

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

$$R_f = (-\infty, +\infty)$$

ب) $y = \frac{1}{x^2-2x} \rightarrow yx^2-2xy-1=0 \xrightarrow{\Delta \geq 0} 4y^2-4y \geq 0 \rightarrow 4y(y-1) \geq 0 \rightarrow \frac{-1}{4} \leq y \leq \frac{1}{4} \rightarrow R_f = (-\infty, -\frac{1}{4}] \cup [\frac{1}{4}, +\infty)$

الف) $y = x^2 - 4x + 10$

$$\frac{-b}{2a} = \frac{4}{2} = 2 \rightarrow y_{\min} = 2$$

$$R_f = [2, +\infty)$$

ج) $y = \sqrt{x^2 - 4x - 3}$

$$\frac{-b}{2a} = \frac{2}{1} = 2 \rightarrow y_{\min} = [-1, +\infty) \rightarrow \sqrt{x^2 - 4x - 3} \rightarrow R_f = [0, +\infty)$$

د) $y = \sqrt{4x - x^2}$

$$\frac{-b}{2a} = \frac{2}{-1} = -2 \rightarrow y_{\max} = 2 \rightarrow R = [-2, 2] \rightarrow \sqrt{4x - x^2} \rightarrow R_f = [0, 2]$$

ب) $y = -x^2 + 4x + 3$

$$\frac{-b}{2a} = 2 \rightarrow y_{\max} = 11$$

$$R_f = (-\infty, 11]$$

ج) $y = \sqrt{x^4 - 4x^2 + 5}$

$$R_f = [0, +\infty)$$

د) $y = (x^4 - 4x^2 + 5)^2$

$$R_f = [0, +\infty)$$

الف) $y = x^3 - 2x^2 + 2x + 1$

$$R_f = \mathbb{R}$$

ب) $y = x^4 - 4x^2 + 3x + 1$

$$R_f = \mathbb{R}$$

الف) $y = \frac{x^2+1}{x-2}$

$$R_f = \mathbb{R} - \{2\}$$

ب) $y = \frac{x^2+1}{x+1}$

$$R_f = \mathbb{R} - \{-1\}$$

$$y = \sqrt{\frac{x^2+4}{x+1}}$$

$$\frac{x^2+4}{x+1} \rightarrow R_f = \mathbb{R} - \{-1\}$$

$$\sqrt{\frac{x^2+4}{x+1}} \rightarrow R_f = [0, +\infty) - \{-1\}$$

ب) $y = \sqrt{\frac{x^2+1}{x-2}}$

$$\frac{x^2+1}{x-2} \rightarrow R_f = \mathbb{R} - \{2\}$$

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

عقده تعریف نشده

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

ب) $y = \frac{x^4 + 1}{x^3} \rightarrow \frac{x^4}{x^3} + \frac{1}{x^3} \rightarrow x + \frac{1}{x^3} \rightarrow R_y = (-\infty, -1] \cup [1, +\infty)$

ج) $y = \frac{\sqrt[3]{x^3 + 1}}{\sqrt{x}} \rightarrow \frac{\sqrt[3]{x^3}}{\sqrt{x}} + \frac{1}{\sqrt{x}} \rightarrow \sqrt{x} + \frac{1}{\sqrt{x}} \rightarrow R_y = (-\infty, -1] \cup [1, +\infty)$

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

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الف) $y = \frac{x^2 + 1}{x^2 + 3} \rightarrow \frac{x^2}{x^2 + 3} + \frac{1}{x^2 + 3} \Rightarrow \frac{x^2 + 3}{x^2 + 3} + \frac{1}{x^2 + 3} - 3 \rightarrow R_f = [\frac{10}{3} - 3, +\infty) \rightarrow R_f = [\frac{4}{3}, +\infty)$

ب) $y = \frac{x^2 + \epsilon + 1}{\sqrt{x^2 + \epsilon}} = \frac{x^2 + \epsilon + 1}{\sqrt{x^2 + \epsilon}} = \sqrt{x^2 + \epsilon} + \frac{1}{\sqrt{x^2 + \epsilon}} \rightarrow R_y = [\frac{4}{\epsilon}, +\infty)$

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الف) $y = |n - 2| + |2n + 2|$

