# Teacher Edition

*Revised Edition*

# Performance Coach™

## Mathematics

## 8

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LESSON 1

# Understanding Rational and Irrational Numbers

Student Edition pages 6–13

## LESSON OVERVIEW

### Objectives

Students will:

- Identify a decimal as either a rational number or an irrational number
- Identify a square root as a rational number or an irrational number
- Convert a repeating decimal to a fraction

### Discussion Questions

MP7 Without converting a fraction to a decimal, describe one thing you can do to help you determine if a fraction is a repeating or nonrepeating decimal.

MP3 Explain how it is possible for the square roots of some numbers to be rational numbers while the square roots of other numbers are irrational numbers.

### Key Terms

irrational number
rational number
repeating decimal
terminating decimal

### Materials

- calculators (suggested)

### Differentiation

**Lesson Support** Have students create a two-column chart for rational numbers and irrational numbers. Have them use their own words to write descriptions of the types of numbers that fall into each category. Encourage them to include examples as well. Students can then use their charts when solving problems that require classifying numbers as rational numbers or irrational numbers.

**Lesson Extension** Ask students to use what they have learned in the lesson to convert $0.\overline{9}$ to a fraction. Ask: *What does your result tell you about the value of $0.\overline{9}$? What conjecture can you make about the value of $3.\overline{9}$?* Have students verify their conjectures and draw relevant conclusions.

## 1 GETTING THE IDEA

### Lesson Opener

Present a fraction, such as $\frac{1}{2}$, and a decimal, such as 0.75. Ask: *How can fractions be represented as decimals? How can decimals be represented as fractions?* Have students write the fraction in its equivalent decimal form, and have them write the decimal in its equivalent fraction form. Then have students suggest other fractions and decimals for the class to try. If students do not suggest a fraction that results in a repeating decimal, have students work with $\frac{1}{3}$ or $\frac{1}{7}$. Ask: *Are there any decimals that cannot be written as fractions?* This will get students thinking about the various types of decimals and considering whether or not they can determine their fraction equivalents.

▲ ***ELL Support*** *The words* rational *and* irrational *both have mathematical and non-mathematical definitions. Discuss these definitions as a class. Have students add each word to their student dictionary. Students should write each math definition in words and should provide specific examples. Have students write 2-3 sentences for each term, using it both in mathematical and non-mathematical ways.*

### ▶ Examples 1, 2, and 3

Students should make a connection between the representation of each decimal and its classification as either a rational number or an irrational number. Ask: *What types of decimals are rational numbers? What types of decimals are irrational numbers?*

▲ ***Common Errors*** *Students may mistakenly believe that all nonterminating decimals are irrational numbers. You can help them understand that this is not the case by using the common equivalence of 0.333… and $\frac{1}{3}$ as an example of a nonterminating decimal that can be written as a fraction. Even though it can be expressed as a repeating decimal, $\frac{1}{3}$ is a rational number.*

### ▶ Example 4

Review the definition of square root. Have students use their calculators to find the value of $\sqrt{11}$. Ask: *Is the square root of 11 a terminating or nonterminating decimal?*

### ▶ Examples 5, 6, and 7

Assist students in understanding why the multiplier of $10^p$ is used. Ask students to describe how they know which power of 10 to use, based on the decimal they are converting.

▲ ***Journal Prompt*** MP3 *What happens when you multiply a repeating decimal by $10^p$, where p is greater than the number of digits that repeat?*

### ▶ Example 8

Discuss the limitations of the calculator display and how to determine whether the decimal shown in the display terminates or does not terminate—and, if it does not terminate, if it repeats. Have them experiment with their calculators to find square roots of whole numbers and decimals that are both perfect squares and non-perfect squares and to convert various fractions to decimals, either by dividing or by using the fraction-to-decimal feature, and practice analyzing each displayed result in order to classify the decimal as terminating or repeating.

## 2 COACHED EXAMPLE

Before students begin, point out that they will be writing a repeating decimal as a fraction. Monitor them as they identify the number of repeating digits and the power of 10 to use in setting up a pair of equations in order to convert the repeating decimal to a fraction.

▲ ***Common Errors*** *Students may misalign digits when subtracting the two equations, causing a decimal result in the difference. Have students write the values of 10n and n without the repeating notation. Remind them to line up the decimal points. When subtracting, they can draw lines through digits with a difference of zero to help them see which digits remain.*

*For answers, see Appendix A.*

## 3 LESSON PRACTICE

As students are working, pay special attention to problems 8, 10, and 11. For these problems, you may want to have students explain their thought processes for classifying each number.

*For answers, see Appendix A.*