

Example 1- Multiply $\frac{x^2-x-6}{4x+4} \cdot \frac{x+1}{x^2+5x+6}$

Step 1 – Write all expressions as fractions

This step is already done.

Step 2 – Completely factor the numerators and denominators

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

Step 3 – Multiply the numerators and multiply the denominators

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

Step 4 – Reduce common factors

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

Step 5 – Write the simplified answer

$$\frac{x - 3}{4(x + 3)}$$

Example 2- Multiply $\frac{x^2-25}{x^3+5x^2-x-5} \cdot (x+1)$

Step 1 – Write all expressions as fractions

We will put the second expression over 1 to make it a fraction.

$$\frac{x^2 - 25}{x^3 + 5x^2 - x - 5} \cdot \frac{(x + 1)}{1}$$

Step 2 – Completely factor the numerators and denominators

$$\frac{x^2 - 25}{x^3 + 5x^2 - x - 5} \cdot \frac{x + 1}{1} =$$

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

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

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

Step 3 – Multiply the numerators and multiply the denominators

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

Step 4 – Reduce common factors

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

Step 5 – Write the simplified answer

$$\frac{x - 5}{x - 1}$$

Example 3- Divide $\frac{2x^2-12x}{x^2-7x+6} \div \frac{2x}{3x-3}$

Step 1 – Write all expressions as fractions

This step is already done

Step 2 – Change each division part of the problem to multiplication (use the **reciprocal** for a fraction appearing immediately following a \div symbol).

$$\frac{2x^2 - 12x}{x^2 - 7x + 6} \div \frac{2x}{3x - 3} = \frac{2x^2 - 12x}{x^2 - 7x + 6} \cdot \frac{3x - 3}{2x}$$

Step 3 – Completely factor the numerators and denominators

$$\frac{2x^2 - 12x}{x^2 - 7x + 6} \cdot \frac{3x - 3}{2x} = \frac{2x(x - 6)}{(x - 6)(x - 1)} \cdot \frac{3(x - 1)}{2x}$$

Step 4 – Multiply the numerators and multiply the denominators

$$\frac{2x(x - 6)}{(x - 6)(x - 1)} \cdot \frac{3(x - 1)}{2x} = \frac{2x(x - 6)(3)(x - 1)}{(x - 6)(x - 1)(2x)}$$

Step 4 – Reduce common factors

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

Step 5 – Write the simplified answer

3