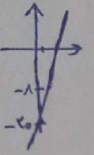


$$y = x^3 - 12$$



$$y = 12x - 20$$



$$x^3 - 4 \geq 12x - 20 \rightarrow a \in [-4, +\infty)$$

$$x^2(x - 12) = -16$$

نقطه تلاقی $x = 4$
 چون شیب $12x - 20$ می باشد و $12 \times 4 - 20 = 28$ است.

$$\Rightarrow a \neq 4 \times \Rightarrow \boxed{a \leq 4}$$

(1)

1

$$f_{(4)} = 2$$

$$3x^2 + K = 2$$

$$K = -10$$

$$f_{(x)} = 3x - 10$$

$$f_{(7)} = 3 \times 7 - 10 = 11$$

$$f_{(f_{(x)})} = 3(3x - 10) - 10 = \boxed{9x - 40}$$

(5)

2

$$2a = \frac{a \times a}{a - 1}$$

$$2a^2 - 2a = a^2$$

$$a^2 - 2a = 0$$

$$a = \begin{cases} 0 \text{ و } 2 \\ 2 \end{cases} \Rightarrow f_{(x)} = \frac{0 \times x}{x - 1} = 0 \Rightarrow \text{واحدی تابع نمی شود} \Rightarrow \text{یک به یک نمی شود}$$

(5)

3

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

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

(1)

4

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

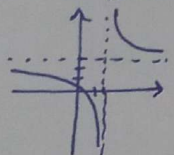
$$f \circ g^{-1} = \{(1, 4), (3, 1), (5, 0)\}$$

(5)

5

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

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



$\Rightarrow$ معکوس پذیر است

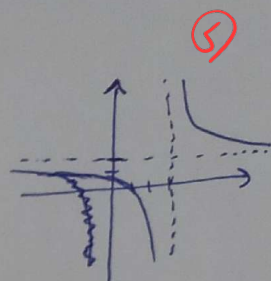
$$y = \frac{x+1}{x-2}$$

$$yx - 2y = x + 1$$

$$yx - 2x = y + 1$$

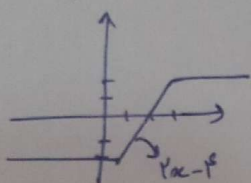
$$x(y-2) = y+1$$

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



6

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

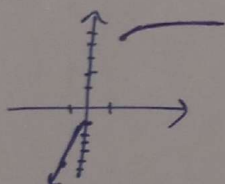


$$y = 2x - 4$$

$$2x = y + 4$$

$$x = \frac{y}{2} + 2 \Rightarrow f^{-1}(x) = \left[\frac{x}{2} + 2 \right] \quad [1, 3] \text{ در } \circledast$$

7



$\Rightarrow$ وارون پذیر است

$$y = x^3 + 1$$

$$x = \sqrt[3]{y-1}$$

$$y = x^3 - 1$$

$$x = \frac{y}{3} + \frac{1}{3}$$

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

8

$$f(x) = \frac{x^2(x+2) - (x+1)^2}{x+2} = \frac{x^3 + 2x^2 - x^2 - 2x - 1 - x^2 - 2x}{x+2} = \frac{-x^2 - 4x - 1}{x+2}$$

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

$$yx + 2y = -x^2 - 1$$

$$yx + 2x = -1 - 2y$$

$$x = \frac{-2y-1}{y+2}$$

$$\Rightarrow f^{-1}(x) = \frac{-2y-1}{y+2} = \frac{-2y-1}{y+2} \Rightarrow b = -2 \quad f^{-1}(-2) = \frac{-2(-2)-1}{-2+2} = \boxed{\infty}$$

9

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

$$|x| \leq \frac{1}{2}$$

10