

الف) $y = x^2 - 5 \Rightarrow y + 5 = x^2 \rightarrow x = \pm \sqrt{y+5} \Rightarrow y+5 \geq 0 \rightarrow y \geq -5 \Rightarrow R_f = [-5, \infty)$ ١

ب) $y = x^3 + 1 \Rightarrow x^3 = y - 1 \Rightarrow x = \sqrt[3]{y-1} \Rightarrow R_f = \mathbb{R}$ ٢

الف) $y = x^4 - 4x + 2 \Rightarrow y - x^4 + 4x - 2 = 0 \Rightarrow x = \frac{-b \pm \sqrt{\Delta}}{2a} \Rightarrow \Delta \geq 0 \Rightarrow 16 - 4(4-y) \geq 0 \Rightarrow y \geq 2 \Rightarrow R_f = [2, \infty)$ ٣
 $y \geq 2 \Rightarrow R_f = [2, \infty)$

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

الف) $y = \frac{x^2 - 3}{x^2 - 2} \Rightarrow y(x^2 - 2) = x^2 - 3 \Rightarrow x^2(y-1) = 2y-3 \Rightarrow x = \pm \sqrt{\frac{2y-3}{y-1}}$ ٤
 $\Rightarrow \frac{2y-3}{y-1} \geq 0 \Rightarrow R_f = (-\infty, -\frac{3}{2}] \cup (1, \infty)$

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

$y = \frac{1}{x^2 - 4x} \Rightarrow y(x^2 - 4x) = 1 \Rightarrow x = \frac{4y \pm \sqrt{16y^2 + 4y}}{2y} \Rightarrow \begin{cases} 16y^2 + 4y \geq 0 \Rightarrow y \neq 0 \\ 16y^2 + 4y \geq 0 \Rightarrow y(y+1) \geq 0 \end{cases} \Rightarrow R_f = (-\infty, -\frac{1}{4}] \cup (0, \infty)$ ٥

الف) $y = x^2 - 4x + 2 \Rightarrow \frac{-b}{2a} = \frac{4}{2} = 2 \Rightarrow R_f = [-2, \infty)$ ٦
 $4 - 16 + 2 = -10$

ب) $y = -x^2 + 4x + 2 \Rightarrow \frac{-b}{2a} = \frac{-4}{-2} = 2 \Rightarrow R_f = (-\infty, 4]$

الف) $y = \sqrt{x^2 - 4x + 2}$ $\Rightarrow$ $\frac{y}{x} = 2$ $\Rightarrow R_f = \sqrt{[-1, +\infty)} = [0, +\infty)$ ①

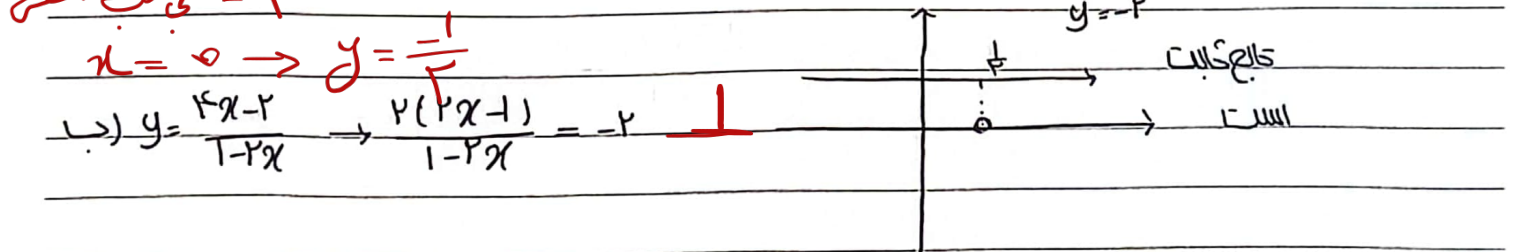
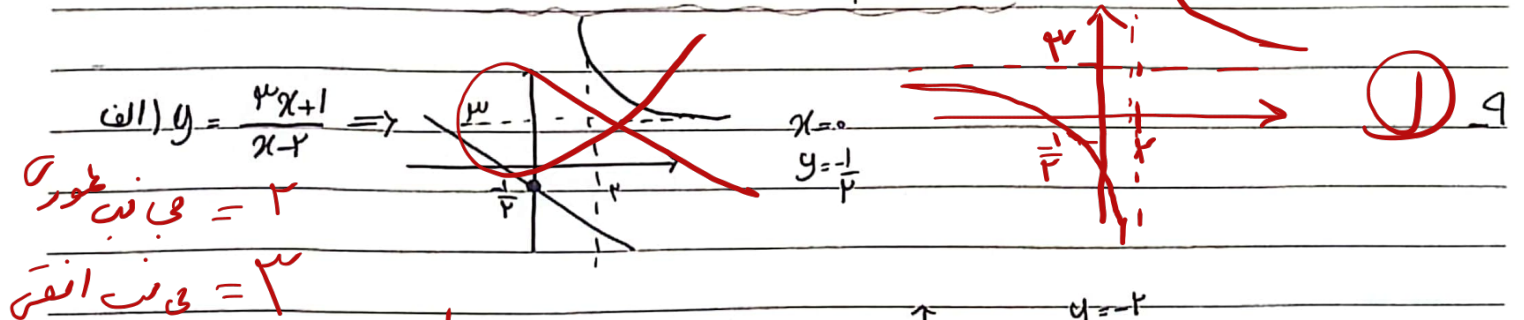
ج) $9 - 11 + 2 = -1$

الف) $y = \sqrt{-x^2 + 14x + 10}$ $\Rightarrow$ $\frac{-x}{-y} = 2$ $\Rightarrow R_f = \sqrt{(-\infty, 14]} = [0, \sqrt{14}]$

ج) $-x + 11 + 10 = 14$

الف) $y = x^4 + 3x^2 + 2x + 1 \Rightarrow R_f = R$ ج) $y = \sqrt{x^4 + 4x^2 + 4x + 1} \Rightarrow R_f = [0, +\infty)$ ②

الف) $y = \frac{3x+1}{x-2} \Rightarrow R = \left\{ \frac{c}{a} \right\} \Rightarrow R = \{3\}$ ج) $y = \sqrt{\frac{3x+1}{x+3}} \Rightarrow R_f = \sqrt{R - \{3\}} = [0, +\infty) - \{3\}$



الف) $y = \cos^2 x + \frac{1}{\cos^2 x} \Rightarrow R_f = [2, +\infty)$ ③

ج) $y = \sqrt[3]{\frac{x^3+1}{x}} = \sqrt[3]{x + \frac{1}{x}} = \sqrt[3]{(-\infty, -2] \cup [2, +\infty)} \Rightarrow R_f = (-\infty, \sqrt[3]{-2}] \cup [\sqrt[3]{2}, +\infty)$