

الف) $x^4 - 1^2 x^2 + 1^2 x + 1 - 1 = (x-1)^2 + 1 \rightarrow y = (x-1)^2 + 1$
 $\Rightarrow y-1 = (x-1)^2 \Rightarrow \sqrt{y-1} = x-1 \rightarrow x = \sqrt{y-1} + 1 \Rightarrow R_f = \mathbb{R}$

ب) $\frac{1}{x^2-1} = y \Rightarrow yx^2 - 1yx = 1 \Rightarrow yx^2 - 2xy - 1 = 0 \Rightarrow \Delta \geq 0$
 $\Delta = b^2 - 4ac = (-2y)^2 - 4(y)(-1) = 4y^2 + 4y \rightarrow 4y^2 + 4y \geq 0 \rightarrow y^2 + y \geq 0 \Rightarrow \frac{-1 \pm \sqrt{1+4}}{2}$
 $R_f = (-\infty, -1] \cup (0, +\infty) \quad y \neq 0$

الف) $\frac{-b}{2a} = \frac{f}{2} = 2 \rightarrow y = (2)^2 - f(2) + 1 = 4 - 1 + 1 = 4, a > 0 \Rightarrow R_f = [4, +\infty)$
 ب) $\frac{-b}{2a} = \frac{-4}{-2} = 2 \rightarrow y = -(2)^2 + 4(2) + 1 = -4 + 8 + 1 = 5, a < 0 \Rightarrow R_f = (-\infty, 5]$
 ج) $\frac{-b}{2a} = \frac{f}{2} = 2 \rightarrow y = (2)^2 - f(2) - 1 = 4 - 1 - 1 = 2, a > 0 \Rightarrow \sqrt{[-1, +\infty)} = [0, +\infty) = R_f$
 د) $\frac{-b}{2a} = \frac{-4}{-2} = 2 \rightarrow y = 4(2) - (2)^2 = 8 - 4 = 4, a < 0 \Rightarrow \sqrt{(-\infty, 4]} = [0, 2] = R_f$

الف) $\Rightarrow R_f = \mathbb{R}$ (بزرگترین توان فرد)
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 د) $\Rightarrow R_f = [0, +\infty)$ (بزرگترین توان فرد و صفر)

الف) $\Rightarrow R_f = \mathbb{R} - \left\{ \frac{a}{c} \right\} = \mathbb{R} - \left\{ 2 \right\}$ (تابع دورانی)

ب) $\Rightarrow R_f = \mathbb{R} - \left\{ \frac{a}{c} \right\} = \mathbb{R} - \left\{ 2 \right\}$ (تابع دورانی)

الف) $\frac{2x+4}{x+1} \Rightarrow R = \mathbb{R} - \left\{ 2 \right\} \Rightarrow \sqrt{\mathbb{R} - \left\{ 2 \right\}} = [0, +\infty) - \left\{ \sqrt{2} \right\} = R_f$ (تابع دورانی)

ب) $\frac{2x+1}{1-x} \Rightarrow R = \mathbb{R} - \left\{ -2 \right\} \Rightarrow \sqrt{\mathbb{R} - \left\{ -2 \right\}} = [0, +\infty) = R_f$ (تابع دورانی)

الف) $\begin{cases} \text{موجب قائم} \Rightarrow x+1=0 \Rightarrow x=-1 \\ \text{موجب اقتر} = \frac{a}{c} = 1 \end{cases}$

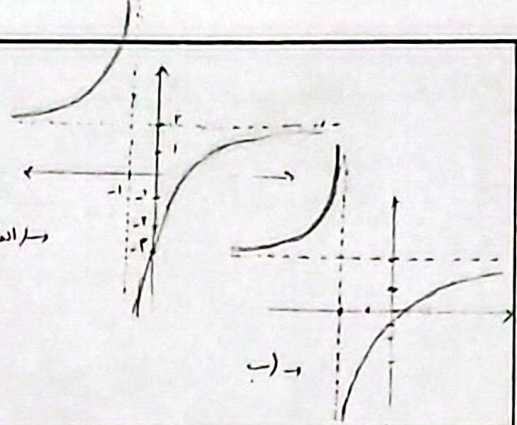
$x=0 \rightarrow y=-3$

ب) $\begin{cases} \text{موجب قائم} \rightarrow x+2=0 \rightarrow x=-2 \\ \text{موجب اقتر} = \frac{a}{c} = 2 \end{cases}$

