**Native American Community Academy**

**Geometry Unit One: Shapes and Transformations**

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| **Stage 1 Desired Results***What are your unit objectives and outcomes?* | | |
| BIG IDEAS  Teamwork  Rigid Transformations (rotation, translation, reflection)  Symmetry | ***Transfer*** | |
| *Students will be able to independently use their learning to…*  Connect Geometric transformations to their heritage (in the form of beading, rugs, quilts, pottery and other traditional objects).  Work in teams more effectively to improve future success in the work force. | |
| ***Meaning*** | |
| UNDERSTANDINGS   1. Year-Long—Question Everything, Demand Acceptable Evidence! 2. Working in teams improves performance by increasing the likelihood of success through individual contributions. 3. Shapes can be created or changed through transformation. 4. Shapes have special qualities that aid in classification and description. | ESSENTIAL QUESTIONS   1. How do teams work together to solve a complex problems? 2. How do you evaluate information, and make the best decisions using logic? 3. How do you communicate ideas accurately and precisely 4. Geometric transformations are seen throughout art and Native American heritage. |
| ***Acquisition*** | |
| *As a result of this unit, students will know…*   1. How to work with each other to improve performance 2. The rigid transformations 3. How to describe any shape completely | *As a result of this unit, students will be be able to…*   1. Hone their visual spatial skills. 2. Describe shapes completely 3. Make strong logical arguments 4. Use predictions to determine outcomes, and test those predictions 5. Use the three major transformations on any shape |
| COMMON CORE STATE STANDARDS  Experiment with transformations in the plane  [CCSS.MATH.CONTENT.HSG.CO.A.1](http://www.corestandards.org/Math/Content/HSG/CO/A/1/) Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.  [CCSS.MATH.CONTENT.HSG.CO.A.2](http://www.corestandards.org/Math/Content/HSG/CO/A/2/) Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).  [CCSS.MATH.CONTENT.HSG.CO.A.3](http://www.corestandards.org/Math/Content/HSG/CO/A/3/) Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.  [CCSS.MATH.CONTENT.HSG.CO.A.4](http://www.corestandards.org/Math/Content/HSG/CO/A/4/) Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.  Understand congruence in terms of rigid motions  [CCSS.MATH.CONTENT.HSG.CO.B.6](http://www.corestandards.org/Math/Content/HSG/CO/B/6/) Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.  [CCSS.MATH.CONTENT.HSG.CO.B.7](http://www.corestandards.org/Math/Content/HSG/CO/B/7/) Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.  [CCSS.MATH.CONTENT.HSG.CO.B.8](http://www.corestandards.org/Math/Content/HSG/CO/B/8/) Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.  Prove geometric theorems  [CCSS.MATH.CONTENT.HSG.CO.C.9](http://www.corestandards.org/Math/Content/HSG/CO/C/9/) Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints*.  **Mathematical Practices**:  1. Make sense of problems and persevere in solving them.  2. **Reason abstractly and quantitatively**.  3. **Construct viable arguments and critique the reasoning of others.**  4. Model with mathematics.  5. **Use appropriate tools strategically.**  6. **Attend to precision.**  7. Look for and make use of structure.  8. **Look for and express regularity in repeated reasoning.** | | |

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| **Stage 2 – Evidence***How will you assess student learning?* | |
| **Evaluative Criteria** | **Assessment Evidence** |
| 1. Rough Draft created 2. Rough Draft critiqued by all group members 3. Critique is used to improve final project. 4. Must show two of the three major transformation (Extra Credit for a third) 5. Must be colored, on non lined paper in the final draft. | SUMMATIVE PERFORMANCE TASK(S)  Students will create a tessellation using at least two of the three major rigid transformations (reflection, translation and rotation). |
