PreCalculus 11 Name_____
Date_____

6.2 Multiplying & Dividing Rational Expressions

Link the Ideas – p. 323 – Multiplying rational numbers

$\left(\frac{5}{8}\right)\left(\frac{4}{15}\right) = \frac{(5)(4)}{(8)(15)}$

$= \frac{(5)(4)}{(4)(2)(5)(3)}$

$= \frac{1}{6}$

$\left(\frac{4x^2}{3xy}\right)\left(\frac{y^2}{8x}\right) = \frac{(4)(x^2)(y^2)}{3(x)(y)(8)(x)}$

$x \neq 0$, $y \neq 0$

$= \frac{4(x^2)(y)(y)}{3(x^2)(y)(4)(2)}$

$= \frac{y}{6}$

We can perform the same operations with rational expressions if we factor first, then look for common factors to divide out.

Example 1: Multiply and leave in simplest form. Identify non-permissible values.

$$\frac{x^2-x-12}{x^2-9} \times \frac{x^2-4x+3}{x^2-4x}$$

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

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

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

& restrictions $x \neq 0, \pm 3, 4$

If at any point we are expanding $(x^2-x-12) \times (x-4x+3)$ we are probably doing the wrong thing!

Factor first

Remember, with dividing fractions, it is easier to multiply by divisor's reciprocal.

e.g. $\frac{5}{3} \div \frac{1}{6}$ can be changed to $\frac{5}{3} \times \frac{6}{1} \longrightarrow \frac{30}{3} = 10$

Example 2: Determine the quotient in simplest form, and give non-permissible values.

$$\frac{x^2-4}{x^2-4x} \div \frac{x^2+x-6}{x^2+x-20}$$ factor everything!

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

$$= \frac{(x+2)\cancel{(x-2)}}{x\cancel{(x-4)}} \times \frac{(x+5)\cancel{(x-4)}}{(x+3)\cancel{(x-2)}}$$

$$= \frac{(x+2)(x+5)}{x(x+3)} \qquad x \neq 0, -3, 4, 2, -5$$

$$\frac{c^2-6c-7}{c^2-49} \div \frac{c^2+8c+7}{7c+c^2}$$

$$\frac{\cancel{(c-7)}(c+1)}{\cancel{(c-7)}(c+7)} \times \frac{c(7+c)}{\cancel{(c+7)}\cancel{(c+1)}}$$

$$= \frac{c}{c+7} \qquad c \neq \pm 7, -1, 0$$

Does the order matter?

$5 + x$ is the same as $x+5$

$5 - x$ is the same as $-(x-5)$

But not equal! (conjugates)

Example 3: Simplify and give non-permissible values:

$$\frac{2m^2-7m-15}{2m^2-10m} \div \frac{4m^2-9}{6} \times (3-2m)$$

$$\frac{(2m+3)(m-5)}{2m(m-5)} \times \frac{6}{(2m-3)(2m+3)} \times -1(2m-3)$$

$$= \frac{-6}{2m}$$

$$= \frac{-3}{m} \qquad m \neq 0, 5, \pm\frac{3}{2}$$

Key Ideas

- Factor each numerator & denominator, then divide out Common Factors.
- Convert division to multiplication by multiplying by divisor's reciprocal.
- No denominator can equal zero. In $\frac{A}{B} \div \frac{C}{D} = \frac{A}{B} \times \frac{D}{C}$ the non-permissible values are

$B \neq 0, D \neq 0, C \neq 0$

Assignment: p.327 # 1, 2, 5-8, 15, 16