

الف) $y = x^3 - 3x^2 + 3x - 1 + 1 \rightarrow y - 1 = (x-1)^3 \rightarrow y = (x-1)^3 + 1 \rightarrow R = \mathbb{R}$

ب) $y = \frac{1}{x^2 - 2x} \rightarrow yx^2 - 2xy = 1 \rightarrow yx^2 - 2xy - 1 = 0 \rightarrow \Delta \geq 0 \rightarrow 4y^2 + 4y \geq 0$

$4y(y+1) \geq 0$
 $\frac{-1}{+4} \leq y \leq \frac{0}{+4} \rightarrow R = (-\infty, -1] \cup [0, +\infty)$
 چون $\frac{1}{x^2 - 2x} \neq 0$

الف) $y = x^2 - 4x + 10 \rightarrow x = -\frac{b}{2a} = 2 \rightarrow y = 4 \xrightarrow{a > 0} [4, +\infty)$

ب) $y = -x^2 + 4x + 3 \rightarrow x = -\frac{b}{2a} = 2 \rightarrow y = 11 \xrightarrow{a < 0} (-\infty, 11]$

ج) $y = \sqrt{x^2 - 4x - 3} \rightarrow x = \frac{b}{2a} = 2 \rightarrow y = -\sqrt{5} \xrightarrow{a > 0} [-\sqrt{5}, +\infty) \xrightarrow{\sqrt{\cdot}} [0, +\infty)$

د) $y = \sqrt{4x - x^2} \rightarrow x = -\frac{b}{2a} = 2 \rightarrow y = 2 \xrightarrow{a < 0} [-\infty, 2] \xrightarrow{\sqrt{\cdot}} [0, 2]$

الف) $y = x^3 - 5x^2 + 2x + 1 \Rightarrow R = \mathbb{R}$

ب) $y = x^4 - 4x^3 + 3x^2 + 2 \rightarrow R = \mathbb{R}$

ج) $y = \sqrt{x^4 - 4x^3 + 5x^2 + 1} \rightarrow R \xrightarrow{\sqrt{\cdot}} [0, +\infty)$

د) $(x^3 - 4x^2 + 3x + 1)^2 \rightarrow R \xrightarrow{(\cdot)^2} [0, +\infty)$

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

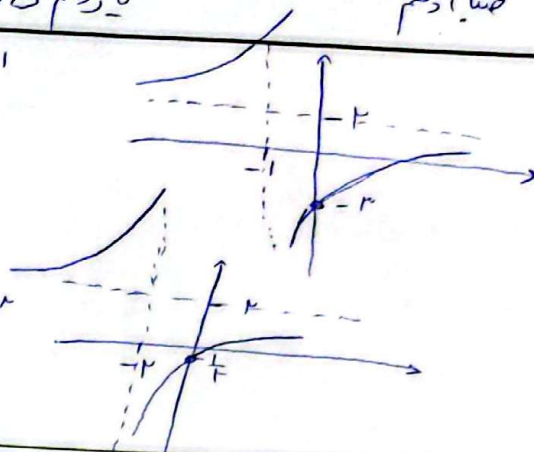
ب) $y = \frac{2x+1}{x+1} \rightarrow R = \mathbb{R} - \{2\}$

الف) $y = \sqrt{\frac{2x+5}{x+1}} \rightarrow R = \mathbb{R} - \{2\} \xrightarrow{\sqrt{\cdot}} [0, +\infty) - \{\sqrt{2}\}$

ب) $y = \sqrt{\frac{3x+1}{x-2}} \rightarrow R = \mathbb{R} - \{-3\} \xrightarrow{\sqrt{\cdot}} [0, +\infty)$

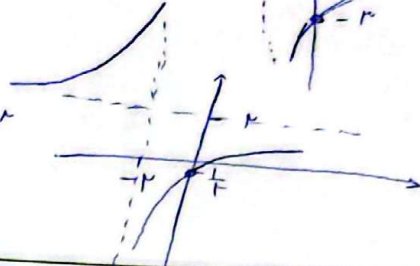
الف) $y = \frac{x-3}{x+1}$

مخانبه $x+1=0 \rightarrow x=-1$
 انقی $y = \frac{a}{c} = 2$



ب) $y = \frac{x-1}{x+2}$

مخانبه $x+2=0 \rightarrow x=-2$
 انقی $y = \frac{a}{c} = 2$



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الف) $y = \sin x + \frac{1}{\sin x} \rightarrow R = (-\infty, -2] \cup [2, +\infty)$

