

الف) $x^3 - 3x^2 + 3x \Rightarrow R_f = \mathbb{R}$ $(x+1)^3 + 1 \Rightarrow y-1 = (x-1)^3 \rightarrow x = \sqrt[3]{y-1} + 1$	۱
ب) $y = \frac{1}{x^2 - 2x} \Rightarrow yx^2 - 2xy = 1 \Rightarrow yx^2 - 4xy - 1 = 0 \Rightarrow \Delta = 4y^2 - (4)(y)(-1) = 4y^2 + 4y$ $4y^2 + 4y \geq 0 \Rightarrow y(y+1) \geq 0 \Rightarrow y = -1 \Rightarrow R_f = [0, +\infty) \cup [-1, -\infty)$	۱
الف) $y = x^2 - 4x + 1, x = \frac{b}{2a} = \frac{4}{2} = 2 \Rightarrow R_f = [2, +\infty)$ $y = 7$	۲
ب) $y = -2x^2 + 4x + 3, x = \frac{b}{2a} = \frac{-4}{-2} = 2 \Rightarrow R_f = (-\infty, 11]$ $y = 11$	۲
ج) $y = \sqrt{x^2 - 4x - 3}, x = \frac{b}{2a} = \frac{4}{2} = 2 \Rightarrow R_f = \sqrt{[-4, +\infty)} = [0, +\infty)$ $y = -1$	۲
د) $y = \sqrt{4x - 2x^2}, x = \frac{b}{2a} = \frac{-4}{-2} = 2 \Rightarrow R_f = \sqrt{[-\infty, 9]} = [0, 3]$ $y = 9$	۲
الف) $y = x^3 - 6x^2 + 9x + 1, R_f = \mathbb{R}$ ب) $y = x^4 - 4x^3 + 6x^2 + 2, R_f = \mathbb{R}$	۳
ج) $y = \sqrt{x^4 - 4x^3 + 6x^2 + 1}, R_f = [0, +\infty)$ د) $y = (\underbrace{x^4 - 4x^3 + 6x^2 + 1}_{\mathbb{R}})^2, R_f = [0, +\infty)$	۳
الف) $y = \frac{4x+1}{x-2}, -4 \neq 1, 1 \neq 0 \Rightarrow R_f = \mathbb{R} - \{2\}$	۴
ب) $y = \frac{4x+1}{x+1}, 4 \neq 1, 1 \neq 0 \Rightarrow R_f = \mathbb{R} - \{2\}$	۴
الف) $y = \sqrt{\frac{4x+1}{x+1}}, 4 \neq 1, 1 \neq 0 \Rightarrow R_f = [0, +\infty) - \{2\}$	۵
ب) $y = \sqrt{\frac{4x+1}{x-2}}, 4 \neq -1, -1 \neq 0 \Rightarrow R_f = [0, +\infty) - \{2\} \Rightarrow R_f = [0, +\infty)$	۵

$$y = \frac{x-3}{x+1}$$

$$x+1 > 0$$



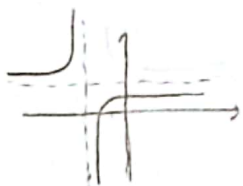
مقابلتي قائم $x = -1$ = الخط المائل

مقابلتي افقي $y = 1$

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$$y = \frac{x-1}{x+2}$$

$$x+2 > 0$$



مقابلتي قائم $x = -2$

مقابلتي افقي $y = 1$

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$$y = \sin x + \frac{1}{\sin x} \Rightarrow -1 \leq \sin x \leq 1 \Rightarrow R_f = (-\infty, -2] \cup [2, +\infty)$$

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

$$2) \sqrt[3]{x^2+1} \Rightarrow \sqrt[3]{x^2} \neq 0 \Rightarrow R_f = (-\infty, -1] \cup [1, +\infty)$$

$$3) \sqrt{x} + \frac{1}{\sqrt{x}} \Rightarrow R_f = [1, +\infty)$$

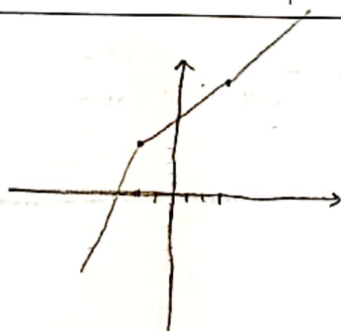
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$$y = \frac{x^2+1}{x^2+3} \rightarrow x^2 \rightarrow \min = 0 \Rightarrow 0 + \frac{1}{3} = \frac{1}{3} \Rightarrow R_f = [\frac{1}{3}, +\infty)$$

$$y = \frac{x^2+0}{x^2+4} \rightarrow x^2 \rightarrow \min = 0 \Rightarrow \frac{0}{4} = 0 \Rightarrow R_f = [0, +\infty)$$

$$y = |x-2| + |3x+4|$$

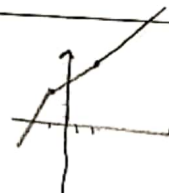
$$\begin{cases} -5x-1 & x < -\frac{4}{3} \\ 4x+6 & -\frac{4}{3} < x < 2 \\ 4x+1 & x > 2 \end{cases}$$



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$$y = |x-1| + |2x+2|$$

$$\begin{cases} -3x & x < -1 \\ x+2 & -1 \leq x \leq 2 \\ 3x & x > 2 \end{cases}$$



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$$y = |2x-2| - |x+1|$$

$$\begin{cases} -x-1 & x < -1 \\ -3x & -1 < x < 1 \\ x-3 & x > 1 \end{cases}$$

