Standard 1 : Understand congruence and similarity using physical models, transparencies, or geometry software. (Major Cluster)

This document was generated on CPALMS - www.cpalms.org

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Number: MAFS.8.G.1

Title: Understand congruence and similarity using physical models, transparencies, or geometry software. (Major Cluster)

Type: Cluster

Subject: Mathematics

Grade: 8

Domain-Subdomain: Geometry

Related Standards

Code	Description
MAFS.8.G.1.1	Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.
MAFS.8.G.1.2	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.
MAFS.8.G.1.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
MAFS.8.G.1.4	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.
MAFS.8.G.1.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*

Related Access Points

Access Point

Access Point Number	Access Point Title
MAFS.8.G.1.AP.1a:	Perform rotations, reflections, and translations using pattern blocks.
MAFS.8.G.1.AP.1b:	Draw rotations, reflections, and translations of polygons.
MAFS.8.G.1.AP.2a:	Demonstrate that two-dimensional polygons that are rotated, reflected, or translated are still congruent using area, perimeter, and length of sides on a coordinate plane.
MAFS.8.G.1.AP.3a:	Dilate common polygons using graph paper and identifying the coordinates of the vertices.
MAFS.8.G.1.AP.4a:	Recognize congruent and similar figures.
MAFS.8.G.1.AP.4b:	Identify two-dimensional figures as similar or congruent given coordinate plane representations.
MAFS.8.G.1.AP.4c:	Compare area and volume of similar figures.
MAFS.8.G.1.AP.5a:	Use angle relationships to find the value of a missing angle.
MAFS.8.G.1.AP.3b:	Given two figures on a coordinate plane, identify if the image is dilated, translated, rotated, or reflected.

Related Resources

Lesson Plan

Name	Description
"Triangle Congruence Show" Starring Rigid Transformations:	Students will be introduced to the definition of congruence in terms of rigid motion and use it to determine if two triangles are congruent.

