

$$f(u) = \sqrt{u+4}\sqrt{u-4} \quad \text{و} \quad g(u) = \sqrt{u-4}\sqrt{u-4}$$

$$(f+g)^2 = f^2 + g^2 + 2fg \Rightarrow u+4\sqrt{u-4} + u-4\sqrt{u-4} + 2fg \quad (1)$$

$$2fg = \sqrt{u^2-16u+48} \Rightarrow 2fg = 2\sqrt{(u-4)^2} \Rightarrow 2fg = 2u-16$$

$$\Rightarrow (f+g)^2 = 2u + 2u - 16 \Rightarrow 4u - 16 \xrightarrow{\text{بجای}} 2\sqrt{u-4} \Rightarrow a=0$$

$$\frac{a+b}{c} = \frac{0+2}{-4} = -\frac{1}{2} \quad \leftarrow \quad \begin{matrix} b=2 \\ c=-4 \end{matrix}$$

$$f(u) = \frac{u+2}{u^2-4u+4} \Rightarrow \frac{u+2}{(u-1)(u-3)} \Rightarrow R = \{1, 3\} \quad (2)$$

$$g(u) = \left\{ \left(\frac{1}{2}, 1 \right), \left(1, 0 \right), \left(\frac{3}{2}, -1 \right), \left(2, 0 \right) \right\} \quad \cap \rightarrow 2, 0$$

$$g(1) = 1 \quad f(1) = -\frac{1}{2} \Rightarrow \frac{-1}{\frac{1}{2}} = -2$$

$$g(0) = 4 \quad f(0) = \frac{2}{3} \Rightarrow \frac{\frac{2}{3}}{4} = \frac{1}{6}$$

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

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

$$f(u) = \left\{ \left(\frac{1}{2}, 1 \right), \left(\frac{3}{2}, -1 \right), \left(2, 0 \right), \left(-\frac{1}{2}, 4 \right) \right\}$$

$$f(u^2) = \left\{ \left(1, 2 \right), \left(-1, 2 \right), \left(2, 2 \right), \left(-2, 2 \right) \right\}$$

$$2g^2(u) + 1 = \left\{ \left(1, 1 \right), \left(1, 3 \right), \left(3, 1 \right), \left(-1, 1 \right) \right\}$$

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

$$\cap \rightarrow \left\{ \left(2, 2 \right), \left(-2, 2 \right), \left(3, 3 \right) \right\} \quad g(u)$$

$$\hookrightarrow \left\{ \left(2, 1 \right), \left(-2, 0 \right), \left(2, 1 \right) \right\} \quad f(u)$$

$$u=2 \rightarrow f+g=0$$

$$u=-2 \rightarrow f+g=4$$

$$u=3 \rightarrow f+g=0$$

$$\Rightarrow h = f+g = \left\{ \left(2, 0 \right), \left(-2, 4 \right), \left(3, 0 \right) \right\}$$

$$f(u) = \frac{\sqrt{u^2-4}}{u-2} \quad u \geq 2$$

$$g(u) = [u] + [-u]$$

$$\hookrightarrow u \in \mathbb{Z} \rightarrow g(u) = 0 \rightarrow g+1=1$$

$$\hookrightarrow u \notin \mathbb{Z} \rightarrow g(u) = -1 \rightarrow g+1=0$$

$$\hookrightarrow \sqrt{u^2-4} \rightarrow u^2 \geq 4 \rightarrow u \geq 2$$

$$\hookrightarrow \sqrt{u^2-4} \geq 0 \rightarrow u^2-4 \geq 0 \rightarrow u^2 \geq 4 \rightarrow u \geq 2 \text{ و } u \leq -2$$

$$u \neq 2$$

$$\cap f = \{0, 1, 3\}$$

$$f(u) = \sqrt{u^2-4} - 4$$

$$g(u) = \left\{ \left(1, 3 \right), \left(2, 2 \right), \left(3, 1 \right), \left(4, 0 \right) \right\} \quad (4)$$

$$\hookrightarrow \frac{u^2-4}{(u-4)(u-1)} \leq 0 \rightarrow \frac{1}{2} \leq u \leq 4$$

$$h(u) = \frac{f(u)}{g(u)} = \left\{ \left(1, 0 \right), \left(2, \frac{1}{2} \right), \left(3, 0 \right) \right\}$$

$$\begin{matrix} f(1) = 0 \\ f(2) = \sqrt{2} \\ f(3) = 1 \\ f(4) = 0 \end{matrix}$$

$$y-1 = u^3 - 3u^2 + 3u - 1 \quad \leftarrow \quad y = u^3 - 3u^2 + 3u$$

$$y-1 = (u-1)^3 \Rightarrow \sqrt[3]{y-1} = u-1 \rightarrow u = 1 + \sqrt[3]{y-1} \Rightarrow R = \mathbb{R}$$

$$y = \frac{1}{u^2-2} \Rightarrow yu^2 - 2yu = 1 \Rightarrow yu^2 - 2yu - 1 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad 2y \rightarrow \neq 0$$

$$\Delta \geq 0 \Rightarrow 4y^2 + 4y \geq 0$$

$$y(4y+4) \geq 0 \Rightarrow y \geq -1$$

$$\Rightarrow \mathbb{R} = (-\infty, -1] \cup (0, +\infty)$$

$$(1) \quad y = 2x^2 - 4x + 6 \rightarrow \frac{y}{x} = \frac{2x^2 - 4x + 6}{x} = 2x - 4 + \frac{6}{x} \Rightarrow [4, +\infty) \quad (1)$$

$$(2) \quad y = -x^2 + 4x + 3 \rightarrow \frac{y}{x} = \frac{-x^2 + 4x + 3}{x} = -x + 4 + \frac{3}{x} \Rightarrow (-\infty, 12] \quad (2)$$

$$(3) \quad y = \sqrt{x^2 - 4x + 4} \rightarrow \frac{y}{x} = \frac{\sqrt{x^2 - 4x + 4}}{x} = \frac{x-2}{x} \Rightarrow [0, +\infty) \quad (3)$$

$$(4) \quad \sqrt{x^2 + 4x} \rightarrow \frac{y}{x} = \frac{\sqrt{x^2 + 4x}}{x} = \sqrt{1 + \frac{4}{x}} \Rightarrow [0, 2] \quad (4)$$

$$(5) \quad y = x^3 - 3x^2 + 3x + 1 \Rightarrow R = \mathbb{R} \quad (5)$$

$$(6) \quad y = \sqrt{x^3 - 9x^2 + 12x + 4} \Rightarrow R = [0, +\infty) \quad (6)$$

$$(7) \quad y = \frac{x+1}{x-2} \Rightarrow R = \left\{ \frac{a}{c} \right\} \Rightarrow R = \{1\}$$

$$(8) \quad y = \frac{x+1}{x+1} \Rightarrow R = \left\{ \frac{a}{c} \right\} \Rightarrow R = \{1\}$$