

# MATH > Frac Didn't Convert!

ClassicView

## Objectives:

- Review how to convert a decimal to a fraction
- Observe that it should NOT convert an irrational number to a fraction
- Lie #1: Calculator did not convert a rational number to a fraction
- Lie #2: Calculator might find a false fraction for an irrational number
- Summarize how MATH > Frac works and its limitations

## Review how to convert a decimal to a fraction

test A

math

In the **math** menu, option 1, >FRAC will convert a decimal answer to a fraction, IF:

- a) the decimal is a rational number (a ratio of two integers) AND
- b) the decimal is in the calculator's database of fractions

## Observe that it should NOT convert an irrational number to a fraction

**Example 1:**  $\pi$  is an irrational number, so it cannot be written exactly as a ratio of two integers.

Let's observe that the calculator knows this.

$\pi$  H entry solve test A entry solve entry solve  
2nd ^ enter math enter enter

To calculate  $\pi$ , press these buttons:

$\pi$   
3.141592654  
Ans  $\rightarrow$  Frac  
3.141592654

See this screen:

The calculator is unable to convert  $\pi$  to an exact fraction of integers, and this is correct.

**CAUTION:** Sometimes math books will ask you to approximate  $\pi$  using 3.1415 or 3.14 or  $\frac{22}{7}$ . These are rational numbers (which have fraction equivalents) but they approximate  $\pi$ , but are not exactly  $\pi$ .

## Lie #1: Calculator did not convert a rational number to a fraction

**Example 2:** Calculate the fraction  $\frac{12357}{12379}$  as a decimal, then convert it back to a fraction, if possible.

L1 Y L2 Z L3 8 L5 U u O e M L1 Y  
1 2 3 5 7  $\div$  1

Press these buttons: Calculate the decimal by dividing

L2 Z L3 8 u O w Q entry solve  
2 3 7 9 enter

then convert to fraction

ans ? test A entry solve entry solve  
2nd (–) math enter enter

12357/12379  
.9982227967  
Ans  $\rightarrow$  Frac  
.9982227967

See this screen:

Answer: The fraction is  $\frac{12357}{12379}$ , but we know it by thinking, not

by calculator. The fraction  $\frac{12357}{12379}$  is not in the calculator's database of fractions and decimal equivalents.

## Lie #2: Calculator might find a false fraction for an irrational number

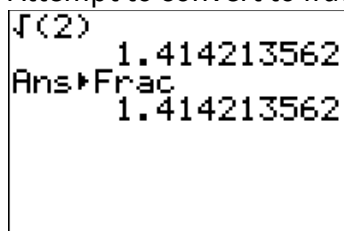
**CAUTION:** In this example, some calculators may respond differently from others.

**Example 2:** Calculate  $\sqrt{2}$  and attempt to convert it to fraction.

Press these buttons:



Attempt to convert to fraction:

**The calculator in this image did this correctly.**

Answer:  $\sqrt{2}$  should not be written as a fraction, because it's irrational.

**CAUTION:** For a while, some calculators had a bug (which has been fixed) that would wrongly convert some decimal approximations of irrational numbers to fractions, like  $\sqrt{2} \approx 1.414213562 = \frac{1,767,766,954}{1,250,000,000}$ .

1.414213562 is a rational number that's approximately  $\sqrt{2}$ .

The exact value of  $\sqrt{2}$  cannot be written as the ratio of two integers.

**PRO TIP:** If your calculator found a fraction for  $\sqrt{2}$ , you probably can upgrade your operating system.

## Summary of how MATH > Frac works and its limitations

Sometimes >Frac does not give a fraction answer. There are two reasons why this happens.

- 1) The number you typed is irrational and cannot be written as a fraction. In this case, you need to think to recognize irrational numbers.
- 2) The number can be written as a fraction, but it's not a fraction in the calculator's database. In this case, you need to think to recognize rational numbers.

**CAUTION:** When the calculator gives a decimal, you must think whether it's rational or irrational!

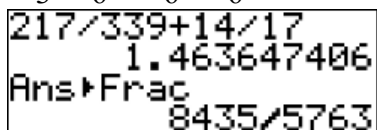
## Try It!

Before using your calculator, decide whether each result is rational or irrational. If it's rational, use calculator to determine the fraction and determine if the calculator did this correctly.

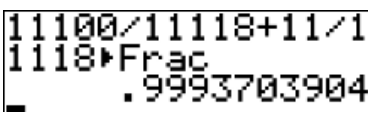
- 1)  $\frac{\pi}{3} - \frac{\pi}{6}$
- 2)  $\frac{217}{339} + \frac{14}{17}$
- 3)  $\frac{11100}{11118} + \frac{11}{11118}$
- 4)  $\frac{\sqrt{2}}{3} + \frac{\sqrt{2}}{3}$

## Solutions

- 1) Irrational.  $\frac{\pi}{3} - \frac{\pi}{6} = \frac{2\pi}{6} - \frac{\pi}{6} = \text{Answer: } \frac{\pi}{6}$



- 2) Rational,  
Correct.

- 3) Rational, 

Incorrect.  $\frac{11111}{11118}$

- 4) Irrational,  $\frac{2\sqrt{2}}{3}$ .