Mathematics Curriculum Guide

Honors Geometry

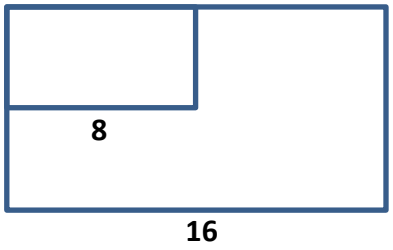
2017-18

Topic 8: Transformations

In this unit students will explore concepts related to transformations. Students will begin with the study of translations, reflections, and rotations. They will define transformations and their properties and distinguish between rotations, reflections, and translations in terms of orientation but see them all as rigid motions. Students will extend that understanding to seeing the importance of symmetry in transformations. Finally, students will examine dilations in which the center of the dilation is on the figure, on one vertex, in its interior and in its exterior and can see that for a given scale factor each of these images are congruent to each other by still similar to the preimage.

Common Misconceptions and/or Errors:

- **Transformations:** Translations have the same size, shape, and orientation. Reflections, however, can have different orientations. Students might not think that a reflection is an isometry because the two figures are oriented differently.
- **Symmetry:** A regular hexagon has 6 lines of symmetry. Students might count 12 lines of symmetry not realizing that they are counting the same lines twice.
- **Dilations:** Given that the larger figure is a dilation image of the smaller figure, students might make an error when finding the scale factor:
    - **Example:**



Incorrect: $\frac{8}{16} = \frac{1}{2}$ Correct: $\frac{16}{8} = 2$

Topic 8: Transformations

Transfer Goals

1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.
2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience.
3) Construct viable arguments and critique the reasoning of others using precise mathematical language.

Timeframe: 3 weeks/14 days
Start Date: March 5, 2018
Assessment Dates: Mar. 21-22, 2018

Standards

G-CO 2 Represent transformations in a plane.

G-CO 3 Describe rotations and reflections that carry a figure onto itself.

G-CO 4 Develop definitions of rotations, reflections, and translations.

G-CO 5 Draw a transformed figure, and specify a sequence of transformations that will carry a figure onto another.

G-CO 6 Use descriptions of rigid motions to transform figures.

G-CO 7 Use the definition of congruence to show that two triangles are congruent.

G-SRT 1 Verify the properties of dilations given by a center and a scale factor.

G-SRT 1a A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

G-SRT 1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

Meaning-Making

Understandings

Students will understand that…

- Geometry is built upon basic geometric principles and figures (ex: point, line, plane, etc.)
- Transformations take points in the plane as inputs and gives other points as outputs, can be rigid (preserve length and angle measure) or non-rigid (ex: dilations, stretch), and can be represented in a plane using transparencies, tracing paper, geometric software, etc.
- Regular polygons have rotations and reflections that map the figure onto itself.
- Using rigid motion to transform a figure results in a congruent figure that has the same size and shape
- Translations can be defined in terms of reflections across parallel lines and rotations can be defined in terms of reflections across intersecting lines
- Dilation is a non-rigid transformation that enlarges or reduces a figure such that its shape is preserved but its size is not.
- A translation is a composition of reflections across parallel lines.
- A rotation is a composition of reflections across intersecting lines.

Essential Questions

Students will keep considering…

- How does a dilation transform a figure?
- How can figures in a plane be transformed, and what are various ways to represent that transformation?
- What are the ways that a regular polygon can be mapped onto itself?
- How can rigid motion transformations be used to show that two figures are congruent?
- How can all rigid transformations be expressed as compositions of reflections?
- How can a composition of isometries be represented in a single transformation?
- What are the properties of a dilation?
- How are the image and pre-image related in a dilation?
- What is the difference between a reduction and an enlargement?

Acquisition

Knowledge

Students will know…

Vocabulary: transformation, function, input, output, rigid, isometry, non-rigid, preserve, rectangle, parallelogram, trapezoid, regular polygon, translation, reflection, rotation, symmetry, rotational symmetry, reflectional symmetry, image, pre-image, composite, congruent/congruence, dilation, center of dilation, scale factor , isometry, composition of isometries, reflections across parallel lines, reflections across intersecting lines, scale factor, dilation, center of dilation, enlargement, reduction