$R_f = [4, +\infty)$

-1	2
-3n	3n
n + 4	

ب) $|2n - 2| - |n + 1|$

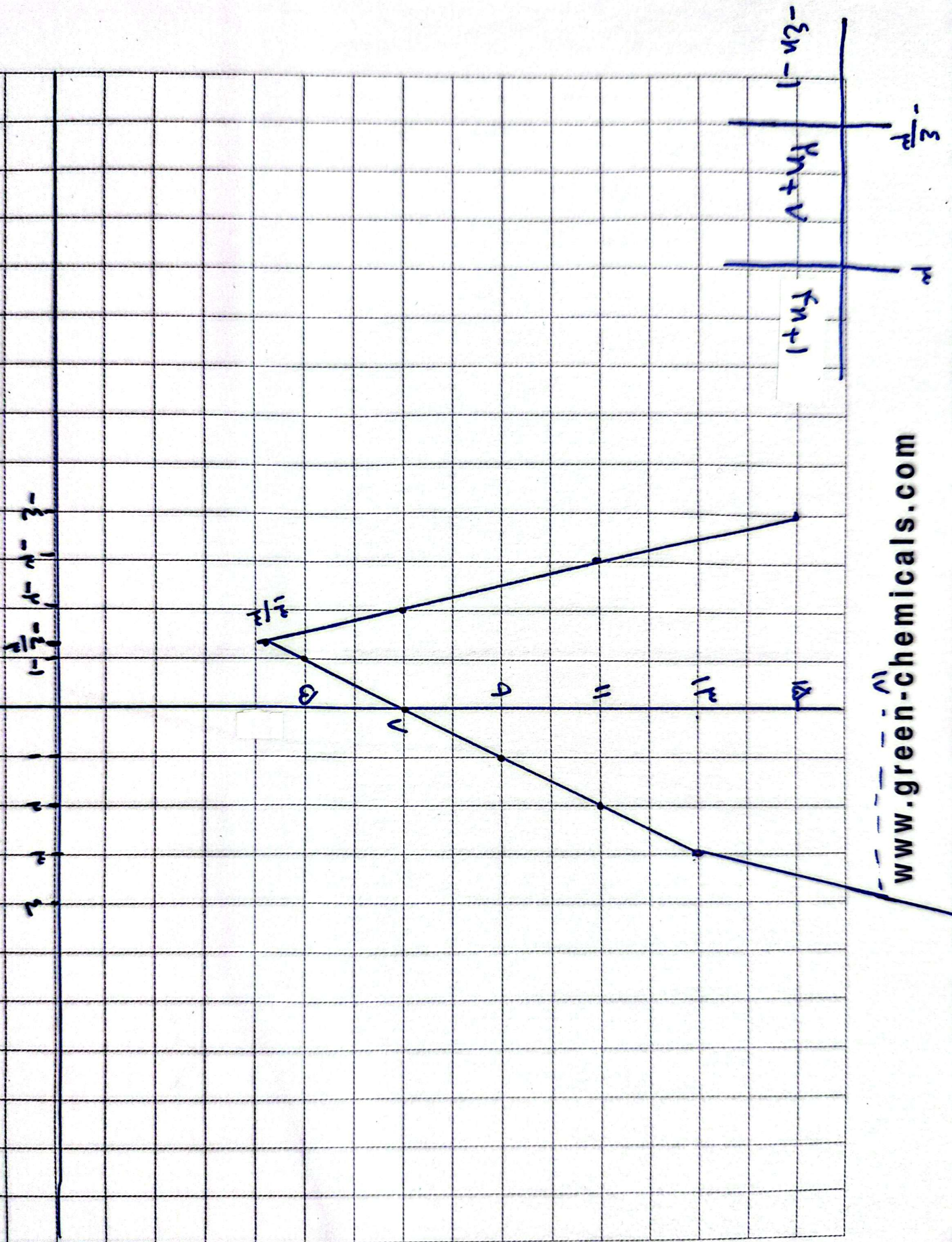
$R_f = [-2, +\infty)$

-1	1
-n + 3	-n + 1
