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

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

ب) $yx^2 - 2xy = 1 \longrightarrow yx^2 - 2xy - 1 = 0 \longrightarrow x = \frac{2y \pm \sqrt{4y^2 - 4(y)(-1)}}{2y}$

$4y^2 + 4y \geq 0 \xrightarrow{\div 4} y^2 + y \geq 0 \longrightarrow y(y+1) \geq 0$

	$-\infty$		-1		0		$+\infty$
y	$+$	0	$-$	0	$+$		

$R = (-\infty, -1] \cup [0, +\infty)$

۲) الف) $ax+b$ | $2 \longrightarrow -\frac{b}{2a} = \frac{4}{2} = 2$, $R = [4, +\infty)$

$4 \longrightarrow 8 + 1 = 4$

ب) $ax+b$ | $2 \longrightarrow -\frac{b}{2a} = \frac{-4}{-2} = 2$, $R = (-\infty, 12]$

$12 \longrightarrow -9 + 18 + 3 = 12$

ج) $ax+b$ | $2 \longrightarrow -\frac{b}{2a} = \frac{4}{2} = 2$, $R = [0, +\infty)$

$-1 \longrightarrow 8 - 9 = -1$

د) $ax+b$ | $-\frac{b}{2a} = -\frac{4}{-2} = 2$, $R = [0, 3]$

$12a - 9 = 9$

۳) الف) $R = \mathbb{R}$ ج) $R = [0, +\infty)$

ب) $R = \mathbb{R}$ د) $R = [0, +\infty)$

۴) الف) $R = \mathbb{R} - \{2\}$

ب) $R = \mathbb{R} - \{2\}$

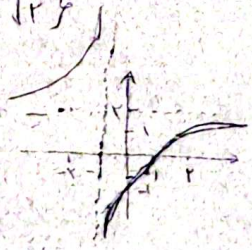
۵) الف) $R = [0, +\infty) - \{\sqrt{2}\}$

ب) $R = [0, +\infty)$

۶) الف) جانب تمام : -1

افقی : 2

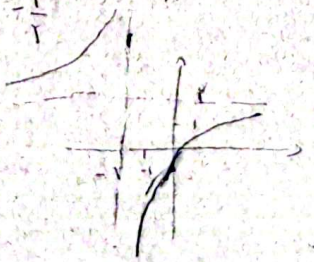
$x = 1 \quad f = \frac{2-2}{1+1} = -\frac{1}{2}$



ب) جانب تمام : -2

افقی : 2

$x = 0 \rightarrow y = -\frac{1}{2}$



۷) الف) $R = (-\infty, -2] \cup [2, +\infty)$

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

ج) $y = \sqrt[3]{x} + \frac{1}{\sqrt[3]{x}} \longrightarrow R = (-\infty, -2] \cup [2, +\infty)$

د) $R = [2, +\infty)$

۸) الف) $y = x^2 - 3 + \frac{1}{x^2+2} \to R : [-3, +\infty)$ $\Rightarrow y = x^2 + 2 + \frac{1}{x^2+2} - 4 \to R : [-1, +\infty)$

ب) $y = \sqrt{x^2+4} + \frac{1}{\sqrt{x^2+4}}$ $R = [\frac{5}{2}, +\infty)$

ج) $y = \sqrt{x+4} + \frac{1}{\sqrt{x+4}}$

۹)

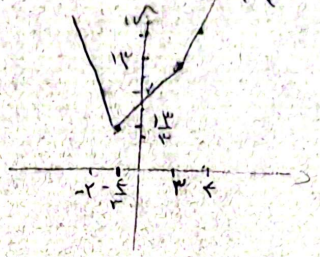
$-\frac{7}{2}$		4	
$-4x-1$	$2x+7$		$4x+1$

$x = 4 \to y = 17$

$x = -\frac{7}{2} \to y = +14 - 1 : \frac{17}{2} = 4\frac{1}{2}$

$x = 4 \to y = 17$

$x = -4 \to y = 7$



۱۰) الف)

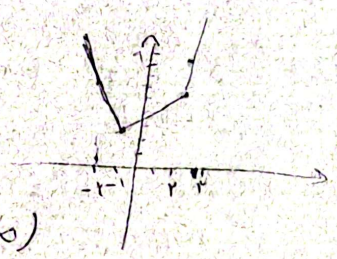
-1		2	
$-3x$	$x+4$		$3x$

$x = 2 \to y = 6$

$x = -1 \to y = 3$ $R = [3, +\infty)$

$x = 4 \to y = 6$

$x = -2 \to y = 7$



ب)

-1		1	
$3-x$	$-3x+1$		$x-3$

$x = 1 \to y = -2$

$x = -1 \to y = 4$

$x = 2 \to y = -1$ $R = [-2, +\infty)$

$x = -2 \to y = 5$