1.6 - Adding and Subtracting Rational Expressions Part 1

Recall: Fractions

a. $\dfrac{1}{7}+\dfrac{3}{7}+\dfrac{8}{7}$

$= \dfrac{12}{7}$

b. $\dfrac{\overset{6}{\cancel{3}}}{\underset{4}{2}}-\dfrac{5}{4}$ $\quad \dfrac{1}{4}$

c. $\dfrac{-1}{\underset{15}{2}}+\dfrac{5}{\underset{10}{3}}-\dfrac{3}{\underset{6}{5}}$

$\dfrac{-15}{30}+\dfrac{50}{30}-\dfrac{18}{30}$

$\dfrac{17}{30}$

$LCD=30$

Rule: To add or subtract fractions, you need a _____

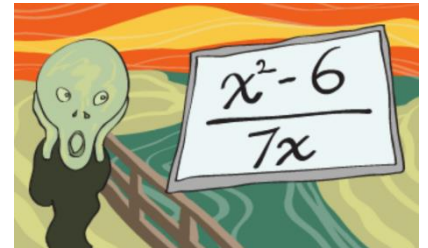# Now with Rational Expressions…

Ex. 1   Simplify the following:

a. $\dfrac{3x}{7}+\dfrac{5x}{7} = \dfrac{8x}{7}$

b. $\dfrac{3x+9}{7}-\dfrac{2x-1}{7} = \dfrac{x+8}{7}$

$\dfrac{x+10}{7}$

c. $\dfrac{3}{x-1}+\dfrac{9}{x-1}$

$\dfrac{12}{2x-2}$ $, x \neq 1$

$\dfrac{x^2-6}{7x}$

d. $\dfrac{(3x+2)}{4}+\dfrac{3(x-4)}{8}-\dfrac{\overset{-4}{2x-1}}{6}$ (×6, ×3, ×4)

$= \dfrac{18x+12+3x-12-8x+4}{24}$

$= \dfrac{13x+4}{24}$

e. $\dfrac{2x+1}{2x^2-7x+12}+\dfrac{3x+5}{2x^2-7x+12}$

$= \dfrac{5x+6}{2x^2-7x+12}$

$\dfrac{ac=24}{\begin{array}{cc} -2 & -12 \\ -3 & -8 \\ -4 & -6 \end{array}}$

let us use b^2-4ac

$(-7)^2-4(2)(12)$

$= 49-96<0$

$= -47<0$

$\therefore$ no solutions

$\therefore$ no restrictions

$$LCD = 30$$

f. $\dfrac{\overset{6}{(3x+1)}}{5x\cancel{6}} + 1 - \dfrac{\overset{-5}{(2x+3)}}{6\times5}$

$\underset{1\times30}{}$

$= \dfrac{18x+6-10x-15}{30}$

$= \dfrac{8x-9}{30}$

$$LCD = 6x^3$$

g. $\dfrac{2}{3x^2}\overset{2x}{\underset{2x}{}} + \dfrac{\overset{3x}{5}}{3x^2 2x}\overset{\cdot 5}{} - \dfrac{\overset{-6}{1}}{6x^3}$

$= \dfrac{4x+15x^2-6}{6x^3} \quad , x \neq 0$

$= \dfrac{15x^2+4x-6}{6x^3}$

$$LCD = x^2y$$

h. $\dfrac{\overset{2xy}{7x^2}}{2xy}\overset{}{x} + \dfrac{\overset{3}{3}}{2x^2y} + \dfrac{\overset{y}{6}}{2yx^2} \quad , \begin{array}{l} x \neq 0 \\ y \neq 0 \end{array}$

$\dfrac{14xy}{2\ x^2y} + \dfrac{6x^2}{2x^2y} + \dfrac{12y}{2x^2y}$

$\dfrac{2(7xy+3x^2+6y)}{2x^2y}$

$= \dfrac{(3x^2+7xy+6y)}{x^2y}$

$$LCD = x-3$$

i. $\dfrac{5}{x-3} + \dfrac{2x}{\underset{-1}{3-x}}\overset{-1}{}$

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

$= \dfrac{5}{x-3} - \dfrac{2x}{x-3}$

$= \dfrac{5-2x}{x-3} \quad , x \neq 3$

Homework: Adding & Subtracting Rational Expressions ~ Part 1 Worksheet #1 – 6 (e.o.)

