

18, 15

سایه جبری

$$f(x) = \begin{cases} x^3 - 4 & x > a \\ 12x - 20 & x \leq a \end{cases} \rightarrow x \leq a \rightarrow 12a - 20 \leq a^3 - 4$$

$$x \rightarrow f(x) = x^3 - 12x + 14 \leq 0 \rightarrow a^3 - 12a + 14 \leq (a-2)(a^2 + 2a - 1)$$

$$(a-2)^2 (a+2) \geq 0 \rightarrow a+2 \geq 0 \rightarrow \boxed{a \geq -2}$$

$$f(x) = 3x + K \rightarrow f(\epsilon) = 3(\epsilon) + K \leq K \rightarrow \boxed{K \leq -1}$$

$$f(v) = 3(v) - 1 \leq 21 - 1 \leq 20$$

$$f(f(x)) \leq f(3x-1) \leq 3(3x-1) - 1 \leq 9x - 4 \leq 9x - 4$$

$$f(x) = 3x - 1$$

$$A(2a, 1) \quad f(x) = \frac{ax}{x-1} \rightarrow f(a) = \frac{a^2}{a-1}$$

$$f(a) = \frac{a^2}{a-1} \rightarrow a^2 \leq \frac{a^2}{a-1} \leq a^2 \leq \frac{a^2}{a-1}$$

$$S = \{(2, 2), (4, 4), (6, 6), (8, 8)\} \quad \mathcal{G} = \{(2, 2), (4, 4), (6, 6), (8, 8)\}$$

$$f = f(f(x)) = \{(2, 2), (4, 4), (6, 6), (8, 8)\}$$

$$f = \{(2, 2), (4, 4), (6, 6), (8, 8)\}$$

سأنا جاري

$$f \circ g^{-1} = f(g^{-1}(x)) = \{(1,2), (2,4), (4,1)\}$$

$$g^{-1} \circ f = \{(2,1), (4,2), (1,4)\}$$

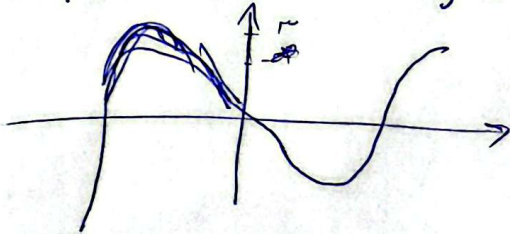
$$h = \{(1,2), (2,4), (4,1)\} \quad g = \{(2,1), (4,2), (1,4)\} \quad (4)$$

$$h \rightarrow h(x) = \{(1, \frac{1}{2}), (2, \frac{1}{4}), (4, \frac{1}{1})\}$$

$$f \circ g^{-1} = g^{-1} \circ f = \{(1,2), (2,4), (4,1)\}$$

$$f(g^{-1}(x)) = \{(2,1), (4,2), (1,4)\}$$

$$y = \frac{3x+1}{x-2} \rightarrow x = \frac{3y+1}{y-2} \rightarrow x(y-2) = 3y+1$$



$$xy - 2x = 3y + 1$$

$$xy - 3y = 2x + 1$$

$$y(x-3) = 2x+1$$

$$f^{-1}(x) = \frac{2x+1}{x-3} \leftarrow y = \frac{2x+1}{x-3}$$

$$f(x) = |x-1| - |x-3|$$

$$(1) x \leq 1 \rightarrow |x-1| = 1-x, |x-3| = 3-x$$

$$(2) 1 < x \leq 3 \rightarrow |x-1| = x-1, |x-3| = 3-x$$

$$f(x) = (x-1) - (3-x) = 2x-4$$

$$(3) |x-1| = x-1 \rightarrow |x-3| = x-3$$

$$f(x) = (x-1) - (x-3) = 2 \rightarrow x \in [1, 3]$$

$$f^{-1}(x) = \frac{x+3}{2} \rightarrow x \in [-3, 5]$$

$$f(x) = \begin{cases} x^3 + 8 & x > 1 \\ x-1 & x \leq 0 \end{cases} \rightarrow y = x^3 + 8 \rightarrow x = \sqrt[3]{y-8}$$

$$y \leq x-1 \rightarrow x \leq \frac{y+1}{2} \rightarrow f^{-1}(x) = \frac{x+1}{2} \rightarrow x \leq -1$$

$$f^{-1}(x) = \begin{cases} \sqrt[3]{x-8} & x > 9 \\ \frac{x+1}{2} & x \leq -1 \end{cases}$$

$$f^{-1}(a) = \frac{-4a-5}{5a+4} = \frac{ax+b}{cx+d} \quad f(x) = x - \frac{(x+1)^5}{x+5} \quad f^{-1}(x) = \frac{ax+b}{cx+d} \quad \text{سأجرب}$$

$$f^{-1}(b) = a$$

$$f^{-1}(b) = x \rightarrow f(x) = b$$

$$f\left(\frac{ax+b}{cx+d}\right) = x \rightarrow (x+1)^5 = x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

$$f(x) = x^5 - \frac{x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1}{x+5} \rightarrow x(x+5) = x^5 + 5x^4$$

$$f(x) = x \left(\frac{x^5 + 5x^4 - x^5 - 5x^4 - 10x^3 - 10x^2 - 5x - 1}{x+5} \right) = x \left(\frac{-10x^3 - 10x^2 - 5x - 1}{x+5} \right)$$

$$f(x) = \frac{x}{x^5+1} \quad y = \frac{x}{x^5+1} \rightarrow x = \frac{y}{y^5+1}$$

$$x(y^5+1) = y \rightarrow xy^5 - y + x = 0 \rightarrow y = \frac{1 \pm \sqrt{1-4x^5}}{2x}$$

$$f^{-1}(x) = \frac{1 \pm \sqrt{1-4x^5}}{2x}$$

$$f^{-1}(b) = \frac{b(a+1)}{cb+d} \quad (1)$$