

(1) Find the domain of the following rational expressions.

(a) $\frac{2x+1}{5-4x}$

$$5-4x=0 \quad \text{so domain is } \mathbb{R} \setminus \{5/4\}$$

$$5=4x$$

$$x = \frac{5}{4}$$

$$= (-\infty, \frac{5}{4}) \cup (\frac{5}{4}, \infty)$$

(b) $\frac{y^2+1}{y^3-3y^2-10y}$

$$y(y^2-3y-10)=0 \quad \text{domain is } \mathbb{R} \setminus \{-2, 0, 5\}$$

$$y(y-5)(y+2)=0$$

$$y = 0, 5, -2$$

$$= (-\infty, -2) \cup (-2, 0) \cup (0, 5) \cup (5, \infty)$$

(2) Perform addition/subtraction and simplify.

(a) $2 - \frac{x}{x+3}$

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

(b) $\frac{1}{x+5} - \frac{x}{x+3}$

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

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

(c) $u+1 + \frac{u}{u+1}$

$$\frac{(u+1)(u+1)+u}{u+1} = \frac{u^2+2u+1+u}{u+1} = \frac{u^2+3u+1}{u+1}$$

(d) $\frac{1}{x} - \frac{2}{x^2} + \frac{3}{x^3}$

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

$$(e) \frac{3}{t-3} + \frac{5}{t^2-9} \quad \frac{3(t+3)+5}{(t-3)(t+3)} = \frac{3t+9+5}{(t-3)(t+3)} = \frac{3t+14}{(t-3)(t+3)}$$

(3) Simplify the compound fractional expressions.

$$(a) \frac{x + \frac{1}{x+2}}{x+3} \quad \frac{\frac{x(x+2)+1}{x+2}}{x+3} = \frac{x^2+2x+1}{(x+2)(x+3)}$$

$$(b) \frac{\frac{x-y}{y} - \frac{y}{x}}{x+y} \quad \frac{\frac{x^2-y^2}{xy}}{x+y} = \frac{(x+y)(x-y)}{xy(x+y)} = \frac{x-y}{xy}$$

$$(c) \frac{1 + \frac{1}{c-1}}{1 - \frac{1}{c-1}} \quad \frac{c-1+1}{c-1-1} = \frac{c}{c-2}$$

$$(d) 1 + \frac{1}{1 + \frac{1}{1+x}} \quad 1 + \frac{1}{\frac{1+x+1}{1+x}} = 1 + \frac{1}{\frac{x+2}{x+1}}$$

$$= 1 + \frac{x+1}{x+2} = \frac{x+2+x+1}{x+2} = \frac{2x+3}{x+2}$$