Core Content

Cluster Title: Know that there are numbers that are not rational, and approximate them by rational numbers.
Standard: 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.
Concepts and Skills to Master
• Know that real numbers that are not rational are irrational. • Understand that finite decimal expansions of irrational numbers are approximations. • Show that rational numbers have decimal expansions that repeat eventually. • Convert a decimal expansion, which repeats eventually, into a rational number.

Supports for Teachers

Critical Background Knowledge	
• Understand the subsets of the real number system (natural numbers, whole numbers, integers, rational numbers). • Convert rational numbers to decimals using long division (terminating and repeating) (7.NS.2d).	
Academic Vocabulary	
decimal expansion, repeating decimal, terminating decimal, rational, irrational, square root, $\sqrt{}$, π	
Suggested Instructional Strategies	**Resources**
• Use the Pythagorean Theorem with non-perfect squares to introduce irrational numbers (8.G.7). • Use the powers of ten technique: Let $n = 0.1\overline{6}$ So, $100n = 16.\overline{6}$ Subtract $-10n = -1.\overline{6}$ $90n = 15$ $\div 90 \quad \div 90$ $n = \frac{1}{6}$	

Sample Formative Assessment Tasks	
Skill-Based Task Convert $0.35\overline{2}$ to a fraction. Group the following numbers based on what you know about the number system: $5.3, 1.\overline{7}, \sqrt{10}, 2, \pi, 4.010010001\ldots$	**Problem Task** Suppose you have a fraction with a denominator of 7. What is the longest string of non-repeating digits that will occur in the decimal expansions of the number? (Hint: Use the long division algorithm to show that for a denominator of *n*, there are only *n* possible remainders, 0 to *n*-1.)

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Core Content

Cluster Title: Know that there are numbers that are not rational, and approximate them by rational numbers.
Standard: 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). 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 on to get better approximations.
Concepts and Skills to Master
• Compare and order irrational numbers. • Place irrational numbers on a number line. • Use approximations of irrational numbers to estimate the value of expressions.

Supports for Teachers

Critical Background Knowledge	
• Compare and place rational numbers on a number line. • Approximate irrational numbers as fractions or decimals.	
Academic Vocabulary	
rational, irrational, decimal expansion, square root, $\sqrt{}$,π, truncating, rounding	
Suggested Instructional Strategies	**Resources**
• Construct the Wheel of Theodorus to create physical lengths of the square roots of the counting numbers. Transfer those lengths onto a number line. • Find increasingly accurate estimations for square roots of numbers by guess-and-check with a calculator.	
Sample Formative Assessment Tasks	
Skill-Based Task Place the following numbers on a number line: $5.3, 1.\overline{7}, \sqrt{10}, 2, \frac{\pi}{2}$ Find between which two integers $\sqrt{42}$ lies?	**Problem Task** Explain when each approximation of π $(3.14, 3, \frac{22}{7})$ is useful in calculating the circumference of a circle. Compare the answers you would get with each approximation. (Extension: Research how different cultures have approximated pi.)

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