Lesson Plan Worksheet

Name __Amy Oestreicher__

Title of the Lesson __Geometric Transformations in Art_

Unit of Study _MATHEMATICS

Subject(s) area/course ___MATH (GEOMETRY)_ _ Grade Level__8th grade__

Specific *Content Standards* addressed in this lesson
(THESE ARE TAKEN FROM THE COMMON CORE STANDARDS FOR EIGHT GRADE MATH)

CCSS.MATH.CONTENT.8.G.A.3

Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

CCSS.MATH.CONTENT.8.G.A.4

Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

CCSS.MATH.CONTENT.8.G.A.1

Verify experimentally the properties of rotations, reflections, and translations:

Specific Essential Questions addressed in this lesson (What leading questions can you ask of students to get them to understand the Big Ideas?)

- **What are reflections, rotations dilations and translations you observe in every day life?**
- **What does is mean to reflect, rotate and translate an object from a mathematical perspective?**
- **How is math found in art?**
- **How are math and art related?**
- **What is a polygon and where can you find them in real life? What makes something *not* a polygon?**

Learning Outcomes/Expectations/objectives:

As a result of this lesson, students will understand that:

- *they will understand the difference between rotating reflecting and translating an object*

- *they will be able to identify what is and what is not a polygon*

As a result of this lesson, students will know that:
Art contains many examples of geometry

As a result of this lesson, students will be able to: define **are reflections, rotations dilations and translations**
Identify what makes a polygon
Rotate, translate and dilate a polygon
Make geometry transformations on their own
Convey the geometry transformations artistically
Create creating cards using colored pencils and construction paper
Be able to identify geometric concepts in peer work, every day life, and in art work

Learning Activities: Step-by-step description of the lesson components as follows:

Pacing – how much time will each component take?

1.) I will remind students what they have learned in the geometry lessons leading up to this that will prepare them for this lesson on geometric transformations by asking them questions and leading a discussion. (5 minutes)
    a. about where they can see reflections in every day life i.e. pudding of water, a mirror, etc.
    b. Draw on white board a geometric reflection
    c. Lead a discussion on what it means to rotate an object, have a cut out shape on construction paper and have student rotate it – turning and object
    d. Introduce idea of translating an object – explain translation in geometry through drawing graph on white board and moving intercepts up 5 and to the left 3 spaces – hand out graph paper so students can do this along with me.
2.) 2.) Review what a polygon is from previous lessons – draw a few figures on the board and have students identify which one is NOT a polygon – go over its definition.
3.) Show slides of different works of art from many different eras on overhead projector and have students identify a reflection, rotation and translation in the art. Have them pick out any polygons then see in the art. (5 minutes)
4.) Go over "Basic Geometry Worksheet" taken from the website http://www.gradeamathhelp.com/transformation-geometry.html (5 minute)
5.) Hand out more graph paper and have students practice rotation, translation and reflection with a quadrilateral of their choice. (5 minutes)
    a. Ask students if there are any questions on what we've learned and reviewed so far.
6.) Inform students of today's objective. Tell them they will learn about reflection, rotation and translation with polygons from a geometric perspective and then transfer that artistically to cards, showing that there are mathematical aspects in many kinds of art. (1 minute)
7.) Hand out paper cut to size for greeting cards – students will make three cards for the holidays. The artistic expression is up to them, but card #1 must have a reflection of a polygon, card #2 must have a reflection and card #3 must have a rotation of a polygon
8.) Students will work with colored pencils, scissors and construction paper to create their holidays cards
    a. 35 minutes to work
9.) Clean up supplies (5 minutes)
10.) Lead discussion on what the students learned, students will go over the polygons in their cards. Students will partner up and identify which card isi which in terms of translated, rotated or reflected polynomial. Student will write down their guesses and see if they have accurately identified

the object being transformed. (10 minutes)

11.) Conclude on geometric transformations by having them so geometric transformations on the whiteboard – teacher will draw polygon and students will volunteer to translate, rotate and reflect it. (5 minutes)

Introduction/Opening: Leading students on discussion of polygon transformations in every day life as well as in art.
(How will you begin to lead the students towards the outcomes you expect of them?)
Demonstration: Drawing on whiteboard, giving supplementary hand out, pointing it out in artwork
(Does something need to be demonstrated to make these expected outcomes clearer?)
Body

Activity #1 – Having students work with polygons and transforming it through the various ways discussed.

Transition – talking about transformations in art and in real life, and discussing how geometric concepts can be conveyed artistically

Activity #2 – students design three greeting cards each with each concept shown on each card

Transition – clean up, reviewing concepts, having students identify the various geometric transformations in one another's work

Closure
- discussion of key concepts and what they learned, having students help translate, rotate and reflect figures on the white board to demonstrate how they have retained their knowledge.

