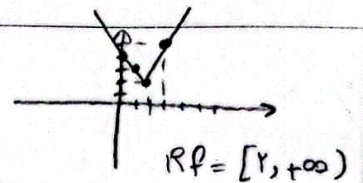
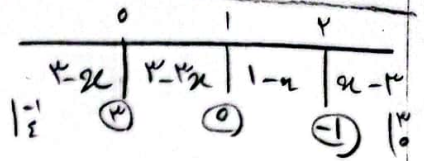
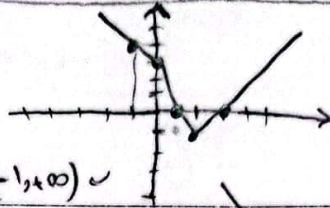


الف) $2x - 2 = 0 \rightarrow x = 1$

$$\begin{cases} x > 2 & 2x - 2 & | \frac{1}{2} & | \frac{1}{2} \\ x < 2 & 2 - x & | \frac{1}{2} & | \frac{1}{2} \end{cases}$$



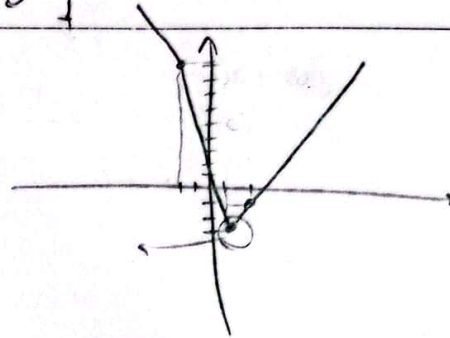
ب) $\begin{cases} x > 2 & x - 2 & | \frac{1}{2} & | \frac{1}{2} \\ 1 < x < 2 & 2 - x & | \frac{1}{2} & | \frac{1}{2} \\ 0 < x < 1 & 2 - 2x & | \frac{1}{2} & | \frac{1}{2} \\ x < 0 & 2 - x & | \frac{1}{2} & | \frac{1}{2} \end{cases}$



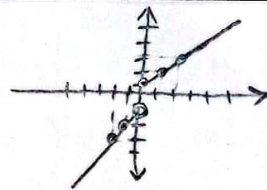
$x = 1 \quad x = -2$

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

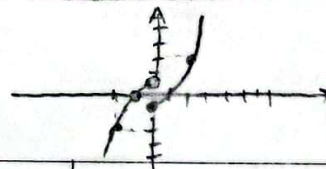
$k = 3 \leftarrow y = 3 \leftarrow x = 1$



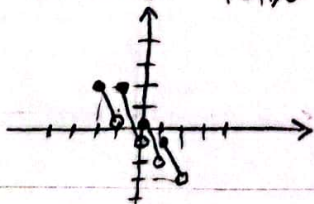
الف) $\begin{cases} x > 0 \rightarrow x+1 & | \frac{1}{2} & | \frac{1}{2} \\ x < 0 \rightarrow x-1 & | \frac{1}{2} & | \frac{1}{2} \end{cases}$



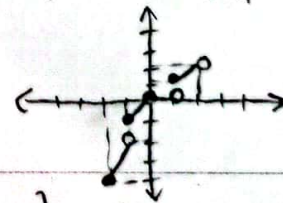
ب) $\begin{cases} x > 0 & x^2 - 1 & | \frac{1}{2} & | \frac{1}{2} \\ x < 0 & -x^2 + 1 & | \frac{1}{2} & | \frac{1}{2} \end{cases}$



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



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



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

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

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

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

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

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

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

ا) $-\sqrt{13} \leq 2 \sin x + 3 \cos x \leq \sqrt{13} \Rightarrow Rf = [-\sqrt{13}, \sqrt{13}]$

ب) $-\sqrt{14} \leq 5 \sin x - 3 \cos x \leq \sqrt{14} \Rightarrow Rf = [-\sqrt{14}, \sqrt{14}]$

ج) $-\sqrt{14} \leq 2 \sin x + 3 \cos x \leq \sqrt{14} \Rightarrow Rf = [-\sqrt{14}, \sqrt{14}]$
 $\{-4, \pm 1, \pm 2, \pm 3, \pm 4, 0\}$

د) $-\sqrt{a} \leq 2 \sin x + \cos x \leq \sqrt{a}$
 $\Downarrow$
 $a \leq \sqrt{2 \sin x + \cos x} \leq \sqrt{a}$
 $\Downarrow$
 $Rf = [0, \sqrt{a}]$

ا) $\begin{cases} \sin x = 1 \rightarrow 1 + 2 + 2 = 4 \text{ max} \\ \sin x = -1 \rightarrow 1 - 2 + 2 = 0 \\ \sin x = \frac{-b}{2a} = \frac{-2}{2} = -1 \rightarrow \frac{9}{4} - \frac{9}{4} + \frac{4}{4} = \frac{1}{4} \end{cases} \Rightarrow Rf = [0, 4]$

ب) $\begin{cases} \sin x = 1 \rightarrow 2 + 2 + 2 = 6 \text{ max} \\ \sin x = -1 \rightarrow 2 - 2 + 2 = 2 \\ \sin x = \frac{-b}{2a} = \frac{-2}{2} = -1 \rightarrow f(-\frac{2}{2}) = \frac{2}{1} \end{cases} \Rightarrow Rf = [\frac{2}{1}, 6]$

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

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

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

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

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

ب) $\frac{(x-1)(x^2+x+1)}{(x-1)} \xrightarrow{x=1} 1+1+1=3$
 $D = \frac{5(1)(1)-1}{5} = \frac{4}{5}$
 $Rf = \mathbb{R}$