

$$f(u) = \sqrt{u - \varepsilon + \varepsilon \sqrt{u - \varepsilon} + \varepsilon} = \sqrt{(\sqrt{u - \varepsilon} + \varepsilon)^2} = |\sqrt{u - \varepsilon} + \varepsilon| = \sqrt{u - \varepsilon} + \varepsilon \quad -1$$

$$g(u) = \sqrt{u - \varepsilon - \varepsilon \sqrt{u - \varepsilon} + \varepsilon} = \sqrt{(\sqrt{u - \varepsilon} - \varepsilon)^2} = |\sqrt{u - \varepsilon} - \varepsilon|, u \geq 1 \Rightarrow g(u) = \sqrt{u - \varepsilon} - \varepsilon$$

$$f(u) + g(u) = \sqrt{u - \varepsilon} + \varepsilon + \sqrt{u - \varepsilon} - \varepsilon = 2\sqrt{u - \varepsilon} \Rightarrow a > 0, b < 2, c = -\varepsilon$$

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

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

$$u^2 - \varepsilon u + \varepsilon \neq 0 \Rightarrow u \neq \{1, \varepsilon\} \quad 3) g/f: D_f \cap D_g = \{-\varepsilon\} = \{2, 0\}$$

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

$$الف) \quad 2u \in D_{f/g} \Rightarrow f(u) = \left\{ \left(\frac{1}{\varepsilon}, 2\right), \left(\frac{\varepsilon}{2}, -1\right), (2, 2), \left(-\frac{1}{\varepsilon}, 4\right) \right\} \quad -2$$

$$ب) \quad u^2 \in D_{f/g} \Rightarrow f(u) = \left\{ (1, 2), (-1, 2), (\sqrt{\varepsilon}, -1), (-\sqrt{\varepsilon}, -1), (2, 2), (-2, 2) \right\}$$

$$ج) \quad g'(u) + 1 = \left\{ (-2, 19), (1, 2), (2, 9), (-1, 1) \right\}$$

$$د) \quad g(u) \neq 0 \Rightarrow \left(\frac{g}{f}\right)(u) = \left\{ (1, -\varepsilon), (2, -1) \right\}$$

$$h(u) = \left\{ (2, 2+\varepsilon), (-2, 2u-1+\varepsilon), (2, 2+\varepsilon) \right\} \quad -3$$

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

$$f(u) = \frac{\sqrt{u} - u}{u - \varepsilon} \quad \begin{matrix} u \geq 2 \\ u \geq 0 \end{matrix}, \quad \sqrt{u} \geq u \quad -4$$

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

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

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

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

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

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

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

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

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

ب) $\frac{-b}{2a} \geq c \Rightarrow y \in [-4+1, -4+1+c] = [-3, -3+c] \Rightarrow R_f = (-\infty, 12] \cup R_f$

ج) $\frac{-b}{2a} \geq 0 \Rightarrow y \in [-1, 1] \Rightarrow R_f = [0, +\infty) \Rightarrow R_f = [0, +\infty)$

د) $\frac{-b}{2a} \geq c \Rightarrow y \in [-4+1, -4+1+c] = [-3, -3+c] \Rightarrow R_f = [-\infty, 9] \Rightarrow R_f = [0, c]$

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

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

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

د) $R \Rightarrow$ برآیند توان فرد $\Rightarrow R_f \subset [0, +\infty)$

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

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