Class_21 Apr 4 - Adding & Subtracting Rational Expressions

Sunday, March 26, 2023 4:09 PM

Tonight's Class:

- **Scholarships?**
- **Working through sections 6.2-6.4**
  - **Dividing Rational Expressions (continued)**
  - **Adding and Subtracting Rational Expressions**
- **Work on practice questions from worktext**

If you

- **Are graduating this year**
- **Are currently enrolled at LEC**
- **Have completed 3 courses with LEC**
- **Plan to attend post-secondary in the next 2 years**

there are around 10 scholarships you could apply for. The deadline is very soon.

If you've got questions about this please check with Jody Primeau, our school counselor.

NPVs

1) $\frac{5}{x}$ $x \neq 0$

2) $\frac{17}{x-4}$ $x \neq 4$

3) $\frac{8}{2-x}$ $x \neq 2$

4) $\frac{x+1}{x}$ $x \neq 0$

5) $\frac{3}{x^2-16}$ $x \neq 4$ $x \neq -4$

BAD denom $= 0$

$x^2 - 16 = 0$

$(x+4)(x-4) = 0$

$x = -4$ $x = 4$

$x^2 - 16 = 0$

$x^2 = 16$

$x = \pm\sqrt{16}$

$x = \pm 4$

6) $\frac{5x}{x^2+7x+12} = \frac{5x}{(x+3)(x+4)}$

$x + 3 = 0$ $x \neq -3$

$x + 4 = 0$ $x \neq -4$

7) $\frac{10+3x}{x^2-7x}$

$x^2 - 7x$

denom $= 0$

$x^2 - 7x = 0$

$x(x-7) = 0$

$x \neq 0$

$x - 7 = 0$

$x \neq 7$

WT page 533

Example 2 Dividing Rational Expressions

Simplify each expression.

a) $\frac{5n^4}{-2} \div \frac{(5n)^2}{6}$

b) $\frac{2(x+1)}{3x} \div \frac{4(x+1)}{x(x-2)}$

NPVs for this:

$x \neq 2$

$x \neq 0$

1) change to multiplication question
2) factor everything
3) NPVs
4) simplify

b) $\frac{2(x+1)}{3x} \cdot \frac{x(x-2)}{4(x+1)}$

$= \frac{2^{\div 2}(x-2)}{12^{\div 2}}$

$= \frac{1(x-2)}{6} = \frac{x-2}{6}$ where $x \neq -1, 0, 2$

NPVs $x \neq 0$, $x \neq -1$, $x \neq 2$

WT page 534

Example 3 Factoring before Simplifying Rational Expressions

Simplify each expression.

a) $\frac{x^2+5x+4}{2x^2-8x+8} \cdot \frac{4x-8}{x^2-1}$ **b)** $\frac{4x-10}{x+3} \div \frac{12x^2-60x+75}{2x^2-18}$

$\frac{x^2+5x+4}{2x^2-8x+8} \cdot \frac{4x-8}{x^2-1}$

FACTOR

$= x^2 + 1x + 4x + 4$

$\frac{(x+1)(x+4)}{} \cdot \frac{4(x-2)}{(x-1)(x+1)}$

$^{\div 2} = 2$

now, get NPVs

$= x^2 + 1x + 4x + 4$

$= x(x+1) + 4(x+1)$ mult. 4 } 1, 4
add 5 }

$= (x+1)(x+4)$

$2x^2 - 8x + 8$

$= 2(x^2 - 4x + 4)$ mult. 4 } -2, -2
add -4 }

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

$= 2[x(x-2) - 2(x-2)]$

$= 2(x-2)(x-2)$

$\frac{(x+1)(x+4)}{2(x-2)(x-2)} \cdot \frac{4(x-2)}{(x-1)(x+1)}$

$= \frac{2(x+4)}{(x-2)(x-1)}$

now, get NPVs

$x \neq 2$
$x \neq 1$
$x \neq -1$

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b) $\frac{4x-10}{x+3} \div \frac{12x^2 - 60x + 75}{2x^2 - 18}$