A Transformation's Adventure with Patty Paper: Exploring Translations, Reflections and Rotations.:	This lesson is an introduction to isometric transformations explained using patty paper. Meant for students with limited access to technology, it uses patty paper as a principal resource. Translations, reflections and rotations will be explained and practiced with this inexpensive element, emphasizing the properties preserved during those transformations and, without sacrificing precision, allowing students to differentiate between these isometries in a simple way.
An Investigation of Angle Relationships Formed by Parallel Lines Cut by a Transversal Using GeoGebra:	In this lesson, students will discover angle relationships formed (corresponding, alternate interior, alternate exterior, same-side interior, same-side exterior) when two parallel lines are cut by a transversal. They will establish definitions and identify whether these angle pairs are supplementary or congruent.
Coding Geometry Challenge #10 & 11:	This set of geometry challenges focuses on scaled drawings and area as students problem solve and think as they learn to code using block coding software. Student will need to use their knowledge of the attributes of polygons and mathematical principals of geometry to accomplish the given challenges. The challenges start out fairly simple and move to more complex situations in which students can explore at their own pace or work as a team. Computer Science standards are seamlessly intertwined with the math standards while providing "Step it up!" and "Jump it up!" opportunities to increase rigor.
Coding Geometry Challenge #23 & 24:	This set of geometry challenges focuses on using transformations to show similarity and congruence of polygons and circles. Students problem solve and think as they learn to code using block coding software. Student will need to use their knowledge of the attributes of polygons and mathematical principals of geometry to accomplish the given challenges. The challenges start out fairly simple and move to more complex situations in which students can explore at their own pace or work as a team. Computer Science standards are seamlessly intertwined with the math standards while providing "Step it up!" and "Jump it up!" opportunities to increase rigor.
Dilly Dallying with Dilations:	Students will understand the concept of dilation by constructing similar polygons on a coordinate grid using coordinate notation of dilation $(x,y) \rightarrow (kx,ky)$. Students use similar figures to determine the scale factor. Students use proportions to determine side lengths of similar figures.
Exploring Rotations with GeoGebra:	This lesson will help students understand the concept of a geometric rotation. The teacher/students will use a GeoGebra applet to derive the rules for rotating a point on the coordinate plane about the origin for a 90 degree, 180 degree, and a 270 degree counterclockwise rotation.
Help me Find my Relationship!:	In this lesson, students will investigate the relationship between angles when parallel lines are cut by a transversal. Students will identify angles, find angle measures, and they will use the free application GeoGebra (see download link under Suggested Technology) to provide students with a visual representation of angles relationships.
How Many Degrees?:	This lesson facilitates the discovery of a formula for the sum of the interior angles of a regular polygon. Students will draw all the diagonals from one vertex of various polygons to find how many triangles are formed. They will use this and their prior knowledge of triangles to figure out the sum of the interior angles. This will lead to the formulation of a formula for finding the sum of interior angles and the measure of one interior angle.
Identifying Similar Triangles:	This 105-minute lesson series helps teachers assess how students reason about geometry, including how they use facts about the angle sum and exterior angles of triangles to calculate missing angles, apply angle theorems to parallel lines cut by a transversal, and interpret geometrical diagrams using mathematical properties to identify similarity of triangles. In order to complete this lesson, students will need whiteboards, pens, wipes, copies of the assessment tasks, pencils, markers, scissors, glue sticks, and poster paper.
Polygon Transformers:	This guided discovery lesson introduces students to the concept that congruent polygons can be formed using a series of transformations (translations, rotations, reflections). As a culminating activity, students will create a robot out of transformed figures.
Rotations and Reflections of an Equilateral Triangle:	Students will apply simple transformations (rotation and reflection) to an equilateral triangle, then determine the result of the action of two successive transformations, eventually determining whether the action satisfies the commutative and associate properties.
Rotations and Reflections of an Equilateral Triangle:	Students will apply simple transformations (rotation and reflection) to an equilateral triangle, then determine the result of the action of two successive transformations, eventually determining whether the action satisfies the commutative and associate properties.
Scientific calculations from a distant planet:	Students will act as mathematicians and scientists as they use models, observations and space science concepts to perform calculations and draw inferences regarding a fictional solar system with three planets in circular orbits around a sun. Among the calculations are estimates of the size of the home planet (using a method more than 2000 years old) and the relative distances of the planets from their sun.
Shape It Up:	Students will draw diagonals for different polygons, separating the polygons into triangles. Using the fact that the sum of the measures of the interior angles of a triangle is 180 degrees, and the fact the angles of the triangles are used to form the angles of the polygons, students will derive the formula for finding the sum of the measures of the angles of a polygon with n sides. Students will also learn to use this formula, along with the fact that all angles of a regular polygon are congruent, to find the measures of the angles of a regular polygon.
Slide to the Left... Slide to the Right!:	Students will identify, review, and analyze transformations. They will demonstrate their understanding of transformations in the coordinate plane by creating original graphs of polygons and the images that result from specific transformations.
Special Angle Pairs Discovery Activity:	This lesson uses a discovery approach to identify the special angles formed when a set of parallel lines is cut by a transversal. During this lesson students identify the angle pair and the relationship between the angles. Students use this relationship and special angle pairs to make conjectures about which angle pairs are considered special angles.
The Ins and Outs of Polygons:	In this lesson, students will explore how to find the sum of the measures of the angles of a triangle and then be able to find the sum of the measures of the angles of other polygons. They will also be able to find the sum of the exterior angles of triangles and other polygons. Using both of these concepts, they will be able to find missing measurements.

Transformations... Geometry in Motion:	Transformations... Geometry in Motion is designed for students to practice their knowledge of transformations. Students will represent transformations in the plane, compare transformations, and determine which have isometry. Students should have a **basic understanding** of the rules for each transformation as they will apply these rules in this activity. There is a teacher-led portion in this lesson followed by partner-activity. Students will be asked to explain and justify reasoning, as well.
Triangles on a Lattice:	In this activity, students will use a 3x3 square lattice to study transformations of triangles whose vertices are part of the lattice. The tasks include determining whether two triangles are congruent, which transformations connect two congruent triangles, and the number of non-congruent triangles (with vertices on the lattice) that are possible.
Triangles on a Lattice:	In this activity, students will use a 3x3 square lattice to study transformations of triangles whose vertices are part of the lattice. The tasks include determining whether two triangles are congruent, which transformations connect two congruent triangles, and the number of non-congruent triangles (with vertices on the lattice) that are possible.
Triangles: Finding Interior Angle Measures:	In this lesson plan, students will start with a hands-on activity and then experiment with a GeoGebra-based computer model to investigate and discover the Triangle Angle Sum Theorem. Then they will use the Triangle Angle Sum Theorem to write and solve equations and find missing angle measures in a variety of examples.

