

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

$$\rightarrow \frac{1+2y}{y-1} \geq 0 \quad + \quad \frac{-1}{y-1} + \quad \rightarrow R_f = (-\infty, -\frac{1}{2}] \cup (1, +\infty)$$

$$ب) y = \frac{x^2+1}{|x|} = \frac{|x|^2+1}{|x|} = |x| + \frac{1}{|x|} \xrightarrow{|x|>0} R_f = [2, +\infty)$$

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$$y = \frac{x^2+2x-2}{x+3} \rightarrow yx+3y = x^2+2x-2 \rightarrow x^2+x(2-y)-2-3y=0$$

$$\Delta \geq 0 \rightarrow 4+y^2-2y+8+12y \geq 0 \rightarrow y^2+10y+12 \geq 0 \xrightarrow{\Delta < 0, a > 0} \text{همیشه بدترار}$$

$$\rightarrow R_f = \mathbb{R}$$

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$$D: x^2-x+1 \neq 0 \xrightarrow{\Delta < 0} \text{همیشه بدترار} \rightarrow D_f = \mathbb{R}$$

$$y = \frac{x^2-x+\frac{1}{x}}{x^2-x+1} \rightarrow yx^2-x+y = x^2-x+\frac{1}{x} \rightarrow x^2(y-1)+x(1-y)+y-\frac{1}{x}=0$$

$$\Delta \geq 0 \rightarrow 1-2y+y^2-4y^2+4y-1 \geq 0 \rightarrow 3y^2-2y \leq 0 \quad + \quad | \quad +$$

$$\left. \begin{array}{l} x^2-x+\frac{1}{x}=0 \rightarrow x=\frac{1}{x} \\ x^2-x+\frac{1}{x}=x^2-x+1 \rightarrow \text{جواب ندارد} \end{array} \right\} \rightarrow R_f = [0, 1)$$

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$$الف) y = \sqrt{-x^2+4x-1} \rightarrow \text{رای} \left| \begin{array}{l} x = \frac{-4 \pm \sqrt{16-4}}{-2} = 2 \\ y = 3 \end{array} \right. \quad R = (-\infty, 3] \quad \sqrt{\quad} \quad [0, \sqrt{3}]$$

$$ب) y = \sqrt[3]{2x^2-12x} \rightarrow \text{رای} \left| \begin{array}{l} \frac{1}{x} = 2 \\ -1 \end{array} \right. \quad R = [-1, +\infty) \quad \sqrt[3]{\quad} \quad [-2, +\infty)$$

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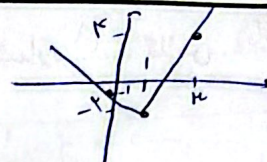
$$y = \log(x^2-x+1) \xrightarrow{f(x)=x^2-x+1} R_f = \mathbb{R} \rightarrow y = \log R = \mathbb{R}$$

$$y = \log \frac{x^2+1}{x} \rightarrow f(x) = \frac{x^2+1}{x} = x + \frac{1}{x} \xrightarrow{\text{رایف}} R = [2, +\infty)$$

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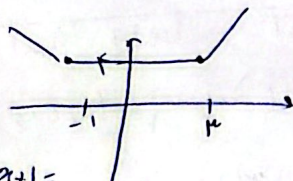
$$\rightarrow y \geq \log 2 \rightarrow y \geq 1 \rightarrow R_y = [1, +\infty)$$

$$y = |x-1| - |x-2| \quad \begin{array}{l} \begin{array}{l} x-1 \geq 0 \\ x-2 \geq 0 \end{array} \Rightarrow \begin{array}{l} x \geq 2 \end{array} \Rightarrow \begin{array}{l} x-1-x+2 = 1 \end{array} \\ \begin{array}{l} x-1 \geq 0 \\ x-2 < 0 \end{array} \Rightarrow \begin{array}{l} 1 \leq x < 2 \end{array} \Rightarrow \begin{array}{l} x-1-x+2 = 1 \end{array} \\ \begin{array}{l} x-1 < 0 \\ x-2 \geq 0 \end{array} \Rightarrow \begin{array}{l} x < 1 \end{array} \Rightarrow \begin{array}{l} -x+1-x+2 = -2x+3 \end{array} \\ \begin{array}{l} x-1 < 0 \\ x-2 < 0 \end{array} \Rightarrow \begin{array}{l} x < 1 \end{array} \Rightarrow \begin{array}{l} -x+1-x+2 = -2x+3 \end{array} \end{array}$$



$$R = [-1, +\infty)$$

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

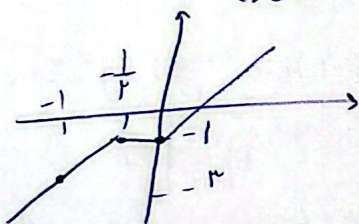


$$R = [-1, +\infty)$$

$$\begin{array}{l} x-1 \geq 0 \\ x+1 \geq 0 \end{array} \Rightarrow \begin{array}{l} x \geq 1 \end{array} \Rightarrow \begin{array}{l} x-1+x+1 = 2x \end{array} \\ \begin{array}{l} x-1 \geq 0 \\ x+1 < 0 \end{array} \Rightarrow \begin{array}{l} 1 \leq x < -1 \end{array} \Rightarrow \begin{array}{l} x-1-x-1 = -2 \end{array} \\ \begin{array}{l} x-1 < 0 \\ x+1 \geq 0 \end{array} \Rightarrow \begin{array}{l} -1 \leq x < 1 \end{array} \Rightarrow \begin{array}{l} -x+1+x+1 = 2 \end{array} \\ \begin{array}{l} x-1 < 0 \\ x+1 < 0 \end{array} \Rightarrow \begin{array}{l} x < -1 \end{array} \Rightarrow \begin{array}{l} -x+1-x-1 = -2x \end{array}$$