$4x^2 - 20x + 25$

$\frac{2(2x-5)}{x+3} \div \frac{3(4x^2 - 20x + 25)}{2(x^2 - 9)}$

$4x^2 - 10x - 10x + 25$ mult { AC = 4(25) = 100
add { -20

$= 2x(2x-5) - 5(2x-5)$

$= (2x-5)(2x-5)$

1, 100
2, 50
5, 20
-10, -10

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

NPVs : $x \neq -3$, $x \neq 3$
$x \neq \frac{5}{2}$

$2x - 5 \neq 0$
$2x \neq 5$
$x \neq \frac{5}{2}$

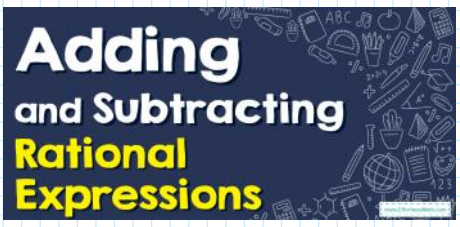
$\frac{2(2x-5)}{x+3} \cdot \frac{2(x-3)(x+3)}{3(2x-5)(2x-5)}$

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

To try CYU p 534; p 537-538, #8, 12

6.3 Add & Subtract Rational Expressions (part 1)

Focus: Add and subtract rational expressions with monomial denominators



Adding and Subtracting Fractions

Rational expressions are like fractions. Remember how to add/subtract fractions:

- find a lowest common denominator (LCD)
- write each term using that same denominator
- add/subtract the terms, keeping that same denominator
- simplify, if possible

$\frac{5}{12} - \frac{1}{30} + \frac{3}{20} =$

1) Get common denominator
2) Make each term have that denominator.

$12 = 2 \cdot 2 \cdot 3$
$30 = 2 \cdot 3 \cdot 5$
$20 = 2 \cdot 2 \cdot 5$

LCD (least common denominator) $= 2 \cdot 2 \cdot 3 \cdot 5 = 60$

$= \frac{5}{12} \cdot \frac{5}{5} - \frac{1}{30} \cdot \frac{2}{2} + \frac{3}{20} \cdot \frac{3}{3}$

$= \frac{25}{60} - \frac{2}{60} + \frac{9}{60}$

3) Add/subtract the numerators.

$= \frac{25-2+9}{60}$

$= \frac{32}{60} \overset{\div 4}{\underset{\div 4}{}} = \boxed{\frac{8}{15}}$

4) Reduce if possible

When rational expressions have common denominators, you

- **state the NPVs**
- **add (or subtract) the numerators**
- **keep the common denominator**

Example $\frac{1}{3x} + \frac{5}{3x}$

1) NPVs $x \neq 0$

$= \frac{1+5}{3x} = \frac{6}{3x} \overset{\div 3}{\underset{\div 3}{}}$

2) add

3) simplify, if possible

$= \frac{2}{x}, x \neq 0$

$\frac{6}{m+4} - \frac{2}{m+4}$

1) NPVs: $m \neq -4$

$= \frac{4}{m+4}, m \neq -4$

Try: page 551, #3 and page 564, #3ab

When rational expressions have different denominators, you must

- **determine the LCD = Lowest Common Denominator**
- **multiply each one by a form of 1 that changes the denominator to the LCD**
- **state the non-permissible values (NPVs)**
- **add/subtract the numerators**
- **simplify answer**

Example

1) Find LCD

use higher exponent for each (5)

Example

Simplify. $\dfrac{5}{12x^5y^3}+\dfrac{7}{18xy^4}=$

$\dfrac{5}{12x^5y^3}\cdot\dfrac{3y}{3y}+\dfrac{7}{18xy^4}\cdot\dfrac{2x^4}{2x^4}$

$=\dfrac{15y+14x^4}{36x^5y^4}$

1) Find LCD

use his/her exponent for each (5)

his/her exponent is 4

$12x^5y^3=2\cdot2\cdot3\cdot x^5\cdot y^3$

$18xy^4=2\cdot3\cdot3\cdot x\cdot y^4$

$36x^5y^4=2\cdot2\cdot3\cdot3\cdot x^5\cdot y^4$

2) Multiply each term by what is needed, to get the LCD

3) NPVs $x\neq0$, $y\neq0$

4) simplify

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Example 1 Adding and Subtracting Rational Expressions with Monomial Numerators

Simplify.

