What's Going On?

Checking In	Homework Logs
Minds on	It's Elementary
Action!	Multiplying and Dividing Rational Expressions
Consolidation	Start, Stop, Continue

Learning Goal - I will be able to multiply and divide rational expressions.

Factoring Quiz

Closed book!

Use a calculator.

Sit at your own table.

Show your work for part marks!

You will have 15 minutes once the announcements end.

You can start right now!

Once you flip it over, you must start.

Checking In

F.F.M.

Get your little books.

Simplify and state restrictions.

$$\frac{t^2 - 7t + 12}{t^3 - 6t^2 + 9t}$$

$$= \frac{(t-3)(t-4)}{t(t^2-6t+9)}$$

$$= \frac{(t-3)(t-4)}{t(t-3)^2}, \quad t \neq 0, 3$$

$$= \frac{(t-4)}{t(t-3)}, \quad t \neq 0, 3$$

Unit Test Next Tuesday

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Minds on

First, a few things you need to know!

open dots

"Holes" occur at restricted values that result from a factor of the denominator that is also a factor of the numerator.

- Basically, holes are restrictions that don't appear after simplification.

Vertical asymptotes occur at restricted values that are still zeros of the denominator after simplification.

- Basically, vertical asymptotes are restrictions that hang around after simplification.

Minds on

Where my holes at?

Holes: $x = -3$

Vertical Asymptotes: $x = 4$

$$m(x) = \frac{x^2 + 5x + 6}{x^2 - x - 12}$$

$$m(x) = \frac{(x+2)(x+3)}{(x+3)(x-4)} \quad x \neq -3, 4$$

$$m(x) = \frac{(x+2)}{(x-4)}, \quad x \neq -3, 4$$

Minds on

Where my holes at?

Holes: $y=0$

Vertical Asymptotes: $x=0$

a) $\frac{30x^4y^3}{-6x^7y}$ $x\neq 0, y\neq 0$

$= \frac{-5y^2}{x^3}, x\neq 0, y\neq 0$

$x^{-3} = \frac{1}{x^3}$

Minds on

Where my holes at?

Holes:

Vertical Asymptotes: $x=0$

b) $\dfrac{10x^4-8x^2+4x}{2x^2}$ $x\neq 0$

$$= \frac{2x(5x^3-4x+2)}{x2x^2}$$

$$= \frac{5x^3-4x+2}{x}, \quad x\neq 0$$

Minds on

Where my holes at?

Holes: $x=1$

Vertical Asymptotes:

c) $\dfrac{x^2+7x-8}{2-2x}$

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

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

$=\dfrac{x+8}{-2}, x\neq 1$

$2-2x\neq 0$

$-2 \quad -2$

$-2x\neq -2$

$\dfrac{-2x}{-2}\neq\dfrac{-2}{-2}$

$x\neq 1$

Minds on

Where my holes at?

Holes: $x=2y$

Vertical Asymptotes: $x=-3y$

d) $\dfrac{4x^2-16y^2}{x^2+xy-6y^2}$

Forgot to CF

$=\dfrac{(2x+4y)(2x-4y)}{(x+3y)(x-2y)}$

$=\dfrac{4(x^2-4y^2)}{(x+3y)(x-2y)}$

$x+3y\neq 0$
$x\neq -3y$

$x-2y\neq 0$
$x\neq 2y$

$=\dfrac{4(x-2y)(x+2y)}{(x+3y)(x-2y)}$

$=\dfrac{4(x+2y)}{(x+3y)}$, $x\neq 2y, -3y$, $y\neq \frac{x}{-3}, \frac{x}{2}$

P.S. We don't need to do this

Minds on

Where my holes at?

Holes: $n = 0, 1$

Vertical Asymptotes: $n = \frac{1}{2}$

e) $P(n) = \dfrac{3n^3 - 3n^2}{8n^3 - 12n^2 + 4n}$

$P(n) = \dfrac{3n^2(n-1)}{4n(2n^2 - 3n + 1)}$

$P(n) = \dfrac{3n^2(n-1)}{4n(2n^2 - 2n - n + 1)}$

$P(n) = \dfrac{3n^2(n-1)}{4n(2n(n-1) - 1(n-1))}$

$= \dfrac{3n^2(n-1)}{4n(2n-1)(n-1)}$ $n \neq 0, \frac{1}{2}, 1$

$= \dfrac{3n}{4(2n-1)}, n \neq 0, \frac{1}{2}, 1$

Minds on

It's Elementary

Evaluate. Show your steps.

NO CALCULATORS

1. $\frac{4}{12} \times \frac{3}{16}$

$= \frac{4 \times 3}{12 \times 16}$

$= \frac{12}{192}$

2. $\frac{15}{5} \times \frac{2}{8}$

$= \frac{30}{40}$

$= \frac{3}{4}$

3. $\frac{3}{10} \div \frac{6}{5}$

$\frac{3}{10} \times \frac{5}{6}$

$= \frac{15}{60} = \frac{1}{4}$

4. $\frac{4}{7} \times \frac{14}{24} \div \frac{8}{18}$

$= \frac{4}{7} \times \frac{14}{24} \times \frac{18}{8}$

$$= \frac{4}{7} \times \frac{14}{24} \times \frac{18}{8}$$

$$= \frac{14 \times 14 \times 18}{17 \times 24 \times 8}$$

$$= \frac{3}{4}$$

$$= \frac{4}{7} \times \frac{14}{24} \times \frac{18}{8}$$

$$= \frac{(4)(14)(18)}{(7)(24)(8)}$$

$$= \frac{4}{8} \times \frac{14}{7} \times \frac{18}{24}$$

$$= \frac{1}{2} \times \frac{2}{1} \times \frac{3}{4}$$

Action!

