Instructor: Lilia Ben Ayed

Course/Grade: Geometry/10th Grade

Unit: Geometric Transformations

1. Translation

2. Symmetry

3. Reflection

4. Rotation

5. Composite transformations

Lesson: investigation of geometric transformations in Islamic and western Arts: This is an interdisciplinary unit for math and Art, which will increase student understanding of real life examples of art from MIDDLE EASTREN and Western cultures.

Students will investigate geometric transformations and symmetry in patterns from Alhambra art visuals and multicultural forerunners of M.C Escher. Students will gain pride in their own heritage and learn respect for other cultures.

Students will compare and contrast the work of M.C. Escher and tile work of the Alhambra Palace in Spain

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| **Stage 1 Desired Results** | | |
| **ESTABLISHED GOALS**  G.CO.*1Develop definitions of rotations, reflections, and translations in terms of angles,circles,*  *perpendicular lines, lines, and line segments.*  *G.CO.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*  *G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it*  *G.CO.4 Given a geometric figure and a rotation, reflection, or*  *translation, draw the transformed figure*  *.Specify a sequence of transformations that will carry a given figure*  *Onto another.*  *G.CO.5 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.*  *G1.C06 use inductive and deductive reasoning*  *to establish the validity of geometric transformations, prove theorems and critique*  *arguments made by other*  1. Gain an appreciation of art around the world and the interconnectedness of peoples in throughout the world.  **Core Learning Goal**  2.1.3 Students will use transformations to move figures, create designs and/or demonstrate geometric properties.  **NCTM’s Standards**  To apply mathematics to contexts outside mathematics and to model and interpret physical, social and mathematical phenomena. | ***Transfer*** | |
| *Students will be able to independently use their learning to…*  1. Describe how art patterns and geometric composite transformations were used in Islamic and western cultures.  1. Work collaboratively to identify geometric transformations in visuals art pieces.  2. Evaluate multiple sources and use evidence in the decision making process.  3. Make connections between western and Islamic arts pieces.  4. Communicate on a plan of action for addressing issues.  5. Develop critical thinking skills by developing engaging questions on similarities and differences of geometric patterns in Muslim and western arts    7. Identify line of symmetry and measure sides and angles in different geometric transformations in art pieces.  8. Differentiate congruent and similar figures in art. | |
| ***Meaning*** | |
| UNDERSTANDINGS  *Students will understand that…*  1. Reflection, translation and rotation are isometric transformations.  2. Distance between pre-image and line of symmetry is congruent to the distance between image and line of symmetry.  3. Transformation in congruent polygons is isometric.  4. Tessellations in M.C Eshers in real world around them are repeated patterns.  5. Islamic art and western art overlap and share similar geometric patterns.  6. Art reflects beliefs, customs and religion of an ethnic group. | **ESSENTIAL QUESTIONS**  1. What are the similarities and differences between the images and pre-images generated by translations?  2. What is the relationship between the coordinates of the vertices of a figure and the coordinates of the vertices of the figure’s image generated by translations?  3. How do composers use geometric transformations in their music?  4. How can you describe and explain structures in our world using geometric transformations?  5. How do art influence our appreciation for cultures?  6. |
| ***Acquisition*** | |
| ***Students will know…***  *How to use mathematics to calculate and describe the relationships between shapes in two different origins of Art.*  *1. The line of reflection is the perpendicular bisector of every segment connecting a point of the pre-image and its image.*  *2.* *A rotation takes an original figure, or pre-image, and turns it about a point of rotation through an angle of rotation, including the direction (clockwise or counter clockwise)*  *3.A translation takes the pre-image, and slides it a given distance and direction. This distance and direction is represented by a translation vector. The image is isometric.*  *4. Gain pride in their own heritage and learn respect for other cultures.*  *5. Gain a global perspective on different art designs, and its role in conflict resolution.*  *6. Gain global competence through analyzing, comparing/contrasting art patterns, and gain cultural perspectives of Muslim and Western worlds.*  *7. Be able to identify and compare the three congruence transformations.*  *8. Apply the three congruence transformations to coordinates of the vertices of figures.*  *9. Identify and apply dilations.*  *10. Apply transformations to real-world situations.* | ***Students will be skilled at…***   * *Using ratio and proportion to identify similar figures in tessellations.*   ***Global culture****:*  *1. By realizing how visual art can bring to life customs, and rituals of a Middle Eastern and western cultures.*  *2. By formulating algebraic transformation equations into the*  *3.By researching across many cultures and experiences.*  ***Global connections****: by promoting the exchanges of information with different cultures and to understand social issues of a culture in terms of geometric transformation in art pieces.*  *By communication with an e pal.*     * *Using process skills to identify composite geometric transformations.* * *Using information technology to gather geometric transformations in Middle Eastern art.* * *Students will classify and, analyze geometric transformations, including translations, rotations, reflections, and composite in given art display.* |
