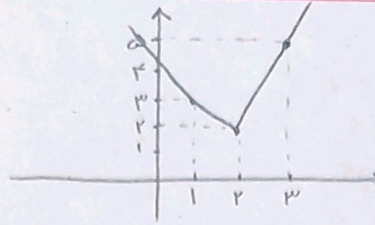


الف) $y = x + |2x - 4|$

$|x-2|$ $3x-4$

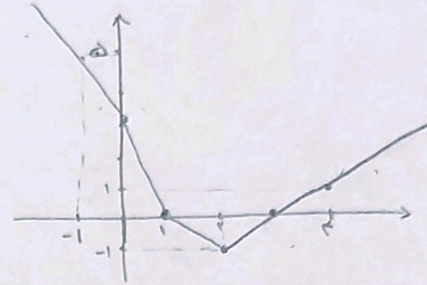


$\Rightarrow R_f: [2, +\infty)$

ب) $y = |x-2| + |x-1| - |x|$

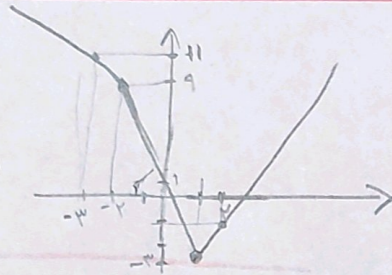
$|x-2|$ $|x-1|$ $-|x|$

$\Rightarrow R_f: [-1, +\infty)$



$|3x-3| - |x+2| = k$

$|3x-3|$ $-|x+2|$

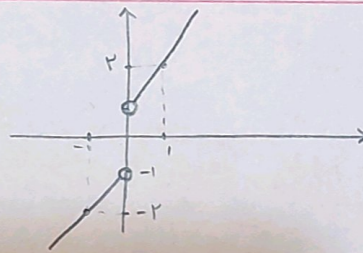


فقط در $y = -3$ $\Rightarrow$ جواب k به اعضای K $\Rightarrow$ یک جواب دارد

$k = -3$

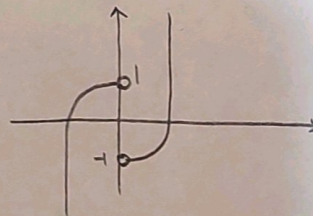
الف) $y = x + \frac{n}{|x|}$

$\begin{cases} x \neq 0 \\ + \rightarrow x+1 \\ - \rightarrow x-1 \end{cases}$



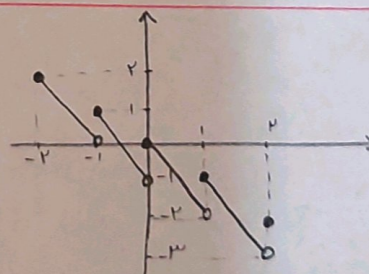
ب) $y = x|x| - \frac{n}{|x|}$

$\begin{cases} x \neq 0 \\ + \rightarrow x^2 - 1 \\ - \rightarrow -x^2 + 1 \end{cases}$



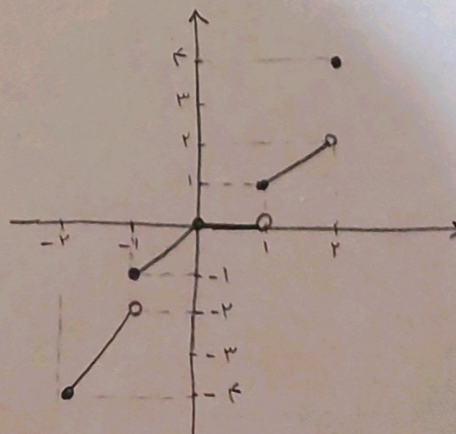
الف) $y = [x] - 2x$

$\begin{cases} -2 \leq x < -1 \rightarrow -2 - 2x \\ -1 \leq x < 0 \rightarrow -1 - 2x \\ 0 \leq x < 1 \rightarrow -2x \\ 1 \leq x < 2 \rightarrow 1 - 2x \\ x = 2 \rightarrow -2 \end{cases}$



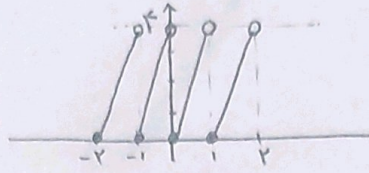
ب) $y = [x]|x|$

$\begin{cases} -2 \leq x < -1 \rightarrow 2x \\ -1 \leq x < 0 \rightarrow x \\ 0 \leq x < 1 \rightarrow 0 \\ 1 \leq x < 2 \rightarrow x \\ x = 2 \rightarrow 2 \end{cases}$



