5.4 Multiply and Divide Rational Expressions
5.5 Add and Subtract Rational Expressions

HW:

ex: True or False?

a) $\frac{x}{x+3} = \frac{1}{3}$

b) $\frac{x+4}{x-8} = -\frac{1}{2}$

c) $\frac{x}{x(x+1)} = \frac{1}{x+1}$

Rational Expressions

A rational expression has the form $\frac{f(x)}{g(x)}$ where $f(x)$ and $g(x)$ polynomials and $g(x) \neq 0$.

A rational expression is in simplified form when its numerator and denominator have NO common factors.

ex: Simplify.

a) $\dfrac{2x^2+10x}{3x^2+16x+5}$

$$\frac{2x(x+5)}{(3x+1)(x+5)}$$

$$\frac{2x}{3x+1}$$

ex: Simplify.

b) $\dfrac{5x^3+20x^2+15x}{x^3-6x^2-9x+54}$

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

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

ex: Simplify.

c) $\dfrac{x^2-4}{x^3-8}$

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

$$\frac{x+2}{x^2+2x+4}$$

ex: Simplify.

d) $\dfrac{2x^2-6x-36}{4x^2-16x+12}$

$$\frac{1\cancel{2}(x-6)(x+3)}{2\cancel{4}(x-3)(x-1)}$$

REVIEW: Peform the indicated operation.

a) $\frac{1}{2} \cdot \frac{4}{5} = \frac{4}{10} = \frac{2}{5}$

b) $\frac{1}{2} \div \frac{4}{5} = \frac{1}{2} \cdot \frac{5}{4} = \frac{5}{8}$

c) $\frac{1 \cdot 5}{2 \cdot 5} + \frac{4 \cdot 2}{5 \cdot 2} = \frac{5}{10} + \frac{8}{10} = \frac{13}{10}$

d) $\frac{1}{2} - \frac{4}{5}$ $\frac{5}{10} - \frac{8}{10} = \frac{-3}{10}$

The rules for multiplying, dividing, adding and subtracting fractions are the SAME for rational expressions!

ex: Perform the indicated operation. Express your answer in simplest form.

a) $\dfrac{x^2-6x-16}{x^2-11x+24}\cdot\dfrac{x-8}{x^2+5x+6}$

$$\frac{(x-8)(x+2)\,(x-8)}{(x-8)(x-3)\,(x+3)(x+2)}$$

$$\frac{x-8}{(x-3)(x+3)}$$

ex: Perform the indicated operation. Express your answer in simplest form.

b) $\dfrac{x^2-5x-36}{x^2-49}\cdot\dfrac{(x^2-11x+28)}{1}$

$$\frac{(x-9)(x+4)(x-7)(x-4)}{(x+7)(x-7)}$$

$$\frac{(x-9)(x+4)(x-4)}{x+7}$$

ex: Perform the indicated operation. Express your answer in simplest form.

c) $\dfrac{8x-20}{x^2+2x-35} \div \dfrac{4x^2-16}{x^2-7x+10}$

ex: Perform the indicated operation. Express your answer in simplest form.

d) $\dfrac{x^3-3x^2-9x+27}{3x^2+10x+8} \div \dfrac{x^2-6x+9}{3x^2+x-4}$

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

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

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

ex: Perform the indicated operation. Express your answer in simplest form.

e) $\dfrac{\dfrac{4x}{x+6}}{x^2+3x-18}$

$\dfrac{4x}{x+6} \div (x^2+3x-18)$

$\dfrac{4x}{x+6} \cdot \dfrac{1}{(x+6)(x-3)} = \dfrac{4x}{(x+6)^2(x-3)}$

REVIEW: Find the LCM.

