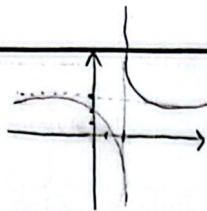


|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <p> <math>f(x) = \begin{cases} x^3 - 4 &amp; ; x &gt; a \\ 12x - 20 &amp; ; x \leq a \end{cases}</math> </p> <p> <math>\rightarrow 12a - 20 \leq a^3 - 4 \rightarrow a^3 \geq 12a - 16</math> </p> <p> <math>a=0 \rightarrow 0 \geq -16, a=1 \rightarrow 1 \geq -8, a=2 \rightarrow 8 \geq 8 \checkmark</math> </p> <p> <math>a=-1 \rightarrow -1 \geq -12, a=-2 \rightarrow -8 \geq -20, a=-3 \rightarrow -27 \geq -32, a=-4 \rightarrow -64 \geq -44 \checkmark</math> </p> <p> <math>a=-4, a=2 \Rightarrow a \geq -4</math> </p> | <p>۱</p> |
| <p> <math>f^{-1}(2) \leq 4 \rightarrow f(4) = 2 \rightarrow \psi(4) + K \leq 2, K \leq -10</math> </p> <p> <math>f(v) \leq \psi(v) - 10 \leq 11</math> </p> <p> <math>f(f(n)) \leq \psi(\psi(n) - 1) - 10 \leq 9n - 2 - 10 = 9n - 12</math> </p>                                                                                                                                                                                                                                                                                    | <p>۲</p> |
| <p> <math>y = \frac{ax}{x-1} \rightarrow yx - y \leq ax \rightarrow x(y-a) \leq y, x \leq \frac{y}{y-a}, f^{-1} = \frac{a}{x-a}</math> </p> <p> <math>A(2a, a) \rightarrow \frac{2a}{2a-a} \leq a \Rightarrow a \leq 2</math> </p>                                                                                                                                                                                                                                                                                                  | <p>۳</p> |
| <p> <math>f^{-1} = \{(\omega, 3), (v, 4), (2, 7), (4, 9)\} \quad g^{-1} = \{(2, 3), (4, 1), (\omega, 9)\}</math> </p> <p> <math>f \circ f^{-1} = \{(\omega, \omega), (v, v), (2, 2), (4, 4)\}</math> </p> <p> <math>f \circ g^{-1} = \{(3, 3), (4, 4), (v, v), (9, 9)\}</math> </p> <p> <math>f \circ g^{-1} = \{(v, \omega), (\omega, 4)\}</math> </p> <p> <math>g^{-1} \circ f = \{(3, 9), (v, 3), (9, 1)\}</math> </p>                                                                                                           | <p>۴</p> |
| <p> <math>g^{-1} = \{(1, 2), (3, 4), (\omega, 4)\} \quad f \circ g^{-1} = \{(1, 4), (3, 8), (\omega, 8)\}</math> </p> <p> <math>\frac{h}{f \circ g^{-1}} = \{(1, \frac{4}{8}), (3, \frac{8}{8}), (\omega, \frac{8}{8})\} = \frac{h}{f \circ g^{-1}} = \{(1, \frac{1}{2}), (3, \frac{1}{1}), (\omega, \frac{1}{1})\}</math> </p>                                                                                                                                                                                                     | <p>۵</p> |

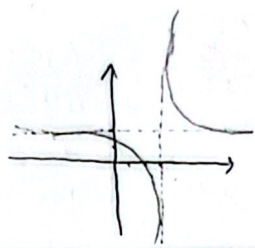


تابع معکوس و معکوس نیز باشد.  
 $x = 2$  و معانب قائم  
 $x = \frac{a}{3}$  و معانب افقی



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

معانب قائم  $x = 3$  و معانب افقی  $y = 2$



6

$$f(x) = |x-1| - |x-3| \quad \frac{1}{-2} \leq \frac{x}{2x-2} \leq \frac{3}{2} \Rightarrow [a, b] \leq [-2, 2]$$

$$f(x) = 2x - 4 \rightarrow 2x \leq y + 4, x \leq \frac{y+4}{2}, f^{-1}(x) \leq \frac{x+4}{2}$$

دایره  $[-2, 2]$

7

$$f(x) = \begin{cases} x^3 + 4 & ; x \geq 1 \\ 4x - 1 & ; x \leq 0 \end{cases} \quad R \in [\infty, +\infty) \rightarrow R \in (-\infty, -1] \rightarrow \text{دایره دایره دایره دایره}$$

$$f^{-1}(x) = \begin{cases} \sqrt[3]{x-4} & ; x \geq 5 \\ \frac{x+1}{4} & ; x \leq -1 \end{cases}$$

1, 1, 1, 1

8

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

$$y \leq \frac{-3x-1}{x+3} \rightarrow yx + 3y \leq -3x - 1 \rightarrow x(y+3) \leq -1-3y \rightarrow x \leq \frac{-1-3y}{y+3} \Rightarrow f^{-1}(x) = \frac{-3x-1}{x+3} \xrightarrow{x^2}$$

$$f^{-1}(x) = \frac{-4x-2}{2x+4} \rightarrow a = -4, b = -2, d = 4 \rightarrow f(-2) \leq \frac{12-2}{-2+4} \leq \infty$$

9

$$y = \frac{x}{x^2+1} \rightarrow yx^2 + y = x \rightarrow yx^2 - x + y = 0 \quad \Delta = 1 - 4y^2 \rightarrow x = \frac{1 \pm \sqrt{1-4y^2}}{2y}$$

$$f^{-1}(x) = \begin{cases} \frac{1 - \sqrt{1-4x^2}}{2x} & ; x > 0 \\ \frac{1 + \sqrt{1-4x^2}}{2x} & ; x < 0 \end{cases}$$

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