

# So, What's A Fraction? & Zero(s) In Fractions

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## What's A Fraction?

A fraction is a number. It is a number written as the ratio or comparison of two numbers. The top number is compared to the bottom number. The numerator is compared to the denominator.

## What's the Job of the Top Number?

The number on the top of the fraction is the numerator, the **NUMBERER**. It states "how many pieces are involved."

## What's the Job of the Bottom Number?

The number on the bottom of the fraction is the denominator, the **NAMER**. It states "the name of the size of the piece." It is the number of equal pieces in one whole."

## So, What Is A Fraction?

A fraction is a number written so as to compare the number of pieces involved to the number of pieces in one whole.

**So, What's A Fraction?**

the ratio or comparison of

the number of pieces involved

to

the number of pieces in one whole.

$\frac{\text{numerator}}{\text{denominator}}$	$\frac{\text{NUMBERER}}{\text{NAMER}}$
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The fraction one-half, written in symbols as  $\frac{1}{2}$ , means "one piece, where it takes two pieces to make a whole."  
 The fraction a half, written in symbols as  $\frac{1}{2}$ , means "one piece, where it takes two pieces to make a whole."  
 The fraction one-fourth, written in symbols as  $\frac{1}{4}$ , means "one piece, where it takes four pieces to make a whole."  
 The fraction one-quarter, written in symbols as  $\frac{1}{4}$ , means "one piece, where it takes 4 pieces to make a whole."  
 The fraction three-quarters, written in symbols as  $\frac{3}{4}$ , means "three pieces, where it takes four pieces to make a whole."

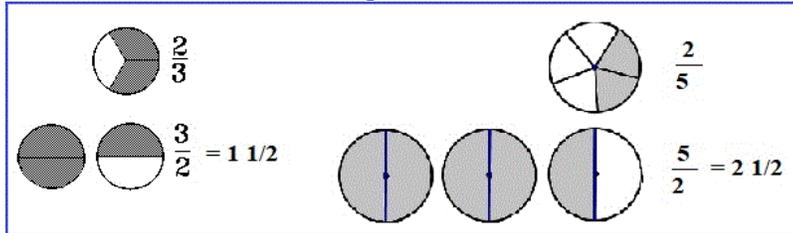
The fraction six-eighths, written in symbols as  $\frac{6}{8}$ , means "six pieces, where it takes eight pieces to make a whole."

### When Are Two Different Fractions Equal?

Two fractions are equal when they name the same number. It is often the case that two fractions are equal. One-half ( $\frac{1}{2}$ ) names the same number as two-quarters ( $\frac{2}{4}$ ), or as three sixths ( $\frac{3}{6}$ ), or as four-eighths ( $\frac{4}{8}$ ). Three-fourths ( $\frac{3}{4}$ ) is equal to six-eighths ( $\frac{6}{8}$ ) because they are different ways of expressing the same number.

### Does It Really Matter Which Way You Write The Fraction?

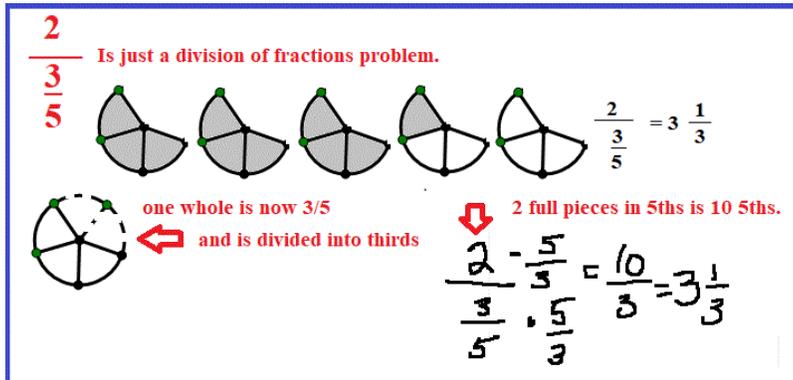
Yes! Examine the two examples below. It must be written "number of pieces / number of pieces in one whole."



### What Does Mean If You Have a Fraction In the Fraction?

It is called a complex fraction and is still "number of pieces / number of pieces in one whole."

For example, below, the denominator, number of pieces in one whole, is now a fraction. So one whole is really  $\frac{3}{5}$ .



### What Does Mean If You Have a Zero in a Fraction

It will be one of these three kinds of expressions and these depend on where the zero(s) are.

**There are 3 types of fractions involving zero(s).**

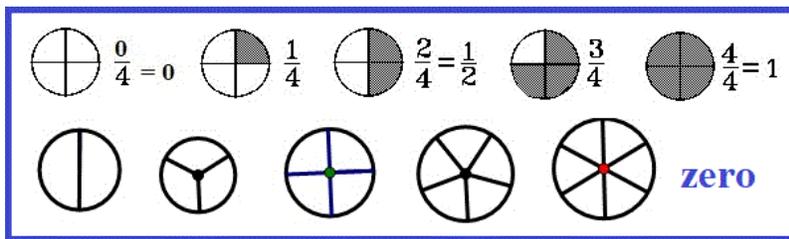
$\frac{0}{c}$  is 0.

