

الف) $x^2 = y + 5 \Rightarrow x = \pm\sqrt{y+5} \Rightarrow y \geq -5 \Rightarrow R_f = [-5, +\infty)$ ✓

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

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

ب) $y = (x^2 - 2/5)^2 - 5/10 \Rightarrow x - 2/5 = \sqrt{y + 5/10} \Rightarrow R_f = [-5/10, +\infty)$ ✓

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الف) $y = \frac{x^2 + 3}{x^2 - 2} \Rightarrow y(x^2 - 2) = x^2 + 3 \Rightarrow x^2 = \frac{y+3}{y-1} \Rightarrow x = \pm\sqrt{\frac{y+3}{y-1}} \Rightarrow R_f = (-\infty, 1) \cup (\frac{5}{4}, +\infty)$

۱۵ $R_f = (-\infty, \frac{5}{4}) \cup (1, +\infty)$

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

۱۵ $y = \frac{1}{x^2 - 4x} \Rightarrow x^2 - 4x - \frac{1}{y} = 0 \xrightarrow{\Delta} \frac{16 \pm \sqrt{16 + \frac{4}{y}}}{2} \Rightarrow x = \frac{4 \pm \sqrt{4 + \frac{1}{y}}}{2}$

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

$R_f = (-\infty, -\frac{1}{4}] \cup (0, +\infty)$

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الف) $y = x^2 - 6x + 2 \Rightarrow \text{ext} \left| \frac{-(-6)}{2} = 3 \right|_{y_{\min}} \Rightarrow y_{\min} = 9 - 18 + 2 = -7 \Rightarrow R_f = [-7, +\infty)$ ✓

ب) $y = -x^2 + 4x + 2 \Rightarrow \text{ext} \left| \frac{-4}{-2} = 2 \right|_{y_{\max}} \Rightarrow y_{\max} = -4 + 16 + 2 = 14 \Rightarrow R_f = (-\infty, 14]$ ✓

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

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

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

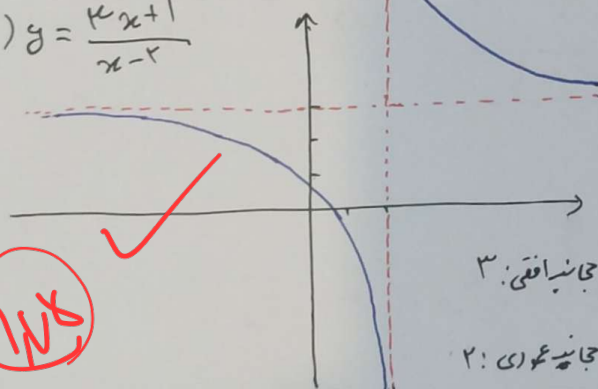
ب) $y = \sqrt{x^2 + 4x^2 + 6x + 1} \rightarrow R_f = \sqrt{\mathbb{R}} = \mathbb{R}^+$ ✓

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

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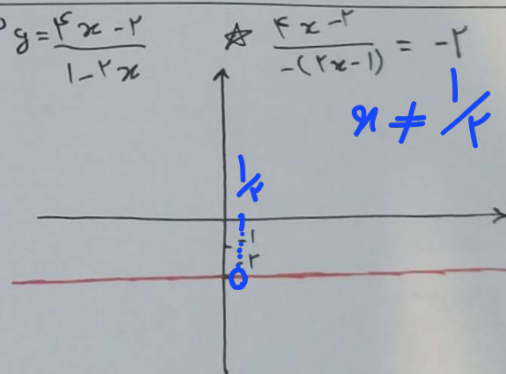
ب) $y = \sqrt{\frac{4x+1}{x+3}}$ $a=4, c=1 \Rightarrow R_f = \sqrt{\mathbb{R}} - \{4\} = [0, +\infty) - \{4\}$ ✓

الف) $y = \frac{4x+1}{x-2}$



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ب) $y = \frac{4x-2}{1-2x}$



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

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

☆ فرجه هم محدودیت ندارد
 $\begin{cases} a > 0 \\ a < 0 \end{cases} \rightarrow R_f = (-\infty, \sqrt{-2}] \cup [\sqrt{2}, +\infty)$