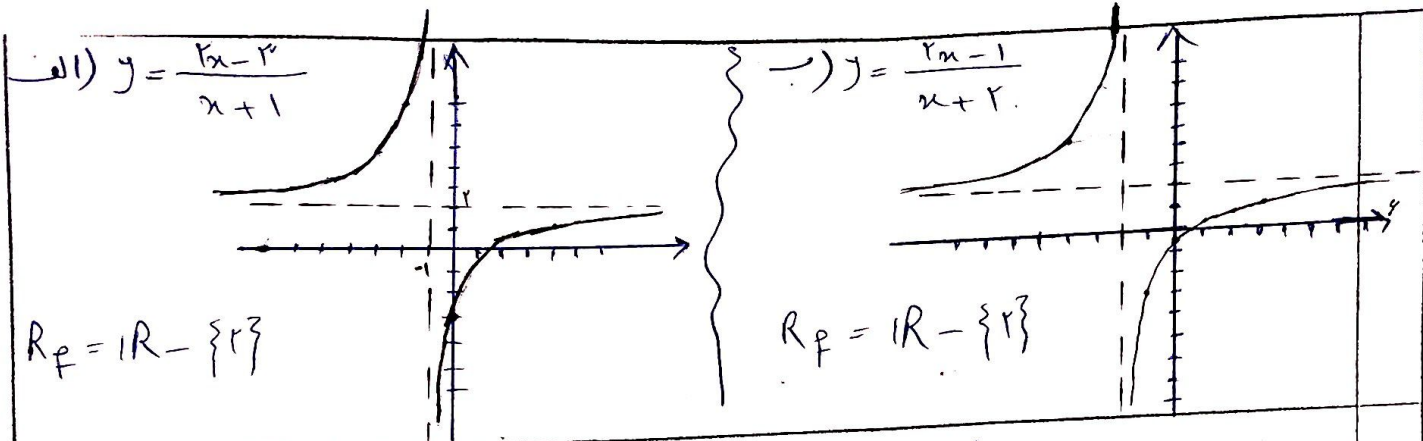


الف) $y = x^3 - 3x^2 + 3x \rightarrow R_f = \mathbb{R}$ تابع رتبه فرد	
ب) $y = \frac{1}{x^2 - 1} \rightarrow y = \frac{1}{(x-1)^2 - 1} \rightarrow y(x-1)^2 - y = 1 \rightarrow y(x-1)^2 = 1+y$ $\rightarrow (x-1)^2 = \frac{1+y}{y} \rightarrow x = \pm \sqrt{\frac{1+y}{y}} + 1 \rightarrow \frac{1+y}{y} \geq 0 \rightarrow \frac{-1 \pm \sqrt{1-4 \cdot (-1) \cdot 1}}{2 \cdot (-1)} \rightarrow R_f = (-\infty, -1] \cup (0, +\infty)$	۱
الف) $y = x^2 - 2x + 1 \rightarrow \begin{cases} x_{\min} = 1 \\ y_{\min} = 0 \end{cases} \rightarrow R_f = [0, +\infty)$ ب) $y = \sqrt{-x^2 + 4x} \rightarrow \begin{cases} x_{\max} = 2 \\ y_{\max} = 2 \end{cases}$ ج) $y = -x^2 + 4x + 3 \rightarrow \begin{cases} x_{\max} = 2 \\ y_{\max} = 11 \end{cases} \rightarrow R_f = (-\infty, 11] \rightarrow R_f = \sqrt{(-\infty, 9]} = [0, 3]$	۲
د) $y = \sqrt{x^2 - 2x - 3} \rightarrow \begin{cases} x_{\min} = 3 \\ y_{\min} = -2 \end{cases} \rightarrow R_f = \sqrt{[-2, +\infty)} = [0, +\infty)$	
الف) $y = x^3 - 8x^2 + 12x + 1 \rightarrow R_f = \mathbb{R}$ ب) $y = x^4 - 4x^2 + 3x + 2 \rightarrow R_f = \mathbb{R}$ ج) $y = \sqrt{x^4 - 4x^2 + 8x + 1} \rightarrow R_f = \sqrt{\mathbb{R}} = [0, +\infty)$	۳
د) $y = (x^3 - 2x^2 + 3x + 1)^2 \rightarrow R_f = \mathbb{R}^+ = [0, +\infty)$	
الف) $y = \frac{x+1}{x-2} \xrightarrow{\text{معرّفی}} R_f = \mathbb{R} - \left\{\frac{a}{c}\right\} = \mathbb{R} - \left\{\frac{1}{2}\right\}$	
ب) $y = \frac{x+1}{x+1} \xrightarrow{\text{معرّفی}} R_f = \mathbb{R} - \{1\}$	۴
الف) $y = \sqrt{\frac{x+2}{x+1}} \rightarrow R_f = \sqrt{\mathbb{R} - \{1\}} = [0, +\infty) - \left\{\sqrt{1}\right\}$	
ب) $y = \sqrt{\frac{x+1}{x-2}} \rightarrow R_f = \sqrt{\mathbb{R} - \left\{\frac{1}{2}\right\}} = [0, +\infty) - \left\{\sqrt{\frac{1}{2}}\right\}$	۵



الف) $y = \sin x + \frac{1}{\sin x} \rightarrow R_f = (-\infty, -1] \cup [1, +\infty)$

ب) $y = x^r + \frac{1}{x^r} \rightarrow R_f = (-\infty, -1] \cup [1, +\infty)$

ج) $y = \sqrt[r]{x} + \frac{1}{\sqrt[r]{x}} \rightarrow R_f = (-\infty, -1] \cup [1, +\infty)$

د) $y = \sqrt{x} + \frac{1}{\sqrt{x}} \rightarrow R_f = [1, +\infty)$

هـ) $y = x^r + \frac{1}{x^r + r} \rightarrow R_f = [\frac{1}{r}, +\infty)$ تغير مقدار $\frac{1}{r}$ است، وابسته به r

و) $y = \frac{x^r + \varepsilon}{\sqrt{x^r + \varepsilon}} + \frac{1}{\sqrt{x^r + \varepsilon}} = \sqrt{x^r + \varepsilon} + \frac{1}{\sqrt{x^r + \varepsilon}}$ تغير مقدار $\sqrt{x^r + \varepsilon}$ است $\rightarrow R_f = [1, \varepsilon, +\infty)$

