

$$\begin{aligned} x^3 - f \quad x > a \quad \frac{x+a}{y+a-4} &\rightarrow R = (a^3 - f, +\infty) \\ 12x - 2 \quad x \leq a \quad \frac{x+a}{y+12a-x} &\rightarrow R = (-\infty, 12a - 2] \end{aligned} \quad \left\{ \begin{array}{l} a \text{ عددی ثابت است و برای} \\ \text{اینکه تابع یک به یک باشد} \\ \text{برده ها نباید برابر باشند} \end{array} \right.$$

آگر در عبارت یذایم برابر کنیم $a^3 - f = 12a - 2 \rightarrow a^3 - 12a + 14 = 0 \rightarrow (a-2)^2(a+4) \rightarrow a=2 \rightarrow a=-4$

$$y = 3x + k \rightarrow 3x = y - k \rightarrow x = \frac{y-k}{3} \rightarrow y = \frac{x-k}{\frac{1}{3}} \rightarrow f_{(x)}^{-1} \rightarrow f = \frac{3-k}{3} \Rightarrow k = -1.$$

$\rightarrow y = 3x - 1.$

الف) $f(v) \Rightarrow y = 3v - 1 = 11$

$$\rightarrow f(f(x)) = f(3x - 1) = 3(3x - 1) - 1 = 9x - 3 - 1 = 9x - 4.$$

$$yx - y = ax \rightarrow x(y-a) = y \rightarrow x = \frac{y}{y-a} \rightarrow y = \frac{x}{x-a} \quad \begin{array}{l} y=a \\ x=x_a \end{array} \rightarrow a = \frac{y_a}{\frac{y_a-a}{a}} \Rightarrow a = 2$$

$$\begin{aligned} f^{-1} &= \{(5,3)(7,4)(2,7)(4,9)\} \quad g^{-1} = \{(2,5)(4,8)(5,9)\} \\ \text{الف) } f \circ f^{-1} &= f(f(x)) = \{(5,5)(7,7)(2,2)(4,4)\} \\ \text{ب) } f^{-1} \circ f &= f^{-1}(f(x)) = \{(3,3)(4,4)(7,7)(9,9)\} \\ \text{ج) } f \circ g^{-1} &= f(g(x)) = \{(2,5)(5,4)\} \\ \text{د) } g^{-1} \circ f &= g^{-1}(f(x)) = \{(3,9)(7,8)(9,8)\} \end{aligned}$$

$$g^{-1} = \{(1,2)(3,4)(5,6)\} \quad f \circ g^{-1} = \{(1,4)(3,8)(5,10)\}$$

$$\frac{h}{f \circ g^{-1}} = \left\{ (1, \frac{1}{4}) (3, \frac{1}{8}) (\cancel{5, \frac{1}{10}}) \right\} \Rightarrow \frac{h}{f \circ g^{-1}} = \left\{ (1, \frac{1}{4}) (3, \frac{1}{8}) \right\}$$

معکوس نیبر است عبارت اول: $\frac{1}{x} = 2 \rightarrow x = \frac{1}{2}$ عبارت اولی: $\frac{a}{c} = \frac{1}{2} \rightarrow x = \frac{1}{2}$ $yx - 2y = 2x + 1 \rightarrow x(y - 2) = 1 + 2y \rightarrow x = \frac{1+2y}{y-2} \Rightarrow f^{-1}(x) = \frac{1+2x}{x-2}$ عبارت اولی: $\frac{1}{x} = 2$ عبارت اولی: $\frac{a}{c} = \frac{1}{2}$ 	۶
دارون نیبر است بازه است $[2, 4]$ $y = \begin{cases} 1-x+2, & x \leq 1 \\ x-1+x-2, & 1 < x < 2 \\ x-1-x, & x \geq 2 \end{cases} \rightarrow y = \begin{cases} -2, & x \leq 1 \\ 2x-3, & 1 < x < 2 \\ 2, & x \geq 2 \end{cases}$ معکوس $y = 2x - 3 \rightarrow 2x = y + 3 \rightarrow x = \frac{y+3}{2} \rightarrow f^{-1}(x) = \frac{x+3}{2} \Rightarrow \frac{x}{2} + \frac{3}{2}$	۷
$x+4, x \geq 1 \rightarrow R = [5, +\infty)$ $f(x) - 1, x \leq 0 \rightarrow R = (-\infty, -1]$ $\left\{ \begin{array}{l} x+4 = y-1 \rightarrow x = y-5 \rightarrow y = \sqrt{x-4} \quad x \geq 4 \\ 5x-1 = y \rightarrow 5x = 1+y \rightarrow x = \frac{1+y}{5} \rightarrow f^{-1}(x) = \frac{1+x}{5} \quad x \leq 0 \end{array} \right.$	۸
$\frac{x^2+2x^2}{x+2} = \frac{x^3+1+x^2+x^2}{x+2} \Rightarrow y = \frac{x^3-1}{x+2} \rightarrow yx+2y = -x^3-1 \Rightarrow x(y+2) = -1-x^3$ $\rightarrow x = \frac{-1-x^3}{y+2} \rightarrow f^{-1}(x) = \frac{-1-x^3}{x+2} \Rightarrow \frac{-2-4x}{x^2+4} \Rightarrow b = -2$ $f^{-1}(x) = \frac{-1+x}{-2+x} = \frac{x}{1} + \frac{1}{1}$	۹
$\frac{1}{x+1} \rightarrow y(x+1) = x \rightarrow yx + y = x \rightarrow yx - x = -y \rightarrow x(y-1) = -y \rightarrow x = \frac{1-y}{y-1}$ $\rightarrow f^{-1}(x) = \frac{1 \pm \sqrt{1-4x}}{2x} \quad x \leq \frac{1}{4} \quad x \neq 0 \Rightarrow \begin{cases} \frac{1 - \sqrt{1-4x}}{2x} & x > 0 \\ \frac{1 + \sqrt{1-4x}}{2x} & x < 0 \end{cases}$	۱۰