

What you will learn about:
Simplifying Rational Complex Expressions

Simplifying Complex Rational Expressions by Dividing

Step 1 - Simplify the numerator and denominator

Step 2 – Rewrite complex expression as a division problem

Step 3 – Divide the expression

$$\frac{y_1}{y_2} \cdot \frac{(y+3)(y-3)}{8} \cdot \frac{8}{2}$$

$$\frac{y+3}{2}$$

Simplify: $\frac{\frac{4}{y-3}}{\frac{8}{y^2-9}}$

$$\frac{\frac{4}{y-3}}{\frac{8}{(y+3)(y-3)}}$$

$\frac{4}{y-3} \div \frac{8}{(y+3)(y-3)}$

Simplify: $\frac{\frac{1}{3} + \frac{1}{6}}{\frac{1}{2} - \frac{1}{3}} \cdot \frac{\frac{1}{3} + \frac{1}{4}}{\frac{1}{2} - \frac{1}{3}}$

$$\frac{\frac{2}{6} + \frac{1}{6}}{\frac{3}{6} - \frac{2}{6}} = \frac{\frac{3}{6}}{\frac{1}{6}}$$

$$\frac{\frac{3}{6}}{\frac{1}{6}} \div \frac{1}{6}$$

$$\frac{3}{6} \cdot \frac{6}{1} = 3$$

Simplify: $\frac{\frac{1}{x} + \frac{1}{y}}{\frac{x}{y} - \frac{y}{x}} \cdot \frac{\frac{1}{x} + \frac{1}{y}}{\frac{x}{y} - \frac{y}{x}}$

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

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

$$\frac{x^2-y^2}{xy}$$

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

$$\frac{x+y}{x^2-y^2}$$

$$(x+y)(x-y)$$

$$\frac{1}{x-y}$$

Simplify: $\frac{\frac{1}{x^2-7x+12}}{\frac{2}{x-4}}$

$$\frac{\frac{1}{(x-4)(x-3)}}{\frac{2}{x-4}} \div \frac{2}{x-4}$$

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

Simplify: $\frac{\frac{3}{4} - \frac{1}{2}}{\frac{1}{8} + \frac{5}{6}}$

$$\frac{\frac{9}{12} - \frac{4}{12}}{\frac{3}{24} + \frac{20}{24}} = \frac{\frac{5}{12}}{\frac{23}{24}}$$

$$\frac{5}{12} \div \frac{23}{24} \quad \frac{5}{12} \cdot \frac{24}{23} = \frac{10}{23}$$

Simplify: $\frac{\frac{1}{a} + \frac{1}{b}}{\frac{1}{a^2} - \frac{1}{b^2}} \cdot \frac{\frac{1}{a} + \frac{1}{b}}{\frac{1}{a^2} - \frac{1}{b^2}}$

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

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

$$\frac{b+a}{ab} \cdot \frac{a^2 b^2}{b^2-a^2}$$

$$(b+a)(b-a)$$

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

Simplify: $\frac{\frac{n}{n+5} - \frac{4n}{n+5}}{\frac{1}{n+5} + \frac{1}{n-5}}$

$$\begin{aligned} & \frac{n(n+5)}{1} - \frac{4n}{n+5} \\ & \underline{\frac{1(n+5)}{n+5} + \frac{1(n+5)}{n-5}} \\ & \frac{n^2+5n - 4n}{n+5} \\ & \underline{\frac{n-5}{(n-5)(n+5)} + \frac{n+5}{(n-5)(n+5)}} \end{aligned}$$

