



Topic A:

Square and Cube Roots

8.NS.A.1, 8.NS.A.2, 8.EE.A.2

Focus Standard:	8.NS.A.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
	8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). <i>For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue to get better approximations.</i>
	8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
Instructional Days: 5		
Lesson 1: The Pythagorean Theorem (P) ¹		
Lesson 2: Square Roots (S)		
Lesson 3: Existence and Uniqueness of Square and Cube Roots (S)		
Lesson 4: Simplifying Square Roots (optional) (P)		
Lesson 5: Solving Radical Equations (P)		

The use of the Pythagorean Theorem to determine side lengths of right triangles motivates the need for students to learn about square roots and irrational numbers in general. While students have previously applied the Pythagorean Theorem using perfect squares, students begin by estimating the length of an unknown side of a right triangle in Lesson 1 by determining which two perfect squares a squared number is between. This leads them to know between which two positive integers the length must be. In Lesson 2, students are introduced to the notation and meaning of square roots. The term and formal definition for

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

irrational numbers is not given until Topic B, but students know that many of this type of number exist between the positive integers on the number line. That fact allows students to place square roots on a number line in their approximate position using perfect square numbers as reference points. In Lesson 3, students are given proof that the square or cube root of a number exists and is unique. Students then solve simple equations that require them to find the square root or cube root of a number. These will be in the form $x^2 = p$ or $x^3 = p$, where p is a positive rational number. In the optional Lesson 4, students learn that a square root of a number can be expressed as a product of its factors and use that fact to simplify the perfect square factors. For example, students know that they can rewrite $\sqrt{18}$ as $\sqrt{3^2 \times 2} = \sqrt{3^2} \times \sqrt{2} = 3 \times \sqrt{2} = 3\sqrt{2}$. The work in this lesson prepares students for what they may need to know in Algebra I to simplify radicals related to the quadratic formula. Some solutions in subsequent lessons are in simplified form, but these may be disregarded if Lesson 4 is not used. In Lesson 5, students solve multi-step equations that require students to use the properties of equality to transform an equation until it is in the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number.