- Proper notation for transformations

Skills

Students will be skilled at and able to do the following…

- Dilate a line segment by a given scale factor.
- Draw the image of a figure after dilation given a scale factor.
- Draw and label geometric figures, and recognize geometric figures within a given diagram.
- Draw transformations in a plane or coordinate grid using tracing paper, transparencies, geometric software, etc.
- Compare and contrast rigid and non-rigid transformations.
- Describe transformations using function notation.
- Map a regular polygon onto itself using rotations and reflections.
- Identify lines of reflectional symmetry and points of rotational symmetry.
- Draw an image given its pre-image and a specific transformation or series of composite transformations.
- Identify a sequence of transformations used to map a given pre-image onto its image.
- Decide if two figures are congruent based on ability to map one figure onto the other using rigid motions.
- Graph a composition of isometries given a composition in function notation.
- Specify when one transformation could give the same image as a composition.
- Use composite function notation to describe a sequence of transformations that will carry a given figure onto another.
- Determine the scale factor given a preimage and its image.
- Graph an image given a figure and a dilation.
- Use composite function notation to describe a sequence of transformations that will carry a given figure onto another when one of the transformations is a dilation.

Topic 8: Transformations

Transfer is a student's ability to independently apply understanding in a novel or unfamiliar situation. In mathematics, this requires that students use reasoning and strategy, not merely plug in numbers in a familiar-looking exercise, via a memorized algorithm.

Transfer goals highlight the effective uses of understanding, knowledge, and skills we seek in the long run – that is, what we want students to be able to do when they confront new challenges, both in and outside school, beyond the current lessons and unit. These goals were developed so all students can apply their learning to mathematical or real-world problems while simultaneously engaging in the Standards for Mathematical Practices. In the mathematics classroom, assessment opportunities should reflect student progress towards meeting the transfer goals.

With this in mind, the revised **PUSD transfer goals** are:

1) **Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.**
2) **Effectively communicate orally, in writing, and by using models (e.g., concrete, representational, abstract) for a given purpose and audience.**
3) **Construct viable arguments and critique the reasoning of others using precise mathematical language.**

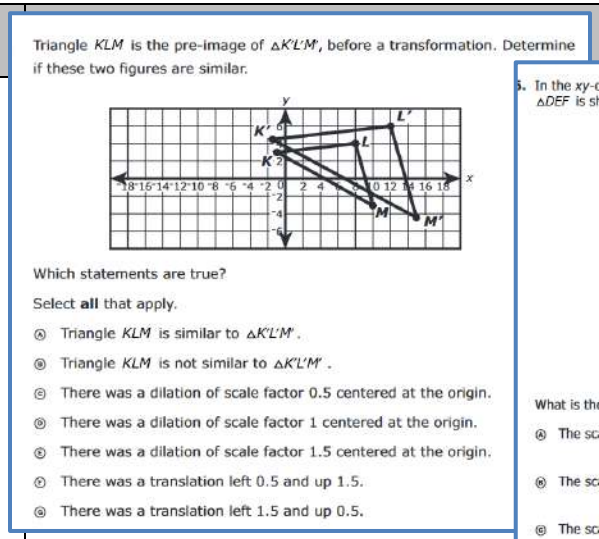
Multiple measures will be used to evaluate student acquisition, meaning-making and transfer. Formative and summative assessments play an important role in determining the extent to which students achieve the desired results in stage one.

Formative Assessment	Summative Assessment
Aligning Assessment to Stage One	
• What constitutes evidence of understanding for this lesson? • Through what other evidence during the lesson (e.g. response to questions, observations, journals, etc.) will students demonstrate achievement of the desired results? • How will students reflect upon, self-assess, and set goals for their future learning?	• What evidence must be collected and assessed, given the desired results defined in stage one? • What is evidence of understanding (as opposed to recall)? • Through what task(s) will students demonstrate the desired understandings?
Opportunities	
• Discussions and student presentations • Checking for understanding (using response boards) • Ticket out the door, Cornell note summary, and error analysis • *Performance Tasks* within a Unit • Teacher-created assessments/quizzes	• Unit assessments • Teacher-created quizzes and/or mid-unit assessments • *Illustrative Mathematics* tasks (https://www.illustrativemathematics.org/) • Performance tasks

Topic 8: Transformations

The following pages address how a given skill may be assessed. Assessment guidelines, examples and possible question types have been provided to assist teachers in developing formative and summative assessments that reflect the rigor of the standards. *These exact examples cannot be used for instruction or assessment, but can be modified by teachers.*

