

**BEDMAS Rules!**

1 2 3 4

Steps for multiplying/dividing:

1. Factor the numerator and denominator separately.
2. Identify restrictions (where is denominator = 0 ?).
3. Divide out common factors to simplify.

Steps for adding/subtracting:

1. Factor the denominator.
2. Identify restrictions (where is denominator = 0 ?).
3. Find the lowest common denominator, LCD
4. Express each rational expression with the same LCD
5. Add/subtract the terms in the numerator, keep the LCD as your denominator.
6. Factor the numerator, if possible, and simplify.

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All (four) operations with Rational Expressions

Ex.1 Simplify and state any restrictions

March 24/2011

$$\begin{aligned}
 \text{(a)} \quad & \frac{x+8}{2x^2+9x+10} - \frac{x-2}{2x^2-x-15} \\
 & = \frac{x+8}{(x+2)(2x+5)} - \frac{x-2}{(x-3)(2x+5)} \\
 & = \frac{(x+8)(x-3)}{(x+2)(2x+5)(x-3)} - \frac{(x-2)(x+2)}{(x-3)(2x+5)(x+2)} \\
 & = \frac{(x^2+5x-24) - (x^2-4)}{(x+2)(2x+5)(x-3)} \\
 & = \frac{5x-20}{(x+2)(2x+5)(x-3)} \\
 & = \frac{5(x-4)}{(x+2)(2x+5)(x-3)} ; x \neq -2, -\frac{5}{2}, 3 \\
 & \quad \begin{aligned} 2x+5 &= 0 \\ 2x &= -5 \\ x &= -\frac{5}{2} \end{aligned}
 \end{aligned}$$

$$\begin{aligned}
 & 2x^2+9x+10 \quad S \ 9 \\
 & = 2x^2+4x+5x+10 \quad P \ 20 \\
 & = 2x(x+2)+5(x+2) \\
 & = (x+2)(2x+5)
 \end{aligned}$$

$$\begin{aligned}
 & 2x^2-x-15 \quad S \ -1 \\
 & = 2x^2-6x+5x-15 \quad P \ -30 \\
 & = 2x(x-3)+5(x-3) \\
 & = (x-3)(2x+5)
 \end{aligned}$$

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$$\begin{aligned}
 \text{(b)} \quad & \frac{x}{x^2-4} - \frac{x-2}{x^2+2x} + \frac{x+2}{x^2-2x} \\
 & = \frac{x}{(x+2)(x-2)} - \frac{x-2}{x(x+2)} + \frac{x+2}{x(x-2)} \quad \text{LCD: } x(x+2)(x-2) \\
 & = \frac{x \cdot x}{x(x+2)(x-2)} - \frac{(x-2)(x-2)}{x(x+2)(x-2)} + \frac{(x+2)(x+2)}{x(x-2)(x+2)} \\
 & = \frac{(x^2) - (x^2 - 4x + 4) + (x^2 + 4x + 4)}{x(x+2)(x-2)} \\
 & = \frac{x^2 + 8x}{x(x+2)(x-2)} \\
 & = \frac{\cancel{x}(x+8)}{\cancel{x}(x+2)(x-2)} \\
 & = \frac{x+8}{(x+2)(x-2)} ; x \neq 0, \pm 2
 \end{aligned}$$

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$$\begin{aligned}
 \text{(c)} \quad & \frac{2}{x} - \frac{x-2}{x+1} \div \frac{x-3}{x+1} \quad x \neq 0, -1, 3 \\
 & = \frac{2}{x} - \frac{x-2}{x+1} \cdot \frac{x+1}{x-3} \\
 & = \frac{2}{x} - \frac{(x-2)\cancel{(x+1)}}{\cancel{(x+1)}(x-3)} \\
 & = \frac{2}{x} - \frac{x-2}{x-3} \quad \text{LCD: } x(x-3) \\
 & = \frac{2(x-3)}{x(x-3)} - \frac{x(x-2)}{x(x-3)} \\
 & = \frac{(2x-6) - (x^2-2x)}{x(x-3)} \\
 & = \frac{-x^2 + 4x - 6}{x(x-3)} \\
 & = \frac{-(x^2 - 4x + 6)}{x(x-3)} ; x \neq -1, 0, 3
 \end{aligned}$$

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Homework:

p. 68 # 10 aceg, 14adf

Additional questions:

1)  $\frac{3x+1}{2x-3} + \frac{x}{x^2-9}$

2)  $\frac{3x}{x^2+3x+2} - \frac{4x}{x^2+5x+6} + \frac{5x}{x^2+4x+3}$

3)  $\frac{3x}{6x^2-x-2} + \frac{2x}{10x^2-x-3}$

4)  $\frac{x+1}{2x^2-7x+6} - \frac{x-3}{2x^2-x-3}$

5)  $\frac{3x}{6x^2+13x-5} + \frac{2x+1}{6x^2+7x-3}$

6)  $\frac{x-2}{6x^2-7x-5} \div \frac{2x}{3x^2-5x} - \frac{3x+2}{2x^2+11x+5}$

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14(a)

$$\frac{m+3}{\cancel{m+2}} \cdot \frac{\cancel{m+2}}{m+1} + \frac{5m}{m+1}$$

$$= \frac{m+3}{m+1} + \frac{5m}{m+1}$$

$$= \frac{6m+3}{m+1}$$

$$= \frac{3(2m+1)}{m+1}$$

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14(f)

$$\begin{aligned}
 & \frac{x^2 + 5x + 6}{x^2 - 3x + 2} \div \frac{x+3}{x-1} - \frac{6}{x+3} \\
 &= \frac{(x+2)\cancel{(x+3)}}{\cancel{(x-1)}(x-2)} \cdot \frac{\cancel{x-1}}{\cancel{x+3}} - \frac{6}{x+3} \\
 &= \frac{x+2}{x-2} - \frac{6}{x+3} \quad \text{LCD} \cdot (x-2)(x+3) \\
 &= \frac{(x+2)(x+3)}{(x-2)(x+3)} - \frac{6(x-2)}{(x+3)(x-2)} \\
 &= \frac{(x^2 + 5x + 6) - (6x - 12)}{(x-2)(x+3)} \\
 &= \frac{x^2 - x + 18}{(x-2)(x+3)} \rightarrow \text{cannot be factored} \\
 & \quad x \neq -3, 1, 2
 \end{aligned}$$

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