

$$f(x) = \begin{cases} x^3 - f & ; x > a \\ 12x - 20 & ; x \leq a \end{cases} \rightarrow 12a - 20 \leq a^3 - f \rightarrow a^3 - 12a + 14 > 0$$

$$\rightarrow (a-2)(a^2 + 2a - 7) \rightarrow a = 2 \rightarrow a = -4 \rightarrow \begin{array}{c|c|c} a < -4 & -4 < a < 2 & a > 2 \\ \hline - & + & + \\ \hline \text{تابع} & \text{تایید} & \checkmark \end{array}$$

$$\rightarrow a \geq -f \rightarrow a = [-f, +\infty)$$

$$f'(2) = f, f(x) = 3x + k \xrightarrow{\text{در } x=2} \frac{x-k}{3} = \frac{2-k}{3} = f = 2-k = 12 \rightarrow k = -10$$

$$f(v) = \frac{v^2}{3} + (-10) = 11$$

$$f(f(a)) = 3(2a - 10) - 10 = 6a - 30 - 10 = 6a - 40$$

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

$$\frac{a^2}{a-1} = 2a \rightarrow a^2 = 2a(a-1) \rightarrow a^2 = 2a^2 - 2a \rightarrow a(a-2) = 0 \rightarrow a = 0 \rightarrow a = 2$$

$$f(x) = \frac{0}{x-1} = 0 \rightarrow \text{دارد} \rightarrow f(x) = \frac{2x}{x-1} \rightarrow \text{دارد} \rightarrow a = 2$$

$$f = \{(3,5), (4,7), (7,2), (9,4)\} \text{ و } g = \{(2,2), (1,4), (6,5)\}$$

$$f \circ f^{-1} = \{(3,3), (4,4), (7,7), (9,9)\}$$

$$f \circ g^{-1} = \{(2,5), (5,4)\}$$

$$f \circ f^{-1} = \{(5,5), (7,7), (2,2), (9,9)\}$$

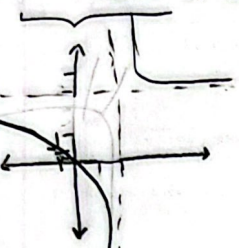
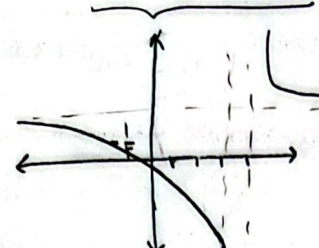
$$g \circ f = \{(2,9), (7,3), (9,1)\}$$

$$f = \{(2,4), (4,8), (4,0)\}$$

$$g = \{(2,1), (4,2), (7,5)\}$$

$$h = \{(1,2), (3,4), (4,1), (5,1)\}$$

$$\frac{h}{f \circ g^{-1}} = \{(1, \frac{1}{2}), (3, \frac{1}{4})\}$$

$y = \frac{3x+1}{x-2} \rightarrow x+2$  $\rightarrow f^{-1}(x) = \frac{3x+1}{2-x}$ 	6
$f(x) = x-1 - x-3 \rightarrow x-1 \geq x-3 \rightarrow x \leq 1 \rightarrow f(x) = -2$ $1 \leq x \leq 3 \rightarrow f(x) = 2x-4 \rightarrow 3-1 = 2 \rightarrow$ $x > 3 \rightarrow f(x) = 2$ $[a, b]$ $\rightarrow f(x) = 2x-4 \rightarrow y = 2x-4 = x = \frac{y+4}{2} \rightarrow f^{-1}(x) = \frac{x+4}{2} \rightarrow x \in [-2, 2]$ $f^{-1}(x) = \frac{x}{2} + 2$	7 8
$f(x) = \begin{cases} x^2+1 & x \geq 1 \rightarrow x: [1, +\infty) \\ x-1 & x \leq 0 \rightarrow x: (-\infty, -1] \end{cases} \rightarrow \checkmark$ $y = x^2+1 \rightarrow x = \sqrt{\frac{y-1}{2}} \rightarrow y \geq 1$ $y = x-1 \rightarrow x = \sqrt[3]{y-1} \rightarrow y \geq -1$ $\Rightarrow f^{-1}(x) = \begin{cases} \frac{x+1}{2} & x \leq -1 \\ \sqrt{\frac{x-1}{2}} & x \geq 1 \end{cases}$	1
$f(x) = \frac{x^3 - (x+1)^3}{x+3} \rightarrow \frac{x^3 + 3x^2 - x^3 - 3x^2 - 1 - 3x}{x+3} = \frac{-1-3x}{x+3}$ $f^{-1}(x) = \frac{ax+b}{cx+d} \rightarrow f^{-1}(x) = \frac{-3x-2}{3x+4} \rightarrow \begin{matrix} a=-3 \\ b=-2 \\ c=3 \\ d=4 \end{matrix}$ $f^{-1}(b) = ? \rightarrow f^{-1}(-2) = \frac{-3(-2)-2}{3(-2)+4} = \frac{1}{-2} = -\frac{1}{2}$	9
$f(x) = \frac{x}{x^2+1} \rightarrow y = \frac{x}{x^2+1} \rightarrow x = y(x^2+1) \rightarrow x = yx^2+y$ $\rightarrow yx^2+y-x=0 \rightarrow \frac{ax^2+bx+c=0}{x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}} = \frac{-(-1) \pm \sqrt{1-4y^2}}{2y} = \frac{1 \pm \sqrt{1-4y^2}}{2y}$ $\rightarrow f^{-1}(y) = \frac{1 \pm \sqrt{1-4y^2}}{2y} \rightarrow f^{-1}(x) = \frac{1 \pm \sqrt{1-4x^2}}{2x}$	$y \in [0, \frac{1}{2}]$ $y \in [-\frac{1}{2}, 0]$