

$$x \cdot f(x) > 0 \Rightarrow \begin{cases} \text{if } x > 0 \Rightarrow f(x) > 0 \\ \text{if } x < 0 \Rightarrow f(x) < 0 \end{cases} \Rightarrow$$

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$$\left. \begin{aligned} x > 0 : [0, 5] \\ f(x) > 0 : [-4, -5] \cup [2, 5] \end{aligned} \right\} \xrightarrow{\oplus \times \oplus} (x > 0) \times (f(x) > 0) = [2, 5]$$

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$$\left. \begin{aligned} x < 0 : [-4, 0] \\ f(x) < 0 : [-5, 2] \end{aligned} \right\} \xrightarrow{\ominus \times \ominus} (x < 0) \times (f(x) < 0) = [-5, 0]$$

$$ID_f = [-5, 0] \cup [2, 5] \quad \text{و شتر (I) و شتر (II) : } ID_f = (-3, 0) \text{ و } ID_f = (0, 2)$$

$$\frac{-x}{f(x)} > 0 \Rightarrow \frac{x}{f(x)} < 0 \Rightarrow \begin{cases} \text{if } x < 0 \Rightarrow f(x) > 0 \\ \text{if } x > 0 \Rightarrow f(x) < 0 \end{cases} \Rightarrow$$

$$\hookrightarrow f(x) \neq 0 \Rightarrow x \neq -3 \text{ و } 0, 2 \text{ و } 5$$

$$ID_f = (-3, 0) \cup (0, 2) \Rightarrow \begin{bmatrix} -3 & 0 & 1 & 2 \\ 2 & 2 & 2 \end{bmatrix}$$

$$-x > 0 \Rightarrow x < 0 : ID_f = [-4, 0]$$

$$x > 0 : ID_f = [0, 5]$$

$$f(x) > 0 \Rightarrow f(x) > 0 : ID_f = (-3, 0) \text{ و } (2, 5) \quad f(x) < 0 : ID_f = (-4, -3) \cup (0, 2)$$

$$f(x) - 2f(2) = x^2 - 2x + 4 \Rightarrow f(2) - 2f(2) = 2^2 - 2 \times 2 + 4 \Rightarrow$$

$$-f(2) = 4 - 4 + 4 = 4 \Rightarrow f(2) = -4$$

$$f(-2) - 2x - 2 = (-2)^2 - 2x - 2 + 4 \Rightarrow f(-2) + 4 = 4 + 4 + 4 \Rightarrow f(-2) = 10$$

$$f(5) = 5 - \sqrt{5+4} = 5 - \sqrt{9} = 5 - 3 = 2$$

$$\hookrightarrow 5 > 3 \uparrow$$

$$f(2) = 2 \times 2 + 2 \Rightarrow f(2) = 6 \quad \text{و} \quad f(1) = 2|1| + 3 \Rightarrow f(1) = 5 \Rightarrow f(5) = 2 \Rightarrow$$

$$\hookrightarrow 2 \leq 3 \uparrow$$

$$\hookrightarrow 1 \leq 2 \uparrow$$

$$f(f(5)) + f(f(1)) = \overset{2}{f(2)} + \overset{5}{f(5)} = 6 + 2 = 8$$

$$f(x-1) = a(x-1)^2 - b(x-1) + 2 \Rightarrow f(x-1) = ax^2 - 2ax + a - bx + b + 2$$

$$f(x-1) - f(x) = (ax^2 - 2ax + a - bx + b + 2) - (ax^2 - bx + 2) \Rightarrow$$

$$(I) f(x-1) - f(x) = \cancel{ax^2} - 2ax + a - \cancel{bx} + b + 2 - \cancel{ax^2} + \cancel{bx} - 2 = -2ax + a + b$$

$$(II) f(x-1) - f(x) = 4x + 2 \Rightarrow (II) - (I) \Rightarrow \underline{4x + 2} = \underline{-2ax + a + b} \Rightarrow 4x = -2ax \Rightarrow$$

