

① چون شیب عددی + است پس رابطه‌ی مختلفه با برابر دارند

$$R_f = (-\infty, 12a - 2] \cup [a^3 - 4, +\infty)$$

$$12a - 2 \leq a^3 - 4 \rightarrow a^3 - 12a + 17 \geq 0$$

$$\begin{array}{r|rr} & -2 & 1 \\ \hline & - & + & - & + \end{array}$$

$$\rightarrow a \in [-2, +\infty)$$

② $f(x) = x^2 + x = 2 \Rightarrow x = -10$

$$f(x) = 21 - 10 = 11 \quad \& \quad f(3n - 1) = 3(3n - 1) - 1 = 9n - 3 - 1 \Rightarrow 9n - 4$$

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

$$f^{-1} = \{(5, 3), (7, 4), (2, 5), (6, 9)\}$$

$$g = \{(3, 2), (8, 4), (9, 5)\} \quad g^{-1} = \{(2, 3), (4, 8), (5, 9)\}$$

الف) $f \circ f^{-1} = \{(5, 5), (7, 7), (2, 2), (6, 6)\}$

ب) $f^{-1} \circ f = \{(3, 3), (4, 4), (5, 5), (9, 9)\}$

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

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

$$\textcircled{1} \textcircled{5} \quad f(a) = \frac{a^r}{a-1} = ra \Rightarrow a^r = ra^r - ra$$

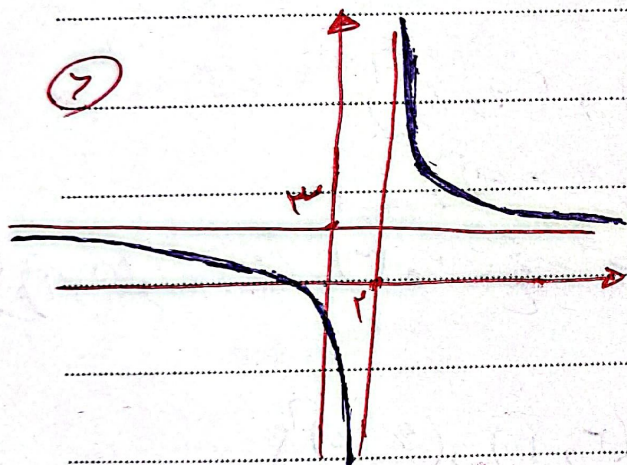
$$\Rightarrow a^r - ra = 0$$

$$\hookrightarrow a = \neq r, 0$$

$$\textcircled{2} \quad g^{-1} = \left\{ (1, r), (r, r), (0, r) \right\}$$

$$f \circ g^{-1} = \left\{ (1, r), (r, r), (0, 0) \right\} \Rightarrow \frac{h}{f \circ g^{-1}} = \left\{ (1, \frac{r}{r}), (r, \frac{r}{r}), (0, \frac{1}{0}) \right\}$$

$$\Rightarrow \left\{ (1, \frac{r}{r}), (r, \frac{r}{r}) \right\}$$



$$\frac{rx+1}{x-r} = x \Rightarrow \frac{rx+1}{x-r} = y$$

$$\Rightarrow y^{-1} = \frac{rx+1}{x-r}$$

④

$$-x+1+x-r$$

$$\textcircled{-r}$$

$$x-1+x-r$$

$$\boxed{rx-r}$$

$$x-1-x+r$$

$$\textcircled{+r}$$

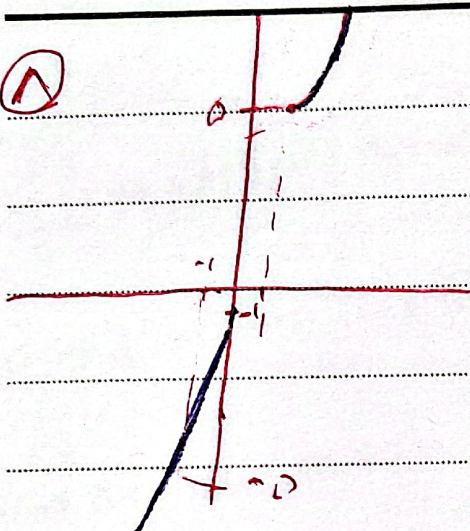
$$\hookrightarrow rx-r=x \Rightarrow \frac{x+r}{r} = x$$

$$\Rightarrow y^{-1} = \frac{x+r}{r}$$

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①



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

④ $f\left(\frac{x^2 + 1 - x^2 - x^2 - x^2 - x^2 - 1}{x + 1}\right) = \frac{-x^2 - 1}{x^2 + 1}$

$b = -1 \Rightarrow \frac{1^2 - 1}{-1^2 + 1} = \Delta$

⑤

$$\frac{x}{x^2 + 1} = x \Rightarrow y^2 x + x = y$$

$$\Rightarrow y^2 x - y + x = 0$$

$$y = \frac{+1 \pm \sqrt{1 - 4x^2}}{2}$$