

$$f(x) = \sqrt{ax - x^2 - f} \quad , \quad g(x) = \{(1, 1), (2, 2), (4, 4), (a, 1)\}$$

$$h(x) = \frac{f(x)}{g(x)} \quad D_f = \{(x^2 - ax + f) \geq 0\} \quad \frac{1}{-f} + \frac{f}{f} \quad D_f = [1, 4]$$

$$h(x) = \left\{ (1, \frac{0}{1}), (2, \frac{\sqrt{2}}{2}), (4, 0) \right\} \quad f(1) = \sqrt{a - 1 - f} = 0 \quad f(2) = \sqrt{10 - 4 - f} = \sqrt{6}$$

$$f(4) = \sqrt{16 - 16 - f} = 0$$

$$h(x) = \left\{ (1, 0), (2, \frac{\sqrt{2}}{2}), (4, 0) \right\} \quad \text{D}$$

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

$$\text{ب) } y = \frac{1}{x^3 - 3x} \rightarrow yx^3 - 3xy = 1 \rightarrow yx^3 - 3xy - 1 = 0 \rightarrow x = \frac{+3y \pm \sqrt{(-3y)^2 - 4(-1)y}}{2y}$$

$$y \neq 0 \rightarrow 9y^2 + 4y \geq 0 \rightarrow 4y(y+1) \geq 0 \quad \frac{-1}{+f} - \frac{0}{-f} \quad D_f = (-\infty, -1] \cup (0, +\infty)$$

$$\text{الف) } y = x^3 - 3x + 1 \quad \min \left| \frac{3}{4} \right| \quad R_f = [9, +\infty)$$

$$\text{ب) } y = -x^3 + 3x + 3 \quad \max \left| \frac{3}{12} \right| \quad R_f = (-\infty, 12]$$

$$\text{ج) } y = \sqrt{x^3 - 3x - 3} \quad \min \left| \frac{3}{-9} \right| \quad R_f = \sqrt{(-\infty, -9]} \rightarrow [0, +\infty)$$

$$\text{د) } y = \sqrt{4x - x^2} \quad \max \left| \frac{3}{9} \right| \quad R_f = \sqrt{(-\infty, 9]} \rightarrow [0, 3]$$

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

$$\text{مشتق دوم را بررسی می‌کنیم} \rightarrow R_f = \mathbb{R}$$

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

$$\text{مشتق دوم را بررسی می‌کنیم} \rightarrow R_f = \mathbb{R}$$

$$\text{ج) } y = \sqrt{x^3 - 4x^2 + 3x + 1}$$

$$R_f = \sqrt{\mathbb{R}} \rightarrow [0, +\infty)$$

$$\text{د) } y = (x^3 - 4x^2 + 3x + 1)^2$$

$$R_f = \mathbb{R}^+ \rightarrow [0, +\infty)$$

$$\text{الف) } y = \frac{3x+1}{x-2} \quad R_f = \mathbb{R} - \{3\}$$

$$\text{ب) } y = \frac{3x+1}{x+1} \quad R_f = \mathbb{R} - \{3\}$$