2.1/2.2 Adding and Subtracting Rational Expressions – Worksheet

MCR3U

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SOLUTIONS

1) Simplify and state any restrictions

a) $\frac{x+1}{18}+\frac{x-1}{45}$

$= \frac{5(x+1)}{90} + \frac{2(x-1)}{90}$

$= \frac{5x+5+2x-2}{90}$

$= \frac{7x+3}{90}$

b) $\frac{2}{3x}-\frac{1}{4x}$

$= \frac{8}{12x} - \frac{3}{12x}$

$= \frac{5}{12x}$, $x \neq 0$

c) $\frac{3}{ab}+\frac{5}{4b}$

$= \frac{12}{4ab} + \frac{5a}{4ab}$

$= \frac{12+5a}{4ab}$, $a \neq 0, b \neq 0$

d) $\frac{2+a}{a^2b}+\frac{4-a}{3ab^2}$

$= \frac{3b(2+a)}{3a^2b^2} + \frac{a(4-a)}{3a^2b^2}$

$= \frac{6b+3ab+4a-a^2}{3a^2b^2}$, $a \neq 0, b \neq 0$

2) Simplify and state the restrictions.

a) $\frac{1}{x-6}-\frac{1}{x+6}$

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

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

$= \frac{12}{(x-6)(x+6)}$, $x \neq -6, 6$

b) $\frac{12}{x+8}+\frac{3}{x-9}$

$= \frac{12(x-9)}{(x+8)(x-9)} + \frac{3(x+8)}{(x+8)(x-9)}$

$= \frac{12x-108+3x+24}{(x+8)(x-9)}$

$= \frac{15x-84}{(x+8)(x-9)}$, $x \neq -8, 9$

c) $\frac{x+10}{x-6} - \frac{x-3}{x+4}$

$= \frac{(x+4)(x+10)}{(x+4)(x-6)} - \frac{(x-6)(x-3)}{(x+4)(x-6)}$

$= \frac{x^2+14x+40-(x^2-9x+18)}{(x+4)(x-6)}$

$= \frac{23x+22}{(x+4)(x-6)}$; $x \neq -4, 6$

d) $\frac{x+5}{x+1} + \frac{x+2}{x-2}$

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

$= \frac{x^2+3x-10}{(x+1)(x-2)} + \frac{x^2+3x+2}{(x+1)(x-2)}$

$= \frac{2x^2+6x-8}{(x+1)(x-2)}$

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

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

3) Simplify and state the restrictions.

a) $\frac{x}{x^2-9x+8} + \frac{2}{x-8}$

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

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

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

$= \frac{3x-2}{(x-8)(x-1)}$; $x \neq 8, 1$

b) $\frac{x+3}{x+5} + \frac{x+2}{x^2+3x-10}$

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

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

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

$= \frac{x^2+2x-4}{(x+5)(x-2)}$; $x \neq -5, 2$

c) $\frac{x}{x^2+3x+2} - \frac{3x-2}{x^2+8x+7}$

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

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

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

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

d) $\frac{x+4}{x^2-121} - \frac{2x-1}{x^2+8x-33}$

$= \frac{x+4}{(x-11)(x+11)} - \frac{2x-1}{(x+11)(x-3)}$

$= \frac{(x+4)(x-3)}{(x-11)(x+11)(x-3)} - \frac{(2x-1)(x-11)}{(x-11)(x+11)(x-3)}$

$= \frac{x^2+x-12-(2x^2-23x+11)}{(x-11)(x+11)(x-3)}$

$= \frac{-1x^2+24x-23}{(x-11)(x+11)(x-3)}$

see bottom of next page...

4) Binomial expressions can differ by a factor of -1. Factor -1 from one of the denominators to identify the common denominator. Then, simplify each expression and state the restrictions.

a) $\frac{1}{x-2} - \frac{1}{2-x}$

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

$= \frac{-1}{-x+2} - \frac{1}{2-x}$

$= \frac{-1}{2-x} - \frac{1}{2-x}$

$= \frac{-2}{2-x}$, $x \neq 2$

b) $\frac{2b+3}{4b-1} + \frac{b+6}{1-4b}$

$= \frac{2b+3}{4b-1} + \frac{-1(b+6)}{-1(1-4b)}$

$= \frac{2b+3}{4b-1} + \frac{-b-6}{-1+4b}$

$= \frac{2b+3}{4b-1} + \frac{-b-6}{4b-1}$

$= \frac{2b+3-b-6}{4b-1}$

$= \frac{b-3}{4b-1}$, $b \neq \frac{1}{4}$

3d) $= \frac{-1(x^2-24x+23)}{(x-11)(x+11)(x-3)}$

$= \frac{-1(x-23)(x-1)}{(x-11)(x+11)(x-3)}$, $x \neq -11, 3, 11$

Answers

1) a) $\frac{7x+3}{90}$, no restrictions **b)** $\frac{5}{12x}, x \neq 0$ **c)** $\frac{12+5a}{4ab}, a \neq 0, b \neq 0$ **d)** $\frac{6b+3ab+4a-a^2}{3a^2b^2}, a \neq 0, b \neq 0$

2) a) $\frac{12}{(x-6)(x+6)}, x \neq -6, 6$ **b)** $\frac{15x-84}{(x+8)(x-9)}, x \neq -8, 9$ **c)** $\frac{23x+22}{(x-6)(x+4)}, x \neq -4, x \neq 6$ **d)** $\frac{2(x+4)(x-1)}{(x+1)(x-2)}, x \neq -1, 2$

3) a) $\frac{3x-2}{(x-1)(x-8)}, x \neq 1, 8$ **b)** $\frac{x^2+2x-4}{(x+5)(x-2)}, x \neq -5, 2$ **c)** $\frac{-2x^2+3x+4}{(x+1)(x+2)(x+7)}, x \neq -7, -2, -1$ **d)** $\frac{-(x-23)(x-1)}{(x+11)(x-11)(x-3)}, x \neq -11, 3, 11$

4) a) $\frac{2}{x-2}, x \neq 2$ **b)** $\frac{b-3}{4b-1}, b \neq \frac{1}{4}$