

الف) $y = x^3 - 3x^2 + 3x = (x-1)^3 + 1 = y \Rightarrow y-1 = (x-1)^3 \Rightarrow x-1 = \sqrt[3]{y-1}$ (1)

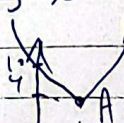
$\Rightarrow x = \sqrt[3]{y-1} + 1 \rightarrow R_f = \mathbb{R}$

ب) $y = \frac{1}{x^2 - 4} \rightarrow y(x^2 - 4) = 1 \Rightarrow x(yx - 4) = 1$

$\Rightarrow x = \frac{1}{yx - 4} \quad (9)$

الف) $y = x^2 - 4x + 1 \rightarrow \frac{-b}{2a} = (2), \frac{-\Delta}{4a} = (4) \rightarrow A = (2, 4)$ (2)

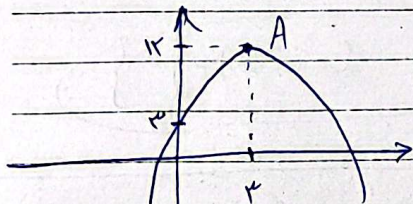
ب) $y = x^2 - 4x + 1$



و جنبه $\rightarrow$ است $\rightarrow$ min

$\Rightarrow R_f = [4, +\infty)$

ب) $y = -x^2 + 4x + 4 \rightarrow \frac{-b}{2a} = \frac{-4}{-2} = (2), \frac{-\Delta}{4a} = (12) \rightarrow A = (2, 12)$



و جنبه $\rightarrow$ است $\rightarrow$ max

$\Rightarrow R_f = (-\infty, 12]$

ج) $y = \sqrt{x^2 - 4x - 3} \rightarrow x^2 - 4x - 3 = y^2 \rightarrow \frac{-b}{2a} = (2), \frac{-\Delta}{4a} = (-7)$ (3)

و جنبه $\rightarrow$ است $\rightarrow$ min

$\rightarrow R_y = x^2 - 4x - 3 = [-7, +\infty) \rightarrow R_y = \sqrt{x^2 - 4x - 3} = [0, +\infty)$

د) $y = \sqrt{4x - x^2} \rightarrow \begin{cases} a < 0 \Rightarrow \text{است max} \\ \frac{-b}{2a} = 2, \frac{-\Delta}{4a} = 4 \end{cases} \rightarrow R_y = 4x - x^2 = (-\infty, 4]$

$\Rightarrow R_y = \sqrt{4x - x^2} = \sqrt{(-\infty, 4]} = [0, 2]$

الف) $y = x^3 - 3x^2 + 2x + 1 \rightarrow$ بازه‌های توان فرد است $\rightarrow R_f = \mathbb{R}$ (۳)

ب) $y = x^4 - 4x^3 + 3x^2 + 2 \rightarrow$ بازه‌های توان فرد است $\rightarrow R_f = \mathbb{R}$

ج) $y = \sqrt{x^4 - 4x^3 + 3x^2 + 1} \rightarrow \sqrt{\mathbb{R}} = [0, +\infty) = R_f$

