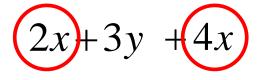
Math-3A

Lesson 4-1

Add and Subtract Rational Expressions

What are "like terms" ?

Like variables:



Multiples of the same variable

Like powers:

$$x^2 + y^2 + x^3 + x^2$$

same 'base' and same exponent.

Like radicals:

$$\sqrt{2} \rightarrow \sqrt{3} \quad \pm 3\sqrt{2}$$

same 'radicand' and same index number.

Like fractions:

$$\left(\frac{2}{3}\right)\left(\frac{4}{3}\right), \frac{3}{4}$$

same denominator.

Adding Fractions

We can add "like fractions"

$$\frac{2}{3} + \frac{1}{3} + \frac{4}{3}$$

Combine the numerator over a common denominator.

$$=\frac{2+1+4}{3} = \frac{7}{3}$$

Identity Property of Multiplication

The numeral <u>"one"</u> multiplied by any number does not change the "value" of the number (the product will have an "equivalent" value).

<u>Used for:</u>

Obtaining Common Denominators:

$$\frac{2}{3} + \frac{3}{5} = \frac{3}{5} \left(\frac{3}{3} + \frac{2}{3} \right) \left(\frac{5}{5} \right) = \frac{10}{15} + \frac{9}{15}$$

Rationalizing Denominators:

$$\frac{2}{\sqrt{3}} * \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

Least Common Multiple: The smallest number that two other numbers divide evenly.

Used for:

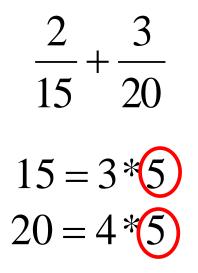
Obtaining Least Common Denominators:

$$\frac{1}{30} + \frac{1}{42} = \frac{1}{6*5} + \frac{1}{6*7} = \frac{1}{6*5} + \frac{1}{6*7} = \frac{1}{6*5} + \frac{7}{7} + \frac{1}{6*7} + \frac{5}{5}$$

Both denominators have a common factor of 6.

Left denominator has an uncommon factor of 5 Multiply $\frac{1}{42}$ by "one" in the form of $\frac{5}{5}$ right denominator has an uncommon factor of 7 Multiply $\frac{1}{30}$ by "one" in the form of $\frac{7}{7}$

Find the LCD



$$\frac{1}{60} + \frac{1}{48}$$

60 = 2 6 5
48 = 6 8 = 6 2 4

$$LCD = 3 * 4 * 5$$
$$LCD = 60$$

$$LCD = 2 * 6 * 4 * 5$$

 $LCD = 240$

Vocabulary

A <u>rational number</u> can be written as a ratio of integers. $\frac{2}{5}, \frac{3}{1}$

A rational expression can be written as a ratio of expressions.

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

We will be looking at <u>ratios of polynomial expressions</u>.

Excluded Value: the value for 'x' that results in division by zero

$$\frac{x}{(x+1)}, \quad x \neq -1$$

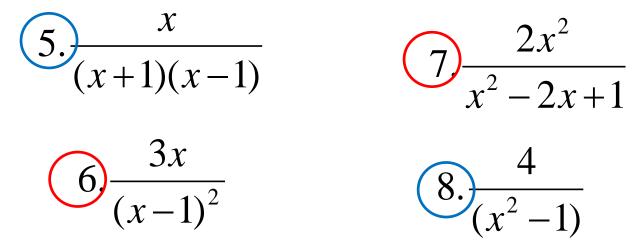
What type of <u>rational expressions</u> can you combine together using addition or subtraction?

"like rational expressions"

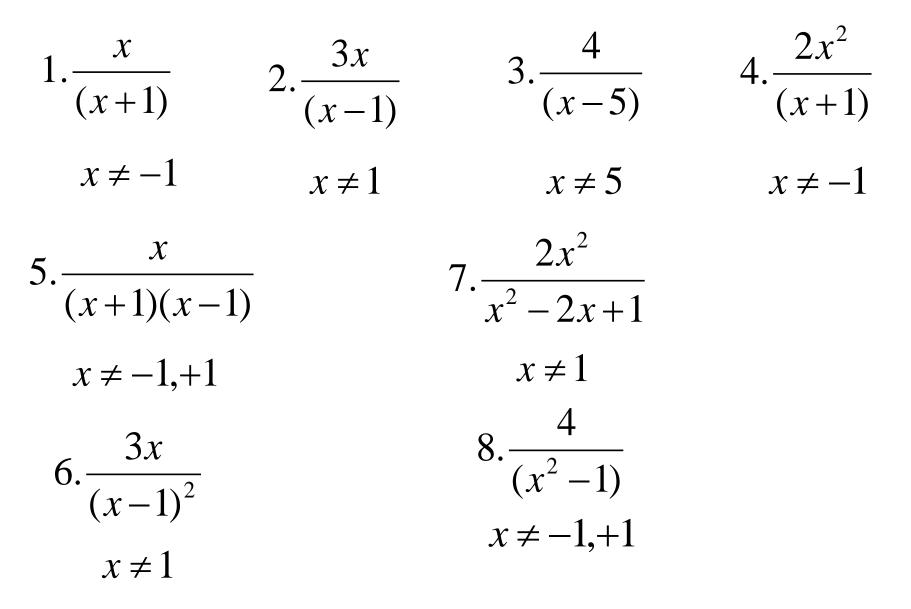
Which of these expressions are "like expressions"?



