

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

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

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

$$\text{ب) } y = x^2 - 5x + 1 \Rightarrow x^2 - 5x + 1 - y = 0 \Rightarrow \Delta = (-5)^2 - 4(1-y) \Rightarrow 25 - 4 + 4y \geq 0$$

$$21 + 4y \geq 0 \Rightarrow \frac{-5, 25}{-4+} \Rightarrow y \geq -5, 25 \Rightarrow R_f = [-5, 25, +\infty)$$

$$\text{الف) } y = \frac{x^2 + 3}{x^2 - 2} \Rightarrow yx^2 - 2y = x^2 + 3 \Rightarrow x^2 - yx^2 + 3 + 2y = 0 \Rightarrow (1-y)x^2 + 3 + 2y = 0 \quad (3)$$

$$\Delta = 0^2 - 4(1-y)(3+2y) \Rightarrow +4(2y^2 + y - 3) \Rightarrow 4(y^2 + y - 6) = 4(y+3)(y-2) \begin{matrix} < \\ -1, 5 \\ +1 \end{matrix}$$

$$\Rightarrow \frac{-1, 5}{+3 - 4+} \Rightarrow -4(1-y)(3+2y) \geq 0 \Rightarrow y = \mathbb{R} - (-1, 5, 1] \Rightarrow R_f = \mathbb{R} - (-1, 5, 1]$$

$$\text{ب) } y = \frac{2|x| + 1}{|x| - 4} \Rightarrow y|x| - 4y = 2|x| + 1 \Rightarrow y|x| - 2|x| = 1 + 4y \Rightarrow (y-2)|x| = 1 + 4y \Rightarrow |x| = \frac{1+4y}{y-2} \Rightarrow \frac{1+4y}{y-2} \geq 0 \quad \frac{-2, 5}{+3 - 4+} \Rightarrow y = \mathbb{R} - (-2, 5, 2]$$

$$\Rightarrow R_f = \mathbb{R} - (-2, 5, 2]$$

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

$$\Delta = (-4y)^2 - 4(-y)$$

$$14y^2 + 4y \geq 0 \Rightarrow 4y(4y + 1) \geq 0 \Rightarrow \frac{-2 \pm \sqrt{4}}{+4 - 4} +$$

$$\Rightarrow y = R - (-0.25, 0) \Rightarrow R_f = R - (-0.25, 0)$$

$$\text{الف) } y = x^2 - 6x + 2 \Rightarrow \min \left| \frac{y}{x} \right| = 3 \quad y = 3^2 - 18 + 2 = -7$$

$$y \rightarrow -7 \Rightarrow R_f = [-7, +\infty)$$

$$\text{ب) } y = -x^2 + 4x + 2 \Rightarrow \max \left| \frac{-y}{x} \right| = 2 \quad y = -4 + 8 + 2 = 6$$

$$\Rightarrow R_f = (-\infty, 6]$$

$$\text{الف) } y = \sqrt{x^2 - 4x + 2} \Rightarrow \min \left| \frac{y}{x} \right| = 3 \quad y = 9 - 18 + 2 = -7 \Rightarrow R = [-7, +\infty)$$

$$\Rightarrow R_f = \sqrt{[-7, +\infty)} = [0, +\infty)$$

$$\text{ب) } \sqrt{-x^2 + 4x + 10} \Rightarrow \max \left| \frac{-y}{x} \right| = 2 \quad y = -4 + 8 + 10 = 14 \Rightarrow R = (-\infty, 14]$$

$$\Rightarrow R_f = \sqrt{(-\infty, 14]} = [0, \sqrt{14}]$$

$$\text{الف) } y = x^2 + 3x^2 + 2x + 1 \Rightarrow R_f = R$$

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

$$\text{الف) } y = \frac{3x+1}{x-2} \Rightarrow R_f = R - \{2\}$$

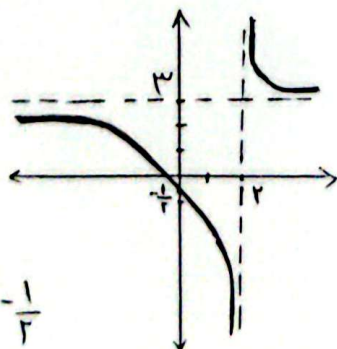
$$\text{ب) } y = \sqrt{\frac{4x+1}{x+3}} \Rightarrow R_f = \sqrt{R - \{4\}} = [0, +\infty) - \{2\}$$

$$\text{الف) } y = \frac{3x+1}{x-2}$$

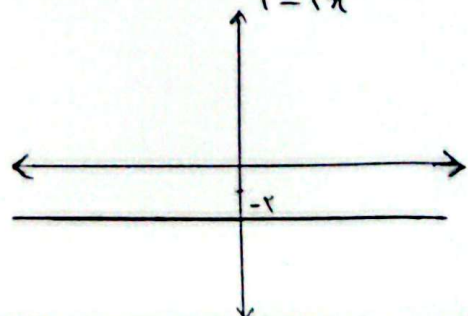
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$$\text{عرض از مبدأ} = \frac{0+1}{-2} = -\frac{1}{2}$$



$$\text{ب) } y = \frac{4x-2}{1-2x} \Rightarrow \frac{-2(-2x+1)}{1-2x} = -2$$



$$\text{a)} \quad y = \cos^r x + \frac{1}{\cos^r x} \Rightarrow \cos^r x > 0 \Rightarrow R_f = [r, +\infty)$$

10

$$\text{b)} \quad y = \sqrt[r]{\frac{x^r + 1}{x}} \rightarrow \frac{x^r}{x} + \frac{1}{x} = x + \frac{1}{x} \Rightarrow \begin{cases} x > 0 \Rightarrow [r, +\infty) \\ x < 0 \Rightarrow (-\infty, -r] \end{cases}$$

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