

7.3 Add & Subtract Rational Expressions

* just like fractions find a common denominator by finding the greatest common multiple

ex #1

$$\frac{5}{3x^2} + \frac{x}{2} = \text{common multiple} \rightarrow (3x^2 \cdot 2) = 6x^2$$

$$(2) \frac{5}{3x^2} + \frac{x(3x^2)}{2(3x^2)} = \frac{10}{6x^2} + \frac{3x^3}{6x^2}$$

$$= \frac{10 + 3x^3}{6x^2}$$

* don't forget
 $x \neq 0$ N.P.V.

ex #2

$$\frac{1}{6xy} - \frac{2}{15x^2}$$

↳ common denominator (ask: a) what does it have, b) what does it need (missing # or variable)

$$6xy = 2 \cdot 3 \cdot x \cdot y$$

$$15x^2 = 3 \cdot 5 \cdot x \cdot x$$

↳ they have 3 & x in common

6xy - needs (5x)

15x² - needs (2y)

to find new denominator - $\overbrace{3 \cdot x}^{\text{in common}} \cdot \overbrace{2y \cdot 5x}^{\text{missing}} = 30x^2y$

new denominator = $30x^2y$

or mult both top/bottom by what is missing

$$\frac{(5x) \frac{1}{6xy} - \frac{2}{15x^2} (2y)}{(5x) \frac{1}{6xy} - \frac{2}{15x^2} (2y)} \Rightarrow \frac{5x}{30x^2y} - \frac{4y}{30x^2y}$$

$$= \frac{5x - 4y}{30x^2y} \quad \begin{array}{l} \text{N.P.V.} \\ x \neq 0, \\ y \neq 0 \end{array}$$

ex #3

$$\frac{x-2}{4x^2} + \frac{x+6}{6x}$$

\downarrow \downarrow

$(2 \cdot 2 \cdot x \cdot x)$ \quad $2 \cdot 3 \cdot x$

* Break down to prime factors

← they have $2x$ in common

$$\frac{(2)(x-2)}{(2)(4x^2)} + \frac{(x+6)(2x)}{6x(2x)}$$

$$\frac{3x-6}{12x^2} + \frac{2x^2+12x}{12x^2} = \frac{2x^2+15x-6}{12x^2}$$

$x \neq 0$
N.P.V.

7.4 Add/Subtract w/ Binomial Denominators

ex #1 $\frac{4n}{n+4} + \frac{3n}{n-5}$ → if no common mult or factor - ~~mult~~ mult both top & bottom by denominator of other expression

$$\frac{(n-5)4n}{(n-5)(n+4)} + \frac{3n(n+4)}{n-5(n+4)}$$

$$\frac{4n^2 - 20n}{n^2 - 5n + 4n - 20} + \frac{3n^2 + 12n}{n^2 - 5n + 4n - 20}$$

once bottoms the same! add top!

$$= \frac{4n^2 - 20n + 3n^2 + 12n}{n^2 - n - 20} = \frac{7n^2 - 8n}{n^2 - n - 20}$$

ex #2 $\frac{1}{(x^2-36)} - \frac{1}{(6x-x^2)}$ ① * factor

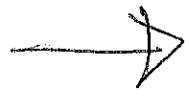
$$\rightarrow -x^2 + 6x \Rightarrow -(x^2 - 6x)$$

$$\frac{1}{(x-6)(x+6)} - \frac{1}{-(x)(x-6)}$$

* common factor

$$\frac{(-x)}{(-x)(x-6)(x+6)} - \frac{1}{-(x)(x-6)(x+6)}$$

② * what is the common factor
③ mult other expression by what is missing.



$$\frac{-x}{(-x)(x-b)(x+b)} - \frac{(x+b)}{(-x)(x-b)(x+b)}$$

Combine
numerator

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

$$\text{or } \frac{2x + b}{x(x-b)(x+b)}$$

* Seemingly more complicated but
Same steps

- ① factor
- ② find common factors
- ③ mult by missing factors
- ④ Combine tops + common bottom

