

1. Multiplication

Example: $\left(\frac{3a-3b}{a}\right)\left(\frac{a^2}{a-b}\right)$

* factor each polynomial, if possible

$$\left(\frac{3(a-b)}{a}\right)\left(\frac{a^2}{a-b}\right) \quad \left. \begin{array}{l} a=0 \\ a-b=0 \end{array} \right\} a \neq \{0, b\}$$

* state the restrictions, then multiply the expressions (canceling any common factors on top and bottom).

$$\frac{3\cancel{(a-b)}a^2}{a\cancel{(a-b)}} = a$$

$$3a \quad \text{where } a \neq \{0, b\}$$

Example: $\left(\frac{y^2 + y}{y - 2}\right)\left(\frac{1}{y + 1}\right)$

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$$

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

$$y \neq \{-1, 2\}$$

$$\frac{\cancel{y}(\cancel{y+1})}{(y-2)(\cancel{y+1})}$$

$$\begin{array}{l} y-2=0 \\ y=2 \\ y+1=0 \\ y=-1 \end{array}$$

$$= \frac{y}{y-2}, y \neq \{-1, 2\}$$

Example: $\frac{x^2-1}{x+3} \times \frac{x-3}{x^2-4x+3}$

∩ ∘ ∘ ∩
m+n m×n
-1, -3

$$\frac{(x+1)(x-1)}{(x+3)} \times \frac{(x-3)}{(x-3)(x-1)}$$

$$\frac{(x+1)\cancel{(x-1)}\cancel{(x-3)}}{(x+3)\cancel{(x-3)}\cancel{(x-1)}}$$

$$\frac{x+1}{x+3}, x \neq \{-3, 1, 3\}$$

$$\left. \begin{array}{l} x+3=0 \\ x-3=0 \\ x-1=0 \end{array} \right\} x \neq \{-3, 1, 3\}$$

2. Division

Example: $\frac{2(x-2)}{x^2+6x+9} \div \frac{x^2-4}{x^2-9}$

(Handwritten notes: $2(x-2)$ circled in pink; $x^2-4 = (x-2)(x+2)$ above; $x^2-9 = (x+3)(x-3)$ below)

* Factor each polynomial, if possible

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

(Handwritten notes: $x+3=0$ and $x-3=0$ next to the denominator; $x \neq \{-3, 3\}$ to the right)

* State the restrictions.

* Change divide to multiply and flip over the second fraction. State any new restriction(s) this creates.

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

(Handwritten notes: $x+2=0$ and $x-2=0$ next to the denominator; $x \neq \{-3, -2, 2, 3\}$ to the right)

- * multiply, canceling any common factors on top and bottom.

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

$$\frac{2(x-3)}{(x+3)(x+2)}, \text{ where } x \neq \{-3, -2, 2, 3\}$$

$$\underline{\underline{\text{OR}}} \frac{2x-6}{x^2+5x+6}, x \neq \{-3, -2, 2, 3\}$$

Example: Divide $\frac{x^2-1}{x+2} \div \frac{x-1}{3x+6}$

$$\frac{(x+1)(x-1)}{x+2} \div \frac{x-1}{3(x+2)} \quad , \quad x \neq -2$$

$$\frac{(x+1)(x-1)}{(x+2)} \times \frac{3(x+2)}{(x-1)} \quad , \quad x \neq \{-2, 1\}$$

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

$$3(x+1) \quad \text{or} \quad 3x+3 \quad , \quad x \neq \{-2, 1\}$$

$$3d \quad \frac{2x^2 + 6x}{x + 4} \times \frac{x^2 + 8x + 16}{5x^2 + 15x}$$

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

$$x \neq \{-4, -3, 0\}$$

$$\frac{\cancel{2x} \cancel{(x+3)} \cancel{(x+4)} \cancel{(x+4)}}{\cancel{(x+4)} \cancel{5x} \cancel{(x+3)}} = \frac{2(x+4)}{5}$$

$$4d) \quad \frac{2x^2 + 2x}{x+5} \div \frac{2x^3 - 2x}{x^2 + 10x + 25}$$

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

P.S.T
 $m \times n = 25$
 $m + n = 10$
 $5, 5$

$$\frac{2x(x+1)}{x+5} \div \frac{2x(x+1)(x-1)}{(x+5)(x+5)} \quad , \quad x \neq -5$$

$$\frac{2x(x+1)}{x+5} \times \frac{(x+5)(x+5)}{(2x)(x+1)(x-1)} \quad , \quad x \neq \{-5, -1, 0, 1\}$$

$$\frac{\cancel{2x}(x+1)\cancel{(x+5)}\cancel{(x+5)}}{\cancel{(x+5)}\cancel{(2x)}\cancel{(x+1)}(x-1)} = \frac{x+5}{x-1} \quad , \quad x \neq \{-5, -1, 0, 1\}$$