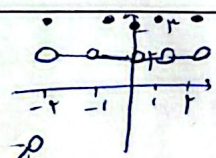
$$\begin{array}{l} x-1 \geq 0 \\ x+1 \geq 0 \end{array} \Rightarrow \begin{array}{l} x \geq 1 \end{array} \Rightarrow \begin{array}{l} 2x \leq 1 \\ x \leq -1 \end{array} \Rightarrow \begin{array}{l} x \leq -1 \end{array} \\ \begin{array}{l} x-1 \geq 0 \\ x+1 < 0 \end{array} \Rightarrow \begin{array}{l} 1 \leq x < -1 \end{array} \Rightarrow \begin{array}{l} -2 \leq x \leq 1 \end{array} \\ \begin{array}{l} x-1 < 0 \\ x+1 \geq 0 \end{array} \Rightarrow \begin{array}{l} -1 \leq x < 1 \end{array} \Rightarrow \begin{array}{l} 2 \leq x \leq 1 \end{array} \\ \begin{array}{l} x-1 < 0 \\ x+1 < 0 \end{array} \Rightarrow \begin{array}{l} x < -1 \end{array} \Rightarrow \begin{array}{l} -2x \leq 1 \\ x \geq -1 \end{array} \Rightarrow \begin{array}{l} x \geq -1 \end{array}$$

$$y = 3x - |x+1| + |x| \quad \begin{array}{l} \begin{array}{l} x+1 \geq 0 \\ x \geq 0 \end{array} \Rightarrow \begin{array}{l} x \geq 0 \end{array} \Rightarrow \begin{array}{l} 3x-x-1+x = 3x-1 \end{array} \\ \begin{array}{l} x+1 \geq 0 \\ x < 0 \end{array} \Rightarrow \begin{array}{l} -1 \leq x < 0 \end{array} \Rightarrow \begin{array}{l} 3x-x-1+x = 3x-1 \end{array} \\ \begin{array}{l} x+1 < 0 \\ x \geq 0 \end{array} \Rightarrow \begin{array}{l} x < -1 \end{array} \Rightarrow \begin{array}{l} 3x-x+1+x = 3x+1 \end{array} \\ \begin{array}{l} x+1 < 0 \\ x < 0 \end{array} \Rightarrow \begin{array}{l} x < -1 \end{array} \Rightarrow \begin{array}{l} 3x-x+1+x = 3x+1 \end{array} \end{array}$$



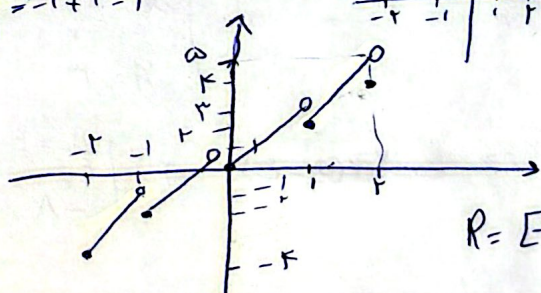
$$R_y = \mathbb{R}$$

$$\text{الف) } y = \lfloor x \rfloor + \lfloor -x \rfloor + 1 \quad \begin{array}{l} x \in \mathbb{Z} \Rightarrow y = 0 + 0 + 1 = 1 \\ x \notin \mathbb{Z} \Rightarrow y = -1 + 1 = 0 \end{array}$$



$$R = \{0, 1\}$$

$$\text{ب) } y = 3x - \lfloor x \rfloor \quad \begin{array}{l} -1 \leq x < 0 \Rightarrow \lfloor x \rfloor = -1 \Rightarrow y = 3x+1 \\ 0 \leq x < 1 \Rightarrow \lfloor x \rfloor = 0 \Rightarrow y = 3x \\ 1 \leq x < 2 \Rightarrow \lfloor x \rfloor = 1 \Rightarrow y = 3x-1 \end{array}$$



$$R = [-1, 2)$$

$$y = \sin^2 x - \sin x + 1 \quad \begin{array}{l} \sin x = -1 \Rightarrow y = 1 \\ \sin x = 1 \Rightarrow y = 1 \\ \sin x = -\frac{1}{2} \Rightarrow y = \frac{3}{4} \end{array} \quad R = [\frac{3}{4}, 1]$$

$$y = \sin^2 x + \sin^2 x + 1 \quad \begin{array}{l} \sin^2 x = 0 \Rightarrow y = 1 \\ \sin^2 x = 1 \Rightarrow y = 3 \end{array} \quad R = [1, 3]$$