Simplifying by using the LCD

Step 1 – Find the LCD of all the fractions in the rational expression

Step 2 – Multiply the numerator and the denominator by the LCD

Step 3 – Simplify the Expression

Simplify: $\frac{\frac{1}{2} + \frac{1}{5}}{\frac{1}{10} + \frac{1}{5}} \cdot \frac{10(\frac{1}{2} + \frac{1}{5})^{10}}{10(\frac{1}{10} + \frac{1}{5})^{10}}$

$$\begin{aligned} & \frac{5+2}{1+2} \\ & \frac{7}{3} \end{aligned}$$

Simplify: $\frac{\frac{1}{x} + \frac{1}{y}}{\frac{x-y}{xy}} \cdot \frac{xy(\frac{1}{x} + \frac{1}{y})^{xy}}{xy(\frac{x-y}{xy})^{xy}}$

$$\begin{aligned} & \frac{y+x}{x^2-y^2} \\ & \frac{xy}{(xy)^2(x-y)} \end{aligned}$$

$$\frac{1}{x-y}$$

Simplify: $\frac{\frac{b}{2} - \frac{3b}{b+5}}{\frac{2}{b+5} + \frac{1}{b-5}}$

$$\begin{aligned} & \frac{\frac{n^2+n}{n+5}}{\frac{2n}{(n-5)(n+5)}} \\ & \frac{n(n+1)}{n+5} \cdot \frac{(n-5)(n+5)}{2n} \\ & \frac{(n+1)(n-5)}{2} \end{aligned}$$

Simplify: $\frac{\frac{1}{4} + \frac{3}{8}}{\frac{1}{2} - \frac{5}{16}} \cdot \frac{16(\frac{1}{4} + \frac{3}{8})^{16}}{16(\frac{1}{2} - \frac{5}{16})^{16}}$

$$\frac{4+6}{8-5} = \frac{10}{3}$$

Simplify: $\frac{\frac{1}{x^2} - \frac{1}{y^2}}{\frac{1}{x} + \frac{1}{y}} \cdot \frac{xy^2(\frac{1}{x^2} - \frac{1}{y^2})^{xy^2}}{xy^2(\frac{1}{x} + \frac{1}{y})^{xy^2}}$

$$\begin{aligned} & \frac{y^2-x^2}{xy^2+x^2y} \\ & \frac{(y-x)(y+x)}{xy(y+x)} \end{aligned}$$

$$\frac{y-x}{xy}$$

$$LCD = (x+2)(x-2)$$

Simplify: $\frac{\frac{2}{x+6}}{\frac{4}{x-6} - \frac{4}{x^2-36}}$.

$$(x-7)(x+7)$$

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

$$2x+14 - x - 7$$

Simplify: $\frac{\frac{2}{x+7} - \frac{1}{x-7}}{\frac{6}{x+7} - \frac{1}{x^2-49}}$.

$$\begin{aligned} & \frac{2(x+7) - (x-7)}{4(x-7) - 1} \\ & \frac{2x+14 - x + 7}{4x-28 - 1} \\ & \frac{x+21}{4x-29} \end{aligned}$$

Simplify: $\frac{\frac{4}{y+5} + \frac{2}{y+6}}{\frac{3y}{y^2+11y+30}}$.

$$\begin{aligned} & \frac{4(y+6) + 2(y+5)}{3y} \\ & \frac{4y+24 + 2y+10}{3y} \\ & \frac{6y+34}{3y} \end{aligned}$$

Simplify: $\frac{\frac{3}{x+2}(x+2)(x-2)}{\frac{5}{x-2} - \frac{3}{x^2-4}}$.

$$\begin{aligned} & \frac{3(x-2)}{5(x+2)-3} \\ & \frac{3x-6}{5x+10-3} = \frac{3x-6}{5x+7} \end{aligned}$$

Simplify: $\frac{3}{\frac{x^2+7x+10}{x+2 + \frac{1}{x+5}}}$.

$$\begin{aligned} & \frac{3}{4(x+5)+1(x+2)} \\ & \frac{3}{4x+20+x+2} \\ & \frac{3}{5x+22} \end{aligned}$$

Simplify: $\frac{\frac{y}{y+1}}{1 + \frac{1}{y-1}}$.

$$\begin{aligned} & \frac{\frac{y}{y+1}}{\frac{y-1}{y-1} + \frac{1}{y-1}} \\ & \frac{\frac{y}{y+1}}{\frac{y-1+1}{y-1}} = \frac{y-1}{y+1} \end{aligned}$$

$$\begin{aligned} & \frac{6y}{3y} + \frac{34}{3y} \\ & 2 + \frac{34}{3y} \end{aligned}$$

$$\frac{y}{y+1} \cdot \frac{y-1}{y}$$