Unit Skills	SBAC Targets (DOK)	Standards
• Dilate a line segment by a given scale factor. • Draw the image of a figure after dilation given a scale factor. • Draw and label geometric figures, and recognize geometric figures within a given diagram. • Draw transformations in a plane or coordinate grid using tracing paper, transparencies, geometric software, etc. • Compare and contrast rigid and non-rigid transformations. • Describe transformations using function notation. • Map a regular polygon onto itself using rotations and reflections. • Identify lines of reflectional symmetry and points of rotational symmetry. • Draw an image given its pre-image and a specific transformation or series of composite transformations.	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3,4) State logical assumptions being used. (2,3) Distinguish correct logic or reasoning form that which is flawed and – if there is a flaw in the argument – explain what it is. (2,3,4) Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2,3)	**G-CO 2** Represent transformations in a plane. **G-CO 3** Describe rotations and reflections that carry a figure onto itself. **G-CO 4** Develop definitions of rotations, reflections, and translations. **G-CO 5** Draw a transformed figure, and specify a sequence of transformations that will carry a figure onto another. **G-CO 6** Use descriptions of rigid motions to transform figures. **G-CO 7** Use the definition of congruence to show that two triangles are congruent. **G-SRT 1** Verify the properties of dilations given by a center and a scale factor. **G-SRT 1a** A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. **G-SRT 1b** The dilation of a line segment is longer or shorter in the ratio given by the scale factor.


Triangle KLM is the pre-image of $\triangle K'L'M'$, before a transformation. Determine if these two figures are similar.

Which statements are true?

Select **all** that apply.

Ⓐ Triangle KLM is similar to $\triangle K'L'M'$.

Ⓑ Triangle KLM is not similar to $\triangle K'L'M'$.

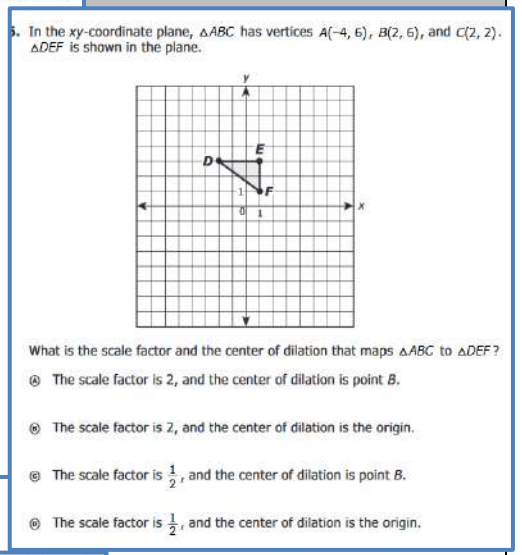
Ⓒ There was a dilation of scale factor 0.5 centered at the origin.

Ⓓ There was a dilation of scale factor 1 centered at the origin.

Ⓔ There was a dilation of scale factor 1.5 centered at the origin.

Ⓕ There was a translation left 0.5 and up 1.5.

Ⓖ There was a translation left 1.5 and up 0.5.


In the xy-coordinate plane, $\triangle ABC$ has vertices $A(-4, 6)$, $B(2, 6)$, and $C(2, 2)$. $\triangle DEF$ is shown in the plane.

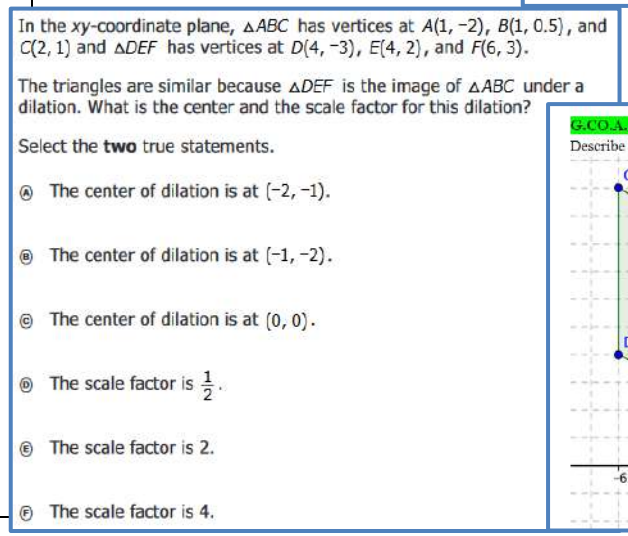
What is the scale factor and the center of dilation that maps $\triangle ABC$ to $\triangle DEF$?

Ⓐ The scale factor is 2, and the center of dilation is point B.

Ⓑ The scale factor is 2, and the center of dilation is the origin.

Ⓒ The scale factor is $\frac{1}{2}$, and the center of dilation is point B.

Ⓓ The scale factor is $\frac{1}{2}$, and the center of dilation is the origin.


In the xy-coordinate plane, $\triangle ABC$ has vertices at $A(1, -2)$, $B(1, 0.5)$, and $C(2, 1)$ and $\triangle DEF$ has vertices at $D(4, -3)$, $E(4, 2)$, and $F(6, 3)$.

