

Sec. 4.3 : Multiplying & Dividing Rationals

Recall how to multiply fractions

$$\frac{3}{5} \times \frac{2}{7} = \frac{6}{35}$$

Rationals are the same.

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ex. 1) $\frac{2x^2 - 12x}{15x} \cdot \frac{5x}{(x-6)}$

Factor first

$$\frac{2x(x-6)}{15x} \cdot \frac{5x}{(x-6)}$$

list non-permissible values

$$x = 0, 6$$

$$\frac{\cancel{2x}(\cancel{x-6})}{\cancel{15x}} \cdot \frac{5x}{\cancel{(x-6)}}$$

Simplify, cross out common factors.

$$\frac{10x}{15} = \frac{2x}{3}, x \neq 0, 6$$

Your turn

$$\frac{12x^3}{3x^2+6x} \cdot \frac{4x^3+8x^2}{5}$$

Factor first

$$\frac{12x^3}{3x(x+2)} \cdot \frac{4x^2(x+2)}{5}$$

non-permissible values
 $x=0, -2$

$$\frac{12x^{\cancel{3}} \cdot 4x^{\cancel{2}}(x+2)}{3x(x+2)} \cdot \frac{1}{5}$$

$$= \frac{48x^4}{15} = \frac{16x^4}{5}, x \neq 0, -2$$

Division

Recall how to divide fractions

$$\frac{3}{8} \div \frac{1}{4}$$

* multiply by reciprocal

$$\frac{3}{8} \cdot \frac{4}{1} = \frac{12}{8} = \frac{3}{2}$$

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ex. 2

$$a) \frac{x-5}{3x^2-9x} \div \frac{5}{6x-18}$$

$$\frac{(x-5)}{3x^2-9x} \cdot \frac{6x-18}{5}$$

$$\frac{(x-5)}{3x(x-3)} \cdot \frac{6(x-3)}{5}$$

* non-permissible values have to be listed for both denominators AND the numerator of the second rational.

$$x = 0, 3$$

$$\frac{(x-5)}{3x(x-3)} \cdot \frac{6(x-3)}{5}$$

cannot cross ifr

$$\frac{6(x-5)}{15x} = \frac{2(x-5)}{5x}, x \neq 0, 3$$

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$$\frac{30x^2 + 15x}{x-3} \div \frac{2x^3 + x^2}{x^2 - 3x}$$

$$\frac{30x^2 + 15x}{(x-3)} \cdot \frac{x^2 - 3x}{2x^3 + x^2}$$

$$\frac{15x(2x+1)}{(x-3)} \cdot \frac{x(x-3)}{x^2(2x+1)}$$

non-permissible

$$x-3 \neq 0$$

$$x \neq 3$$

$$x^2 \neq 0$$

$$x \neq 0$$

$$2x+1 \neq 0$$

$$2x \neq -1$$

$$x \neq -\frac{1}{2}$$

$$\frac{15x(2x+1)}{(x-3)} \cdot \frac{x(x-3)}{x^2(2x+1)}$$

$$= \frac{15x^2}{x^2} = 15, \quad x \neq -\frac{1}{2}, 0, 3$$

Your turn

$$\frac{4x^2 - 1}{x + 2} \div \frac{4x^2 + 2x}{8x^2 - 32}$$

$$\frac{4x^2 - 1}{x + 2} \cdot \frac{8x^2 - 32}{4x^2 + 2x}$$

$$\frac{(2x+1)(2x-1)}{(x+2)} \cdot \frac{8(x^2-4)}{2x(2x+1)}$$

factor further
(x-2)(x+2)

$$\frac{(2x+1)(2x-1)}{(x+2)} \cdot \frac{8(x-2)(x+2)}{2x(2x+1)}$$

$$x \neq -2, 0, -\frac{1}{2}, 2$$

$$\begin{aligned} 2x+1 &\neq 0 \\ 2x &\neq -1 \\ x &\neq -\frac{1}{2} \end{aligned}$$

$$= \frac{8(2x-1)(x-2)}{2x}$$

$$= \frac{4(2x-1)(x-2)}{x}, \quad x \neq -2, -\frac{1}{2}, 0, 2$$

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