

$$y = \frac{x^2 + x + 2}{x - 1} \rightarrow xy - y = x^2 + x + 2 \Rightarrow x^2 + (1 - y)x + y + 2 = 0 \quad (1)$$

$$\rightarrow \Delta \geq 0 \rightarrow y^2 - 2y + 1 - 4y - 4 = 0 \rightarrow y^2 - 6y + 5 = 0$$

$$y^2 - 6y + 5 = (y - 1)(y - 5) \geq 0 \rightarrow y \in (-\infty, -1] \cup [5, +\infty)$$

$$\text{الف) } 2x^2 - 5x + 1 = y \rightarrow y \in [\min, +\infty) \quad (2)$$

$$\min = \frac{-\Delta}{2a} = \frac{-(-5) + 4(2)(1)}{4(-2)} = -\frac{17}{8} \rightarrow y \in [-\frac{17}{8}, +\infty)$$

$$\text{ب) } y = \sqrt{-x^2 + 4x - 5} \rightarrow y \in [-\infty, \max] \rightarrow y \in [0, \sqrt{\max}]$$

$$\max = \frac{-\Delta}{2a} = \frac{-4 + 4(-1)(-5)}{4(-1)} = 4 \rightarrow y \in [0, 2]$$

$$\text{ج) } y = \sqrt{x^2 - 3x^2 + 4x + 1} \rightarrow y \in [0, +\infty) \quad (3)$$

$y = \sqrt{1/R}$

$$\text{د) } y = \log(x^3 - 4x^2 + 7x + 4) \rightarrow y \in \mathbb{R} \rightarrow y \in \mathbb{R}$$

$\log: \mathbb{R}^+ \rightarrow \mathbb{R}$

$$\text{الف) } y = \frac{3x + 1}{2x - 4} \rightarrow y \in \mathbb{R} - \{\frac{3}{2}\} \rightarrow y \in \mathbb{R} - \{\frac{3}{2}\} \quad (4)$$

$$\text{ب) } y = \sqrt{\frac{4x + 1}{x - 2}} \rightarrow y \in \sqrt{\mathbb{R} - \{\frac{1}{4}\}} \rightarrow y \in [0, 2) \cup (2, +\infty)$$

$$\text{ج) } y = \frac{x^2 + 4}{\sqrt{x^2 + 3}} = \frac{\sqrt{x^2 + 3} + 1}{\sqrt{x^2 + 3}} \rightarrow y \geq \sqrt{3} \quad \frac{1}{\sqrt{3}} = \frac{4\sqrt{3}}{3}$$

$x = 0$

$$y \in [\frac{4\sqrt{3}}{3}, +\infty)$$

$$\text{د) } y = x^2 + \frac{1}{x^2 + 4} + 4 - 4 \rightarrow y = x^2 + \frac{1}{x^2 + 4} - 4 \rightarrow y \geq \frac{1}{4} - 4 \rightarrow y \geq -\frac{15}{4}$$

$x \geq \frac{1}{2}$

$$[\frac{1}{4}, +\infty)$$

$$y = \frac{3x^2 + 4}{x^2 - 1} \rightarrow \begin{cases} \square = x^2 \in [0, +\infty) \rightarrow x=0 \rightarrow y = -4 \\ \rightarrow (x \rightarrow +\infty) \rightarrow y = 3 \end{cases} \quad y \in (-\infty, -4] \cup (3, +\infty) \quad (4)$$

$$y = \frac{3x^2 + 4}{x^2 - 1} \rightarrow x^2 = \frac{y+4}{y-3} \geq 0 \rightarrow \frac{-4}{y-3} \geq 0 \rightarrow y \in (-\infty, -4] \cup (3, +\infty)$$

$$y = \frac{3 \sin x - 1}{\sin x + 3} \rightarrow \begin{cases} \sin x = -1 \rightarrow y = -\frac{4}{4} \\ \sin x = 1 \rightarrow y = \frac{2}{4} \end{cases} \quad y \in [-\frac{1}{2}, \frac{1}{2}] \quad (5)$$

$$\sin x = \frac{y+1}{3-y} \rightarrow -1 \leq \frac{y+1}{3-y} \leq 1 \rightarrow -1 \leq \frac{y+1}{y-3} \leq 1$$

