

$$\rightarrow yx - y = x^2 + x + 2 \rightarrow x^2 + (1-y)x + (y+2) = 0 \rightarrow x = \frac{-b \pm \sqrt{\Delta}}{2a}$$

$$\rightarrow \frac{y-1 \pm \sqrt{y^2 - 4y + 1 - 4y - 8}}{2} \rightarrow y^2 - 4y - 7 \geq 0 \rightarrow \begin{matrix} -1 \\ + \phi - \phi + \end{matrix}$$

$$\rightarrow R = (-\infty, -1] \cup [7, +\infty) \quad \checkmark$$

الف) $x_s = -\frac{b}{2a} = \frac{5}{2} \rightarrow y_s = \frac{10}{2} - \frac{5^2}{2} + \frac{1}{2} = -\frac{19}{2}$ $\rightarrow x^2 - 3x^2 + 2x + 1 \in R(-\infty, +\infty)$
 $\rightarrow R = [-\frac{19}{2}, +\infty)$ $(a > 0)$ $\rightarrow R = [0, +\infty)$ $\checkmark$

ب) $x_s = -\frac{b}{2a} = 2 \rightarrow y_s = 4 \rightarrow R = (-\infty, 4]$ $\checkmark$
 $\rightarrow R = [0, 2]$ $\checkmark$ $\rightarrow R = (-\infty, +\infty)$ $\checkmark$

الف) $R = R - \{\text{مجاذب اقصی}\} = R - \{\frac{a}{c}\}$ $\rightarrow R = R - \{\frac{3}{2}\}$ $\checkmark$
 $\rightarrow R = [\frac{4}{\sqrt{3}}, +\infty)$ $\checkmark$

ب) $\rightarrow R = R - \{4\} \xrightarrow{\text{مخرج}} R = [0, +\infty) - \{2\}$ $\rightarrow x_{\min} = 0 \rightarrow y_{\min} = \frac{1}{2}$
 $\rightarrow R = [\frac{1}{2}, +\infty)$ $\checkmark$

روش اول: $\rightarrow yx^2 - y = 3x^2 + 4 \rightarrow (3-y)x^2 + (y+4) = 0 \rightarrow x = \frac{-b \pm \sqrt{\Delta}}{2a} = \frac{\pm \sqrt{-4(3-y)(y+4)}}{2(3-y)} \rightarrow y \neq 3$
 $\rightarrow -4(3-y)(y+4) \geq 0 \rightarrow \begin{matrix} -4 & 3 \\ + \phi - \phi + \end{matrix} \xrightarrow{\text{مخرج}} (-\infty, -4] \cup (3, +\infty)$ $\checkmark$

روش دوم: $\rightarrow x=0 \rightarrow y=-4$ $\rightarrow x=\infty \rightarrow y=3$ $\rightarrow R = (-\infty, -4] \cup (3, +\infty)$ $\checkmark$

روش اول: $\rightarrow y \sin x + 3y = 2 \sin x - 1 \rightarrow (2-y) \sin x - (3y+1) = 0$
 $\rightarrow \sin x = \frac{3y+1}{2-y} \Rightarrow -1 \leq \frac{3y+1}{2-y} \leq 1$ $\rightarrow \begin{matrix} \frac{3y+1}{2-y} \geq -1 \rightarrow [-\frac{3}{2}, 2) \\ \frac{3y+1}{2-y} \leq 1 \rightarrow (-\infty, \frac{1}{2}] \end{matrix}$ $\rightarrow R = [-\frac{3}{2}, \frac{1}{2}]$ $\checkmark$

$$f(x) = \frac{x^2 - x + \frac{1}{4}}{x^2 - x + 1} = \frac{(x - \frac{1}{2})^2}{(x - \frac{1}{2})^2 + \frac{3}{4}}$$

$\Delta < 0$
 $a > 0 \rightarrow \oplus \rightarrow D_f = \mathbb{R}$ ✓

$\square = +\infty \rightarrow 1$
 $\square = 0 \rightarrow 0 \rightarrow \text{Fr}(\Sigma, 1)$

$R = (-\infty, 0] \cup (1, +\infty)$
 $= \mathbb{R} - (0, 1]$

ج) $y = \begin{cases} x+1 & x > 2 \\ 3x-2 & 1 < x \leq 2 \\ -x-1 & x \leq 1 \end{cases}$

$\Rightarrow R = [-1, +\infty)$

د) $y = \begin{cases} 2x-2 & x > 2 \\ 1 & -1 < x \leq 2 \\ -2x+2 & x \leq -1 \end{cases}$

$\Rightarrow R = [1, \infty)$

$|x-2| - |2x+2|$

$\begin{cases} -x-2 & x > 2 \\ -3x & -1 < x \leq 2 \\ x+2 & x \leq -1 \end{cases}$

$\Rightarrow |x-2| - |2x+2| \leq 1$
 $\Rightarrow (-\infty, -2] \cup [-\frac{1}{3}, +\infty)$
 $= \mathbb{R} - (-2, -\frac{1}{3})$

ه) $y = \begin{cases} 3 & x \in \mathbb{Z} \\ 2 & x \notin \mathbb{Z} \end{cases} \quad R = \{2, 3\}$

و) $R = [-2, 0)$

$y = \begin{cases} 3x+2 & x < -1 \\ 3x+1 & -1 \leq x < 0 \\ 3x & 0 \leq x < 1 \\ 3x-1 & 1 \leq x < 2 \\ 2 & x = 2 \end{cases}$

ز) $\rightarrow \sin x = \frac{b}{ra} = \frac{1}{2} \rightarrow y = \frac{2}{2} \min$
 $\sin x = 1 \rightarrow y = 1$
 $\sin x = -1 \rightarrow y = 3 \max$
 $\Downarrow$
 $R = [\frac{2}{2}, 3]$

ح) $\rightarrow \sin^2 x = \frac{b}{ra} = -\frac{1}{2}$
 $\sin^2 x = 0 \rightarrow y = 1 \min$
 $\sin^2 x = 1 \rightarrow y = 3 \max$
 $\Downarrow$
 $R = [1, 3]$