5-1 Multiplying and Dividing Rational Expressions

I can multiply and divide rational expression and simplify using factoring.
I can simplify a rational expression.

Multiply Rational Numbers

$$\frac{2}{3} \cdot \frac{4}{3} = \frac{8}{9}$$

$$-\frac{4}{5} \cdot \frac{5}{2} = \frac{-20}{10} = -2$$

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

$$\frac{3}{7} \cdot \frac{2}{1} = \frac{6}{7}$$

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Multiply Rational Expressions

$$\frac{1}{x} \cdot \frac{x}{4} = \frac{x}{4x} = \frac{1}{4}$$

$$\frac{x^2}{2} \cdot \frac{3}{x} = \frac{3x^2}{2x} = \frac{3 \cdot x \cdot x}{2 \cdot x} = \frac{3x}{2}$$

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

To multiply rational expressions:

1. Factor and terms that need to be factored

2. Multiply straight across (numerator times numerator, denominator times denominator)

3. Simplify the product by canceling common factors.

*Find the excluded values of the product, which are values of the variable for which the expression is undefined.

Find the product and any excluded values

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

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

$$= \frac{6x^2}{(x+2)(x-4)} \qquad x \neq -2, 4, 5$$

Find the product and any excluded values

$$\frac{(x^2 - 8x}{14(x+3)(x+5)} \cdot \frac{\overset{7 \cdot 5}{7x+35}}{x+8}$$

$$= \frac{x(x-8)}{14(x+3)(x+5)} \cdot \frac{7(x+5)}{(x+8)}$$

$$= \frac{7x(x-8)}{14(x+3)(x+8)} = \boxed{\frac{x(x-8)}{2(x+3)(x+8)}} \quad x \neq \cdot 3, -5, -8$$

Find the product and any excluded values

$$\frac{(x+3)(x-3)}{(x-8)(x+3)} \cdot \frac{(x-8)}{2x^2 - 18x}$$

$$2x(x-9)$$

$$= \frac{(x-3)}{(x-8)} \cdot \frac{(x-8)}{2x(x-9)}$$

$$= \frac{x-3}{2x(x-9)} \qquad x \neq 8, -3, 0, 9$$

Find the product and any excluded values

$$\frac{x}{(x-9)} \bullet \frac{\overset{3 \cdot x - 3 \cdot 9}{(3x-27)}}{(x+1)}$$

$$= \frac{x}{(x-9)} \bullet \frac{3(x-9)}{(x+1)}$$

$$= \frac{3x}{x+1} \quad x \neq 9, -1$$

Find the product and any excluded values

$$\frac{(x+3)(x+11)}{4x} \cdot \frac{x^2-3x}{(x+3)} \cdot \frac{(8x-56)}{(x-7)(x+11)}$$

$$= \frac{(x+3)(x+11)}{4x} \cdot \frac{x(x-3)}{(x+3)} \cdot \frac{8(x-7)}{(x-7)(x+11)}$$

$$= \frac{8(x-3)}{4} = \boxed{2(x-3) \quad x \neq 0, -3, 7, -11}$$

Dividing Rational Numbers

$$\frac{2}{3} \div \frac{4}{3} = \frac{2}{\cancel{3}^{1}} \cdot \frac{\cancel{3}^{1}}{4} = \frac{2}{4} = \frac{1}{2}$$

$$-\frac{4}{5} \div \frac{5}{2}$$

$$\frac{3}{7} \div 3$$

Dividing Rational Expressions

$$\frac{1}{x} \bullet \frac{x}{4}$$

$$\frac{x^2}{2} \div \frac{x}{3} = \frac{x^2}{2} , \frac{3}{x} = \frac{x \cdot x}{2} \cdot \frac{3}{x} = \frac{3x}{2}$$

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

Divide and find any excluded values

$$\frac{(x+7)^2}{x^2} \div \frac{(x+7)(x+2)}{(x+2)(x-1)}$$

$$\frac{(x+7)^2}{x^2}$$

$$\frac{(x+7)(x+2)}{(x+2)(x-1)}$$

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

$$= \frac{(x+7)(x-1)}{x^2} \qquad x \neq 0, -2, 1, -7$$

Divide and find any excluded values

$$\frac{(x+7)^2}{x^2} \div \frac{(x+7)(x+2)}{(x+2)(x-1)}$$

Divide and find any excluded values

$$\frac{6x}{3x-30} \div \frac{9(x+1)(x-4)}{x^2-10x}$$

$$= \frac{\overset{2}{\cancel{6}}}{\cancel{3(x-10)}} \cdot \frac{x(x\cdot10)}{9(x+1)(x-4)}$$

$$= \frac{2x}{9(x+1)(x-4)} \qquad x \neq 10, 0, -1, 4$$

Divide and find any excluded values

$$\frac{x+11}{4x} \div \frac{2x+6}{(x-1)(x+3)}$$

$$= \frac{x+11}{4x} \cdot \frac{(x-1)(x+3)}{2(x+3)}$$

$$= \boxed{\frac{(x+11)(x-1)}{8x}, \; x \neq 1, -3, 0}$$

Divide and find any excluded values

$$\frac{(x-1)(x-9)}{3x} \div \frac{(x-9)(x+2)}{x^2+2x}$$

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

$$= \boxed{\frac{x-1}{3}, \quad x \neq 0, 9, -2}$$

Divide and find any excluded values

$$\frac{8x+32}{(x+4)(x+4)} \div \frac{x^2-6x}{(x-6)(x+4)}$$

$$= \frac{8(x+4)}{(x+4)(x+4)} \cdot \frac{(x-6)(x+4)}{x(x-6)}$$

$$= \boxed{\frac{8}{x}, x \neq -4, 0, 6}$$