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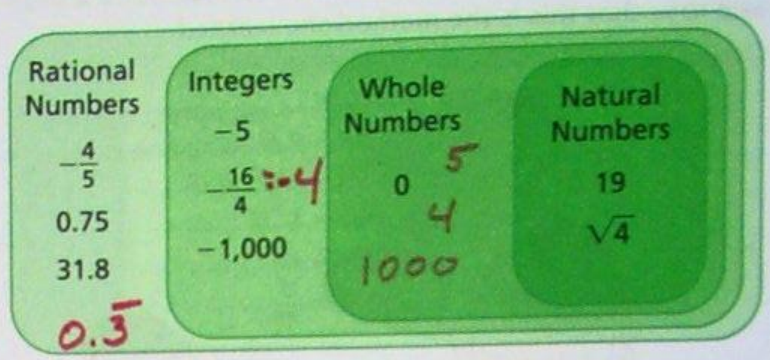
AMPLE 1 Identify Irrational Numbers

he Venn diagram shows the relationships mong rational numbers.

ow would you classify the number .24758326... ?

Reasoning How can you use the definition of each number set to classify numbers? MP.2

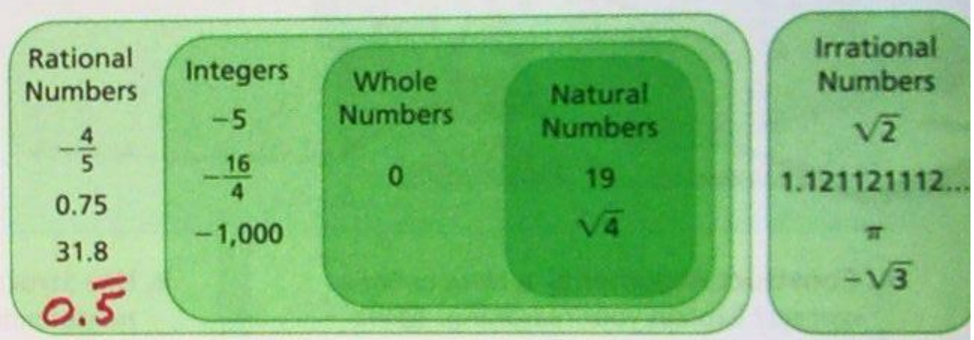


0.24758326...

The decimal expansion does not terminate or repeat, so it cannot be written as a ratio of two integers.

The number 0.24758326... is not a rational number.

Numbers that are not rational are called *irrational*. An **irrational number** is a number that cannot be written in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$.



The number 0.24758326... is irrational because the decimal expansion is nonrepeating and nonterminating.

Try It!

Classify each number as rational or irrational.

π	3.565565556...
0.04053661...	−17
$0.\overline{76}$	3.275

Rational	Irrational
$0.\overline{76}$	π
−17	0.04053...
3.275	3.56556...

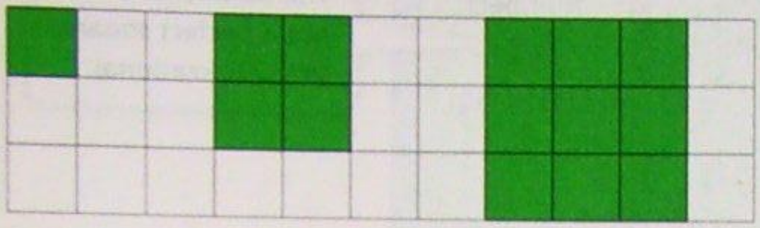
Convince Me! **Construct Arguments** Jen classifies the number 4.567 as irrational because it does not repeat. Is Jen correct? Explain. MP.3

as Irrational Numbers

Classify $\sqrt{3}$.

$\sqrt{3}$ means "the nonnegative square root of 3."

The **square root** of a number is a number that when multiplied by itself equals the original number. The radical symbol $\sqrt{}$ is used to denote the nonnegative square root.



$1 \cdot 1 = 1$ $\quad$ $2 \cdot 2 = 4$ $\quad$ $3 \cdot 3 = 9$

$\sqrt{1} = 1$ $\quad$ $\sqrt{4} = 2$ $\quad$ $\sqrt{9} = 3$

A **perfect square** is a number that is the square of an integer. The first three integer perfect squares are 1, 4, and 9.

The number 3 is not a perfect square, so $\sqrt{3}$ cannot be written as an integer. So, $\sqrt{3}$ is irrational.

Generalize For any whole number b that is not a perfect square, $\sqrt{b}$ is irrational. MP.8

EXAMPLE 3 Classify Numbers as Rational or Irrational

Classify each number as rational or irrational. Explain how you classified each number.

$-81{,}572$ $\quad$ $\sqrt{11}$ $\quad$ $5.636336333\ldots$ $\quad$ $\sqrt{16}$

Rational	Irrational
$-81{,}572$	$\sqrt{11}$
$\sqrt{16}$	$5.636336333\ldots$

$-81{,}572$ is an integer and can be written as the fraction $\frac{-81{,}572}{1}$, so it is rational.

11 is not a perfect square, so $\sqrt{11}$ is irrational.

The number 16 is a perfect square, so $\sqrt{16} = 4$ is rational.

This decimal expansion does not repeat or terminate, so it is irrational.

Try It!

Classify each number as rational or irrational and explain.

$\frac{2}{3}$ $\quad$ $\sqrt{25}$ =5 $\quad$ $-0.7\overline{5}$ $\quad$ $\sqrt{2}$ $\quad$ 7,548,123

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