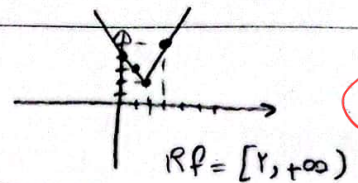
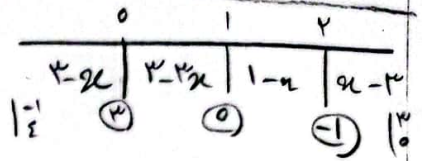
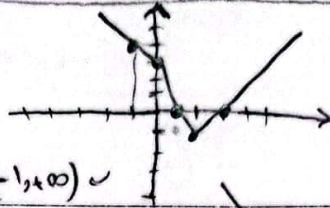


الف) $2x - 2 = 0 \rightarrow x = 1$

$$\begin{cases} x > 2 & 2x - 2 & | \begin{smallmatrix} 2 \\ 2 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ x < 2 & 2 - x & | \begin{smallmatrix} 2 \\ 2 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 2 \end{smallmatrix} \end{cases}$$



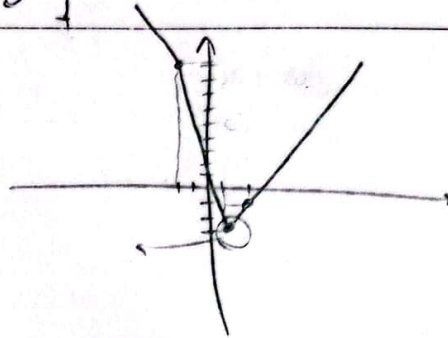
ب) $\begin{cases} x > 2 & x - 2 & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ 1 < x < 2 & 1 - x & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ 0 \leq x < 1 & 2 - 2x & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ x < 0 & 2 - x & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 2 \end{smallmatrix} \end{cases}$



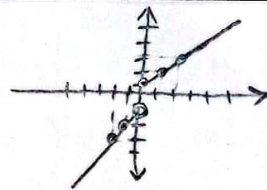
$x = 1 \quad x = -2$

$$\begin{array}{c|c|c} -2 & 1 & \\ \hline -2x + 0 & -5x + 1 & 2x - 0 \\ \hline 1 & -2 & 2 \\ & & -1 \end{array}$$

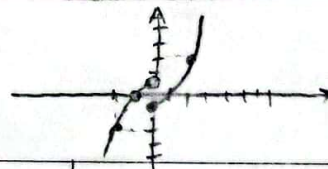
$k = 3 \leftarrow y = 3 \leftarrow x = 1$



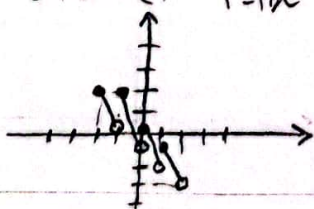
الف) $\begin{cases} x > 0 \rightarrow x + 1 & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} \\ x < 0 \rightarrow x - 1 & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} -1 \\ -1 \end{smallmatrix} \end{cases}$



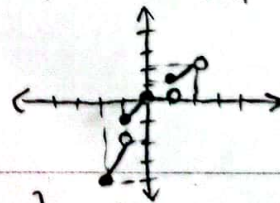
ب) $\begin{cases} x > 0 & x^2 - 1 & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ x < 0 & -x^2 + 1 & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ -1 \end{smallmatrix} \end{cases}$



الف) $\begin{cases} -2 \leq x < -1 & -2 - 2x & | \begin{smallmatrix} 2 \\ 2 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ -1 \leq x < 0 & -1 - 2x & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ 0 \leq x < 1 & -2x & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 1 \end{smallmatrix} \\ 1 \leq x < 2 & 1 - 2x & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 1 \end{smallmatrix} \end{cases}$



ب) $\begin{cases} -2 \leq x < -1 & -2|x| & | \begin{smallmatrix} 2 \\ 2 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ -1 \leq x < 0 & -1|x| & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ 0 \leq x < 1 & 0 & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 0 \end{smallmatrix} \\ 1 \leq x < 2 & |x| & | \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} & | \begin{smallmatrix} 0 \\ 1 \end{smallmatrix} \end{cases}$



