Algebra 2

5.2 Multiplying and Dividing Rational Expressions

Objectives:
- Simplify rational expressions.
- Multiply and Divide rational expressions.

A **rational expression** is a quotient of two polynomials.

Examples: $\frac{x^2-4}{x+2}$ $\frac{10}{x^2-6}$ $\frac{x+3}{x-7}$

Remember:
To write a fraction in simplest form, you can divide out common factors in the numerator and the denominator.

A RATIONAL EXPRESSION IS UNDEFINED IF THE DENOMINATOR IS EQUAL TO 0!!!

Simplify. Identify any x-values for which the expression is undefined.

Ex. 1: $\frac{10x^8}{6x^4} = \frac{5x^4}{3}$

$6x^4 \neq 0$

$\frac{6x^4}{6} \neq \frac{0}{6}$

$x^4 \neq 0$

$x \neq 0$

Ex. 2: $\frac{x^2+x-2}{x^2+2x-3}$ Factor 1st!!

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

$x+3 \neq 0$

$x \neq -3$

$x-1 \neq 0$

$x \neq 1$

Ex. 3: $\frac{10-2x}{x-5} = \frac{-2(-5+x)}{x-5}$

$= \frac{-2(x-5)}{x-5} = -2$

$x-5 \neq 0$

$x \neq 5$

Ex. 4: $\frac{-x^2+3x}{2x^2-7x+3} = \frac{-x(x-3)}{(2x-1)(x-3)}$

$2x-1 \neq 0$ $x-3 \neq 0$

$2x \neq 1$ $x \neq 3$

$x \neq \frac{1}{2}$

$= \frac{-x}{2x-1}$

We multiply rational expressions the same way that we multiply numerical fractions.

Multiplying Rational Expressions

- Factor all numerators and denominators completely.
- Divide out common factors of the numerator and denominator.
- Multiply numerators. Then multiply denominators.
- Make sure the numerators and denominators have no common factors other than 1.

Multiply. Assume that all expressions are defined.

no need to find restrictions

Ex. 5: $\frac{3x^5y^3}{2x^3y^7} \cdot \frac{10x^3y^4}{9x^2y^5} = \frac{5x^3}{3y^5}$

$\frac{5x^8y^7}{3x^5y^{12}}$

adding or subtracting in num or denom

Factor 1st!!

Ex. 6: $\frac{x-3}{4x+20} \cdot \frac{x+5}{x^2-9}$

$4(x+5) \quad (x-3)(x+3)$

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

Ex. 7: $\frac{x+2}{x^3-27} \cdot \frac{(x^2+3x+9)}{1} = \frac{x+2}{x-3}$

$(x-3)(x^2+3x+9)$

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Remember: To divide by a fraction, we multiply by its reciprocal.

Divide. Assume that all expressions are defined.

Ex. 8: $\frac{5x^4}{8x^2y^2} \div \frac{15}{8y^5} = \frac{5x^4}{8x^2y^2} \cdot \frac{8y^5}{15} = \frac{1x^2y^3}{3}$

Ex. 9: $\frac{x^4-9x^2}{x^2-4x+3} \div \frac{x^4+2x^3-8x^2}{x^2-16}$

$= \frac{x^2(x^2-9)}{(x-3)(x-1)} \cdot \frac{(x+4)(x-4)}{x^2(x^2+2x-8)}$

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

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

Assignment: Worksheet 5.2

Q: Why did the doctor send the expression to a psychiatrist?

A: Because it wasn't rational.