~~RAA~~

$$\frac{5}{(x^2-25)} + \frac{4}{x^2+10x+25}$$

$$\textcircled{1} = \frac{5}{(x+5)(x-5)} + \frac{4}{(x+5)(x+5)}$$

$$\textcircled{4} \frac{5(x+5) + 4(x-5)}{(x+5)(x-5)(x+5)}$$

$$\frac{5x+25+4x-20}{(x+5)(x-5)(x+5)} = \frac{9x+5}{(x+5)^2(x-5)}$$

$$\frac{n-2}{n^2-5n+6} - \frac{n+4}{n^2-11n+30}$$

- ① $\frac{n-2}{(n-2)(n-3)} - \frac{n+4}{(n-5)(n-6)}$ * reduce if possible
- ② none - no common factors
- ③ $1(n-5)(n-6) - (n-3)(n+4)$
- ④ $\frac{(n-3)(n-5)(n-6) - (n^2-11n+30) - (n^2+3n^2+4n+12)}{(n-3)(n-5)(n-6)}$ ← simplify

$$= \frac{-12n+42}{(n-3)(n-5)(n-6)} = \frac{-6(2n-7)}{(n-3)(n-5)(n-6)}$$

7.5 Solving Rational Equations

$$\frac{5}{2x} + \frac{3}{4} = \frac{9}{4x}$$

\downarrow \downarrow \downarrow
 $\frac{2 \cdot x}{\text{needs } 2}$ $\frac{2 \cdot 2}{\text{needs } x}$ $\frac{2 \cdot 2 \cdot x}{\text{done}}$

* Same steps as last chapter

- ① factor if needed
- ② list common factors
- ③ mult by missing factors
- ④ combine tops & bottoms

$$\frac{(2)5}{(2)(2)x} + \frac{3(x)}{(2)(2)(x)} = \frac{9}{4x}$$

~~(4x)x~~ $\frac{10 + 3x}{4x} = \frac{9(4x)}{4x}$ * Solve using algebra

$$\begin{aligned} 10 + 3x &= 9 \\ -10 &\quad -10 \\ 3x &= -1 \\ x &= -\frac{1}{3} \end{aligned}$$

OR

Quick 'cheater' way.

Find highest multiple of denominator

$$\frac{5}{2x} + \frac{3}{4} = \frac{9}{4x} \quad * \boxed{4x} \text{ then mult all to get rid of fractions}$$

$$\frac{5(4x)}{2x} + \frac{3(4x)}{4} = \frac{9(4x)}{4x} = \frac{20x}{2x} + \frac{12x}{4} = \frac{36x}{4x} \Rightarrow \begin{aligned} 10 + 3x &= 9 \\ -10 &\quad -10 \\ 3x &= -1 \\ x &= -\frac{1}{3} \end{aligned}$$

ex#2 * find common denominator

$$\frac{5}{x+4} = \frac{3}{x-2}$$

↓

$$(x+4)(x-2)$$

* mult by missing factor

$$\frac{(x-2)5}{(x-2)x+4} = \frac{3(x+4)}{x-2(x+4)}$$

$$\frac{5(x-2)}{(x-2)(x+4)} = \frac{3(x+4)}{(x-2)(x+4)}$$

Solve using algebra

$$\frac{\cancel{(x-2)}\cancel{(x+4)}5(x-2)}{\cancel{(x-2)}\cancel{(x+4)}} = \frac{3(x+4)\cancel{(x-2)}\cancel{(x+4)}}{\cancel{(x-2)}\cancel{(x+4)}}$$

$$5(x-2) = 3(x+4)$$

$$\begin{array}{r} 5x - 10 = 3x + 12 \\ +10 \qquad +10 \end{array}$$

$$\begin{array}{r} 5x = 3x + 22 \\ -3x \quad -3x \end{array}$$

$$\begin{array}{r} 2x = 22 \\ \div \quad \div \\ x = 11 \end{array}$$

* or use cheater way: cross multiply

$$\frac{5}{x+4} \times \frac{3}{x-2} \Rightarrow 5(x-2) = 3(x+4)$$

$$\Rightarrow \begin{array}{r} 5x - 10 = 3x + 12 \\ -3x + 10 \quad -3x + 10 \end{array}$$

$$2x = 22 \quad x = 11$$

7.6 - go thru problems
on pg 593-596 as a
class. Students should
do the following using these
examples.

Use
ex #1

① Fred's average speed in still water
is x km/h.

When travelling up stream his speed is
 $(x-5)$

When travelling down stream his speed is
 $(x+5)$

He travels 30 km (down + up) in 5 hrs.

Use
ex #2

② Barney mows the lawn in 30 minutes.
Bam-Bam mows the lawn in 17 minutes.
How long would it take them if they
mowed the lawn together?

Use
ex #3

③ How much bleach should be added
to a 47L of water to make 6% solution
of bleach?