

find all excluded values

$$\textcircled{1} \frac{2x-6}{3x+2}$$

$$3x+2=0$$

$$3x = -2$$

$$\boxed{x = -\frac{2}{3}}$$

$$\textcircled{4} \frac{\text{whatever}}{x^2-17x+70}$$

$$x^2-17x+70=0$$

$$(x-7)(x-10)=0$$

↓

$$\boxed{x=7}$$

↓

$$\boxed{x=10}$$

$$\textcircled{2} \frac{x^2-7}{x^2-25}$$

$$x^2-25=0$$

$$(x+5)(x-5)=0$$

↓

$$\boxed{x=-5}$$

↓

$$\boxed{x=5}$$

$$\textcircled{3} \frac{x+8}{x^2+9}$$

$$x^2+9 > 0$$

Not factorable

$\boxed{\text{None}}$

$$\textcircled{5} \frac{\text{whatever}}{4x^2-7x+3}$$

$$4x^2-7x+3=0$$

$$(x-1)(4x-3)=0$$

$$x-1=0$$

$$4x-3=0$$

$$\boxed{x=1}$$

$$\boxed{x=\frac{3}{4}}$$

Simplify:

$$\textcircled{1} \frac{x^2-25}{x^2-3x-10} \cdot \frac{x+2}{x}$$

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

$$= \boxed{\frac{x+5}{x}}$$

$$\textcircled{2} \frac{8x^2-18}{2x^2-5x+3} \div \frac{6x^2+7x-3}{x^2-9x+8}$$

$$= \frac{2(4x^2-9)}{2x^2-5x+3} \cdot \frac{(x-8)(x-1)}{6x^2+7x-3}$$

$$= \frac{2(2x+3)(2x-3)}{(2x-3)(x-1)} \cdot \frac{(x-8)(x-1)}{(2x+3)(3x-1)}$$

$$= \boxed{\frac{2(x-8)}{3x-1}}$$

Add or Subtract like rational expressions:

$$\textcircled{1} \quad \frac{9}{x+8} + \frac{x-1}{x+8}$$

$$= \frac{9+x-1}{x+8} = \frac{x+8}{x+8} = \boxed{1}$$

$$\textcircled{2} \quad \frac{4x}{x^2+2x-15} - \frac{12}{x^2+2x-15}$$

$$= \frac{4x-12}{x^2+2x-15} = \frac{4(x-3)}{(x+5)(x-3)} = \boxed{\frac{4}{x+5}}$$

$$\textcircled{3} \quad \frac{2x^2}{x-5} - \frac{25+x^2}{x-5}$$

$$= \frac{2x^2-25-x^2}{x-5} = \frac{x^2-25}{x-5}$$

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

$$\textcircled{4} \quad \frac{7x+1}{x+4} - \frac{2x-19}{x+4}$$

$$= \frac{7x+1-2x+19}{x+4}$$

$$= \frac{5x+20}{x+4} = \frac{5(x+4)}{x+4} = \boxed{5}$$

$$\textcircled{5} \quad \frac{3x-1}{x^2+5x-6} - \frac{2x-7}{x^2+5x-6}$$

$$= \frac{3x-1-2x+7}{x^2+5x-6}$$

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

$$\frac{2}{6} = \frac{2}{2 \cdot 3} = \frac{1}{3}$$

$$\textcircled{6} \quad \frac{x^2+9x}{x^2-49} - \frac{4x+14}{x^2-49}$$

$$= \frac{x^2+9x-4x-14}{x^2-49}$$

$$= \frac{x^2+5x-14}{x^2-49}$$

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

Adding & Subtracting unlike rational expressions
Different denominators

$$\begin{aligned}
 & \frac{5}{(x-1)(x+4)} - \frac{2}{(x+4)(x-3)} \\
 &= \frac{5(x-3)}{(x-1)(x+4)(x-3)} - \frac{2(x-1)}{(x+4)(x-3)(x-1)} \\
 &= \frac{5(x-3) - 2(x-1)}{(x-1)(x+4)(x-3)} = \frac{5x-15-2x+2}{(x-1)(x+4)(x-3)} \\
 &= \boxed{\frac{3x-13}{(x-1)(x+4)(x-3)}}
 \end{aligned}$$

$$\begin{aligned}
 & \frac{x}{(x-1)(x+8)} - \frac{3}{(x+2)(x-1)} \\
 &= \frac{x(x+2)}{(x-1)(x+8)(x+2)} - \frac{3(x+8)}{(x+2)(x-1)(x+8)} \\
 &= \frac{x(x+2) - 3(x+8)}{(x-1)(x+8)(x+2)} = \frac{x^2 + 2x - 3x - 24}{(x-1)(x+8)(x+2)} \\
 &= \boxed{\frac{x^2 - x - 24}{(x-1)(x+8)(x+2)}}
 \end{aligned}$$

$$\begin{aligned}
 & \frac{4}{x^2 - 3x + 2} - \frac{2}{x^2 - 4} \\
 &= \frac{4(x+2)}{(x-2)(x-1)(x+2)} - \frac{2(x-1)}{(x+2)(x-2)(x-1)} \\
 &= \frac{4(x+2) - 2(x-1)}{(x-2)(x-1)(x+2)} = \frac{4x+8-2x+2}{(x-2)(x-1)(x+2)} \\
 &= \boxed{\frac{2x+10}{(x-2)(x-1)(x+2)}}
 \end{aligned}$$