$\frac{c}{0}$  is UNDEFINED.

$\frac{0}{0}$  is INDETERMINANT.

where  $c$  is a non-zero constant.

- $0/c$ , where  $c$  is a non-zero constant, equals 0.



\* It is zero pieces and any non-zero number in one whole.

\* For example,  $0/5 = 0$ ,  $0/2 = 0$  -- 0 pieces and some number of pieces in one whole.

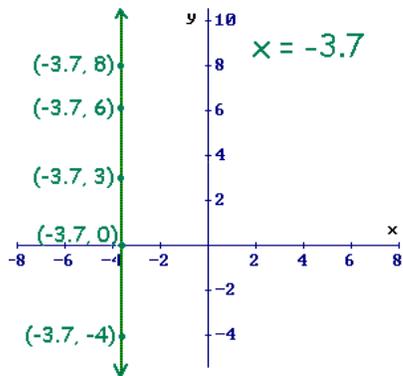
\*  $0/c$  is found in everyday computation. It is just plain zero.

- $c/0$ , where  $c$  is a non-zero constant, is UNDEFINED.

\* "You can't divide by 0." There is no computation rule, as one might find for fractions, for division by zero. Division by zero is NOT DEFINED.

\*  $c/0$  is probably first found in middle school when learning order of operations and getting ready for computation in which  $c/0$  has a useful meaning.

\* That happens in computing the slope of a vertical line



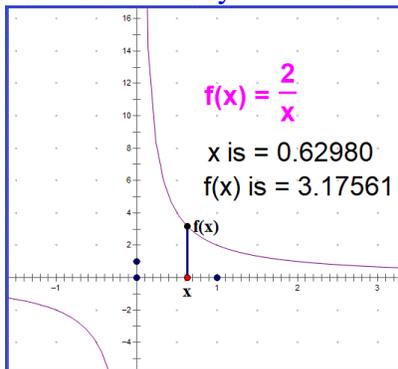
\*  $c/0$  is the reciprocal 0, of  $0/c$ . One might examine  $2/0$  in a few different ways.

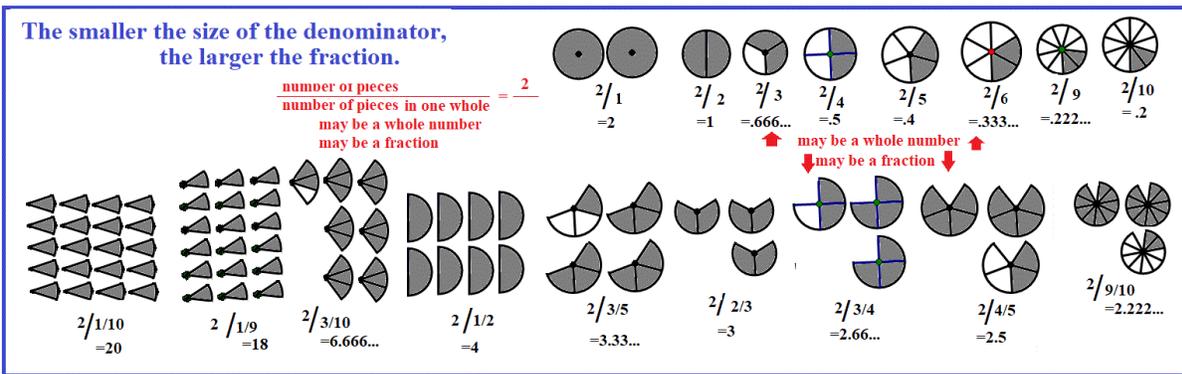
A. using the function  $2/x$  in the graph below;

B. in limit.gsp for taking a limit;

C. using the picture below and the definition of fraction as discussed above, "number of pieces" / "number of pieces in one whole"

D. using the calculator on this web page. Try a few numbers. Don't forget to try 0 to see what this html math function says.





Enter negatives as "-x" rather than "- x"

- 0/0 is INDETERMINANT.

\* A number of expressions are called INDETERMINANT, meaning the value of the number can not be DETERMINED as is.

\* The expressions are:  $0/0$ ,  $0^x$ ,  $\infty$ ,  $\infty/\infty$ ,  $-\infty$ ,  $\infty^0$ ,  $0^0$ ,  $1^\infty$

\* A student probably first sees the fraction 0/0 in calc I when studying limits.

\* Here are some examples of Special Limits. In each case  $f(0)$  is 0/0, INDETERMINANT.

\* For more on indeterminate forms see:

<https://calcworkshop.com/limits/limits-indeterminate-forms/> and

<https://byjus.com/maths/indeterminate-forms/#definition>.

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