GEOMETRY:

TRANSLATIONS, ROTATION, REFLECTION AND DILATIONS IN ETHNIC PATTERNS AND DESIGNS

BY JEN OGITANI

Why is it important to learn about the diversity of cultures that comprise each student and how this diversity is reflected locally in the class, the school, the community and the world?

HIGH SCHOOL **NINTH - TWELFTH GRADE**

TIMEFRAME **THREE - 1 HOUR CLASS SESSIONS**

STANDARD BENCHMARKS AND VALUES

MATHEMATIC COMMON CORE HAWAII STATE STANDARDS:

- **G-SRT.2:** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangle as the equality of all corresponding pairs of angles and proportionality of all corresponding pairs of sides.

- **G-CO.12:** Make formal geometric constructions with a variety of tools and methods. Copying a segment, angle, bisecting an angle, perpendicular lines and bisector.

ENDURING UNDERSTANDINGS

- People from all over the world create art using patterns to express and pass on myths, history and traditions.
- Various art forms, such as tattooing, scarification, or textile design, use geometric patterns. Furthermore, the manipulations of these patterns are common throughout the world, more importantly, in the diversity of the cultural backgrounds of our students.
- These art forms convey significant cultural aspects of society such as hierarchy, religious and political affiliations.

CRITICAL SKILLS AND CONCEPTS:

- Moving a figure from one quadrant to another quadrant over the x-axis or y-axis creates a reflection.
- Sliding a figure without turning creates a translation.
- Turning a certain number of degrees creates a rotation.
- Enlarging or shrinking a figure creates dilation.

AUTHENTIC PERFORMANCE TASK:

Students will research and create a personalized cultural design using symbols from their ethnic backgrounds. The student will have a presentation demonstrating how reflection, rotation, translation and/ or dilation are utilized in their design.

AUTHENTIC AUDIENCE:

Through an academic showcase held in the spring, a slide show of student's work will be presented to the community, peers, parents, teachers and administration.

OTHER EVIDENCE:

Student will be able to:

- Identify basic two-dimensional regular and irregular shapes.
- Have knowledge about the coordinate system.
- Have instruction on transformative movement (translations, rotation, reflections and dilations).

LEARNING PLAN

BACKGROUND

For centuries, various art forms using patterns, such as tattooing and textile, has graced the bodies and materials that satisfy the souls of people around the world. The vast majority of what we know today about ancient arts has been passed down through oral legends, songs and ritual ceremonies. The roles, techniques and motifs of art have continued to exist for thousands of years. Some design elements use geometric motifs and were displayed in textile, architectures and ceramics. These geometric designs includes triangles, circles and other polygons that may have multiple meanings based on placement, culture or regional locations. Usually a master of this art form determines what is appropriate and the story being passed along for future generations. Apart from cultural designs, environmental and natural styles were incorporated into the story, thereby, changing the design of the art, enhancing it. Other imageries included, but not limited to, plants, animals, or daily life experiences. (As referenced by numerous authors at www.pbs.org)
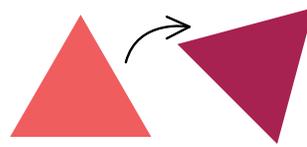
SCHEDULE:

Background: Approximately one month prior to the activity, students are to research through family interviews, online research, textbook research or any means that will inspire a ethnic pattern or design of their choosing.
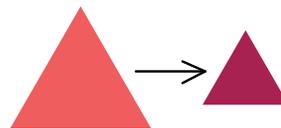
FOUR TYPES OF TRANSFORMATIONS
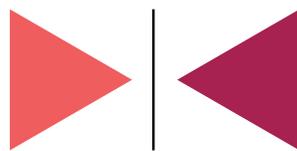
REFLECTION

ROTATION

TRANSLATION

DILATION

DAY ONE:

Introducing Cultural Patterns and Other Transformation - Power point presentation, brainstorming, class discussion for ideas and ethnicity. Ideas for Personal Design and History of Cultural Design graphic organizers, first draft of design and first peer editing. Homework: Revise draft using editor's recommendations. Student needs to list all geometrical terms relating to their design.