The triangles are similar because $\triangle DEF$ is the image of $\triangle ABC$ under a dilation. What is the center and the scale factor for this dilation?

Select the **two** true statements.

Ⓐ The center of dilation is at $(-2, -1)$.

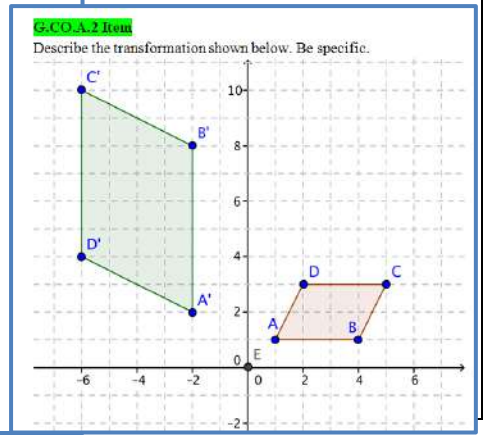
Ⓑ The center of dilation is at $(-1, -2)$.

Ⓒ The center of dilation is at $(0, 0)$.

Ⓓ The scale factor is $\frac{1}{2}$.

Ⓔ The scale factor is 2.

Ⓕ The scale factor is 4.


G.CO.A.2 Item

Describe the transformation shown below. Be specific.

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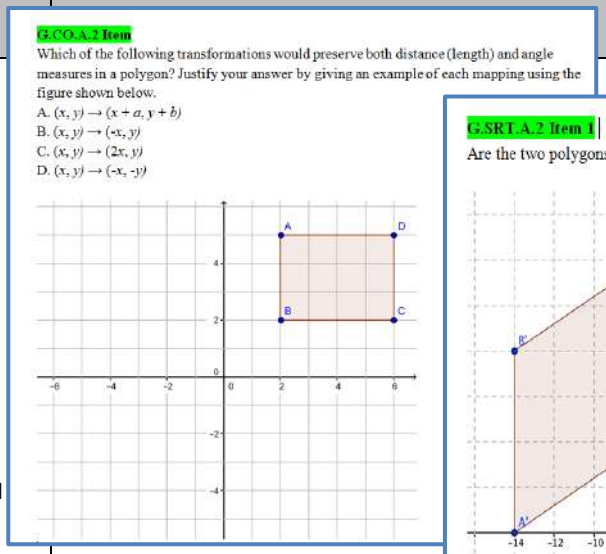
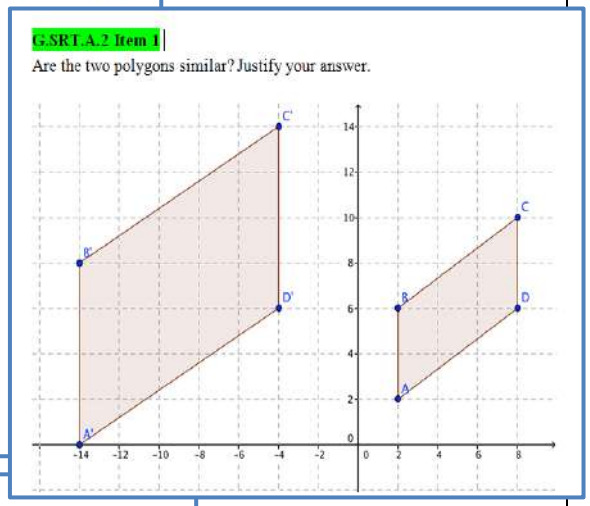
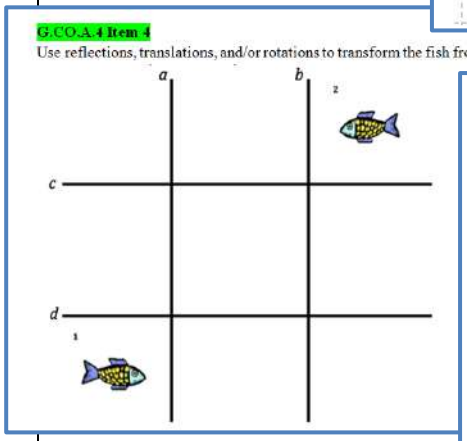
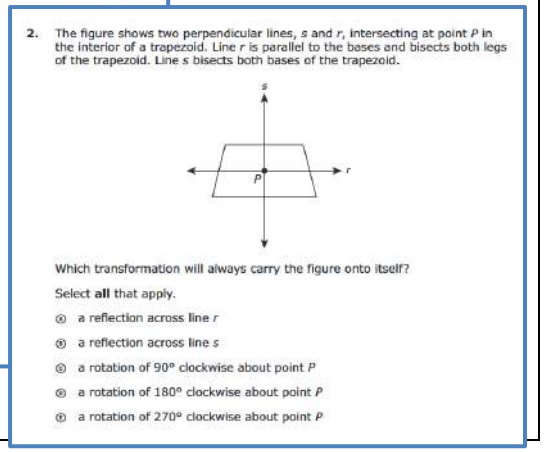
• Identify a sequence of transformations used to map a given pre-image onto its image. • Decide if two figures are congruent based on ability to map one figure onto the other using rigid motions. • Graph a composition of isometries given a composition in function notation. • Specify when one transformation could give the same image as a composition. • Use composite function notation to describe a sequence of transformations that will carry a given figure onto another. • Determine the scale factor given a preimage and its image. • Graph an image given a figure and a dilation. • Use composite function notation to describe a sequence of transformations that will carry a given figure onto another when one of the transformations is a dilation.	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3,4) State logical assumptions being used. (2,3) Distinguish correct logic or reasoning form that which is flawed and – if there is a flaw in the argument – explain what it is. (2,3,4) Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2,3)	**G-CO 2** Represent transformations in a plane. **G-CO 3** Describe rotations and reflections that carry a figure onto itself. **G-CO 4** Develop definitions of rotations, reflections, and translations. **G-CO 5** Draw a transformed figure, and specify a sequence of transformations that will carry a figure onto another. **G-CO 6** Use descriptions of rigid motions to transform figures. **G-CO 7** Use the definition of congruence to show that two triangles are congruent. **G-SRT 1** Verify the properties of dilations given by a center and a scale factor. **G-SRT 1a** A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. **G-SRT 1b** The dilation of a line segment is longer or shorter in the ratio given by the scale factor.









