

Review of Number Classification

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Summary: Provides a review of how to classify numbers.

Learning Objectives: To define natural and whole numbers, integers, and rational and irrational numbers.

Every number can be classified into one or more groups. In mathematics, we classify numbers as being rational or irrational, natural, whole, or integer. What are these groups and how can we tell where the number we are looking at falls?

Let's start with **natural** numbers. These are the numbers you started with way back before you started school. Natural numbers are more commonly known as "counting" numbers. These are the numbers that most people are comfortable and familiar with. Zero is not a natural number, but we will include zero in the whole numbers.

Natural numbers include 1, 2, 3, 4, 5 ...

Next there are **whole** numbers. These numbers are the same as the natural numbers, except that zero (0) is also included. Whole numbers are still pretty familiar. Whole numbers are all positive numbers or zero. Zero is neither positive nor negative.

Whole numbers include 0, 1, 2, 3, 4, 5 ...

After whole numbers we get **integers**. Integers are all of the whole numbers plus the negative natural numbers. Negative naturals are the numbers we use when we owe money or we lose points. When we look at fractions, if the fraction can simplify into a whole number (either positive or negative) then it is an integer. Because not all fractions can simplify into a whole number, not all fractions are integers. Also, since decimals are not whole numbers, they also are not integers.

Integers include ... -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5 ...

Rational (from the word **ratio**) numbers are still somewhat familiar territory for us. These are the numbers that we see on sale signs and in ads. Rational numbers are fractions. Integers can be turned into fractions by adding a one as a denominator, thus making integers rational. Rational numbers can also be written as terminating or repeating decimals.

Rational numbers include: $\frac{2}{3}$, $\frac{3}{4}$, $-\frac{7}{1}$, $\frac{8}{2}$, .232, .25, .333333..., .5

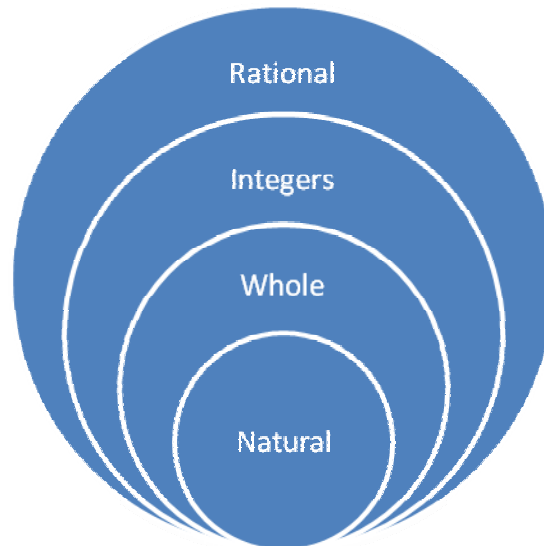


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A number that is natural is also a whole number. A whole number is also an integer. An integer is also a rational number. We can visualize this classification as a series of filters. When we put a number into the top filter, if it is rational it will fit through the largest holes of this filter. The next filter, integers, has slightly smaller holes, so not every number will fit through them. Only those numbers that fit into the description of an integer will fit. Next is the whole number filter. This filter has smaller holes than the integer filter. Again, if the number does not fit the description of a whole number, then it will not fit through the filter. Those numbers that are left must then fit through the filter holes for natural numbers. These holes are the smallest. Only those numbers that match the description for natural numbers will fit.

The set of Rational Numbers can also be thought of as a stacked Venn diagram. Each element fits neatly inside the next element.



All natural numbers fit inside, and are included in, whole numbers. All whole numbers fit inside, and are included in, integers. All integers fit inside, and can be included in, rational numbers.

Irrational numbers are non-repeating, non-terminating decimals. These are the numbers that do not fit into any of the classifications already mentioned. An irrational number cannot be written as a fraction. Numbers like π or $\sqrt{2}$ are decimals that don't repeat and continue indefinitely. While they can be *approximated* as a fraction, they cannot truly be written as a fraction.

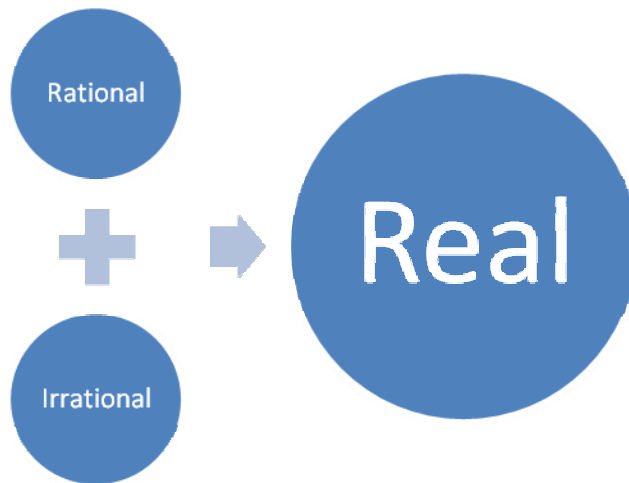
The entire set of natural, whole, integer, rational and irrational numbers together make up the **real** numbers. All numbers that we see and use on a daily basis fall into the set of real numbers.

The set of Real Numbers can also be thought of in a visual way. If a number is rational it cannot be irrational, so when you put the two together, you get the set of Real Numbers.



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For more information, visit this page <http://www.purplemath.com/modules/numtypes.htm>.

Classify each of the following numbers as Natural, Whole, Integer, Rational, or Irrational. Some may have more than one classification.

1. -95
2. $\sqrt{169}$
3. π
4. 28
5. $\frac{3}{4}$

Answers:

1. -95 – Integer, Rational
2. $\sqrt{169}$ – Natural, Whole, Integer, Rational ($\sqrt{169}$ can be simplified to 13.)
3. π – Irrational
4. 28 – Natural, Whole, Integer, Rational
5. $\frac{3}{4}$ – Rational



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