

الف) $y = x^2 - 5 \rightarrow y + 5 = x^2 \rightarrow x = \pm \sqrt{y+5} \rightarrow y+5 \geq 0 \rightarrow y \geq -5 \rightarrow R_f = [-5, +\infty)$

ب) $y = x^3 + 1 \rightarrow y - 1 = x^3 \rightarrow x = \sqrt[3]{y-1}$ محدودیت زیر رادیکال با فرجه فرد ندارد. $R_f = \mathbb{R}$

الف) $y = x^2 - 4x + 6 \rightarrow y = (x-2)^2 + 2 \rightarrow y - 2 = (x-2)^2 \rightarrow x - 2 = \pm \sqrt{y-2} + 2 \rightarrow y - 2 \geq 0 \rightarrow y \geq 2 \rightarrow R_f = [2, +\infty)$

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

الف) $y = \frac{x^2 + 3}{x^2 - 2} \rightarrow yx^2 - 2y = x^2 + 3 \rightarrow yx^2 - x^2 = 2y + 3 \xrightarrow{\text{عالمه}} x^2(y-1) = 2y+3 \rightarrow x^2 = \frac{2y+3}{y-1} \rightarrow x = \pm \sqrt{\frac{2y+3}{y-1}} \rightarrow \frac{-3}{-1} < \frac{2y+3}{y-1} < \frac{3}{1} \rightarrow R_f = (-\infty, -\frac{3}{1}] \cup (1, +\infty)$

ب) $y = \frac{2|x|+1}{|x|-4} \rightarrow 2|x|+1 = y|x|-4y \rightarrow y|x|-2|x| = 4y+1 \rightarrow |x|(y-2) = 4y+1 \rightarrow |x| = \frac{4y+1}{y-2} \rightarrow \frac{4y+1}{y-2} \geq 0 \rightarrow \frac{-\frac{1}{4}}{-2} < \frac{4y+1}{y-2} < \frac{1}{1} \rightarrow R_f = (-\infty, -\frac{1}{4}] \cup (2, +\infty)$

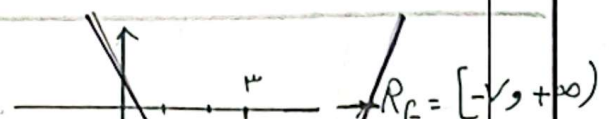
$yx^2 - 4xy = 1 \rightarrow yx^2 - 4yx - 1 = 0 \xrightarrow{\Delta=0} b^2 - 4ac \geq 0 \rightarrow$

$14y^2 + 4y \geq 0 \rightarrow$

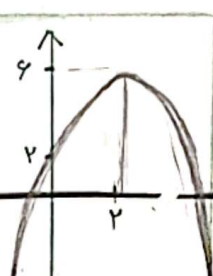
$4y(4y+1) \geq 0 \rightarrow \frac{-\frac{1}{4}}{-1} < \frac{4y+1}{y-2} < \frac{1}{1} \rightarrow$

$R_f = (-\infty, -\frac{1}{4}] \cup (2, +\infty)$

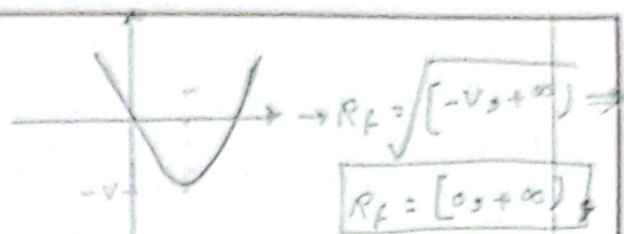
الف) $y = x^2 - 4x + 2 \rightarrow \text{Min} \left| \begin{array}{c} -\frac{b}{2a} = 2 \\ -4 \end{array} \right|$



