TOPIC 1 OVERVIEW

Rigid Motion Transformations

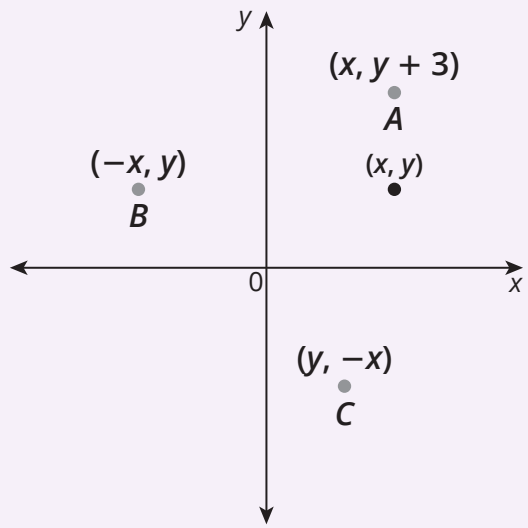
How are the key concepts of *Rigid Motion Transformations* organized?

In *Rigid Motion Transformations*, students use patty paper and the coordinate plane to investigate congruent figures. Throughout the topic, students are expected to make conjectures, investigate conjectures, and justify true results about transformations.

The topic begins with an introduction to the problem-solving model. Students will use this model throughout the course when solving problems. Afterward, there is an introduction to congruent figures through the use of patty paper. Students use informal language to describe how one figure can be mapped to a congruent figure. In the second lesson, students formalize the language of rigid motion transformations (translations, reflections, and rotations) and describe how a single rigid motion maps between congruent figures. They learn that all rigid motions preserve the size and shape of a figure, translations and rotations preserve the orientation of a figure and its vertices, and reflections do not preserve orientation of the figure nor its vertices.

Math Representation

Consider the point (x, y) located in the first quadrant on the coordinate plane.



Point *A* represents a vertical translation of 3 units.

Point *B* represents a reflection across the *y*-axis.

Point *C* represents a rotation of 90° clockwise about the origin.

The next three lessons involve investigating each of the three rigid motion transformations on the coordinate plane. Students describe the effect of translations, reflections, and rotations on two-dimensional figures using coordinates.

In the final lesson, students define congruent line segments and angles and write congruence statements for triangles, angles, and segments. They generalize the effects of rigid motion transformations on the coordinates of figures.

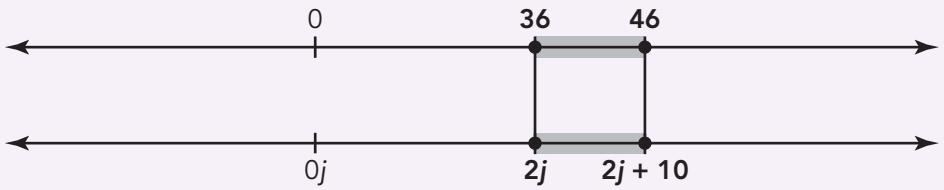
What is the entry point for students?

Students began identifying geometric figures in previous courses. They know the properties of plane figures and how to describe and sort them based on characteristics. In previous courses, students used double number lines to reason about equations. They moved equivalent expressions on the number line, shifting to add or subtract values and scaling to multiply or divide. These transformations on the double number lines are the precursor for transformations on the coordinate plane.

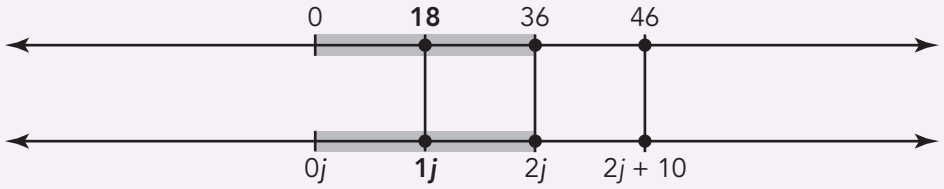
Math Representation

You can use a double number line to solve the equation $2j + 10 = 46$.

Start by moving the expression 10 units to the left, so $2j = 36$.



The expression $1j$, or j, is halfway between $0j$ and $2j$, and 18 is halfway between 0 and 36. So, $j = 18$.