Perspectives Video: Professional/Enthusiast

Name	Description
All Circles Are Similar- Especially Circular Pizza!:	What better way to demonstrate that all circles are similar then to use pizzas! Gaines Street Pies explains how all pizza pies are similar through transformations.

Formative Assessment

Name	Description
Angle Transformations:	Students are given the opportunity to experimentally verify the properties of angle transformations (translations, reflections, and rotations).
Dilation Coordinates:	Students are asked to dilate two-dimensional figures in the coordinate plane and identify the coordinates of the vertices of the images.
Justifying Angle Relationships:	Students are asked to describe and justify the relationship between corresponding angles and alternate interior angles.
Justifying the Exterior Angle of a Triangle Theorem:	Students are asked to apply the Exterior Angle of a Triangle Theorem and provide an informal justification.
Justifying the Triangle Sum Theorem:	Students are asked to provide an informal justification of the Triangle Sum Theorem.
Multistep Congruence:	Students are asked to describe a sequence of rigid motions to demonstrate the congruence of two polygons.
Parallel Line Transformations:	Students are given the opportunity to experimentally verify the properties of parallel line transformations (translations, reflections, and rotations).
Proving Congruence:	Students are asked to explain congruence in terms of rigid motions.
Proving Similarity:	Students are asked to explain similarity in terms of transformations.
Reflection Coordinates:	Students are asked to reflect two-dimensional figures in the coordinate plane and identify the coordinates of the vertices of the images.
Rigid Motion - 1:	Students are asked to describe a rigid motion to demonstrate that two polygons are congruent.
Rigid Motion - 2:	Students are asked to describe a rigid motion to demonstrate two polygons are congruent.
Rigid Motion - 3:	Students are asked to describe a rigid motion to demonstrate two polygons are congruent.
Rotation Coordinates:	Students are asked to rotate two-dimensional figures in the coordinate plane and identify the coordinates of the vertices of the images.
Same Side Interior Angles:	Students are asked to describe and justify the relationship between same side interior angles.
Segment Transformations:	Students are given the opportunity to experimentally verify the properties of segment transformations (translations, reflections, and rotations).
Similarity - 1:	Students are asked to describe a sequence of transformations to show that two polygons are similar.
Similarity - 2:	Students are asked to describe a sequence of transformations to show that two polygons are similar.
Similarity - 3:	Students are asked to describe a sequence of transformations that demonstrates two polygons are similar.
Translation Coordinates:	Students are asked to translate two-dimensional figures in the coordinate plane and identify the coordinates of the vertices of the images.
What Is the Triangle Relationship?:	Students are asked to write an informal justification of the AA Similarity Theorem.

Image/Photograph

Name	Description
Angles (Clipart ETC):	This large collection of clipart contains images of angles that can be freely used in lesson plans, worksheets, and presentations.

