

الف) $y = \frac{|x|+1}{|x|-2} \rightarrow |x| = -\frac{-2y-1}{y-1} = \frac{2y+1}{y-1} \rightarrow \frac{2y+1}{y-1} > 0 \rightarrow \frac{-\frac{1}{y-1}}{+\frac{1}{y-1}-\frac{1}{y-1}}$ (۱)
 $R_f = \mathbb{R} - (-\frac{1}{y-1})$ (۲)

ب) $y = \frac{x^2+1}{|x|} = \frac{|x|^2+1}{|x|} = |x| + \frac{1}{|x|} \xrightarrow{a>0} R_f = [2, +\infty)$

$y = \frac{x^2+2x-2}{x+3} \xrightarrow{\text{مخرج وین}} yx + y = x^2 + 2x - 2 \rightarrow x^2 + (2-y)x - (2+3y) = 0$ (۲) (۲)
 $x = \frac{y-2 \pm \sqrt{\Delta}}{1} \rightarrow \Delta = (2-y)^2 - 4(-2-3y) = y^2 + 4y + 12 = (y+2)(y+6)$
 $\Delta \geq 0 \rightarrow \frac{-6}{+6-6} \rightarrow R_f = \mathbb{R} - (-4, 2)$

$f(x) = \frac{x^2-x+\frac{1}{x}}{x^2-x+1} \xrightarrow{\text{مخرج وین}} yx^2 - yx + y = x^2 - x + \frac{1}{x} \rightarrow (y-1)x^2 + (1-y)x + y - \frac{1}{x} = 0$ (۲) (۳)
 $x = \frac{y-1 \pm \sqrt{\Delta}}{2(y-1)} \rightarrow \Delta \geq 0 \rightarrow (1-y)^2 - 4(y-1)(y-\frac{1}{x}) \geq 0 \rightarrow -3y^2 + 3y \geq 0 \rightarrow \frac{0}{-3+3} = 0$
 $y-1 \neq 0 \rightarrow y \neq 1$ (۱, ۱) $R_f = [0, 1)$
 ب) $x^2 - x + 1 \neq 0 \rightarrow D_f = \mathbb{R}$

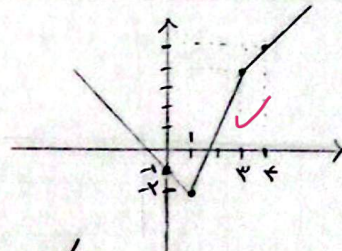
الف) $y = \sqrt{-x^2+6x-1}$ $\max \left| \frac{-\frac{b}{2a}}{-4+1-12} \right| = 2 \rightarrow \text{بردارت زیر: } (-\infty, 3] \xrightarrow{\sqrt{}} R_f = [0, \sqrt{3}]$ (۲) (۴)

ب) $y = \sqrt[3]{2x^2-x}$ $\max \left| \frac{-\frac{b}{2a}}{1-14} \right| = 2 \rightarrow \text{بردارت زیر: } [-1, +\infty) \xrightarrow{\sqrt[3]{}} R_f = [-2, +\infty)$

الف) $y = \log(x^2-x+1)$ چون کبرترین دهن عبارت $\log 1 = 0$ $\log \mathbb{R} \rightarrow R_f = \mathbb{R}$ (۲) (۵)
 جدولی $\log$ فرد است $\mathbb{R}$ برابر

ب) $y = \log_2(\frac{x^2+1}{x})$ $\frac{x^2+1}{x} = x + \frac{1}{x}$ $\rightarrow \text{تابع زوجی تابع مثبت} \rightarrow \text{برد این عبارت} = [2, +\infty)$
 $\rightarrow \log [2, +\infty) \rightarrow R_f = [1, +\infty)$

الف) $y = |2x-3| - |x-3|$
 $\begin{array}{c|c|c} & 1 & 3 \\ \hline -2x+3+x-3 & 2x-2+x-3 & 2x-2-x+3 \\ \hline = -x-1 & = 3x-5 & = x+1 \end{array}$
 (-2) (3) $R_f = [-5, +\infty)$ (۲) (۶)



