

$$f(x) = \left(\frac{1}{x}\right)^{x-2} - 1 \rightarrow f(x+1) = \left(\frac{1}{x}\right)^{x-1} - 1 \Rightarrow y = \sqrt{x^3 f(x+1)} = \sqrt{x^3 \left(\left(\frac{1}{x}\right)^{x-1} - 1\right)}$$

$$\rightarrow x^3 \left(\left(\frac{1}{x}\right)^{x-1} - 1\right) > 0 \quad \begin{array}{c} x \\ \hline -1 \quad + \quad 1 \end{array} \rightarrow x \in [0, 1]$$

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

$$\begin{array}{c} 2 \\ \hline 2-2x \quad | \quad -2 \end{array}$$

$$x > 2 \rightarrow y = -2 \Rightarrow -2 > 0 \quad x \quad \textcircled{1}$$

$$x < 2 \rightarrow y = 2-2x \Rightarrow 2-2x > 0 \rightarrow x \in (-\infty, 1] \quad \textcircled{2}$$

$$\textcircled{1} \cup \textcircled{2} \rightarrow x \in (-\infty, 1]$$

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$$y = \sqrt{\frac{x-1}{f(x)}} \rightarrow \frac{x-1}{f(x)} > 0$$

$$x-1=0 \rightarrow x=1$$

$$f(x)=0 \rightarrow x = -5, -4, -2, 3$$

$$\begin{array}{c|ccccc} x & -5 & -4 & 1 & 2 & 3 \\ \hline & - & - & + & - & + \end{array}$$

$$\rightarrow x \in (-5, -1) \cup (2, 3) \cup \{1\}$$

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$$9x^2 - \sqrt{x^2} - 4x - 3 = 9x^2 - 4x^2 + 1 - x^2 - 4x - 3 = (3x^2 - 1)^2 - (x+2)^2$$

$$= (3x^2 + x + 1)(3x^2 - x - 3) \Rightarrow 3x^2 + ax + b = 3x^2 - x - 3$$

$$\hookrightarrow a < 0$$

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$$\Rightarrow \sqrt{-(a+b)} = \sqrt{-(-4)} = 2$$

$$y = \sqrt{f(x) - f\left(\frac{1}{x}\right)} = \sqrt{x^3 + x - \frac{4x}{x^3} - \frac{1}{x}} \rightarrow x^3 + x - \frac{4x}{x^3} - \frac{1}{x} > 0$$

$$x^3 + x - \frac{4x}{x^3} - \frac{1}{x} = 0 \rightarrow x^3 + x - \frac{4x}{x^3} + \frac{1}{x} \rightarrow 4x = x^4, 1 = x^2 \rightarrow x = \pm 1$$

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$$\begin{array}{c|ccc} x & -2 & 0 & 2 \\ \hline & - & + & - \end{array}$$

$$x \in [-2, 0) \cup [2, +\infty)$$

$$\left. \begin{array}{l} x^{\sqrt{}} + x = 2 \rightarrow x^{\sqrt{}} + x - 2 = 0 \Rightarrow x = 1 \\ \frac{-x^{\sqrt{}} + x - 2}{0} \mid \frac{x-1}{x^{\sqrt{}} + x + 2} \\ x^{\sqrt{}} + x = 10 \rightarrow x^{\sqrt{}} + x - 10 = 0 \Rightarrow x = 2 \\ \frac{-x^{\sqrt{}} + x - 10}{0} \mid \frac{x-2}{x^{\sqrt{}} + x + 10} \end{array} \right\} f(2) + f(1) = 2(1)^{\sqrt{}} - 1 + 2(2)^{\sqrt{}} - 1 = 8$$

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$$f(x) = x^{\sqrt{}} - 4x^{\sqrt{}} + 12x = (x+2)^{\sqrt{}} + 8$$

$$g(x) = x^{\sqrt{}} + 4x^{\sqrt{}} + 22 = (x+2)^{\sqrt{}} - 22x$$

$$\frac{g(\sqrt{2}-2)}{f(\sqrt{2}+2)} = \frac{18-22\sqrt{2}}{10}$$

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

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

$$x > 4 \rightarrow f(x) + g(x) = 4 + 0\sqrt{x-4} \Rightarrow \frac{a+b}{c} = \frac{4+0}{-4} = -1$$

$$x > 4 \rightarrow f(x) + g(x) = 0 + 2\sqrt{x-4} \Rightarrow \frac{a+b}{c} = \frac{0+2}{-4} = -\frac{1}{2}$$

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

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$$g(2) = 1 \quad g(0) = 4$$

$$f(2) = -4 \quad f(0) = \frac{2}{\sqrt{}}$$

$$f(1) = 0$$

$$f(2) = 0$$

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

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

$$\text{ج) } 2g'(x) + 1 = \left\{ (-2, 9), (1, 3), (2, 9), (-1, 1) \right\}$$

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

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