Multiplying and Dividing Rational Expressions

Example 1: Simplify and state the restrictions: $\frac{6x^2}{5xy} \times \frac{15xy^3}{8xy^4}$

$$\frac{6x^2}{5xy} \times \frac{15xy^3}{8xy^4}, x \neq 0, y \neq 0$$

$$= \frac{6x}{5y} \times \frac{15}{8y}$$

$$= \frac{90x}{40y^2}$$

$$= \frac{9x}{4y^2}, x \neq 0, y \neq 0$$

Action!

Multiplying and Dividing Rational Expressions

To multiply rational expressions:

1. Factor the numerators and denominators, if possible
2. Divide out any factors that are common to the numerator and denominator
3. Multiply the numerators, multiply the denominators, and then write the result as a single rational expression , simplify.

To divide rational expressions:

1. Multiply by the reciprocal of the divisor
2. Follow the steps for multiplication

(Flip and multiply!)

To determine the restrictions:

1. Solve for the zeros of all the denominators in the factored expressions
2. If division, you must use solve for the zeros of the numerator AND denominator of the divisor

Action!

Multiplying and Dividing Rational Expressions

Example 2: Simplify and state the restrictions: $\frac{x^2-4}{(x+6)^2} \times \frac{x^2+9x+18}{2(2-x)}$

$$\frac{x^2-4}{(x+6)^2} \times \frac{x^2+9x+18}{2(2-x)}$$

FACTOR

$$= \frac{(x+2)(x-2)}{(x+6)^2} \times \frac{(x+3)(x+6)}{2(2-x)}$$

$x \neq -6$ RESTRICT $x \neq 2$

$$= \frac{(x+2)(x-2)}{(x+6)^2} \times \frac{(x+3)(x+6)}{2(2-x)}$$

SIMPLIFY

factor out -1 to make $(2-x) \to (x-2)$

$$= \frac{(x+2)(x-2)}{(x+6)^2} \times \frac{(x+3)(x+6)}{-2(x-2)}$$

$(x+6)$

COMBINE

$$= \frac{(x+2)(x+3)}{-2(x+6)}, \quad x \neq 2, -6$$

hole, vertical asymptote

Action!

Multiplying and Dividing Rational Expressions

Example 3: Simplify and state the restrictions: $\frac{21p-3p^2}{16p+4p^2} \div \frac{14-9p+p^2}{12+7p+p^2}$

$$\frac{21p-3p^2}{16p+4p^2} \div \frac{14-9p+p^2}{12+7p+p^2}$$

Everything is in a wonky order... rearrange!

$$= \frac{-3p^2+21p}{4p^2+16p} \div \frac{p^2-9p+14}{p^2+7p+12}$$

FACTOR

$$= \frac{-3p(p-7)}{4p(p+4)} \div \frac{(p-7)(p-2)}{(p+4)(p+3)}$$ divisor

RESTRICT

* Division... restrict numerator & denominator of divisor

$$= \frac{-3p(p-7)}{4p(p+4)} \div \frac{(p-7)(p-2)}{(p+4)(p+3)}$$

$p \neq 0$, $p \neq -4$, $p \neq 7$, $p \neq 2$, $p \neq -4$, $p \neq -3$

$p \neq -4, -3, 0, 2, 7$

FLIP & MULTIPLY

$$= \frac{-3p(p-7)}{4p(p+4)} \times \frac{(p+4)(p+3)}{(p-7)(p-2)}$$

SIMPLIFY

$$= \frac{-3p(p-7)}{4p(p+4)} \times \frac{(p+4)(p+3)}{(p-7)(p-2)}$$

$$= \frac{-3(p+3)}{4(p-2)}, \quad p \neq -4, -3, 0, 2, 7$$

vertical asymptote

holes

I have broken up the previous problem onto two slides for better viewing.

Multiplying and Dividing Rational Expressions

Example 3: Simplify and state the restrictions: $\frac{21p-3p^2}{16p+4p^2} \div \frac{14-9p+p^2}{12+7p+p^2}$

$$\frac{21p-3p^2}{16p+4p^2} \div \frac{14-9p+p^2}{12+7p+p^2}$$

Everything is in a wonky order... rearrange!

$$= \frac{-3p^2+21p}{4p^2+16p} \div \frac{p^2-9p+14}{p^2+7p+12}$$

FACTOR

$$= \frac{-3p(p-7)}{4p(p+4)} \div \frac{(p-7)(p-2)}{(p+4)(p+3)}$$

divisor

RESTRICT

* Division... restrict numerator + denominator of divisor

$$= \frac{-3p(p-7)}{4p(p+4)} \div \frac{(p-7)(p-2)}{(p+4)(p+3)}$$

$p \neq 0$, $p \neq -4$, $p \neq 7$, $p \neq 2$, $p \neq -4$, $p \neq -3$

$$p \neq -4, -3, 0, 2, 7$$

FLIP & MULTIPLY

$$= \frac{-3p(p-7)}{4p(p+4)} \times \frac{(p+4)(p+3)}{(p-7)(p-2)}$$

SIMPLIFY

$$= \frac{-3p\cancel{(p-7)}}{4\cancel{p}\cancel{(p+4)}} \times \frac{\cancel{(p+4)}(p+3)}{\cancel{(p-7)}(p-2)}$$

$$= \frac{-3(p+3)}{4(p-2)}, \quad p \neq -4, -3, 0, 2, 7$$

vertical asymptote

holes

Consolidation

Start, Stop, Continue

Consolidation

Homework!

Pg. 121: 1 - 10, ***11***, ***13***

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