

①

$$f(x) = \sqrt{x+1} \sqrt{x-4} \xrightarrow{-4+4} \sqrt{(x-4)+4} \sqrt{x-4+4} = \sqrt{(\sqrt{x-4}+2)^2} \sqrt{x-4+4}$$

$$g(x) = \sqrt{x-4} \sqrt{x-4} \xrightarrow{-4+4} \sqrt{(x-4)+4} \sqrt{x-4+4} = \sqrt{(\sqrt{x-4}-2)^2} \sqrt{x-4+4}$$

$$f(x) + g(x) = \sqrt{x-4} + \sqrt{x-4} = 2\sqrt{x-4} = a + b\sqrt{ac}$$

$$\frac{0+2}{-4} = -\frac{1}{2}$$

②

$$f(x) = \frac{x+2}{x^2-4x+3} = \frac{x+2}{(x-3)(x-1)} \quad D = \mathbb{R} - \{1, 3\}$$

$$x \leq 3 \quad x \geq 1$$

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

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

③

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

$$g(x) = \left\{ (-2, 3), (1, -1), (3, 2), (-1, 0) \right\}$$

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

$$b) f(x^2) = \left\{ (1, 2), (\sqrt{3}, -1), (2, 2), (-2, 2) \right\}$$

$$c) 2g^2(x) + 1 = \left\{ (-2, 19), (1, 13), (3, 9), (-1, 1) \right\}$$

$$d) \frac{f}{g} = Df \cap Dg - \{x | g(x) = 0\} = \left\{ (1, -4), (3, -1) \right\}$$

(e) $f(x) = \{(1,1), (2,1), (3,9), (-1,0)\}$ $g(x) = \{(1,1), (2,3), (-1,4), (-1,2), (3,3)\}$

$h = f + g$

$h = \{(1,2), (2,4), (-1,9)\}$

$f(x) = \frac{\sqrt{4x-x}}{x-2}$

$g(x) = [x] + [-x] \quad x \in \mathbb{Z} \rightarrow 0$
 $x \notin \mathbb{Z} \rightarrow -1$

$\left(\frac{f}{g+1}\right)(x) = D(f \cap Dg - \{x \mid g(x) = 0\}) = \{0, 1, 2\}$

$\sqrt{4x-x} \geq 0 \Rightarrow \sqrt{4x-x} \geq x$
 $4x-x \geq x^2$
 $3x-x^2 \leq 0$

$x(x-3) \leq 0 \quad | \quad \begin{array}{c} 3 \\ -1-1+ \end{array} \quad [0, 3] - \{2\}$

(9) $f(x) = \sqrt{-x^2 + 6x - 8} = \sqrt{-(x^2 - 6x + 8)} = \sqrt{-(x-1)(x-4)}$

$g(x) = \{(1,3), (2,4), (3,5), (4,1)\}$

$| \quad \begin{array}{c} 1 \\ -1+1- \end{array} \quad |$

$x=1 \quad x=4$
 $[1, 4]$

$h(x) = \frac{f(x)}{g(x)} \rightarrow D(f \cap Dg - \{x \mid g(x) = 0\}) = \{1, 2, 3\}$

$-\frac{4+1-4}{\sqrt{2}}$

$h(x) = \{(1, \frac{3}{3}), (2, \frac{4}{4}), (3, \frac{5}{5})\}$

$2\sqrt{2}$

$$a) \quad x^2 - 2x + 3x - 1 + 1$$

$$(x-1)^2 + 1 = y$$

$$(x-1)^2 = y-1$$

$$x-1 = \sqrt{y-1} \quad x = \sqrt{y-1} + 1 \quad R = [1, \infty)$$

$$b) \quad y = \frac{1}{x^2 - 2x}$$

$$R_f = [-\infty, -1] \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad y = -1$$

$$U = [0, +\infty)$$

$$(x^2 - 2x)(y) \leq 1 \rightarrow x^2 - 2x = \frac{1}{y} \rightarrow x^2 - 2x - \frac{1}{y} = 0$$

$$\Delta = 4 + \frac{4}{y} \geq 0$$

$$a) \quad y \leq x^2 - 4x + 1 \quad \alpha > 0 \quad \Delta \leq 16 - 4 = 12 < 0 \quad U \rightarrow \textcircled{1}$$

$$\text{ent} \left| \frac{-b}{2a} \right|$$

$$\frac{-\Delta}{4a} = \frac{4}{4} = 1$$

$$R_f = [9, +\infty)$$

$$b) \quad y = x^2 + 4x + 1 \quad \alpha < 0 \quad \Delta \leq 16 + 4 = 20 > 0 \quad A \rightarrow$$

$$\text{ent} \left| \frac{-b}{2a} \right|$$

$$\frac{-\Delta}{4a} = \frac{-20}{4} = -5$$

$$R_f = (-\infty, 17]$$

$$c) \quad y = \sqrt{x^2 - 4x - 1} \quad \alpha > 0 \quad \Delta \leq 16 - 4 = 12 > 0 \quad V \rightarrow$$

$$\text{ent} \left| \frac{-b}{2a} \right|$$

$$\frac{-\Delta}{4a} = \frac{-12}{4} = -3$$

$$R_f = [-3, +\infty) \Rightarrow R_f = [0, +\infty)$$

$$d) \quad y = \sqrt{4x - x^2} \quad \alpha < 0 \quad \Delta \leq 16 > 0 \quad A \rightarrow$$

$$\text{ent} \left| \frac{-b}{2a} \right|$$

$$\frac{-\Delta}{4a} = \frac{-16}{4} = -4$$

$$R_f = (-\infty, 4) \Rightarrow R_f = [0, 4]$$

ا) $y = x^2 - 4x + 4, x \in \mathbb{R} \Rightarrow R_f = \mathbb{R}$

ب) $y = x^2 - 4x + 4, x \in \mathbb{R} \Rightarrow R_f = \mathbb{R}$

ج) $y = \sqrt{x^2 - 4x + 4}, x \in \mathbb{R} \Rightarrow R_f = \mathbb{R} \Rightarrow R_f = [0, +\infty)$

د) $y = (x^2 - 4x + 4)^2, x \in \mathbb{R} \Rightarrow R_f = \mathbb{R} \Rightarrow R_f = [0, +\infty)$

الف) $y = \frac{x+1}{x-2}$

$x = 2$
 $y = 2$

$-1 < 0$

$R_f = \mathbb{R} - \{2\}$

ب) $y = \frac{x+1}{x+1}$

$x = -1$

$y = 2$

$2 > 0$

$R_f = \mathbb{R} - \{2\}$

