''}{12''}$ (divided by 3) = _____
 $\frac{12''}{12''}$ (divided by 3) = _____

OR $\frac{1}{3} \times \frac{24''}{1} =$

$\frac{1}{3} \times \frac{12''}{1} =$

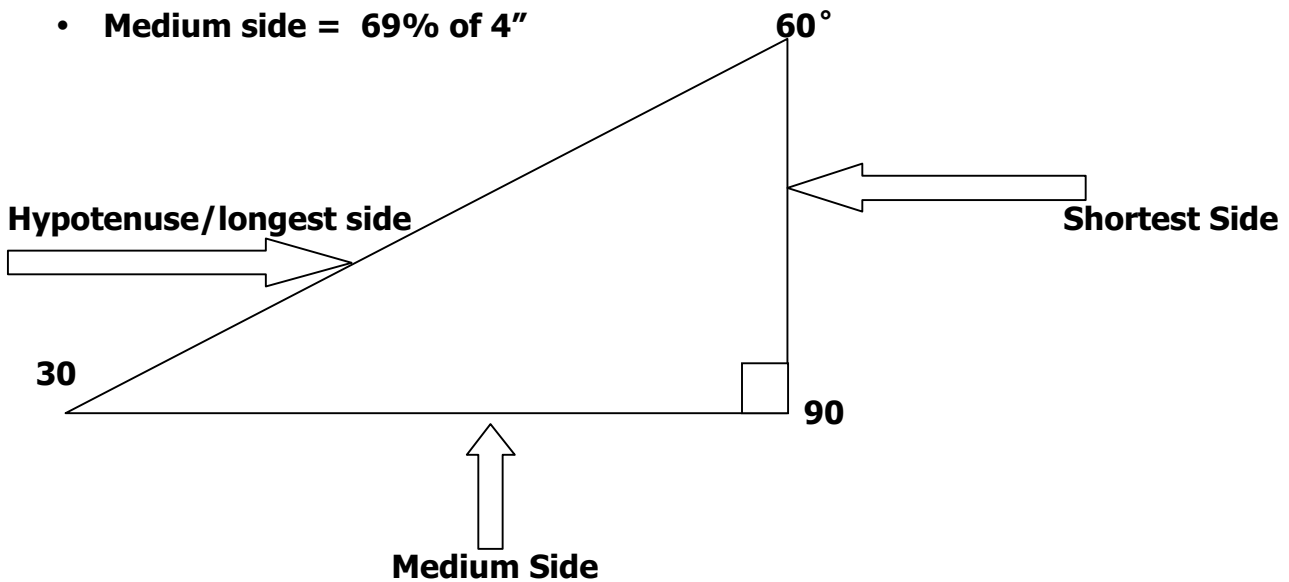
BAMBOO

- The height of the small kite is 4 inches.
- Spine = 100% of 4"
- Spars = 109% of 4"
- Spreader attachment point = 81% of 4"

KEEL DIMENSIONS:

Scalene Right Triangle

- Hypotenuse = 79% of 4"
- Shortest side = 33% of 4"
- Medium side = 69% of 4"



Worksheet design by Nancy Givens