Problem-Solving Task

Name	Description
Congruent Segments:	Students' first experience with transformations is likely to be with specific shapes like triangles, quadrilaterals, circles, and figures with symmetry. Exhibiting a sequence of transformations that shows that two generic line segments of the same length are congruent is a good way for students to begin thinking about transformations in greater generality.
Congruent Triangles:	This task has two goals: first to develop student understanding of rigid motions in the context of demonstrating congruence. Secondly, student knowledge of reflections is refined by considering the notion of orientation in part (b). Each time the plane is reflected about a line, this reverses the notions of "clockwise" and "counterclockwise."
Find the Angle:	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
Find the Missing Angle:	This task provides us with the opportunity to see how the mathematical ideas embedded in the standards and clusters mature over time. The task "Uses facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure (MAFS.7.G.2.5)" except that it requires students to know, in addition, something about parallel lines, which students will not see until 8th grade. As a result, this task is especially good at illustrating the links between related standards across grade levels.
Partitioning a Hexagon:	The purpose of this task is for students to find a way to decompose a regular hexagon into congruent figures. This is meant as an instructional task that gives students some practice working with transformations.
Point Reflection:	The purpose of this task is for students to apply a reflection to a single point. The standard MAFS.8.G.1.1 asks students to apply rigid motions to lines, line segments, and angles. Although this problem only applies a reflection to a single point, it has high cognitive demand if the students are prompted to supply a picture. This is because the coordinates of the point (1000,2012) are very large. If students try to plot this point and the line of reflection on the usual x-y coordinate grid, then either the graph will be too big or else the point will lie so close to the line of reflection that it is not clear whether or not it lies on this line. A good picture requires a careful choice of the appropriate region in the plane and the corresponding labels. Moreover, reflections of lines, line segments, and angles are all found by reflecting individual points.
Reflecting a Rectangle Over a Diagonal:	The task is intended for instructional purposes and assumes that students know the properties of rigid transformations described in MAFS.8.G.1.1. Note that the vertices of the rectangles in question do not fall exactly at intersections of the horizontal and vertical lines on the grid. This means that students need to approximate and this provides an extra challenge. Also providing a challenge is the fact that the grids have been drawn so that they are aligned with the diagonal of the rectangles rather than being aligned with the vertical and horizontal directions of the page. However, this choice of grid also makes it easier to reason about the reflections if they understand the descriptions of rigid motions indicated in MAFS.8.G.1.3.
Reflecting Reflections:	In this resource, students experiment with successive reflections of a triangle in a coordinate plane.
Tile Patterns I: octagons and squares:	In this task students are given a tile pattern involving congruent regular octagons and squares. They are asked to determine the interior angle measure of the octagon and verify the attributes of the square.
Tile Patterns II: hexagons:	This task is ideally suited for instruction purposes where students can take their time and develop several of the Mathematical Practice standards, as the mathematical content is directly related to, but somewhat exceeds, the content of standard MAFS.8.G.1.5 on sums of angles in triangles. Careful analysis of the angles requires students to construct valid arguments (MAFS.K12.MP.3.1) using abstract and quantitative reasoning (MAFS.K12.MP.2.1). Producing the picture in part (c) helps students identify a common mathematical argument repeated multiple times (MAFS.K12.MP.8.1). If students use pattern blocks in order to develop the intuition for decomposing the hexagon into triangles, then this is also an example of MAFS.K12.MP.5.1.
Triangle congruence with coordinates:	In this resource, students will decide how to use transformations in the coordinate plane to translate a triangle onto a congruent triangle. Exploratory examples are included to prompt analytical thinking.

Virtual Manipulative

Name	Description
Congruent Triangles:	This manipulative is a virtual realization of the kind of physical experience that might be available to students given three pieces of straws and told to make them into a triangle. when working with pieces that determine unique triangles (SSS, SAS, ASA). Students construct triangles with the parts provided. After building a red and a blue triangle, students can experience congruence by actually moving one on the top of the other.
Rotation of a Point:	This virtual manipulative is an interactive visual presentation of the rotation of a point around the origin of the coordinate system. The original point can be dragged to different positions and the angle of rotation can be changed with a 90° increment.
Transformations - Dilation:	Students use a slider to explore dilation and scale factor. Students can create and dilate their own figures. (source: NLVM grade 6-8 "Transformations - Dilation")
Transformations - Reflections:	The user clicks and drags a shape they have constructed to view its reflection across a line. A background grid and axes may or may not be used. The reflection may by examined analytically using coordinates. Symmetry may be displayed.
Transformations - Rotation:	Rotate shapes and their images with or without a background grid and axes.
Transformations - Translation:	The user can demonstrate or explore translation of shapes created with pattern blocks, using or not using a coordinate axes and lattice points background, by changing the translation vector. (source: NLVM grade 6-8 "Transformations - Translation")

Student Center Activity

Name	Description
Edcite: Mathematics Grade 8:	Students can practice answering mathematics questions on a variety of topics. With an account, students can save their work and send it to their teacher when complete.

Educational Software / Tool

Name	Description
Glossary:	This resource is an online glossary to find the meaning of math terms. Students can also use the online glossary to find words that are related to the word typed in the search box. For example: Type in "transversal" and 11 other terms will come up. Click on one of those terms and its meaning is displayed.
Transformations Using Technology:	This virtual manipulative can be used to demonstrate and explore the effect of translation, rotation, and/or reflection on a variety of plane figures. A series of transformations can be explored to result in a specified final image.