$0 \leq f(x) - [f(x)] < 1$

الف) $0 \leq 2x - [2x] < 1 \rightarrow RF = [0, 1)$

ب) $0 \leq f(x - [x]) < 1 \rightarrow RF = [0, 1)$

ج) $0 \leq f\left(\frac{x}{2} - \left[\frac{x}{2}\right]\right) < 1 \rightarrow RF = [0, 1)$

$-1 < [x] - 0 \leq 0$

د) $-1 < [2x] - 2x \leq 0 \rightarrow RF = (-1, 0]$

$$-\sqrt{a^2+b^2} \leq a \sin x + b \cos x \leq \sqrt{a^2+b^2}$$

$$\text{ا) } \sqrt{17} \leq 4 \sin x + 3 \cos x \leq \sqrt{17} \Rightarrow Rf = [-\sqrt{17}, \sqrt{17}]$$

$$\text{ب) } -\sqrt{17} \leq 4 \sin x - 3 \cos x \leq \sqrt{17} \Rightarrow Rf = [-\sqrt{17}, \sqrt{17}]$$

$$\text{ج) } -\sqrt{17} \leq 4 \sin x + 3 \cos x \leq \sqrt{17} \Rightarrow Rf = [-\sqrt{17}, \sqrt{17}]$$

$$\{-4, \pm 1, \pm 2, \pm 3, \pm 4, 0\}$$

$$\text{د) } \sqrt{a} \leq \sqrt{1-\sin x + \cos x} \leq \sqrt{a}$$

$$\Rightarrow 0 \leq \sqrt{1-\sin x + \cos x} \leq \sqrt{a}$$

$$\Rightarrow Rf = [0, \sqrt{a}]$$

$$\text{ا) } \begin{cases} \sin x = 1 \rightarrow 1 + 4 + 4 = 9 \text{ max} \\ \sin x = -1 \rightarrow 1 - 4 + 4 = 1 \\ \sin x = -\frac{b}{a} = -\frac{3}{4} \rightarrow \frac{9}{16} - \frac{9}{16} + \frac{9}{16} = \frac{9}{16} \end{cases} \Rightarrow Rf = [0, 9]$$

$$\text{ب) } \begin{cases} \sin x = 1 \rightarrow 4 + 4 + 4 = 12 \text{ max} \\ \sin x = -1 \rightarrow 4 - 4 + 4 = 4 \\ \sin x = -\frac{b}{a} = -\frac{3}{4} \rightarrow f(-\frac{3}{4}) = \frac{4}{16} \end{cases} \Rightarrow Rf = [\frac{4}{16}, 12]$$

$$\text{ج) } 4 \cos^2 x + (1 - \cos^2 x) = 3 \cos^2 x + 1 \Rightarrow (0 \leq \cos^2 x \leq 1) \Rightarrow 1 \leq 3 \cos^2 x + 1 \leq 4 \Rightarrow Rf = [1, 4]$$

$$\text{د) } \frac{4 \cos x}{\sin x} \times \sin^2 x = 4 \sin x \cos x = \sin 2x \Rightarrow Rf = [-1, 1]$$

$$\frac{1}{2} \leq \sin^2 x + \cos^2 x \leq 1 \Rightarrow \text{ا) } \frac{1}{2} \leq \sin^2 x + \cos^2 x \leq 1 \Rightarrow Rf = [\frac{1}{2}, 1]$$

$$\text{ب) } \left[\frac{1}{2} \leq \sin^2 x + \cos^2 x \leq 1 \right] \rightarrow Rf = \{0, 1\}$$

$$\text{ا) } \frac{(x-1)(x+2)}{x+2} = x-1 \xrightarrow{x=-2} = -3 \Rightarrow Rf = \mathbb{R} - \{-3\}$$

$$\text{ب) } \frac{(x-1)(x^2+x+1)}{(x-1)} \xrightarrow{x=1} 1+1+1=3$$

$$D = \frac{(1)(1)-1}{1} = 0$$

$$Rf = \mathbb{R}$$

$$R = [\frac{3}{1}, +\infty)$$