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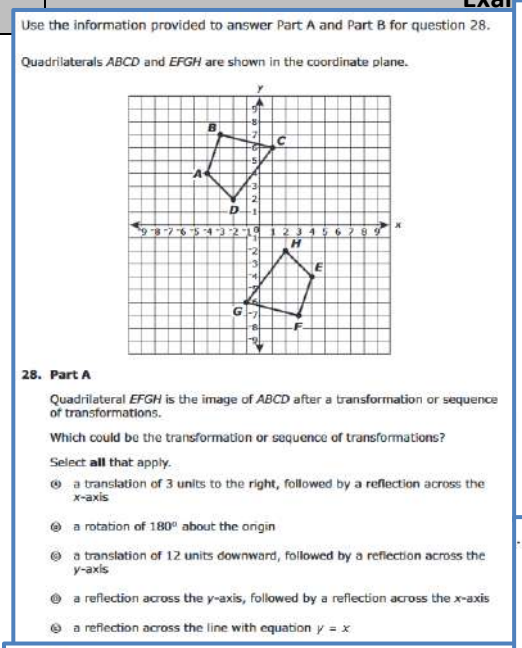
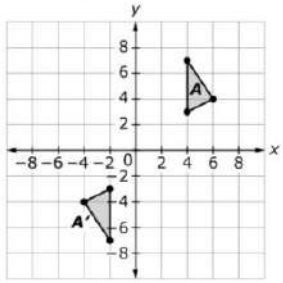
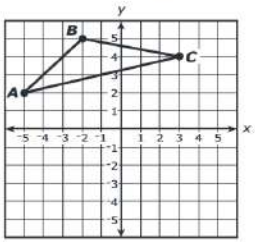
• Identify a sequence of transformations used to map a given pre-image onto its image. • Decide if two figures are congruent based on ability to map one figure onto the other using rigid motions. • Graph a composition of isometries given a composition in function notation. • Specify when one transformation could give the same image as a composition. • Use composite function notation to describe a sequence of transformations that will carry a given figure onto another. • Determine the scale factor given a preimage and its image. • Graph an image given a figure and a dilation. • Use composite function notation to describe a sequence of transformations that will carry a given figure onto another when one of the transformations is a dilation.	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3,4) State logical assumptions being used. (2,3) Distinguish correct logic or reasoning form that which is flawed and – if there is a flaw in the argument – explain what it is. (2,3,4) Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2,3)	**G-CO 2** Represent transformations in a plane. **G-CO 3** Describe rotations and reflections that carry a figure onto itself. **G-CO 4** Develop definitions of rotations, reflections, and translations. **G-CO 5** Draw a transformed figure, and specify a sequence of transformations that will carry a figure onto another. **G-CO 6** Use descriptions of rigid motions to transform figures. **G-CO 7** Use the definition of congruence to show that two triangles are congruent. **G-SRT 1** Verify the properties of dilations given by a center and a scale factor. **G-SRT 1a** A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. **G-SRT 1b** The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	 Use the information provided to answer Part A and Part B for question 28. Quadrilaterals *ABCD* and *EFGH* are shown in the coordinate plane. **28. Part A** Quadrilateral *EFGH* is the image of *ABCD* after a transformation or sequence of transformations. Which could be the transformation or sequence of transformations? Select **all** that apply. Ⓐ a translation of 3 units to the right, followed by a reflection across the *x*-axis Ⓑ a rotation of 180° about the origin Ⓒ a translation of 12 units downward, followed by a reflection across the *y*-axis Ⓓ a reflection across the *y*-axis, followed by a reflection across the *x*-axis Ⓔ a reflection across the line with equation $y = x$ **Part B** Quadrilateral *ABCD* will be reflected across the *x*-axis and then rotated 90° clockwise about the origin to create quadrilateral *A'B'C'D'*. What will be the *y*-coordinate of *B'*? . Triangle *ABC* has vertices at *A*(1, 2), *B*(4, 6), and *C*(4, 2) in the coordinate plane. The triangle will be reflected over the *x*-axis and then rotated 180° about the origin to form $\triangle A'B'C'$. What are the vertices of $\triangle A'B'C'$? Ⓐ *A'*(1, −2), *B'*(4, −6), *C'*(4, −2) Ⓑ *A'*(−1, −2), *B'*(−4, −6), *C'*(−4, −2) Ⓒ *A'*(−1, 2), *B'*(−4, 6), *C'*(−4, 2) Ⓓ *A'*(1, 2), *B'*(4, 6), *C'*(4, 2)  José and Tina are studying geometric transformations. José is able to move triangle *A* to triangle *A'* using the following sequence of basic transformations: 1. Reflection across the *x*-axis 2. Reflection across the *y*-axis 3. Translation two units to the right Tina claims that the same three transformations, done in any order, will always produce the same result. Explain why Tina's claim is incorrect. . Triangle *ABC* is shown in the *xy*-coordinate plane.  The triangle will be rotated 180° clockwise around the point (3, 4) to create $\triangle A'B'C'$. Which characteristics of $\triangle A'B'C'$ will be the same for the corresponding characteristics of $\triangle ABC$? Select **all** that apply. Ⓐ the coordinates of *A'* Ⓑ the coordinates of *B'* Ⓒ the perimeter of $\triangle A'B'C'$ Ⓓ the area of $\triangle A'B'C'$ Ⓔ the measure of $\angle B'$ Ⓕ the length of segment *A'B'*