Adding & Subtracting Rational Expressions ~ Part 1 Worksheet

Practise

In each of the following, state any restrictions

A $y \neq 0$

1. Simplify.

a) $\frac{2}{y} + \frac{4}{y} - \frac{5}{y} = \frac{1}{y}$ $x \neq 0$ b) $\frac{5}{x^2} - \frac{3}{x^2} + \frac{6}{x^2} = \frac{8}{x^2}$

$x \neq -3$ c) $\frac{4}{x+3} + \frac{5}{x+3} = \frac{9}{x+3}$ d) $\frac{x}{x-2} - \frac{y}{x-2} = \frac{x-y}{x-2}$ $x \neq 2$

2. Simplify.

a) $\frac{x+7}{2} + \frac{x+4}{2} = \frac{2x+11}{2}$ b) $\frac{2y-1}{3} + \frac{3y-6}{3} = \frac{5y-7}{3}$

$= \frac{-a+1}{a}$ $a \neq 0$ c) $\frac{3a-1}{a} - \frac{4a+2}{a}$ d) $\frac{5x-y}{3x} - \frac{4x+y}{3x} = \frac{x-2y}{3x}$ $x \neq 0$

$x \neq -1$ e) $\frac{x^2+4}{x+1} + \frac{2x^2}{x+1} = \frac{3x^2+4}{x+1}$ f) $\frac{6t-8}{7} + \frac{3-5t}{7} = \frac{t-5}{7}$

$-z \neq \frac{1}{2}$ $\frac{4z+3}{2z-1}$ g) $\frac{5z}{2z-1} - \frac{z-3}{2z-1}$ h) $\frac{2x+3}{x^2-1} + \frac{3x-4}{x^2-1} = \frac{5x-1}{x^2-1} = \frac{5x-1}{(x-1)(x+1)}$ $x \neq \pm 1$

$x \neq 0$ i) $\frac{4x+1}{x^2+5x+6} + \frac{3x+2}{x^2+5x+6} = \frac{7x+3}{x^2+5x+6} = \frac{7x+3}{(x+3)(x+2)}$ $x \neq -3, -2$

j) $\frac{2y}{2x^2+3x+1} - \frac{5y+3}{2x^2+3x+1} = \frac{(2y-1)2y}{(2x+1)(x+1)} = \frac{-7y-4}{2x^2+3x+1} = \frac{-7y-4}{(2x+1)(x+1)}$ $x \neq -1, -\frac{1}{2}$

3. Find the LCM.

a) 4, 5, 6 $= 60$
b) 4, 9, 12 $= 36$
c) 8, 10, 12 $= 120$
d) 20, 15, 10 $= 60$

4. Simplify.

$LCD = 6$ a) $\frac{x}{2} + \frac{x}{3} = \frac{6x}{6} + \frac{2x}{6} = \frac{8x}{6} = \frac{4x}{3}$

$LCD = 12$ b) $\frac{3a}{4} + \frac{a}{2} - \frac{2a}{6} = \frac{9a}{12} + \frac{6a}{12} - \frac{4a}{12} = \frac{11a}{12}$

$LCD = 10$ c) $\frac{x}{5} - \frac{y}{2} + \frac{7}{10} = \frac{2x}{10} - \frac{5y}{10} + \frac{7}{10} = \frac{2x-5y+7}{10}$

$LCD = 24$ d) $\frac{3m}{8} - \frac{m}{6} - \frac{2m}{3} = \frac{9m}{24} - \frac{4m}{24} - \frac{16m}{24} = \frac{-11m}{24}$