| EVALUATIVE CRITERIA:   1. Answers to Socratic questioning not graded, but reviewed for logical reasoning processes 2. Daily entrance tickets are not graded, but are recorded  (+, -, √) plus = shows understanding and has correct answer, a √ = shows understanding of concept but does not have the correct answer, minus = no understanding, incorrect answer. 3. Quizzes are graded on a standard grading scale. Quizzes will be based on the work of the week. 4. Homework: 10/10 if all problems attempted, 5/10 if work is incomplete but corrected during homework review, 0/0 homework not attempted, no corrections made during review. | FORMATIVE ASSESSMENT:   1. Socratic questioning method 2. Daily exit tickets based on the day’s tasks and homework 3. Nightly homework: Monday, Tuesday, Wednesday, Thursday, grade report to have parents sign on Friday. 4. Group reflections and personal reflections in the Learning Logs |

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| **Stage 3 – Learning Plan***What lessons will you teach, and what skills will students master, as a result of this unit?* | | | | |
| **Topical EU/EQ**  **For Lesson** | **CCSS Alignment with Stage 1** | **Formative Assessment of Lesson** | **Unit Modifications** | **Activities to Support the Lesson** |
| 1.1.1 Creating a Quilt- | [CCSS.MATH.CONTENT.HSG.CO.A.2](http://www.corestandards.org/Math/Content/HSG/CO/A/2/) | Assess how groups are working together to create quilt  Exit ticket: Why did we build a quilt? | 1. Pretest students prior to the start of Unit One to assess student needs.  Change class placement if necessary. 2. Give simple one step directions 3. Read all directions to all students 4. Prepare a list of instructions for students to follow if necessary 5. Provide manipulatives as necessary.  See **specific modifications**for a list of manipulatives for that lesson 6. Virtual manipulatives via smart phone or computer 7. Students may have extended time on homework and assessments.  Classwork is group based, and we don’t move on until all groups have finished. 8. Students may have alternative assessments where applicable 9. Reference guides provided to students who have a need 10. Eliminate distractions 11. Preferential seating 12. Shortened assignments for entirety of regular class for discretion 13. Use of real life models 14. Write model algorithms on the top of the page if necessary 15. Provide plenty of examples and models of correct work. 16. Check for accuracy 17. Check for understanding frequently 18. Follow IEP’s for additional information     Gifted Students:   1. Provide extension material 2. Group with intellectually challenging peers 3. Pretest for mastery prior to teaching material 4. Differentiated homework assignments 5. Opportunities for independent and/or accelerated work 6. Access to multiple learning sources and technology 7. Opportunities for inquiry and problem solving 8. Consider eliminating previously mastered material 9. Utilize IEP’s for more specialized modifications. | Video- Native American Rug Design, Quilt design.  Creating a Class Quilt, will be added to Class Quilt from last year.  **\*Project introduction: tessellations, MC Escher slide show** |
| 1.1.2 Mobius Strips-Predicting outcomes and experimentation is the core of learning | [CCSS.MATH.CONTENT.HSG.CO.C.9](http://www.corestandards.org/Math/Content/HSG/CO/C/9/)  **Construct viable arguments and critique the reasoning of others.**  **Reason abstractly and quantitatively** | Review homework  Warm-up to assess Lateral thinking skills  Assess group work.  Are they working together to make predictions.  Are they testing their predictions and recording outcomes accurately  Exit ticket- “What outcome surprised you the most? Why?” | Introduction to the Mobius strip,  Students will create mobius strips and predict the outcome of cutting the strips in prescribed ways. |
