

## 5 Adding and Subtracting Rational Expressions part 2

February 2, 2020 4:18 PM

PRE-CALCULUS 11

Ch 6 – Day 5: ADDING AND SUBTRACTING RATIONAL EXPRESSIONS (Part 2)

### MODELLING BY ADDING AND SUBTRACTING RATIONAL EXPRESSIONS



example: The **current** of a river is  **$c$**  miles per hour. A boat's speed in still water is **12 miles** per hour. Write a simplified **expression** that will represent the **difference** in the times required for this boat to travel **150 miles downriver** and **upriver**.

boat's speed (mi/hr)  
 · in still water: 12  
 · down (with current):  $12 + c$   
 upriver (against " "):  $12 - c$

$$t = \frac{d}{s}$$

$$t_{\text{upriver}} - t_{\text{downriver}}$$

$$= \frac{150}{12 - c} - \frac{150}{12 + c} \quad \text{LCD: } (12 - c)(12 + c)$$

$$\frac{150}{(12 - c)} \times \frac{(12 + c)}{(12 + c)} - \frac{150}{12 + c} \times \frac{(12 - c)}{(12 - c)}$$

Don't FOIL denominator, only numerator!

$$\frac{1800 + 150c - 1800 + 150c}{(12 - c)(12 + c)}$$

It will take  $\frac{300c}{(12 - c)(12 + c)}$  hours longer to go 150 mi. upriver.



exercise: Ann and Bob drove separately the 300 km from Kamloops to Banff. They left at the same time. Ann drove  $x$  hours and arrived 1 hour before Bob. Write a simplified expression that represents how much faster Ann drove.



$$s = \frac{d}{t}$$

	Bob	Ann
distance	300km	300km
t	$x+1$	$x$
s	$\frac{300}{x+1}$	$\frac{300}{x}$

Diff. in speed:

$$\text{Speed Ann} - \text{Speed Bob}$$

$$\frac{300}{x} - \frac{300}{x+1}$$

$$\text{LCD: } x(x+1)$$

$$\frac{300 \cdot (x+1)}{x(x+1)} - \frac{300 \cdot x}{(x+1)x}$$

$$\frac{300x + 300 - 300x}{x(x+1)}$$

Ann's speed was  $\frac{300}{x(x+1)}$  km/hr faster.

If it took her 3 hours, what was her speed?  $\frac{300}{x}$  (see above!)  
 $\frac{300}{3} = 100 \text{ km/hr.}$

## COMPLEX FRACTIONS

fractions inside of fractions!

Complex fractions are rational expressions with fractions in the numerator and/or the denominator.

Complex fractions can be simplified in two ways.

1. Rewrite the numerator and denominator as single fractions and divide them.
2. Multiply the numerator and denominator by the lowest common denominator of the fractions within.

example: Evaluate  $\frac{8 + \frac{2}{5}}{\frac{3}{10} - \frac{1}{1}}$ ; simplify your answer.

Rewrite numerator & denominator as individual fractions  
 solution: Method 1

$$\frac{8 + \frac{2}{5}}{\frac{3}{10} - \frac{1}{1} \times \frac{10}{10}}$$

$$\frac{\frac{40}{5} + \frac{2}{5}}{\frac{3}{10} - \frac{10}{10}}$$

$$\frac{\frac{42}{5}}{-\frac{7}{10}}$$

Keep, Kiss, Flip!

$$\frac{42}{5} \times \frac{10}{-7} = \frac{42 \times 10}{5 \times -7}$$

x

$$-12$$

Find the LCD of the fractions inside the fraction  $\Rightarrow$   
 LCD of  $\frac{2}{5} + \frac{3}{10}$  is 10.

Method 2

Mult. numerator & denominator by that LCD of 10.

$$\frac{10(8 + \frac{2}{5})}{10(\frac{3}{10} - 1)}$$

$$\frac{10(8) + 10(\frac{2}{5})}{10(\frac{3}{10}) - 10(1)}$$

$$\frac{80 + 4}{3 - 10}$$

$$\frac{84}{-7}$$

$$-12$$

Ex 1: Simplify  $\frac{8-\frac{2}{3}}{\frac{5}{6}+\frac{1}{1}}$  } LCD = 3  
 } LCD = 6

Method 1

$$\frac{8 \times \frac{3}{3} - \frac{2}{3}}{1 \times \frac{5}{6} + \frac{1 \times 6}{1 \times 6}}$$

$$\frac{24-2}{5+6}$$

$$\frac{22}{11}$$

$$\frac{11}{6}$$

$$\frac{22}{3} \div \frac{11}{6}$$

$$\frac{22}{3} \times \frac{6}{11}$$

$$\boxed{4}$$

Ex 2: Simplify  $\frac{\frac{1}{2}+\frac{x}{3}}{\frac{1}{3-x}}$  } LCD = 2  
 } LCD = 3-x

Method 1

$$\frac{\frac{1}{2} + \frac{x}{3}}{\frac{1}{3-x}}$$

$$= \frac{1+2x}{2} \div \frac{1}{3-x}$$

$$= \frac{(1+2x)}{2} \times \frac{(3-x)}{1}$$

$$= \frac{(1+2x)(3-x)}{2}$$

$$= \frac{3-x+6x-2x^2}{2}$$

$$= \boxed{\frac{-2x^2+5x+3}{2}}$$

Method 2

$$LCD = 2(3-x)$$

$$2(3-x) \left( \frac{1}{2} + \frac{x}{3} \right)$$

$$2(3-x) \left( \frac{1}{3-x} \right)$$

$$= \frac{3-x + (6-2x)(x)}{2}$$

$$= \frac{3-x + 6x - 2x^2}{2}$$

$$=$$

**Assignment:** Sec 6.3, p. 337 #10, 12 (use hypotenuse = c in  $a^2 + b^2 = c^2$ ), 14, 20b, optional: 16, 25-27.