Original Student Tutorial

Name	Description
Home Transformations:	Learn to describe a sequence of transformations that will produce similar figures. This interactive tutorial will allow you to practice with rotations, translations, reflections, and dilations.

Tutorial

Name	Description
Introduction to Transformations:	This video introduces the concept of rigid transformation and congruent figures.
Proving congruent angles:	In this tutorial, students are asked to prove two angles congruent when given limited information. Students need to have a foundation of parallel lines, transversals and triangles before viewing this video.
Rotating polygons 180 degrees about their center:	Students will investigate symmetry by rotating polygons 180 degrees about their center.
Scaling Down a Triangle by Half:	This video demonstrates the effect of a dilation on the coordinates of a triangle.
Sum of measures of triangles proof:	This video gives the proof of sum of measures of angles in a triangle. This video is beneficial for both Algebra and Geometry students.
Testing Similarity Through Transformations:	This video shows testing for similarity through transformations.

Assessment

Name	Description
Sample 1 - Eighth Grade Math State Interim Assessment:	This is a State Interim Assessment for eighth grade.
Sample 2 - Eighth Grade Math State Interim Assessment:	This is a State Interim Assessment for eighth grade.
Sample 3 - Eighth Grade Math State Interim Assessment:	This is a State Interim Assessment for eighth grade.
Sample 4 - Eighth Grade Math State Interim Assessment:	This is a State Interim Assessment for eighth grade.

Educational Game

Name	Description
Transformation Complete:	Play this interactive game and determine whether the similar shapes have gone through rotations, translations, or reflections.

Student Resources

Title	Description
Congruent Segments:	Students' first experience with transformations is likely to be with specific shapes like triangles, quadrilaterals, circles, and figures with symmetry. Exhibiting a sequence of transformations that shows that two generic line segments of the same length are congruent is a good way for students to begin thinking about transformations in greater generality.
Congruent Triangles:	This task has two goals: first to develop student understanding of rigid motions in the context of demonstrating congruence. Secondly, student knowledge of reflections is refined by considering the notion of orientation in part (b). Each time the plane is reflected about a line, this reverses the notions of "clockwise" and "counterclockwise."
Congruent Triangles:	This manipulative is a virtual realization of the kind of physical experience that might be available to students given three pieces of straws and told to make them into a triangle. when working with pieces that determine unique triangles (SSS, SAS, ASA). Students construct triangles with the parts provided. After building a red and a blue triangle, students can experience congruence by actually moving one on the top of the other.
Edcite: Mathematics Grade 8:	Students can practice answering mathematics questions on a variety of topics. With an account, students can save their work and send it to their teacher when complete.

