Multiplying and Dividing Rational Expressions

Simplify each of the following and state any restrictions on the variables:

Example 1

(monomial example)

$$\frac{3x^2y^3}{8} \times \frac{2x^4y^5}{9x^6y^2} = \frac{\cancel{6}^{1}\cancel{x^6}\,y^{\cancel{8}\,6}}{\cancel{72}^{12}\,\cancel{x^6}\,\cancel{y^2}} = \frac{y^6}{12}$$

☆ no factoring with monomials

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

Example 2

$$\frac{6m^3n^4}{5k^4p^5} \div \frac{18m^5n^2}{20k^5}$$

☆ monomials (no factoring)

$$= \frac{6m^3n^4}{5k^4p^5} \times \frac{20k^5}{18m^5n^2}$$

$$= \frac{\cancel{120}^{4}\,\cancel{m^3}\,\cancel{n^4}^{n^2}\,\cancel{k^5}\,k}{\cancel{90}^{3}\,\cancel{m^5}_{m^2}\,\cancel{n^2}\,\cancel{k^4}\,p^5}$$

$$= \frac{4n^2k}{3m^2p^5}$$

$m \neq 0$
$n \neq 0$
$k \neq 0$
$p \neq 0$

Example 3 $\dfrac{5y-10}{y+1} \times \dfrac{y+1}{10}$

Factor First!

$$= \frac{5(y-2)}{1(y+1)} \times \frac{1(y+1)}{10}$$

$$= \frac{\cancel{5}(y-2)\cancel{(y+1)}}{\cancel{10}\,\cancel{(y+1)}}$$

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

$y \neq -1$

Example 4 $\dfrac{x^2-4}{x+3} \div \dfrac{4x-8}{3x+9}$

$$= \frac{x^2-4}{x+3} \times \frac{3x+9}{4x-8}$$

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

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

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

$x \neq -3$

$x \neq 2$

Example 5 $\dfrac{a^2+7a+12}{a^2+4a+4} \times \dfrac{a^2-a-6}{a^2-9}$

$$= \frac{(a+\cancel{3})(a+4)}{(a+2)(\cancel{a+2})} \cdot \frac{(\cancel{a-3})(\cancel{a+2})}{(\cancel{a+3})(\cancel{a-3})}$$

$$= \frac{(a+4)}{(a+2)}$$

$a \neq -2$
$a \neq -3$
$a \neq 3$

Example 6 $\dfrac{x^2-xy-20y^2}{x^2-8xy+15y^2} \div \boxed{\dfrac{x^2+2xy-8y^2}{x^2-xy-6y^2}}$

$$= \frac{x^2-xy-20y^2}{x^2-8xy+15y^2} \times \boxed{\frac{x^2-xy-6y^2}{x^2+2xy-8y^2}}$$

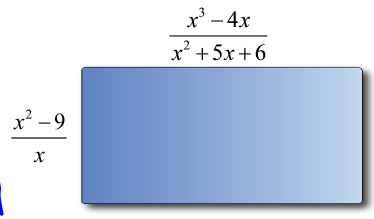
$$= \frac{(x-\cancel{5y})(x+\cancel{4y})}{(x-\cancel{3y})(x-\cancel{5y})} \cdot \boxed{\frac{(\cancel{x-3y})(x+2y)}{(x-2y)(\cancel{x+4y})}}$$

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

$x \neq 3y$
$x \neq 5y$
$x \neq 2y$
$x \neq -4y$
$x \neq -2y$

Example 7

Express the area of the rectangle in simplest form:



$$A = l \times w$$

$$= \frac{x^3-4x}{x^2+5x+6} \times \frac{x^2-9}{x}$$

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

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

$$= (x-2)(x-3)$$

Example 8

Do from your text.....Page 123 #13