| **Stage 2 - Evidence** | | |
| **Evaluative Criteria** | **Assessment Evidence** | |
| Document is completed accurately and submitted correctly on evernote on time.  Data table is correctly labeled, geometric transformations are correctly identified. Axis of symmetry of each transformation is stated.  Data table is correctly labeled, geometric transformations are correctly identified. Axis of symmetry of each transformation is stated.  Chart is complete and common forms are accurate. Findings reflect important connections and differences between the two types of art.  Action plan is realistic and attainable.  Movie clearly highlights geometric transformations and clear according to rubric.  neat and informative according to rubric guidelines. | TRANSFER TASK(S):   * Students prepare for unit by watching a video about Islamic art patterns in Alhambra palace in Spain to complete a pretest activity on shapes and patterns and record their results and observations on Evernote. * Identify rotation, translation, reflection and symmetry in a Middle Eastern Alhambra piece of art and create a data table.   <https://www.google.com/search?q=alhambra+art+prints&tbm=isch&tbo=u&source=univ&sa=X&ei=zPJ3UueWAq>   * Identify rotation, translation, reflection and symmetry in western piece of art and create a data table.   <https://www.google.com/search?q=alhambra+art+prints&tbm=isch&tbo=u&source=univ&sa=X&ei=zPJ3UueWAqbkyQG3kIDoDQ&ved=0CIUBELAE&biw=1024&bih=639#q=westren+art+prints&tbm=isch>   * Create a chart highlighting common forms of geometric transformations in pieces of arts for Alhambra palace and western art. * Analyze, and Compare and contrast the symmetries of geometric patterns in both pieces of art and write a report that highlights the importance of the designs and how they reflect each culture.   1. Students will search the internet and choose an art design visuals from M.C Escher Alhambra portfolio. <http://www.mcescher.com/Gallery/gallery-symmetry.htm> and art designs from a western artist Leonardo di Vinci.  2. students will focus on the following questions:  What are the reasons of the number of repeated shapes created from a combination of overlapping circles?  3. Which artist uses recognizable, realistic images in their art? (The shape of the circle is important as a symbol for unity, and as the single shape that provides the basis for the multitude of shapes and patterns found in Islamic design.   * Develop an action plan describing what individuals as a local and global citizen can do to promote cultural competency through the study of designs and shapes in art   5. Produce an animated movie where you highlight most used geometric transformations and explain the reasons behind it.  6. Design a poster which highlight composite transformations in an art piece of your choice  Should reflect customs and beliefs of a designed culture. | |
| Handed in at the end of the activity and demonstrates thoughtful reflection on the activity.  Each quiz is worth 30 points. Tests are worth 100 points per department policy.  per teacher observation | OTHER EVIDENCE:  Pre- and Post-Tests on geometric transformations in art.  Homework and activity Assignments  Quizzes and Tests  Reading/group/class discussions | |
| **Stage 3 – Learning Plan** | | |
| *Summary of Key Learning Events and Instruction*  Lesson 1—Assess Prior Knowledge  Prior to beginning unit, students will watch a video about Islamic art patterns in Alhambra palace in Spain. They will investigate different shapes patterns in MC Escher art complete a pretest activity on shapes and patterns and record their results and observations on Evernote. pairs of students will generate questions about the repeated geometric patterns in Islamic art.  Lesson 2—What is translation? How does it look in Art?  Students will investigate Translation,: rules and how to formula and an equation based on mapping points on the plane. Next, They will be paired to identify translation in real life context and in art.  Lesson 3—What is Reflection? How does it look in Art?  Students will investigate Reflection: lines of Reflections, and how to formulate t Reflection equation of regular polygons on the plane. Next, They will be paired to identify Reflection and the axis of symmetries in real life context and in Art.  Lesson 4—What is Rotation? How does it look in Art? ( 2 days)  Students will investigate Rotation: angles of Rotation, center of Rotation and how to formula a Rotation equation of regular polygons on the plane. Next, They will be paired to identify translation in real life context and in art.  Lesson 5— Geometric Transformations in Art  Students will Identify rotation, translation, reflection and symmetry in western piece of art and create a data table.  Identify rotation, translation, reflection and symmetry in a Middle Eastern Alhambra piece of art and create a data table.  Create a chart highlighting common forms of geometric transformations in pieces of arts for Alhambra palace and western art.  Lesson 6— Compare and Contrast  Students will compare and contrast the symmetries of geometric patterns in both pieces of art and write a report that highlights the importance of the designs and how they reflect each culture.  Students will search the internet and choose an art design visuals from M.C Escher Alhambra portfolio and Leonard Di Vinci  Students will focus on the following questions:  What are the reasons of the number of repeated shapes created from a combination of overlapping circles?  Which artist uses recognizable, realistic images in their art?  Students will design a poster which highlight composite transformations in an art piece of their choice  Lesson 7— Check your Knowledge  Students will produce an animated movie where they highlight most used geometric transformations and explain the reasons behind it.  Unit test: assessment over unit learning objectives. | | |