

الف) $x^2 = y + 4 \Rightarrow x = \pm\sqrt{y+4} \Rightarrow y \geq -4 \Rightarrow R_f = [-4, +\infty)$

ب) $x^3 = y - 1 \Rightarrow x = \sqrt[3]{y-1} \Rightarrow y \in \mathbb{R} \Rightarrow R_f = \mathbb{R}$

الف) $y = x^2 - 4x + 4 + 2 \Rightarrow y = (x-2)^2 + 2 = x(x-2) + 2 = y - 2 \Rightarrow x - 2 = \sqrt{y-2} \Rightarrow y \geq 2 \Rightarrow R_f = [2, +\infty)$

ب) $y = (x^2 - 2/\omega)^2 - \omega/2\omega \Rightarrow x - 2/\omega = \sqrt{y + \omega/2\omega} \Rightarrow R_f = [-\omega/2\omega, +\infty)$

الف) $y = \frac{x^2 + 3}{x^2 - 2} \Rightarrow y(x^2 - 2) = x^2 + 3 \Rightarrow x^2 = \frac{2y + 3}{y - 1} \rightarrow \begin{matrix} \frac{3}{+} \\ \frac{1}{-} \end{matrix} \Rightarrow R_f = (-\infty, 1) \cup (\frac{3}{2}, +\infty)$
 $\rightarrow x = \pm\sqrt{\frac{2y + 3}{y - 1}}$

ب) $y = \frac{2|x| + 1}{|x| - 4} \Rightarrow y|x| - 2|x| = 2y + 1 \Rightarrow |x| = \frac{2y + 1}{y - 2} \rightarrow \begin{matrix} \frac{1}{+} \\ \frac{2}{-} \end{matrix} \Rightarrow R_f = (-\infty, \frac{1}{2}) \cup (2, +\infty)$

$y = \frac{1}{x^2 - 4x} \Rightarrow x^2 - 4x - \frac{1}{y} = 0 \xrightarrow{\Delta} \frac{4 \pm \sqrt{16 + \frac{4}{y}}}{2}$

$\Rightarrow 16 + \frac{4}{y} \geq 0 \Rightarrow \frac{1}{16} \leq \frac{y}{-4} \Rightarrow y \leq -\frac{1}{4} \Rightarrow R_f = (-\infty, -\frac{1}{4}]$

الف) $y = x^2 - 6x + 2 \quad ext \left| \begin{matrix} -6 \\ 2 \end{matrix} \right| = 9 \Rightarrow y_{min} = 9 - 18 + 2 = -7 \Rightarrow R_f = [-7, +\infty)$

ب) $y = -x^2 + 4x + 2 \quad ext \left| \begin{matrix} 4 \\ -1 \end{matrix} \right| = 4 \Rightarrow y_{max} = -4 + 16 + 2 = 14 \Rightarrow R_f = (-\infty, 14]$

$$\text{الف) } y = \sqrt{x^2 - 9x + 2} \Rightarrow y_{\min} = 4 - 18 + 2 = -12 \Rightarrow R_f = \sqrt{[-12, +\infty)} \Rightarrow R_f = [0, +\infty)$$

$-\frac{b}{2a} = \frac{9}{2}$

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$$\text{ب) } y = \sqrt{-x^2 + 4x + 10} \Rightarrow y_{\max} = -1 + 4 + 10 = 13 \Rightarrow R_f = \sqrt{(-\infty, 13]} \Rightarrow R_f = [0, \sqrt{13}]$$

$-\frac{b}{2a} = 2$

$$\text{الف) } y = x^5 + 3x^4 + 2x + 1 \rightarrow R_f = \mathbb{R}$$

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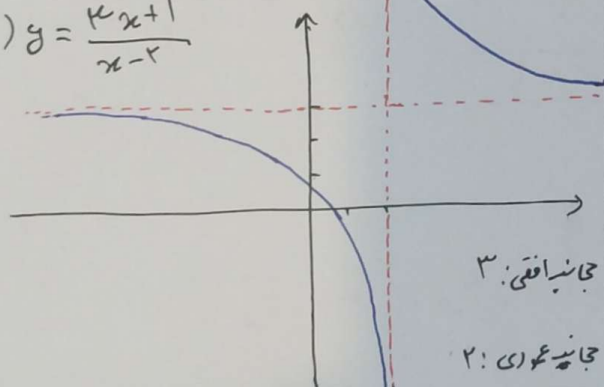
$$\text{ب) } y = \sqrt{x^4 + 4x^2 + 6x + 1} \rightarrow R_f = \sqrt{\mathbb{R}} = \mathbb{R}^+$$

$$\text{الف) } y = \frac{3x+1}{x-2} \quad a=3, c=1 \Rightarrow R_f = \mathbb{R} - \{3\}$$

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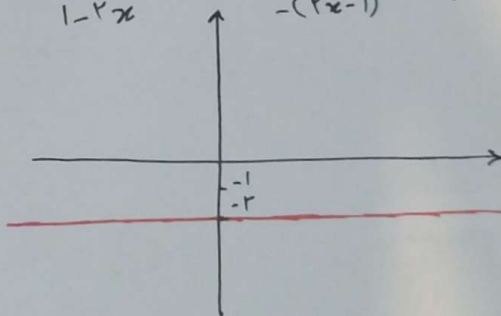
$$\text{ب) } y = \sqrt{\frac{4x+1}{x+3}} \quad a=4, c=1 \Rightarrow R_f = \sqrt{\mathbb{R}} - \{4\} = [0, +\infty) - \{4\}$$

$$\text{الف) } y = \frac{4x+1}{x-2}$$



$$\text{ب) } y = \frac{4x-2}{1-2x}$$

$$\star \frac{4x-2}{-(2x-1)} = -2$$



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$$\text{الف) } y = \cos^2 x + \frac{1}{\sin^2 x} \Rightarrow R_f = [2, +\infty)$$

$$\text{ب) } y = \sqrt{\frac{x^2+1}{x}} \rightarrow R_f = \mathbb{R}$$

☆ فرجه هم محدودیت ندارد

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