د) $y = (x^3 - 3x^2 + 2x + 1)^2 \rightarrow (\mathbb{R})^2 = [0, +\infty) = R_f$

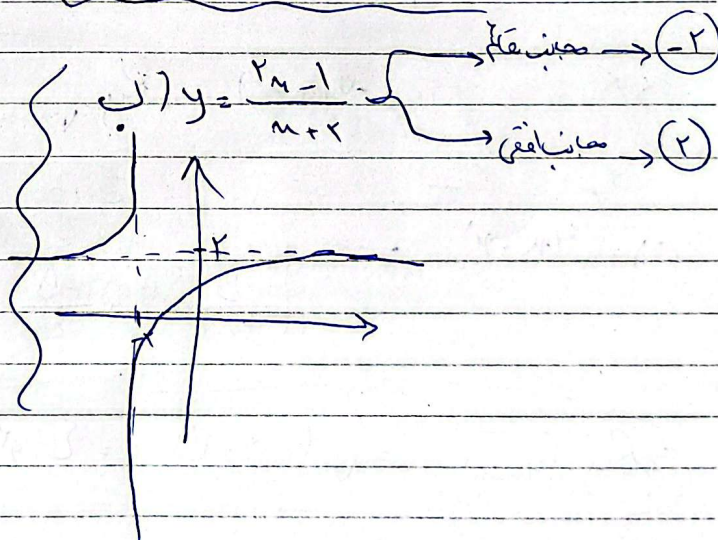
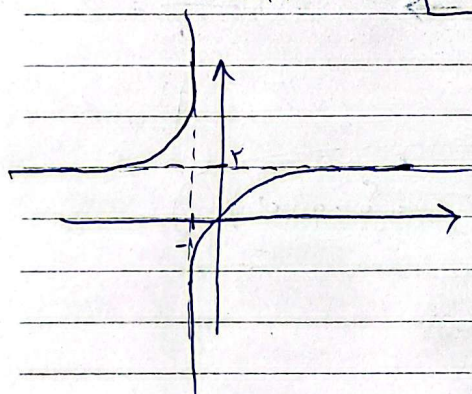
الف) $y = \frac{x^3 + 1}{x - 2} \Rightarrow R_f = \mathbb{R} - \{2\}$ (۴)

ب) $y = \frac{x^3 + 1}{x + 1} \Rightarrow \mathbb{R} - \{2\} = R_f$

الف) $y = \sqrt{\frac{x^3 + 1}{x + 1}} \rightarrow R_f = [0, +\infty) - \{2\}$ (۵)

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

الف) $y = \frac{x^3 - 1}{x + 1}$
 $\rightarrow$ ضرایب فردی $\rightarrow$ (۱)
 $\rightarrow$ ضرایب زوجی $\rightarrow \frac{a}{c} = (2)$



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

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

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

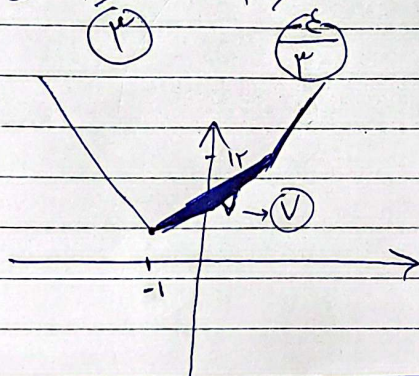
$$د) y = \sqrt{x} + \frac{1}{\sqrt{x}} \rightarrow R_f = [2, +\infty)$$

$$الف) y = \frac{x^2 + 1}{x^2 + x} \rightarrow R_f = [2, +\infty)$$

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$$ب) \frac{x^2 + \varepsilon}{\sqrt{x^2 + \varepsilon}} = \frac{x^2 + \varepsilon + 1}{\sqrt{x^2 + \varepsilon}} = \sqrt{x^2 + \varepsilon} + \frac{1}{\sqrt{x^2 + \varepsilon}} \rightarrow R_f = [2, +\infty)$$

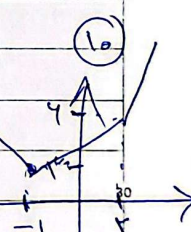
$$y = |x - 1| + |x + 1|$$



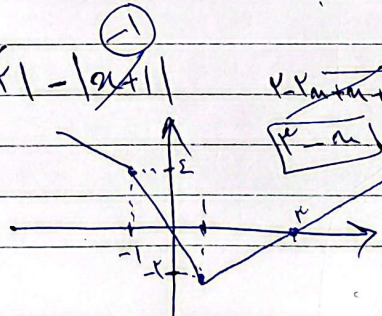
$x < -1$	$-1 < x < 1$	$x > 1$
$-x - 1$	$-x + 1 + x + 1 = 2$	$x - 1 + x + 1 = 2x$
$-x - 1$	2	$2x$

$$الف) y = |x - 1| + |x + 1|$$

$x < -1$	$-1 < x < 1$	$x > 1$
$-x - 1$	$-x + 1 + x + 1 = 2$	$x - 1 + x + 1 = 2x$
$-x - 1$	2	$2x$



$$ب) y = |x - 1| - |x + 1|$$



$x < -1$	$-1 < x < 1$	$x > 1$
$-x - 1$	$-x + 1 - x - 1 = -2x$	$x - 1 - x - 1 = -2$
$-x - 1$	$-2x$	-2