6.1 Multiplying and Dividing Rational Expressions

A rational expression is the quotient of two polynomials

Examples

$$\frac{x-5}{2x+1} \qquad \frac{x^2-7x-18}{x^2-4}$$

$$\frac{2a^2+5ab+2b^2}{a^2-6ab+8b^2} \qquad \frac{1}{x-3}$$

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Determine the domain of the rational expressions.

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

$x-3 \neq 0$

$x \neq 3$

all reals, $x \neq 3$

$\{x \mid x \neq 3\}$

$(-\infty, 3) \cup (3, \infty)$

$$\frac{p^2+5p+6}{p^2-4}$$

$p^2-4 \neq 0$

$(p+2)(p-2)$

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You Try

$$\frac{z^2-9}{z^2+3z-28}$$

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Reduction Property

$$\frac{ac}{bc} = \frac{a\cancel{c}}{b\cancel{c}} = \frac{a}{b} \qquad \text{if } b \neq 0,\ c \neq 0$$

We do this all the time when we reduce fractions.
For example:

$$\frac{12}{20} = \frac{2 \cdot 2 \cdot 3}{2 \cdot 2 \cdot 5}$$

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Simplify each rational expression, always name the domain restrictions.

$$\frac{x^2+2x-15}{2x^2-3x-9} = \frac{(x+5)(x-3)}{(2x+3)(x-3)} = \frac{x+5}{2x+3}$$

$x \neq -\frac{3}{2}, 3$

$2x^2 - 6x + 3x - 9$

$2x(x-3) + 3(x-3)$

$$\frac{q^3-8}{3q^2-6q} = \frac{(q-2)(q^2+2q-4)}{(3q)(q-2)} = \frac{q^2+2q-4}{3q}$$

$q \neq 2, 0$

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Simplify each rational expression

$$\frac{3x^2+11x-4}{1-3x}$$

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Watch out for bad math.

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

ugh!!

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You try

$$\frac{x^2-7x+12}{x^2+4x-21}$$

$$\frac{3w^2+13w-10}{2-3w}$$

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Multiply and simplify

$$\frac{x^2+2x-15}{x+1}\cdot\frac{x^2+7x}{x^2+4x-21}$$

$$\frac{(x+5)(x-3)}{(x+1)}\cdot\frac{x(x+7)}{(x+7)(x-3)}=\frac{x(x+5)}{(x+1)}$$

$x\neq -1,-7,3$

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You try

$$\frac{p^2-9}{p^2+5p+6}\cdot\frac{3p^2-p-2}{2p-6}$$

$3p^2-3p+2p-2$

$3p(p-1)+2(p-1)$

$$\frac{(p-3)(p+3)}{(p+3)(p+2)}\cdot\frac{(3p+2)(p-1)}{2(p-3)}=\frac{(3p+2)(p-1)}{2(p+2)}$$

$x\neq -3,-2,3$

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Multiply and simplify

$$\frac{p^2+5pq+6q^2}{2p^2+7pq+3q^2}\cdot\frac{2p+q}{3p+6q}$$

$$\frac{(p+3q)(p+2q)}{(2p+q)(p+3q)}\cdot\frac{(2p+q)}{3(p+2q)}=\frac{1}{3}$$

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You try

$$\frac{2x+8}{2x^2+11x+12}\cdot\frac{2x^2-3x-9}{6-2x}$$

$$\frac{m^2+2mn+n^2}{2m^2+3mn+n^2}\cdot\frac{2m^2-5mn-3n^2}{3n-m}$$

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Divide and simplify

$$\frac{20x^3}{3y} \cdot \frac{15y^4}{4x^2} = 25x^3y^4$$

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

$x \neq 0, y \neq 0$

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Divide and simplify

$$\frac{\dfrac{x^2-4x-12}{4x^3-6x^2}}{\dfrac{x^3+8}{2x^3-4x^2+8x}}$$

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You try

$$\frac{\dfrac{m^2-5}{m-7}}{\dfrac{2m}{m^2-6m-7}}$$

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Find the domain of the rational function. State your answer in set notation.

$$\frac{x+2}{x^2-5x-14}$$

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Given that $f(x)=\frac{x^2-4}{3x^2+9x}$, $g(x)=\frac{x+3}{x^2-2x-8}$, and $h(x)=\frac{2x^2+7x+6}{x^2+5x}$ find

$R(x)=f(x)\cdot g(x)$

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Given that $f(x)=\frac{x^2-4}{3x^2+9x}$, $g(x)=\frac{x+3}{x^2-2x-8}$, and $h(x)=\frac{2x^2+7x+6}{x^2+5x}$ find

$H(x)=\frac{f(x)}{h(x)}$

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Nov 21-1:31 PM