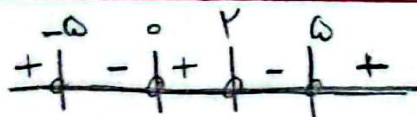


$$x f(x) \geq 0$$

$$x \neq 0$$

$$f(x) = 0 \rightarrow 2, 5, -5$$



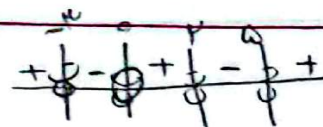
$$D_f = (-\infty, -5] \cup [0, 2] \cup [5, +\infty)$$

①

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

$$f(x) \neq 0 \rightarrow x \neq 5, 2, -3$$

$$\frac{-x}{f(x)} \geq 0 \rightarrow \begin{matrix} -x \geq 0 \\ x \leq 0 \end{matrix}$$



$$D_f = (-\infty, -3) \cup [0, 2) \cup (5, +\infty)$$

②

$$f(x) - 2f(2) = x^2 - 2x + 2$$

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

$$f(2) = f(2) - 2f(2) = 4 - 4 + 2 \rightarrow (-f(2) = 2) \times (-2) \rightarrow +2f(2) = 4$$

$$f(-2) = 10 \checkmark$$

③

$$f(x) = \begin{cases} x - \sqrt{x+1} & x \geq 1 \\ 2x + 3 & x \leq 1 \end{cases}$$

$$f(f(1)) + f(f(1)) = ? \quad 1+2=3 \checkmark$$

④

$$f(1) = 1 + 3 = 4$$

$$f(4) = 4 - \sqrt{4+1} = 3$$

$$f(3) = 3 + 3 = 6$$

⑤

$$f(x) = ax^2 - bx + 2$$

$$f(x-1) - f(x) = 4x + 2 \xrightarrow{x=1} f(0) - f(1) = 6 \rightarrow 2 - (a - b + 2) = 6$$

$$a - b = -6 \checkmark$$

$$x - a + b - x = 6$$

$$-a + b = 6$$

$$-(a - b) = 6 \rightarrow a - b = -6$$

⑥

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

$$\frac{f(1) + 5}{1} = \sqrt{7}$$

$$f(3) = 9 - 9 + 1 = 1$$

$$f(2) = 4 - 6 + 1 = -1$$

$$f(-1) = 1 + 3 + 1 = 5$$

$$\frac{f(f(1)) - f(f(1))}{1} = \frac{1}{1}$$

⑦

$$f(x) = \begin{cases} 3x + 1 & x \geq 2 \\ x^2 & x < 2 \end{cases}$$

$$f(2) = 7$$

$$f(-2) = 4$$

$$f(2) = 7$$

⑧

$$\frac{f(f(1)) - f(f(1))}{f(1) - 1} = 0$$

$$f(x) = \frac{x^r + rx + 9}{x^r + rx + a} \rightarrow f(\sqrt{r}) = \frac{(\sqrt{r})^r + r(\sqrt{r}) + 9}{(\sqrt{r})^r + r(\sqrt{r}) + a} = \frac{r + r - \cancel{r\sqrt{r}} + \cancel{r\sqrt{r}} - 1 + 9}{r + r - \cancel{r\sqrt{r}} + \cancel{r\sqrt{r}} - 1 + a} \quad (9)$$

$$= \frac{\cancel{r} - 1 + 9}{\cancel{r} - 1 + a} = \frac{1}{r} = r \quad f(r) = \frac{r + r + 9}{r + r + a} = \frac{r}{14} \checkmark$$

$$f(x) = x^r + \frac{1}{x^r} \quad f(\sqrt{x}) = x + \frac{1}{x} \xrightarrow{(\cdot)^r} x^r + \frac{1}{x^r} + r$$

$$x^r + \frac{1}{x^r} + r - \cancel{x^r} - \frac{1}{\cancel{x^r}} = r \checkmark$$