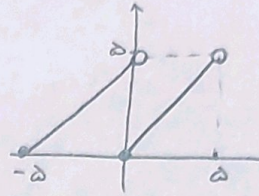
الف) $y = 3x - [3x] \rightarrow R_f: [0, 1)$ ← $0 \leq \square - [\square] < 1 \rightarrow R_f: [0, 1)$

ب) $y = 4x - f[x] = f(x - [x])$



$\Rightarrow R_f = [0, 4)$

ج) $y = x - \omega \left[\frac{x}{\omega} \right] \rightarrow \begin{cases} 0 \leq x < \omega \rightarrow x \\ -\omega \leq x < 0 \rightarrow x + \omega \\ -1 \leq x < -\omega \rightarrow x + 1 \end{cases}$



$\Rightarrow R_f = [0, \omega)$

د) $y = [2x] - 2x \rightarrow 0 \leq \square - [\square] < 1 \xrightarrow{\text{قرینه}} R_f: (-1, 0]$

الف) $y = 3 \sin x + 2 \cos x \rightarrow -\sqrt{3^2 + 2^2} \leq y \leq \sqrt{3^2 + 2^2} \Rightarrow R_f: [-\sqrt{13}, \sqrt{13}]$

ب) $y = 4 \sin x - 3 \cos x \rightarrow -\sqrt{4^2 + 3^2} \leq y \leq \sqrt{4^2 + 3^2} \Rightarrow R_f: [-5, 5]$

ج) $y = [2 \sin x + \omega \cos x] \Rightarrow -\sqrt{2^2 + \omega^2} \leq y \leq \sqrt{2^2 + \omega^2} \Rightarrow [-\sqrt{4 + \omega^2}, \sqrt{4 + \omega^2}] \xrightarrow{\text{برائت}} R_f: \{-\omega, -\omega/2, \dots, \omega/2, \omega\}$

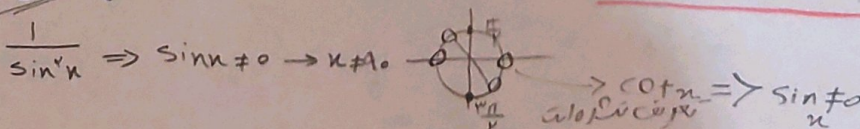
د) $y = \sqrt{\cos x - 2 \sin x} \Rightarrow -\sqrt{1^2 + 2^2} \leq y \leq \sqrt{1^2 + 2^2} \Rightarrow [-\sqrt{5}, \sqrt{5}] \xrightarrow{\sqrt{\cdot}} R_f: [0, \sqrt{5}]$

الف) $y = \sin^2 x + 3 \sin x + 2 \rightarrow \begin{cases} 1 \rightarrow 4 \text{ max} \\ 0 \rightarrow 2 \\ -\frac{b}{2a} \rightarrow -\frac{3}{2} \times \sin x \leq -1 \end{cases} \Rightarrow R_f = [0, 4]$

ب) $y = 2 \sin^2 x + 3 \sin x + 2 \rightarrow \begin{cases} 1 \rightarrow 7 \text{ max} \\ 0 \rightarrow 2 \\ -\frac{b}{2a} = -\frac{3}{4} \end{cases} \Rightarrow R_f = [1, 7]$

الف) $y = \sin^2 x + 4 \cos^2 x = 3 \cos^2 x + 1 \Rightarrow R_f = [1, 4]$

ب) $y = \frac{2 \cot x}{1 + \cot^2 x} = \sin 2x \Rightarrow R_f = [-1, 1] - \{0\}$



الف) $y = \sin^4 x + \cos^4 x \Rightarrow \forall x \in \mathbb{R} \Rightarrow \sin^4 x + \cos^4 x \leq 1 \Rightarrow R_f = \left[\frac{1}{2}, 1 \right]$

سوال ٩

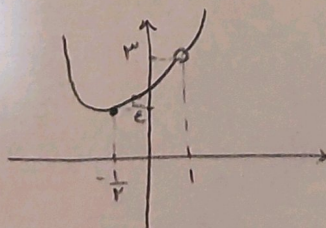
ب) $y = [\sin^4 x + \cos^4 x] \Rightarrow \forall x \in \mathbb{R} \Rightarrow \sin^4 x + \cos^4 x \leq 1 \Rightarrow \left[\frac{1}{2}, 1 \right]$

برائے
 $\Rightarrow R_f = \{0, 1\}$

الف) $y = \frac{x^2 + 7x - 4}{x + 4} \xrightarrow{(x-1)(x+5)} x - 1 \Rightarrow R_f = \mathbb{R} - \{-9\}$

سوال ١٠

ب) $y = \frac{x^3 - 1}{x - 1} = x^2 + x + 1 \quad x \neq 1$



$\Rightarrow R_f = \left[\frac{3}{4}, +\infty \right) - \{3\}$