

# Using >Frac To Simplify Irrational Expressions MathPrintView

## Objectives:

- Review rational and irrational numbers
- Recognize irrational numbers in an expression
- Use calculator to simplify rational terms of an expression
- Use calculator to simplify rational coefficients of terms

## Review rational and irrational numbers

A **rational number** is a number that can be written as a fraction (or ratio) of two integers.

An **irrational number** cannot be written as a fraction of two integers.

**NOTE:** “Ir” means “not”, so “ir” + “rational” = “not rational”. A number is either rational or irrational, but cannot be both!

**NOTE:** Both rational numbers and irrational numbers are real numbers.

**Example 1:**  $\frac{2}{3}$ ,  $-7$ ,  $0$  and  $\sqrt{9}$  are rational.  $-7$  and  $0$  can be written using  $1$  as the denominator.  $\sqrt{9}$

simplifies to  $3$ , and can be written using  $1$  as the denominator.

**Example 2:**  $\pi$  and  $\sqrt{2}$  are irrational, and cannot be written as a fraction of two integers.

## Recognize irrational numbers in an expression

Any expression which can be simplified (using algebra!) to a fraction of integers will be a rational result.

These expressions can be simplified with the calculator.

If a square root or  $\pi$  remains after simplifying, the result is irrational.

**Example 3:** Is  $\frac{\sqrt{9}}{2} + \frac{\sqrt{16}}{3} + \frac{\sqrt{4}}{4}$  rational or irrational?

$\sqrt{9}$ ,  $\sqrt{16}$ , and  $\sqrt{4}$  all simplify to rational numbers, so this expression will simplify to a rational number.

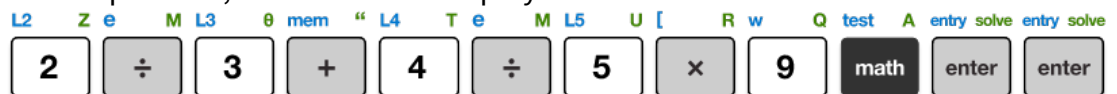
**Example 4:** Is  $\frac{2}{3} - \pi + \frac{4}{5}(9)$  rational or irrational? Is  $\frac{\pi}{3} + \frac{5\pi}{6}$  rational or irrational?

$\pi$  will remain when these are simplified, so both expressions will simplify to irrational numbers.

## Use calculator to simplify rational terms of an expression

**Example 5:** Calculate  $\frac{2}{3} - \pi + \frac{4}{5}(9)$  exactly.

Because there's a  $\pi$  in the expression, it's irrational. Simplify the other terms that do not contain  $\pi$ :



Press these buttons:



See this screen:

Your instructor may want you to subtract with common denominator (by hand) to get a single fraction

$$\text{Answer: } \frac{118}{15} - \pi = \frac{118}{15} - \frac{15\pi}{15} = \frac{118 - 15\pi}{15}$$

## Use calculator to simplify rational coefficients of terms

**Example 6:** Calculate  $\frac{\pi}{3} + \frac{5\pi}{6}$  exactly.

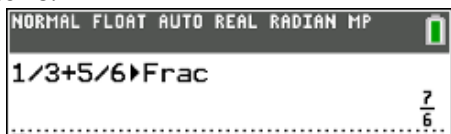
Because there's a  $\pi$  in the expression, it's irrational.

We can use the calculator simplify the coefficients, by first factoring out  $\pi$ :

$$\pi \left( \frac{1}{3} + \frac{5}{6} \right)$$



Press these buttons:



See this screen:

Answer:  $\frac{7\pi}{6}$

## Try it!

Simplify each expression. Do not approximate, so no rounding!