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Transfer Goals	
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Essential Questions: • How does a dilation transform a figure? • How can figures in a plane be transformed, and what are various ways to represent that transformation? • What are the ways that a regular polygon can be mapped onto itself? • How can rigid motion transformations be used to show that two figures are congruent? • How can all rigid transformations be expressed as compositions of reflections? • How can a composition of isometries be represented in a single transformation? • What are the properties of a dilation? • How are the image and pre-image related in a dilation? • What is the difference between a reduction and an enlargement?	**Standards: G-CO 2, G-CO 3, G-CO 4, G-CO 5, G-CO 6, G-CO 7, G-SRT 1, G-SRT 1a, G-SRT 1b** **Timeframe: 3 weeks/14 days** **Start Date: March 5, 2018** **Assessment Dates: March 21-22, 2018**

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Resources
1 Day (Mar. 6th)	**Topic Opener – Name Reflection** SMP: 2 **G-CO 2, G-CO 4, G-CO 6** **"Kaleidoscope Project"** (see attached)	**Building up to …** How can figures in a plane be transformed and what are various ways to represent that transformation?	• Congruent images can be created by reflecting an image over a line.	**Vocabulary:** congruent images, reflection, image, transformation	• Reflect an image over a line	Graph paper cut into 8 inch by 8 inch squares (one per student plus extra for demonstration and mistakes), color pencils, crayons, etc.

