

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

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

الف) $y = x^2 - 4x + 4 + 2$ $y = (x-2)^2 + 2$ $(x-2)^2 = y - 2$
 $x - 2 = \sqrt{y-2}$ $x = \sqrt{y-2} + 2$ $y - 2 \geq 0$ $y \geq 2$ $R_f = [2, +\infty)$

ب) $\frac{x}{2} \rightarrow \left(\frac{-5}{2}\right)^2 = \frac{25}{4}$ $y = (x^2 - 5x + \frac{25}{4}) + 1 - \frac{25}{4}$
 $y = (x - \frac{5}{2})^2 - \frac{21}{4}$ $(x - \frac{5}{2})^2 \geq 0$ $y \geq -\frac{21}{4}$ $R_f = [-\frac{21}{4}, +\infty)$

الف) $y = \frac{x^2 + 3}{x^2 - 2} \Rightarrow yx^2 - 2y = x^2 + 3$ $yx^2 - x^2 = 3 + 2y$
 $x^2(y-1) = 3+2y$ $x = \pm \sqrt{\frac{3+2y}{y-1}}$ $R_f = (-\infty, -1.5] \cup (1, +\infty)$

ب) $y|x| - 4y = 2|x| + 1$ $y|x| - 2|x| = 1 + 4y$ $|x|(y-2) = 1+4y$
 $|x| = \frac{1+4y}{y-2}$ $R_f = (-\infty, -1.25] \cup (2, +\infty)$

$x^2 - 4x = \frac{1}{y}$ $x^2 - 4x - \frac{1}{y} = 0$

$\Delta = b^2 - 4ac = 16 - 4(-\frac{1}{y}) = 16 + \frac{4}{y}$ $\Delta \geq 0$ $\frac{16}{y} + \frac{4}{y} \geq 0$
 $y \leq -\frac{1}{4}$ $y > 0$
 $y_{\min} = -\frac{1}{4} = -0.25$ $R_f = (-\infty, -\frac{1}{4}] \cup (0, +\infty)$

الف) $a > 0 \rightarrow \begin{cases} x = -\frac{b}{2a} = \frac{4}{2} = 2 \\ y = 9 - 18 + 2 = -7 \end{cases}$ $R_f = [-7, +\infty)$

ب) $a < 0 \rightarrow \begin{cases} x = -\frac{b}{2a} = \frac{-4}{-2} = 2 \\ y = -4 + 18 + 2 = 16 \end{cases}$ $R_f = (-\infty, 16]$

الف) $a > 0 \rightarrow \begin{cases} \frac{-b}{2a} = \frac{4}{2 \cdot 3} \rightarrow x \\ y = -v \end{cases} \Rightarrow R_f = \sqrt{[-v, +\infty)} = \boxed{R_f = [0, +\infty)}$ ✓

ب) $a < 0 \rightarrow \begin{cases} x = \frac{-b}{2a} \\ y = 14 \end{cases} \Rightarrow R_f = \sqrt{(-\infty, 14]} = \boxed{(-\infty, \sqrt{14}]} = R_f$ ✓

الف) $R_f = 1R$ ✓ زیرا این لترین توان ندارد

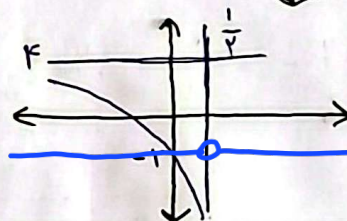
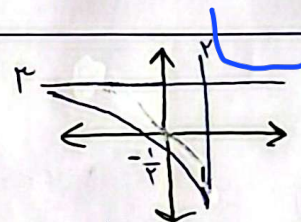
ب) $R_f = \sqrt{1R} \Rightarrow \boxed{R_f = [0, +\infty)}$ ✓

الف) تابع همبند است $a = 3, c = 1 \Rightarrow \boxed{R_f = R - \{3\}}$ ✓

ب) $R_f = \sqrt{(R)} - \sqrt{\{4\}} = \boxed{R_f = [0, +\infty) - \{2\}}$ ✓

الف) $\Rightarrow$ بیانه مخالف $\Rightarrow x \neq 2$ ✓
 " $\Rightarrow \frac{a}{c} \Rightarrow \frac{3}{1} \Rightarrow 3$ ✓
 $x=0 \Rightarrow \frac{0+1}{0-2} = \frac{1}{-2}$

ب) $\frac{1}{x} = \frac{1}{2}$ $y = -2, x \neq \frac{1}{2}$
 افقی $= 4$
 $x=0 = \frac{0-2}{1-0} = \frac{-2}{1} = -2$



الف) $R_f = [2, +\infty) \rightarrow$ نمی تواند منفی باشد زیرا توان ۲ دارد $a + \frac{1}{a} \xrightarrow{a \rightarrow 0} [2, +\infty)$ ✓

ب) $y = x + \frac{1}{x} \rightarrow$ فرجه زوج تاثیر ندارد $a + \frac{1}{a} \xrightarrow{a \rightarrow 0} [2, +\infty)$
 $a + \frac{1}{a} \xrightarrow{a \rightarrow 0} (-\infty, -2]$

$R_f = \sqrt{[-\infty, -2] \cup [2, +\infty)} \rightarrow R_f = (-\infty, \sqrt{-2}] \cup [\sqrt{2}, +\infty)$