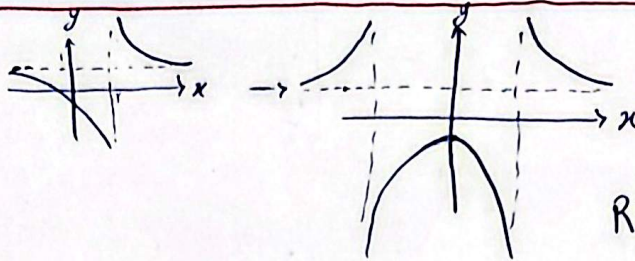


الف) $y = \frac{|x|+1}{|x|-2} \rightarrow \frac{x+1}{x-2}$



$$R_f = (-\infty, -\frac{1}{3}) \cup (1, +\infty)$$

ب) $y = \frac{x^2+1}{|x|} = |x| + \frac{1}{|x|} \Rightarrow R_f = [2, +\infty)$

$y = \frac{x^2+2x-2}{x+2} \quad x^2+2x-2 = yx+2y \Rightarrow x^2+(2-y)x-2-y=0$

$$x = \frac{y-2 \pm \sqrt{(y-2)^2 - 4(-2-y)}}{2} = \frac{y-2 \pm \sqrt{y^2+1y+12}}{2} \quad \Delta \geq 0$$

$\Rightarrow y^2+1y+12 \geq 0 \Rightarrow (y+2)(y+6) \geq 0$

$$R_y = (-\infty, -6] \cup [-2, +\infty)$$

$f(x) = \frac{x^2-x+\frac{1}{x}}{x^2-x+1} \rightarrow \Delta < 0 \Rightarrow$ (ریشه ندارد) $D_f = \mathbb{R}$

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

As $x \rightarrow +\infty$, $1 - \frac{1}{+\infty} = 1$

As $x \rightarrow \frac{1}{x^2-x+1} = \frac{1}{\frac{1}{x^2}-\frac{1}{x}+1} = 1-1=0$

$$R_f = [0, 1)$$

الف) $y = \sqrt{-x^2+2x-1} \rightarrow \left| x = \frac{-b}{2a} = 1 \right.$

$$R_y = \sqrt{(-\infty, 3]} \Rightarrow R_y = [0, \sqrt{3}]$$

ب) $y = \sqrt[3]{2x^2-11x} \rightarrow \left| x = \frac{-b}{2a} = \frac{11}{4} \right.$

$$\Rightarrow R_y = \sqrt[3]{[-11, +\infty)} \Rightarrow R_y = [-\sqrt[3]{11}, +\infty)$$

الف) $y = \lg(x^2-x+1) \rightarrow x^2-x+1 = 0 \Rightarrow x = \pm \frac{1}{2} \rightarrow x = \pm \frac{1}{2} \rightarrow f(\frac{1}{2}) > 0$

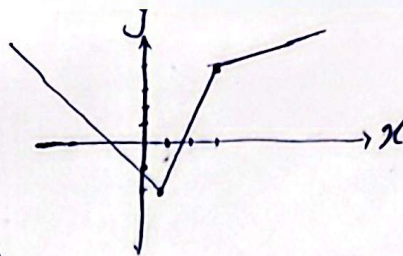
$\rightarrow x^2-x+1 > 0 \Rightarrow R_y = \mathbb{R}$

ب) $y = \lg(\frac{x^2+1}{x})$

$x + \frac{1}{x} \rightarrow [2, +\infty) \checkmark \rightarrow \lim_{x \rightarrow 0} \frac{x^2+1}{x} = 1$

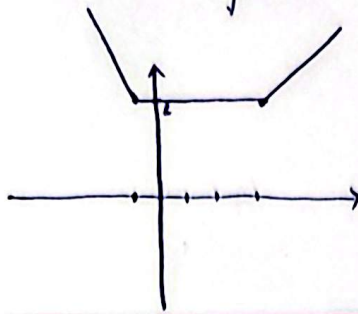
$$R_y = [1, +\infty)$$

الف) $y = |2x-2| - |x-3|$



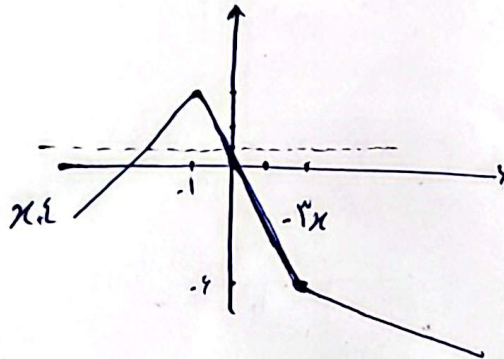
$R_y = [-2, +\infty)$

ب) $y = |x-3| + |x+1|$



$R_y = [4, +\infty)$

$|x-2| - |2x+2| \leq 1$



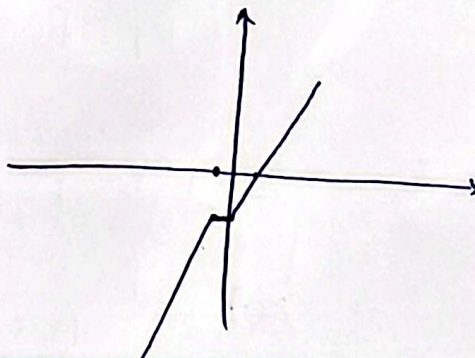
$-3x = 1 \quad x = -\frac{1}{3}$

$x+2=1 \quad x=-1$

$D_f = \mathbb{R} - (-1, -\frac{1}{3})$

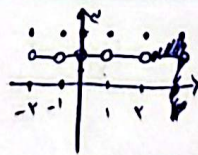
$y = 3x - |2x+1| + |x|$

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



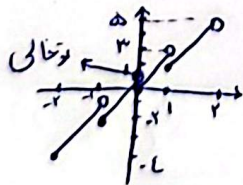
$R_y = \mathbb{R}$

الف) $y = [x] + [2-x] = [x] + [-x] + 2$



$R_y = \{2, 3\}$

ب) $y = 3x - [x]$



$R_y = [-1, \infty)$

الف) $y = \sin^2 x - \sin x + 1$

$\sin^2 x = 1 \rightarrow (-1)^2 - (-1) + 1 = 3$
 $\sin^2 x = \frac{1}{4} \rightarrow (\frac{1}{2})^2 - (\frac{1}{2}) + 1 = \frac{5}{4}$
 $\sin^2 x = 0 \rightarrow (0)^2 - (0) + 1 = 1$

$R_y = [\frac{5}{4}, 3]$

ب) $y = \sin^2 x + \sin^2 x + 1$

$\sin^2 x = 1 \rightarrow (1)^2 + (1) + 1 = 3$
 $\sin^2 x = 0 \rightarrow (0)^2 + (0) + 1 = 1$
 $\rightarrow \frac{-b}{2a} = -\frac{1}{2} < 0 \quad X$

$R_y = [1, 3]$