

$x f(x) \geq 0$ $D_f: [-5, 0] \cup [2, 5]$ برای آنکه نیرادیکال نباشد باید x و $f(x)$ علامت باشند، پس: $\begin{array}{ccccccc} -4 & -5 & 0 & 2 & 5 \\ \hline - & + & + & - & + \end{array}$	۱
$x \geq 0, f(x) < 0 \rightarrow (0, 2)$ $x \leq 0, f(x) > 0 \rightarrow (-3, 0)$ $\rightarrow (-3, 0) \cup (0, 2)$ اعداد صحیح: $\{-2, -1, 1\}$ $\begin{array}{ccccccc} -4 & -3 & 0 & 2 & 5 \\ \hline - & + & - & - & + \end{array}$	۲
$f(2) - 2f(2) = 4 - 6 + 2 \rightarrow -f(2) = 2 \rightarrow f(2) = -2$ $f(-2) + 2 = 4 - 6 + 4 \rightarrow f(-2) = 1$	۳
$f(f(5)) \rightarrow 5 > 3 \Rightarrow 5 - 3 = 2 \rightarrow f(2) \rightarrow 2 < 3 \Rightarrow 2 + 3 = 5$ $f(f(1)) \rightarrow 1 < 3 \Rightarrow 1 + 3 = 4 \rightarrow f(4) \rightarrow 4 > 3 \Rightarrow 4 - 3 = 1$ $5 + 4 = 9$	۴
$f(x-1) = a(x-1)^2 - b(x-1) + 2 = ax^2 + a - 2ax - bx + b + 2$ $f(x) = ax^2 - bx + 2$ $a(x^2) + (-2a-b)(x) + a+b+2$ $a(x^2) + (-2a-b)(x) + a+b+2 - ax^2 + bx + 2 = 6x + 2$ $-2a(x) + a + b$ $-2a = 6 \Rightarrow a = -3$ $-3 + b = 2 \Rightarrow b = 5$ $a = -3, b = 5$ $-3 - 5 = -8$	۵

$$f(f(3)) = f(9 - 9 + 1) = 1$$

$$f(-1) = 1 + 3 + 1 = 5$$

$$f^3(1) = (1 - 9 + 1)^3 = 1$$

$$\frac{3+5}{1} = 8$$

② ✓

6

$$f(f(4)) = 16 > 4 \rightarrow f(16+1) = 17$$

$$-f(f(-2)) = -2 < 2 \rightarrow -f(4) = -1$$

$$f(2) = 2 = 2 \rightarrow 2+1 = 3$$

$$\frac{17-1}{3} = \frac{16}{3}$$

② ✓

7

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

$1 \xrightarrow{f} 1 \xrightarrow{f} 4 \rightarrow f(f(1)) = 4$
 $2 \xrightarrow{f} 2 \xrightarrow{f} 4 \rightarrow f(f(2)) = 4$
 $1 \xrightarrow{f} 4 \rightarrow f(1) = 4$

✓ ②

8

$$\frac{(x+1)^3 + 1}{(x+1)^3 + 1} = \frac{(\sqrt{x})^3 + 1}{(\sqrt{x})^3 + 1} = \frac{1}{x} = \frac{1}{4}$$

$$f(4) = \frac{16+1}{16+1} = \frac{17}{17} = 1$$

② ✓

9

$$(f(\sqrt{x}))^3 = \left(x + \frac{1}{x}\right)^3 = x^3 + \frac{1}{x^3} + 3$$

$$x^3 + \frac{1}{x^3} + 3 - x^3 - \frac{1}{x^3} = 3$$

② ✓

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