a) $\frac{5}{3x^2}+\frac{x}{2}$ **b)** $\frac{1}{6xy}-\frac{2}{15x^2}$

LCD $=30x^2y$

$6xy=2\cdot3\cdot x\cdot y$

$15x^2=3\cdot5\cdot x^2$

$2\cdot3\cdot5x^2y=30x^2y$

a) $\dfrac{5}{3x^2}\cdot\dfrac{2}{2}+\dfrac{x}{2}\cdot\dfrac{3x^2}{3x^2}$

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

LCD $=6x^2$

NPV $x\neq0$

b) $\dfrac{1}{6xy}\cdot\dfrac{5x}{5x}-\dfrac{2}{15x^2}\cdot\dfrac{2y}{2y}$

$=\dfrac{5x-4y}{30x^2y}$ $x\neq0$, $y\neq0$

CYU p 548 1b)

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Example 2 Adding and Subtracting Rational Expressions with Binomial Numerators

Simplify.

a) $\frac{x-2}{4x^2}+\frac{x+6}{6x}$ **b)** $\frac{2a+1}{2a^2b}-\frac{b-3}{9ab^2}$

Please add them!

a) $\frac{x-2}{4x^2}+\frac{x+6}{6x}$ **b)** $\frac{2a+1}{2a^2b}-\frac{b-3}{9ab^2}$

Please show me!

a) $\frac{(x-2)}{4x^2}\cdot\frac{3}{3}+\frac{(x+6)}{6x}\cdot\frac{2x}{2x}$ LCD $= 12x^2$

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

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

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

NPV $x \neq 0$

b) $\frac{(2a+1)}{2a^2b}\cdot\frac{9b}{9b}-\frac{(b-3)}{9ab^2}\cdot\frac{2a}{2a}$ LCD $= 18a^2b^2$

$= \frac{9b(2a+1)-2a(b-3)}{18a^2b^2}$

$= \frac{18ab+9b-2ab+6a}{18a^2b^2}$

$= \frac{16ab+9b+6a}{18a^2b^2}$

NPVs: $a \neq 0$, $b \neq 0$

CYU p549, #2

Remember.....never cancel individual terms!

Cancelling is okay here, because "3" is a common factor: $\frac{(4)(3)(x)}{(3)(y)} = \frac{4x}{y}$

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Example 3 Simplifying Rational Expressions Involving more than One Operation

Simplify.

a) $\frac{4}{3a^3} + \frac{a}{6a^2} - \frac{5}{2a}$

b) $\frac{w+3}{4w^2} - \frac{w-1}{3w} + \frac{w+2}{6}$

$LCD = 12w^2$

$4w^2 = 2 \cdot 2 \cdot w^2$

$3w = 3 \cdot w$

$6 = 2 \cdot 3$

$2 \cdot 2 \cdot 3 \cdot w^2 = 12w^2$

$$\frac{(w+3)}{4w^2} \cdot \frac{3}{3} - \frac{(w-1)}{3w} \cdot \frac{4w}{4w} + \frac{(w+2)}{6} \cdot \frac{2w^2}{2w^2}$$

$$= \frac{3(w+3) - 4w(w-1) + 2w^2(w+2)}{12w^2}$$

$$= \frac{3w + 9 - 4w^2 + 4w + 2w^3 + 4w^2}{12w^2}$$

$$= \frac{2w^3 + 7w + 9}{12w^2}$$

NPV $w \neq 0$

Try: page 556: #12d

6.4 Add & Subtract Rational Expressions (part 2)

Focus: Add and subtract rational expressions with binomial and trinomial denominators

Whenever a denominator can be factored, we need to do it! This will help us to

- **Figure out the LCD**
- **Identify the non-permissible values**

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Example 1 Adding and Subtracting Rational Expressions with Binomial Denominators

Simplify.

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

b) $\frac{1}{x^2 - 36} - \frac{1}{6x - x^2}$

1) LCD = $(n+4)(n-5)$

b) $\frac{1}{x^2-36} - \frac{1}{6x-x^2}$

1) LCD = $(n+4)(n-5)$

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

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

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

$= \frac{7n^2 - 8n}{(n+4)(n-5)} = \frac{n(7n-8)}{(n+4)(n-5)}$

NPV = $n \neq 5$, $n \neq -4$

For next class

- **Work on the worktext questions for 6.3**

Revised timeline:

- **Thursday, April 6 - sections 6.4-6.5**
- **Tuesday, April 11 - Pro-D day, no school**
- **Thursday, April 13 - section 6.6**
- **Tuesday, April 18 - Chapter 6 Test, sections 7.1-7.2**
- **Thursday, April 20 - Unit 3 Exam (Chapters 5 and 6)**
- **Tuesday, April 25 - sections 7.2-7.3**
- **Thursday, April 27 - Chapter 7 Test. Last class**