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۱۵/۱۰

$f(x) = \left(\frac{1}{2}\right)^{x-2}$ $\quad y = \sqrt{x^{2} f(x+1)}$ (۱) ۱/۰

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

$y = \sqrt{x^{2} \times \left(\frac{1}{2}\right)^{x-1}}$ $\quad \to x=1$

$x^{2}\left(\frac{1}{2}\right)^{x-1} \geq 0 \longrightarrow \left(\frac{1}{2}\right)^{x-1} \geq 0$

$x^{2} \geq 0 \longrightarrow x \geq 0 \longrightarrow D_f = [0, +\infty)$ $\quad D_f = [0,1]$

$f(x) = \sqrt{x+1|x+2|}$ (۲)

$f(-x) = \sqrt{-x+1|-x+2|}$ (۵)

$-x+2 \geq 0 \to x \leq 2$

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

$-2x+2 \geq 0 \longrightarrow x \leq 1$

$-x+2 < 0 \to x > 2 \Rightarrow f(x) = \sqrt{-x+(x-2)} = \sqrt{-2}$

$x \leq 1$

$D_f = (-\infty, 1]$

$y = \sqrt{\frac{x-1}{f(x)}} \to f(x) \neq 0 \to \frac{x-1}{f(x)} \geq 0$ (۳)

(۵)

$x = 3, 2, -\varepsilon, -\omega$

$(-\delta, -\varepsilon) \to f(x) > 0$ ×

$(\varepsilon, 1) \to f(x) < 0$ ✓

$(2, 2) \to f(x) > 0$ ✓

$D_f = (-\varepsilon, 1] \cup (2, 2)$

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(۴)

$y = \frac{1}{3x^2+ax+b}$

$9x^2-7x^2-4x-3 = 2x^2-4x-3$

$\frac{2}{3} = -\frac{4}{a} = \frac{-3}{b}$ ① $\frac{2}{3} = \frac{-4}{a} \Rightarrow 2a = -12 \Rightarrow a = -6$

② $\frac{2}{3} = -\frac{3}{b} \Rightarrow 2b = -9 \Rightarrow b = -\frac{9}{2}$

$a+b = -6+(-\frac{9}{2}) = -\frac{12}{2}-\frac{9}{2} = -\frac{21}{2}$

$\sqrt{-(a+b)} = \sqrt{-(-\frac{21}{2})} = \sqrt{\frac{21}{2}}$

$\sqrt{\frac{21}{2}} = \frac{\sqrt{21}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{42}}{2}$

$3x^2-x-3 = 3x^2+ax+b$

$a=-1, b=-3$

$\sqrt{-(a+b)} = 2$

(۵)

$f(x) = x^3+x$ $y = \sqrt{f(x)f(\frac{4}{x})}$

$f(x)f(\frac{4}{x}) = (x^3+x) - ((\frac{4}{x})^3 + \frac{4}{x}) = (x^3 - \frac{64}{x^3}) + (x-\frac{4}{x})$

$x^3 - \frac{64}{x^3} = (x-\frac{4}{x})(x^2+4+\frac{16}{x^2})$

$(x-\frac{4}{x})(x^2+4+\frac{16}{x^2}) + (x-\frac{4}{x}) = (x-\frac{4}{x})(x^2+4+\frac{16}{x^2})$

$= (x-\frac{4}{x})(x^2+5+\frac{16}{x^2})$

$\frac{x^2-4}{x} \geq 0 \rightarrow \frac{(x-2)(x+2)}{x} \geq 0$

$D_f = [-2, 0) \cup [2, +\infty)$

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$f(x^3+x) = 2x-1$ $f(1.1) = 2(2^2) = 7$ (2)

$x^3+x = 10$

$x = 2 \rightarrow 2^3+2 = 8+2 = 10$

$f(10) = 2(2) - 1 = 4-1 = 3$

$x^3+x = 2 \rightarrow x = 1 \rightarrow 1^3+1 = 1+1 = 2$ (1)

$f(2) = 2(1) - 1 = 2-1 = 1 \rightarrow f(10) + f(2) = 3+1 = 4$ ^

$g(x) = x^3+9x^2+27x$ $t = \sqrt[3]{7} - 2$ (7)

$g(t) = (\sqrt[3]{7}-2)^3 + 9(\sqrt[3]{7}-2)^2 + 27(\sqrt[3]{7}-2)$

$= (7-27) + 27\sqrt[3]{7} - 9\sqrt[3]{49} - 20 + 27\sqrt[3]{7} - 9\sqrt[3]{49}$

$9(\sqrt[3]{7}-2)^2 = 9((\sqrt[3]{7})^2 - 4\sqrt[3]{7} + 4)$ (3)

