

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

$$g(u) = \sqrt{u-4-4\sqrt{u-4}+4} = \sqrt{(u-4-2)^2} = |u-4-2| = \sqrt{u-4} - 2, u \geq 4 \Rightarrow g(u) = \sqrt{u-4} - 2$$

$$f(u) + g(u) = \sqrt{u-4} + 2 + \sqrt{u-4} - 2 = 2\sqrt{u-4} \Rightarrow a=0, b=2, c=-4 \Rightarrow \frac{a+b}{c} = \frac{2}{-4} = -\frac{1}{2}$$

$$1) f: \mathbb{R} - \{1, 4\} \rightarrow \mathbb{R} \quad g: \{2, 1, 0, 4\} \rightarrow \mathbb{R} \quad f(u) \neq 0$$

$$u^2 - 4u + 4 \neq 0 \Rightarrow u \neq \{1, 4\} \quad D_{g/f} = D_f \cap D_g = \{-2\} = \{2, 0\}$$

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

$$2) f(u) = \{(1, 2), (2, -1), (2, 2), (-\frac{1}{2}, 4)\}$$

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

$$4) g(u) + 1 = \{(-2, 1), (1, 2), (2, 9), (-1, 1)\}$$

$$5) g(u) \neq 0 \Rightarrow (g/f)(u) = \{(1, -2), (2, -1)\}$$

$$h(u) = \{(2, 2+2), (-2, (2u-1)+9), (2, 2+2)\}$$

$$\Rightarrow h(u) = \{(2, 0), (-2, 9), (2, 0)\}$$

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

$$\Rightarrow u^2 - 2u \leq 0 \Rightarrow 0 \leq u \leq 2 \Rightarrow D_f = [0, 2] \cup (2, 2]$$

$$D_g = \mathbb{R} \quad g+1 \neq 0 \Rightarrow [u] + [-u] + 1 \neq 0 \Rightarrow [u + [u]] \neq -1$$

$$\Rightarrow u \in \mathbb{Z} \Rightarrow a \wedge b = \{0, 1, 2\}$$

$$-u^2 + 8u - 4 \geq 0 \Rightarrow D_f = [1, 4] \quad g(u) \neq 0$$

$$\Rightarrow h(u) = \{(1, 0), (2, \frac{\sqrt{2}}{2}), (2, 0)\}$$

الف) $y = u^2 - 2u + 1 + 1 \Rightarrow y = (u-1)^2 + 1 \Rightarrow y-1 = (u-1)^2 \Rightarrow \sqrt{y-1} = u-1 \Rightarrow \sqrt{y-1} + 1 = u \Rightarrow y-1 \in \mathbb{R} \Rightarrow R_f = \mathbb{R}$ ✓

ب) $yu^2 - 2yu = 1 \Rightarrow yu^2 - 2yu - 1 = 0 \Rightarrow u = \frac{2y \pm \sqrt{4y^2 + 4y}}{2y}$

$y \neq 0, 4y^2 + 4y > 0 \Rightarrow y^2 + y > 0 \Rightarrow y(y+1) > 0 \Rightarrow y < -1 \vee y > 0$

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

الف) $\frac{-b}{2a} \geq 2$ $y = 4 - 1 + 1 = 4, a > 0 \Rightarrow R_f = [4, +\infty)$ ✓

ب) $\frac{-b}{2a} \geq c$ $y = -4 + 1 + c = c - 3, a < 0 \Rightarrow (-\infty, c-3] = R_f$ ✓

ج) $\frac{-b}{2a} \geq 0$ $y = 4 - 1 - c = 3 - c \Rightarrow R_f = [3-c, +\infty) \Rightarrow R_f = [0, +\infty)$ ✓

د) $\frac{-b}{2a} \leq c$ $y = -4 + 1 + c = c - 3 \Rightarrow R_f = (-\infty, c-3] \Rightarrow R_f = (-\infty, 0]$ ✓

الف) $R_f \subset \mathbb{R} \Rightarrow$ برآیند توان فرد ✓

ب) $R_f \subset \mathbb{R} \Rightarrow$ برآیند توان فرد ✓

ج) $R_f \subset \sqrt{(-\infty, +\infty)} \Rightarrow R_f \subset [0, +\infty)$

د) R بر روی $\mathbb{R}$ متناهی است $\Rightarrow R_f \subset [0, +\infty)$ ✓

الف) $R_f \subset \mathbb{R} - \left\{ \frac{a}{c} \right\} \Rightarrow R_f \subset \mathbb{R} - \{c\}$ ✓

ب) $R_f \subset \mathbb{R} - \left\{ \frac{a}{c} \right\} \Rightarrow R_f \subset \mathbb{R} - \{c\}$ ✓