

RATIONAL NUMBERS

Rational Numbers

A Rational Number

Define a rational number

A **Rational Number** is a real number that can be written as a simple fraction (i.e. as a **ratio**).

Most numbers we use in everyday life are Rational Numbers.

Number	As a Fraction	Rational?
5	5/1	Yes
1.75	7/4	Yes
.001	1/1000	Yes
-0.1	-1/10	Yes
0.111...	1/9	Yes
$\sqrt{2}$ (square root of 2)	?	NO !

The square root of 2 cannot be written as a simple fraction! And there are many more such numbers, and because they are **not rational** they are called **Irrational**.

The Basic Operations on Rational Numbers

Perform the basic operations on rational numbers

Addition of Rational Numbers:

To add two or more rational numbers, the denominator of all the rational numbers should be the same. If the denominators of all rational numbers are same, then you can simply add all the numerators and the denominator value will be the same. If all the denominator values are not the

same, then you have to make the denominator value as same, by multiplying the numerator and denominator value by a common factor.

Example 1

$$\frac{1}{3} + \frac{4}{3} = \frac{5}{3}$$

$$\frac{1}{3} + \frac{1}{5} = \frac{5}{15} + \frac{3}{15} = \frac{8}{15}$$

Subtraction of Rational Numbers:

To subtract two or more rational numbers, the denominator of all the rational numbers should be the same. If the denominators of all rational numbers are same, then you can simply subtract the numerators and the denominator value will be the same. If all the denominator values are not the same, then you have to make the denominator value as same by multiplying the numerator and denominator value by a common factor.

Example 2

$$\frac{4}{3} - \frac{2}{3} = \frac{2}{3}$$

$$\frac{1}{3} - \frac{1}{5} = \frac{5}{15} - \frac{3}{15} = \frac{2}{15}$$

Multiplication of Rational Numbers:

Multiplication of rational numbers is very easy. You should simply multiply all the numerators and it will be the resulting numerator and multiply all the denominators and it will be the resulting denominator.

Example 3

$$\frac{4}{3} \times \frac{2}{3} = \frac{8}{9}$$

Division of Rational Numbers:

Division of rational numbers requires multiplication of rational numbers. If you are dividing two rational numbers, then take the reciprocal of the second rational number and multiply it with the first rational number.

Example 4

$$\frac{4}{3} \div \frac{2}{5} = \frac{4}{3} \times \frac{5}{2} = \frac{20}{6} = \frac{10}{3}$$

Irrational Numbers

Irrational Numbers

Define irrational numbers

An irrational number is a real number that cannot be reduced to any ratio between an integer p and a natural number q . The union of the set of irrational numbers and the set of rational numbers forms the set of real numbers. In mathematical expressions, unknown or unspecified irrationals are usually represented by u through z . Irrational numbers are primarily of interest to theoreticians. Abstract mathematics has potentially far-reaching applications in communications and computer science, especially in data encryption and security.

Examples of irrational numbers are $\sqrt{2}$ (the square root of 2), the cube root of 3, the circular ratio π , and the natural logarithm base e . The quantities $\sqrt{2}$ and the cube root of 3 are examples of algebraic numbers. π and e are examples of special irrationals known as transcendental numbers. The decimal expansion of an irrational number is always nonterminating (it never ends) and non-repeating (the digits display no repetitive pattern).

Real Numbers

Real Numbers

Define real numbers

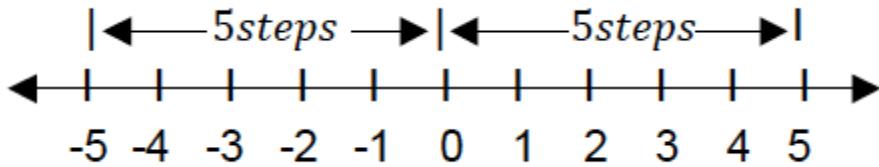
The type of number we normally use, such as 1, 15.82, -0.1 , $\frac{3}{4}$, etc. Positive or negative, large or small, whole numbers or decimal numbers are all Real Numbers.

They are called "Real Numbers" because they are not Imaginary Numbers.

Absolute Value of Real Numbers

Find absolute value of real numbers

The absolute value of a number is the magnitude of the number without regard to its sign. For example, the absolute value of x or x written as $|x|$. The sign before x is ignored. This is because the distance represented is the same whether positive or negative. For example, a student walking 5 steps forward or 5 steps backwards will be considered to have moved the same distance from where she originally was, regardless of the direction.



The 5 steps forward ($+5$) and 5 steps backward (-5) have an absolute value of 5

Thus $|x| = x$ when x is positive ($x \geq 0$), but $|x| = -x$ when x is negative ($x \leq 0$).

For example, $|3| = 3$ since 3 is positive ($3 \geq 0$) And $-3 = (-3) = 3$ since -3 is negative ($3 \leq 0$)

Related Practical Problems

Solve related practical problems

Example 5

Solve for x if $|x| = 5$

Solution

For any number x , $|x| = 5$, there are two possible values. Either $x = +5$ or $x = -5$

Example 6

Solve for x , given that $|x + 2| = 4$

Solution

$$\begin{array}{ll}
 \text{Either } + (x + 2) = 4 & \text{or } -(x + 2) = 4 \\
 \rightarrow x = 4 - 2 & \quad \quad \quad -x - 2 = 4 \\
 \quad \quad \quad = 2 & \quad \quad \quad = -6
 \end{array}$$

Therefore, $x = 2$ or -6