



# Rational Numbers

## GATS Programming Challenges

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## Introduction

A *rational number* is any number that can be expressed as the fraction  $\frac{p}{q}$  of two integers, a numerator  $p$  and a non-zero denominator  $q$  (more on [Wikipedia](https://en.wikipedia.org/wiki/Rational_number)). Rational numbers are indispensable in mathematics involving the partitioning of groups of whole things (things you can't divide like a person).

## The Challenge

Write a program that demonstrates the use of a *Rational* number class. Operations that your class should support include:

- Construction
- Arithmetic (add, subtract, multiply, divide, negate).
- Common functions (abs, inverse, power, max, min).
- Relational operations (greater, less, equals).
- Conversion (to string, to double, to integer).
- Harmonization (making the denominator of two fractions the same without changing the value of the number).

Write a solution for the class and a program to demonstrate its features and functions.

## The Solutions

- Java

## Sample (Java) Output

Java Console...

Rational Number Demo

d...Constrution

zero = 0 / 1

one = 1 / 1

half = 1 / 2

Caught: [java.lang.RuntimeException](#): bad Rational: zero denominator

...Utilities

Reduce 144 / 24 = 6 / 1

Reduce -144 / 24 = -6 / 1

Reduce 144 / -24 = -6 / 1

Reduce -144 / -24 = 6 / 1

...Arithmetic

3 / 2 plus 4 / 3 = 17 / 6

3 / 2 minus 4 / 3 = 1 / 6

3 / 2 times 4 / 3 = 2 / 1

3 / 2 divide 4 / 3 = 9 / 8

4 / 3 plus 3 / 2 = 17 / 6

4 / 3 minus 3 / 2 = -1 / 6

4 / 3 times 3 / 2 = 2 / 1

4 / 3 divide 3 / 2 = 8 / 9

negate 3 / 2 = -3 / 2

inverse of 3 / 2 = 2 / 3

5 / 2 to the 3rd power = 125 / 8

5 / 2 to the 0th power = 1 / 1

5 / 2 to the -3rd power = 8 / 125

...Comparison

5 / 2 is not less than 4 / 3

4 / 3 is less than 5 / 2

5 / 2 is greater than 4 / 3

4 / 3 is not greater than 5 / 2

5 / 2 is not equal to 4 / 3

4 / 3 is not equal to 5 / 2

5 / 2 is equal to 5 / 2

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