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۱)
$y=\frac{x^2+x-2}{x-1}=6x-6=x^2+x-2 \Rightarrow x^2+x-6x+6+9=0$

$\Rightarrow x^2+x(1-y)+y+2=0 \xrightarrow{\Delta\geq 0} (1-y)^2-4y-8\geq 0 \rightarrow y^2-6y-7\geq 0$

$\rightarrow 7, -1$ — sign chart: -1, 7: $0\ -\ 0\ +$ — $(-\infty,-1]\cup[7,+\infty)$

۲) الف) $x_{min}=-\frac{b}{2a}=\frac{5}{4} \rightarrow y_{min}=\frac{25}{8}-\frac{25}{4}+1=-\frac{17}{8} \rightarrow R_f=[-\frac{17}{8},+\infty)$

ب) $x_{max}=-\frac{b}{2a}=3 \rightarrow y_{max}=-9+18-5=4 \rightarrow R_f=(0,4]$

$\mathbb{R} \rightarrow (0,+\infty)$

ج) بزرگترین توان فرد دی زیر رادیکال $\mathbb{R} \rightarrow (\infty,+\infty)$

د) بزرگترین توان فرد $\mathbb{R}$

۳) الف) $\frac{3x+1}{2x-6} \rightarrow \mathbb{R}-\{3\}$

ب) $\sqrt{\frac{4x+1}{x-4}} \rightarrow [0,+\infty)-\{4\}$

ج) $\frac{x^2+3}{\sqrt{x^2+3}}+\frac{1}{\sqrt{x^2+3}}=\sqrt{x^2+3}+\frac{1}{\sqrt{x^2+3}}$; $a+\frac{1}{a}\geq 2 \rightarrow \mathbb{R}$; $min=\sqrt{3}+\frac{1}{\sqrt{3}}$

$\mathbb{R}=[\sqrt{3}+\frac{1}{\sqrt{3}},+\infty)$

د) $x^4+\frac{1}{x^2+4}\geq 0 \rightarrow min\ x=0 \rightarrow 0.25 \rightarrow [0.25,+\infty)$

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$x^2y - y = x^2 + 4 \rightarrow x^2 = \frac{y+4}{y-1}$ $\quad x = \pm\sqrt{\frac{10}{3}}$ (۴

	-4		3	
	$+$	$-$	$+$	

$\rightarrow R_f = (-\infty, -4] \cup (3, +\infty)$

$\min x^2 = 0 \rightarrow -4 \max x^2 \rightarrow R_f = (-\infty, -4] \cup (3, +\infty)$

$y\sin x + 2y = 2\sin x - 1 \rightarrow \sin x = \frac{-2y-1}{y-2} \rightarrow -1 \le \frac{-2y-1}{y-2} \le 1$ (۵

$0 \le \frac{-3y-3}{y-2} \rightarrow [-\frac{1}{2}, 2)$ $\quad \frac{-4y+1}{y-2} \le 0 \rightarrow (-\infty, \frac{1}{4}] \cup (2, +\infty)$

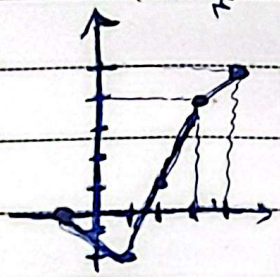
$R_f = [-\frac{1}{2}, \frac{1}{4}]$

$\min \sin x = -1 \rightarrow -\frac{\pi}{2}$ $\quad [-\frac{\pi}{2}, \frac{1}{4}]$

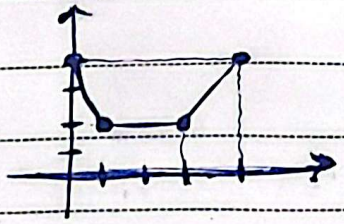
$\max \sin x = 1 \rightarrow \frac{1}{\pi}$

$\frac{(x-\frac{1}{2})^2}{(x-\frac{1}{2})^2 + \frac{3}{4}} \rightarrow (x-\frac{1}{2})^2 \rightarrow \max = 1 \quad \min = 0 \quad R_f = (0, 1)$ (۶

$D_f = x^2 - x + 1 > 0 \rightarrow D_f = \mathbb{R}$



$|2x-3| - |x-2|$ $\quad R_f = [-3, +\infty)$ (۷



$|x-3| + |x-1| \rightarrow$ (ب

$R_f = [2, +\infty)$

	-1		2	
$x+4$	$-$	$x+1$	$+$	
$-x-4$	$+$	$x+1$	$-$	
	$x < -4$		$x \ge 2$	

(۸

$(-\infty, -3] \cup [\frac{1}{3}, 2] \cup (3, +\infty)$

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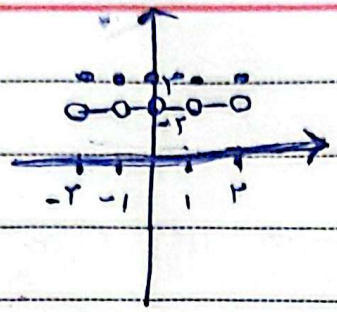
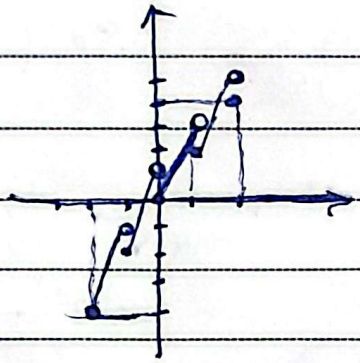
۹) الف

$[x] + [۳-x] = y$



$۳x - [x] = y$

$R_f = [-۴, ۵)$



۱۵) الف)

$\sin x$: $۱ \to ۱$, $-۱ \to ۳$, $\frac{۱}{۲} \to \frac{۳}{۴}$ $\quad R_f = [۱, ۳]$

$\sin^۲ x$: $۰ \to ۱$, $۱ \to ۳$, $-\frac{۱}{۳}$ ✗ $\quad R_f = [۱, ۳]$