The least common multiple (LCM) of two numbers or expressions is the smallest quantity (not zero) that is a divisible by both numbers or expressions.

a) 5, 2

10

b) 3, 12

12

REVIEW: Find the LCM.

c) 8, 12

$2 \cdot 2 \cdot 2$ $\quad$ $2 \cdot 2 \cdot 3$

$2 \cdot 2 \cdot 2 \cdot 3$ (24)

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d) 24, 30

$2 \cdot 2 \cdot 2 \cdot 3$ $\quad$ $2 \cdot 3 \cdot 5$

$2 \cdot 3 \cdot 2 \cdot 2 \cdot 5 = 120$

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e) 35, 50

$5 \cdot 7$ $\quad$ $5 \cdot 5 \cdot 2$

$5 \cdot 7 \cdot 5 \cdot 2 = 350$

REVIEW: Find the LCM.

f) $x^3 - x^2 - 2x, \quad x^2 - 4x + 4$

$x(x-2)(x+1)$ $\quad (x-2)(x-2)$

$x(x-2)(x+1)(x-2)$

$x(x-2)^2(x+1)$

REVIEW: Find the LCM.

g) $x^2 - 10x + 25, \quad 5x^2 - 24x - 5$

$(x-5)(x-5) \qquad (5x+1)(x-5)$

$(x-5)(x-5)(5x+1)$

ex: Perform the indicated operation. Express your answer in simplest form.

a) $\dfrac{5}{6x-18} - \dfrac{3(x-1)}{4x^2-14x+6}$

$6(x-3)$ $(2x-1)$ $\quad 2(2x-1)(x-3)\cdot 3$

$$\frac{10x-5-3(x-1)}{6(x-3)(2x-1)}$$

$$\frac{7x-2}{6(x-3)(2x-1)}$$

LCM

$6x-18$ $\quad 4x^2-14x+6$

$6(x-3)$ $\quad 2(2x-1)(x-3)$

$2\cdot 3(x-3)$ $\quad 2(2x-1)(x-3)$

$2(x-3)3(2x-1)$

LCD: $6(x-3)(2x-1)$

ex: Perform the indicated operation. Express your answer in simplest form.

b) $\dfrac{5x+1}{3x^2+3x} + \dfrac{7x}{x+1}$

LCD: $3x(x+1)$

$3x^2+3x$

$\dfrac{5x+1}{3x(x+1)} + \dfrac{7x \cdot 3x}{(x+1)\cdot 3x}$

$\dfrac{5x+1+21x^2}{3x(x+1)} = \dfrac{21x^2+5x+1}{3x(x+1)}$

ex: Perform the indicated operation. Express your answer in simplest form.

c) $6 - \dfrac{x+5}{x^2-2}$ $= \dfrac{6(x^2-2)}{1(x^2-2)} - \dfrac{x+5}{x^2-2}$

$$\frac{6(x^2-2)-(x+5)}{x^2-2}$$

$$\frac{6x^2-12-x-5}{x^2-2} = \frac{6x^2-x-17}{x^2-2}$$

ex: Perform the indicated operation. Express your answer in simplest form.

d) $\dfrac{x}{x-2} - \dfrac{x}{5} \div \dfrac{x^3-4x}{15x+5}$

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

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

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

ex: Perform the indicated operation. Express your answer in simplest form.

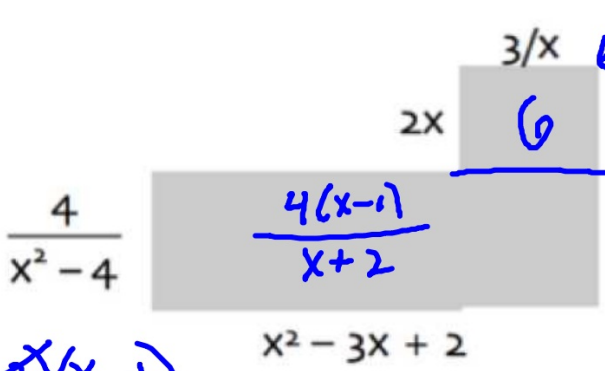
e) $\left(\frac{5x^3y}{35} \cdot \frac{21x}{15y^2}\right) \div \frac{25x}{9y}$

$\frac{x^4y}{5y^2}$

$\frac{x^4}{5y} \cdot x^3 \cdot \frac{9y}{25x} =$

$\frac{9x^3}{125}$

ex: Find the area.



$2x \cdot \frac{3}{x} = 6$

$\frac{10x+8}{x+2}$

$\frac{4}{(x-2)(x+2)} \cdot \frac{(x-2)(x-1)}{1}$

$\frac{4(x-1)}{x+2} + 6 = \frac{4x-4+6(x+2)}{x+2} = \frac{4x-4+6x+1}{x+2}$