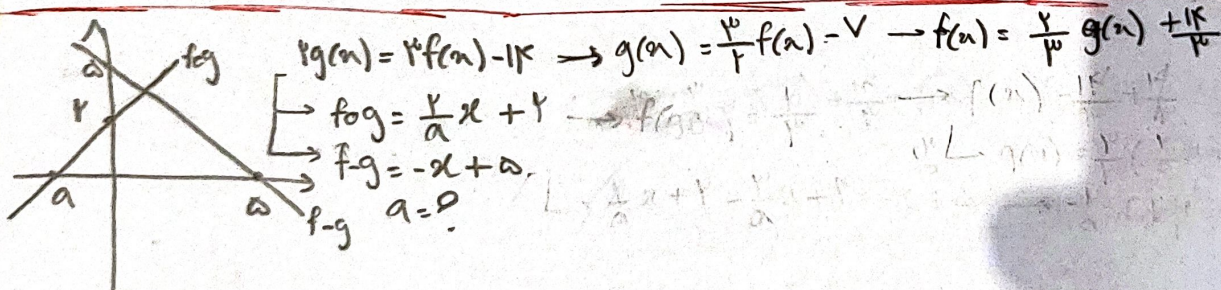


$f(x) = \sqrt{\log_r(x-1)} \rightarrow D_f = \{x > 1\}$, $\log_r x > 0 \rightarrow x-1 > 1 \rightarrow x > 2 \rightarrow [2, \infty)$
 $g(x) = \sqrt{-x^2 + 4x - 4} \rightarrow \sqrt{-(x^2 - 4x + 4)} \rightarrow \sqrt{-(x-2)^2} \rightarrow (x-2)^2 = 0 \rightarrow D_g = \{2\}$
 $D_{g \circ f} = \{x \in D_f : f(x) \in D_g\} = \{x \in [2, \infty) : \log_r x = 2 \rightarrow x-1 = 4 \rightarrow x = 5\} = \{5\}$

$f(x) = 2x - 2$
 $g(x) = x^2 - 4x + 11$
 $f \circ g(x) = g \circ f(x) \rightarrow 2(x^2 - 4x + 11) - 2 = (2x - 2)^2 - 4(2x - 2) + 11 \rightarrow 2x^2 - 4x + 11 = 4x^2 - 8x + 11$

$g \circ f(x) = 2x^2 + 11 \rightarrow g(2x) = 2x^2 + 11 \rightarrow g(t) = 2\left(\frac{t}{2}\right)^2 + 11 = \frac{\Delta x t^2}{4} + 11 \rightarrow g(x) = \frac{\Delta x^2}{4} + 11$
 $f(x) = 2x$
 $g(x-1) \rightarrow g(x-1) = \frac{\Delta}{4}(x-1)^2 + 11 = \frac{\Delta}{4}x^2 - \frac{\Delta}{2}x + \frac{\Delta}{4} + 11 \rightarrow \frac{\Delta}{4}x^2 - \frac{\Delta}{2}x + \frac{\Delta}{4} + 11$
 $\rightarrow \frac{\Delta}{4}x^2 + 11x + 11 \rightarrow \min = \frac{-\Delta}{\frac{\Delta}{4}} = \frac{-(\frac{\Delta}{4})}{\frac{\Delta}{4}} = \frac{11}{4} = 2.75$

$f(x) = 2x - 2$
 $g(x) = x^2 - 4x + 1$
 $g \circ f(x) = (2x-2)^2 - 4(2x-2) + 1 = 4x^2 - 8x + 4 - 8x + 8 + 1 = 4x^2 - 16x + 13$



$f(x) = 9^x$
 $g(x) = \log_9 x$
 $f \circ g(x) \leq g \circ f(x) \rightarrow 9^{\log_9 x} \leq \log_9 9^x \rightarrow x \leq 2x \rightarrow x - 2x \leq 0 \rightarrow -x \leq 0 \rightarrow x \geq 0$

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

$f(x) = \log_2 x$
 $g(x) = 12x - 2^x$
 $D_{f \circ g} = ? \rightarrow A = \{x \in D_g : g(x) \in D_f\} \rightarrow \{x \in \mathbb{R} : 12x - 2^x > 0 \rightarrow 12x < 2^x \rightarrow x(x-1) < 0\}$
 $R_{f \circ g} = ? \rightarrow B = \{y \in \mathbb{R} : y = \log_2(12x - 2^x)\} \rightarrow R_{f \circ g} = \mathbb{R} \rightarrow B = \mathbb{R}$

$$f \circ f(x) = 1 - 3f'(x) \rightarrow f(f(x)) = 1 - 3f'(x) \rightarrow f(x) = 1 - x \rightarrow$$

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$$g(x) = x - 1$$

$$h(x) = x^3 + 2x + 1$$

$$\left. \begin{array}{l} g(x) = x - 1 \\ h(x) = x^3 + 2x + 1 \end{array} \right\} \rightarrow (x-1)^3 + 2(x-1) + 1 = x^3 - 3x^2 + 3x - 1 + 2x - 2 + 1 \rightarrow x^3 + 2x - 3x^2$$

$$h(g(x)) = f(x) \rightarrow \text{find } x$$

$$f(x) = x - \frac{1}{x} \rightarrow x - \frac{1}{x} = 1 \rightarrow x^2 - 3x - 1 = 0 \rightarrow (x-1)(x+1) = 0$$

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$$g \circ f(x) = ax^3 + 2x$$

$$\rightarrow f(1) \rightarrow 4a + 1 = 1 \rightarrow a = 0$$

$$\rightarrow f(-1) \rightarrow -a - 1 = 1 \rightarrow a = -1$$

$$g(1) = 1$$

$$a = 0$$