6.2 Multiplying and Dividing Rational Expressions

* As with fractions, use:

$$\frac{A}{B} \times \frac{C}{D} = \frac{A \times C}{B \times D}$$

$B \neq 0, D \neq 0$

$$\frac{A}{B} \div \frac{C}{D} = \frac{A}{B} \times \frac{D}{C}$$

$B \neq 0, D \neq 0, C \neq 0$ ← additional restriction

ex. $\frac{x^2 - x - 12}{x^2 - 9} \cdot \frac{x^2 - 4x + 3}{x^2 - 4x}$

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

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

* restrictions

$x \neq \pm 3, 4, 0$

* domain

$\{x \in \mathbb{R} \mid x \neq \pm 3, 0, 4\}$

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ex. $\frac{x^2 - 4}{x^2 - 4x} \div \frac{x^2 + x - 6}{x^2 + x - 20}$

$$\frac{(x+2)(x-2)}{x(x-4)} \div \frac{(x-2)(x+3)}{(x+5)(x-4)}$$

$$\frac{(x+2)(x-2)}{x(x-4)} \times \frac{(x+5)(x-4)}{(x-2)(x+3)}$$

$$= \frac{(x+2)(x+5)}{x(x+3)}$$

* restrictions

$x \neq 0, 4, -5$

$x \neq 2, -3$

* domain

$\{x \in \mathbb{R} \mid x \neq -5, -3, 0, 2, 4\}$

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$$\frac{c^2-6c-7}{c^2-49} \div \frac{c^2+8c+7}{c^2+7c}$$

$$= \frac{(c-7)(c+1)}{(c+7)(c-7)} \div \frac{(c+7)(c+1)}{c(c+7)}$$

$$= \frac{(c-7)(c+1)}{(c+7)(c-1)} \times \frac{c(c+7)}{(c+7)(c+1)}$$

$c \neq \pm 7, 0, -1$

$$= \frac{c(c-7)}{(c-1)(c+7)}$$

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$$\frac{3x+12}{3x^2-5x-12} \div \frac{12}{3x+4} \times \frac{2x-6}{x+4}$$

$$\left[\frac{3(x+4)}{(3x+4)(x-3)} \div \frac{12}{3x+4}\right] \times \frac{2(x-3)}{x+4}$$

$x \neq 3, -\frac{4}{3}, -4$

$$\frac{3(x+4)}{(3x+4)(x-3)} \cdot \frac{3x+4}{12} \cdot \frac{2(x-3)}{x+4}$$

no new restrictions

$$= \frac{3 \cdot 2}{12} = \frac{1}{2}$$

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