Simplify

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

$$\begin{aligned}
 & \frac{27}{x^2-81} + \frac{3}{2x+18} \\
 &= \frac{27 \cdot 2}{(x+9)(x-9) \cdot 2} + \frac{3(x-9)}{2(x+9)(x-9)} \\
 &= \frac{54 + 3x - 27}{2(x+9)(x-9)} = \frac{3x + 27}{2(x+9)(x-9)} = \frac{3\cancel{(x+9)}}{2\cancel{(x+9)}(x-9)} \\
 & \quad \boxed{\frac{3}{2(x-9)}}
 \end{aligned}$$

$$\begin{aligned}
 & \frac{6}{5x^2-25x+30} - \frac{2}{4x^2-8x} \\
 &= \frac{6}{5(x^2-5x+6)} - \frac{\cancel{2}^1}{\cancel{4}_2 x(x-2)} \\
 &= \frac{6 \cdot 2x}{5(x-2)(x-3) \cdot 2x} - \frac{1 \cdot 5(x-3)}{2x(x-2) \cdot 5(x-3)} \\
 &= \frac{12x - 5x + 15}{10x(x-2)(x-3)} = \boxed{\frac{7x + 15}{10x(x-2)(x-3)}}
 \end{aligned}$$

Simplify:

$$\begin{aligned}
 & \frac{8}{x^2+6x+5} - \frac{3x}{x^2+4x-5} + \frac{2}{x^2-1} \\
 &= \frac{8(x-1)}{(x+5)(x+1)(x-1)} - \frac{3x(x+1)}{(x+5)(x-1)(x+1)} + \frac{2(x+5)}{(x+1)(x-1)(x+5)} \\
 &= \frac{8x-8-3x^2-3x+2x+10}{(x+5)(x+1)(x-1)} \\
 &= \boxed{\frac{-3x^2+7x+2}{(x+5)(x+1)(x-1)}}
 \end{aligned}$$

Basic Math

Simplify

$$\frac{\frac{2}{\textcircled{3}} - \frac{1}{\textcircled{2}}}{\frac{1}{\textcircled{4}}} = \frac{\cancel{12} \cdot \frac{2}{\cancel{3}} - \cancel{12} \cdot \frac{1}{\cancel{2}}}{\cancel{3} \cdot \cancel{12} \cdot \frac{1}{\cancel{4}}} = \frac{8-6}{3} = \boxed{\frac{2}{3}}$$

LCD = 12

Simplify

$$\frac{x - \frac{4}{\textcircled{x}}}{1 + \frac{2}{\textcircled{x}}} = \frac{x \cdot x - \cancel{x} \cdot \frac{4}{\cancel{x}}}{x \cdot 1 + \cancel{x} \cdot \frac{2}{\cancel{x}}} = \frac{x^2-4}{x+2} = \frac{\cancel{(x+2)}(x-2)}{\cancel{x+2}} = \boxed{x-2}$$

Complex fraction

LCD = x

Simplify

$$\frac{1 - \frac{3}{x} + \frac{2}{x^2}}{1 - \frac{4}{x^2}} = \frac{\cancel{x^2} \cdot 1 - \cancel{x^2} \cdot \frac{3}{\cancel{x}} + \cancel{x^2} \cdot \frac{2}{\cancel{x^2}}}{\cancel{x^2} \cdot 1 - \cancel{x^2} \cdot \frac{4}{\cancel{x^2}}}$$

$$LCD = x^2$$

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

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

$$\text{Simplify: } \frac{\frac{1}{y} + \frac{3}{y^2}}{y + \frac{27}{y^2}} = \frac{\cancel{y^2} \cdot \frac{1}{\cancel{y}} + \cancel{y^2} \cdot \frac{3}{\cancel{y^2}}}{\underbrace{y^2 \cdot y}_{y^3} + \cancel{y^2} \cdot \frac{27}{\cancel{y^2}}}$$

$$LCD = y^2$$

$$= \frac{y + 3}{y^3 + 27}$$

$$y^3 + 3^3$$

$$= \frac{\cancel{y+3}}{(\cancel{y+3})(y^2 - 3y + 9)}$$

$$= \boxed{\frac{1}{y^2 - 3y + 9}}$$

Simplify

$$\frac{1}{x+5} + \frac{2}{x+3} = \frac{\cancel{x+3} \cdot \frac{1}{\cancel{x+5}} + \cancel{x+5} \cdot \frac{2}{\cancel{x+3}}}{\frac{3x+13}{x^2+8x+15}}$$

$$LCD = (x+5)(x+3)$$

$$\boxed{1}$$

$$= \frac{1(x+3) + 2(x+5)}{3x+13}$$

$$= \frac{x+3 + 2x+10}{3x+13} = \frac{3x+13}{3x+13}$$