

## Worksheet Solutions

1. Add or subtract the following rational expressions. Answers should be written in simplest form.

(a)  $\frac{x}{8} + \frac{3x}{8}$

$$\begin{aligned}\frac{x}{8} + \frac{3x}{8} &= \frac{x + 3x}{8} \\ &= \frac{4x}{8} \\ &= \frac{4 \cdot x}{4 \cdot 2} \\ &= \frac{x}{2}\end{aligned}$$

(b)  $\frac{9}{y} - \frac{2}{y}$

$$\begin{aligned}\frac{9}{y} - \frac{2}{y} &= \frac{9 - 2}{y} \\ &= \frac{7}{y}\end{aligned}$$

(c)  $\frac{4}{xy} + \frac{7}{xy}$

$$\begin{aligned}\frac{4}{xy} + \frac{7}{xy} &= \frac{4 + 7}{xy} \\ &= \frac{11}{xy}\end{aligned}$$

(d)  $\frac{5x}{12} - \frac{x}{12}$

$$\begin{aligned}\frac{5x}{12} - \frac{x}{12} &= \frac{5x - x}{12} \\ &= \frac{4x}{12} \\ &= \frac{4 \cdot x}{4 \cdot 3} \\ &= \frac{x}{3}\end{aligned}$$

(e)  $\frac{7}{x+5} + \frac{9}{x+5}$

$$\begin{aligned}\frac{7}{x+5} + \frac{9}{x+5} &= \frac{7+9}{x+5} \\ &= \frac{16}{x+5}\end{aligned}$$

(f)  $\frac{7w}{w+3} + \frac{21}{w+3}$

$$\begin{aligned}\frac{7w}{w+3} + \frac{21}{w+3} &= \frac{7w + 21}{w+3} \\ &= \frac{7(w+3)}{w+3} \\ &= 7\end{aligned}$$

(g)  $\frac{8p}{p-4} - \frac{32}{p-4}$

$$\begin{aligned}\frac{8p}{p-4} - \frac{32}{p-4} &= \frac{8p - 32}{p-4} \\ &= \frac{8(p-4)}{p-4} \\ &= 8\end{aligned}$$

(h)  $\frac{x^2}{x-6x+9} - \frac{9}{x-6x+9}$

$$\begin{aligned}\frac{x^2}{x-6x+9} - \frac{9}{x-6x+9} &= \frac{x^2 - 9}{x-6x+9} \\ &= \frac{x^2 - 9}{-5x+9} \\ &= \frac{(x-3)(x+3)}{-5x+9}\end{aligned}$$

(i)  $\frac{s^2+4s}{s+3} - \frac{2s+3}{s+3}$

$$\begin{aligned}\frac{s^2+4s}{s+3} - \frac{2s+3}{s+3} &= \frac{(s^2+4s) - (2s+3)}{s+3} \\ &= \frac{s^2+4s-2s-3}{s+3} \\ &= \frac{s^2+2s-3}{s+3} \\ &= \frac{(s+3)(s-1)}{s+3} \\ &= s-1\end{aligned}$$

$$\begin{aligned}
 \text{(j)} \quad \frac{4m+7}{6m^2+4} + \frac{2m+5}{2(3m^2+2)} &= \frac{4m+7}{2(3m^2+2)} + \frac{2m+5}{2(3m^2+2)} \\
 &= \frac{4m+7+2m+5}{2(3m^2+2)} \\
 &= \frac{6m+12}{2(3m^2+2)} \\
 &= \frac{2 \cdot 3(m+2)}{2(3m^2+2)} \\
 &= \frac{3(m+2)}{3m^2+2}
 \end{aligned}$$

2. Add or subtract the following rational expressions. Answers should be written in simplest form.

$$\text{(a)} \quad \frac{3}{x} + \frac{4}{5}$$

$$\begin{aligned}
 \frac{3}{x} + \frac{4}{5} &= \frac{5}{5} \cdot \frac{3}{x} + \frac{x}{x} \cdot \frac{4}{5} \\
 &= \frac{15}{5x} + \frac{4x}{5x} \\
 &= \frac{15+4x}{5x} \\
 &= \frac{4x+15}{5x}
 \end{aligned}$$

$$\text{(b)} \quad \frac{7}{3w} - \frac{5}{w^2}$$

$$\begin{aligned}
 \frac{7}{3w} - \frac{5}{w^2} &= \frac{w}{w} \cdot \frac{7}{3w} - \frac{3}{3} \cdot \frac{5}{w^2} \\
 &= \frac{7w}{3w^2} - \frac{15}{3w^2} \\
 &= \frac{7w-15}{3w^2}
 \end{aligned}$$

$$\text{(c)} \quad \frac{x}{x+2} + \frac{2}{5}$$

$$\begin{aligned}
 \frac{x}{x+2} + \frac{2}{5} &= \frac{5}{5} \cdot \frac{x}{x+2} + \frac{x+2}{x+2} \cdot \frac{2}{5} \\
 &= \frac{5x}{5(x+2)} + \frac{2(x+2)}{5(x+2)} \\
 &= \frac{5x}{5(x+2)} + \frac{2x+4}{5(x+2)} \\
 &= \frac{5x+2x+4}{5(x+2)} \\
 &= \frac{7x+4}{5(x+2)}
 \end{aligned}$$

