

## Understanding Rational and Irrational Numbers ([8.NS.A.1](#))

A **rational number** is any number that can be written as the ratio of two integers,  $\frac{a}{b}$ , where  $b$  is not 0.

Rational numbers include:

- Integers
- Fractions
- Mixed numbers
- **Terminating decimals**
- **Repeating decimals**

To write a terminating decimal as a fraction, use the place value of the last digit in the decimal as the denominator of the fraction. Simplify if possible.

$$0.2694 = \frac{2694}{10,000} = \frac{1,347}{5,000}$$

To write a repeating decimal as a fraction, write and solve an equation. Let  $x$  be the repeating decimal. Multiply  $x$  by the power of 10 given by the number of repeating digits.

Write  $0.\overline{83}$  as a fraction.

Let $x = 0.\overline{83}$ .	Define the variable.
$100x = 83.\overline{83}$	There are 2 repeating digits, so multiply by $10^2 = 100$ .
$100x - 0.\overline{83} = 83.\overline{83} - 0.\overline{83}$	Subtract $0.\overline{83}$ from both sides.
$100x - 0.\overline{83} = 83$	
$100x - x = 83$	Since $x = 0.\overline{83}$ , substitute $0.\overline{83}$ for $x$ .
$99x = 83$	Simplify.
$x = \frac{83}{99}$	Divide

Therefore,  $0.\overline{83} = \frac{83}{99}$

An **irrational number** is any number that cannot be written as the ratio of two integers. Irrational numbers include:

- Non-terminating, non-repeating decimals
- Square roots of numbers that are not **perfect squares**
- Numbers such as  $\pi$

If your students...

**Have difficulty writing repeating decimals as fractions:**

WATCH: How do You Turn a Repeating Decimal into a Fraction?

<http://www.virtualnerd.com/pre-algebra/rational-numbers/repeating-decimal-to-fraction-conversion.php>

**Confuse rational and irrational numbers:**

WATCH: Rational and Irrational Numbers

<https://www.opened.com/video/rational-and-irrational-numbers/918417>

**For extra practice with understanding irrational numbers:**

Converting 1-Digit Repeating Decimals to Fractions

[https://www.khanacademy.org/math/algebra/solving-linear-equations-and-inequalities/conv\\_rep\\_decimals/e/converting\\_repeating\\_decimals\\_to\\_fractions\\_1](https://www.khanacademy.org/math/algebra/solving-linear-equations-and-inequalities/conv_rep_decimals/e/converting_repeating_decimals_to_fractions_1)

COMPLETE: Converting Multi-Digit Repeating Decimals to Fractions

[https://www.khanacademy.org/math/algebra/solving-linear-equations-and-inequalities/conv\\_rep\\_decimals/e/converting\\_repeating\\_decimals\\_to\\_fractions\\_2](https://www.khanacademy.org/math/algebra/solving-linear-equations-and-inequalities/conv_rep_decimals/e/converting_repeating_decimals_to_fractions_2)

COMPLETE: Know that Numbers that are Not Rational are Called Irrational

<https://www.opened.com/homework/8-ns-1-know-that-numbers-that-are-not-rational-are-called/3691334?run=true>

PLAY: Rational and Irrational Numbers Game

<http://www.math-play.com/rational-and-irrational-numbers-game/rational-and-irrational-numbers-game.html>

COMPLETE: Rational Numbers: Identify Rational and Irrational Numbers

<https://www.opened.com/exercise/rational-numbers-identify-rational-and-irrational-numbers/243876>