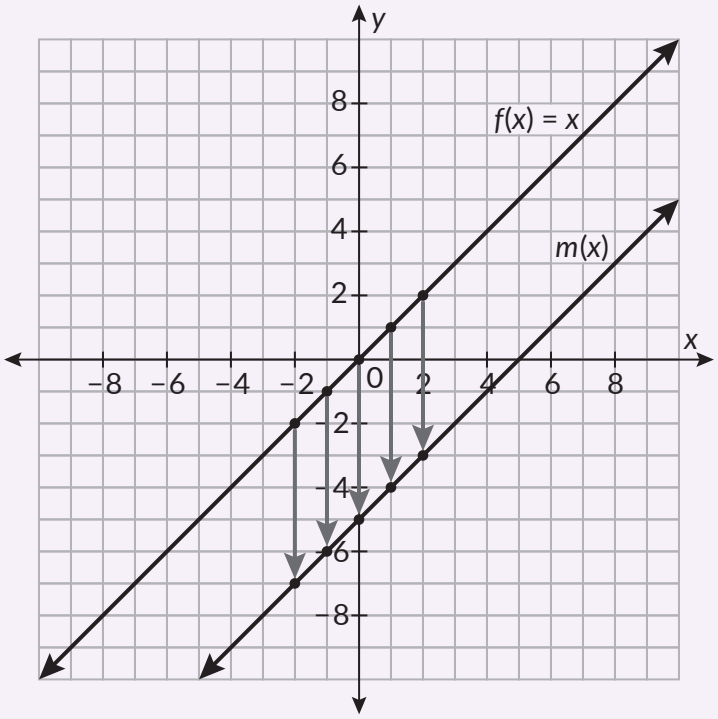


Why is *Rigid Motion Transformations* important?

Rigid Motion Transformations sets the stage for similarity. Students will contrast these properties with the properties of dilations in the next topic, revisiting similar terminology and notation. They will use transformations to investigate the angle relationships formed when a transversal cuts parallel lines. Students will use rigid motions to transform lines on the coordinate plane when studying linear relationships in this course and future courses.

Math Representation

You can translate the graph of $f(x)$ down 5 units by moving each point 5 units down. The transformed graph is labeled as $m(x)$.



Original Graph	
x	$f(x)$
−2	−2
−1	−1
0	0
1	1
2	2

Transformed Graph	
x	$m(x)$
−2	−7
−1	−6
0	−5
1	−4
2	−3

How does a student demonstrate understanding?

Students will demonstrate understanding of the standards in this topic when they can:

- Define and identify translations, rotations, and reflections.
- Translate, reflect, and rotate geometric figures using patty paper and on the coordinate plane.
- Verify congruence of figures by measuring and comparing the properties of the geometric figures after undergoing a translation, reflection, or rotation.
- Verify that lines and line segments, angles, and parallel lines remain the same length after undergoing a translation, reflection, or rotation.
- Explain how to tell whether a two-dimensional figure is congruent to another figure using translations, reflections, and rotations.
- Verify that all rigid motions preserve the size and shape of a figure, translations and rotations preserve the orientation of a figure and its vertices, and reflections do not preserve orientation of the figure nor its vertices.
- Describe the effects of rigid motion transformations to the *x*- and *y*-coordinates of a figure using algebraic representations.

How do the activities in *Rigid Motion Transformations* promote student expertise in the TEKS mathematical process standards?

Every topic is written with the goal of creating mathematical thinkers who are active participants in class discourse, so the TEKS mathematical process standards should be evident in all lessons. Students are expected to make sense of problems and work toward solutions, reason using concrete and abstract ideas, and communicate their thinking while providing a critical ear to the thinking of others.

The standards of this topic link directly to the TEKS mathematical process standards of using a problem-solving model (8.1B), selecting tools (8.1C), analyzing mathematical relationships (8.1F), and practicing precise mathematical language (8.1G). By reasoning about their explorations with tools (8.1C), students make and test conjectures about the relationships between corresponding sides and angles after applying transformations (8.1F).

After sufficient work with a transformation on the coordinate plane, students make generalizations about the coordinates of the images of the transformations (8.1F). They use patty paper to make, test, and verify conjectures about congruent figures (8.1F).

How can you use cognates to support EB students?

Cognates are provided for new key terms when applicable. Encourage students to keep a bilingual math journal, recording reflections and background knowledge on new topics, in either written or verbal format, with added visuals for clarity. Incorporate journal excerpts into a shared word wall or digital bilingual glossary, with a focus on highlighting cognates.

