

$x \in \mathbb{R} \rightarrow -\infty, 2, \infty$
 $D_f = [-\infty, 0] \cup [2, \infty)$
 $x < -\infty, f(x) > 0$
 $-\infty < x < 2, f(x) < 0$
 $2 < x < \infty, f(x) > 0$
 $x < 0, f > 0 \Rightarrow x f < 0 \quad \times$
 $x = -\infty \rightarrow \text{حاصل صفر} \checkmark$
 $x > 0, f < 0 \Rightarrow x f < 0 \rightarrow 0 < x < 2 \quad \times$
 $x > 0, f < 0 \Rightarrow x f < 0 \quad \times$
 $x = 2 \checkmark$
 $x > 0, f > 0 \Rightarrow x f > 0 \rightarrow 2 < x < \infty \checkmark$
 $x = \infty \rightarrow \text{حاصل صفر} \checkmark$

1

$\frac{-x}{f(x)} \neq 0, f(x) \neq 0 \rightarrow x = -3, 2, \infty$
 $x < -3, f(x) > 0$
 $-3 < x < 2, f(x) < 0$
 $2 < x < \infty, f(x) > 0$
 $x = -3, f(-3) = 0 \rightarrow \text{مخرج صفر} \checkmark$
 $-3 < x < 0 \rightarrow \text{مخرج صفر} \rightarrow \times$
 $x = 0 \rightarrow \text{مخرج صفر} \rightarrow \times$
 $0 < x < 2 \rightarrow \text{مخرج صفر} \rightarrow \times$
 $x > 2, f < 0 \rightarrow \text{مخرج صفر} \rightarrow \times$
 $x = 2 \checkmark$
 $f(2) = 0, x = 2 \rightarrow \text{مخرج صفر} \times$
 $2 < x < \infty, f > 0 \rightarrow -x < 0 \rightarrow \text{مخرج صفر} \times$
 $x = 0 \checkmark$

2

$f(2) - 2f(2) = 4 - 4 + 2 = 2$
 $-f(2) = 2 \rightarrow f(2) = -2$

3

$f(1) \rightarrow 1 \leq x \rightarrow f(1) = 2 + 4 = 6$
 $f(f(1)) = f(6) \rightarrow \omega > 3 \quad f(6) = 6 - \sqrt{6+2} = 6 - 4 = 2$
 $f(2) = 2 \times 2 + 4 = 8 \rightarrow 2 \leq x \rightarrow f(f(6)) = f(2)$
 $f(f(1)) + f(f(6)) = f(6) + f(2) = 2 + 8 = 10$

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$f(x-1) = a(x-1)^2 - b(x-1) + 2 = a(x^2 - 2x + 1) - bx + b + 2 = ax^2 - 2ax + a - bx + b + 2$
 $f(x-1) - f(x) = (ax^2 - 2ax + a - bx + b + 2) - (ax^2 - bx + 2) = -2ax + a + b$
 $-2ax + (a+b) = 4x + 2 \rightarrow -2a = 4 \rightarrow a = -2, b = 6$
 $a - b = -2 - 6 = -8$

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$$f(\sqrt{x}-2) = \frac{\cancel{1-x} + \cancel{f(\sqrt{x})} - 1 + 5}{\cancel{1-x} + \cancel{f(\sqrt{x})} - 1 + 1} = \frac{4}{1} = \frac{4}{1}$$

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$$\frac{a^{\frac{1}{n}}}{a^{\frac{1}{n}}} = \frac{a^{\frac{1}{n}}}{a^{\frac{1}{n}}} + \frac{1}{a^{\frac{1}{n}}} = a^{\frac{1}{n}} + \frac{1}{a^{\frac{1}{n}}}$$

$$f\left(a - \frac{1}{a}\right) = a^{\frac{1}{n}} + \frac{1}{a^{\frac{1}{n}}} \rightarrow \left(a - \frac{1}{a}\right)^{\frac{1}{n}} = a^{\frac{1}{n}} + \frac{1}{a^{\frac{1}{n}}} - 2$$

$$a - \frac{1}{a} = -2 \rightarrow a^{\frac{1}{n}} + \frac{1}{a^{\frac{1}{n}}} = a - 2 = 0$$

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$$\Rightarrow \frac{f(1)}{g(1)} = \frac{-4}{\sqrt{2}} = -2\sqrt{2} \quad \frac{f(2)}{g(2)} = 0 \quad \frac{f(0)}{g(0)} = \frac{2}{3}$$

$$\left\{ -2\sqrt{2}, 0, \frac{2}{3} \right\}$$

$$\frac{g}{f} \Rightarrow \frac{g(1)}{f(1)} = \frac{2}{-4} = -\frac{1}{2}, \quad \frac{g(2)}{f(2)} = \frac{\sqrt{2}}{0} = -\frac{\sqrt{2}}{0}$$

$$\frac{f}{g} = \left\{ -2\sqrt{2}, \frac{2}{3} \right\}$$

$$g(2) = \sqrt{4-2} = \sqrt{2}$$

$$g(1) = \sqrt{4-1} = \sqrt{3}$$

$$g(0) = \sqrt{4} = 2$$

$$g(2) \rightarrow \text{تقریباً}$$

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$$الف) f(a) = \{(2,2), (2,1), (-5,4), (1,-4)\}$$

$$ب) f(a)+1 = \{(2,3), (2,2), (-5,5), (1,-3)\}$$

$$ج) f(f(a)+1) = \{(2,4), (2,3), (-5,6), (1,2)\}$$

$$د) f(a) = \left\{ (1,1), \left(\frac{1}{2}, 2\right), \left(-\frac{1}{2}, 2\right), \left(\frac{1}{4}, -2\right) \right\}$$

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$$الف) = \{(2,2), (2,2), (4,1)\}$$

$$f-1 = 2 \leftarrow g(1) = 0, f(1) = 4 \leftarrow a=1 \text{ برای}$$

$$f-1 = 2 \leftarrow g(2) = 1, f(2) = 3 \leftarrow a=2 \text{ برای}$$

$$1 - (-1) = 2 \leftarrow g(3) = -1, f(3) = 1 \leftarrow a=3 \text{ برای}$$

$$\text{تقریباً} \leftarrow \left(\frac{1}{2}\right) \leftarrow g(1) = 0 \leftarrow a=1 \text{ برای}$$

$$\frac{2}{1} = \frac{f(1)}{g(2)} \leftarrow a=2 \text{ برای}$$

$$-1 = \frac{1}{-1} = \frac{f(3)}{g(3)} \leftarrow a=3 \text{ برای}$$

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

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