Common Core Practices

- ☐ Instruction in the Standards for Mathematical Practices
- ☐ Use of Talk Moves
- ☐ Note-taking
- ☐ Use of Manipulatives
- ☐ Use of Technology
- ☐ Use of Real-world Scenarios
- ☐ Project-based Learning
- ☐ Thinking Maps

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
4 Days (Mar. 7-10)	**Lesson 9-1 thru 9-3: Translations, Reflections, Rotations** SMP: 1,3,4,7 (pp. 545-567) **G-CO 2, G-CO 4, G-CO 5, G-CO 6**	**Focus Questions:** • How can figures in a plane be transformed? • What are various ways to represent that transformation? **Inquiry Question:** 9-1 p. 545 Solve It!	• Transformations are functions that take points as inputs and give other points as outputs. • Transformations can be rigid or non-rigid. • The distance between points and the angles in a geometric figure stay the same when it is transformed using rigid motion.	**Vocabulary:** transformation, mapping, rigid motion, non-rigid motion, function notation, input, output, preimage, image, prime notation, corresponding parts, translation, reflection, line of reflection, rotation, center of rotation, angle of rotation	• Represent transformations in the plane using tracing paper. • 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 measure to those that do not (e.g., translation versus horizontal stretch). • Given a geometric figure and a rotation, reflection, or translation (in words, ordered-pair rules, or function notation), draw the transformed figure using graph paper, tracing paper, etc. • Identify a transformation given the coordinates of a preimage and its image or the graph of a preimage and its image • Describe a sequence of transformations that will carry a given figure onto another.	• Tracing Paper **Common Core Problems:** **9.1:** #4, 5, 6, 22, 27, 28, 35 **9.2:** 4, 5, 23, 26, 31, 35 **9.3: #**5, 6, 7, 8, 24, 25, 31, 32, 33, 36, 37, 49 **Thinking Map:** Create a Tree Map with Branches that show examples of translations, reflections, and rotations.
1 day (Mar. 13th)	**Performance Task: Revisit "Kaleidoscope"** Refer to Notes and Additional Resources **CCSS: G-CO 5** **SMP 7**				• Given a pre-image and its image, write the transformation in function notation. • Identify reflectional and rotational symmetry in a design.	Provide copies of pre-made design or have students work on their own design. Use worksheet at end of this document or similar questions.

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2 Days (Mar. 14-15)	**Lesson 9-4: Compositions of Isometries** SMP: 1,3,6 (pp. 570-576) **G-CO 5, G-CO 6**	**Focus Question:** • How can a composition of isometries be represented in a single transformation? **Inquiry Question:** 9-4 p. 570 Solve It!	• A translation is a composition of reflections across parallel lines. • A rotation is a composition of reflections across intersecting lines.	**Vocabulary:** isometry, composition of isometries, reflections across parallel lines, reflections across intersecting lines	• Graph a composition of isometries given a composition in function notation • Specify when one transformation could give the same image as a composition • Use composite function notation to describe a sequence of transformations that will carry a given figure onto another.	**Common Core Problems:** **9.4:** #4,5,22.26, 27, 28,40 **Thinking Map:** Create a Flow Map showing the steps for composing reflections across intersecting lines.
1 Day (Mar. 16th)	**Lesson 9-5: Congruence Transformations** SMP: 1,3,4 (pp. 578-585) **G-CO 6, G-CO 7**	**Focus Question:** • Suppose two figures are congruent. What do you know about how the figures are related in the plane? **Inquiry Question:** 9-5 p. 578 Solve It!	• If two figures can be mapped to each other by a sequence of rigid motions, then the figures are congruent.	**Vocabulary:** congruent, congruence transformation	• Identify congruence transformations. • Prove triangle congruence using isometries.	**Common Core Problems:** **9.5:** #3,4,5, 12, 13, 17-1921, 22, 23, 24, 25, 26, 27, 28

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- ☐ Thinking Maps

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
2 Days (Mar. 17th, 20th)	**Lesson 9-6: Dilations** SMP: 1,3,4,7 (pp. 587-593) **G-CO 2, G-SRT 1a, G-SRT 1b**	**Focus Question:** • What are the properties of a dilation? • How are the image and pre-image related in a dilation? • What is the difference between a reduction and an enlargement? **Inquiry Question:** 9-6 p. 587 Solve It!	• Properties of dilations • A dilation maps a line segment to a parallel line segment • The distance from center of dilation to the image is equal to the distance from the center of dilation to the pre-image times the scale factor • The length of the image is equal to the length of the pre-image times the scale factor • The center of dilation is on the same line with the pre-image and image points (collinear).	**Vocabulary: s**cale factor, dilation, center of dilation, enlargement, reduction	• Determine the scale factor given a preimage and its image. • Graph an image given a figure and a dilation. • Use composite function notation to describe a sequence of transformations that will carry a given figure onto another when one of the transformations is a dilation.	**Common Core Problems:** **9.6:** #5,6, 34, 35, 36, 39, 44, 45-48
1 Day (Mar. 21st)	**Review Topic 8 Concepts & Skills** Use Textbook Resources and/or Teacher Created Items					
2 Days (Mar. 22-23)	**Topic 8 Assessment** (Created and provided by PUSD)					

