Plan for Geometry Unit 5: Solid Geometry

Relevant Unit(s) to review: Area and volume skill units: Grade 6 Unit 1,
Grade 7 Unit 3 and Unit 7 (lessons 11-16),
Grade 8 Unit 5 (lessons 11-22)

Essential prior concepts to engage with this unit	In previous grades, students solved problems involving area, surface area, and volume for various solids. In grade 6, students worked with areas of triangles and quadrilaterals, as well as surface areas and volumes of right rectangular prisms including those with fractional edge lengths. In grade 7, students found areas of circles, solved problems involving the volume and surface area of right prisms, and described plane sections of three-dimensional figures. In grade 8, students solved problems involving volumes of spheres, cones, and cylinders using given volume formulas. In order to be successful in this unit students need to be comfortable with finding areas and have a conceptual understanding of area, surface area, and volume.
Brief narrative of approach	In this unit, students practice spatial visualization in three dimensions, study the effect of dilation on area and volume, derive volume formulas using dissection arguments and Cavalieri's Principle, and apply volume formulas to solve problems involving surface-area-to-volume ratios, density, cube roots, and square roots. This guide does not recommend specific lessons be cut or modified because in grades 6–8 the year was not interrupted. However, current learning and school structures should dictate if low priority lessons are eliminated.

Lessons to Add	Lessons to Remove or Modify
For this unit, there are no lessons that need to be added, because most students will have completed the prerequisite lessons in middle school units. However, Grade 6 Unit 1, Grade 7 Unit 3 and Unit 7 (Lessons 11–16) and Grade 8 Unit 5 (Lessons 11-22) might be a nice reference to activate prior knowledge.	This unit does not require any lessons to be removed. However, the last three lessons are all application based and are not necessary to be successful in the rest of the course and beyond. So, if time is needed, you can skip those lessons or choose to do only some of them.
Lessons added: 0	Lessons removed: 0

Modified Plan for Geometry Unit 5

Day	IM lesson	Notes
	assessment	G5 Check Your Readiness
1	G.5.1	Solids of rotation created from rotating two-dimensional figures using an axis of rotation
2	G.5.2	Cross sections
3	G.5.3	Cross sections by dilating (and building solids through cross sections)
4	G.5.4	Scaling and the effect of scaling on area
5	G.5.5	Scaling, unscaling, and scale factors
6	G.5.6	Scaling and the effect of scaling on solids
7	G.5.7	Work backwards to calculate scale factors

8	G.5.8	Apply knowledge of scale factors to solve application problems
9	G.5.9	Cylinder volumes as layers
10	G.5.10	Oblique vs Right prisms and cross sections
11	G.5.11	Prisms practice (with Trigonometry and Pythagorean Theorem)
12	G.5.12	Prisms and pyramids and how they are related
13	G.5.13	Pyramid formulas
14	G.5.14	Volume of pyramids and working backwards to find possible dimensions of a pyramid
15	G.5.15	Putting it all together! Students apply their knowledge of pyramid, cone, prism, and cylinder volume formulas.
16	G.5.16	Surface area and volume application
17	G.5.17	Density and volume application
18	G.5.18	Volume and graphing
19	Assessment	G5 End of Unit Assessment

Priority and Category List for Lessons

High priority (+), Medium priority (0), Low priority (-)

E: Explore, Play, and Discuss, D: Deep Dive, A: Synthesize and Apply

Lesson	Priority (+, 0, -)	Category (E, D, A)	Notes
G.5.1	+	E	In this lesson, students visualize solids of rotation created from rotating two-dimensional figures using an axis of rotation. These visualization skills will be useful in later lessons when students need to analyze two-dimensional figures that are cross sections of three-dimensional figures.
G.5.2	0	E	In grade 7, students described the two-dimensional figures that result from slicing three-dimensional figures. Here, these concepts are revisited with some added complexity. Students analyze cross sections, or the intersections between planes and solids, by slicing three-dimensional objects. Next, they identify three-dimensional solids given parallel cross-sectional slices.
G.5.3	0	E	In this lesson, students build on their work with dilations in earlier units. Students create dilations of a rectangle and suspend them to resemble cross sections of a pyramid. They learn that given a pyramid's base, its cross sections are dilations of the base with scale factors between 0 and 1.
G.5.4	+	D	In previous units, students learned that the dilation of a line segment is longer or shorter in the ratio given by the scale factor. In the last lesson, students dilated a rectangle by a factor of k and observed that the area was *not* multiplied by k. In this lesson, students analyze the result of scaling on area. This concept will be essential to creating a volume formula for pyramids later in the unit.
G.5.5	+	D	In this lesson, students practice working with areas of scaled figures, connecting them to cross sections and encountering a common misconception.
G.5.6	+	E	Students previously learned that when a two-dimensional shape is dilated by a scale factor of k, the area is multiplied by a factor of k^2. Here, students continue their analysis of the

			connections between geometric measurement and dimension by studying the results of dilating a three-dimensional solid.
[G.5.7](#)	+	D	In this lesson, students work backwards from the volumes of original and scaled solids to calculate scale factors. To illustrate the relationship between volume and scale factor, students create a graph of the cube root equation ($y = (x)^{(1/3)}$) based on a situation arising from a geometric context.
[G.5.8](#)	0	A	In this lesson, students apply their knowledge of the relationships between original and scaled figures. Students decide what information is necessary to move backwards and forwards between lengths, surface areas, and volumes of an original solid and its dilation.
[G.5.9](#)	0	E	In previous grades, students learned formulas for the volumes of cones, cylinders, and spheres. In this lesson, they recall how to calculate the volume of a cylinder, using informal arguments to compare the volume of a cylinder to the volume of a prism that has an equal height and area of its base.
[G.5.10](#)	0	D	In this lesson, students develop the idea of oblique versus right solids. They analyze volumes of two prisms: one right and one oblique, but of equal height and with bases that have equal area. They conclude the volumes of the two prisms are equal. This leads to the introduction of Cavalieri's Principle.
[G.5.11](#)	0	A	This lesson gives students the opportunity to practice and apply what they have learned about volumes of prisms.
[G.5.12](#)	0	E	In this lesson, students analyze relationships between prisms and pyramids. They categorize pyramids and cones as solids with a single base and an apex or central vertex, as opposed to cylinders and prisms which have 2 congruent bases.
[G.5.13](#)	0	D	In this lesson, students use informal arguments to show that the volume of *any* pyramid is one-third the volume of the prism with equal height and congruent base.
[G.5.14](#)	0	A	Students calculate the volume of several pyramids, and they work backwards to find possible dimensions of a pyramid given its volume.

G.5.15	-	A	In this lesson, students apply their knowledge of pyramid, cone, prism, and cylinder volume formulas. Trigonometry and the Pythagorean Theorem are incorporated as additional tools.
G.5.16	-	A	The purpose of the lesson is for students to strengthen their understanding of geometric measurement and dimension by analyzing relationships between surface area and volume in application problems.
G.5.17	-	A	In this lesson, students apply volume problem-solving concepts to situations involving density, which is defined as the mass of a substance per unit volume. Density is an important concept for many modeling applications.
G.5.18	-	A	In this lesson, students analyze the graphs of cube root and square root equations in geometric contexts. This work builds on earlier lessons in the unit that analyzed square root and cube root graphs.