Pre-Calculus 11

7.2

Multiplying & Dividing Rational Expressions.

Steps for multiplying & dividing rational expressions:

1. When dividing, multiply by the reciprocal
2. Factor the numerators & denominators
3. State restrictions (NPVs)
4. Cancel common factors.
5. Express answer as one rational.

Examples // Simplify each expression

1 a) $\frac{\cancel{b}}{\cancel{12}_{4}} \times \frac{\cancel{3}^{1}a}{2b^{\cancel{2}}} \rightarrow$ option 2: $\frac{3a\cancel{b}}{24b^{\cancel{2}}} = \frac{a}{8b}$

$= \frac{a}{8b}, b \neq 0$

b) $\frac{\cancel{6}^{2}\cancel{m^3}(n+1)}{{}_{5}\cancel{15}\cancel{m}\,\cancel{(n-1)}} \times \frac{2\cancel{(n-1)}}{\cancel{m}n}$

$= \frac{4m(n+1)}{5n}$

NPVs: $n \neq 0, n \neq 1, m \neq 0$

2 a) $\frac{12x^2}{15} \div \frac{3x}{2y}$

$= \frac{{}^{4}\cancel{12}x^{\cancel{2}}}{15} \times \frac{2y}{{}_{1}\cancel{3x}}$

$= \frac{8xy}{15}$

NPVs: $y \neq 0, x \neq 0$

c) $\frac{14(m-1)}{15m^2} \div \frac{m(m-1)}{5(m+2)}$

$= \frac{14\cancel{(m-1)}}{{}_{3}\cancel{15}m^2} \times \frac{\cancel{5}(m+2)}{m\cancel{(m-1)}}$

$= \frac{14(m+2)}{3m^3}$

NPVs: $m \neq 0, m \neq 1, m \neq -2$

3. Simplify

a) $\dfrac{x^2+7x+12}{x^2+2x-15} \cdot \dfrac{x^2-5x+6}{x^2-16}$

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

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

NPVs:

$x+5 \neq 0$ $\quad$ $x-3 \neq 0$

$x \neq -5$ $\quad$ $x \neq 3$

$x+4 \neq 0$ $\quad$ $x-4 \neq 0$

$x \neq -4$ $\quad$ $x \neq 4$

b) $\dfrac{x^2+15x+56}{x^2-3x-54} \div \dfrac{x^2+6x-16}{x^2+4x-12}$

$= \dfrac{x^2+15x+56}{x^2-3x-54} \times \dfrac{x^2+4x-12}{x^2+6x-16}$

*NOTE: NPV's are found from all factors EVER located in the denominator!

$= \dfrac{\cancel{(x+8)}(x+7)}{(x-9)\cancel{(x+6)}} \times \dfrac{\cancel{(x+6)}\cancel{(x-2)}}{\cancel{(x+8)}\cancel{(x-2)}}$

$x \neq -6$ $\quad$ $x \neq 2$

$x \neq 2$ $\quad$ $x \neq -6$

$x \neq -8$ $\quad$ $x \neq 9$

$= \dfrac{x+7}{x-9}$

NPVs: $x \neq -6$, $x \neq -8$

$x \neq 2$, $x \neq 9$

c) $\dfrac{12m^2-3}{2mn^2-2m^2n} \div \dfrac{2m+1}{5mn-5n^2}$

*NOTE:

$(m-n)$

$= -1(-m+n)$

$= -(n-m)$

$= \dfrac{12m^2-3}{2mn^2-2m^2n} \times \dfrac{5mn-5n^2}{2m+1}$

$= \dfrac{3(4m^2-1)}{2mn(n-m)} \times \dfrac{5n(m-n)}{2m+1}$

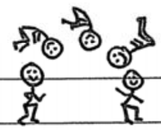
$= \dfrac{3(2m-1)\cancel{(2m+1)}}{2m\cancel{n}\cancel{(n-m)}} \times \dfrac{-5\cancel{n}\cancel{(n-m)}}{\cancel{2m+1}}$

$= \dfrac{-15(2m-1)}{2m}$

NPV's: $m \neq 0$ $\quad$ $m-n \neq 0$

$n \neq 0$ $\quad$ $m \neq n$

$m \neq -\dfrac{1}{2}$

Complex Fractions - 

A complex fraction is a fraction with a
in the numerator and/or denominator.

Examples //

1. Simplify the following.

$$\dfrac{\dfrac{x^2-4}{x+3} \longrightarrow \neq 0}{\dfrac{2x-4}{x^2+2x-3} \begin{matrix} \longrightarrow \neq 0 \\ \longrightarrow \neq 0 \end{matrix}}$$

$$= \frac{x^2-4}{x+3} \div \frac{2x-4}{x^2+2x-3}$$

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

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

NPVs: $x \neq -3,\ x \neq 1,\ x \neq 2$
or $x \neq -3, 1, 2$

2. $$\frac{2-\frac{6}{x}}{1-\frac{9}{x^2}}$$

method 1: Clear The Fractions

$$\frac{\left(2-\frac{6}{x}\right)\cdot\frac{x^2}{1}}{\left(1-\frac{9}{x^2}\right)\cdot\frac{x^2}{1}}$$

① multiply everything by the LCD of the individual fractions (tops only)

$$=\frac{2x^2-\frac{6x^{\cancel{2}}}{\cancel{x}}}{x^2-\frac{9\cancel{x^2}}{\cancel{x^2}}}$$

② simplify individual fractions

$$=\frac{2x^2-6x}{x^2-9}$$

③ simplify the rational

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

NPVs: $x\neq 3, x\neq -3$

method 2: simplify

$$\frac{\frac{2}{1}-\frac{6}{x}}{\frac{1}{1}-\frac{9}{x^2}}$$

LCD = x

LCD = x^2

① Find LCD for the numerator & denominator separately

② write over LCD

$$=\frac{\frac{2x}{x}-\frac{6}{x}}{\frac{x^2}{x^2}-\frac{9}{x^2}}=\frac{2x-6}{x}\div\frac{x^2-9}{x^2}=\frac{2\cancel{(x-3)}}{\cancel{x}}\cdot\frac{x^{\cancel{2}}}{\cancel{(x-3)}(x+3)}$$

③ simplify

$$=\frac{2x}{x+3}$$