

Topic 4.3 Multiplying and Dividing Rational Expressions

Essential Question:

How does understanding operations with fractions help you multiply and divide rational expressions?

Concept

CONCEPT Rational Expression

A **rational expression** is the quotient of two polynomials. The domain is all real numbers except those for which the denominator is equal to 0.

$\frac{x^2}{x^2 - 9}$ is an example of a rational expression.

Since the denominator cannot equal 0, $x^2 - 9 \neq 0$.

$$x^2 \neq 9 \rightarrow x \neq 3 \text{ or } -3.$$

So the domain of $\frac{x^2}{x^2 - 9}$ is all real numbers except 3 and -3.

Q: In a rational expression, why is the denominator not equal to 0?

Q: How does the word rational explain what a *rational* expression is?

CONCEPT Summary

CONCEPT SUMMARY Products and Quotients of Rational Expressions

	Multiply	Multiply an Integer or a Polynomial	Divide
RATIONAL EXPRESSIONS	$\frac{3x}{x+1} \cdot \frac{x^2+x}{3x-6}$ <p>The domain is $x \neq -1$ or 2.</p>	$\frac{x+2}{x^2-4} \cdot (x^2-2x)$ $= \frac{x+2}{x^2-4} \cdot \frac{x^2-2x}{1}$ <p>The domain is $x \neq -2$ or 2.</p>	$\frac{1-x^2}{x^2+3x-4} \div \frac{x+1}{x+4}$ $= \frac{1-x^2}{x^2+3x-4} \cdot \frac{x+4}{x+1}$ <p>The domain is $x \neq -4, -1, \text{ or } 1$.</p>
WORDS	Identify common factors and simplify.	Write the polynomial as a rational expression with 1 in the denominator. Then multiply.	Multiply by the reciprocal of the divisor.

Q: How do multiplying or dividing rational expressions compare to multiplying or dividing fractions?

Notes:

Examples & Questions

Examples 1

Q: Why does the simplified rational expression have the same domain as the original rational expression?

Q: Why does the denominator affect the domain but the numerator does not?

Examples 2

Q: Why is -1 factored out of $2-x$ in the numerator?

Q: What would happen if you factored -1 out of the expression $x-2$ in the denominator instead?

Examples 3

Part A

Q: How can you determine that the domain is $z \neq 0$ and $y \neq 0$ by looking at the rational expressions?

Part B

Q: Why do you factor the expressions in the numerator and the denominator?

Examples 4

Q: What do you already know about multiplying a fraction and a whole number that is helpful here?

Q: Is there a number for x that would make $x^2 + 4 = 0$?

Examples 5

Q: Why do you factor out -1?

Q: How is dividing rational expressions similar to dividing fractions?

Examples 6

Q: What does it mean to have the lesser ratio of surface area to volume?

Q: How do the efficiency ratios of the rectangular prism and the cylinder compare to each other?

Practice and Problem Solving

Complete MathXL for School: Practice and Problem Solving (online)

Complete MathXL for School: Enrichment (online)

Challenge: #14, 16, 10, 34 – key will be posted in Power School Learning.

Lesson Quiz 4.3