Rational Expressions and Equations Lesson #6:
Division of Rational Expressions

Review *Division of Rational Numbers*

Recall that the procedure for dividing by a rational number is to multiply by the reciprocal of the rational number.

Divide: **a)** $\frac{7}{10} \div \frac{3}{14}$ **b)** $\frac{6}{5} \div \frac{9}{10} \times \frac{1}{20}$ **c)** $\frac{6}{5} \div \left(\frac{9}{10} \times \frac{1}{20}\right)$

$\frac{7}{10} \cdot \frac{14}{3}^{7} = \frac{49}{5}$

Review *Division of Monomials*

The above method can be extended to division of monomials containing variables. Remember to invert the divisor and multiply.

Simplify. At this stage, do not state the restrictions on the variables.

a) $\frac{16a}{9b^2} \div \frac{32a^2}{15b}$ **b)** $\frac{-5xy^3}{7xz^3} \times \frac{2z}{15x} \div \frac{10x^2y^2}{-21z^4}$

Nonpermissible Values in Division of Rational Expressions

Consider the division $\frac{a}{b} \div \frac{c}{d}$, where a, b, c and d are variables.

For the rational expression $\frac{a}{b}$, the nonpermissible value is $b \neq 0$.

For the rational expression $\frac{c}{d}$, the nonpermissible value is $d \neq 0$.

The first step in simplifying $\frac{a}{b} \div \frac{c}{d}$ is to invert the divisor and multiply to obtain $\frac{a}{b} \times \frac{d}{c}$.

This introduces another nonpermissible value $c \neq 0$.

For a division of the type $\frac{a}{b} \div \frac{c}{d}$, we need to consider nonpermissible values at b, c and d.

Any variable which appears in the denominator at **any** stage in the simplification should be considered for nonpermissible values.

State the restrictions on the variables in Class Example 2.

a) $\frac{16a}{9b^2} \div \frac{32a^2}{15b}$

b) $\frac{-5xy^3}{7xz^3} \times \frac{2z}{15x} \div \frac{10x^2y^2}{-21z^2}$

Division of Single Variable Rational Expressions

The method for division of rational expressions is similar to the method described for division of rational numbers. The first step is usually to invert the divisor and multiply. Then follow the procedure for multiplication of rational expressions. Nonpermissible values occur when a variable is present in the denominator at any stage in the simplification.

FRS

Simplify. State the restrictions on the variable.

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

b) $\dfrac{\dfrac{4x+12}{3x+12}}{\dfrac{3x^2+9x}{(x+4)^2}}$

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

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

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

Perform the indicated operations for each of the following expressions.
Express final answers in lowest terms, and identify the nonpermissible values.

a) $\dfrac{4x^2-12x}{x^2-9} \div \dfrac{7x^3+7x^2}{x^2+4x+3}$ **b)** $\dfrac{20m^2+30m}{9-4m^2} \div \left(\dfrac{11m^3-11m}{2m^2-m-3} \times \dfrac{2m+3}{m-1}\right)$

$x \neq \pm 3, 0, -1$

$$\frac{4x(x-3)}{(x+3)(x-3)} \cdot \frac{(x+3)(x+1)}{7x^2(x+1)}$$

$$= \frac{4}{7x}$$

#1-4 (a only), 6-9

Simplify $\dfrac{\dfrac{10}{a}-\dfrac{12}{2a+1}}{\dfrac{5}{a}+4}$. State the restrictions on the value of a.

Complete Assignment Questions #1 - #10