x - 3	

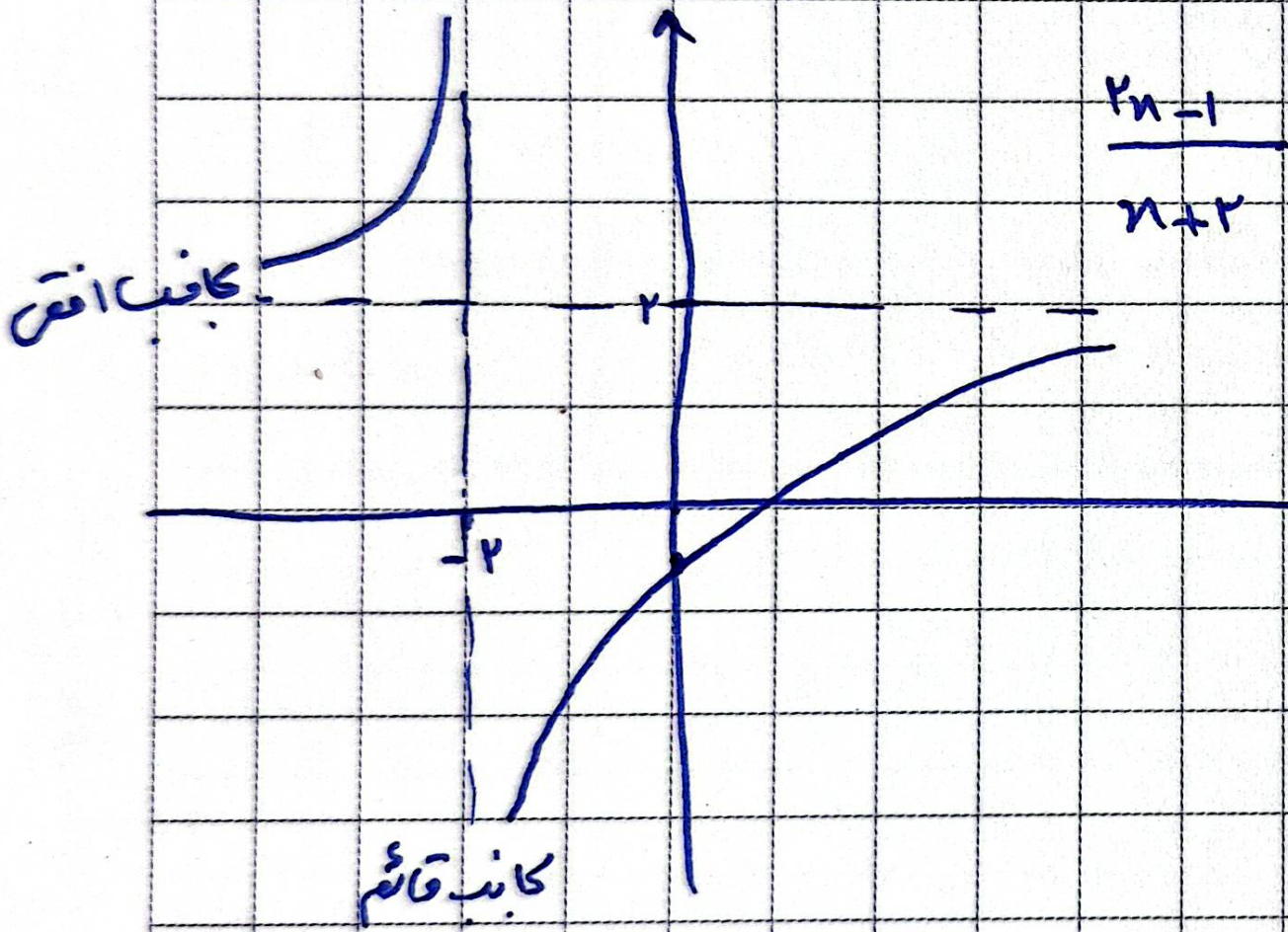
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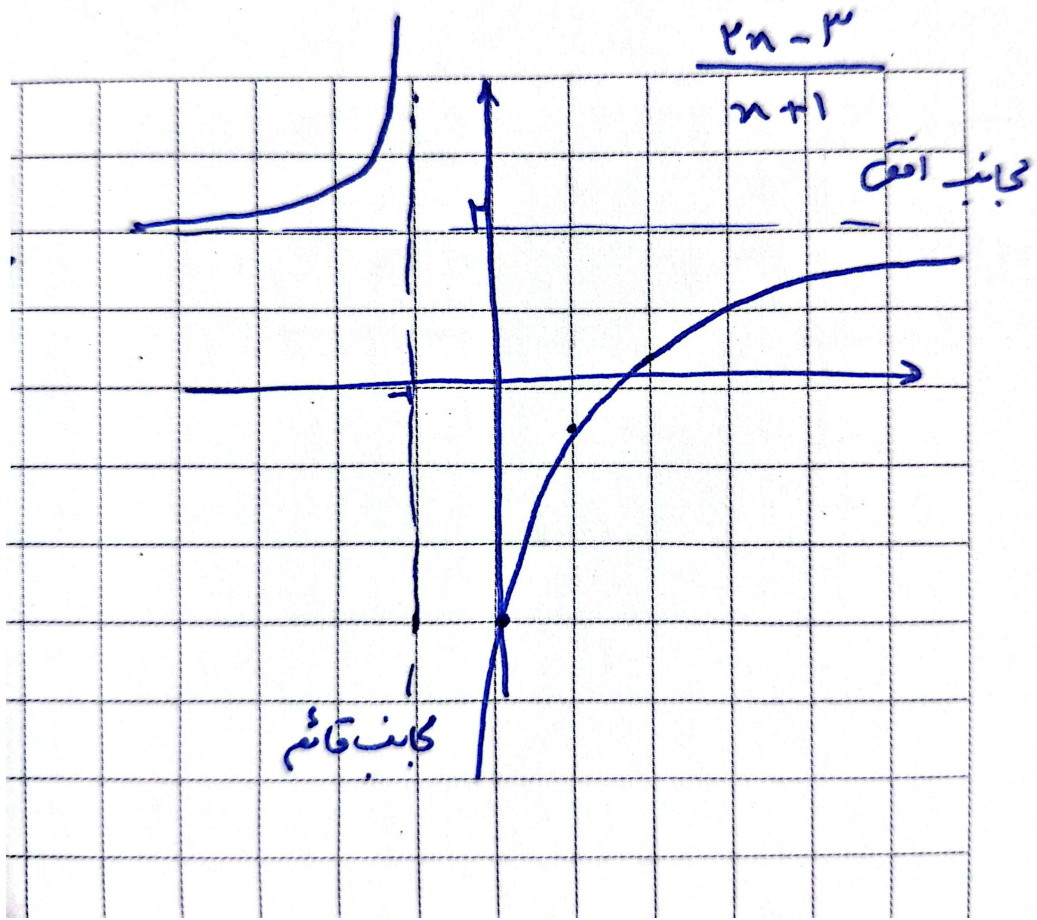