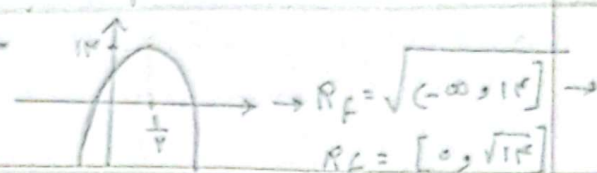
ب) $y = -x^2 + 4x + 2 \rightarrow \text{Max} \left| \begin{array}{c} -\frac{b}{2a} = 2 \\ 4 \end{array} \right|$
 $R_f = (-\infty, 4]$



الف) $y = \sqrt{x^2 - 4x + 4} \rightarrow \min \quad -\frac{b}{2a} = 2$
 $-v$



ب) $y = \sqrt{-x^2 + 4x + 10} \rightarrow \max \quad -\frac{b}{2a} = 2$
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الف) $y = x^2 + 3x^2 + 2x + 1 \xrightarrow{\text{نیزترین توان فرادست}} R_f = \mathbb{R}$

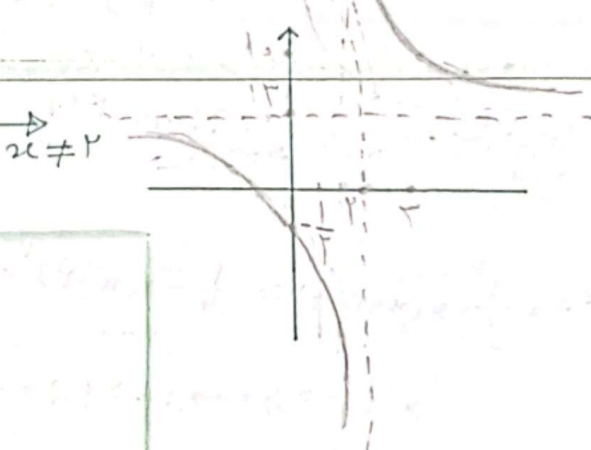
ب) $y = \sqrt{x^2 + 3x^2 + 2x + 1} \rightarrow R_f = \sqrt{R} = [0, +\infty)$
 نیزترین توان فرادست

الف) $y = \frac{3x+1}{x-2} \rightarrow R_f = \mathbb{R} - \left\{\frac{a}{c}\right\} \rightarrow R_f = \mathbb{R} - \{3\}$

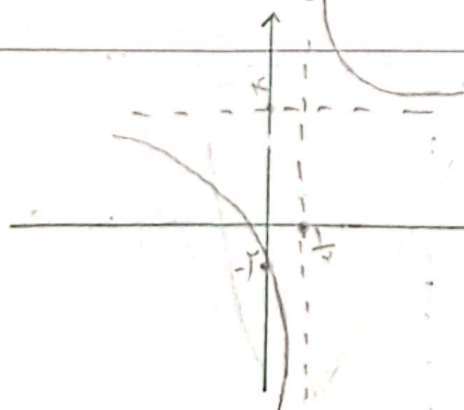
$y = \frac{ax+b}{cx+d}$

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

الف) $y = \frac{3x+1}{x-2}$
 $x=0 \rightarrow y = -\frac{1}{2}$
 $x=2 \rightarrow y=10$
 $x=3 \rightarrow y=10$



ب) $y = \frac{3x-2}{1-2x}$
 $x \neq \frac{1}{2}$
 $x=0 \rightarrow y = -2$



الف) $y = \cos^2 x + \frac{1}{\cos^2 x}$
 $y = a + \frac{1}{a} \begin{cases} \frac{a > 0}{a < 0} \end{cases} \begin{cases} [2, +\infty) \\ (-\infty, 2] \end{cases} \quad D_a = \mathbb{R} - \{0\} \rightarrow$
 $\cos^2 x = a$
 $y = a + \frac{1}{a} \xrightarrow{a > 0} R_f = [2, +\infty)$

ب) $y = \sqrt{\frac{x^2+1}{x}} \rightarrow y = \sqrt{x + \frac{1}{x}} \quad \frac{a=x}{D_a = \mathbb{R} - \{0\}}$
 $R_f = \sqrt{(-\infty, -2] \cup [2, +\infty)} \rightarrow$

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