

Essential Question

How is an irrational number different from a rational number?



VISUAL
LEARNING



ASSESS

EXAMPLE 1 Identify Irrational Numbers

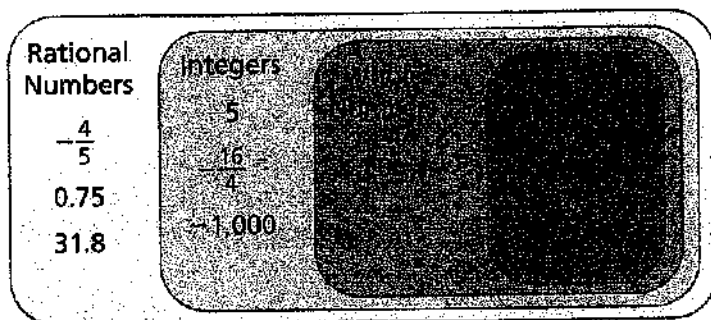
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The Venn diagram shows the relationships among rational numbers.

How would you classify the number $0.24758326\ldots$?

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

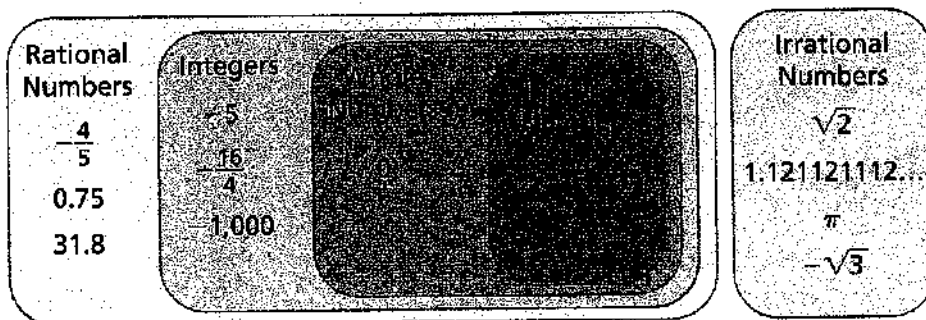


$0.24758326\ldots$

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

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

Try It!

Classify each number as rational or irrational.

π

$3.565565556\ldots$

$0.04053661\ldots$

-17

$0.7\overline{6}$

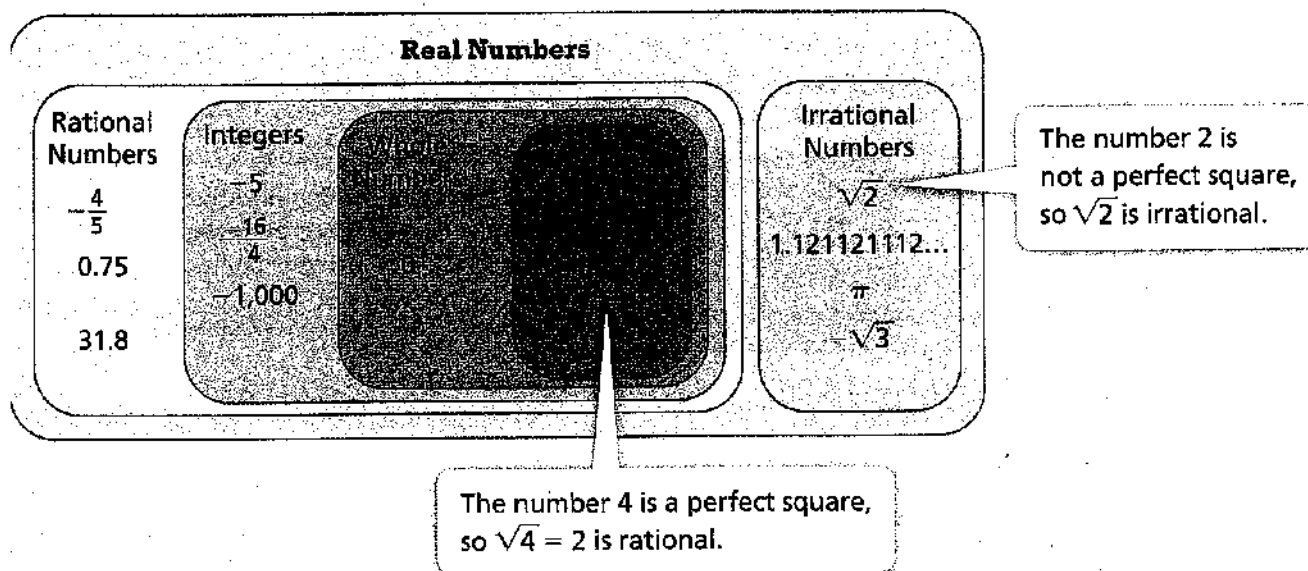
3.275

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

Rational	Irrational



Numbers that are not rational are called irrational numbers.



Do You Understand?