| 1.1.3 How can I Predict the area? | [CCSS.MATH.CONTENT.HSG.CO.C.9](http://www.corestandards.org/Math/Content/HSG/CO/C/9/)  **Construct viable arguments and critique the reasoning of others.**  **Reason abstractly and quantitatively** | Review homework  Warm-up to assess Lateral thinking skills  Assess group work.  Are they working together to make predictions.  Are they testing their predictions and recording outcomes accurately  Exit ticket- “What will the 100th rug look like?” | Students will be given a rug pattern.  They will use precision to copy the pattern on graph paper and predict how it will grow. |
| 1.1.4 Logical Arguments—“Question Everything, demand acceptable evidence” | [CCSS.MATH.CONTENT.HSG.CO.C.9](http://www.corestandards.org/Math/Content/HSG/CO/C/9/)  **Construct viable arguments and critique the reasoning of others.**  **Reason abstractly and quantitatively** | Review Homework  Warm-up for Lateral Thinking  Collect and assess their “votes” of innocence or guilt.    Exit Ticket: “Did you change your mind about the defendant’s innocence or guilt.  Why or Why not?” | We will look at a controversial trial from history.  I will feed them pieces of evidence one at a time and ask them to reassess their beliefs after each new piece of evidence. Ideally evidence should reverse their thinking if possible. This can get heated “Twelve Angry Men” style, but it is very powerful for student engagement. |
| 1.1.5 What shapes can you find in a kaleidoscope  PA- Do we have kaledoscopes to use as models? | [CCSS.MATH.CONTENT.HSG.CO.A.1](http://www.corestandards.org/Math/Content/HSG/CO/A/1/) | Review Homework  Warm-up for Lateral Thinking  Teamwork assessment.  Reorganize groups if there are obvious problems with team dynamics.    Exit Ticket: “If you could open the mirror less than 1 degree and look inside, what shape would you expect to see?” | Students will use mirrors to build a basic kaleidoscope.  They will experiment with angles of mirrors to create different shapes in the reflection  **\*Project reminder, more examples of tessellations** |
| 1.2.1 Spatial Visualizations and Reflections and 1.2.2 Rigid Transformations | [CCSS.MATH.CONTENT.HSG.CO.A.2](http://www.corestandards.org/Math/Content/HSG/CO/A/2/)  [CCSS.MATH.CONTENT.HSG.CO.A.3](http://www.corestandards.org/Math/Content/HSG/CO/A/3/)  [CCSS.MATH.CONTENT.HSG.CO.A.4](http://www.corestandards.org/Math/Content/HSG/CO/A/4/)  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) | Review Homework  Warm-up for Lateral Thinking  Teamwork assessment.  Reorganize groups if there are obvious problems with team dynamics.    Exit Ticket: “1. Were you able to visual the new shapes without using tracing paper? 2. Another sample spatial change to predict” | Students will use mental processes alone to determine what shapes will look like if folded, spun or reflected.  They should not use any tools to answer the questions |
| 1.2.3 What is the relationship between slope and parallel lines?  What is the relationship between slope and perpendicular lines? | [CCSS.MATH.CONTENT.HSG.CO.A.1](http://www.corestandards.org/Math/Content/HSG/CO/A/1/)  [CCSS.MATH.CONTENT.HSG.CO.A.3](http://www.corestandards.org/Math/Content/HSG/CO/A/3/)  [CCSS.MATH.CONTENT.HSG.CO.A.4](http://www.corestandards.org/Math/Content/HSG/CO/A/4/)  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) | Review Homework  Warm-up for Lateral Thinking  Teamwork assessment.  Reorganize groups if there are obvious problems with team dynamics.  Learning Log  Exit Ticket: “1. Sample question asking them to predict the slope of a parallel line 2. Another sample question asking them to predict the slope of a perpendicular line 3. What must change in an equation to make a parallel line?  4. What must change in an equation to make a perpendicular line?” | Mini lecture: What does parallel really mean?  Relating Algebra to Geometry    Have students use Equation grapher (at [www.mathisfun.com](http://www.mathisfun.com/) ) to find parallel and perpendicular lines. |
