

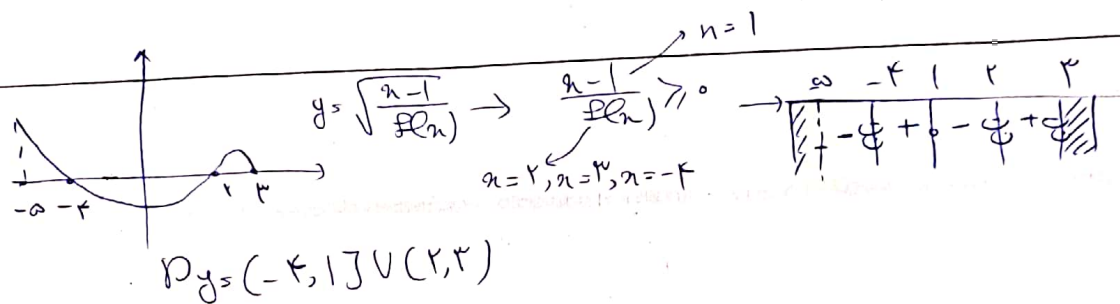
$$y = \sqrt{x^2 f(x+1)} \Rightarrow x^2 f(x+1) \geq 0 \Rightarrow x^2 \left(\left(\frac{1}{x} \right)^{n-1} - 1 \right) \geq 0$$

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

$\rightarrow \frac{1}{-} \frac{0}{+} \frac{1}{+} \frac{1}{-} \rightarrow D_f = [0, 1]$

$$f(x) = \sqrt{x + |x+2|} \Rightarrow f(x) = \sqrt{-x + |x+2|} \Rightarrow -x + |x+2| \geq 0 \Rightarrow |x+2| \geq x$$

مقادیر $x^2 + 4 - 4x \geq x^2 \Rightarrow 4 \geq 4x \Rightarrow 1 \geq x \rightarrow D_f = (-\infty, 1]$



$$y = \frac{1}{x^2 + ax + b} \rightarrow 9x^2 - 4x^2 - 4x - 3 = (x^2 + ax + b)(x^2 + cx + d) = 5x^2 + (c+4a)x + (d+4b)x + bcd$$

$$\begin{cases} bcd = -3 \\ ad + bc = -4 \\ c + 4a = 0 \\ d + 4b = -4 \end{cases} \rightarrow \begin{cases} b = -3, d = 1 \\ ad + bc = -4 \rightarrow ad - 3b = -4 \rightarrow ad + 9 = -4 \rightarrow ad = -13 \\ c + 4a = 0 \rightarrow c = -4a \\ d + 4b = -4 \rightarrow 1 - 12 = -4 \end{cases}$$

$a = -1, b = -3, c = 4, d = 1$

$$\sqrt{-(a+b)} = \sqrt{-(-1-3)} = \sqrt{4} = 2$$

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

$$y = \sqrt{f(x) - f\left(\frac{x}{2}\right)} \Rightarrow f(x) - f\left(\frac{x}{2}\right) \geq 0 \Rightarrow x^2 + x - \frac{x^2}{4} - \frac{x}{2} \geq 0 \Rightarrow x^2 - \frac{x^2}{4} + x - \frac{x}{2} \geq 0$$

$$\rightarrow \left(x - \frac{x}{2}\right) \left(x^2 + \frac{3x}{2} + \frac{1}{4}\right) \geq 0 \rightarrow \left(x - \frac{x}{2}\right) \left(x^2 + \frac{3x}{2} + \frac{1}{4}\right) \geq 0$$

$\rightarrow \frac{-3}{-} \frac{1}{+} \frac{1}{+} \rightarrow D_f = [-2, 0) \cup [2, +\infty)$

$$f(x^2 + 1) = x^2 - 1$$

$$x^2 + 1 = 2 \xrightarrow{n=1} f(2) = 2 - 1 = 1$$

$$x^2 + 1 = 10 \xrightarrow{n=3} f(10) = 10 - 1 = 9$$

$$f(2) + f(10) = 1 + 9 = 10$$

$$f(x) = x^2 - 9x + 12 = x^2 - 9x + 12x - 1 + 1 = (x-2)^2 + 1$$

$$g(x) = x^2 + 9x + 12 = x^2 + 9x + 12x + 12 - 12 = (x+3)^2 - 12$$

$$g(\sqrt{5}-2) = (\sqrt{5}-2+3)^2 - 12 = 5 - 2\sqrt{5} - 2 = 3 - 2\sqrt{5}$$

$$\frac{g(\sqrt{5}-2)}{f(\sqrt{5}+2)} = \frac{3-2\sqrt{5}}{10} = -\frac{2}{5}$$

$$f(x) = \sqrt{x+4\sqrt{x-4}} \quad f(x) + g(x) = \sqrt{x+4\sqrt{x-4}} + \sqrt{x-4\sqrt{x-4}} = \sqrt{x+4\sqrt{x-4}+4} + \sqrt{x-4\sqrt{x-4}+4}$$

$$g(x) = \sqrt{x-4\sqrt{x-4}} = \sqrt{(x-4)+4\sqrt{x-4}} = |\sqrt{x-4}+2| + |\sqrt{x-4}-2| = a+b\sqrt{x-4}$$

$$1 > x > 4 \rightarrow \text{در این بازه، } \sqrt{x-4}+2 > 0, \sqrt{x-4}-2 < 0 \rightarrow \sqrt{x-4}+2+2-\sqrt{x-4} = 4$$

$$x > 4 \rightarrow \text{در این بازه، } \sqrt{x-4}+2 > 0, \sqrt{x-4}-2 > 0 \rightarrow \sqrt{x-4}+2+\sqrt{x-4}-2 = 2\sqrt{x-4} \rightarrow a=0, b=2, c=-4$$

$$\frac{a+b}{c} = \frac{0+2}{-4} = -\frac{1}{2}$$

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

$$g(x) = \{ (2, 1), (1, 0), (3, 0), (0, 3) \}$$

$$\frac{g}{f} = \left\{ \left(2, \frac{1}{f} \right), \left(1, \frac{0}{f} \right) \right\}$$

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

$$f(0) = \frac{0+2}{0-0+3} = \frac{2}{3}$$

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

$$f(3) = \frac{3+2}{9-3+3} = \frac{5}{9}$$

$$f(x) = \{ (1, 2), (3, -1), (5, 2), (-1, 4) \} \quad g(x) = \{ (-2, 3), (1, -1), (3, 2), (-1, 0) \}$$

$$f(x) = \left\{ \left(\frac{1}{f}, 2 \right), \left(\frac{3}{f}, -1 \right), \left(\frac{5}{f}, 2 \right), \left(\frac{-1}{f}, 4 \right) \right\}$$

$$x=1 \rightarrow n=\frac{1}{f}, x=3 \rightarrow n=\frac{3}{f}, x=5 \rightarrow n=\frac{5}{f}, x=-1 \rightarrow n=\frac{-1}{f}$$

$$f(x) = \{ (1, 2), (-1, 2), (\sqrt{3}, -1), (-\sqrt{3}, -1), (4, 2), (5, 2) \}$$

$$x^2=1 \rightarrow x=\pm 1, x^2=3 \rightarrow x=\pm\sqrt{3}, x^2=4 \rightarrow x=\pm 2, x^2=-1 \rightarrow x=\pm i$$

$$g(x) = \{ (-2, 9), (1, 3), (3, 9), (-1, 1) \}$$

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