ب) $y = |x-3| + |x+1|$ تابع قطعی

 $R_f = [2, +\infty)$

$$|n-r| - |r_m+r| \leq 1$$

$$\begin{array}{c|c|c} -1 & & r \\ \hline -n+r+r_m+r \leq 1 & -n+r-r_m-r \leq 1 & n-r-r_m-r \leq 1 \\ n+r \leq 1 \rightarrow n \leq 1-r & -r_m \leq 1 & -n-r \leq 1 \\ (-\infty, -r] & n \geq -\frac{1}{r} & n \geq -\omega \quad \checkmark \\ & [-\frac{1}{r}, r] & \end{array}$$

(r) (v)

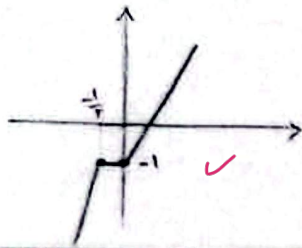
$$\Rightarrow n \in (-\infty, -r] \cup [-\frac{1}{r}, +\infty)$$

$$y = r_m - |r_m+1| + |n|$$

$$\begin{array}{c|c|c} -\frac{1}{r} & & 0 \\ \hline r_m+r_m+1-n & r_m-r_m-1-n & r_m-r_m-1+n \\ = r_m+1 & = -1 & = r_m-1 \\ \text{(-)} & \text{(-)} & \text{(-)} \end{array}$$

(r) (1)

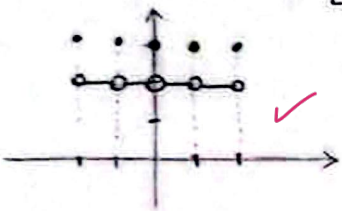
$$R_f = \mathbb{R}$$



$$\text{a) } y = [n] + \frac{[r-n]}{[-n]+r} = [n] + [-n] + r = \begin{cases} -1+r=r & ; n \notin \mathbb{Z} \\ 0+r=r & ; n \in \mathbb{Z} \end{cases}$$

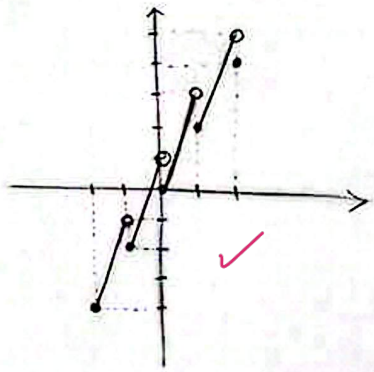
(r) (9)

$$R_f = \{r, r\}$$



$$\text{b) } y = r_m - [n]$$

$$\begin{aligned} -r \leq n < 1 &\rightarrow y = r_m + r \\ -1 \leq n < 0 &\rightarrow y = r_m + 1 \\ 0 \leq n < 1 &\rightarrow y = r_m \\ 1 \leq n < r &\rightarrow y = r_m - 1 \\ n = r &\rightarrow y = r \end{aligned}$$



$$R_f = [-r, \omega)$$

$$\text{a) } y = \sin^r n - \sin n + 1$$

$$\begin{aligned} \sin n = 1 &\rightarrow y = 1 \\ \sin n = -1 &\rightarrow y = r \\ \sin n = \frac{1}{r} = \frac{-b}{ra} &\rightarrow y = \frac{r}{r} \end{aligned} \Rightarrow R_f = [\frac{r}{r}, r]$$

(r) (10)

$$\text{b) } y = \sin^r n + \sin^r n + 1$$

$$\begin{aligned} \sin^r n = 1 &\rightarrow y = r \\ \sin^r n = 0 &\rightarrow y = 1 \\ \sin^r n = \frac{-b}{ra} = \frac{1}{r} &\rightarrow y = \frac{r}{r} \end{aligned} \Rightarrow R_f = [1, r]$$