

صورت برد تمام توابع چند جمله‌ای از مرتبه فرد برابر  $\mathbb{R}$  می باشد.

الف)  $y = x^3 - 3x^2 + 3x \Rightarrow \mathbb{R}_f = \mathbb{R}$

ب)  $y = \frac{1}{x-2} \Rightarrow yx^2 - 2yx - 1 = 0 \xrightarrow{\Delta \geq 0} (2y)^2 - 4(-1 \times y) \geq 0$

$(y^2 + 4y \geq 0 \Rightarrow y(y+4) \geq 0 \xrightarrow{\text{جدول}} \begin{array}{c|c|c|c} & - & + & - \\ \hline y & -4 & 0 & + \end{array}$

$\mathbb{R}_f = (-\infty, -4] \cup [0, +\infty)$

الف)  $a > 0 \Rightarrow \downarrow \min y = \frac{-b}{2a} = 4 \Rightarrow \mathbb{R}_f = [4, +\infty)$

ب)  $a < 0 \Rightarrow \uparrow \max y = \frac{-b}{2a} = 12 \Rightarrow \mathbb{R}_f = (-\infty, 12]$

ج)  $a > 0 \Rightarrow \downarrow \min y = \frac{-b}{2a} = -7 \Rightarrow \sqrt{[7, +\infty)} \Rightarrow \mathbb{R}_f = [0, +\infty)$

د)  $a < 0 \Rightarrow \uparrow \max y = \frac{-b}{2a} = 9 \Rightarrow \sqrt{(-\infty, 9]} \Rightarrow \mathbb{R}_f = [0, 3]$

الف)  $\mathbb{R}_f = \mathbb{R} \leftarrow \text{طبق نکته}$

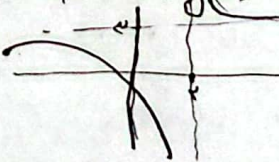
ب)  $\mathbb{R}_f = \mathbb{R} \leftarrow \text{طبق نکته}$

ج)  $\mathbb{R}_f = \sqrt{\mathbb{R}} = [0, +\infty)$

د)  $\mathbb{R}_f = -\sqrt{\mathbb{R}} = [0, +\infty)$

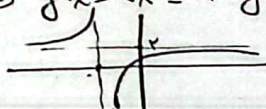
الف)  $yx + 2y = 4x + 1 \Rightarrow yx - 4x = 1 - 2y \Rightarrow x(y-4) = 1-2y \Rightarrow$

$x = \frac{1-2y}{y-4} \Rightarrow \mathbb{R}_f = \mathbb{R} - \{4\}$



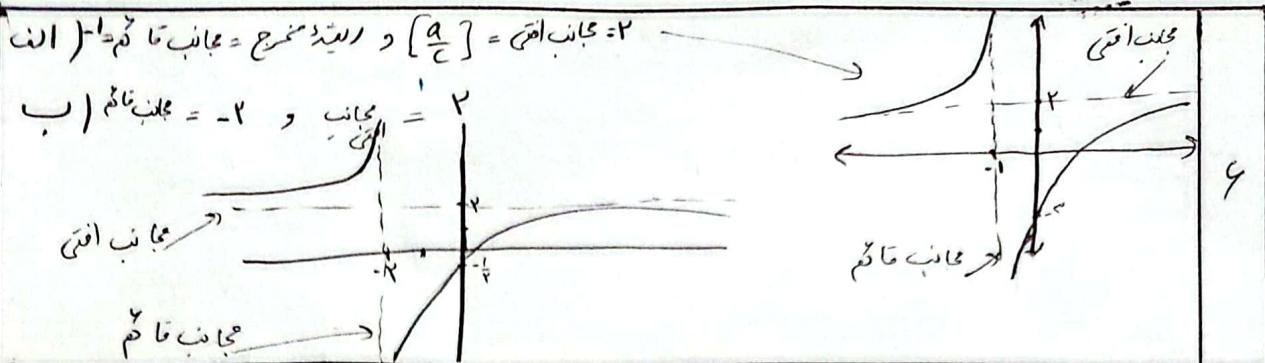
ب)  $yx + y = 2x + 1 \Rightarrow yx - 2x = 1 - y \Rightarrow x(y-2) = 1-y \Rightarrow x = \frac{1-y}{y-2}$

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



الف)  $\sqrt{\mathbb{R} - \{\frac{a}{c}\}} \Rightarrow \frac{a}{c} = 2 \Rightarrow \sqrt{\mathbb{R} - \{2\}} \Rightarrow [0, +\infty) - \{2\}$

ب)  $\sqrt{\mathbb{R} - \{\frac{a}{c}\}} \Rightarrow \frac{a}{c} = [-3] \Rightarrow \sqrt{\mathbb{R} - \{-3\}} \Rightarrow [0, +\infty)$



الف)  $\sin x + \frac{1}{\sin x} = a + \frac{1}{a}$   $(-\infty, -2] \cup [2, +\infty) = \text{IRf}$

ب)  $x^3 + \frac{1}{x^3} = a + \frac{1}{a}$   $(-\infty, -2] \cup [2, +\infty) = \text{IRf}$

ج)  $\sqrt[3]{x^3 + 1} = \sqrt[3]{x} + \frac{1}{\sqrt[3]{x}} = a + \frac{1}{a}$   $(-\infty, -2] \cup [2, +\infty) = \text{IRf}$

د)  $\sqrt{x} + \frac{1}{\sqrt{x}} = a + \frac{1}{a}$   $[2, +\infty) = \text{IRf}$

الف)  $x^2 + \frac{1}{x^2+3} \Rightarrow x^2 + \frac{1}{x^2+3} - 3 \Rightarrow a + \frac{1}{a} - 3$

$a + \frac{1}{a} \xrightarrow{\text{شیت}} [2, +\infty) \rightarrow a + \frac{1}{a} - 3 \rightarrow [-1, +\infty) = \text{IRf}$

ب)  $\frac{x^2 + \omega}{1 + x^2 + 4} = \frac{x^2 + 4}{1 + x^2 + 4} + \frac{1}{1 + x^2 + 4} = \sqrt{x^2 + 4} + \frac{1}{\sqrt{x^2 + 4}} \rightarrow a + \frac{1}{a} \xrightarrow{\text{هواره شیت}}$

$[2, +\infty) = \text{IRf}$

