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Date: _____

HW Pre-Calculus 11 Section 6.3 Adding and Subtracting Rational Expressions

1. Unscramble the words to complete the following sentence:

When adding or subtracting two fractions, they must have a "moncmo tmaenodnior"Common Denominator

2. Given the three rational expressions, what is the common denominator?
- $\frac{1}{2x}, \frac{1}{x+2}, \frac{1}{x-2}$

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

3. Add or Subtract each of the following rational expressions:

a) $\frac{x}{2} - \frac{8}{3x}$ $\frac{x(3x)}{2(3x)} - \frac{8(2)}{3x(2)}$ $\frac{3x^2 - 16}{2(3x)}$	b) $\frac{5}{x} - \frac{2}{x+1}$ $\frac{5(x+1)}{x(x+1)} - \frac{2(x)}{x+1(x)}$ $= \frac{5x+5-2x}{(x)(x+1)}$ $= \frac{3x+5}{(x)(x+1)}$	c) $\frac{3}{x+1} + \frac{2}{x-1}$ $\frac{3(x-1)}{x+1(x-1)} + \frac{2(x+1)}{x-1(x+1)}$ $\frac{3x-3+2x+2}{(x+1)(x-1)}$ $= \frac{5x-1}{(x+1)(x-1)}$
d) $\frac{2}{x+5} + \frac{3}{x^2+5x}$ $\frac{2}{x+5} + \frac{3}{x(x+5)}$ $= \frac{2(x)}{(x+5)(x)} + \frac{3}{x(x+5)}$ $\frac{2x+3}{(x)(x+5)}$	e) $\frac{5x}{2} + \frac{3}{x} - \frac{4x}{3}$ $\frac{5x(3x)}{2(3x)} + \frac{3(6)}{x(6)} - \frac{4x(2x)}{3(2x)}$ $= \frac{15x^2+18-8x^2}{2(3x)}$ $= \frac{7x^2+18}{2(3x)}$	f) $\frac{4}{x+8} - \frac{3}{x} + \frac{2}{3}$ $\frac{4(3x)}{(x+8)(3x)} - \frac{3(3)(x+8)}{x(3(x+8))} + \frac{2(x+8)}{3(x+8)}$ $\frac{12x-9x-72+2x^2+16x}{3x(x+8)}$ $\frac{2x^2+19x-72}{3x(x+8)}$
g) $\frac{5x}{3x+9} - \frac{4x}{2x+6}$ $\frac{5x}{3(x+3)} - \frac{4x}{2(x+3)}$ $\frac{10x}{6(x+3)} - \frac{12x}{6(x+3)}$ $\frac{-2x}{6(x+3)} = \frac{-x}{3(x+3)}$	h) $\frac{9}{x+2} + \frac{7}{x^2-4}$ $\frac{9}{x+2} + \frac{7}{(x+2)(x-2)}$ $\frac{9(x-2)}{(x+2)(x-2)} + \frac{7}{(x+2)(x-2)}$ $= \frac{9x-11}{(x+2)(x-2)}$	i) $\frac{5}{x-1} + \frac{4x}{1-x} + \frac{x+3}{x-1}$ $\frac{5}{x-1} - \frac{4x}{x-1} + \frac{x+3}{x-1}$ $= \frac{5-4x+x+3}{x-1}$ $= \frac{8-4x}{x-1}$ $= \frac{4(2-x)}{x-1}$