NEW KEY TERMS

- congruent figures [figuras congruentes]
- corresponding sides
- corresponding angles [ángulos correspondientes]
- plane [plano]
- transformation [transformación]
- rigid motion [movimiento rígido/directo/propio]
- pre-image [preimagen]
- image [imagen]
- translation [traslación]
- orientation of a figure [orientación de una figura]
- orientation of the vertices [orientación de los vértices]
- reflection [reflexión]
- line of reflection [línea de reflexión]
- rotation [rotación]
- center of rotation [centro de rotación]
- angle of rotation [ángulo de rotación]
- congruent line segments [segmentos de línea congruentes]
- congruent angles [ángulos congruentes]

NEW SYMBOLS

Symbol	Description
$\overline{AB}$	Line segment AB
A'	Prime
$\cong$	Congruent
AB	Length of segment AB
$m\overline{AB}$	Measure of segment AB

MODULE 1, TOPIC 1 PACING GUIDE

165-Day Pacing

1 Transforming Geometric Objects

TOPIC 1: Rigid Motion Transformations

1 DAY PACING = 45-MINUTE SESSION

TEKS Mathematical Process Standards: 8.1A, 8.1B, 8.1C, 8.1D, 8.1E, 8.1F, 8.1G

ELPS: 1.A, 1.C, 1.E, 2.E, 2.I, 3.B, 3.D, 3.E, 3.H, 4.C, 4.D, 4.F, 4.G, 4.H

Topic Pacing: 20 Days

Lesson	Lesson Title	Highlights	TEKS*	Pacing
	Introduction to the Problem-Solving Model and Learning Resources	Students reflect on learning a new skill and the variety of ways they learn. The problem-solving model, TEKS mathematical process standards, and the Academic Glossary help students complete a problem-solving activity. Students reflect on and summarize the problem-solving process. Since the intent of this lesson is to introduce the problem-solving model and review the TEKS mathematical process standards, the focus is on process, not content. Students will need access to the Academic Glossary, Problem-Solving Model Graphic Organizer, Problem-Solving Questions to Ask, and TEKS mathematical process standards, which are located in the Course Guide. These materials should always be available to students throughout the course. **Materials Needed:** (located in the Course Guide) Academic Glossary, Problem-Solving Model Graphic Organizer, Problem-Solving Model Questions to Ask, TEKS Mathematical Process Standards	**8.10C**	1
1	Introduction to Congruent Figures	Students use patty paper to indirectly measure segments and angles and use folds to make observations about a figure. They determine if figures are the same size and shape. The term *congruent figures* is defined. Students use patty paper to determine if figures are congruent. They then make conjectures about congruence, investigate their conjectures, and justify their conjectures using informal transformation language. **Materials Needed:** Patty Paper, Scissors, Figures (located at the end of the lesson)	8.10A	2
2	Introduction to Rigid Motions	Students develop a formal understanding of translations, rotations, and reflections in the plane. The terminology of transformations is introduced, including *pre-image*, *image*, *translation*, *orientation of a figure*, *orientation of the vertices*, *reflection*, *line of reflection*, *rotation*, *center of rotation*, and *angle of rotation*. Students use patty paper to investigate each transformation, create images from pre-images, and determine the properties of each transformation. They learn that each rigid motion transformation preserves the size and shape of the original figure and translations and rotations also preserve the orientation of the figure and its vertices. At the end of the lesson, students state the formal name for transformations that carry figures onto congruent figures and reason that an image of an image of a pre-image is congruent to the pre-image. **Materials Needed:** Patty Paper, Protractors, Centimeter Rulers, Transformation Mats (located at the end of the lesson)	8.10A 8.10B	3

*Bold TEKS = Readiness Standard

MODULE 1, TOPIC 1 PACING GUIDE

165-Day Pacing

Lesson	Lesson Title	Highlights	TEKS*	Pacing
3	Translations of Figures on the Coordinate Plane	Students use patty paper to explore translations of various figures on a coordinate plane. They then generalize about the effects of translating a figure on its coordinates. Students verify that two figures are congruent by describing translations that map one figure onto another. **Materials Needed:** Patty Paper	8.10A **8.10C**	2
4	Reflections of Figures on the Coordinate Plane	Students use patty paper to explore reflections of various figures on a coordinate plane. They then generalize about the effects reflecting a figure has on its coordinates. Students verify that two figures are congruent by describing reflections that map one figure onto another. **Materials Needed:** Patty Paper, Problem-Solving Model Graphic Organizer	8.10A **8.10C**	2
5	Rotations of Figures on the Coordinate Plane	Students use patty paper to explore rotations of various figures on a coordinate plane. They then generalize about the effects of rotating a figure on its coordinates. Students verify that two figures are congruent by describing a rigid motion that maps one figure onto another. **Materials Needed:** Patty Paper, Problem-Solving Model Graphic Organizer	8.10A **8.10C**	2
6	Congruence and Rigid Motions	Students use coordinates to determine the rigid motion used to map one congruent figure onto another. They learn about and write congruence statements for congruent triangles. Using a coordinate plane, students determine whether two figures are congruent. They then generalize the effects of rigid motions on the angle measures, side lengths, area and perimeter of the figures. **Materials Needed:** Problem-Solving Model Graphic Organizer	8.10A **8.10C**	2
End of Topic Assessment				1
Learning Individually with Skills Practice *Schedule these days strategically throughout the topic to support student learning.*				5

