

(1) [5 points] Let $f(x) = \frac{1}{x}$. Find and simplify $\frac{f(x) - f(a)}{x - a}$.

$$\begin{aligned} & \frac{f(x) - f(a)}{x - a} \\ &= \frac{\frac{1}{x} - \frac{1}{a}}{x - a} \\ &= \frac{\frac{a - x}{ax}}{x - a} \\ &= \frac{-\cancel{(x-a)}}{ax} \cdot \frac{1}{\cancel{(x-a)}} \\ &= \frac{-1}{ax} \end{aligned}$$

(2) [5 points] Let $f(x) = x + \frac{1}{x}$ and $g(x) = \frac{x+1}{x+2}$. Find $(f \circ g)(x)$ and state the domain.

$$(f \circ g)(x) = f(g(x))$$

$$= \frac{x+1}{x+2} + \frac{1}{\left(\frac{x+1}{x+2}\right)} \quad \left. \vphantom{\frac{x+1}{x+2}} \right\} *$$

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

$$= \frac{x^2 + 2x + 1 + x^2 + 4x + 4}{(x+1)(x+2)}$$

$$= \frac{2x^2 + 6x + 5}{(x+1)(x+2)}$$

Using *, must have

$$x+2 \neq 0 \quad \& \quad \frac{x+1}{x+2} \neq 0$$

$$\therefore x \neq -2, \quad x \neq -1$$

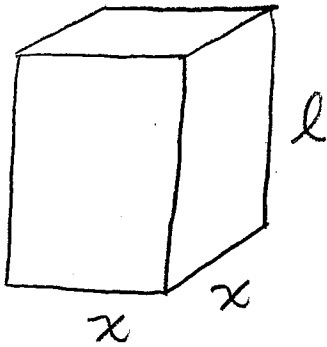
\therefore domain of $f \circ g$ is

$$\{x \mid x \neq -2, x \neq -1\}$$

or

$$(-\infty, -2) \cup (-2, -1) \cup (-1, \infty).$$

(3) [5 points] An open rectangular box with volume 2 m^3 has a square base of side length x . Express the surface area of the box as a function of the length of a side of the base.



$$V = x^2 l = 2$$

$$\therefore l = \frac{2}{x^2}$$

$$S = 4xl + x^2$$

$$= 4x \left(\frac{2}{x^2} \right) + x^2$$

$$= \frac{8}{x} + x^2$$

$$\therefore S(x) = \frac{8}{x} + x^2, \quad x > 0$$