ب) $y = \frac{x^4+1}{x^3} = x + \frac{1}{x^3} \rightarrow R = (-\infty, -2] \cup [2, +\infty)$

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

د) $\sqrt{x} + \frac{1}{\sqrt{x}} \Rightarrow R = [2, +\infty)$

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الف) $y = x^2 + \frac{1}{x^4+1} \rightarrow \min x^2 = 0 \rightarrow 0 + \frac{1}{1} = 1 \rightarrow R = [\frac{1}{1}, +\infty)$

ب) $y = \frac{x^2+5}{\sqrt{x^2+5}} = \frac{x^2+5}{\sqrt{x^2+5}} + \frac{1}{\sqrt{x^2+5}} = \sqrt{x^2+5} + \frac{1}{\sqrt{x^2+5}} \rightarrow \min x^2 = 0$

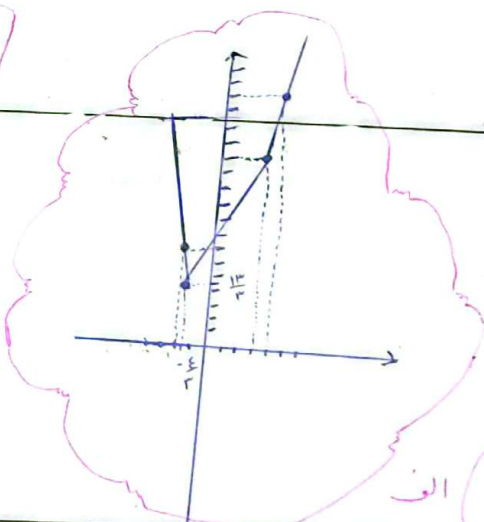
$x=0 \rightarrow 2 + \frac{1}{2} = \frac{5}{2} \rightarrow R = [\frac{5}{2}, +\infty)$

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$y = |x-3| + |3x+5|$

$x=3$ $x=-\frac{5}{3}$

$-x+3-3x-5$	$-x+3+3x+5$	$x-3+3x+5$
$-4x-2$	$+2x+8$	$4x+2$



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الف) $y = |x-2| + |3x+2|$

$x=2$ $x=-\frac{2}{3}$

$R = [2, +\infty)$

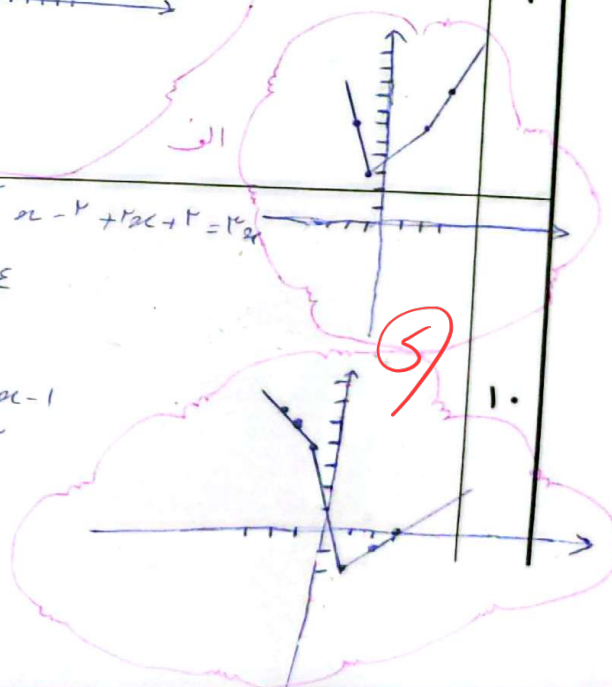
$-x+2-3x-2$ $-x+2+3x+2$ $x-2+3x+2$
 $-4x$ $+2x+4$ $4x$

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

ب) $y = |3x-2| - |x+1|$

$x=1$ $x=-1$

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



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