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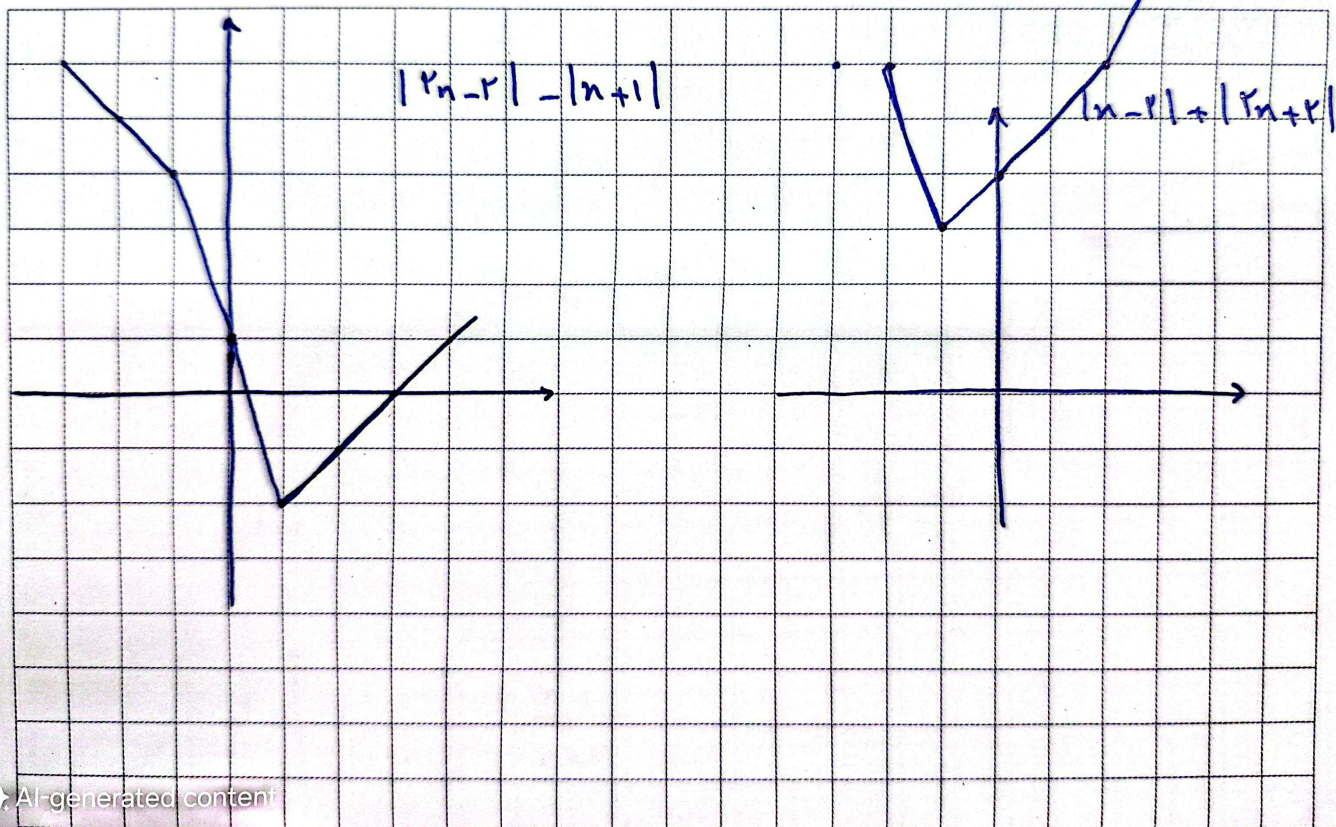
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