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

$$\begin{aligned} \frac{5}{a-1} + \frac{2}{a} &= \frac{a}{a} \cdot \frac{5}{a-1} + \frac{a-1}{a-1} \cdot \frac{2}{a} \\ &= \frac{5a}{a(a-1)} + \frac{2(a-1)}{a(a-1)} \\ &= \frac{5a}{a(a-1)} + \frac{2a-2}{a(a-1)} \\ &= \frac{5a+2a-2}{a(a-1)} \\ &= \frac{7a-2}{a(a-1)} \end{aligned}$$

$$(e) \frac{4}{y-2} - \frac{1}{y+1}$$

$$\begin{aligned} \frac{4}{y-2} - \frac{1}{y+1} &= \frac{y+1}{y+1} \cdot \frac{4}{y-2} - \frac{y-2}{y-2} \cdot \frac{1}{y+1} \\ &= \frac{4(y+1)}{(y+1)(y-2)} - \frac{y-2}{(y+1)(y-2)} \\ &= \frac{4y+4}{(y+1)(y-2)} - \frac{y-2}{(y+1)(y-2)} \\ &= \frac{(4y+4) - (y-2)}{(y+1)(y-2)} \\ &= \frac{4y+4-y+2}{(y+1)(y-2)} \\ &= \frac{3y+6}{(y+1)(y-2)} \\ &= \frac{3(y+2)}{(y+1)(y-2)} \end{aligned}$$

$$(f) \frac{x}{x+4} - \frac{2}{3x+12}$$

$$\begin{aligned} \frac{x}{x+4} - \frac{2}{3x+12} &= \frac{x}{x+4} - \frac{2}{3(x+4)} \\ &= \frac{3}{3} \cdot \frac{x}{x+4} - \frac{2}{3(x+4)} \\ &= \frac{3x}{3(x+4)} - \frac{2}{3(x+4)} \\ &= \frac{3x-2}{3(x+4)} \end{aligned}$$

$$(g) \frac{2}{3w+3} + \frac{5}{2w+2}$$

$$\begin{aligned} \frac{2}{3w+3} + \frac{5}{2w+2} &= \frac{2}{3(w+1)} + \frac{5}{2(w+1)} \\ &= \frac{2}{2} \cdot \frac{2}{3(w+1)} + \frac{3}{3} + \frac{5}{2(w+1)} \\ &= \frac{4}{6(w+1)} + \frac{15}{6(w+1)} \\ &= \frac{4+15}{6(w+1)} \\ &= \frac{19}{6(w+1)} \end{aligned}$$

$$(h) \frac{x+2}{x-1} - \frac{x}{3x-6}$$

$$\begin{aligned} \frac{x+2}{x-1} - \frac{x}{3x-6} &= \frac{x+2}{x-1} - \frac{x}{3(x-2)} \\ &= \frac{3(x-2)}{3(x-2)} \cdot \frac{x+2}{x-1} - \frac{x-1}{x-1} \cdot \frac{x}{3(x-2)} \\ &= \frac{3(x-2)(x+2)}{3(x-2)(x-1)} - \frac{x(x-1)}{3(x-2)(x-1)} \\ &= \frac{3x^2-12}{3(x-2)(x-1)} - \frac{x^2-x}{3(x-2)(x-1)} \\ &= \frac{(3x^2-12)-(x^2-x)}{3(x-2)(x-1)} \\ &= \frac{3x^2-12-x^2+x}{3(x-2)(x-1)} \\ &= \frac{2x^2+x-12}{3(x-2)(x-1)} \end{aligned}$$

$$(i) \frac{7a}{a^2+a-12} - \frac{4}{a+4}$$

$$\begin{aligned} \frac{7a}{a^2+a-12} - \frac{4}{a+4} &= \frac{7a}{(a-3)(a+4)} - \frac{4}{a+4} \\ &= \frac{7a}{(a-3)(a+4)} - \frac{a-3}{a-3} \cdot \frac{4}{a+4} \\ &= \frac{7a}{(a-3)(a+4)} - \frac{4a-12}{(a-3)(a+4)} \\ &= \frac{7a - (4a-12)}{(a-3)(a+4)} \\ &= \frac{7a - 4a + 12}{(a-3)(a+4)} \\ &= \frac{3a + 12}{(a-3)(a+4)} \\ &= \frac{3(a+4)}{(a-3)(a+4)} \\ &= \frac{3}{a-3} \end{aligned}$$

$$(j) 2 + \frac{4x+12}{x^2-x-12}$$

$$\begin{aligned} 2 + \frac{4x+12}{x^2-x-12} &= \frac{2}{1} + \frac{4x+12}{x^2-x-12} \\ &= \frac{x^2-x-12}{x^2-x-12} \cdot \frac{2}{1} + \frac{4x+12}{x^2-x-12} \\ &= \frac{2x^2-2x-24}{x^2-x-12} + \frac{4x+12}{x^2-x-12} \\ &= \frac{2x^2-2x-24+4x+12}{x^2-x-12} \\ &= \frac{2x^2+2x-12}{x^2-x-12} \\ &= \frac{2(x^2+x-6)}{x^2-x-12} \\ &= \frac{2(x-2)(x+3)}{(x-4)(x+3)} \\ &= \frac{2(x-2)}{x-4} \end{aligned}$$