

The Number System

In eighth grade, students develop greater understanding of the number system by exploring irrational numbers. **Irrational numbers** are numbers that cannot be expressed as ratios. They have endless, non-repeating digits to the right of the decimal point (e.g., $\pi \approx 3.14592$ and $\sqrt{2} \approx 1.414213$).

Previously, students learned that **rational numbers** are numbers that can be written as ratios. Rational numbers can be written as fractions and as decimals that either repeat (e.g., $\frac{4}{3} = 1.3333\dots$) or terminate (e.g., $\frac{5}{4} = 1.25$). Any whole number is a rational number because it can be written as a fraction (e.g., $8 = \frac{8}{1}$). Rational numbers also can be written in other forms that simplify to more familiar forms ($\sqrt{16} = 4$).

Students may be interested in knowing why the differences between rational and irrational numbers matter. It might help to explain that using numbers grew out of the practical need to count objects. In ancient times, people counted objects in units, such as 1, 2, 3 “apples.” Over time, the need for additional numbers grew as the need to measure arose—there was a need to express numbers between 0 and 1, 1 and 2, 2 and 3, and so on. Precise measuring needed to account for all places on the ruler. Rational and irrational numbers allow for that to occur in that all rational and irrational numbers can be located or approximated on a number line.

The Grade 8 Common Core State Standards for The Number System specify that students should—

- Know that there are numbers that are not rational, and approximate them by rational numbers.

The following hands-on activities will help students understand the differences between rational and irrational numbers. They will equip students to apply the processes necessary to compare the sizes, estimate the values, and find the locations or approximate locations of rational and irrational numbers on the number line. The activities will give students concrete experiences that will help them reason abstractly and make sense of the number system and understand the real-world contexts of these numbers.