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

SEVENTH GRADE—LESSON ONE: Kites: Calculations and Designs:

Enlarging Scale Part I

Artist-Mentor – Meredith Essex Grade Level: 7th

Examples:

Enduring Understanding

Application of knowledge of ratio, scale factor and proportion can be used to accurately enlarge the scale of

shapes used in design and construction.

Art

Target: Plans a symmetrical design for surface decoration (of kite sail).

Criteria: Organizes and draws geometric shapes in reflection on a proportional isosceles triangle on

one-inch grid paper—formula: b:h=2:1.

Art and Math

Target: Accurately applies calculations to make a larger scale pattern.

Criteria: Measures using grid, ruler and protractor (optional) and draws full-size proportional pattern of

isosceles (sail) and scalene (keel) on 1-inch grid paper. (Delta-style kite)

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Session I

Materials

1-inch grid paper 9x12”, small rulers, pencils,

erasers, My Kite Journal (MKJ), 2-gallon zipper bags

(ex: Ziploc)

Resources

TAM Image: Leroy the Big Pup by Scott Fife

Kite images, SAM Cultural geometric designs

Learning Targets

• Plans a symmetrical design for surface

decoration (of kite sail).

Do Now

Draw 3 symmetrical polygons (straight-sided, closed shapes) that include lines of symmetry.

Activities/Prompts

• Meet Leroy the Big Pup (MKJ 8-2). How did

the sculptor (artist who works in 3-D) use

math to make this giant dog in proportion?

• Kites have been made for over 2000 years

and have scientific, cultural and religious

roles in many countries. What do all of these

kites have in common? Symmetry. Why? For

aerodynamic balance in flight. See

www.drachen.org.

• The kites (Delta style designed by Tony

Cyphert) we will build are composed of an

isosceles triangle (sail) and a scalene

triangle (keel). We use a proportional

formula for aerodynamic design that is the

same whether building a huge or tiny kite.

• Sketch three simple

symmetrical designs using

polygons only. MKJ 8-3

• Create a small scale sail shape for your kite

sail (isosceles triangle) using a 2:1 b:h ratio

on 1-inch grid paper. Count and number (in

the middle of the square) six squares for

sail/triangle base and up three for the height

or spine of the sail. MKJ 8-3

• Choose your best design and draw it on

your small scale sail.

Big Math and Art Ideas

Ratio/proportion, symmetry, polygons/similar

figures isosceles triangle, scalene triangle, balance

Self Assessment/Reflection

Students peer check for symmetry + correct

number and proportion of grid squares for sail.

Closure Students put MKJ and grid paper (and

any other tools as directed by teacher) in zipper

bag with name on it. Binder clip student desk/table

group bags together for ease of distribution; store.

Assessment Criteria

o Organizes and draws geometric shapes in

 reflection on a proportional isosceles triangle on

 1-inch grid paper—formula: b:h=2:1.

Next Steps/Follow up Needs Cut 1-inch grid paper to 15x30 inches, if needed.

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Session II

Materials

1-inch grid paper 15x30”, small and large rulers,

pencils, erasers

Resources Color wheels, TAM or SAM resources

showing complementary color geometric designs

Learning Targets

• Accurately applies calculations to make a

larger scale pattern.

Do Now

 Calculate the dimensions for other delta kites using the 2:1 base to height formula.

Practice Measuring: Find and mark 1and one half, 2 and one fourth, and 3 and three fourth on the ruler shown.

Activities/Prompts

• Color preview: We are using complementary

color combinations (across from another on

the color wheel) for contrast. Which pair will

you use?

• Using our Delta Kite formula, multiply h (3

inches) of small scale sail design by the

following percentages for

keel dimensions:

Keel Formula MKJ 8-4

shortest side: 33% x h

medium side: 69% x h

hypotenuse/long side: 79% x h (round off)

• Draw 30/60/90 degree keel scalene triangle

on 1-inch grid paper. Start with aligning the

90 degree angle with a grid paper square,

measure and draw. Label the 90 degree

angle; add geometric design to keel.

• Make it bigger!

Calculate kite sail full size

(b:h = 24:12 inches) and

draw

pattern on 1-inch grid paper.

What is the scale factor? Use your ruler:

line up with grid squares to be accurate!

MKJ 8-5

• Count and number (in the middle of the

square) 24 squares for sail/triangle base and

up 12 for the height/ spine of the sail.

• Use formula to calculate full size keel,

measure and draw on 1-inch grid paper.

Big Math and Art Ideas

scalene right triangle, isosceles triangle, scalene

triangle, scale factor, ratio/ proportion, symmetry,

polygons, similar figures, balance,

contrast/complementary colors

Self Assessment

Peer check. Students complete

self-checklist and reflect: Why is it

important that the formula stays

the same no matter the size of the kite? MKJ 8-5

Closure Students place MKJ and all drawings in

zipper bag and store as directed.

Assessment Criteria

o Measures using grid, ruler and protractor

 (optional) and draws full-size proportional

 pattern of isosceles (sail) and scalene (keel) on

 1-inch grid paper.

