

Ch. 5-2 Multiplying and Dividing
RATIONAL Expression

↑
RATIO = fraction

RATIONAL Expressions \Rightarrow A quotient of
(divide)
two polynomials

(EX) $\frac{x^2-4}{x+2} \quad ; x \neq -2$

*

you MUST identify
any values of the
domain where the
expression is UNDEFINED,
that is, what value(s)
of x would result
in division by zero?

$x = -2$ in this case

Simplifying \Rightarrow identify undefined values of variable

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(EX 1) (A)

$$\frac{3x^7}{2x^4} = \boxed{\frac{3}{2}x^3} \quad \boxed{x \neq 0}$$

(B)

$$\frac{x^2 - 2x - 3}{x^2 + 5x + 4}$$

$$\begin{array}{l} \text{sum} = -2 \\ \text{prod} = -3 \\ \quad \quad \quad \uparrow \\ \quad \quad \quad +1-3 \end{array}$$

$$\begin{array}{l} \text{sum} = 5 \\ \text{prod} = 4 \\ \quad \quad \quad \uparrow \\ \quad \quad \quad +1+4 \end{array}$$

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

$$= \boxed{\frac{x-3}{x+4}} \quad \boxed{x \neq -4} \quad \boxed{x \neq -1}^*$$

MUST include even though terms cancel.

$$x = -1 \text{ or } x = -4$$

$$\text{make } x^2 + 5x + 4 = 0$$

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Steps to multiply RATIONAL EXPRESSIONS: DIVIDE ⇒ FIP; MULTIPLY!

① factor top / bottom completely
GCF, FBG, MNM, PST, DOS

② Cancel any common factors in top / bottom
EX $\frac{(x-2)(x+4)}{(x-2)}$

EX $\frac{3x(4x+1)}{3x(2x-5)}$

③ multiply $\frac{\text{top} * \text{top}}{\text{bottom} * \text{bottom}}$

④ MAKE SURE 1 is only common factor in top, bottom.

EX 3A

$$\frac{2x^4y^5}{3x^2} \cdot \frac{15x^2}{8x^3y^2}$$

$$\frac{\overset{1}{2}x^4y^5}{\underset{1}{3}x^2} \cdot \frac{\overset{5}{15}x^2}{\underset{4}{8}x^3y^2} = \frac{5x^4y^5}{4x^3y^2} = \boxed{\frac{5xy^3}{4}}$$

EX
3B
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$$\frac{x+2}{3x+12} \cdot \frac{x+4}{x^2-4}$$

\uparrow GCF \uparrow DOS

ASSUME
ALL
DEFINED

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

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

EX 4A
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$$\frac{4x^3}{9x^2y} \div \frac{16}{9y^5}$$

$$\frac{\overset{1}{4}x^3}{9x^2y} \cdot \frac{9y^5}{\frac{16}{4}} = \frac{x^3y^5}{4x^2y}$$

$$= \boxed{\frac{xy^4}{4}}$$

SOLVE SINGLE RATIONAL EQUATIONS ⁽⁵⁾

EX (5A)

$$\frac{x^2 - 9}{x + 3} = 7 \quad x \neq -3$$

$$\frac{(x-3)\cancel{(x+3)}}{\cancel{(x+3)}} = 7$$

$$x - 3 = 7$$

$$\boxed{x = 10} \quad x \neq -3 \quad \checkmark$$

ck?

(5B)

$$\frac{x^2 + 3x - 4}{x - 1} = 5 \quad x \neq 1$$

$$\frac{\cancel{(x-1)}(x+4)}{\cancel{(x-1)}} = 5$$

$$x + 4 = 5$$

$$x = 1$$

∴ $\boxed{\text{NO SOLUTION}}$

#4 Ex B

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sum = -1
prod = -2
-1 -2

$$\frac{x^5 - 4x^3}{x^2 - x - 2} \div \frac{x^5 - x^4 - 2x^3}{x^2 - 1}$$

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

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

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

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

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

or

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