4. Factor and simplify. Then state all the NPV's:

a) $\frac{4x^2 - 20x}{x^2 + 2x - 35} + \frac{3x - 6}{x^2 - 12x + 20}$ $\frac{4x(x-5)}{(x+7)(x-5)} + \frac{3(x-2)}{(x-2)(x-10)}$ $\frac{4x(x-10)}{(x+7)(x-10)} + \frac{3(x+7)}{(x+7)(x-10)}$ $\frac{4x^2 - 40x + 3x + 21}{(x+7)(x-10)}$ $\frac{4x^2 - 37x + 21}{(x+7)(x-10)}$ NPV's: $x \neq -7, 5, 2, 10$	b) $\frac{2x - 6}{x^2 - 5x + 6} - \frac{3x - 12}{x^2 - x - 12}$ $\frac{2(x-3)}{(x-3)(x-2)} - \frac{3(x-4)}{(x-4)(x+3)}$ $\frac{2(x+3)}{(x-2)(x+3)} - \frac{3(x-2)}{(x-2)(x+3)}$ $= \frac{2x + 6 - 3x + 6}{(x-2)(x+3)}$ $= \frac{12 - x}{(x-2)(x+3)}$ NPV's: $x \neq 3, 2, 4, -3$	c) $\frac{2x}{3x^2 - 11x + 6} - \frac{3x - 12}{3x^2 - 14x + 8}$ $\frac{2x}{(3x-2)(x-3)} - \frac{3(x-4)}{(3x-2)(x-4)}$ $\frac{2x}{(3x-2)(x-3)} - \frac{3(x-3)}{(3x-2)(x-3)}$ $= \frac{2x - 3x + 9}{(3x-2)(x-3)}$ $= \frac{9 - x}{(3x-2)(x-3)}$ NPV's: $x \neq \frac{2}{3}, 3, 4$
d) $\frac{2x}{3-x} - \frac{3x}{x+3} + \frac{2}{x^2 - 9}$ NPV's:	e) $\frac{w-6}{w^2 - 12w + 36} + \frac{7w+56}{w^2 + 11w + 24}$ $\frac{(w-6)}{(w-6)(w-6)} + \frac{7(w+8)}{(w+8)(w+3)}$ $\frac{1}{w-6} + \frac{7}{(w+3)}$ $\frac{w+3}{(w-6)(w+3)} + \frac{7(w-6)}{(w-6)(w+3)}$ $\frac{w+3+7w-42}{(w-6)(w+3)}$ $\frac{8w-39}{(w-6)(w+3)}$ NPV's: $w \neq 6, -3, -\frac{39}{8}$	f) $\frac{-4c-4}{c^2 + 2c - 15} + \frac{6c+42}{c^2 + 12c + 35}$ $\frac{-4(c+1)}{(c+5)(c-3)} + \frac{6(c+7)}{(c+7)(c+5)}$ $\frac{-4c-4}{(c+5)(c-3)} + \frac{6(c-3)}{(c+5)(c-3)}$ $\frac{-4c-4+6c-18}{(c+5)(c-3)}$ $\frac{2c-22}{(c+5)(c-3)} = \frac{2(c-11)}{(c+5)(c-3)}$ NPV's: $c \neq -5, 3, 11$
g) $\frac{a}{a+b} - \frac{b}{b-a} + \frac{2ab}{a^2 - b^2}$ $\frac{a}{a+b} + \frac{b}{a-b} + \frac{2ab}{(a+b)(a-b)}$ $\frac{a(a-b) + b(a+b) + 2ab}{(a+b)(a-b)}$ $\frac{a^2 - ab + ab + b^2 + 2ab}{(a+b)(a-b)}$ $\frac{a^2 + 2ab + b^2}{(a+b)(a-b)} = \frac{(a+b)(a+b)}{(a+b)(a-b)}$ $\frac{a+b}{a-b}$ NPV's: $a \neq b, a \neq -b$	h) $\frac{2x}{3-x} - \frac{3x}{x+3} + \frac{2}{x^2 - 9}$ $\frac{-2x}{x-3} - \frac{3x}{x+3} + \frac{2}{(x-3)(x+3)}$ $\frac{-2x(x+3)}{(x-3)(x+3)} - \frac{3x(x-3)}{(x+3)(x-3)} + \frac{2}{(x-3)(x+3)}$ $\frac{-2x^2 - 6x - 3x^2 + 9x + 2}{(x-3)(x+3)}$ $= \frac{-5x^2 + 3x + 2}{(x-3)(x+3)} = \frac{(5x+2)(1-x)}{(x-3)(x+3)}$ $= \frac{-(5x+2)(x-1)}{(x-3)(x+3)}$ NPV's: $x \neq \pm 3$	

5. Given each of the following statements, indicate whether if they are true or false: Explain:

i) $\frac{x}{y} - \frac{y}{x} = \frac{x-y}{xy}$ TRUE / **FALSE**

ii) $\frac{x-y}{y-x} = -1$ **TRUE** / FALSE

iii) $\frac{wx+wy}{w+v} = \frac{x+y}{v}$ TRUE / **FALSE**

iv) $\frac{1}{x-y} + \frac{1}{y-x} = 0$ **TRUE** / FALSE

6. Simplify and find all the NPV's

a) $\frac{x+1}{x+6} + \frac{x^2+4x+3}{x^2+x-6} \times \frac{x^2-2x}{x^2-1}$ $\frac{x+1}{x+6} + \frac{(x+3)(x+1)}{(x+3)(x-2)} \cdot \frac{x(x-2)}{(x+1)(x-1)}$ $\frac{x+1}{x+6} + \frac{x}{x-1}$ $\frac{(x+1)(x-1)}{(x+6)(x-1)} + \frac{x(x+6)}{(x+6)(x-1)}$ $= \frac{x^2-1+x^2+6x}{(x+6)(x-1)} = \frac{2x^2+6x-1}{(x+6)(x-1)}$ NPV's: $x \neq -6, -3, 2, -1, 1$	b) $\frac{x+8}{x-3} - \frac{6x^2+x-2}{24x^2+7x-6} \div \frac{2x^2-7x+3}{8x^2-3x}$ NPV's:
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7. Simplify and state all the NPV's:

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

① LCD $2x(x+2)(x+3)$

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

$\left(\frac{3}{2} - \frac{6}{x(x+3)}\right) \cdot 2x(x+2)(x+3)$

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

$= \frac{(x+3)[x^2-4+2x]}{(x+2)[3x^2+9x-12]}$

$= \frac{(x+3)[x^2+2x-4]}{3(x+2)(x^2+3x-4)}$

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

NPV: $x \neq 0, -2, -3, -4, 1$

8. Challenge: if $\frac{1}{a(b+1)} + \frac{1}{b(a+1)} = \frac{1}{(a+1)(b+1)}$, then what is the value of $\frac{1}{a} + \frac{1}{b}$?

$\frac{b(a+1) + a(b+1)}{ab(a+1)(b+1)} = \frac{1}{(a+1)(b+1)}$

$\frac{ab+b+ab+a}{ab} = 1$

$\frac{2ab+a+b}{ab} = 1$

$\frac{2ab}{ab} + \frac{a}{ab} + \frac{b}{ab} = 1$

$2 + \frac{1}{b} + \frac{1}{a} = 1$

$\frac{1}{b} + \frac{1}{a} = -1$

NPV
 $a, b \neq 0, -1$