



# Adding and Subtracting Rational Expressions

Obj: Find a common denominator of algebraic fractions.

Obj: Add and subtract algebraic fractions.



Finding the least common multiple (LCM)  $\frac{3}{3} \cdot \frac{1}{2} + \frac{2 \cdot 2}{3 \cdot 2} = \frac{3}{6} + \frac{4}{6} = \frac{7}{6}$

- Factor each number or polynomial
- LCM contains each factor the greatest number of times it appears as a factor (greatest exponent)

1) Find LCM of  $15a^2bc^3$ ,  $16b^5c^2$ , and  $20a^3c^6$ .

$$15a^2bc^3 = 3 \cdot 5 \cdot a^2 \cdot b \cdot c^3$$

$$16b^5c^2 = 2^4 \cdot b^5 \cdot c^2$$

$$20a^3c^6 = 2^2 \cdot 5 \cdot a^3 \cdot c^6$$

$$\begin{array}{r}
 4 \cdot 5 \\
 \wedge \quad | \\
 2 \cdot 2 \quad 5
 \end{array}$$

$$\text{LCM} = 2^4 \cdot 3 \cdot 5 \cdot a^3 \cdot b^5 \cdot c^6 = 240a^3b^5c^6$$



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2) Find LCM of  $x^3 - x^2 - 2x$  and  $x^2 - 4x + 4$

$$x^3 - x^2 - 2x = x(x^2 - x - 2) = x(x+1)(x-2)$$

$$x^2 - 4x + 4 = (x-2)(x-2) = (x-2)^2$$

$$\text{LCM} = x(x+1)(x-2)^2$$



To add & subtract rational expressions, you must have a common denominator. ( $LCD = LCM$ )

Recall:  $\frac{2}{3} + \frac{3}{5} = \frac{19}{15}$

$$\frac{2}{15} + \frac{3}{50} = \frac{29}{150}$$



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3)  $\frac{5a^{2,7a^2b}}{6b} + \frac{9 \cdot 3}{14a^2b^2} =$

LCM =  $2 \cdot 3 \cdot 7 \cdot a^2 \cdot b^2$   
 $42a^2b^2$

$\frac{(35a^4b^2 + 27)}{42a^2b^2} = \frac{35a^4b^2 + 27}{42a^2b^2}$

4)  $\frac{5a^v}{6v} + \frac{7 \cdot 3}{4v^2}$

LCM =  $2^2 \cdot 3 \cdot v^2$   
 $12v^2$

$= \frac{(10v + 21)}{12v^2}$

5)  $\frac{(x+10)}{3(x-5)} - \frac{(3x+15)}{6(x-5)}$

LCM =  $2 \cdot 3 \cdot (x-5)$   
 $6(x-5)$

$\frac{2x+20 - (3x+15)}{6(x-5)} = \frac{2x+20-3x-15}{6(x-5)} = \frac{-x+5}{6(x-5)}$

$\frac{-1}{6}$



Make sure answer is in simplest form



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~~6)~~  $\frac{a}{(a-4)} - \frac{-3}{(4-a)}$  opp  
 $(a-4)$

LCD = a - 4

$$\frac{a - (-3)}{a-4}$$

$$\boxed{\frac{(a+3)}{(a-4)}}$$

7)  $\frac{(d-4)}{d^2+2d-8} - \frac{*}{d^2-16}$   
 LCD: (d+4)(d-2)(d-4)  
 $\frac{(d-4)}{(d+4)(d-2)} - \frac{(d+2)(d-2)}{(d+4)(d-4)}$

$$\frac{d^2 - 8d + 16 - (d^2 - 4)}{\text{LCD}} =$$

$$\frac{d^2 - 8d + 16 - d^2 + 4}{\text{LCD}} =$$

$$\frac{-8d + 20}{\text{LCD}}$$

$$\boxed{\frac{-4(2d-5)}{(d+4)(d-2)(d-4)}}$$



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## Simplifying Complex Fractions

$$8) \frac{\frac{1}{a} + \frac{1}{b}}{\frac{1}{b} - 1}$$

First, simplify numerator.

Then, simplify denominator.

Then, rewrite as division.

Keep change flip

$$\frac{\frac{1}{a} + \frac{1}{b}}{b+a} \quad \text{LCD} = ab$$

$$\frac{\frac{1}{b} - \frac{1}{1}}{b} \quad \text{LCD} = b$$

$$\frac{\frac{b+a}{ab}}{\frac{1-b}{b}}$$

$$\Rightarrow \frac{(b+a)}{ab} \cdot \frac{b}{(1-b)} =$$

$$\boxed{\frac{b+a}{a(1-b)}}$$