$= 9\sqrt[3]{49} - 36\sqrt[3]{7} + 36$

$27(\sqrt[3]{7}-2) = 27\sqrt[3]{7} - 54$

$g(-t) = (-20 + 27\sqrt[3]{7} - 9\sqrt[3]{49}) + (9\sqrt[3]{49} - 36\sqrt[3]{7} + 36)$

$= (27\sqrt[3]{7} - 54) = -20$

$f(x) = (\sqrt[3]{2}+2)^3 - 9(\sqrt[3]{2}+2)^2 + 12(\sqrt[3]{2}+2)$

$f(x) = (10 + 6\sqrt[3]{4} + 12\sqrt[3]{2}) + (-6\sqrt[3]{4} - 24\sqrt[3]{2} - 36) + (12\sqrt[3]{2} + 24)$

$10 - 36 + 24 = 10$

$\frac{g(x)}{f(x)} = -\frac{20}{10} = -2$

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$f(x) = \sqrt{x + 6\sqrt{x-6}}$ (۸)

$F(x) + g(x) = \sqrt{x-6} + 2 + \sqrt{x-1}$

$f(x) = \sqrt{(\sqrt{x-6}+3)^2} = \sqrt{x-6} + 3$

$g(x) = \sqrt{(\sqrt{x-6}-3)^2} = |\sqrt{x-6} - 3|$

$x \geq 10 \Rightarrow 3\sqrt{x-6} = a + b\sqrt{x+c}$ ✓

$6 \leq x \leq 10 \Rightarrow 6 - a + b\sqrt{x+c}$ ✗

$\frac{a+b}{c} = \frac{-1}{3}$

(۹)

$f(x) = \frac{x+1}{(x-1)(x-3)}$

$D_f = \mathbb{R} - \{1, 3\}$

$x = 1 \rightarrow$ ∄

$x = 3 \rightarrow \frac{3+1}{(3-1)(3-3)} \frac{6}{1(-1)} = -6$ $D_f \cap D_g = \{3, 0\}$

$\frac{g}{f} = \{(3, -\frac{1}{3})(0, 9)\}$

$\frac{g(3)}{F(3)} = \frac{1}{-6} = -\frac{1}{6}$

$x = 3 \rightarrow f(x) = 0$

$x = 6 \Rightarrow f(6) = \frac{6+3}{(6-1)(6-3)} \frac{9}{3(1)} = 3$ $\frac{g(6}{F(6)} = \frac{0}{3} = 0$

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(1.) $f(a) = \{(-1,6), (1,2), (3,-1), (2,4)\}$

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

الف) $f = -1, 1, 3, 4$

$2x = -1 \Rightarrow x = -\frac{1}{2}$

$2x = 1 \Rightarrow x = \frac{1}{2}$

$2x = 3 \Rightarrow x = \frac{3}{2}$

$2x = 4 \Rightarrow x = 2$

$f(2x) = \{(-\frac{1}{2}, 6), (\frac{1}{2}, 2), (\frac{3}{2}, -1), (2, 4)\}$

ب) $f(x^2)$

$x^2 = 1 \Rightarrow x = \pm 1 \Rightarrow f(1) = 2$

$x^2 = 3 \Rightarrow x = \pm\sqrt{3} \Rightarrow f(3) = -1$

$x^2 = 4 \Rightarrow x = \pm 2 \Rightarrow f(4) = 2$

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

ج) $2f(x) + 1$

$g^2(-2) = 2 \times 9 + 1 = 19$

$g(1) = (-1)^2 = 1 \Rightarrow 2 \times 1 + 1 = 3$

$g(3) = 2^2 = 4 \Rightarrow 2 \times 4 + 1 = 9$

$g(-1) = 0^2 = 0 \Rightarrow 2 \times 0 + 1 = 1$

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

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

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$f(x) = \sqrt{x - \varepsilon\sqrt{x-\varepsilon}}$ (۸)

$g(x) = \sqrt{x - \varepsilon\sqrt{x-\varepsilon}}$

$f(x) = g(x) = a + b\sqrt{x+c}$

$(x + \varepsilon\sqrt{x-\varepsilon}) + (x - \varepsilon\sqrt{x-\varepsilon}) = 2\sqrt{(x+\varepsilon\sqrt{x-\varepsilon})(x - \varepsilon\sqrt{x-\varepsilon}}$

$2x + 2(x+\wedge) = \varepsilon x + 14$

$g(x) + g(x) = \sqrt{\varepsilon x + 14} = 2\sqrt{x+\varepsilon}$

$a = 0 \quad b = 2 \quad c = \varepsilon \longrightarrow \frac{x+b}{c} = \frac{2}{\varepsilon} = \frac{1}{2}$