

What do we need to add fractions?

Add or subtract. Identify any x -values for which the expression is undefined.

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

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



$$\frac{3x-4}{x^2+1} - \frac{6x+1}{x^2+1} = \frac{3x-4-(6x+1)}{x^2+1}$$

$$\frac{3x-4-6x-1}{x^2+1} = \frac{-3x-5}{x^2+1}$$

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

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

But what if we don't have a common denominator?

Least Common Multiple (LCM) of Polynomials

To find the LCM of polynomials:

1. Factor each polynomial completely. Write any repeated factors as powers. For example,
 $x^3 + 6x^2 + 9x = x(x + 3)^2$.
2. List the different factors. If the polynomials have common factors, use the highest power of each common factor.



Example Time!

Find the least common multiple for each pair.

$$x^2 \cdot x^2 = x^4 \qquad x^4 \cdot 1 = x^4$$

A. $4x^2y^3$ and $6x^4y^5$

$$\begin{array}{l}
 \underline{4}x^2y^3 \quad \underline{6}x^4y^5 \\
 \underline{2}x^2y^3 \cdot \underline{2}x^2y^3 = y^5 \\
 \underline{2}x^4y^5 \cdot \underline{1} = y^5 \\
 \underline{12}x^4y^5
 \end{array}$$

B. $x^2 - 2x - 3$ and $x^2 - x - 6$

$$\begin{array}{cc}
 (x-3)(x+1) & (x-3)(x+2) \\
 \checkmark \quad \checkmark & \checkmark \quad \checkmark
 \end{array}$$

$$\text{LCM: } (x-3)(x+1)(x+2)$$

You're Turn

Find the least common multiple for each pair.

a. $4x^3y^7$ and $3x^5y^4$

$$12x^5y^7$$

b. $x^2 - 4$ and $x^2 + 5x + 6$

$$(x+2)(x-2) \quad (x+2)(x+3)$$

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

Its Time!

Add. Identify any x-values for which the expression is undefined.

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

$$\frac{x-3}{\cancel{(x+4)}\cancel{(x-1)}} + \frac{2x}{\cancel{(x+4)}\cancel{(x-1)}} \quad \text{LCD: } (x+4)(x-1)$$

$$\frac{x-3}{(x+4)(x-1)} + \frac{2x^2-2x}{(x+4)(x-1)} = \frac{2x^2-x-3}{(x+4)(x-1)}$$

$$\frac{(2x^2+2x)(3x-3)}{(x+4)(x-1)} = \frac{2x(x+1)-3(x+1)}{(x+4)(x-1)} = \frac{(2x-3)(x+1)}{(x+4)(x-1)}$$

$x \neq -4 \quad x \neq 1$

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

$$\frac{\cancel{(x-2)}x}{\cancel{(x+2)}\cancel{(x-2)}} + \frac{-8}{\cancel{(x+2)}\cancel{(x-2)}} \quad \text{LCD: } (x+2)(x-2)$$

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

$$\frac{\cancel{(x-4)}\cancel{(x+2)}}{\cancel{(x+2)}\cancel{(x-2)}} = \frac{x-4}{x-2} \quad \begin{matrix} x \neq 2 \\ x \neq -2 \end{matrix}$$

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

Subtract $\frac{3x-2}{2x+5} - \frac{2}{5x-2}$. Identify any x-values for which the expression is undefined.

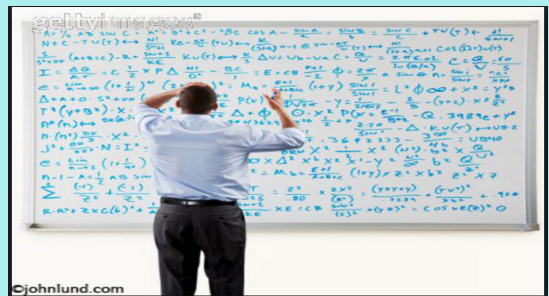
Now, You Try!

Subtract $\frac{2x^2 - 30}{x^2 - 9} - \frac{x + 5}{x + 3}$. Identify any x -values for which the expression is undefined.

$$\frac{x}{x + 3} + \frac{2x + 6}{x^2 + 6x + 9}$$

Complex Fractions

A **complex fraction** contains one or more fractions in its numerator, its denominator, or both.



$\frac{x + 2}{\frac{3}{x}}$	$\frac{1 + \frac{1}{x}}{4x + 5}$	$\frac{x + 3}{\frac{x}{x + 4}}$
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Examples(Whoo!)

$$1) \frac{x+2}{\frac{x-1}{\frac{x-3}{x+5}}} \uparrow \text{divide}$$

Method 1

$$\frac{x+2}{x-1} \cdot \frac{x-3}{x+5}$$

$$\frac{x+2}{x-1} \cdot \frac{x+5}{x-3}$$

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

$$\text{LCD: } (x-1)(x+5)$$

Method 2:

$$\frac{(x+2)}{\cancel{(x-1)}} \cdot \frac{\cancel{(x-1)}(x+5)}{1}$$

$$\frac{(x-3)}{\cancel{x+5}} \cdot \frac{\cancel{(x-1)}(x+5)}{1}$$

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

And Another!

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

Method 1:

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

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

$$\left(\frac{6}{2x} + \frac{x^2}{2x}\right) \cdot \left(\frac{x}{x-1}\right)$$

$$\left(\frac{6+x^2}{2x}\right) \cdot \left(\frac{x}{x-1}\right)$$

$$\frac{6+x^2}{2(x-1)}$$

LCD: $2x$

Method 2:

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

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

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

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

$$\frac{6+x^2}{2(x-1)}$$