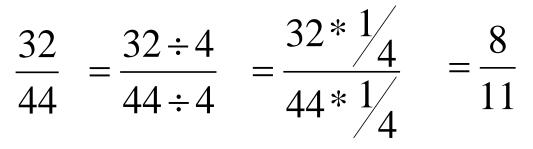
Which of these expressions are "like expressions"?



What is the excluded value for each expression?



Simplifying Fractions



What property are you applying?

Identity Property Of Multiplication "multiplying by '1' in the form of 1/4 over 1/4"

<u>Unfortunately</u> this method <u>WILL NOT WORK</u> for simplification of ratios of polynomials.

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

Simplifying Fractions

You must FACTOR the fractions.

$$\frac{32}{44} = \frac{4*8}{4*11}$$

Break them apart into the product of fractions.

$$=\frac{4}{4}*\frac{8}{11}$$

Notice the fractions that equal '1'

$$=1*\frac{8}{11} = \frac{8}{11}$$

Simplifying Fractions

You must FACTOR the fractions.

$$\frac{32}{44} = \frac{4*8}{4*11} \qquad \qquad \frac{x^2 - 4}{x^2 - 3x + 2} = \frac{(x-2)(x+2)}{(x-2)(x-1)}$$

Break them apart into the product of fractions.

$$=\frac{4}{4}*\frac{8}{11} = \frac{(x-2)}{(x-2)}*\frac{(x+2)}{(x-1)}$$

Notice the fractions that equal '1'

$$=1*\frac{8}{11} = \frac{8}{11}$$

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

Adding/Subtraction Rational Expressions

The easy problem:
$$\frac{2}{7} + \frac{3}{7} = \frac{2+3}{7} = \frac{5}{7}$$

Combine the numerator over a <u>common</u> denominator.

easy problem:
$$\frac{4}{(x-5)} + \frac{3x}{(x-5)} = \underbrace{4+3x}_{(x-5)}$$

Combine the numerator over a common denominator.

Can you combine Why not? 4 and 3x ?

The

Your turn: add/subtract

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

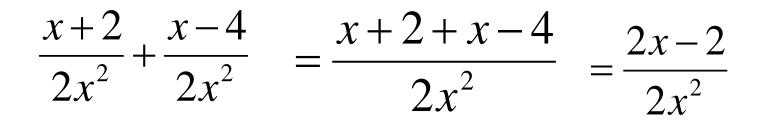
$$=\frac{2(x-1)}{2^{*}x^{2}} = \frac{(x-1)}{x^{2}}$$

What property are we using? Inverse Property of Multiplication.

Can you do it this way?

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

Why not? You CANNOT use the Inverse Property of Multiplication on <u>addends.</u> Your turn: add/subtract



$$=\frac{2(x-1)}{2^*x^2}$$

I <u>will not</u> allow you to simplify using the Inverse Property of Multiplication until you have factored it into two fractions.

$$=\frac{2}{2}*\frac{(x-1)}{x^2} = \frac{(x-1)}{x^2}$$

Only then will you be able to see how the Inverse Property of Multiplication changes the rational expression into <u>multiplication by one.</u> Your turn: add/subtract

Which one is correct?

3

$$\frac{(2x-7)}{x^2+2} + \frac{x-4}{x^2+2} = \frac{2x-7-x-4}{x^2+2}$$
$$= \frac{2x-7-x+4}{x^2+2}$$
$$= \frac{2x-7-x+4}{x^2+2}$$

$$\frac{(2x-7) - (x-4)}{x^2 + 2} = \frac{2x - 7 - x - (-4)}{x^2 + 2} = \frac{x-3}{x^2 + 2}$$

Subtract every term in the right side numerator! (Half of you will make this mistake on the HW and on the Test).

Can you factor this into two fractions multiplied together?

One third of you will miss this on the test.