| 1.2.4  Rotations on a Grid. | [CCSS.MATH.CONTENT.HSG.CO.A.2](http://www.corestandards.org/Math/Content/HSG/CO/A/2/)  [CCSS.MATH.CONTENT.HSG.CO.A.1](http://www.corestandards.org/Math/Content/HSG/CO/A/1/)  [CCSS.MATH.CONTENT.HSG.CO.A.3](http://www.corestandards.org/Math/Content/HSG/CO/A/3/)  [CCSS.MATH.CONTENT.HSG.CO.A.4](http://www.corestandards.org/Math/Content/HSG/CO/A/4/)  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) | Review Homework  Warm-up for Lateral Thinking  Teamwork assessment.  Reorganize groups if there are obvious problems with team dynamics.    Exit Ticket: “1. Rotate this object on the point given” | Video and Slide show of rotations and comparing them to translation and reflection.  Slideshow of traditional Native American Art that shows all three rigid transformations.  Students will use this information to rotate objects on grids.  Students bring in traditional objects (or photos of them), and show examples of the rigid transformations.  (Submissions via email for projection?)  AKL |
| 1.2.5 How can you use transformations to create new shapes? | [CCSS.MATH.CONTENT.HSG.CO.A.3](http://www.corestandards.org/Math/Content/HSG/CO/A/3/)  [CCSS.MATH.CONTENT.HSG.CO.A.4](http://www.corestandards.org/Math/Content/HSG/CO/A/4/)  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) | Review Homework  Warm-up for Lateral Thinking  Teamwork assessment.    Exit Ticket: “Use a simple shape to build a larger composite shape using the three transformations: reflection, translation, and rotation | **\*Project: Students should be creating rough draft of Tessellation.** |
| 1.2.6 What shapes have symmetry?  Can there be more than one line of symmetry? | [CCSS.MATH.CONTENT.HSG.CO.A.2](http://www.corestandards.org/Math/Content/HSG/CO/A/2/)  [CCSS.MATH.CONTENT.HSG.CO.A.3](http://www.corestandards.org/Math/Content/HSG/CO/A/3/)  [CCSS.MATH.CONTENT.HSG.CO.A.4](http://www.corestandards.org/Math/Content/HSG/CO/A/4/)  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) | Review Homework  Warm-up for Lateral Thinking  Learning Log: draw examples of the major types of symmetry.  Exit Ticket: “1. Were you able to visual the new shapes without using tracing paper? 2. Another sample spatial change to predict” |  |
| 1.3.1 How can you classify shapes? | [CCSS.MATH.CONTENT.HSG.CO.A.1](http://www.corestandards.org/Math/Content/HSG/CO/A/1/)  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) | Review Homework  Warm-up for Lateral Thinking  Teamwork assessment.    Exit Ticket: “A Hexagon is a regular shape, but it is also a composite shape.  What shape(s) are used to build it?” |  | Students will be give complex composite shapes that are formed from simpler shapes.  They must cut the composite shapes into the shapes we will be focusing on for the rest of the course.  They will place the shapes on a series of Venn diagrams, challenging them to sort the shapes based on specific attributes |
| 1.3.2 How do you describe a shape completely? | [CCSS.MATH.CONTENT.HSG.CO.A.1](http://www.corestandards.org/Math/Content/HSG/CO/A/1/)  [CCSS.MATH.CONTENT.HSG.CO.A.3](http://www.corestandards.org/Math/Content/HSG/CO/A/3/)  [CCSS.MATH.CONTENT.HSG.CO.A.4](http://www.corestandards.org/Math/Content/HSG/CO/A/4/)  [CCSS.MATH.CONTENT.HSG.CO.A.5](http://www.corestandards.org/Math/Content/HSG/CO/A/5/) | Review Homework  Warm-up Exercise  Learning Log:  Exit Ticket:  In pairs.  I will give a picture of a shape to one student and have them describe a shape to the other student.  The other student will attempt to sketch the shape. |  | Students will continue to sort shapes based on important attributes and placing the cut out shapes on a series of Venn diagrams.  **\*Project-student peer critique using rubric** |
| Chapter One Closure | Review all of the above CCSS especially those of rigid transformations, lines and angles | Review Homework  Warm-up exercise  Group created closure activity  Exit ticket: “Of the material we have covered, is there anything you are struggling with, or don’t quite understand |  | Students will choose a closure activity: Graphic organizer, Portfolio, or answer the closure activity questions. |
| Project Completion | Look for understanding of all of the above CCSS especially those of rigid transformations, lines and angle | Warm-up exercise  Presentation of closure activities |  | Students will complete their final tessellation in class.  No more than two days in class time for project completion |