PC11 Lesson 6.2

Wednesday, April 26, 2017 4:40 PM

6.2 Multiplying and Dividing Rational Expressions

Warm Up

1. What is the reciprocal of each expression?

a) $\frac{5}{7}$ $\quad \frac{7}{5}$

b) $-2\frac{1}{3} = -\frac{7}{3}$ $\quad -\frac{3}{7}$

c) $3x$ $\quad \frac{1}{3x}$

d) $\frac{3x}{y-3}$ $\quad \frac{y-3}{3x}$

e) $\frac{x+y}{-4}$ $\quad \frac{-4}{x+y}$

2. What are the non-permissible values, if any, for each rational expression?

a) $\frac{5x^2}{2y}$ $\quad 2y \neq 0$, $y \neq 0$

b) $\frac{x^2-9}{x+3}$ $\quad x \neq -3$

c) $\frac{7m}{(m-4)(2m+1)}$ $\quad m \neq 4$, $m \neq -\frac{1}{2}$

d) $\frac{-2x+1}{2x^2-x-3}$ $\quad (2x-3)(x+1) \neq 0$, $x \neq \frac{3}{2}$, $x \neq -1$

e) $\frac{t+5}{25-t^2}$ $\quad (5+t)(5-t) \neq 0$, $t \neq \pm 5$

3. Write an expression that satisfies the given conditions in each case.

a) equivalent to $\frac{y-3}{4}$ with a denominator of $4x$

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

NPV $x \neq 0$

b) equivalent to $\frac{a-3}{a^2-9}$ with a numerator of 1

$\frac{a-3 \div (a-3)}{(a+3)(a-3) \div (a-3)} = \frac{1}{a+3}$

NPV $a \neq \pm 3$

c) equivalent to $\frac{x+2}{x-4}$ with non-permissible values of ± 4

$\frac{x+2 \cdot (x+4)}{x-4 \cdot (x+4)} = \frac{x^2+6x+8}{x^2-16}$

NPV $x \neq \pm 4$

d) equivalent to $\frac{c-3f}{4d}$ with a numerator of $3c-9f$

$\frac{(c-3f) \times 3}{(4d) \times 3} = \frac{3c-9f}{12d}$

NPV $d \neq 0$

4. Multiply the following:

a) $\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$

b) $\frac{2}{5} \times \frac{2}{1} = \frac{4}{5}$

c) $\frac{3}{7} \times \frac{2}{5} = \frac{6}{35}$

d) $\frac{\cancel{2}}{5} \times \frac{8}{\cancel{2}} = \frac{8}{5}$

e) $\frac{17}{21} \times \frac{\cancel{6}2}{\cancel{3}1} = \frac{34}{21}$

5. Divide the following:

a) $\frac{1}{3} \div \frac{1}{2}$ $\quad = \frac{1}{3} \times \frac{2}{1}$ $\quad = \frac{2}{3}$

b) $\frac{1}{3} \div 4$ $\quad = \frac{1}{3} \times \frac{1}{4}$ $\quad = \frac{1}{12}$

c) $\frac{3}{7} \div \frac{5}{2}$ $\quad = \frac{3}{7} \times \frac{2}{5}$ $\quad = \frac{6}{35}$

d) $\frac{8}{3} \div \frac{1}{6}$ $\quad = \frac{8}{3} \times \frac{6}{1}$ $\quad = \frac{48}{3}$ $\quad = 16$

e) $\frac{11}{6} \div \frac{5}{8}$ $\quad = \frac{11}{\cancel{6}_3} \times \frac{\cancel{8}^4}{5}$ $\quad = \frac{44}{15}$

To simplify a product or quotient of rational expressions, treat them as you would fractions.

* **Remember: always factor first!**

All **non-permissible** values of each expression being multiplied or divided **must be stated**.
(before simplification)

Example 1: Simplify each expression. State the non-permissible values

a. $\frac{3x^{\cancel{2}\,1}y}{2\cancel{8}} \times \frac{\cancel{12}^{\,3}y}{\cancel{x}}$

can't factor

NPV
$x \neq 0$

$= \frac{9xy^2}{2}$

b. $\frac{10x^2(y+3)}{5\cancel{(y-3)}} \times \frac{2\cancel{(y-3)}}{xy}$

can't factor

NPV
$x \neq 0$
$y \neq 0, 3$

$= \frac{{}^{4}\cancel{20}x^{\cancel{2}\,1}(y+3)}{\cancel{5}xy}$

$= \frac{4x(y+3)}{y}$ OR $\frac{4xy+12x}{y}$

OR $4x + \frac{12x}{y}$

c. $\frac{3a^3}{-5} \div \frac{(3a)^2}{10}$

can't factor

NPV
$a \neq 0$

$= \frac{3a^3}{-5} \times \frac{10}{(3a)^2}$

$= \frac{30a^{\cancel{3}\,1}}{-5 \times 9\cancel{a^2}}$

$= \frac{\cancel{30}^{\,2}a}{-\cancel{45}_{\,3}}$

$= -\frac{2a}{3}$

d. $\frac{4(x-2)}{x^2} \div \frac{8(x-2)}{x(x+1)}$

$= \frac{4\cancel{(x-2)}}{x^2} \times \frac{x(x+1)}{8\cancel{(x-2)}}$

NPV
$x \neq 0, -1, 2$

$= \frac{4x(x+1)}{8x^{\cancel{2}\,1}}$

$= \frac{x+1}{2x}$

Example 2: Simplify each expression. State the non-permissible values.

a. $\dfrac{3m-2n}{m^2-2mn+n^2} \div \dfrac{9m^2-4n^2}{3m^2n-3mn^2}$

$= \dfrac{3m-2n}{(m-n)(m-n)} \div \dfrac{(3m+2n)(3m-2n)}{3mn(m-n)}$

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

$= \dfrac{3mn}{(m-n)(3m+2n)}$

NPV

$m \neq n, 0, \pm\dfrac{2n}{3}$

$n \neq m, 0, \pm\dfrac{3m}{2}$

b. $\dfrac{3x+12}{3x^2-5x-12} \div \dfrac{12}{3x+4} \times \dfrac{2x-6}{x+4}$

$= \dfrac{3(x+4)}{(3x+4)(x-3)} \div \dfrac{12}{3x+4} \times \dfrac{2(x-3)}{x+4}$

$= \dfrac{3\cancel{(x+4)}}{\cancel{(3x+4)}\cancel{(x-3)}} \times \dfrac{\cancel{3x+4}}{12} \times \dfrac{2\cancel{(x-3)}}{\cancel{x+4}}$

$= \dfrac{6}{12}$

$= \dfrac{1}{2}$

NPV

$x \neq -\dfrac{4}{3}, 3, -4$