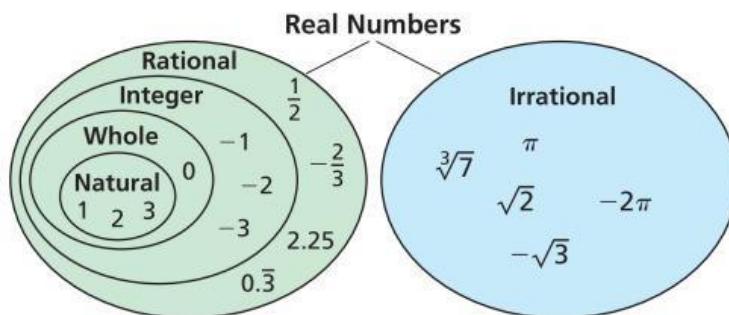


## Classifying Real Numbers

A **rational number** is a number that can be written as the ratio of two integers. An **irrational number** cannot be written as the ratio of two integers.

- The square root of any whole number that is not a perfect square is irrational. The cube root of any integer that is not a perfect cube is irrational.
- The decimal form of an irrational number neither terminates nor repeats.

Rational numbers and irrational numbers together form the set of **real numbers**.



**Example 1** Classify each real number in as many ways as possible.

Number	Subset(s)	Reasoning
a. $\sqrt{18}$	Irrational	18 is not a perfect square.
b. $0.\overline{33}$	Rational	$0.\overline{33}$ is a repeating decimal.
c. $-\sqrt{4}$	Integer, Rational	$-\sqrt{4}$ is equal to -2.
d. $\frac{56}{7}$	Natural, Whole, Integer, Rational	$\frac{56}{7}$ is equal to 8.
e. $\sqrt[3]{5}$	Irrational	5 is not a perfect cube.

### Practice

Check your answers at [BigIdeasMath.com](http://BigIdeasMath.com).

Classify the real number in as many ways as possible.

1. $\sqrt{17}$ irrational	2. $\frac{1}{5}$ rational	3. 0.25 rational
4. $\frac{48}{6}$ natural, whole, integer, rational	5. $-\sqrt{25}$ integer, rational	6. $\sqrt[3]{32}$ irrational

Determine whether the statement is *always*, *sometimes*, or *never* true.  
Explain your reasoning.

7. A natural number is a whole number. <i>always</i> ; The set of whole numbers includes the natural numbers.	8. An integer is a natural number. <i>sometimes</i> ; The set of integers includes natural numbers, as well as their opposites and 0.
9. A natural number is negative. <i>never</i> ; The natural numbers are positive.	10. A real number is an irrational number. <i>sometimes</i> ; The set of real numbers includes irrational numbers, as well as rational numbers.
11. A rational number is a real number. <i>always</i> ; The set of real numbers is made up of all rational and irrational numbers.	12. A whole number is an irrational number. <i>never</i> ; Whole numbers can be written as the ratio of two integers, so they are not irrational.