March 22/2012

## Multiplying and Dividing Rational Expressions

recall these operations with fractions:

Simplify each of the following

$\frac{1}{2} \cdot \frac{-3}{5} = \frac{(1)(-3)}{(2)(5)} = \frac{-3}{10}$

$\frac{50}{27} \cdot \frac{-3}{5} = \frac{(10)(-1)}{9(1)} = \frac{-10}{9}$

$\frac{12}{27} \div \frac{20}{15} = \frac{12}{27} \times \frac{15}{20} = \frac{1}{3}$

multiply by reciprocal of the divisor

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Multiplying and Dividing rational expressions is very similar to carrying these operations out with fractions, except for the factoring and stating restrictions.

Steps:

1. Factor the numerator and denominator separately.
2. Perform the correct fractional operation.
3. Identify restrictions (where is <u>any</u> denominator = 0 ?).
4. Divide out common factors to simplify.

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Ex.1 Simplify and state any restrictions

(a) $\frac{x}{4} \cdot \frac{12}{x^2}$ $= \frac{^{3}\cancel{12}\,x^{1}}{\cancel{4}\,x \cdot \cancel{x}_{1}}$

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

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(b) $\frac{-5x^3}{3y} \div \frac{y}{25x^2}$

started in a denominator

$= \frac{-5x^3}{3y} \times \frac{25x^2}{y}$

$= \frac{-125x^5}{3y^2}$, $y \neq 0$, $x \neq 0$

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c) $\dfrac{x+2}{x^2-4x+3} \cdot \dfrac{x-1}{x^2+3x+2}$

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

$= \dfrac{1}{(x-3)(x+1)}$, $x \neq 3, -1, 1, -2$

Same as

$x \neq 3$

$x \neq -1$

$x \neq 1$

$x \neq -2$

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(d) $\dfrac{2x+4}{x^2-9} \div \dfrac{x^2-4}{x^2-2x-3}$

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

factor + reciprocal at same time

$= \dfrac{2(x+1)}{(x+3)(x-2)}$, $x \neq 3, -3, 2, -2, -1$

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(e) $\dfrac{x^2 - x - 20}{x^2 - 6x} \div \dfrac{x^2 + 9x + 20}{x^2 - 12x + 36}$

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(e) $\dfrac{3a + 6}{9a^2} \div \dfrac{a + 2}{-3a} \bullet \dfrac{15a}{2}$

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Homework:

p.50 # 5ad, 6adgh, 7ae, 8ab, 18

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p. 50

6 (a) $\frac{4x+4}{3x-3} \times \frac{6x-6}{5x+5}$

$= \frac{4(x+1)^{1}}{3(x-1)_{1}} \times \frac{{}^{2}6(x-1)^{1}}{5(x+1)_{1}}$

$= \frac{8}{5}, x \neq 1, x \neq -1$

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6(g) $\frac{4x-6}{8x^2y} \times \frac{4xy}{6x-9}$

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

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

$2x-3=0$

$2x=3$

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

$x \neq \frac{3}{2}$

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7(a) $\frac{x^2+5x+6}{x^2-6x+5} \times \frac{x^2+x-30}{x^2+9x+18}$

$= \frac{(x+2)(x+3)}{(x-1)(x-5)} \cdot \frac{(x+6)(x-5)}{(x+3)(x+6)}$

$= \frac{x+2}{x-1}, x \neq 1, 5, -3, -6$

asymptote

hole

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8(b) $\dfrac{x^2+3xy}{x^2-xy-42y^2} \times \dfrac{x^2-10xy+21y^2}{x^2-9y^2}$

$= \dfrac{x(x+3y)}{(x-7y)(x+6y)} \times \dfrac{(x-7y)(x-3y)}{(x-3y)(x+3y)}$

$= \dfrac{x}{x+6y}$, $x \neq -6y, x \neq 3y$

$x \neq -3y, x \neq 7y$

asymptote

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