

Using >Frac To Simplify Irrational Expressions ClassicView

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: π 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 π 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?

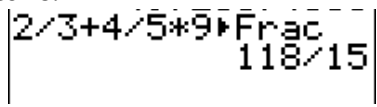
π will remain when these are simplified, so both expressions will simplify to irrational numbers.

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 π in the expression, it's irrational. Simplify the other terms that do not contain π :

Press these buttons: 

See this screen: 

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

$$\frac{118}{15} - \pi = \frac{118}{15} - \frac{15\pi}{15} = \frac{118 - 15\pi}{15}$$

Answer: $\frac{118}{15} - \pi$ or $\frac{118 - 15\pi}{15}$

Use calculator to simplify rational coefficients of terms

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

Because there's a π in the expression, it's irrational.

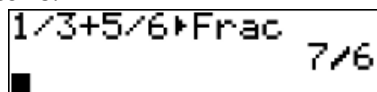
We can use the calculator simplify the coefficients, by first factoring out π :

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

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

1)

2)

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

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

5) $\frac{667\pi}{420}$

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