Materials Needed for the lesson.

- white board
- graph paper
- overhead projector
- art slides with transformations in them
- blank paper to make greeting cards from (hard cardstock)
- construction paper
- scissor
- glue sticks
- colored pencils
- markers
- sketching pencils
- worksheets from http://www.gradeamathhelp.com/transformation-geometry.html

Modifications/Extensions (for students on IEP's or language differences.)

- Extra assistance and explanation
- Supplementary handouts
- Student peer mentor
- Have them sit in front of class if they have any additional questions
- Write key words on white board
- Help with scissors if needed
- Demonstration
- Work in partners

Attach handouts (if any). See "Geometric Transformation Worksheet" taken from the website http://www.gradeamathhelp.com/transformation-geometry.html

Assessment of Student Understanding

(How will you assess student understanding of the content of the lesson?)

- Authentic, performance based tasks that have students apply what they have learned and demonstrate their understanding.
- includes pre-assessment, formative assessment, and summative assessment evidence
- Can be individual or group based
- Can include informal methods (such as thumbs up, thumbs down, and formal assessments, such as quiz, answers to questions on a worksheet, written reflection, essay

- closure discussion at the end where we discuss what we've learned
- if students can correctly identify the transformation in each other's artwork when they partner up in pairs after activity
- after partnering exercise, when I call students up to help me transform various polygons on the white board – I will see if they are successfully able to do this.
- Pre-assessment – see the difference between how well the students can identify the art in the overhead projector slides at the beginning of class versus the end when they are partnered up and reviewing each other's greeting cards for the accuracy of their transformations

GEOMETRY WORKSHEET I WILL HAND OUT:

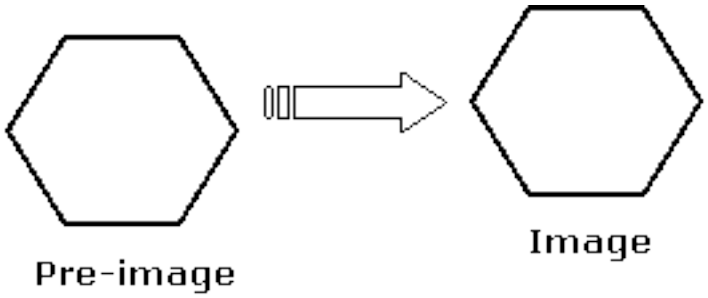
Basic Transformation Geometry

From the website http://www.gradeamathhelp.com/transformation-geometry.html

For transformation geometry there are two basic types: rigid transformations and non-rigid transformations. This page will deal with three rigid transformations known as translations, reflections and rotations.

The Vocabulary of Transformation Geometry

In short, a transformation is a copy of a geometric figure, where the copy holds certain properties. Think of when you copy/paste a picture on your computer.

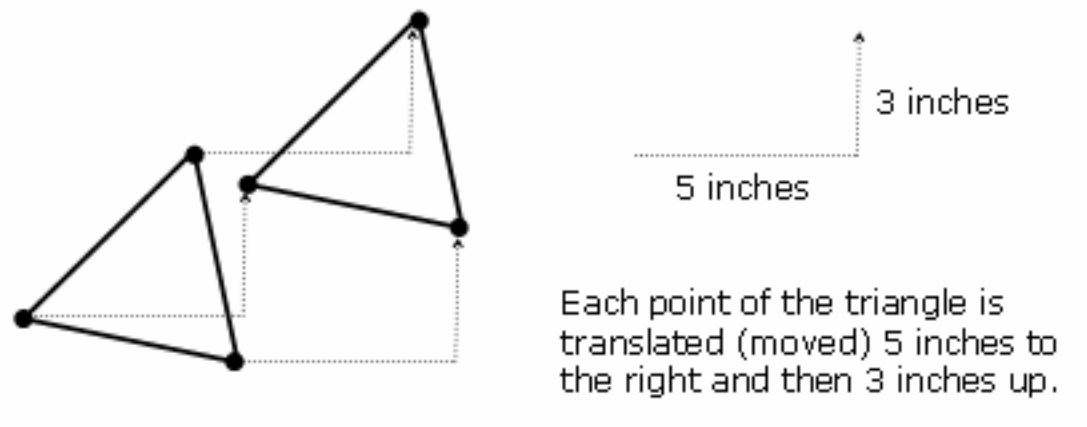


The original figure is called the **pre-image**; the new (copied) picture is called the**image** of the transformation.

