

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

سوال ۱:

$$\rightarrow t = \sqrt{x-4} \rightarrow x \geq 4 \rightarrow t \geq 2$$

$$f = t+2, \quad g = t-2$$

$$f+g = 2t = 2\sqrt{x-4} \rightarrow a=0, b=2, c=-4$$

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

$$f(x) = \frac{x+2}{x^2-4x+3}, \quad g(x) = \left\{ \frac{(2,1)}{x}, \frac{(1,0)}{x}, \frac{(3,5)}{x}, \frac{(0,4)}{x} \right\}$$

$$x^2-4x+3 \neq 0 \rightarrow (x-1)(x-3) \neq 0 \rightarrow x \neq 1, 3$$

$$f(2) = \frac{2+2}{4-8+3} = -4$$

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

$$x=2 \rightarrow \left(\frac{1}{-2} \right), \quad x=0 \rightarrow \frac{\frac{2}{3}}{\frac{2}{3}} = 1 \rightarrow \frac{g}{f} = \left\{ (0,4) \text{ و } (2, \frac{1}{-2}) \right\}$$

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

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

$$\text{ب) } f(x^2) = \left\{ (\pm 1, 2), (\pm \sqrt{3}, -1), (\pm 2, 2) \right\} \quad \sqrt{-1} \rightarrow \text{غیرممکن}$$

$$\text{ج) } 2g(x)+1 = \left\{ (-2, 9), (1, 3), (3, 9), (-1, 3) \right\}$$

$$\text{د) } \frac{2f}{g} = \left\{ (1, -4), (3, -1) \right\}$$

$$\frac{4}{0} \text{ غیرممکن}$$

$$f(x) = \{(2,1), (3,1), (4,9), (-2,0)\} \quad \text{سؤال ٤}$$

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

$$\begin{aligned} x=2 &\rightarrow h(2) = 2(1) + 3 = 5 \\ x=3 &\rightarrow h(3) = 2(1) + 3 = 5 \\ x=-2 &\rightarrow h(-2) = 2(0) + 4 = 4 \end{aligned} \rightarrow h = 2f + g = \{(2,5), (3,5), (-2,4)\}$$

$$f(x) = \frac{\sqrt{3x} - x}{x-2} \quad , \quad g(x) = [x] + [-x] \quad \text{سؤال ٥}$$

$$\sqrt{3x} - x \geq 0 \rightarrow x \leq \sqrt{3x}$$

$$x^2 \leq 3x \rightarrow x^2 - 3x \leq 0 \rightarrow x(x-3) \leq 0 \rightarrow [0, 3] - \{2\}$$

$$D = \{0, 1, 3\}$$

$$f(x) = \sqrt{5x - x^2 - 4} \quad , \quad g(x) = \{(1,3), (2,2), (3,4), (0,1)\} \quad \text{سؤال ٦}$$

$$h(x) = \frac{f(x)}{g(x)}$$

$$5x - x^2 - 4 \geq 0 \rightarrow \frac{-5 \pm \sqrt{25 - 4(-1)(-4)}}{-1}$$

$$x = (1, 4)$$

$$[1, 4]$$

$$x=1 \rightarrow f(1) = 0 \quad , \quad f(2) \xrightarrow{x=2} \sqrt{2} \quad , \quad f(3) = 2 \rightarrow \text{في } g(x)$$

$$f(4) \rightarrow 0$$

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

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سوال ۷:

چون بنابر سراسر تار فاصله در زیر سراسر $R_f = R$ به صفر است

$$y = \frac{1}{x^2 - 2x} \rightarrow (x-1)^2 - 1 \rightarrow \text{خارج} [-1, +\infty)$$

$$Ry = (-\infty, 1] \cup (0, +\infty)$$

سوال ۸:

$$y = x^2 - 4x + 10 \quad \left| \begin{array}{l} -\frac{b}{2a} \rightarrow \frac{-(-4)}{2} = 2 \\ 2^2 - 4 \times 2 + 10 = 4 \end{array} \right. \rightarrow Ry = [4, +\infty)$$

$a > 0 \rightarrow \min$

$$y = -x^2 + 4x + 3 \quad \left| \begin{array}{l} -\frac{b}{2a} = \frac{-(4)}{2(-1)} = 2 \\ -9 + 11 + 3 = 12 \end{array} \right. \rightarrow Ry = (-\infty, 12]$$

$a < 0 \rightarrow \max$

$$y = \sqrt{x^2 - 4x - 3} \quad \left| \begin{array}{l} -\frac{b}{2a} = \frac{-(-4)}{2} = 2 \\ 4 - 11 - 3 = -7 \end{array} \right. \rightarrow Ry = [0, +\infty)$$

$a > 0 \rightarrow \min$

$$y = \sqrt{-x^2 + 4x} \quad \left| \begin{array}{l} -\frac{b}{2a} \rightarrow \frac{-(4)}{2(-1)} = 2 \\ -9 + 11 = 2 \end{array} \right. \rightarrow Ry = [0, 2]$$

$a < 0 \rightarrow \max$

سوال ۹.

الف) $y = x^3 - 5x^2 + 2x + 1 \rightarrow \boxed{R_y = R}$ ← بزرگترین و کوچکترین فرد

ب) $y = x^5 - 4x^4 + 3x + 2 \rightarrow \boxed{R_y = R}$ ← بزرگترین و کوچکترین فرد

ج) $y = \sqrt{x^5 - 4x^4 + 5x + 1} \rightarrow \sqrt{R} \rightarrow \boxed{R_y = [0, +\infty)}$

د) $y = (x^5 + (-4x^4) + 3x + 1)^2 \rightarrow \text{زوج}^2 \text{ و زوج}^2 \rightarrow \boxed{R_y = [0, +\infty)}$

سوال ۱۰.

الف) $y = \frac{3x+1}{x-2} \rightarrow R_y = R - \left\{ \frac{a}{c} \right\} \rightarrow \boxed{R_y = R - \left\{ \frac{3}{1} \right\}}$

ب) $y = \frac{2x+1}{x+1} \rightarrow R_y = R - \left\{ \frac{2}{1} \right\} \rightarrow \boxed{R_y = R - \left\{ 2 \right\}}$