- Essential Question** How is an irrational number different from a rational number?
- Reasoning** How can you tell whether a square root of a whole number is rational or irrational?
- Construct Arguments** Could a number ever be both rational and irrational? Explain.

Do You Know How?

- Is the number 65.4349224... rational or irrational? Explain.
- Is the number $\sqrt{2,500}$ rational or irrational? Explain.
- Classify each number as rational or irrational.
4.27 0.375 0.232342345... $\sqrt{62}$ $\frac{13}{1}$

Rational	Irrational

EXAMPLE 2



Identify Square Roots as Irrational Numbers



ACTIVITY

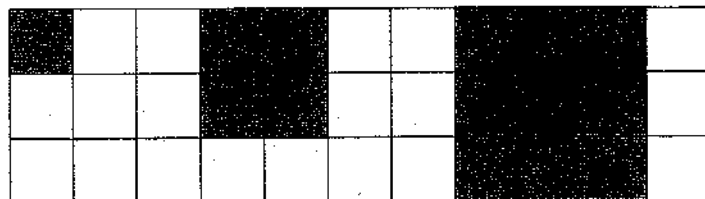


ASSESS

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.



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

$$1 \cdot 1 = 1$$

$$2 \cdot 2 = 4$$

$$3 \cdot 3 = 9$$

$$\sqrt{1} = 1$$

$$\sqrt{4} = 2$$

$$\sqrt{9} = 3$$

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.

EXAMPLE 3



Classify Numbers as Rational or Irrational

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

$$-81,572$$

$$\sqrt{11}$$

$$5.636336333\dots$$

$$\sqrt{16}$$

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

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

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.

$$\frac{2}{3}$$

$$\sqrt{25}$$

$$-0.75$$

$$\sqrt{2}$$

$$7,548,123$$

Name: _____



PRACTICE



TUTORIAL

Practice & Problem Solving



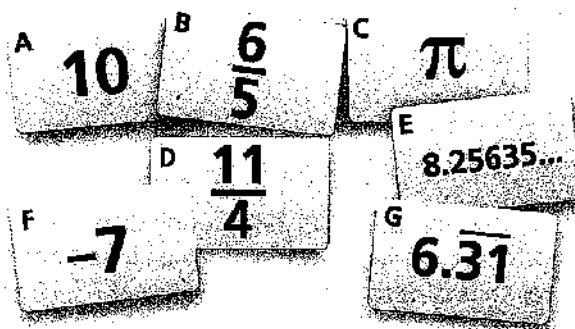
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7. Is $5.787787778\dots$ a rational or irrational number? Explain.

8. Is $\sqrt{42}$ rational or irrational? Explain.

9. A teacher places seven cards, lettered A–G, on a table. Which cards show irrational numbers?



10. Circle the irrational number in the list below.

7.27

$\frac{5}{9}$

$\sqrt{15}$

$\sqrt{196}$

11. Lisa writes the following list of numbers.

$5.737737773\dots$, 26, $\sqrt{45}$, $-\frac{3}{2}$, 0, 9

a. Which numbers are rational?

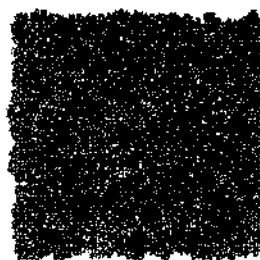
b. Which numbers are irrational?

12. **Construct Arguments** Deena says that $9.565565556\dots$ is a rational number because it has a repeating pattern. Do you agree? Explain.

13. Is $\sqrt{1,815}$ rational? Explain.

14. Is the decimal form of $\frac{13}{3}$ a rational number? Explain.

15. Write the side length of the square rug as a square root. Is the side length a rational or irrational number? Explain.



Area = 100 ft^2

16. **Reasoning** The numbers 2.888... and 2.999... are both rational numbers. What is an irrational number that is between the two rational numbers?

17. **Higher Order Thinking** You are given the expressions $\sqrt{76 + n}$ and $\sqrt{2n + 26}$. What is the smallest value of n that will make each number rational?

Assessment Practice

18. Which numbers are rational?

I. 1.1111111...

II. 1.567

III. 1.101101110...

(A) II and III

(B) III only

(C) II only

(D) I and II

(E) I only

(F) None of the above

19. Determine whether the following numbers are rational or irrational.

	Rational	Irrational
$\frac{8}{5}$	<input type="checkbox"/>	<input type="checkbox"/>
π	<input type="checkbox"/>	<input type="checkbox"/>
0	<input type="checkbox"/>	<input type="checkbox"/>
$\sqrt{1}$	<input type="checkbox"/>	<input type="checkbox"/>
4.46466...	<input type="checkbox"/>	<input type="checkbox"/>
-6	<input type="checkbox"/>	<input type="checkbox"/>
$\sqrt{2}$	<input type="checkbox"/>	<input type="checkbox"/>