1)  $\frac{\sqrt{9}}{2} + \frac{\sqrt{16}}{3} + \frac{\sqrt{4}}{4}$

3)  $\frac{5\pi}{3} + \frac{4}{7} + \frac{8\pi}{5} - \frac{9}{4}$

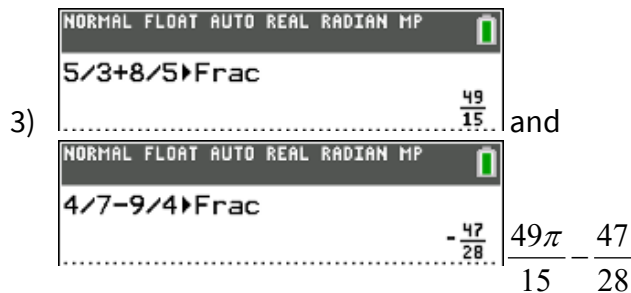
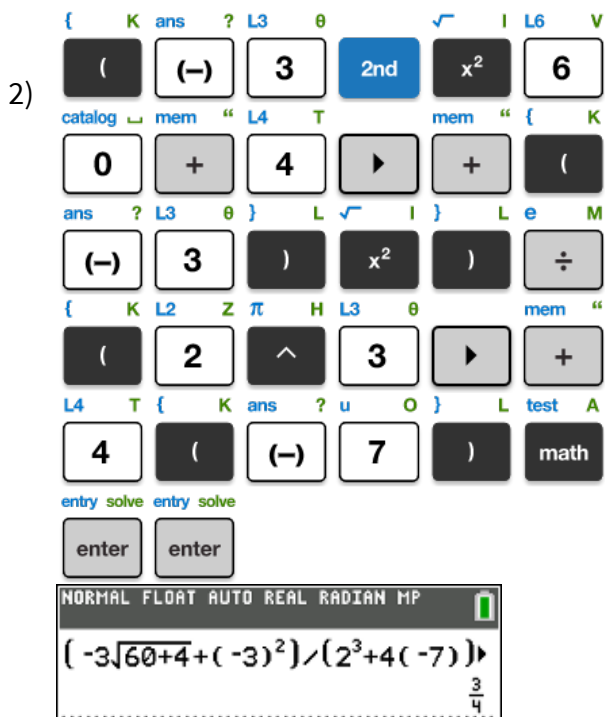
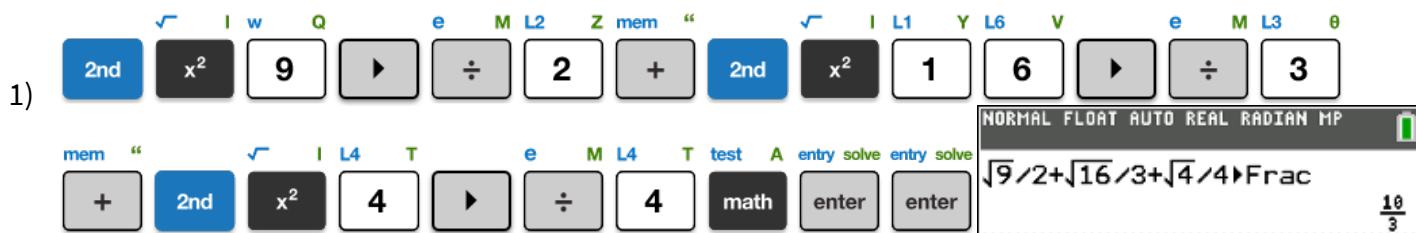
5)  $\frac{5\pi}{3} + \frac{4\pi}{7} + \frac{8\pi}{5} - \frac{9\pi}{4}$

2)  $\frac{-3\sqrt{60+4} + (-3)^2}{2^3 + 4(-7)}$

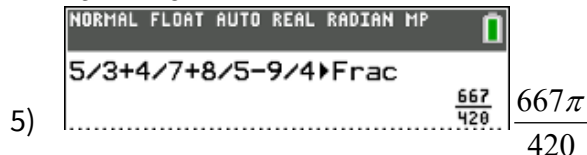
4)  $\frac{5}{3} + \frac{4\sqrt{3}}{7} + \frac{8}{5} - \frac{9\sqrt{3}}{4}$

6)  $\frac{5\sqrt{2}}{3} + \frac{4\sqrt{3}}{7} + \frac{8\sqrt{2}}{5} - \frac{9\sqrt{3}}{4}$

## Answers



3)  $\frac{49}{15}$  and  $\frac{49\pi}{15} - \frac{47}{28}$



4)  $\frac{49}{15} - \frac{47\sqrt{3}}{28}$  (same work as #3)

5)  $\frac{49\sqrt{2}}{15} - \frac{47\sqrt{3}}{28}$  (same work as #3)