Next Steps/Follow up Needs Guide completion of full size sail and keel pattern in preparation for

drawing enlarged design on full size pattern.

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Session I

Teaching and Learning Strategies

DO NOW WARM-UP

Draw 3 symmetrical polygons (straight-sided closed shapes) that include lines of symmetry.

1. Warm-up: Introduces LeRoy the Big Pup by Scott Fife from the Tacoma Art Museum Collection.

(MKJ 8-2) Prompts: When you look at this sculpture, what do you notice—does it look like a real dog? Share

what mathematical operations or processes you think the artist would have needed to create his dog in

proportion—with all parts of the animal having the same ratio or relationship to one another—on a much

larger scale? Why is it important to know how to proportionally increase or decrease the scale of an object or

design?

Student: Participates in discussion.

2. Introduces scope of kite-making art lessons and shares a brief history with images of kites and

focus on their significance culturally and scientifically. Shares images of kites from all different

cultures and countries on www.drachen.org. Prompts: You will use Math and Visual Arts to create kites

that are unique and beautiful works of art that fly! Kites have been in existence for over 2000 years and

probably originated in China. They have been a part of religious celebrations, also used for competitions and

recreation. They have been put to work in the service of construction, military, transportation and scientific

purposes. Kites have been used to solve many problems: to lift meteorological instruments to high altitudes,

study weather, take photographs, and to transport cables over bodies of water in early construction projects.

Why do you think all of the kites are symmetrical in shape? Think about science and the concept of balance.

We will be using symmetry to make sure that our kites are balanced aerodynamically, artistically and

mathematically. Symmetry will also simplify our process of measuring and enlarging our kite pattern and kite

designs. We will be starting a scale design today that we will be enlarged for a full sized kite.

Student: Participates in discussion.

Guides students in identifying shapes for kite pattern. Prompts: We are going to create a kite using an

aerodynamic formula designed for flight created by a kite designer named Tony Cyphert. Our basic kite shapes

include a sail and keel—both triangles. The sail is an isosceles triangle and the keel is a scalene triangle.

The sail catches the wind and provides a tow attachment point that sets the kite into the wind at an angle that

makes flight possible. No matter how big or small the kite is, if the same formula and ratio of all of the parts is

used, it will be aerodynamic.

Student: Notes shapes.

3. Guides students in looking at TAM and SAM collection art and visualizing a geometric design for

the surface of the kite that is composed of polygons in reflection. Prompts: Describe how many lines

of symmetry you see in this work of art? We will all be working with very simple geometric shapes—

polygons (circles/half-circles can be used—at discretion of math teacher) Here are some ideas: think simple

lines and shapes. When we enlarge the kites we can add more detail.

No Letters and no numbers; just purely geometric shapes.

 Student: Participates in discussion. Sketches three different ideas for a symmetrical geometric kite

design. MKJ 8-3

4. Demonstrates drawing proportional triangle as a small design/pattern on 1-inch grid paper

using b:h=2:1 ratio. Prompts: The ratio of base to height in the Delta kite formula is b:h=2:1. All critical

measurements for the kite are related to the height of the sail (isosceles triangle). We are starting with a small

scale drawing that is 6 (one inch) squares for the base and 3 squares for the height. The height of our

kite/triangle is 3 inches. Number your grid squares right in the middle of each square and count 6 for the base

and 3 for the height. Dot vertices and connect dots by drawing with a ruler.

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Pick your most interesting symmetrical sketch in My Kite Journal and draw it on your grid paper sail shape by

precisely lining up a ruler with grid lines and counting squares for symmetry. Use dots on the grid to mark the

vertices of all figures. MKJ 8-3

Student: Draws small scale design for sail.

Embedded Assessment: Criteria-based teacher checklist

Session II

Teaching and Learning Strategies

DO NOW WARM-UP

Calculate the sail size for other delta kites listed using the 2:1 base to height formula.

Practice Measuring: Find and mark 1 and one half, 2 and one fourth, and 3 and three fourths on the ruler shown.

1. Previews focus on complementary color for kite design. Prompts: We are using complementary color

combinations for contrast to make our kites visually POP! Complements are directly across from each other on

the color wheel. Start thinking about which complementary pair you will use in your design.

Student: Starts to visualize kite color combinations.

2. Demonstrates calculating and drawing a small scale keel in proportion. Using our Delta formula,

we multiply the height (3 inches) of our small scale sail design by the following percentages to get the keel

dimensions.

Keel Dimensions: 30/60/90 degree scalene triangle

shortest side = 33%xh (3 inches)

medium side = 69%xh (3 inches)

hypotenuse/long side = 79%xh (3 inches)

It is a right scalene triangle with 30-60-90 degree angles. Prompts: This type of triangle is used in

many real world applications—especially construction. The ratios of the sides are special, and you will learn

more about these in geometry. Draw 30/60/90 degree keel scalene triangle on 1-inch grid paper. Start with

aligning the 90 degree angle with a grid paper square, measure and mark shortest and medium length sides of

the triangle, then draw the hypotenuse (longest side) from vertex to vertex. On the keel shape, create a simple

geometric design using grid lines and vertices—it does not have to be symmetrical since it is on a triangle that

does not have any lines of symmetry, but, you might want to align the design with your sail design.