$LCD = 14$

5. Simplify.

a) $\frac{2m+3}{7} + \frac{3m+4}{2} = \frac{14m+21}{14} + \frac{6m+8}{14} = \frac{20m+29}{14}$

b) $\frac{4x-3}{7x} + \frac{4x+2}{4x} = \frac{12x-9}{12} + \frac{4x+8}{12} = \frac{16x-1}{12}$

c) $\frac{y-5}{6} - \frac{2y-3}{4} = \frac{2y-10}{12} - \frac{6y+9}{12} = \frac{-4y-1}{12}$

d) $\frac{2x+3y}{5} - \frac{4x-y}{2} = \frac{4x+6y}{10} - \frac{20x+5y}{10} = \frac{-16x+11y}{10}$

e) $\frac{4t-1}{6} + \frac{3t+2}{2} - \frac{2t+1}{3} = \frac{4t-1}{6} + \frac{9t+6}{6} - \frac{4t-2}{6} = \frac{9t+3}{6} = \frac{3t+1}{2}$

f) $\frac{8a-2b}{18} - \frac{6a+12b}{18} - \frac{7a+9b}{18} = \frac{-12a+19b}{18}$

g) $\frac{8x-6}{30} + 1 - \frac{4x+8}{30} = \frac{15}{30} = \frac{10x+9}{30}$

6. Simplify.

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

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

c) $\frac{a-2}{2a-3} + \frac{-a+3}{-(2a-3)} = \frac{-5}{2a-3}$ $a \neq \frac{3}{2}$

d) $\frac{-2y+3}{-(3y-4y)} + \frac{4+y}{4y-3} = \frac{-y+1}{4y-3}$ $a \neq 2$ $y \neq \frac{3}{4}$

e) $\frac{5x-5}{x^2-9} + \frac{3x+1}{-(x^2-9)} = \frac{8x-6}{x^2-9} = \frac{8x-4}{(x-3)(x+3)}$ $x \neq \pm 3$

f) $\frac{2x^2+3x+1}{4x^2-9} + \frac{x^2-3x-1}{-(4x^2-9)} = \frac{3x^2+6x+2}{(4x^2-9)} = \frac{3x^2}{(4x^2-9)}$ $x = \pm\frac{3}{4}, \pm\frac{3}{2}$

$(2x-3)(2x+3)$

$LCD = 12$
$LCD = 12$
$LCD = 10$

Answers

1. a) $\frac{1}{y}$, $y \neq 0$ b) $\frac{8}{x^2}$, $x \neq 0$ c) $\frac{9}{x+3}$, $x \neq -3$ d) $\frac{x-y}{x-2}$, $x \neq 2$

2. a) $\frac{2x+11}{2}$ b) $\frac{5y-7}{3}$ c) $\frac{-a-3}{a}$, $a \neq 0$ d) $\frac{x-2y}{3x}$, $x \neq 0$

e) $\frac{3x^2+4}{x+1}$, $x \neq -1$ f) $\frac{t-5}{7}$ g) $\frac{4z+3}{2z-1}$, $z \neq \frac{1}{2}$ h) $\frac{5x-1}{x^2-1}$, $x \neq \pm 1$

i) $\frac{7x+3}{x^2+5x+6}$, $x \neq -2, -3$ j) $\frac{-7y-2}{2x^2+3x+1}$, $x \neq -1, -\frac{1}{2}$

3. a) 60 b) 36 c) 120 d) 60 4. a) $\frac{4x}{3}$ b) $\frac{11a}{12}$ c) $\frac{2x-5y+7}{10}$

d) $-\frac{11m}{24}$ 5. a) $\frac{20m+29}{14}$ b) $\frac{16x-1}{12}$ c) $\frac{-4y-1}{12}$

d) $\frac{-16x+11y}{10}$ e) $\frac{3t+1}{2}$ f) $\frac{-12a+19b}{18}$ g) $\frac{10x+39}{30}$

6. a) $\frac{-1}{x-2}$, $x \neq 2$ b) $\frac{2}{x-1}$, $x \neq 1$ c) $\frac{-5}{2a-3}$, $a \neq \frac{3}{2}$

d) $\frac{-y+1}{4y-3}$, $y \neq \frac{3}{4}$ e) $\frac{8x-4}{x^2-9}$, $x \neq \pm 3$ f) $\frac{3x^2}{4x^2-9}$, $x \neq \pm\frac{3}{2}$

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f) $\frac{6t-8}{7} + \frac{3-5t}{7}$

$\frac{(6t-8)}{7} - \frac{(5t-3)}{7} = \frac{t-11}{7}$

$$\text{f)}\ \frac{2x^2 + 3x + 1}{4x^2 - 9}\ \frac{-x^2 - 3x - 1}{-1\,(4x^2 - 9x)^2}$$

$ac = -1$