

# Adding and Subtracting Rational Expressions

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Example 1:

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

Since these are NOT like terms, we must make them like terms.

$$\text{LCD} = 2x^2$$

The first fraction needs to be multiplied by  $\frac{2x}{2x}$  to make the denominator  $2x^2$  [the second fraction does not need to be changed].

$$\begin{aligned} \left(\frac{2x}{2x}\right) \frac{4}{x} + \frac{1}{2x^2} &= \frac{8x}{2x^2} + \frac{1}{2x^2} \\ &= \boxed{\frac{8x + 1}{2x^2}} \end{aligned}$$

Example 2:

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$$\frac{3}{a} + \frac{2}{b}$$

$$\text{LCD} = ab$$

$$\begin{aligned} \left(\frac{b}{b}\right) \frac{3}{a} + \left(\frac{a}{a}\right) \frac{2}{b} &= \frac{3b}{ab} + \frac{2a}{ab} \\ &= \boxed{\frac{3b + 2a}{ab}} \end{aligned}$$

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Example 3:

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

$$\text{LCD} = x^2y^2$$

$$\begin{aligned} \left(\frac{y}{y}\right)\frac{3}{x^2y} + \left(\frac{x}{x}\right)\frac{2}{xy^2} - \left(\frac{xy}{xy}\right)\frac{1}{xy} &= \frac{3y}{x^2y^2} + \frac{2x}{x^2y^2} - \frac{xy}{x^2y^2} \\ &= \boxed{\frac{3y + 2x - xy}{x^2y^2}} \end{aligned}$$

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Example 4:

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

$$\text{LCD} = x(x+4)$$

$$\begin{aligned} \left(\frac{x}{x}\right)\frac{1}{x+4} + \left(\frac{x+4}{x+4}\right)\frac{2}{x} &= \frac{x}{x(x+4)} + \frac{2(x+4)}{x(x+4)} \\ &= \frac{x+2(x+4)}{x(x+4)} \end{aligned}$$

Now simplify the numerator completely.

**NOTE:** There is no need to multiply the denominator out.

$$\begin{aligned} &= \frac{x+2x+8}{x(x+4)} \\ &= \boxed{\frac{3x+8}{x(x+4)}} \end{aligned}$$

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Example 5:

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$$\frac{x}{x-2} - \frac{8}{x^2-4}$$

To find the LCD, we must first factor each denominator completely.

$$\frac{x}{x-2} - \frac{8}{(x+2)(x-2)}$$

$$\text{LCD} = (x+2)(x-2)$$

$$\begin{aligned} \left(\frac{x+2}{x+2}\right) \frac{x}{x-2} - \frac{8}{(x+2)(x-2)} &= \frac{x(x+2)}{(x+2)(x-2)} - \frac{8}{(x+2)(x-2)} \\ &= \frac{x(x+2)-8}{(x+2)(x-2)} \end{aligned}$$

Now simplify the numerator completely.

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

We need to factor the numerator (if possible) to see if anything cancels.

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

The  $(x-2)$ 's cancel out, so our final answer is:

$$= \boxed{\frac{x+4}{x+2}}$$

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## Practice Problems

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Evaluate:

1.  $\frac{3}{x} + \frac{7}{4x^2}$

2.  $\frac{6}{a^2b} - \frac{3}{ab^2} + \frac{1}{ab}$

3.  $\frac{2x}{x-1} - \frac{3}{x^2-1}$