

1
 الف) $y = x^2 - 5 \Rightarrow x^2 = y + 5 \Rightarrow x = \sqrt{y+5} \quad y+5 \geq 0 \Rightarrow y \geq -5$
 $R_f = [-5, +\infty)$

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

2
 الف) $y = x^2 - 4x + 2 \Rightarrow y = (x-2)^2 + 2 \Rightarrow y-2 = (x-2)^2 \Rightarrow x = 2 + \sqrt{y-2}$
 $y-2 \geq 0 \Rightarrow y \geq 2 \quad R_f = [2, +\infty)$
 ب) $y = x^2 - 5x + 1 \Rightarrow x^2 - 5x + 1 - y = 0 \Rightarrow \frac{5 \pm \sqrt{25 - 4(1-y)}}{2} = x$
 $25 - 4 + 4y \geq 0 \Rightarrow 21 + 4y \geq 0 \Rightarrow 0/21 \geq -y \Rightarrow y \geq -5/4 \quad R_f = [-5/4, +\infty)$

3
 الف) $y = \frac{x^2+3}{x^2-1} \Rightarrow yx^2 - 2y = x^2 + 3 \Rightarrow yx^2 - x^2 = 3 + 2y \Rightarrow x^2(y-1) = 3+2y$
 $\Rightarrow x^2 = \frac{3+2y}{y-1} \Rightarrow x = \sqrt{\frac{3+2y}{y-1}} \quad + \frac{-1/0}{-0-0} + \quad R_f = (-\infty, 1/0] \cup (1, +\infty)$
 ب) $y = \frac{x^2+1}{x^2-1} \Rightarrow y|x| - 2y = |x| + 1 \Rightarrow y|x| - |x| = 2y + 1 \Rightarrow |x|(y-2) = 2y+1$
 $|x| = \frac{2y+1}{y-2} \quad + \frac{-1/0}{+0-0} + \quad R_f = (-\infty, -1/2] \cup (2, +\infty)$

4
 $y = \frac{1}{x^2+4} \Rightarrow yx^2 - 4yx = 1 \Rightarrow yx^2 - 4yx - 1 = 0 \Rightarrow \frac{4y \pm \sqrt{16y^2 - 4(-1)y}}{2y} = 0$
 $16y^2 + 4y \geq 0 \Rightarrow y(16y+4) \geq 0 \quad + \frac{0}{+0-0} + \quad R_f = (-\infty, 0] \cup [1/4, +\infty)$

5
 الف) $y = x^2 - 4x + 2 \xrightarrow{\min} \begin{cases} \frac{y}{x} = 3 = \frac{-10}{2a} \\ -v \end{cases} \quad R_f = [-v, +\infty)$

ب) $y = -x^2 + 4x + 2 \xrightarrow{\max} \begin{cases} \frac{-f}{g} = v \\ \frac{-f}{g} \end{cases} \quad R_f = (-\infty, v]$

$$\text{ا) } y = \sqrt{x^2 - 4x + 4} \xrightarrow{\text{Min}} \begin{cases} \frac{y}{x} = 2 \\ -1 \end{cases} \quad R_f = [-1, +\infty) = [0, +\infty)$$

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$$\text{ب) } y = \sqrt{-x^2 + 4x + 1} \xrightarrow{\text{Max}} \begin{cases} \frac{-x}{-2} = 2 \\ 4 \end{cases} \quad R_f = [-\infty, 4] = [0, \sqrt{4}]$$

$$\text{ا) } y = x^5 + x^3 + 4x + 1 \Rightarrow R_f = \mathbb{R}$$

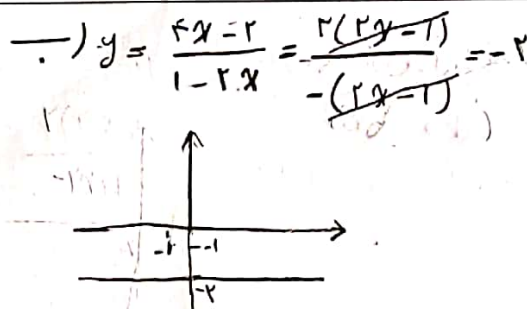
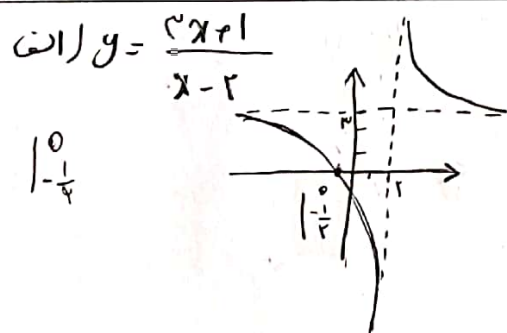
7

$$\text{ب) } y = \sqrt{x^6 + 4x^2 + 4x + 1} \Rightarrow R_f = [0, +\infty)$$

$$\text{ا) } y = \frac{x+1}{x-2} \Rightarrow R_f = \mathbb{R} - \{2\}$$

8

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



9

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

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

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