

$$f(x) = \begin{cases} x^2 - 2; x > 1 \rightarrow R_m \Rightarrow x = 1 \rightarrow (1^2 - 2, +\infty) \\ 12x - 2; x \leq 1 \rightarrow R_m \Rightarrow x = 1 \rightarrow (-\infty, 12 \cdot 1 - 2] \end{cases} \quad 12x - 2 \leq x^2 - 2$$

$$x^2 - 12x + 14 \geq 0 \rightarrow x = 1 \rightarrow x^2 - 12x + 14 \geq 0 \rightarrow \text{پایه زیرین!} \quad \frac{x^2 - 12x + 14}{x^2 + 12x - 14}$$

$$(x-1)(x+1)(x-2) \geq 0 \quad -\frac{1}{1} + \frac{1}{1} + \frac{1}{1} \rightarrow x \in [-1, +\infty)$$

الف) $f(v) = \rightarrow f(1) = 1$
 $x = 1, y = 1 \rightarrow 12 + 1 = 1 \rightarrow 12 = 1$
 $f(x) = 12x - 1 \rightarrow f(v), 12 \times v - 1$
 $f(v) = 11$

$\rightarrow f(f(x)) \rightarrow f(x) = 12x - 1$
 $12 \times (12x - 1) - 1 = 144x - 12 - 1 = 144x - 13$
 $144x - 13 = f(f(x))$

$A = (12a, a) \quad f(x) = \frac{12ax}{12a - x} = y \rightarrow x = \frac{y}{12 - y} \rightarrow f^{-1}(x) = \frac{x}{12 - x}$
 $\rightarrow x = 12a, y = a \rightarrow a = \frac{12a}{12 - a} \Rightarrow a^2 = 12a \rightarrow a^2 - 12a = 0 \rightarrow a = 0 \rightarrow 12$
 $a = 0 \rightarrow f(x) = 0 \rightarrow \text{پایه زیرین!} \quad x \times x \quad a = 12$
 $a = 12 \checkmark$

الف) $f \circ f^{-1} \rightarrow f^{-1} = \{(0, 12), (12, 1), (1, 12), (12, 1)\}$
 $a = 12 \rightarrow a$
 $v = 12 \rightarrow v$
 $12 \rightarrow 12 \rightarrow 12$
 $1 \rightarrow 1 \rightarrow 1$
 $f \circ f^{-1} = \{(12, 12), (1, 1), (12, 1), (1, 12)\}$

ب) $f \circ g^{-1} \rightarrow g^{-1} = \{(12, 1), (1, 12), (12, 1)\}$
 $12 \rightarrow 12 \rightarrow 12$
 $1 \rightarrow 1 \rightarrow 1$
 $12 \rightarrow 12 \rightarrow 12$
 $f \circ g^{-1} = \{(12, 12), (1, 1), (12, 1)\}$

$f = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$
 $g = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$
 $h = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$

$f \circ g^{-1} = g^{-1} = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$
 $1 \rightarrow 1 \rightarrow 1$
 $12 \rightarrow 12 \rightarrow 12$
 $12 \rightarrow 12 \rightarrow 12$
 $1 \rightarrow 1 \rightarrow 1$
 $f \circ g^{-1} = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$

$h = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$
 $f \circ g^{-1} = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$
 $h = \{(1, 12), (12, 1), (1, 12), (12, 1)\}$

$$y = \frac{r(x+1)}{x-r} \rightarrow \text{نقطه تقاطع} \rightarrow x = \frac{-ry-1}{y-r} \text{ و } \frac{ry+1}{y-r} \rightarrow f^{-1}(y) = \frac{r(x+1)}{x-r}$$

نقطه تقاطع: $x-r=0 \rightarrow x=r$ و $y=1$

$$f(x) = \frac{|x-1|}{x-r} \rightarrow \text{نقطه تقاطع} \rightarrow x-1=0 \rightarrow x=1 \rightarrow y=1$$

$x-r=0 \rightarrow x=r \rightarrow y=1$

$\rightarrow [a, b] = [1, r] \rightarrow 1 \leq x \leq r \rightarrow \text{نقطه تقاطع}$

$x-1 + x-r = r(x-1) \rightarrow y = r(x-1)$

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

$$f(x) = \begin{cases} x^r + r & ; x \geq 1 \\ x-1 & ; x \leq 0 \end{cases} \rightarrow x=1 \rightarrow y=r$$

$x=0 \rightarrow y=-1$

$y = x^r + r \rightarrow x = y^r + r \rightarrow y^r = x-r \rightarrow y = \sqrt[r]{x-r}$

$y = x-1 \rightarrow x = y+1 \rightarrow ry \leq x+1 \rightarrow y \leq \frac{x+1}{r}$

$f^{-1}(y) = \begin{cases} \sqrt[r]{x-r} & x \geq r \\ \frac{x+1}{r} & x \leq -1 \end{cases}$

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

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

$f^{-1}(y) = \frac{ax+b}{cy+d} \rightarrow \text{نقطه تقاطع} \left(\frac{-rx-1}{r+y} \right) \text{ و } y = \frac{-4x-r}{r+y} \rightarrow a=-4, b=-r, c=1, d=r$

$f^{-1}(-1) = \frac{y-1}{r-y} = 1 \rightarrow y=r$

$$f(x) = \frac{x}{x^r + r} \rightarrow yx^r + y = x \rightarrow x^r y - x + y = 0 \rightarrow x = \frac{1 \pm \sqrt{1-ry^r}}{ry}$$

$R_f = \left[-\frac{1}{r}, \frac{1}{r} \right]$

$f^{-1}(y) = \frac{1 \pm \sqrt{1-ry^r}}{ry}, x \in \left[-\frac{1}{r}, \frac{1}{r} \right]$