

Let's recall how to multiply and divide fractions

Multiplication

$$\frac{8}{7} \cdot \frac{9}{182} = \frac{8}{14} = \frac{4}{7}$$

Division

$$\frac{8}{7} \div \frac{9}{182} = \frac{8}{7} \cdot \frac{182}{9} = \frac{16}{7}$$

Multiplying and Dividing Rational Expressions 8.3

Steps to simplifying:

1. Factor correctly.
2. State domain restrictions.
3. Divide out like factors.

Ex. 1

$$\frac{3x^2+5x+2}{x^2-1} \cdot \frac{x^2+6x-7}{x^2+7x}$$

$$\frac{(3x+2)(x+1)}{(x+1)(x-1)} \cdot \frac{(x+7)(x-1)}{x(x+7)}$$

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

Domain restrictions:  $x \neq \pm 1, 0, -7$

Ex. 2

$$\frac{8x^3-1}{x^2+3x-4} \div \frac{4x^2-1}{2x^2+9x+4}$$

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

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

$$\frac{4x^2+2x+1}{x-1}$$

Domain Restrictions:  $x \neq -4, 1, \pm \frac{1}{2}$

Ex. 3  $\frac{x-4}{(x-2)^2} \div \frac{x^2-3x-4}{x^2-4}$

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

Domain restrictions?

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

Domain restrictions?

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

$x \neq \pm 2, 4, -1$

Ex. 4  $\frac{4a^2-1}{a^2-4} \div \frac{2a-1}{a+2}$   $x \neq \pm 2, \frac{1}{2}$

$$\frac{(2a+1)(2a-1)}{(a+2)(a-2)} \div \frac{2a-1}{a+2}$$

$$\frac{(2a+1)(2a-1)}{(a+2)(a-2)} \cdot \frac{(a+2)}{(2a-1)}$$

DR

$$\frac{2a+1}{a-2}$$

$x \neq \pm 2, \frac{1}{2}$

Ex. 5  $\frac{x^4 - 4x^2}{x^2 - 9} \div \frac{4x^2 - 4x^3 + x^4}{x^2 - 6x + 9}$  Hint: rearrange Domain restrictions:  $x \neq \pm 3, 0, 2$

$$\frac{\cancel{x^2}(x+2)(\cancel{x-2}) \cdot (\cancel{x-3})(x-3)}{(x+3)(\cancel{x-3}) \cdot \cancel{x^2}(\cancel{x-2})(x-2)}$$

$$= \frac{(x+2)(x-3)}{(x+3)(x-2)}, x \neq \pm 3, 0, 2$$

work for factoring

$$\begin{array}{l} x^4 - 4x^3 + 4x^2 \\ x^2(x^2 - 4x + 4) \\ \boxed{x^2(x-2)(x-2)} \end{array} \quad \begin{array}{l} x^4 - 4x^2 \\ x^2(x^2 - 4) \\ \boxed{x^2(x+2)(x-2)} \end{array}$$

Ex. 6  $\frac{x^2 - 9}{x^2 + 1} \cdot (3 - x)^{-1}$

$$= \frac{x^2 - 9}{x^2 + 1} \cdot \frac{1}{3 - x}$$

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

$$= \frac{x+3}{x^2 + 1}, x \neq 3$$

$$\begin{aligned} &\rightarrow 3 - x \\ &= -x + 3 \\ &= -1(x - 3) \end{aligned}$$