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$x=0 \rightarrow y = -\frac{1}{2}$

مراتب



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الف) $R_f = (-\infty, -2] \cup [2, +\infty) \rightarrow (\sin x > 0 \text{ و } \sin x < 0)$

ب) $\frac{x^4+1}{x^3} = x + \frac{1}{x^3} \Rightarrow R_f = (-\infty, -2] \cup [2, +\infty) \rightarrow (x^3 > 0 \text{ و } x^3 < 0)$

ج) $\sqrt{x} + \frac{1}{\sqrt{x}} \Rightarrow R_f = (-\infty, -2] \cup [2, +\infty) \rightarrow (\sqrt{x} > 0 \text{ و } \sqrt{x} < 0)$

د) $\sqrt{x} + \frac{1}{\sqrt{x}} \Rightarrow R_f = [2, +\infty) \rightarrow (\sqrt{x} > 0)$

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الف) $\text{بردار} : x^2 + \frac{1}{x^2} : \text{نقطه} = 2 + \frac{1}{2} = \frac{5}{2} \quad (g(x) \text{ مشتق} = \frac{1}{x^3})$

$R_f = \text{بردار} : (x^2 + \frac{1}{x^2}) - 2 \Rightarrow \frac{5}{2} - 2 = \frac{1}{2} \rightarrow R_f = [\frac{1}{2}, +\infty)$

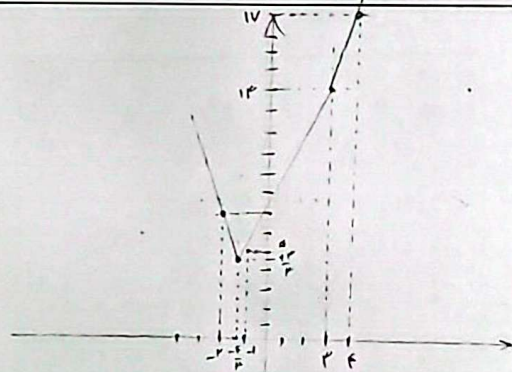
ب) $\frac{x^2+1}{\sqrt{x^2+1}} = \sqrt{x^2+1} + \frac{1}{\sqrt{x^2+1}} \rightarrow \text{نقطه} = 2 + \frac{1}{2} = \frac{5}{2} \Rightarrow R_f = [\frac{5}{2}, +\infty)$

$(\sqrt{x^2+1} > 0)$

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$\begin{cases} x-3+3x+6 = 4x+3 & x > 3 \\ 3-x+3x+6 = 2x+9 & -\frac{1}{3} \leq x \leq 3 \\ 3-x-6-3x = -4x-3 & x < -\frac{1}{3} \end{cases}$

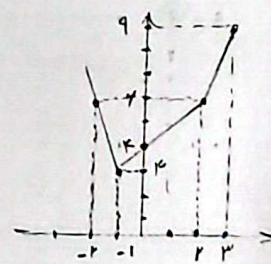
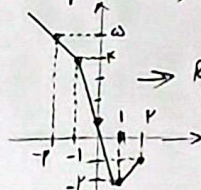
x	3	4	$-\frac{1}{3}$	-1	-2
y	13	14	$\frac{14}{3}$	5	4



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الف) $\begin{cases} x-2+2x+2 = 3x & x > 2 \\ 2x+2+2-x = x+4 & -1 \leq x \leq 2 \\ 2-x-2x-2 = -3x & x < -1 \end{cases} \Rightarrow R_f = [2, +\infty)$

ب) $\begin{cases} 2x-2-x-1 = x-3 & x > 1 \\ 2-2x-x-1 = -3x+1 & -1 \leq x \leq 1 \\ 2-2x+x+1 = 3-x & x < -1 \end{cases} \Rightarrow R_f = [-1, +\infty)$



x	2	1	0	-1	-2
y	4	3	4	3	4

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