

Rational Expressions Division

To Divide Rational Expressions

- 1.) Change the sign to Multiplication AND invert(flip) the SECOND fraction.
- 2.) Completely factor numerators & denominators of both fractions.
- 3.) Multiply tops together & bottoms together (but leave factored)
- 4.) Cancel factors that are common to both the numerator & denominator (write in lowest terms).

The order of the first 2 steps is EXTREMELY IMPORTANT. Your answer will be wrong if you try to cancel before you change to multiplication!

Examples:

$$\begin{aligned} \frac{(x+3)^2}{5} \div \frac{5x+15}{25} &\xrightarrow{\text{Invert \& Multiply}} \frac{(x+3)^2}{5} * \frac{25}{5x+15} \\ &\xrightarrow{\text{Factor}} \frac{(x+3)^2}{5} * \frac{5*5}{5(x+3)} \xrightarrow{\text{cancel}} \frac{(x+3)}{1} * \frac{1}{1} \rightarrow x+3 \end{aligned}$$

$$\begin{aligned} \frac{x+4}{x^2-16} \div \frac{5x-10}{(x-2)^2} &\xrightarrow{\text{Invert \& Multiply}} \frac{x+4}{x^2-16} * \frac{(x-2)^2}{5x-10} \\ &\xrightarrow{\text{Factor}} \frac{(x+4)}{(x+4)(x-4)} * \frac{(x-2)^2}{5(x-2)} \xrightarrow{\text{Cancel}} \frac{x-2}{5(x-4)} \end{aligned}$$

$$\begin{aligned} \frac{3w^2+6w-24}{5w^2+30w+45} \div \frac{w^2-4w+4}{10w+30} &\xrightarrow{\text{Invert \& Multiply}} \frac{3w^2+6w-24}{5w^2+30w+45} * \frac{10w+30}{w^2-4w+4} \\ &\xrightarrow{\text{Factor}} \frac{3(w+4)(w-2)}{5(w+3)^2} * \frac{5*2(w+3)}{(w-2)^2} \xrightarrow{\text{Cancel}} \frac{3(w+4)*2}{(w+3)(w-2)} \rightarrow \frac{6(w+4)}{(w+3)(w-2)} \end{aligned}$$

$$\begin{aligned}
& \frac{18s^2 + 18st + 4t^2}{3s^2 - 2st - t^2} \div \left(\frac{s-t}{3s^2 + 4st + t^2} * \frac{3s+2t}{s+t} \right) \xrightarrow{\text{Inside_Parentheses}} \\
& \frac{18s^2 + 18st + 4t^2}{3s^2 - 2st - t^2} \div \left(\frac{(s-t)}{(3s+t)(s+t)} * \frac{(3s+2t)}{s+t} \right) \rightarrow \frac{18s^2 + 18st + 4t^2}{3s^2 - 2st - t^2} \div \left(\frac{(s-t)(3s+2t)}{(3s+t)(s+t)(s+t)} \right) \\
& \xrightarrow{\text{Invert \& Multiply}} \frac{18s^2 + 18st + 4t^2}{3s^2 - 2st - t^2} * \frac{(3s+t)(s+t)(s+t)}{(s-t)(3s+2t)} \xrightarrow{\text{Factor}} \\
& \frac{2(3s+2t)(3s+t)}{(3s+t)(s-t)} * \frac{(3s+t)(s+t)(s+t)}{(s-t)(3s+2t)} \xrightarrow{\text{Cancel}} \frac{2(3s+2t)(s+t)^2}{(s-t)^2}
\end{aligned}$$