Common Core Practices

- ☐ Instruction in the Standards for Mathematical Practices
- ☐ Use of Talk Moves
- ☐ Note-taking
- ☐ Use of Manipulatives
- ☐ Use of Technology
- ☐ Use of Real-world Scenarios
- ☐ Project-based Learning
- ☐ Thinking Maps

PROJECT

Kaleidoscope

An actual kaleidoscope creates its unique design by reflecting a fundamental image (e.g. a group of colorful pebbles) through a series of mirrors. The kaleidoscope design in this activity is created in the same way. However, the fundamental image is an artistic rendering of the student's name, and reflecting lines are substituted for the mirrors.

The fundamental image (the student's name) is reflected over the nearest line, and then the reflected image is subsequently reflected over each successive line until all eight cells of the paper are filled. The next step is to label each type of transformation as a reflection or rotation (the cells alternate between the two options). Stress to the students that the goal is to create a complex pattern in which the original name is no longer recognizable. A unique design should be the final result (see figure on the left). This is best accomplished by making sure that the name reaches from one side of the cell to the other.

Concepts
Transformations, reflections, rotations, composite reflections.

Time: 1 hour

Materials
Student Handout, rulers, paper and colored pencils.

Preparation
Students should be familiar with basic transformations, reflections and rotations in particular.

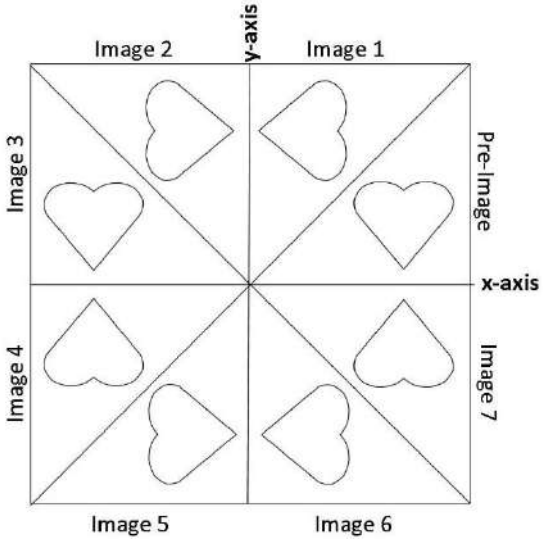
NAME REFLECTION FOLLOW-UP

Objectives

Apply the vocabulary and ideas learned in Topic 2 to a name reflection design.

What To Do …

1. Identify your pre-image.
2. Choose a horizontal and vertical fold to be the x-axis and y-axis.
3. Starting from your pre-image, label each triangle as Image 1, Image 2, etc. (see example below)
4. Answer the questions below using your design. When comparing your pre-image to each image, think of the folds in the paper that you identified as the x- and y-axis.



Name Reflection Questions

Question 1 – How would we name the lines formed by the diagonal (corner-to-corner) folds?

Question 2 – Compare each image to the pre-image & describe the transformation that resulted in the image. (For example: Image 4 is a 180° rotation of the pre-image about the origin)

Image 1 is a _____

Image 2 is a _____

Image 3 is a _____

Image 4 is a _____

Image 5 is a _____

Image 6 is a _____

Image 7 is a _____

Question 2 – Does your design have reflectional symmetry? If so, how many lines of reflection are there?
_____

Question 3 – Does your design have rotational symmetry? If so, what is the angle of rotational symmetry? _____

Josh is animating a scene where a troupe of frogs is auditioning for the Animal Channel reality show, "The Bayou's Got Talent.: In this scene the frogs are demonstrating their "leap frog" acrobatics act. Josh has completed a few key images in this segment, and now needs to describe the transformations that connect various images in the scene.

For each pre-image/image combination listed below, describe the transformation that moves the pre-image to the final image.

- If you decide the transformation is a **rotation**, you will need to give the **center of rotation**, the **direction** of the rotation (clockwise or counterclockwise), and the **measure of the angle** of rotations.
- If you decide the transformation is a **reflection**, you will need to give the **equation of the line** of reflection.
- If you decide the transformation is a **translation**, you will need to describe the **"rise" and "run"** between pre-image points and their corresponding image points.
- If you decide it takes a **combination of transformations** to get from the pre-image to the final image, **describe each transformation in the order** they would be completed.

Pre-image	Final Image	Description
Image 1	Image 2	
Image 2	Image 3	
Image 3	Image 4	
Image 1	Image 5	
Image 2	Image 4