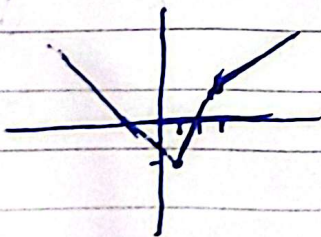
$$\rightarrow \frac{y+1}{y-3} - 1 = \frac{y+4}{y-3} \leq 0 \rightarrow y \in [-\frac{3}{4}, 3)$$

$$\rightarrow \frac{y+1}{y-3} + 1 = \frac{4y-2}{y-3} \geq 0 \rightarrow y \in (-\infty, \frac{1}{4}] \cup (3, +\infty) \quad y \in [-\frac{3}{4}, \frac{1}{4}]$$

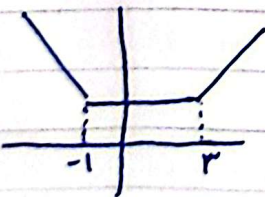
$$y = \frac{x^2 + x + \frac{1}{4}}{x^2 + x + 1} = \frac{(\frac{x+1}{2})^2}{(\frac{x+1}{2})^2 + \frac{3}{4}} \rightarrow D_f = \mathbb{R} \quad (6)$$

$$\rightarrow y = \frac{\square}{\square + \frac{3}{4}} \rightarrow \square \in [0, +\infty) \rightarrow \begin{cases} \square = 0 \rightarrow y = 0 \\ \square \rightarrow \infty \rightarrow y = 1 \end{cases} \quad y \in [0, 1]$$

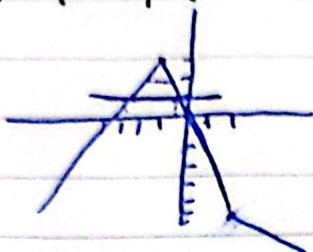
$$y = |2x-2| - |x-3| \begin{cases} x+1 & ; x > 3 \\ 2x-5 & ; 1 \leq x \leq 3 \\ -x-1 & ; x \leq 1 \end{cases} \rightarrow y \geq -2 \quad y \in [-2, +\infty) \quad (7)$$



$$y = |x-3| + |x+1| \begin{cases} 2x-2 & ; x > 3 \\ 4 & ; -1 \leq x \leq 3 \\ -2x+2 & ; x \leq -1 \end{cases} \rightarrow y \geq 4 \quad y \in [4, +\infty)$$



$$y = |x-2| - |2x+1|$$

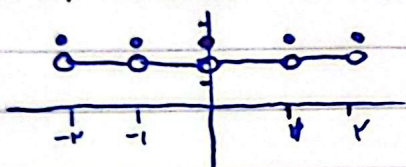


$$y=1 \rightarrow \begin{cases} x_1 = -\frac{1}{3} \\ x_2 = -\frac{1}{3} \end{cases} \rightarrow x \in (-\infty, -\frac{1}{3}] \cup [-\frac{1}{3}, +\infty)$$

(1)

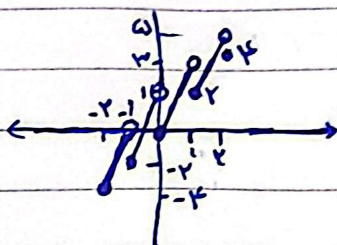
$$\text{ج) } y = [x] + [3-x] = 3 + [x] + [-x]$$

(9)



$$\rightarrow y \in \{3, 2\}$$

$$\text{ب) } y = 3x - [x]$$



$$y \in [-4, 4)$$

$$\text{الف) } y = \sin^2 x - \sin x + 1 \rightarrow \sin x = 1 \rightarrow y = 1$$

$$\rightarrow \sin x = -1 \rightarrow y = 3$$

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