 Student: Calculates small scale keel dimension, rounds off and converts to inches and draws on same

paper as small scale sail design, then adds simple geometric design. MKJ 8-4

3. Demonstrates enlarging the sail for the full sized kite pattern. Prompts: Now, let’s make it

bigger. I am drawing a full size isosceles triangle for my kite sail using a 2:1 b:h ratio on 1-inch grid paper

(24:12). What is the scale factor (4)? Count and number (in the middle of the square) 24 squares for

sail/triangle base and up 12 for the height/ spine of the sail. It is really important to be mathematically

accurate in counting squares and confirming symmetry—otherwise errors will compound and you will have put

a lot of time into a design that has to be re-done.

Student: Confirms correct ratio and dimensions and draws full size pattern for sail. MKJ 8-5

Embedded Assessment: Peer check for correct number of squares/proportional triangle

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4. Demonstrates enlarging the keel for the full-sized kite pattern. Prompts: I am calculating full-size

keel dimensions using the formula above. Multiply the height (12 inches) by each percentage. Notice I draw

the full size 30/60/90 degree keel scalene triangle on 1-inch grid paper. Start with aligning the 90 degree angle

with a grid paper square as with the small keel, measure and mark shortest and medium length sides of the

triangle, then draw the hypotenuse (longest side) from vertex to vertex. Label the 90 degree angle with a

square to show which angle is 90 degrees.

Student: Confirms correct ratio and dimensions and draws full size pattern for keel. MKJ 8-5

Embedded Assessment: Peer check for correct keel measurements

Vocabulary Materials and Community

Resources

WA Essential Learnings & Frameworks

Arts Infused:

Enlarge

Geometric shape

Pattern

Proportion

Scale

Symmetry

Math:

Angle

Base

Isosceles triangle

Ratio

Reflection

Scale factor

Scalene triangle

Side

Triangle

Vertex

Vertices

Art

Abstract

Balance

Complementary

Colors

Contrast

Kite

Base

Keel

Sail

Museum Artworks

Color wheel poster

Tacoma Art Museum Collections:

Scott Fife, LeRoy the Big Pup, 2004

Picturing America:

Anasazi Cylinder Jars, c. 1100,

Pueblo Bonito, Chaco Canyon

Beacon Lights, 1904-05, Louisa

Keyser

Gullah rice fanner basket, 1872-

1960, Attributed to Caesar Johnson

Diamond in the Square – Sunshine

and Shadow Variation Pattern Quilt,

c. 1935, Gift of “The Great Women

of Lancaster”

Bars – Wild Goose Chase Pattern

Quilt, c. 1920, Gift of Irene N.

Walsh

Lone Star Pattern Quilt, c. 1920,

Gift of Irene N. Walsh

Additional Resources:

The Making of Japanese Kites:

Tradition, Beauty and Creation by

Masaaki Modegi, Japan Publications

Trading Co., 2007

www.drachen.org

Kites for Everyone: How to Make

and Fly Them by Margaret Gregor,

Dover Books, 2000

Delta Kite Design Formula by Tony

Cyphert

Art Materials:

My Kite Journal

Pencils

Vinyl erasers

1-inch grid paper, 9x12

1-inch grid paper, 15x30

Small and large rulers

Optional:

Protractor

Compass

Calculator

Arts State Grade Level Expectations

AEL 1.1 concepts

Geometric shape

Scale

AEL 1.1.2 composition

Proportion

Symmetry/balance

AEL 1.2 skills and techniques: Measuring, drawing, enlarging

AEL 4.2 connections between the arts and other content areas

Explains relationships between the arts and other content areas

Math State Grade Level Expectations

7.2.B proportionality and similarity

Solves single- and multi-step problems involving proportional relationships and

verifies the solutions

7.2.C proportionality and similarity

Describes proportional relationships in similar figures and solves problems

involving similar figures

7.2.D proportionality and similarity

Makes scale drawings and solves problems related to scale

7.2.H proportionality and similarity

Determines whether or not a relationship is proportional and explains reasoning

7.2.I proportionality and similarity

Solves single- and multi-step problems involving conversions within or between

measurement systems and verifies the solutions

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SEVENTH GRADE—LESSON ONE: Kites: Calculations and Designs:

Enlarging Scale Part I

ASSESSMENT WORKSHEET

Disciplines ART ART AND MATH

Total

4

Points Concept Balance Ratio: Proportion

Students Draws proportional

isosceles triangle

with line of

symmetry

Draws geometric

shapes in reflection

Measures using

grid, ruler and

protractor

Draws full size

proportional

pattern

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25.

26.

Total

Percentage

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

Why is it important that the formula stays the same no matter the size of the kite?

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: