Warm-Up...

The algebraic expression $\left(\frac{x}{1}-\frac{4}{(x-3)}\right)\div\left(\frac{x}{1}+\frac{2+6x}{(x-3)}\right)$ in its most simplified form is:

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

B) $\frac{2(x-1)}{(x-3)}$

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

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

$\left[\frac{x(x-3)-4}{x-3}\right]\div\left[\frac{x(x-3)+2+6x}{x-3}\right]$

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

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

Simplifying complex fractions...fractions within fractions!!

Here is an example:

Simplify this expression...

$$\frac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{4}+\frac{2}{3}} = \frac{10}{11}$$

What were your strategies??

Simplifying Complex Fractions — First Technique. To simplify a complex fraction, proceed as follows:

1. Simplify the numerator.
2. Simplify the denominator.
3. Simplify the division problem that remains.

$$\frac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{4}+\frac{2}{3}} = \frac{\frac{3}{6}+\frac{2}{6}}{\frac{3+8}{12}} = \frac{\frac{5}{6}}{\frac{11}{12}} \quad (\div) \Rightarrow \frac{5}{\cancel{6}_{1}} \cdot \frac{\cancel{12}^{2}}{11} = \frac{10}{11}$$

$$\frac{3}{8}\frac{x^2}{x^2} = \frac{6}{16}$$

Simplifying Complex Fractions — Second Technique. To simplify a complex fraction, proceed as follows:

1. Find a common denominator for both numerator and denominator.
2. Clear fractions from the numerator and denomaintor by multiplying each by the common denominator found in the first step.

$$\frac{\left(\frac{1}{2}+\frac{1}{3}\right)(12)}{\left(\frac{1}{4}+\frac{2}{3}\right)(12)} = \frac{6+4}{3+8} = \frac{10}{11}$$

LCD

LCD

Note that the technique indicates that you should multiply the numerator and denominator by the common denominator...NOT...change the denominators.

Does this make sense?? Let's have a look

Let's give these a try...

$$\frac{\frac{3x^2+5x}{x^2-25}}{\frac{2}{x-5}+\frac{1}{x+5}} = x$$

$$\frac{(2x+7)(x-3)}{(x+5)(5x-13)}$$

Solution A: Common Denominators

$$\frac{\frac{x(3x+5)}{(x-5)(x+5)}}{\frac{2(x+5)+1(x-5)}{(x-5)(x+5)}} \div$$

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

$$= x$$

or Solution B: Multiply by LCD

$$\frac{\frac{3x^2+5x}{(x-5)(x+5)}}{\left(\frac{2}{x-5}+\frac{1}{x+5}\right)} \cdot \frac{(x-5)(x+5)}{(x-5)(x+5)}$$

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

$$\frac{x(3x+5)}{3x+5}$$

$$= x$$

$$\frac{\left(\frac{2}{1}-\frac{3}{x+5}\right)}{\left(\frac{5}{1}+\frac{2}{x-3}\right)}\cdot\frac{(x+5)(x-3)}{(x+5)(x-3)}$$

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

$$=\frac{2(x^2+2x-15)-3x+9}{5(x^2+2x-15)+2x+10}$$

$$=\frac{2x^2+x-21}{5x^2+12x-65}$$

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$2x^2+7x-6x-21$

$x(2x+7)-3(2x+7)$

$(2x+7)(x-3)$

$5x^2+25x-13x-65$

$5(x+5)-13(x+5)$

$(5x-13)(x+5)$

$$=\frac{(2x+7)(x-3)}{(5x-13)(x+5)}$$

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

$(x+1)^2$

$$\left[\frac{(x+1)(x+1)-(1-x)(x-1)}{(x-1)(x+1)}\right]$$

$-1(-1+x)$
$-1(x-1)$

$$\left[\frac{(x-1)^2+(x+1)^2}{(x-1)^2(x+1)^2}\right]$$

$$\left[\frac{(x+1)^2+(x-1)^2}{(x-1)(x+1)}\right]\cdot\frac{(x-1)^2(x+1)^2}{(x-1)^2+(x+1)^2}$$

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

$$=x^2-1$$

Practice Problems...

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BONUS:

#23 (Must clearly show all work)