

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

$$g(x) = \sqrt{x-4} \sqrt{x-4} \xrightarrow{\pm 4} f(x) = \sqrt{x-4-4} \sqrt{x-4+4} = \sqrt{(x-4-4)^2} = \sqrt{x-4-4}$$

$$g(x) = \sqrt{x-4-4} \quad / \quad g(x) + f(x) = \sqrt{x-4-4} + \sqrt{x-4+4} = \sqrt{x-4-4} + \sqrt{x-4+4} = 2\sqrt{x-4} = a \quad | \quad b = 2 \quad | \quad c = -4 \quad \frac{a+b}{c} = \frac{2-4}{-4} = \frac{1}{2}$$

$$f(x) = \frac{x+2}{(x-1)(x-2)} \quad g(x) = \{(2,1), (1,0), (3,0), (0,4)\} \quad Df \cap Dg \rightarrow \{0,2\}$$

$$Df \cap Dg \rightarrow \{0,2\} \quad Dg = \{(2,1), (1,0), (3,0)\} \Rightarrow$$

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

$$f(x) \rightarrow x = 1, 3, 2, -1 \rightarrow x = \pm \frac{1}{x} \rightarrow x, \frac{1}{x} \quad f(x) = (\frac{1}{x} + 1)(\frac{1}{x} - 1) = (\frac{1}{x^2} - 1)$$

$$f(x) \rightarrow x^2 = 1, 3, 2 \rightarrow x = \pm 1, \pm \sqrt{3}, \pm \sqrt{2}$$

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

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

$$f(x) \rightarrow Df \cap Dg = \{1, 3\} \rightarrow \frac{f(x)}{g(x)} = -1$$

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

$$Df \cap Dg = \{3, 4, 2\} \quad h = f \circ g \rightarrow h = \{(3,0), (-4,4), (2,5)\}$$

$$f(x) = \frac{\sqrt{x^2-1}}{x-2} \quad g(x) = [x] + [-x] \quad (\frac{f}{g})x = \frac{\sqrt{x^2-1}}{x-2}$$

$$\begin{cases} ① x^2-1 > 0 \rightarrow x > 1 \\ ② \sqrt{x^2-1} > 0 \rightarrow x^2-1 < 0 \rightarrow [0, 3] \\ ③ x-2 \neq 0 \rightarrow x \neq 2 \\ ④ [x] + [-x] + 1 \neq 0 \rightarrow [x] + [-x] \neq -1 \rightarrow x \in \mathbb{Z} \end{cases}$$

$$\frac{f}{g} = \{0, 1, 3\}$$

$$[x] + [-x] = -1 \rightarrow x \notin \mathbb{Z}$$

$$[x] + [-x] = 0 \rightarrow x \in \mathbb{Z}$$

$$f(x) = \sqrt{x^2 + 0.5x - 4} \quad g(x) = \{(1, x^2)(x, 2)(2, x)(0, 1)\} \quad Df = [1, 4] \Rightarrow \text{range } g = \{1, 2, x, 4\}$$

$$-1 \leq \frac{x}{x+1} \leq \frac{x^2 + 0.5x - 4}{x^2 + 0.5x - 4} \Rightarrow (x+1)(x+4) \Rightarrow x = 1, 2 \quad \text{range } g = \{1, 2, x, 4\}$$

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

$$\text{الف) } y = x^3 - 3x^2 + 3x \xrightarrow{+1} y = x^3 - 3x^2 + 3x - 1 + 1 \rightarrow (x-1)^3 + 1$$

$$y-1 = (x-1)^3 \rightarrow x-1 = \sqrt[3]{y-1} + 1 \rightarrow R_f = \mathbb{R} \quad \text{ب) } \frac{-1}{x^2-1} \rightarrow \frac{-1}{x^2-1} = \frac{0}{x^2-1} \rightarrow \frac{-1}{x^2-1} = \frac{0}{x^2-1}$$

$$\text{ب) } y = \frac{1}{x^2-1} \rightarrow y(x^2-1) = 1 \rightarrow x = \frac{y \pm \sqrt{y^2 + 4y}}{y} \rightarrow \langle y, \frac{y^2 + 4y}{y} \rangle$$

$$R_f = \mathbb{R} \setminus \{-1, 0\}$$

$$\text{الف) } y = x^2 - 4x + 1 \rightarrow y_{\min} = \frac{4a - b^2}{4a} = \frac{4 - 16}{4} = 1 - 4 = -3 \quad R_f = [4, +\infty)$$

$$\text{ب) } y = x^2 + 4x + 3 \rightarrow y_{\max} = \frac{-12 - 16}{-4} = 3 + 4 = 7 \rightarrow R_f = (-\infty, 7]$$

$$\text{ج) } y = \sqrt{x^2 - 4x + 4} \rightarrow y_{\min} = \frac{-12 - 16}{4} = -3 - 4 = -7 \rightarrow R_f = \sqrt{-7, +\infty} \Rightarrow \langle 0, 3, +\infty \rangle$$

$$\text{د) } y = \sqrt{4x - x^2} = y_{\max} \rightarrow \frac{-4}{-2} = 2 \rightarrow R_f = \sqrt{0, 4} \rightarrow R_f = [0, 2]$$

$$\text{الف) } y = x^3 - 0.5x^2 + 2x + 1 \rightarrow R_f = \mathbb{R}$$

$$\text{ب) } y = x^3 - 4x^2 + 3x + 2 \rightarrow R_f = \mathbb{R}$$

$$\text{ج) } y = \sqrt{x^3 - 4x^2 + 0.5x + 1} \rightarrow R_f = [0, +\infty)$$

$$\text{د) } y = (x^3 - 0.5x^2 + 2x + 1) \rightarrow R_f = [0, +\infty)$$

$$\text{الف) } y = \frac{x^2 + 1}{x - 2} \rightarrow R_f = \mathbb{R} \setminus \{2\}$$

$$\text{ب) } y = \frac{x^2 + 1}{x + 1} \rightarrow R_f = \mathbb{R} \setminus \{-1\}$$