Find the Angle:	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
Find the Missing Angle:	This task provides us with the opportunity to see how the mathematical ideas embedded in the standards and clusters mature over time. The task "Uses facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure (MAFS.7.G.2.5)" except that it requires students to know, in addition, something about parallel lines, which students will not see until 8th grade. As a result, this task is especially good at illustrating the links between related standards across grade levels.
Glossary:	This resource is an online glossary to find the meaning of math terms. Students can also use the online glossary to find words that are related to the word typed in the search box. For example: Type in "transversal" and 11 other terms will come up. Click on one of those terms and its meaning is displayed.
Home Transformations:	Learn to describe a sequence of transformations that will produce similar figures. This interactive tutorial will allow you to practice with rotations, translations, reflections, and dilations.
Introduction to Transformations:	This video introduces the concept of rigid transformation and congruent figures.
Partitioning a Hexagon:	The purpose of this task is for students to find a way to decompose a regular hexagon into congruent figures. This is meant as an instructional task that gives students some practice working with transformations.
Point Reflection:	The purpose of this task is for students to apply a reflection to a single point. The standard MAFS.8.G.1.1 asks students to apply rigid motions to lines, line segments, and angles. Although this problem only applies a reflection to a single point, it has high cognitive demand if the students are prompted to supply a picture. This is because the coordinates of the point (1000,2012) are very large. If students try to plot this point and the line of reflection on the usual x-y coordinate grid, then either the graph will be too big or else the point will lie so close to the line of reflection that it is not clear whether or not it lies on this line. A good picture requires a careful choice of the appropriate region in the plane and the corresponding labels. Moreover, reflections of lines, line segments, and angles are all found by reflecting individual points.
Proving congruent angles:	In this tutorial, students are asked to prove two angles congruent when given limited information. Students need to have a foundation of parallel lines, transversals and triangles before viewing this video.
Reflecting a Rectangle Over a Diagonal:	The task is intended for instructional purposes and assumes that students know the properties of rigid transformations described in MAFS.8.G.1.1. Note that the vertices of the rectangles in question do not fall exactly at intersections of the horizontal and vertical lines on the grid. This means that students need to approximate and this provides an extra challenge. Also providing a challenge is the fact that the grids have been drawn so that they are aligned with the diagonal of the rectangles rather than being aligned with the vertical and horizontal directions of the page. However, this choice of grid also makes it easier to reason about the reflections if they understand the descriptions of rigid motions indicated in MAFS.8.G.1.3.
Reflecting Reflections:	In this resource, students experiment with successive reflections of a triangle in a coordinate plane.
Rotating polygons 180 degrees about their center:	Students will investigate symmetry by rotating polygons 180 degrees about their center.
Rotation of a Point:	This virtual manipulative is an interactive visual presentation of the rotation of a point around the origin of the coordinate system. The original point can be dragged to different positions and the angle of rotation can be changed with a 90° increment.
Scaling Down a Triangle by Half:	This video demonstrates the effect of a dilation on the coordinates of a triangle.
Sum of measures of triangles proof:	This video gives the proof of sum of measures of angles in a triangle. This video is beneficial for both Algebra and Geometry students.
Testing Similarity Through Transformations:	This video shows testing for similarity through transformations.
Tile Patterns I: octagons and squares:	In this task students are given a tile pattern involving congruent regular octagons and squares. They are asked to determine the interior angle measure of the octagon and verify the attributes of the square.
Tile Patterns II: hexagons:	This task is ideally suited for instruction purposes where students can take their time and develop several of the Mathematical Practice standards, as the mathematical content is directly related to, but somewhat exceeds, the content of standard MAFS.8.G.1.5 on sums of angles in triangles. Careful analysis of the angles requires students to construct valid arguments (MAFS.K12.MP.3.1) using abstract and quantitative reasoning (MAFS.K12.MP.2.1). Producing the picture in part (c) helps students identify a common mathematical argument repeated multiple times (MAFS.K12.MP.8.1). If students use pattern blocks in order to develop the intuition for decomposing the hexagon into triangles, then this is also an example of MAFS.K12.MP.5.1.
Transformation Complete:	Play this interactive game and determine whether the similar shapes have gone through rotations, translations, or reflections.
Transformations - Dilation:	Students use a slider to explore dilation and scale factor. Students can create and dilate their own figures. (source: NLVM grade 6-8 "Transformations - Dilation")
Transformations - Reflections:	The user clicks and drags a shape they have constructed to view its reflection across a line. A background grid and axes may or may not be used. The reflection may by examined analytically using coordinates. Symmetry may be displayed.
Transformations - Rotation:	Rotate shapes and their images with or without a background grid and axes.
Transformations - Translation:	The user can demonstrate or explore translation of shapes created with pattern blocks, using or not using a coordinate axes and lattice points background, by changing the translation vector. (source: NLVM grade 6-8 "Transformations - Translation")

Transformations Using Technology:	This virtual manipulative can be used to demonstrate and explore the effect of translation, rotation, and/or reflection on a variety of plane figures. A series of transformations can be explored to result in a specified final image.
Triangle congruence with coordinates:	In this resource, students will decide how to use transformations in the coordinate plane to translate a triangle onto a congruent triangle. Exploratory examples are included to prompt analytical thinking.