جواب نهایی

$$a - b = -3 - 5 = -8 \quad \leftarrow \quad a + b = 2 \Rightarrow -3 + b = 2 \Rightarrow b = 5 \quad \leftarrow \quad -2a = 4 \Rightarrow a = -2$$

$$F(x) = \frac{x^3 + 1x + 5}{x^3 + 1x + 1} = \frac{(x^3 + 1x + 1) + 1}{(x^3 + 1x + 1) + 1} = \frac{(x^3 + 1x + 1)^2 + 1}{(x^3 + 1x + 1)^2 + 1} \Rightarrow$$

$$\frac{(\sqrt{3} - 1 + 1)^2 + 1}{(\sqrt{3} - 1 + 1)^2 + 1} = \frac{(\sqrt{3})^2 + 1}{3 + 1} = \frac{4}{4} = \frac{1}{1} = \boxed{\frac{1}{1}}$$

$$\Rightarrow F(\sqrt{3} - 1) = \frac{1}{1}$$

$$F(x - \frac{1}{x}) = \frac{x^3}{x^3} + \frac{1}{x^3} = x^3 + \frac{1}{x^3} = (x + \frac{1}{x})^3 \Rightarrow$$

$$(x - \frac{1}{x})^3 = x^3 + \frac{1}{x^3} - 2x \times (x) \times (\frac{1}{x}) = x^3 + \frac{1}{x^3} - 2 \Rightarrow F(x - \frac{1}{x}) - 2 = (x - \frac{1}{x})^3$$

$$x - \frac{1}{x} = -3 \Rightarrow (-3)^3 = F(x - \frac{1}{x}) - 2 \Rightarrow 9 + 1 = F(x - \frac{1}{x}) \Rightarrow F(-3) = 11$$

$$\text{الف) } \frac{F}{g} = \left\{ (2, \frac{0}{\sqrt{5}}) \text{ و } (1, \frac{-\sqrt{5}}{1 \times \sqrt{5}} = \frac{-\sqrt{5}}{\sqrt{5} \times \sqrt{5}} = -\sqrt{5}) \text{ و } (0, \frac{3}{1}) \right\} \Rightarrow \frac{F}{g} = \left\{ (2, 0) \text{ و } (1, -\sqrt{5}) \text{ و } (0, \frac{3}{1}) \right\}$$

$$g(x) = \sqrt{4 - x^2} \Rightarrow 4 - x^2 \geq 0 \Rightarrow 4 \geq x^2 \Rightarrow 2 \geq x \geq -2 \Rightarrow \text{ID}_g = [-2, 2]$$

$$\text{ID}_f = \{2, 1, 0, 1, 2\} \Rightarrow \text{ID}_f \cap \text{ID}_g = \{2, 1, 0\} \Rightarrow g(2) = \sqrt{4 - 4} = \sqrt{0} = 0, g(1) = \sqrt{4 - 1} = \sqrt{3} = \sqrt{3}, g(0) = \sqrt{4 - 0} = 2$$

$$\text{ب) } \frac{g}{f} = \left\{ (2, \frac{0}{\sqrt{5}}) \text{ و } (1, \frac{\sqrt{5}}{1 \times \sqrt{5}} = \frac{\sqrt{5}}{\sqrt{5} \times \sqrt{5}} = \sqrt{5}) \text{ و } (0, \frac{3}{1}) \right\} \Rightarrow \frac{g}{f} = \left\{ (1, \sqrt{5}) \text{ و } (0, \frac{3}{1}) \right\}$$

$$\text{الف) } 2F(x) = \left\{ (2, 2) \text{ و } (3, 8) \text{ و } (-5, 4) \text{ و } (1, -4) \right\}$$

$$\text{ب) } F(x) + 1 = \left\{ (2, 2) \text{ و } (3, 8) \text{ و } (-5, 4) \text{ و } (1, -1) \right\}$$

$$\text{ج) } 3F(x) + 1 = \left\{ (2, 4) \text{ و } (3, 9) \text{ و } (-5, 3) \text{ و } (1, 3) \right\}$$

$$\text{د) } F(2x) = \left\{ (1, 1) \text{ و } (\frac{3}{2}, 4) \text{ و } (-\frac{5}{2}, 2) \text{ و } (\frac{1}{2}, -2) \right\}$$

$$\text{الف) } F - g = \left\{ (1, 4) \text{ و } (2, 2) \text{ و } (3, 2) \right\}$$

$$\text{ب) } \frac{2F}{g} = \left\{ (2, 4) \text{ و } (3, -2) \right\}$$