PREPARATION

1. Students will research one ethnicity of their choice. The design or pattern that best represents the culture and the individual.

2. Introduce cultural art patterns using PowerPoint slides. Have students discuss the importance of symbols in their own culture.

3. Hand out design packet – content:

- Title page
- Ideas for Personal Design survey
- History of Cultural Design graphic organizer
- 5 Steps to Answer an Equation graphic organizer
- 1st Reflection
- Word Bank – 3 pages with definition and examples
- Graphic grid sheet draft #1

- Peer Critique for draft #1
- Plan Graphic grid sheet draft #2
- Peer Critique for draft #2
- Transparency for Final design
- Rubric
- Final Reflection

4. PowerPoint presentation will give students some ideas of various culture and patterns or designs representing that culture.
5. Students will decide which designs they will use based on their research and personal choice that will best depict the medium of choice, such as, tattoos, quilting, ceramic or painting.
6. Draft #1: Students will construct a cultural design drawn on grid paper.
7. A peer will edit the design and give positive feedback
8. Homework: Students are to revise draft #1 using peer editor's suggestions on how to improve the assignment.

REFERENCES/RESOURCES:

Laura Farris, Tribal Tattoo Transformation, Ethnomathematics Resource

www.pbs.org

NAME —————————————————— **DATE** ——————————————

GEOMETRY:

Translations, Rotation, Reflection and Dilations in Ethnic Patterns and Designs

OBJECTIVE: You are to create a personalized tribal tattoo or textile product using ethnic symbols. You must be able to show and explain Reflection, Rotation, Translation and/or Dilations in your pattern.

ETHNIC CULTURE: ——————————————————

1. Research one (1) of your ethnicities.

2. Reveal the history of your design.

3. Create a design.

4. Display your design on a graph.

NAME _____   **DATE** _____

IDEAS FOR PERSONAL DESIGN

1. What are some important places to you?

2. What symbols represent these places?

3. What are your favorite hobbies/activities?

4. What symbols represent these activities?

5. What animal represents you?

6. What plant represents you?

7. What else is important to you and should be represented in your design?

8. What color represents you?

NAME _____ DATE _____

HISTORY OF CULTURAL DESIGN ORGANIZER

Name:	**Date:**
Culture: **Art Form:**	**Objective:** Transformation, Translation, Transform, Dilations, Stretch and Shrink. Students will be able to show on a graph and present to their audience a cultural design art pattern shown through various mediums of their choosing (tattooing, scarring, quilting, textile patterns, pottery design, etc.).
Background ● Ethnicity ● Cultural period ● Social significance	**History:**
Place of Origin ● Name: ● Where would you find your pattern?	**Shape(s) used and its meaning:**
Connections (Past to Present): Where would you see this art work?	**Shape or Design Representation: What does the overall design mean?**
Do you know of anyone that has this design or something similar if so, where?	**Is there significant meaning to your family and how?**

NAME _____   **DATE** _____

5 STEPS TO ANSWER AN EQUATION

PROBLEM:

SUMMARY: Paraphrase, use own words

STRATEGY: What do you need to do to solve the problem?

SOLUTION: Solve the problem

JUSTIFICATION: How did you get your answer?

REFLECTION: A few things to reflect on as you write your reflection:
Did you get the correct answer? Did you use all the strategies you listed? If you got the answer wrong, were you able to still complete all the steps needed? Was the answer wrong because of minor calculation errors, forgetting a step in the equation, or another reason? Be sure to use correct vocabulary.

