M2.5 Similarity

• Verify experimentally properties of dilations, and use center and scale factor to describe them.
• Use the definition of similarity to decide if two figures are similar.
• Use the properties of similarity to establish AA criterion for two triangles to be similar.
• Prove and use some theorems about triangles.
• Prove and use slope criteria for parallel and perpendicular lines.
• Construct points that partition a segment in a given ratio.
• Explore why all circles are similar.

Students describe dilations in terms of center and scale factor and use these terms to describe properties of dilations (for example, as a result of a dilation, the image of a line segment that does not include the center of dilation is parallel to its pre-image, with a proportional length determined by the scale factor). As in unit G1, students work with concepts from grade 8, but now use constructions created by hand or with software rather than physical models and transparencies. They develop a more precise definition of similarity in terms of a dilation, drawing on their knowledge of proportional relationships developed in grades 6 and 7. Students also use the definition of similarity to show that two objects are similar and establish the AA criterion for triangle similarity. With this knowledge they then prove and use theorems about triangles, prove and use slope criteria for parallel and perpendicular lines, construct points that partition a line segment into a given ratio, and explore why all circles are similar.

In units G1 and G2, students worked with rigid motions: translations, rotations, and reflections. They used these to show congruences between triangles, and prove theorems, after defining congruence in terms of transformations. In grade

8, they used physical models, transparencies, and geometry software to understand congruence and similarity in terms of transformations, and described the effects of transformations on given two-dimensional figures in terms of coordinates for the figures. As in unit G2, students work with concepts from grade 8, but use constructions, by hand or with software, rather than physical models and transparencies. This unit also draws on the knowledge of proportional relationships that students developed in grades 6 and 7. In this unit, students describe dilations in terms of center and scale factor, and use these terms to describe properties of dilations. They use these properties to solve problems and prove theorems. In the next unit, students extend their knowledge of similar triangles to build an understanding of the trigonometric ratios and use these ratios to solve problems involving right triangles.

M2.5.0 Pre-unit diagnostic assessment

Assess students' ability to

• draw the transformed figure, given a figure and a reflection, rotation, or translation;
• show that two figures are congruent by describing a series of rigid motions that map one onto another.

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M2.5.1 Motivate the need for similarity

Understand the properties of dilations in order to solve a problem.

Students describe dilations in terms of center and scale factor and use these terms to describe properties of dilations (for example, as a result of a dilation, the image of a line segment that does not include the center of dilation is parallel to its pre-image, with a proportional length determined by the scale factor). As in unit G1, students work with concepts from grade 8, but now use constructions created by hand or with software rather than physical models and transparencies. They develop a more precise definition of similarity in terms of a dilation, drawing on their knowledge of proportional relationships developed in grades 6 and 7. Students also use the definition of similarity to show that two objects are similar and establish the AA criterion for triangle similarity. With this knowledge they then prove and use theorems about triangles, prove and use slope criteria for parallel and perpendicular lines, construct points that partition a line segment into a given ratio, and explore why all circles are similar.

M2.5.2 Properties of dilations

- **Verify experimentally the properties of a dilation.**
- **Produce a transformed figure given an initial figure and scale factor.**

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M2.5.3 Introduction to similarity

Use the definition of similarity in terms of transformations.

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M2.5.4 Prove all circles are similar

Prove that all circles are similar.

Students describe dilations in terms of center and scale factor and use these terms to describe properties of dilations (for example, as a result of a dilation, the image of a line segment that does not include the center of dilation is parallel to its pre-image, with a proportional length determined by the scale factor). As in unit G1, students work with concepts from grade 8, but now use constructions created by hand or with software rather than physical models and transparencies. They develop a more precise definition of similarity in terms of a dilation, drawing on their knowledge of proportional relationships developed in grades 6 and 7. Students also use the definition of similarity to show that two objects are similar and establish the AA criterion for triangle similarity. With this knowledge they then prove and use theorems about triangles, prove and use slope criteria for parallel and perpendicular lines, construct points that partition a line segment into a given ratio, and explore why all circles are similar.

M2.5.5 Mid-Unit Assessment

Assess students' ability to establish similarity of shapes by showing a series of transformations in the plane.

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M2.5.6 Establish AA criterion for triangles

• Explore and establish the AA criterion for triangles, if two triangles with two pairs of angles congruent, then the triangles are similar.
• Consider the analogous question for quadrilaterals, i.e., "Is there an AAA criterion for quadrilaterals?,"

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M2.5.7 Prove theorems about triangles using similarity

• Prove that a line parallel to one side of a triangle partitions the other two sides proportionally.
• Prove the segment joining the midpoints of two sides of a triangle is parallel to the third side and half the length.
• Prove the Pythagorean Theorem using triangle similarity.
• Prove and use slope criteria for parallel and perpendicular lines.

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M2.5.8 Use similarity to solve problems

Solve problems and prove relationships using properties of similar triangles.

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M2.5.9 Summative Assessment

Assess students' ability to meet the mathematical goals outlined at the beginning of the unit.

Students describe dilations in terms of center and scale factor and use these terms to describe properties of dilations (for example, as a result of a dilation, the image of a line segment that does not include the center of dilation is parallel to its pre-image, with a proportional length determined by the scale factor). As in unit G1, students work with concepts from grade 8, but now use constructions created by hand or with software rather than physical models and transparencies. They develop a more precise definition of similarity in terms of a dilation, drawing on their knowledge of proportional relationships developed in grades 6 and 7. Students also use the definition of similarity to show that two objects are similar and establish the AA criterion for triangle similarity. With this knowledge they then prove and use theorems about triangles, prove and use slope criteria for parallel and perpendicular lines, construct points that partition a line segment into a given ratio, and explore why all circles are similar.