A **rigid transformation** is one in which the pre-image and the image both have the exact same size and shape.

Translations - Each Point is Moved the Same Way

The most basic transformation is the translation. The formal definition of a translation is "every point of the pre-image is moved the same distance in the same direction to form the image." Take a look at the picture below for some clarification.

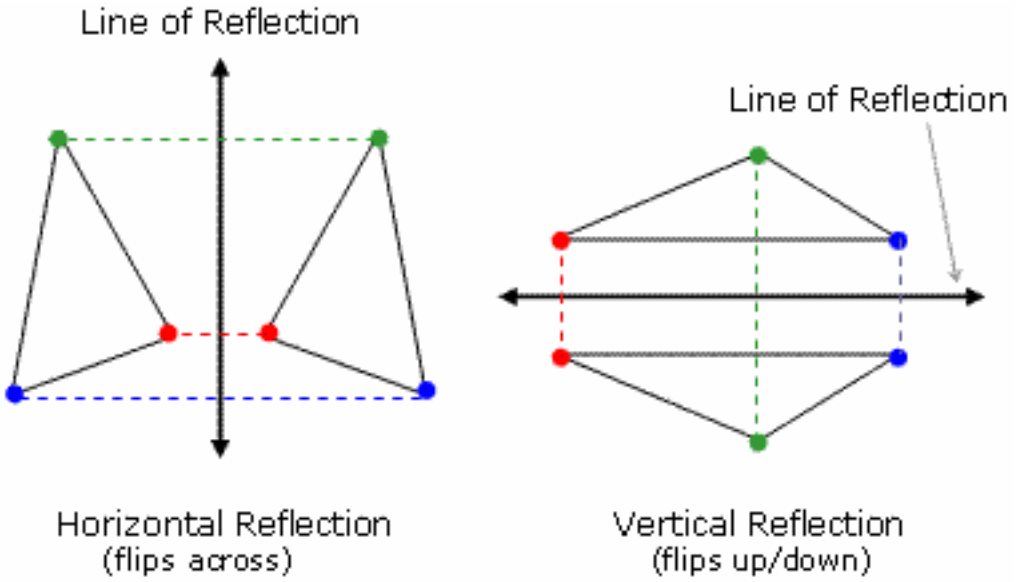


Each translation follows a rule. In this case, the rule is "5 to the right and 3 up." You can also translate a pre-image to the left, down, or any combination of two of the four directions.

More advanced transformation geometry is done on the coordinate plane. The transformation for this example would be T(x, y) = (x+5, y+3).

Reflections - Like Looking in a Mirror

A reflection is a "flip" of an object over a line. Let's look at two very common reflections: a horizontal reflection and a vertical reflection.



Notice the colored vertices for each of the triangles. The*line of reflection* is equidistant from both red points, blue points, and green points. In other words, the line of reflection is directly in the middle of both points.

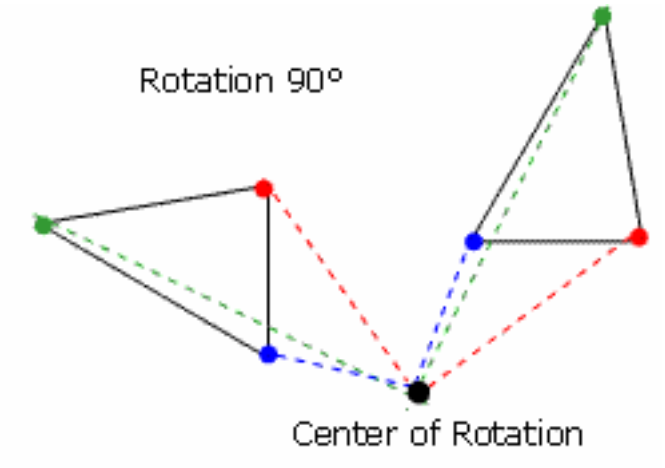
Examples of transformation geometry in the coordinate plane...

- Reflection over x-axis: T(x, y) = (x, -y)
- Reflection over y-axis: T(x, y) = (-x, y)

- Reflection over line $y = x$: $T(x, y) = (y, x)$

• Rotations - Turning Around a Circle

A rotation is a transformation that is performed by "spinning" the object around a fixed point known as the *center of rotation*. You can rotate your object at any degree measure, but 90° and 180° are two of the most common. Also, rotations are done **counterclockwise**!



Some geometry lessons will connect back to algebra by describing the formula causing the translation. In the example above, for a 180° rotation, the formula is:

Rotation 180° around the origin: $T(x, y) = (-x, -y)$

This type of transformation is often called **coordinate geometry** because of its connection back to the coordinate plane.