Algebra II Notes on Adding/ Subtracting Rational Expressions

Today you will be doing problems that deal with adding or subtracting rational expressions. First we need to review adding and subtracting fractions. **Read this material and follow the steps and directions exactly.**

Remember from elementary/middle school, you must have **common denominators** to add or subtract fractions.

For example:	$\frac{3}{8} - \frac{1}{8}$	The problem has a common denominator (8)
	$\frac{2}{8}$	Subtract numerators
	$\frac{1}{4}$	Reduce to get the answer

If the problem did not have common denominators, you would have to make adjustments

	$\frac{5}{1}$	
For example:	6 9	The denominators are different.
	$\overline{18}$ $\overline{18}$	Why is the common denominator 18?
	$\frac{15}{18} - \frac{2}{18}$	How did we adjust the numerators?
	$\frac{13}{18}$	If the answer could be reduced, you would do that.

Now let's apply that procedure to rational expressions.

Example:	$\frac{3a}{a+2} + \frac{6}{a+2}$	The denominators are the same.
	$\frac{3a+6}{a+2}$	Add the numerators
	$\frac{3(a+2)}{(a+2)}$	To reduce, you must factor the numerator.

3 When you cancel, you get the answer. Here's another example:

$$\frac{2y}{y^2 - 4y - 12} + \frac{y}{y^2 - 10y + 24}$$

The denominators are different.

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

Factor the denominators

$$\overline{(y-6)(y+2)(y-4)}^+ \overline{(y-6)(y+2)(y-4)}$$
 Assemble the various factors

$$\frac{2y(y-4)}{(y-6)(y+2)(y-4)} + \frac{y(y+2)}{(y-6)(y+2)(y-4)}$$
 Adjust the numerators

$$\frac{2y^2 - 8y}{(y - 6)(y + 2)(y - 4)} + \frac{y^2 + 2y}{(y - 6)(y + 2)(y - 4)}$$
 Simplify the numerators

$$\frac{3y^2 - 6y}{(y - 6)(y + 2)(y - 4)}$$
Add the numerators
$$\frac{3y(y - 2)}{(y - 6)(y + 2)(y - 4)}$$
Factor the numerator

Since nothing can cancel, this is your answer.

Study each of the examples below. Make notes about what was done or what questions you have.

a.
$$\frac{6x^{2}}{3x-2} + \frac{5x-6}{3x-2} =$$
$$\frac{6x^{2}+5x-6}{(3x-2)} =$$
$$\frac{(3x-2)(2x+3)}{(3x-2)} =$$
$$\frac{(2x+3)}{1} =$$
$$(2x+3)$$

b.

$$\frac{2x+3}{9x^2+4x} - \frac{9-6x}{18x^2-19x-12} =$$

$$\frac{(2x+3)}{x(9x+4)} - \frac{(9-6x)}{(9x+4)(2x-3)} =$$

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

$$\frac{4x^2-9}{x(9x+4)(2x-3)} - \frac{9x-6x^2}{x(9x+4)(2x-3)} =$$

$$\frac{10x^2-9x-9}{x(9x+4)(2x-3)}$$

$$\frac{2c}{3a^{2}b} + \frac{a}{4bc^{2}} =$$

$$\frac{12a^{2}bc^{2}}{12a^{2}bc^{2}} + \frac{12a^{2}bc^{2}}{12a^{2}bc^{2}} =$$

$$\frac{2c(4c^{2})}{12a^{2}bc^{2}} + \frac{a(3a^{2})}{12a^{2}bc^{2}} =$$

$$\frac{8c^{3}}{12a^{2}bc^{2}} + \frac{3a^{3}}{12a^{2}bc^{2}} =$$

$$\frac{8c^{3} + 3a^{3}}{12a^{2}bc^{2}}$$

Now do these problems on your own. Check your answers on the last page when you are Finished.

d.
$$\frac{9}{5x^2y} - \frac{3}{10xy^2}$$
 e. $\frac{5a+3c}{2a} - \frac{a-c}{2a}$

f.
$$\frac{m-3}{m^2+5m+6} + \frac{m-6}{m^2-4m-12}$$
 g. $\frac{a}{a^2+3ab} - \frac{3b}{a^2-9b^2}$

c.

Now do page 378 – 379 #1, 3,5, 23, 25, 27, 29

Answers

d.
$$\frac{9}{5x^2y} - \frac{3}{10xy^2} = \frac{3}{10x^2y^2} - \frac{9(2y)}{10x^2y^2} - \frac{3(x)}{10x^2y^2} = \frac{18y - 3x}{10x^2y^2}$$

e.
$$\frac{5a+3c}{2a} - \frac{a-c}{2a} = \frac{4a+4c}{2a} = \frac{4(a+c)}{2a} = \frac{2(a+c)}{a}$$

f.

$$\frac{m-3}{m^2+5m+6} + \frac{m-6}{m^2-4m-12} = \frac{m-3}{(m+3)(m+2)} + \frac{m-6}{(m+2)(m-6)} = \frac{(m+2)(m+3)(m-6)}{(m+2)(m+3)(m-6)} = \frac{(m-3)(m-6)}{(m+2)(m+3)(m-6)} + \frac{(m-6)(m+3)}{(m+2)(m+3)(m-6)} = \frac{m^2-9m+18}{(m+2)(m+3)(m-6)} + \frac{m^2-3m-18}{(m+2)(m+3)(m-6)} = \frac{2m^2-12m}{(m+2)(m+3)(m-6)} = \frac{2m(m-6)}{(m+2)(m+3)(m-6)} = \frac{2m(m-6)}{(m+2)(m+3)(m-6)} = \frac{2m}{(m+2)(m+3)(m-6)} = \frac{2m$$

g.

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

$$\frac{a(a+3b)(a-3b)}{a(a+3b)(a-3b)} - \frac{a(a+3b)(a-3b)}{a(a+3b)(a-3b)} =$$

$$\frac{a^{2}-3ab}{a(a+3b)(a-3b)} - \frac{3ab}{a(a+3b)(a-3b)} =$$

$$\frac{a^{2}-6ab}{a(a+3b)(a-3b)} = \frac{a(a-6b)}{a(a+3b)(a-3b)} = \frac{a-6b}{(a+3b)(a-3b)}$$