

الف) $y = x^3 - 3x^2 + 3x - 1$
 $\rightarrow y - 1 = x^3 - 3x^2 + 3x - 1$
 $\rightarrow y - 1 = (x - 1)^3 \rightarrow \sqrt[3]{y - 1} + 1 = x$
 $y \in \mathbb{R}$

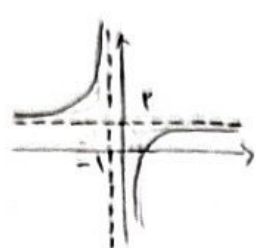
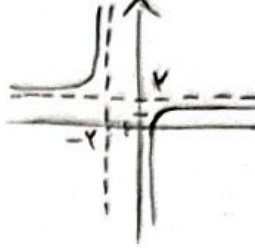
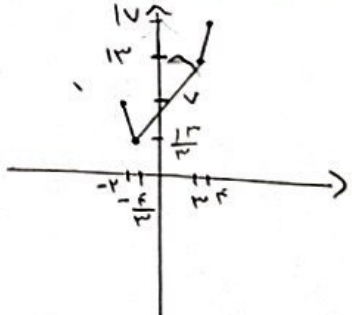
ب) $y = \frac{1}{x^2 - 2x}$
 $y x^2 - 2y x = 1 \rightarrow y x^2 - 2y x - 1 = 0$
 $x = \frac{2y \pm \sqrt{4y^2 + 4y}}{2y} \rightarrow 4y^2 + 4y \geq 0$
 $\frac{y}{+} \frac{-1}{+} \frac{0}{+} \rightarrow y \in (-\infty, -1] \cup [0, +\infty)$

الف) $a > 0 \rightarrow \min \quad x_{\min} = -\frac{b}{2a} = 2 \mid y_{\min} = 4 \Rightarrow y \in [4, +\infty)$
 ب) $a < 0 \rightarrow \max \quad x_{\max} = -\frac{b}{2a} = 3 \rightarrow y_{\max} = 12 \Rightarrow y \in (-\infty, 12]$
 ج) $a > 0 \rightarrow \min \quad x_{\min} = -\frac{b}{2a} = 2 \rightarrow y_{\min} = -4 \Rightarrow y \in \sqrt{[-4, +\infty)} = [0, +\infty)$
 د) $a < 0 \rightarrow \max \quad x_{\max} = -\frac{b}{2a} = 3 \rightarrow y_{\max} = 9 \Rightarrow y \in \sqrt{(-\infty, 9]} = [0, 3]$

الف) $y = x^3 - 5x^2 + 2x + 1 \rightarrow y \in \mathbb{R}$
 ب) $y = x^4 - 4x^2 + 3x + 2 \rightarrow y \in \mathbb{R}$
 ج) $y = \sqrt{x^4 - 4x^2 + 5x + 1} \rightarrow y \in \sqrt{\mathbb{R}} = [0, +\infty)$
 د) $y = (x^3 - 5x^2 + 2x + 1)^2 \Rightarrow y \in (\mathbb{R})^2 = [0, +\infty)$

الف) $y = \frac{3x+1}{x-2} \rightarrow y \in \mathbb{R} - \{\frac{3}{2}\} = \mathbb{R} - \{3\}$
 ب) $y = \frac{2x+1}{x+1} \rightarrow y \in \mathbb{R} - \{\frac{2}{1}\} = \mathbb{R} - \{2\}$

الف) $y = \sqrt{\frac{3x+1}{x+1}} \rightarrow y \in \sqrt{\mathbb{R} - \{\frac{3}{2}\}} = [0, +\infty) - \{\sqrt{2}\}$
 ب) $y = \sqrt{\frac{2x+1}{2-x}} \rightarrow y \in \sqrt{\mathbb{R} - \{\frac{2}{2}\}} = [0, +\infty)$

الف) $x = \frac{1}{y} \Rightarrow y = \frac{1}{x}$ $y = \frac{x-1}{x+1}$ $x=1 \rightarrow y = -\frac{1}{2}$ 	ب) $x = \frac{1}{y} \Rightarrow y = \frac{1}{x}$ $y = \frac{x-1}{x+1}$ $x=1 \rightarrow y = \frac{1}{2}$ 
الف) $y = \sin x + \frac{1}{\sin x} \rightarrow y \in (-\infty, -2] \cup [2, +\infty)$ ب) $y = \frac{x^4+1}{x^2} = x^2 + \frac{1}{x^2} \rightarrow y \in (-\infty, -2] \cup [2, +\infty)$ ج) $y = \frac{\sqrt{x^2+1}}{\sqrt{x}} = \sqrt{x} + \frac{1}{\sqrt{x}} \rightarrow y \in (-\infty, -2] \cup [2, +\infty)$ د) $y = \sqrt{x} + \frac{1}{\sqrt{x}} \rightarrow y \in [2, +\infty)$	الف) $y = x^2 + \frac{1}{x^2+1} \rightarrow y+1 = x^2+1 + \frac{1}{x^2+1}$ $x^2+1 = u \Rightarrow u = 1 \rightarrow y+1 = 2 \rightarrow y = 1$ $\rightarrow y \in [1, +\infty)$
الف) $y = x^2 + \frac{1}{x^2+1} \rightarrow y+1 = x^2+1 + \frac{1}{x^2+1}$ $x^2+1 = u \Rightarrow u = 1 \rightarrow y+1 = 2 \rightarrow y = 1$ $\rightarrow y \in [1, +\infty)$	ب) $y = \frac{x^2+1}{\sqrt{x^2+1}} = \sqrt{x^2+1} + \frac{1}{\sqrt{x^2+1}}$ $\sqrt{x^2+1} = u \Rightarrow u = 1 \rightarrow y = 2$ $\rightarrow y \in [2, +\infty)$
$x-1=0 \rightarrow x=1 \mid 1x+1=0 \rightarrow x=-1$ $\frac{-1}{-1x-1} \mid \frac{1}{1x+1}$ $x=1 \rightarrow y=1$ $x=-1 \rightarrow y=1$	
الف) $x-1=0 \rightarrow x=1 \mid 1x+1=0 \rightarrow x=-1$ $\frac{-1}{-1x-1} \mid \frac{1}{1x+1}$ $R_f \in [1, +\infty)$ $x=1 \rightarrow y=1 \mid x=-1 \rightarrow y=1$	ب) $1x-1=0 \rightarrow x=1 \mid x+1=0 \rightarrow x=-1$ $\frac{-1}{1x-1} \mid \frac{1}{x+1}$ $x=1 \rightarrow y=-1$ $x=-1 \rightarrow y=1$ $R_f \in [-1, +\infty)$