Ex 1) Simplify: \[
\frac{x + 2}{x - 2} \cdot \frac{x^2 - 4}{x^2 + x - 2}
\]

When asked to multiply rational expressions, don't multiply (just say NO). Think of it as one rational expression that someone partially factored. Then follow the steps from our previous lesson:
1) Factor the numerators completely
2) Factor the denominators completely
3) Divide any like FACTORS (not terms)
4) Leave your answer in factored form (usually).

\[
\frac{(x + 2)(x^2 - 4)}{(x - 2)(x^2 + x - 2)} \cdot \frac{(x + 2)}{(x - 2)(x + 2)(x - 1)}
\]
\[
\frac{(x+2)(x-2)(x+2)}{(x-2)(x+2)(x-1)}
\]

Division Rule for Fractions

Let \( a, b, c \) and \( d \) be real numbers with \( b \neq 0 \) and \( d \neq 0 \)

\[
\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}
\]
Ex 2) Simplify: \[
\frac{x^2 - 1}{x+1} \div \frac{x^2 - 2x + 1}{x+1}
\]

\[
\frac{x^2 - 1}{x+1} \cdot \frac{x+1}{x^2 - 2x + 1}
\]

\[
\frac{(x^2 - 1)(x+1)}{(x+1)(x^2 - 2x + 1)}
\]

\[
\frac{(x+1)(x-1)(x+1)}{(x+1)(x-1)(x-1)}
\]

\[
\frac{(x+1)(x-1)(x+1)}{(x+1)(x-1)(x-1)}
\]

\[
\frac{x+1}{x-1}
\]
Ex 3) Simplify:

\[
\frac{x^3 + 8}{x^2 - 4} \div \frac{x^2 - 2x + 4}{x^2 - 4x + 4}
\]

\[
= \frac{x^3 + 8}{x^2 - 4} \cdot \frac{x^2 - 4x + 4}{x^2 - 2x + 4}
\]

\[
= \frac{x^3 + 8}{x^2 - 4} \cdot \frac{x^2 - 4x + 4}{x^2 - 2x + 4}
\]

\[
= \frac{(x^3 + 8)(x^2 - 4x + 4)}{(x^2 - 4)(x^2 - 2x + 4)}
\]
\[
\frac{(x+2)(x^2-2x+4)(x-2)(x-2)}{(x+2)(x-2)(x^2-2x+4)}
\]

\[
=\frac{(x+2)(x^2-2x+4)(x-2)(x-2)}{(x+2)(x-2)(x^2-2x+4)}
\]

\[
=x-2
\]