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

ex: True or Faslse?

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 Expression

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) $\dfrac{2x^2+10x}{3x^2+16x+5} = \dfrac{2x(x+5)}{(x+5)(3x+1)} = \dfrac{2x}{(3x+1)}$

ex: Simplify.

b) $\dfrac{5x^3+20x^2+15x}{x^3-6x^2-9x+54}$ $= \dfrac{5x(x+3)(x+1)}{(x+3)(x-3)(x-6)}$

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

ex: Simplify.

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

SOAP

REVIEW: Peform the indicated operation.

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

b) $\frac{1}{2} \div \frac{4}{5} = \frac{1}{2} \cdot \frac{5}{4} = \frac{5}{8}$ $\quad 10 \div 2$ $\quad 10 \cdot \frac{1}{2} = 5$

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

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

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) $\dfrac{x^2-6x-16}{x^2-16x+24}\cdot\dfrac{x-8}{x^2+5x+6}$ $= \dfrac{(x-8)(x+2)(x-8)}{(x^2-16x+24)(x+3)(x+2)}$

$= \dfrac{(x-8)^2}{(x^2-16x+24)(x+3)}$

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

$$\frac{4(2x-5)(x-5)(x-2)}{(x+7)(x-5)(x+2)(x-2)}$$

$$\frac{2x-5}{(x+7)(x+2)}$$

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

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

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

e) $\dfrac{\left(\dfrac{4x}{x+6}\right)}{\left(\dfrac{x^2+3x-18}{1}\right)} = \dfrac{4x}{x+6} \cdot \dfrac{1}{x^2+3x-18} = \dfrac{4x}{(x+6)^2(x-3)}$

Complex fraction: a fraction divided by another fraction

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 LCM: 10

5: 5, 10, 15, 20
2: 2, 4, 6, 8, 10, 12, 14

b) 3, 12 LCM: 12

REVIEW: Find the LCM.

c) 8, 12

8, 16, 24, 32
12, 24, 36

d) 24, 30

24: 2·2·2·3
30: 2·3·5

2·2·2·3·5
120

e) 35, 50

350

REVIEW: Find the LCM.

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

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

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

$2 \cdot 7$

$2 \cdot 2 \cdot 3$

$2 \cdot 7 \cdot 2$

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

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

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

$= \dfrac{5(2x-1) - 3(x-1)}{6(x-3)(2x-1)}$

1) *Find LCM*
2) *Multiple each fraction to create the LCM for the denominator*
3) *Distribute and simplify*

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

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

LCM:

$6(x-3)$

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

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

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

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

$3(x+1)(x^2-x+1)$ $\quad 3(x^2-x+1)$

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

LCM: $3(x+1)(x^2-x+1)$

$\dfrac{21x^3-21x^2+26x+1}{3(x+1)(x^2-x+1)}$

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

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

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

$\dfrac{6x^2-x-17}{x^2-2}$

$3 - \dfrac{2}{3}$

$\dfrac{3\cdot 3}{3\cdot 1} - \dfrac{2}{3}$

$\dfrac{9-2}{3}$

$\dfrac{7}{3}$