

-1

X

$$f(x) = \frac{x+2}{x^2-5x+3} \Rightarrow (x-1)(x-3) \neq 0 \Rightarrow D_f = \mathbb{R} - \{1, 3\} \quad D_g = \{-1, 1, 3, 9\}$$

$$D_{\frac{f}{g}} = D_g \cap D_f = \{x \mid f(x) \neq 0\} = \{x \neq -3\} \Rightarrow \frac{f}{g} = \left\{ \left(2, -\frac{1}{2}\right), \left(-1, \frac{2}{5}\right) \right\}, \left\{ \left(2, -\frac{1}{2}\right), \left(-1, \frac{2}{5}\right) \right\}$$

-2

الف) $f(x) = \left\{ \left(\frac{1}{x}, x\right), \left(\frac{x}{x^2-1}, -1\right), \left(x, x\right), \left(-\frac{1}{x}, x\right) \right\}$

ب) $f(x^2) = \left\{ (1, x), (-1, x), (\sqrt{x}, -1), (-\sqrt{x}, -1), (x, x), (-x, x) \right\}$

ج) $g^2(x) + 1 = \{(-2, 1), (1, 3), (3, 1), (-1, 1)\}$

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

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

$h = f \circ g = \{(2, 2), (-2, 4), (3, 2)\}$

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

① $x \geq 0 \Rightarrow x \geq 0 \quad \text{② } \sqrt{x^2-1} \geq 0 \Rightarrow x^2-1 \geq 0 \Rightarrow [x] + [-x] \leq 0 \Rightarrow [x] + [-x] + 1 \leq 1$

③ $x-2 \neq 0 \Rightarrow x \neq 2$

④ $[x] + [-x] + 1 \neq 0 \Rightarrow x \neq 2$

⑤ $[x] + [-x] + 1 \neq 0 \Rightarrow x \neq 2$

$\left\{ \begin{array}{l} [x] + [-x] + 1 = -1 \Rightarrow x \neq 2 \\ [x] + [-x] + 1 = 0 \Rightarrow x \in \mathbb{Z} \\ [x] + [-x] + 1 = 1 \Rightarrow x \in \mathbb{Z} \end{array} \right\} \Rightarrow \frac{f}{g} = \{-1, 1, 3\}$

ز) $h(x) = \frac{f(x)}{g(x)} = \frac{\sqrt{x^2-2x-3}}{g(x)} \quad -x^2+2x-3 \geq 0 \Rightarrow x^2-2x-3 \leq 0 \Rightarrow (x-1)(x-3) \leq 0 \Rightarrow x \in [1, 3]$

$g(x) \neq 0 \Rightarrow D_h = \{1, 2, 3\} \Rightarrow h = \left\{ (1, 0), \left(2, \frac{\sqrt{2}}{2}\right), (3, 1) \right\}$

$$\text{الف) } y = x^3 - 3x^2 + 3x - 1 \Rightarrow y = x^3 - 3x^2 + 3x - 1 + 1 = (x-1)^3 + 1 \quad y-1 = (x-1)^3 \quad -v$$

$$x-1 = \sqrt[3]{y-1} \Rightarrow x = \sqrt[3]{y-1} + 1 \Rightarrow \mathbb{R}_f = \mathbb{R}$$

$$\text{ب) } y = \frac{1}{x^2 - 2x} \Rightarrow yx^2 - 2yx - 1 = 0 \Rightarrow \Delta = 4y^2 + 4y \Rightarrow y \neq 0 \Rightarrow x = \frac{2y \pm \sqrt{4y^2 + 4y}}{2y} \Rightarrow \frac{-1 \pm \sqrt{1+4y}}{2y}$$

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

$$\text{الف) } \text{Min}|_4 \Rightarrow \mathbb{R}_f = [4, +\infty) \quad -1$$

$$\text{ب) } \text{Max}|_4 \Rightarrow \mathbb{R}_f = (-\infty, 12]$$

$$\text{ج) } \text{Min}|_{-v} \Rightarrow [-v, +\infty) \Rightarrow \mathbb{R}_f = [-v, +\infty)$$

$$\text{د) } \text{Max}|_4 \Rightarrow (-\infty, 4] \Rightarrow \mathbb{R}_f = [-1, 4]$$

$$\text{الف) } x^3 - 5x^2 + 3x + 1 \Rightarrow \mathbb{R}_f = \mathbb{R} \quad -9$$

$$\text{ب) } x^3 - 4x^2 + 3x + 2 \Rightarrow \mathbb{R}_f = \mathbb{R}$$

$$\text{ج) } \sqrt{x^3 - 4x^2 + 3x + 1} \Rightarrow \sqrt{\mathbb{R}} = [-1, +\infty)$$

$$\text{د) } (x^3 - 4x^2 + 3x + 1)^2 \Rightarrow (\mathbb{R})^2 = [-1, +\infty)$$

$$\text{الف) } \frac{x+1}{x-2} \Rightarrow x = \frac{(y-1)}{y-2}, \frac{y+1}{y-2} \Rightarrow y \neq 2 \Rightarrow \mathbb{R}_f = \mathbb{R} - \{2\} \quad -1.$$

$$\text{ب) } \frac{x+1}{x+1} \Rightarrow x = \frac{(y-1)}{y-2}, \frac{1-y}{y-2} \Rightarrow y \neq 2 \Rightarrow \mathbb{R}_f = \mathbb{R} - \{2\}$$