Warm-Up:

Add or Subtract the following:

① $\dfrac{12}{x^2+5x-24} + \dfrac{3}{x-3} \cdot \dfrac{x+8}{x+8}$

$(x+8)(x-3)$

$\dfrac{12}{(x+8)(x-3)} + \dfrac{3(x+8)}{(x+8)(x-3)}$

$\dfrac{12+3x+24}{(x+8)(x-3)} = \dfrac{3x+36}{(x+8)(x-3)} = \boxed{\dfrac{3(x+12)}{(x+8)(x-3)}}$

② $\dfrac{x+6}{x+6} \cdot \dfrac{3}{(x+4)} - \dfrac{1}{(x+6)} \cdot \dfrac{x+4}{x+4}$

$\dfrac{3(x+6) - 1(x+4)}{(x+4)(x+6)}$

$\dfrac{3x+18-x-4}{(x+4)(x+6)}$

$\dfrac{2x+14}{(x+4)(x+6)} = \boxed{\dfrac{2(x+7)}{(x+4)(x+6)}}$

Simplify the complex fraction:

③ $\dfrac{\dfrac{x}{3} - 6 \cdot \dfrac{3}{3}}{\dfrac{x}{x}\left[10 + \dfrac{4}{x}\right]} = \dfrac{\dfrac{x-18}{3}}{\dfrac{10x+4}{x}} = \dfrac{x-18}{3} \cdot \dfrac{x}{10x+4} = \boxed{\dfrac{x(x-18)}{6(5x+2)}}$

$2(5x+2)$

④ $\dfrac{\left[\dfrac{16}{x-2}\right]}{\dfrac{x}{x}\left[\dfrac{4}{(x+1)}\right] + \dfrac{6}{x} \cdot \dfrac{x+1}{x+1}} = \dfrac{\dfrac{16}{x-2}}{\dfrac{4x+6(x+1)}{x(x+1)}} = \dfrac{16}{x-2} \cdot \dfrac{x(x+1)}{4x+6x+6} = \dfrac{\overset{8}{\cancel{16}}x(x+1)}{(x-2)\cdot\cancel{2}(5x+3)}$

$10x+6$

$2(5x+3)$

$= \boxed{\dfrac{8x(x+1)}{(x-2)(5x+3)}}$

⑤ $\dfrac{x+2\left[\dfrac{3}{x-2} - \dfrac{6}{x^2-4}\right]}{} = \dfrac{3(x+2) - 6}{(x+2)(x-2)} = \dfrac{3x+6-6}{} \cdot \dfrac{(x+2)(x-2)}{}$

⑤

$$\cfrac{\dfrac{x+2}{x+2}\left[\dfrac{3}{x-2} - \dfrac{6}{x^2-4}\right]}{\dfrac{x-2}{x-2}\cdot\left[\dfrac{3}{x+2} + \dfrac{1}{x-2}\right]\cdot\dfrac{x+2}{x+2}}$$

$$= \cfrac{\dfrac{3(x+2)-6}{(x+2)(x-2)}}{\dfrac{3(x-2)+1(x+2)}{(x+2)(x-2)}}$$

$$= \frac{3x+6-6}{(x+2)(x-2)}\cdot\frac{(x+2)(x-2)}{3x-6+x+2}$$

$$= \frac{3x}{4x-4} = \boxed{\frac{3x}{4(x-1)}}$$

⑥

$$\frac{x-4}{x-4}\cdot\cfrac{\left[\dfrac{1}{3x^2-3}\right]}{\left[\dfrac{5}{x+1} - \dfrac{x+4}{x^2-3x-4}\right]}\underset{(x-4)(x+1)}{}$$

$$= \cfrac{\dfrac{1}{3(x^2-1)}}{\dfrac{5(x-4)-(x-4)}{(x-4)(x+1)}}$$

$$= \frac{1}{3(x-1)(x+1)}\cdot\frac{(x-4)(x+1)}{5x-20-x+4}\underset{4x-16 \atop 4(x-4)}{}$$

$$= \frac{1(x-4)}{12(x-1)(x-4)}$$

$$= \boxed{\frac{1}{12(x-1)}}$$