Topic A

Scale Drawings

G-SRT.A.1, G-SRT.B.4, G-MG.A.3

Focus Standards:

G-SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:
   a. 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.
   b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

G-SRT.B.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

G-MG.A.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Instructional Days: 5

Lesson 1: Scale Drawings (P)<sup>1</sup>
Lesson 2: Making Scale Drawings Using the Ratio Method (P)
Lesson 3: Making Scale Drawings Using the Parallel Method (P)
Lesson 4: Comparing the Ratio Method with the Parallel Method (S)
Lesson 5: Scale Factors (S)

Students embark on Topic A with a brief review of scale drawings and scale factor, which they last studied in Grades 7 and 8. In Lesson 1, students recall the properties of a well-scaled drawing and practice creating scale drawings using basic construction techniques. Lessons 2 and 3 explore systematic techniques for creating scale drawings. With the ratio method, students dilate key points of a figure according to the scale factor to produce a scale drawing (G-SRT.A.1). Note that exercises within Lesson 2 where students apply the ratio method to solve design problems relate to the modeling standard G-MG.A.3. With the parallel method, students construct sides parallel to corresponding sides of the original figure to create a scale drawing. Lesson 4 is an examination of these two methods, with the goal of understanding why the methods produce identical drawings. The outcome of this comparison is the triangle side splitter theorem, which states that a segment splits two sides of a triangle proportionally if and only if it is parallel to the third side (G-SRT.B.4).

<sup>1</sup>Lesson Structure Key: P-Problem Set Lesson, M-Modeling Cycle Lesson, E-Exploration Lesson, S-Socratic Lesson
This theorem is then used in Lesson 5 to establish the dilation theorem: A dilation from a center $O$ maps a segment $PQ$ to a segment $P'Q'$ so that $P'Q' = r \cdot PQ$; additionally, if $O$ is not contained in $PQ$ and $r \neq 1$, then $\overline{PQ} \parallel \overline{P'Q'}$.

As opposed to work done in Grade 8 on dilations, where students observed how dilations behaved and experimentally verified properties of dilations by examples, high school Geometry is anchored in explaining why these properties are true by reasoned argument. Grade 8 content focused on what was going on, while high school Geometry content focuses on explaining why it occurs. This is particularly true in Lessons 4 and 5, where students rigorously explain their explorations of dilations using the ratio and parallel methods to build arguments that establish the triangle side splitter and dilation theorems (MP.3).