

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

$$\begin{aligned}
 2) \quad & \left[\left(x + \frac{2x}{x-2} \right) \left(\frac{2x}{x-2} - 2 \right) \right] : \frac{4x^2}{x^2-4} \\
 &= \left[\frac{x(x-2) + 2x}{x-2} \cdot \frac{2x-2(x-2)}{x-2} \right] \cdot \frac{x^2-4}{4x^2} \\
 &= \left[\frac{x^2}{x-2} \cdot \frac{4}{x-2} \right] \cdot \frac{(x-2)(x+2)}{4x^2} = \frac{4x^2}{(x-2)^2} \cdot \frac{(x-2)(x+2)}{4x^2} \\
 &= \frac{x+2}{x-2}
 \end{aligned}$$

$$\begin{aligned}
 3) \quad & \left(\frac{1}{x} - \frac{1}{x^2} \right) : \left[\left(\frac{y}{x} + 1 \right) \left(\frac{y}{x} - 1 \right) \frac{x}{y^2-x^2} - \frac{1}{x^2} \right] \\
 &= \frac{x-1}{x^2} : \left[\frac{y+x}{x} \cdot \frac{y-x}{x} \cdot \frac{x}{(y-x)(y+x)} - \frac{1}{x^2} \right] \\
 &= \frac{x-1}{x^2} : \left[\frac{1}{x} - \frac{1}{x^2} \right] = \frac{x-1}{x^2} : \frac{x-1}{x^2} = \frac{x-1}{x^2} \cdot \frac{x^2}{x-1} = 1
 \end{aligned}$$

$$\begin{aligned}
 4) \quad & \left(\frac{1}{x} - \frac{2}{x^2} - \frac{3}{x^3} \right) : \left(\frac{1}{x^2} - 1 \right) = \frac{x^2-2x-3}{x^3} : \frac{1-x^2}{x^2} \\
 &= \frac{x^2-2x-3}{x^3} \cdot \frac{x^2}{1-x^2} = \frac{(x-3)(x+1)}{x^3} \cdot \frac{x^2}{(1-x)(1+x)} \\
 &= \frac{x-3}{x(1-x)}
 \end{aligned}$$

$$\begin{aligned}
 5) \quad & \frac{2x-1}{x+y} \cdot \frac{x^2-y^2}{4x^2-1} \cdot \left(1 - \frac{2x}{2x-1} + \frac{1}{2x+1} \right) \\
 &= \frac{2x-1}{x+y} \cdot \frac{x^2-y^2}{4x^2-1} \cdot \frac{(2x-1)(2x+1) - 2x(2x+1) + (2x-1)}{(2x-1)(2x+1)} \\
 &= \frac{2x-1}{x+y} \cdot \frac{(x-y)(x+y)}{(2x-1)(2x+1)} \cdot \frac{-2}{(2x-1)(2x+1)} \\
 &= \frac{-2(x-y)}{(2x-1)(2x+1)^2} = \frac{2(y-x)}{(2x-1)(2x+1)^2}
 \end{aligned}$$

$$\begin{aligned}
6) \quad & \left(\frac{x}{x+y} + \frac{y}{x-y} - 1 \right) \left(\frac{y}{x} - \frac{x}{y} \right) - \left(1 - \frac{x}{y} \right) \left(2 - \frac{2y}{x} \right) \\
&= \frac{x(x-y) + y(x+y) - (x-y)(x+y)}{(x-y)(x+y)} \cdot \frac{y^2 - x^2}{xy} \\
&\quad - \frac{y-x}{y} \cdot \frac{2x-2y}{x} \\
&= \frac{2y^2}{(x-y)(x+y)} \cdot \frac{-(x^2 - y^2)}{xy} + \frac{x-y}{y} \cdot \frac{2x-2y}{x} \\
&= \frac{2y^2}{(x-y)(x+y)} \cdot \frac{-(x-y)(x+y)}{xy} + \frac{x-y}{y} \cdot \frac{2(x-y)}{x} \\
&= \frac{-2y}{x} + \frac{2(x-y)^2}{xy} \\
&= \frac{-2y^2 + 2(x-y)^2}{xy} = \frac{2x^2 - 4xy}{xy} = \frac{2x(x-2y)}{xy} \\
&= \frac{2(x-2y)}{y}
\end{aligned}$$