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الف) $R = [0, +\infty)$ $0 \leq \left(\frac{x}{2} - \left[\frac{x}{2}\right]\right)^2 < 1$ $R_f = [0, 1)$

ب) $\log y = \frac{[+5, +3]}{\sin x + 4} \rightarrow +5 \geq \log y \geq +3 \rightarrow 10000 \geq y \geq 1000$

$y^2 = \frac{x^2 - 4}{x^2 - 9} \rightarrow (y^2 - 1)x^2 - 9y^2 + 4 = 0 \xrightarrow{\Delta} -4(-9y^2 + 4)(y^2 - 1)$

$\rightarrow 2 \geq y^2 - 2 \leq y^2 + 1 \xrightarrow{y^2 = t} 2 \geq t - 2 \leq t + 1 \xrightarrow{\Delta} (2t^2) - (4)(16)(36)$

$\frac{2t \pm 20}{2t} \rightarrow \frac{1}{9} \rightarrow y^2 = 1 \rightarrow y = \pm 1$ $\xrightarrow{\text{بانتیجین}} R = [-1, \frac{2}{3}] \cup (1, +\infty) \xrightarrow{-1 \leq x} [0, \frac{2}{3}] \cup (1, +\infty)$
 $\frac{2t \pm 20}{2t} \rightarrow \frac{1}{9} \rightarrow y^2 = \frac{4}{9} \rightarrow y = \pm \frac{2}{3}$ $\xrightarrow{\text{بانتیجین}} R = [-1, \frac{2}{3}] \cup (1, +\infty) \xrightarrow{-1 \leq x} [0, \frac{2}{3}] \cup (1, +\infty)$
 $a + b + c = \frac{2}{3} + 1 = \frac{5}{3}$

الف) $\frac{x^2 + 1}{x} + 2\sqrt{\frac{x^2 + 1}{x}} \rightarrow \frac{x^2 + 1}{x} \geq 0 \rightarrow x > 0$

if $x = 1 \rightarrow \frac{x^2 + 1}{x} = 2$ $R = [2 + 2\sqrt{2}, +\infty)$

ب) $-\sin x + 2\sin x + 3 = y \rightarrow R = [0, 4]$

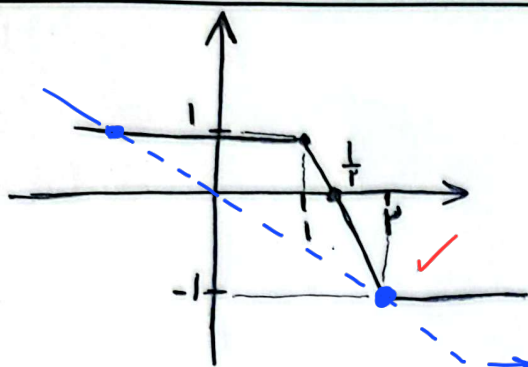
$D_f = (1, 2, 3, \dots, 9)$

$R_f = \left\{ \frac{29}{3}, \frac{28}{3}, \frac{27}{3}, \frac{26}{3}, \frac{25}{3}, \frac{24}{3}, \frac{23}{3}, \frac{22}{3}, \frac{21}{3} \right\}$

مجموع = $\frac{225}{3} = 75$

$D_f = [2, +\infty) \rightarrow \text{تابع زوج} \rightarrow a = 0 \rightarrow \begin{cases} \sqrt{2b+c} = 0 \\ \sqrt{3b+c} = 1 \end{cases} \rightarrow \begin{cases} b = 1 \\ c = -2 \end{cases}$

$\sqrt{bx^2 + ax - 2c} = \sqrt{x^2 + 4} \rightarrow R = [2, +\infty)$



$$|x-2| - |x-1| = kx$$

$$kx = 1, -1 \rightarrow k < 0$$

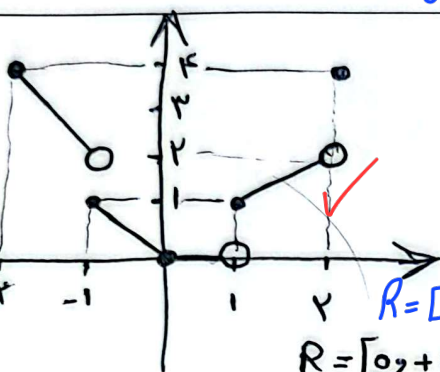
$$k = (-1, 0)$$

①

$$y = kx \rightarrow k = -\frac{1}{x}$$

الف)

$$\begin{aligned} -2 < x < -1 &\rightarrow y = -1/2 \\ -1 \leq x < 0 &\rightarrow y = -x \\ 0 \leq x < 1 &\rightarrow y = 0 \\ 1 \leq x < 2 &\rightarrow y = x \\ x = 2 &\rightarrow y = 2 \end{aligned}$$

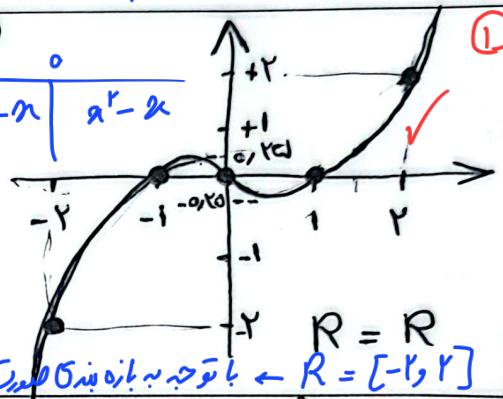


$$R = [0, 2] - \{1\}$$

$$R = [0, +\infty)$$

ب)

$$\begin{aligned} -x^2 - x &| \\ x^2 - x & \end{aligned}$$



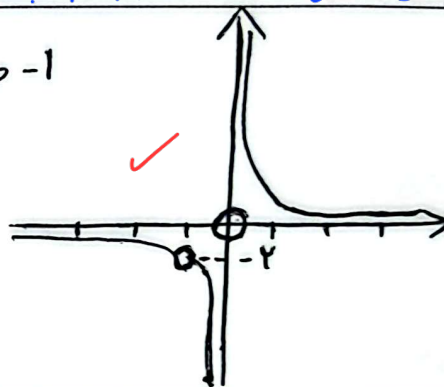
$$R = R$$

$$R = [-2, 2]$$

$$\frac{x+1+x+1}{x(x+1)} = \frac{2(x+1)}{x(x+1)} = \frac{2}{x} \rightarrow x \neq 0, -1$$

$$\begin{aligned} a &= -2 \\ b &= 0 \end{aligned} \left\} a+b = (-2) \right.$$

②



$$\sqrt{x} = t \rightarrow \frac{t^2 - 4t + 3}{t^2 - 2t + 1} = \frac{(t-1)(t-3)}{(t-1)^2} = \frac{t-3}{t-1} \cdot t \neq 1 \rightarrow \sqrt{x} \neq 1$$

$$\rightarrow x \neq 1 \quad \begin{array}{c|c} 1 & 3 \\ \hline + & - \\ \hline \end{array} \rightarrow R = (-\infty, 1) \cup (3, +\infty)$$

③

$$\frac{x^2 + 2x^2 - x - 2}{x^2 - 1} \rightarrow \frac{x^2(x+2) - (x+2)}{(x-1)(x+1)} = \frac{(x^2-1)(x+2)}{x^2-1} = x+2$$

$$x \neq \pm 1$$

$$\begin{aligned} x=1 &\rightarrow 3 \\ x=-1 &\rightarrow 1 \end{aligned} \left\} R = (-\infty, 1) \cup (1, 3) \cup (3, +\infty) \right.$$

$$a+b = 4$$