2.2 Add and Subtract Rational Expressions

DO IT NOW!

$LCD = 30$

Note: the product of the denominators will give a common denominator (but not always the lowest common denominator)

a)

$$\frac{{}^{\times 5}1}{{}^{\times 5}6} + \frac{1^{\times 6}}{5^{\times 6}}$$

$$= \frac{5}{30} + \frac{6}{30}$$

$$= \frac{11}{30}$$

b) Simplify and state restrictions

$$\frac{x^2 - 1}{x^2 - 4} \times \frac{x^2 + 3x - 4}{x^2 + 5x + 4} = \frac{(x-1)(x+1)}{(x-2)(x+2)} \times \frac{(x+4)(x-1)}{(x+4)(x+1)}$$

$$= \frac{(x-1)^2}{(x-2)(x+2)} \ ; \ x \neq 2, -2, -4, -1$$

c) $\frac{^{2x}2x}{^{2x}3y} + \frac{y^{\,y}}{6x^{\,y}}$

$LCD = 6xy$

$= \frac{4x^2}{6xy} + \frac{y^2}{6xy}$; $x \neq 0$
$\qquad\qquad\qquad\quad y \neq 0$

$= \frac{4x^2 + y^2}{6xy}$; $x \neq 0$
$\qquad\qquad\qquad y \neq 0$

Add and Subtract Rational Expressions With Monomial Denominators

a)

$\frac{^{x2}1}{^{x2}5x} + \frac{1^{\,x5}}{2x^{\,x5}}$

$LCD = 10x$

1. factor denominators if possible
2. get a common denominator
3. re-write expression with a common denominator
4. add/subtract the numerator
(keep denominator the same)
5. simplify where possible
6. state restrictions (throughout process)

$= \frac{2}{10x} + \frac{5}{10x}$; $x \neq 0$

$= \frac{7}{10x}$; $x \neq 0$

b)

$$\frac{ab^2 + 2}{2ab^2} - \frac{b+2}{2b}\frac{(ab)}{(ab)} \qquad LCD = 2ab^2$$

$$= \frac{ab^2+2}{2ab^2} - \frac{ab(b+2)}{2ab^2} \quad ; a \neq 0$$
$$\qquad\qquad\qquad\qquad\qquad b \neq 0$$

$$= \frac{ab^2+2}{2ab^2} - \frac{ab^2+2ab}{2ab^2} \quad ; a \neq 0$$
$$\qquad\qquad\qquad\qquad\qquad b \neq 0$$

$$= \frac{ab^2+2-ab^2-2ab}{2ab^2} \quad ; a \neq 0$$
$$\qquad\qquad\qquad\qquad\qquad b \neq 0$$

$$= \frac{2-2ab}{2ab^2} \quad ; a \neq 0$$
$$\qquad\qquad\qquad b \neq 0$$

$$= \frac{\cancel{2}(1-ab)}{\cancel{2}ab^2} \quad ; a \neq 0$$
$$\qquad\qquad\qquad\quad b \neq 0$$

$$= \frac{1-ab}{ab^2} \quad ; a \neq 0$$
$$\qquad\qquad\qquad b \neq 0$$

Add and Subtract Rational Expressions with Polynomial Denominators

a) $\quad LCD: (x-3)(x+2)$

1. factor denominators if possible
2. get a common denominator
3. re-write expression with a common denominator
4. add/subtract the numerator
(keep denominator the same)
5. simplify where possible
6. state restrictions (throughout process)

$$(x+2)\frac{x+5}{x-3} + \frac{x-7}{x+2}(x-3)$$
$$(x+2)\qquad\qquad\qquad (x-3)$$

$$= \frac{(x+2)(x+5)}{(x+2)(x-3)} + \frac{(x-7)(x-3)}{(x+2)(x-3)} \quad ; x \neq -2, 3$$

$$= \frac{x^2+7x+10}{(x+2)(x-3)} + \frac{x^2-10x+21}{(x+2)(x-3)} \quad ; x \neq -2, 3$$

$$= \frac{2x^2-3x+31}{(x+2)(x-3)} \quad ; x \neq -2, 3$$

b)

$$\frac{x+9}{x^2+2x-48} - \frac{x-9}{x^2-x-30}$$

LCD $= (x-6)(x+5)(x+8)$

$$= \frac{\overset{(x+5)}{x+9}}{(x+5)(x+8)(x-6)} - \frac{x-9 \quad (x+8)}{(x-6)(x+5)(x+8)}$$

$$= \frac{(x+5)(x+9)}{(x+5)(x+8)(x-6)} - \frac{(x-9)(x+8)}{(x+5)(x+8)(x-6)}$$

$$= \frac{x^2+14x+45 - (x^2-1x-72)}{(x+5)(x+8)(x-6)}$$

$$= \frac{15x+117}{(x+5)(x+8)(x-6)} \quad ; x \neq -5, -8, 6$$

c)

$$\frac{x-2}{x+2} + \frac{x+10}{x^2+6x+8}$$

LCD $= (x+2)(x+4)$

$$= \frac{\overset{(x+4)}{x-2}}{\underset{(x+4)}{x+2}} + \frac{x+10}{(x+2)(x+4)}$$

$$= \frac{(x+4)(x-2)}{(x+4)(x+2)} + \frac{x+10}{(x+4)(x+2)}$$

$$= \frac{x^2+2x-8+x+10}{(x+4)(x+2)}$$

$$= \frac{x^2+3x+2}{(x+4)(x+2)} \quad \leftarrow \text{factor}$$

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

$$= \frac{x+1}{x+4} \quad ; x \neq -4, -2$$

d)

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

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

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

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

$$= \frac{2x^2+8x-x-2}{(x+4)(x-1)}$$

$$= \frac{2x^2+7x-2}{(x+4)(x-1)} \quad ; x \neq -4, 1$$

e)

$$\frac{a+1}{5-2a} - \frac{a-4}{2a-5}$$

Binomial expressions can differ by a factor of -1. Factor -1 from one of the denominators to identify the common denominator. Then simplify each expression and state the restrictions.

$$= \frac{a+1}{-1(-5+2a)} - \frac{a-4}{2a-5}$$

$$= \frac{(-1)\,a+1}{(-1)-1(2a-5)} - \frac{a-4}{2a-5}$$

$$= \frac{-1(a+1)}{2a-5} - \frac{a-4}{2a-5}$$

$$= \frac{-1(a+1) - (a-4)}{2a-5}$$

$$= \frac{-a-1-a+4}{2a-5}$$

$$= \frac{-2a+3}{2a-5} \quad ; a \neq \frac{5}{2}$$

Complete Worksheet