



Topic D:

Applications of Radicals and Roots

8.G.B.7, 8.G.C.9

Focus Standard:	8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
	8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
Instructional Days:	5	
	Lesson 19:	Cones and Spheres (P) ¹
	Lesson 20:	Truncated Cones (P)
	Lesson 21:	Volume of Composite Solids (E)
	Lesson 22:	Average Rate of Change (S)
	Lesson 23:	Nonlinear Motion (M)

In Lesson 19, students use the Pythagorean Theorem to determine the height, lateral length (slant height), or radius of the base of a cone. Students also use the Pythagorean Theorem to determine the radius of a sphere given the length of a cord. Many problems in Lesson 19 also require students to use the height, length, or radius they determined using the Pythagorean Theorem to then find the volume of a figure. In Lesson 20, students learn that the volume of a truncated cone can be determined using facts about similar triangles. Specifically, the fact that corresponding parts of similar triangles are equal in ratio is used to determine the height of the part of the cone that has been removed to make the truncated cone. Then students calculate the volume of the whole cone (removed part and truncated part) and subtract the volume of the removed portion to determine the volume of the truncated cone. In this lesson, students learn that the formula to determine the volume of a pyramid is analogous to that of a cone. That is, the volume of a pyramid is exactly one-third the volume of a rectangular prism with the same base area and height. In Lesson 21, students determine the volume of solids comprised of cylinders, cones, spheres, and combinations of those figures as composite solids. Students consistently link their understanding of expressions (numerical and algebraic) to the volumes they represent. In Lesson 22, students apply their knowledge of volume to compute the average

¹ Lesson Structure Key: **P**-Problem Set Lesson, **M**-Modeling Cycle Lesson, **E**-Exploration Lesson, **S**-Socratic Lesson

rate of change in the height of the water level when water drains into a conical container. Students bring together much of what they have learned in Grade 8, such as Pythagorean Theorem, volume of solids, similarity, constant rate, and rate of change, to work on challenging problems in Lessons 22 and 23. The optional modeling lesson, Lesson 23, challenges students with a problem about nonlinear motion. In describing the motion of a ladder sliding down a wall, students bring together concepts of exponents, roots, average speed, constant rate, functions, and the Pythagorean Theorem. Throughout the lesson students are challenged to reason abstractly and quantitatively while making sense of problems, applying their knowledge of concepts learned throughout the year to persevere in solving them.