

1. Find the domain.

a) $f(x) = \frac{x}{x^2+4x-21} = \frac{x}{(x+7)(x-3)}$

exclude when
 $(x+7)(x-3) = 0$
 $x = -7, x = 3$

$$D = (-\infty, -7) \cup (-7, 3) \cup (3, \infty)$$

b) $f(x) = \frac{\sqrt{x-2}}{x-5}$

exclude when $x-5=0$
 $x=5$ and need $x-2 \geq 0$
 $x \geq 2$

$$D = [2, 5) \cup (5, \infty)$$

c) $f(x) = \frac{x-1}{\sqrt{4-x}}$

need $4-x > 0$
 $4 > x$
 $x < 4$

$$D = (-\infty, 4)$$

2. Let $f(x) = \sqrt{x+7}$ and $g(x) = \sqrt{x-1}$. $D_f = [-7, \infty)$ $D_g = [1, \infty)$ a) Find $(f+g)(x)$ and its domain.

$$(f+g)(x) = f(x) + g(x) = \sqrt{x+7} + \sqrt{x-1}$$

$$D_{f+g} = D_f \cap D_g = [1, \infty)$$

b) Find $\left(\frac{f}{g}\right)(x)$ and its domain

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} = \frac{\sqrt{x+7}}{\sqrt{x-1}}$$

$$D_{\frac{f}{g}} = D_f \cap D_g \text{ where } g \neq 0$$

$$= (1, \infty)$$

 $g=0$ when $x=1$

3. Find $(f \circ g)(x)$ and its domain.

a) $f(x) = \frac{x+1}{x-2}$, $g(x) = \frac{1}{x}$

$$f(g(x)) = f\left(\frac{1}{x}\right) = \frac{\left(\frac{1}{x} + 1\right)}{\left(\frac{1}{x} - 2\right)} \cdot \frac{x}{x} = \boxed{\frac{1+x}{1-2x}}$$

domain

① domain of g
exclude $x=0$

$$D = (-\infty, 0) \cup (0, \frac{1}{2}) \cup (\frac{1}{2}, \infty)$$

② domain $f(g(x)) = \frac{1+x}{1-2x}$
exclude $1-2x=0$
 $x = \frac{1}{2}$

b) $f(x) = \sqrt{x-1}$, $g(x) = x+3$

$$f(g(x)) = f(x+3) = \sqrt{x+3-1} = \boxed{\sqrt{x+2}}$$

domain

① domain g
no restriction

$$D = [-2, \infty)$$

② domain $f(g(x)) = \sqrt{x+2}$
need $x+2 \geq 0 \Rightarrow x \geq -2$

4. Let $f(x) = \sqrt{x}$ and $g(x) = x^2 + 3$.

a) Find $(f \circ g)(x) = f(g(x)) = f(x^2 + 3) = \boxed{\sqrt{x^2 + 3}}$

b) Find $(f \circ g)(1) = \sqrt{1^2 + 3} = \sqrt{4} = \boxed{2}$

c) Find $(g \circ f)(x) = g(f(x)) = g(\sqrt{x}) = (\sqrt{x})^2 + 3 = \boxed{x+3}$

d) Find $(g \circ f)(1) = 1+3 = \boxed{4}$