

1. Find the non-permissible values.

a)  $\frac{3}{x(x+1)}$   $x \neq 0, -1$       b)  $\frac{x^2}{3x^2-x-4}$   $(3x-4)(x+1) \neq 0$   $x \neq \frac{4}{3}, -1$       c)  $\frac{2x-1}{4}$   $\boxed{\text{no restriction}}$

2. Simplify

a)  $\frac{x^2-81}{18-2x} = \frac{(x+9)(\cancel{x-9})}{2(9-x)} = \boxed{\frac{-x-9}{2}}$

b)  $\frac{2\pi r^2 h}{2\pi r^2 + 2\pi r h} = \frac{\cancel{2\pi} r^2 h}{\cancel{2\pi} r (r+h)} = \boxed{\frac{rh}{r+h}}$

c)  $\frac{2x^2-x-6}{x^2-5x+6} = \frac{(2x+3)(x-2)}{(x-2)(x-3)} = \boxed{\frac{2x+3}{x-3}}$

d)  $\frac{x^2-17x+72}{x^2-4x+3} \div \frac{x^2-6x-27}{9-x^2} = \frac{(\cancel{x-9})(x-8)}{(x-1)(\cancel{x-3})} \times \frac{(3-x)(3+x)}{(\cancel{x-9})(x+3)} = \boxed{\frac{-x+8}{x-1}}$

e)  $\frac{2}{y-5} - \frac{1}{y} = \frac{2y - (y-5)}{y(y-5)} = \boxed{\frac{y+5}{y(y-5)}}$

f)  $\frac{3x}{x-9} - \frac{2x}{x-12} = \frac{3x(x-12) - 2x(x-9)}{(x-9)(x-12)} = \frac{3x^2 - 36x - 2x^2 + 18x}{(x-9)(x-12)} = \boxed{\frac{x^2 - 18x}{(x-9)(x-12)}}$

g)  $\frac{1}{4-x} - \frac{1}{x^2-8x+16} = \frac{1}{4-x} - \frac{1}{(x-4)(x-4)} = \frac{-1}{(x-4)} - \frac{1}{(x-4)^2} = \frac{-(x-4) - 1}{(x-4)^2} = \boxed{\frac{-x+3}{(x-4)^2}}$

h)  $\frac{x+1}{x-2} + \frac{x^2+4x-5}{x^2+5x-14} \times \frac{x^2+4x-21}{x-1}$  (remember order of operations!)

i)  $\frac{9x-x^3}{10x-10} \div \frac{x^2-11x+24}{3x^2-4x+1} \div \frac{27x+9x^2}{x-8}$

j)  $\frac{4x}{2x^2-5x-3} - \frac{1-2x}{9-x^2}$

$$\begin{aligned}
 h) \quad & \frac{x+1}{x-2} + \frac{x^2+4x-5}{x^2+5x-14} \times \frac{x^2+4x-21}{x-1} \\
 & = \frac{x+1}{x-2} + \left[ \frac{(x+5)(\cancel{x-1})}{(\cancel{x+1})(x-2)} \times \frac{(\cancel{x+1})(x-3)}{(\cancel{x-1})} \right] \\
 & = \frac{x+1}{x-2} + \frac{(x+5)(x-3)}{x-2} \\
 & = \frac{x+1+x^2+2x-15}{x-2} \\
 & = \boxed{\frac{x^2+3x-14}{x-2}}
 \end{aligned}$$

$$\begin{aligned}
 i) \quad & \frac{9x-x^3}{10x-10} = \frac{x^2-11x+24}{3x^2-4x+1} = \frac{27x+9x^2}{x-8} \\
 & = \frac{\cancel{x}(3+\cancel{x})(3-\cancel{x})}{10(\cancel{x-1})} \times \frac{(3x-1)(\cancel{x+1})}{(\cancel{x-5})(\cancel{x+8})} \times \frac{\cancel{x-8}}{9x(3+\cancel{x})} \\
 & = \boxed{\frac{-3x+1}{90}}
 \end{aligned}$$

$$\begin{aligned}
 j) \quad & \frac{4x}{2x^2-5x-3} - \frac{1-2x}{9-x^2} \\
 & = \frac{4x}{(2x+1)(x-3)} - \frac{1-2x}{(3+x)(3-x)} \\
 & = \frac{4x}{(2x+1)(x-3)} + \frac{1-2x}{(x+3)(x-3)} \\
 & = \frac{4x(x+3) + (1-2x)(2x+1)}{(2x+1)(x-3)(x+3)} \\
 & = \frac{\cancel{4x^2}+12x+2x+1-\cancel{4x^2}-2x}{(2x+1)(x-3)(x+3)} \\
 & = \boxed{\frac{12x+1}{(2x+1)(x-3)(x+3)}}
 \end{aligned}$$