*Bold TEKS = Readiness Standard

MODULE 1, TOPIC 1 PACING GUIDE

165-Day Pacing

1 DAY PACING = 45-MINUTE SESSION

Day 1	Day 2	Day 3	Day 4	Day 5
TEKS: **8.10C** Introduction to the Problem-Solving Model and Lesson Resources GETTING STARTED ACTIVITY 1 TALK THE TALK	TEKS: 8.10A **LESSON 1** Introduction to Congruent Figures GETTING STARTED ACTIVITY 1	**LESSON 1** continued ACTIVITY 2 TALK THE TALK	TEKS: 8.10A, 8.10B **LESSON 2** Introduction to Rigid Motions GETTING STARTED ACTIVITY 1	**LESSON 2** continued ACTIVITY 2
Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
LESSON 2 continued ACTIVITY 3 TALK THE TALK	**LEARNING INDIVIDUALLY** Skills Practice *This is a suggested placement. Move based on student data and individual needs.*	TEKS: 8.10A, **8.10C** **LESSON 3** Translations of Figures on the Coordinate Plane GETTING STARTED ACTIVITY 1	**LESSON 3** continued ACTIVITY 2 ACTIVITY 3 TALK THE TALK	**LEARNING INDIVIDUALLY** Skills Practice *This is a suggested placement. Move based on student data and individual needs.*
Day 11	**Day 12**	**Day 13**	**Day 14**	**Day 15**
TEKS: 8.10A, **8.10C** **LESSON 4** Reflections of Figures on the Coordinate Plane GETTING STARTED ACTIVITY 1	**LESSON 4** continued ACTIVITY 2 ACTIVITY 3 TALK THE TALK	**LEARNING INDIVIDUALLY** Skills Practice *This is a suggested placement. Move based on student data and individual needs.*	TEKS: 8.10A, **8.10C** **LESSON 5** Rotations of Figures on the Coordinate Plane GETTING STARTED ACTIVITY 1	**LESSON 5** continued ACTIVITY 2 ACTIVITY 3 TALK THE TALK
Day 16	**Day 17**	**Day 18**	**Day 19**	**Day 20**
LEARNING INDIVIDUALLY Skills Practice *This is a suggested placement. Move based on student data and individual needs.*	TEKS: 8.10A, **8.10C** **LESSON 6** Congruence and Rigid Motions GETTING STARTED ACTIVITY 1 ACTIVITY 2	**LESSON 6** continued ACTIVITY 3 TALK THE TALK	**LEARNING INDIVIDUALLY** Skills Practice *This is a suggested placement. Move based on student data and individual needs.*	**END OF TOPIC ASSESSMENT**

*Bold TEKS = Readiness Standard

How can you incorporate Skills Practice with students?

There are five Learning Individually days scheduled within this topic. The placement of these days within the topic is flexible. The intent is to distribute spaced and interleaved practice throughout a topic and throughout the year. It is not necessary for students to complete all Skills Practice for the topic and different students may complete different problem sets. You should use data to strategically assign problem sets aligned to individual student needs. You should analyze student responses from the following embedded assessment opportunities to help assess individual needs: Essential Questions, Talk the Talks, Student Self-Reflections, and End of Topic Assessments. For students who are building their proficiency, you can assign problem sets to target specific skills. For students who have demonstrated proficiency, there are extension problems of varied levels of challenge.

How can you identify whether students are ready for new learning?

The Prepare section of the Lesson Assignments and the Spaced Practice set of Skills Practice can serve as diagnostic tools. Depending on available time, you can assign the Prepare section of the Lesson Assignments as homework or as a warm-up to identify students' prior knowledge for the upcoming lesson's activities. You can also use the Spaced Practice sets of Skills Practice to analyze individual students' level of proficiency on standards from previous topics.