6.2 Multiplying and Dividing Rational Expressions

Multiplying and dividing rational expressions is similar to multiplying and dividing rational numbers. We need to ensure we are identifying non-permissible values as we work our way through simplifying an expression.

Example: Simplify each expression. Identify all non-permissible values

a) $\left(\frac{4x^2}{3xy}\right)\left(\frac{y^2}{8x}\right)$ $x\neq 0, y\neq 0$

$= \frac{4x^2y^2}{24x^2y}$

$= \frac{y}{6}, x\neq 0, y\neq 0$

b) $\left(\frac{3x^2}{y^2}\right)\div\left(\frac{x}{y}\right)$ $y\neq 0$

$= \frac{3x^2}{y^2}\cdot\frac{y}{x}, x\neq 0$

$= \frac{3x}{y}, x\neq 0, y\neq 0$

Recall: To divide fractions we multiply by the reciprocal of the second fraction

Factor first

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

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

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

$= \frac{x-1}{x}, x\neq \pm 3, 04$

Remember that you CANNOT cancel the xs out here!!!

d) $\frac{x^2-9}{y^3-y}\times\frac{y^2-y}{x+3}$

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

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

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

$= \frac{x-3}{y+1}, x\neq -3, y\neq \pm 1, 0$

Factor by Decomposition

e) $\frac{x^2-4}{x^2-4x} \div \frac{2x^2-x-6}{x^2+x-20}$

	$2x$	$+3$
x	$2x^2$	$+3x$
-2	$-4x$	-6

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

$x \neq -5, 0, 4$

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

$x \neq -3/2, 2$

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

$x \neq -5, -3/2, 0, 2, 4$

f) $\frac{3x+12}{3x^2-5x-12} \div \frac{12}{3x+4} \cdot \frac{2x-6}{x+4}$

	$3x$	$+4$
x	$3x^2$	$+4x$
-3	$-9x$	-12

$= \frac{3(x+4)}{(x-3)(3x+4)} \div \frac{12}{(3x+4)} \cdot \frac{2(x-3)}{(x+4)}$

$x \neq -4, -4/3, 3$

$= \frac{3(x+4)}{(x-3)(3x+4)} \cdot \frac{(3x+4)}{12} \cdot \frac{2(x-3)}{(x+4)}$

no new non-permissible values!

$= \frac{6}{12}$

$= \frac{1}{2}, \quad x \neq -4, -4/3, 3$