

$$f(x) = \begin{cases} x^2 - 4 & x > a \\ 12x - 2 & x \leq a \end{cases}$$

$$\begin{aligned} &\rightarrow a^2 - 4 \geq 12a - 2 \rightarrow a^2 - 12a + 14 \geq 0 \\ &= (a-2)(a^2 + 2a - 1) \geq 0 \end{aligned}$$

$$\begin{array}{c|c|c} - & + & + \\ \hline - & + & + \end{array}$$

$$\rightarrow (-\infty, 2) \cup (2, +\infty) \rightarrow = [-\infty, +\infty) \rightarrow a \geq -4$$

$$f^{-1}(2) = 4 \rightarrow f(4) = 2 \rightarrow f(4) = 12k + 2 \rightarrow k = -1$$

$$f(7) = 2x - 10 = 21 - 10 = 11$$

$$b) f(f(x)) = f(2x - 10) = 2(2x - 10) - 10 = 4x - 20 - 10 = 4x - 30$$

$$f(x) = \frac{ax}{x-1}$$

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

$$a^2 = 2a(a-1) \Rightarrow a^2 = 2a^2 - 2a \rightarrow a^2 - 2a = 0 \rightarrow a(a-2) = 0$$

$$\left. \begin{array}{l} a=0 \rightarrow \text{مخرج صفر دارد} \\ a=2 \end{array} \right\} \checkmark$$

$$f^{-1} = \{(5, 2), (7, 4), (5, 7), (4, 9)\} \quad g^{-1} = \{(5, 4), (4, 1), (5, 9)\}$$

$$a) f \circ f^{-1} = 5 \rightarrow 2 \rightarrow 5 \quad V \rightarrow 4 \rightarrow V \quad 2 \rightarrow 7 \rightarrow 2 \quad 4 \rightarrow 9 \rightarrow 4$$

$$b) f^{-1} \circ f = 3 \rightarrow 5 \rightarrow 3 \quad 4 \rightarrow V \rightarrow 4 \quad V \rightarrow 2 \rightarrow V \quad 9 \rightarrow 4 \rightarrow 9$$

$$c) f \circ g^{-1} = 1 \rightarrow 2 \rightarrow 5 \quad 4 \rightarrow 1 \rightarrow 4 \quad 5 \rightarrow 9 \rightarrow 5$$

$$d) g^{-1} \circ f = 3 \rightarrow 5 \rightarrow 4 \quad V \rightarrow 2 \rightarrow V \quad 4 \rightarrow 9 \rightarrow 1 \quad 9 \rightarrow 4 \rightarrow 1$$

$$g^{-1} = (1, 2), (3, 4), (5, 9)$$

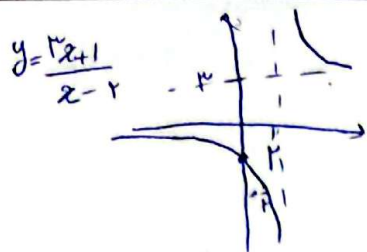
$$f \circ g^{-1} = 3 \rightarrow 4 \rightarrow 1 \quad 1 \rightarrow 2 \rightarrow 4 \quad 5 \rightarrow 9 \rightarrow 5$$

$$= \{(5, 0), (3, 1), (1, 4)\}$$

$$\frac{D_h}{f \circ g^{-1}} = \{(1, \frac{1}{4}), (3, \frac{1}{4})\} \rightarrow x=1 \rightarrow \frac{1}{4} = (1, \frac{1}{4})$$

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

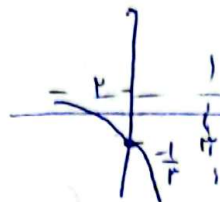
$$x=3 \rightarrow \frac{3}{4} = (3, \frac{1}{4})$$



مستقیم
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$$y = \frac{x+1}{x-2} \rightarrow xy - 2y - x - 1 = 0$$

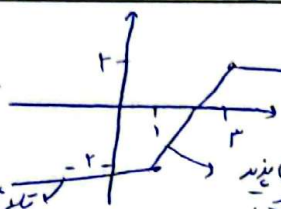
$$x(y-2) = 1+2y \rightarrow x = \frac{1+2y}{y-2} \rightarrow y = \frac{1+2x}{x-2} = f^{-1}(x)$$



$$D = \mathbb{R} - \{2\}$$

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$$f(x) = |x-1| - |x-2|$$



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$$[a, b] = [-5, 2]$$

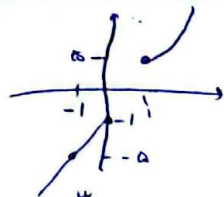
دارد باز → باز

$$(1, 2) \rightarrow -1 = a + b$$

$$(5, 2) \rightarrow 2 = 3a + b$$

$$\begin{aligned} y &= 3x - 4 \\ x &= 2y - 2 \rightarrow 2y = x + 2 \rightarrow y = \frac{x+2}{2} \end{aligned} \leftarrow \begin{aligned} 2a &= 4 \rightarrow a = 2 \\ b &= -4 \end{aligned}$$

$$f(x) = \begin{cases} x+2 & x \geq 1 \\ 3x-4 & x \leq 0 \end{cases}$$



دارد باز

$$D_f = (-\infty, -1] \cup [2, +\infty)$$

$$\textcircled{1} y = x+2 \rightarrow x = y-2 \rightarrow y = x-2 \rightarrow y = \sqrt{x-2}$$

$$\textcircled{2} y = 3x-4 \rightarrow x = \frac{y+4}{3} \rightarrow y = \frac{x+1}{3}$$

$$f^{-1}(x) = \begin{cases} \sqrt{x-2} & x \geq 2 \\ \frac{x+1}{3} & x \leq -1 \end{cases}$$

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

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

$$\rightarrow x = \frac{-1-2y}{y+2} \rightarrow y = \frac{-x-1}{x+2} = f^{-1}(x) \xrightarrow{\text{بجای } x} f^{-1}(x) = \frac{-4x-2}{x+4} \xrightarrow{x=-2} f^{-1}(-2) = \frac{4-1}{-2+4} = \frac{3}{2}$$

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

دارد باز

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$$f^{-1}(x) = \frac{1 + \sqrt{1-4x^2}}{2x} \quad x > 0$$