Adding and Subtracting Rational Expressions

March 23/ 2011

recall these operations with fractions:

Simplify each of the following

$\frac{1}{2} + \frac{1}{5}$ LCM: 10

$= \frac{5}{10} + \frac{2}{10}$

$= \frac{7}{10}$

$\frac{1}{2} + \frac{3}{14}$ LCM: 14

$= \frac{7}{14} + \frac{3}{14}$

$= \frac{10^{5}}{14_{7}}$

$= \frac{5}{7}$

$\frac{5}{6} - \frac{3}{8}$ LCM: 24

$= \frac{20}{24} - \frac{9}{24}$

$= \frac{11}{24}$

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Ex.1 Simplify and state any restrictions

(a) $\frac{2}{x} + \frac{3}{y} = \frac{2y}{xy} + \frac{3x}{xy}$

LCM: xy $= \frac{3x + 2y}{xy}$; $x \neq 0, y \neq 0$

$\frac{xy}{x} = y$

$\frac{xy}{y} = x$

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Steps:

1. Factor the denominator.
2. Identify restrictions (where is denominator = 0 ?).
3. Find the lowest common denominator, LCD (by multiplying the common factor(s) by the distinct factors.)
4. Express each rational expression with the same LCD (by multiplying each numerator by the factors in the LCD that are not in the expression's denominator.)
5. Add/subtract the terms in the numerator, keep the LCD (without expanding) as your denominator.
6. Factor the numerator, if possible, and simplify.

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(b) $\dfrac{2x}{x-2} - \dfrac{x+4}{x-2}$

$= \dfrac{2x-(x+4)}{x-2}$

$= \dfrac{2x-x-4}{x-2}$

$= \dfrac{x-4}{x-2}$; $x \neq 2$

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

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

$= \dfrac{2x^2-x^2-4}{x-2}$

$= \dfrac{x^2-4}{x-2}$

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

$= x+2 \; ; \; x \neq 2$

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c) $\dfrac{x}{x+1} + \dfrac{3x}{x+2}$

① ✓ already factored

② $x \neq -1, -2$

③ LCM: $(x+1)(x+2)$

$= \dfrac{x(x+2)}{(x+1)(x+2)} + \dfrac{3x(x+1)}{(x+1)(x+2)}$ ④

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

$= \dfrac{4x^2+5x}{(x+1)(x+2)}$

$= \dfrac{x(4x+5)}{(x+1)(x+2)} \; ; \; x \neq -2, -1$ ⑥

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

$= \frac{1 \cdot 2}{3 \cdot 2} + \frac{3 \cdot 1}{3 \cdot 2}$

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

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(e) $\dfrac{2}{x^2+x} + \dfrac{x}{x^2-1}$

$= \dfrac{2}{x(x+1)} + \dfrac{x}{(x-1)(x+1)}$ ① , ② : $x \neq 0, -1, 1$

③ LCM: $x(x+1)(x-1)$

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

$= \dfrac{2x-2+x^2}{x(x+1)(x-1)}$ $\longrightarrow$ x^2+2x-2 cannot be factored

$= \dfrac{x^2+2x-2}{x(x+1)(x-1)}$; $x \neq -1, 0, 1$

OR

$x \neq 0, \pm 1$

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(f) $\dfrac{2x-6}{3x+6} + \dfrac{x-3}{x^2+5x+6}$

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Homework:

p.58 # 1c, 4c, 5g, 6ac, 10
p. 67 # 5c, 6ace, 8ace

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