Rational Expressions: Different Denominators

Addition and Subtraction of Rational Expressions Having Different Denominators

1. Find the LCD of the rational expression.
2. Write each rational expression as an equivalent rational expression with the LCD as the denominator.
3. Perform the indicated addition or subtraction as before.
4. Reduce the result to lowest terms.

$\frac{2}{w^2-16}+\frac{3}{4w+16}-\frac{7}{4w-16}$ Factor the denominators. $\frac{2}{(w+4)(w-4)}+\frac{3}{4(w+4)}-\frac{7}{4(w-4)}$

The LCD is: $4(w+4)(w-4)$. Multiply each fraction (top and bottom) by the missing factor of the LCD.

$$\frac{2(4)}{(4)(w+4)(w-4)}+\frac{3(w-4)}{4(w+4)(w-4)}-\frac{7(w+4)}{4(w-4)(w+4)}$$

Add or subtract the resulting expression.

$$\frac{8}{(4)(w+4)(w-4)}+\frac{3w-12}{4(w+4)(w-4)}-\frac{7w+28}{4(w-4)(w+4)}$$

$$\frac{8+3w-12-(7w+28)}{(4)(w+4)(w-4)}=\frac{8+3w-12-7w-28}{(4)(w+4)(w-4)}=\frac{-4w-32}{(4)(w+4)(w-4)}$$

ALWAYS check to see if the final rational expression can be factored and reduced.

$\frac{-4w-32}{(4)(w+4)(w-4)}=\frac{-4(w+8)}{(4)(w+4)(w-4)}=\frac{-(w+8)}{(w+4)(w-4)}$ usually written $-\frac{w+8}{(w+4)(w-4)}$

One may leave the denominator in factored form.

Sometimes the denominators cannot be factored, so the LCD is the product of the denominators.

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

$$\frac{2(x+4)+5(2x-3)}{(2x-3)(x+4)}=\frac{2x+8+10x-15}{(2x-3)(x+4)}=\frac{12x-7}{(2x-3)(x+4)}$$

Sometimes the original rational expressions can be factored and reduced, thus making a smaller LCD.

$$\frac{8r}{2r^2+4r+2}-\frac{3r-3}{r^2-1} = \frac{8r}{2(r+1)(r+1)}-\frac{3(r-1)}{(r-1)(r+1)} = \frac{4r}{(r+1)(r+1)}-\frac{3}{(r+1)} \quad \text{LCD = } (r+1)(r+1)$$

$\frac{4r}{(r+1)(r+1)}-\frac{3(r+1)}{(r+1)(r+1)}$ Only the denominator of the last rational expression needed to be changed.

$$\frac{4r-3(r+1)}{(r+1)(r+1)} = \frac{4r-3r-3}{(r+1)(r+1)} = \frac{r-3}{(r+1)(r+1)} \text{ or } \frac{r-3}{(r+1)^2}$$

TRY:

$$\frac{2}{15x^2}+\frac{5}{12x}$$

$$\frac{5x^2}{30xy}-\frac{30x}{80y}$$

$$\frac{2}{a^2b}-\frac{3}{ab^2}$$

$$\frac{5}{x+2}+\frac{3}{x-2}$$

$$\frac{3}{x-5}+\frac{7}{5-x}$$

$$\frac{1}{x^2+5x+6}-\frac{1}{x^2+6x+9}$$

$$\frac{2}{z^2-25}+\frac{2}{5z+25}-\frac{2}{5z-25}$$