

الف) $y = x^2 - 5 \Rightarrow x^2 = y + 5 \Rightarrow x = \sqrt{y+5}$ $y+5 \geq 0 \Rightarrow y \geq -5$ $R_f = [-5, +\infty)$ ب) $y = x^3 + 1 \Rightarrow x^3 = y - 1 \Rightarrow x = \sqrt[3]{y-1}$ $R_f = \mathbb{R}$	۱
الف) $y = x^2 - 4x + 2 \Rightarrow y = (x-2)^2 + 2 \Rightarrow y-2 = (x-2)^2 \Rightarrow x = 2 + \sqrt{y-2}$ $y-2 \geq 0 \Rightarrow y \geq 2$ $R_f = [2, +\infty)$ ب) $y = x^2 - 5x + 1 \Rightarrow x^2 - 5x + 1 - y = 0 \Rightarrow \frac{5 \pm \sqrt{25 - 4(1-y)}}{2} = x$ $25 - 4 + 4y \geq 0 \Rightarrow 21 + 4y \geq 0 \Rightarrow 0/21 \geq -y \Rightarrow y \geq -5.25$ $R_f = [-5.25, +\infty)$	۲
الف) $y = \frac{x^2+3}{x^2-1} \Rightarrow yx^2 - 2y = x^2 + 3 \Rightarrow yx^2 - x^2 = 3 + 2y \Rightarrow x^2(y-1) = 3+2y$ $\Rightarrow x^2 = \frac{3+2y}{y-1} \Rightarrow x = \sqrt{\frac{3+2y}{y-1}}$ $R_f = (-\infty, 1/5] \cup (1, +\infty)$ ب) $y = \frac{x^2+1}{x^2-1} \Rightarrow y x - 2y = x + 1 \Rightarrow y x - x = 2y + 1 \Rightarrow x (y-2) = 2y+1$ $x = \frac{2y+1}{y-2}$ $R_f = (-\infty, -\frac{1}{2}] \cup (2, +\infty)$	۳
$y = \frac{1}{x^2-4x} \Rightarrow yx^2 - 4yx = 1 \Rightarrow yx^2 - 4yx - 1 = 0 \Rightarrow \frac{4y \pm \sqrt{16y^2 - 4(-1)y}}{2y} = 0$ $16y^2 + 4y \geq 0 \Rightarrow y(16y+4) \geq 0$ $R_f = (-\infty, 0] \cup [\frac{1}{4}, +\infty)$ $\hookrightarrow 4y(4y+1) \geq 0$ $R_f = (-\infty, -\frac{1}{4}] \cup (0, +\infty)$	۴
الف) $y = x^2 - 4x + 2 \xrightarrow{\min} \begin{cases} \frac{y}{x} = 3 = \frac{-10}{2a} \\ -4 \end{cases}$ $R_f = [-4, +\infty)$ ب) $y = -x^2 + 4x + 2 \xrightarrow{\max} \begin{cases} \frac{-f}{4} = 2 \\ -2 \end{cases}$ $R_f = (-\infty, 2]$	۵

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

(15)

$$\text{ب) } y = \sqrt{-x^2 + 4x + 1} \xrightarrow{\text{Max}} \begin{cases} \frac{-x}{-2} = 2 \\ x = 4 \end{cases} \quad R_f = \sqrt{[-\infty, 4]} = [0, \sqrt{17}]$$

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

$$\text{ا) } y = x^2 + 2x + 1 \Rightarrow R_f = \mathbb{R} \quad \checkmark$$

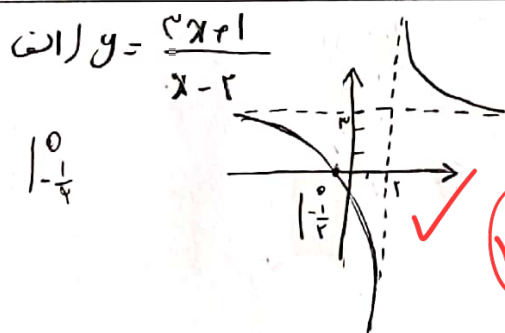
$$\text{ب) } y = \sqrt{x^2 + 4x + 1} \Rightarrow R_f = [0, +\infty) \quad \checkmark$$

(2)

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

(15)

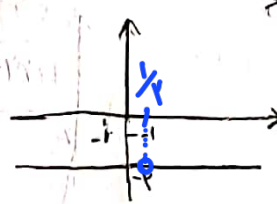
$$\text{ب) } y = \sqrt{\frac{x+1}{x+2}} \Rightarrow R_f = \sqrt{\mathbb{R} - \{2\}} \Rightarrow R_f = [0, +\infty) - \{2\}$$



(1, 1/5)

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

$x \neq \frac{1}{2}$



$$\text{ا) } y = \cos^2 x \Rightarrow R_f = [0, +\infty) \quad \checkmark$$

(1/5)

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

$$R_f = (-\infty, \sqrt[3]{-2}] \cup [\sqrt[3]{2}, +\infty)$$