Parent Resources

Title	Description
Congruent Segments:	Students' first experience with transformations is likely to be with specific shapes like triangles, quadrilaterals, circles, and figures with symmetry. Exhibiting a sequence of transformations that shows that two generic line segments of the same length are congruent is a good way for students to begin thinking about transformations in greater generality.
Congruent Triangles:	This task has two goals: first to develop student understanding of rigid motions in the context of demonstrating congruence. Secondly, student knowledge of reflections is refined by considering the notion of orientation in part (b). Each time the plane is reflected about a line, this reverses the notions of "clockwise" and "counterclockwise."
Congruent Triangles:	This manipulative is a virtual realization of the kind of physical experience that might be available to students given three pieces of straws and told to make them into a triangle. when working with pieces that determine unique triangles (SSS, SAS, ASA). Students construct triangles with the parts provided. After building a red and a blue triangle, students can experience congruence by actually moving one on the top of the other.
Find the Angle:	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
Find the Missing Angle:	This task provides us with the opportunity to see how the mathematical ideas embedded in the standards and clusters mature over time. The task "Uses facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure (MAFS.7.G.2.5)" except that it requires students to know, in addition, something about parallel lines, which students will not see until 8th grade. As a result, this task is especially good at illustrating the links between related standards across grade levels.
Glossary:	This resource is an online glossary to find the meaning of math terms. Students can also use the online glossary to find words that are related to the word typed in the search box. For example: Type in "transversal" and 11 other terms will come up. Click on one of those terms and its meaning is displayed.
Partitioning a Hexagon:	The purpose of this task is for students to find a way to decompose a regular hexagon into congruent figures. This is meant as an instructional task that gives students some practice working with transformations.
Point Reflection:	The purpose of this task is for students to apply a reflection to a single point. The standard MAFS.8.G.1.1 asks students to apply rigid motions to lines, line segments, and angles. Although this problem only applies a reflection to a single point, it has high cognitive demand if the students are prompted to supply a picture. This is because the coordinates of the point (1000,2012) are very large. If students try to plot this point and the line of reflection on the usual x-y coordinate grid, then either the graph will be too big or else the point will lie so close to the line of reflection that it is not clear whether or not it lies on this line. A good picture requires a careful choice of the appropriate region in the plane and the corresponding labels. Moreover, reflections of lines, line segments, and angles are all found by reflecting individual points.
Reflecting a Rectangle Over a Diagonal:	The task is intended for instructional purposes and assumes that students know the properties of rigid transformations described in MAFS.8.G.1.1. Note that the vertices of the rectangles in question do not fall exactly at intersections of the horizontal and vertical lines on the grid. This means that students need to approximate and this provides an extra challenge. Also providing a challenge is the fact that the grids have been drawn so that they are aligned with the diagonal of the rectangles rather than being aligned with the vertical and horizontal directions of the page. However, this choice of grid also makes it easier to reason about the reflections if they understand the descriptions of rigid motions indicated in MAFS.8.G.1.3.
Reflecting Reflections:	In this resource, students experiment with successive reflections of a triangle in a coordinate plane.
Tile Patterns I: octagons and squares:	In this task students are given a tile pattern involving congruent regular octagons and squares. They are asked to determine the interior angle measure of the octagon and verify the attributes of the square.
Tile Patterns II: hexagons:	This task is ideally suited for instruction purposes where students can take their time and develop several of the Mathematical Practice standards, as the mathematical content is directly related to, but somewhat exceeds, the content of standard MAFS.8.G.1.5 on sums of angles in triangles. Careful analysis of the angles requires students to construct valid arguments (MAFS.K12.MP.3.1) using abstract and quantitative reasoning (MAFS.K12.MP.2.1). Producing the picture in part (c) helps students identify a common mathematical argument repeated multiple times (MAFS.K12.MP.8.1). If students use pattern blocks in order to develop the intuition for decomposing the hexagon into triangles, then this is also an example of MAFS.K12.MP.5.1.
Transformations - Dilation:	Students use a slider to explore dilation and scale factor. Students can create and dilate their own figures. (source: NLVM grade 6-8 "Transformations - Dilation")
Transformations - Rotation:	Rotate shapes and their images with or without a background grid and axes.
Transformations - Translation:	The user can demonstrate or explore translation of shapes created with pattern blocks, using or not using a coordinate axes and lattice points background, by changing the translation vector. (source: NLVM grade 6-8 "Transformations - Translation")
Triangle congruence with coordinates:	In this resource, students will decide how to use transformations in the coordinate plane to translate a triangle onto a congruent triangle. Exploratory examples are included to prompt analytical thinking.