NAME _____   DATE _____

WORD BANK FOR CULTURAL PATTERNS AND OTHER TRANSFORMATION

	WORD	DEFINE	EXAMPLE
A	Acute Angle	An angle whose measure is greater than 0 degrees and less than 90 degrees.	
B	Adjacent • Angles • Vertices	Sharing common sides • Angles with a common vertex and one common side. Vertices that share a common side.	
C	Bisector	To divide into two (2) equal parts.	
D	Congruent • Angles • Segments • Triangles	Having the exact same size and shape • Angles that have equal measures. • Segments that have the same lengths. • Triangles whose corresponding angles and sides are congruent.	
E	Diagonal	A line segment connecting any two nonadjacent vertices of a polygon.	
F	Dilation	A process by which a geometric figure is enlarged or shrunk.	
G	Equilateral triangle	A triangle with three equal sides.	
H	Hexagon	A six-sided figure.	
I	Image	Reflection of an object.	
J	Isosceles • Triangle	A geometric figure with two (2) sides of equal length. • A triangle with (2) equal sides	

	WORD	DEFINE	EXAMPLE
K	Line of Reflection	The line halfway between an object and its reflected image.	
L	Line of Symmetry	Reflection line of an object that the object coincides with the image.	
M	Obtuse • Angle • Triangle	• An angle whose measure is greater than 90 degrees but less than 180 degrees. • A triangle having one angle greater than 90 degrees.	
N	Octagon	An eight (8) sided polygon.	
O	Pentagon	A five (5) sided figure.	
P	Polygon	A closed, many-sided geometric figure.	
Q	Proportion	The equality of two (2) ratios.	
R	Ratio • Of Similarities	Comparing two (2) like quantities • A ratio comparing the relative sizes of similar figures.	
S	Rectangle	A parallelogram with four (4) right angles.	
T	Rhombus	A parallelogram with four (4) equal sides.	
U	Right Triangle	A triangle having one (1) right angle	
V	Rotation	Transformation in which a geometric figure turns around a center without affecting the size or shape.	
W	Scalene • Triangle	A geometric figure with sides of unequal length. • A triangle with no equal sides.	

	WORD	DEFINE	EXAMPLE
X	Square	A rectangle with sides of equal length.	
Y	Transform	To change the size or shape of a figure	
Z	Transformation	Movement of a geometric figure from one location to another	
A1	Translation	Transformation in which a geometric figure slides from one location to another without affecting it size or shape.	
A2	Vertex • Vertices	The point common to both sides of an angle. • Plural of vertex.	
A3			
A4			
A5			
A6			
A7			

WRITING AND PRESENTING RUBRIC

WRITING:	EXCEEDS	PROFICIENT	APPROACHING	FAR TO GO
Vocabulary	• Complete or proper use of a graphic organizer • List of all appropriate vocabulary	• Most sections and proper use of a graphic organizer • List of most appropriate vocabulary	• Some sections and proper use of a graphic organizer • List of some appropriate vocabulary	• No words or attempts were made • List of few appropriate vocabulary
Edit/Revision	Peer edit Revision - all corrections made Signature/date of editor	Peer edit Revision-all corrections made Signature/date of editor	Peer edit Revision-all corrections made Signature/date of editor	Peer edit Revision-all corrections made Signature/date of editor
PRESENTATION:				
Eye-contact	Not reading from assignment Complete entire presentation without notes	Not reading from assignment Complete entire presentation without notes	Some reading from Assignment Some notes needed	Reading from assignment Entire presentation with notes
Courtesy	Well prepared	Mostly prepared	Somewhat prepared	Not ready
QUESTIONS AND ANSWERS:				
Impromptu Skills	Very relaxed, delivers answers with confidence	Confident and relaxed. Answers questions.	Slightly anxious Answers without prior thoughts	Very anxious, unable to answer questions
Quality of Response	Answers accurately, responses are to the point and appropriate.	Responses reflect outcomes accurately and appropriate.	Responses reflect outcomes with some inconsistencies	Responses does not answer questions

FINAL SCORE: _____   90% + = 18-20PTS.   80%+=16-17PTS.   70% + =14-15PTS.   60% + =12-13PTS.

REFLECTION: WRITE 2-3 SENTENCES ANSWERING THE FOLLOWING QUESTIONS.
What did you do that made this presentation good?

What can you do to improve your score for the next time?

Name one thing you learned from another presenter. Who was that presenter and what was the topic?