

الف) $y = (x-1)^3 + 1 \Rightarrow (x-1)^3 = y-1 \Rightarrow x-1 = \sqrt[3]{y-1} \Rightarrow x = \sqrt[3]{y-1} + 1$
 $\Rightarrow R_f = \mathbb{R}$

ب) $yx^2 - 2yx = 1 \Rightarrow yx^2 - 2yx - 1 = 0 \xrightarrow{\Delta \text{ش}} 2y \pm \sqrt{4y^2 + 4y} \Rightarrow$
 $y \neq 0 \rightarrow A \quad 4y^2 + 4y \geq 0 \Rightarrow y^2 + y \geq 0 \Rightarrow y(y+1) \geq 0$
 $\xrightarrow{ANB} R_f = (-\infty -1] \cup (0 +\infty)$

الف) $x_{\min} = \frac{-b}{2a} = 2 \quad y_{\min} = 4 \Rightarrow \min |y|$

 $R_f = [4 +\infty)$

ب) $x_{\max} = \frac{-9}{-2} = 3 \Rightarrow y_{\max} = 12$

 $R_f = (-\infty 12]$

ج) $x_{\min} = 2 \Rightarrow y = -7$

 $\Rightarrow R_f = [-7 +\infty)$

د) $x_{\max} = 3 \Rightarrow y = 9$

 $\Rightarrow R_f = [-\infty 9]$

الف) $R_f = \mathbb{R}$

ب) $R_f = \mathbb{R}$

ج) $R_f = [0 +\infty)$

د) $R_f = [0 +\infty)$

الف) $R_f = \mathbb{R} - \{3\}$

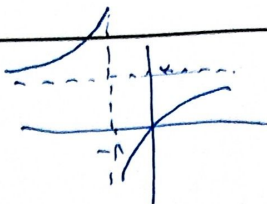
ب) $R_f = \mathbb{R} - \{2\}$

الف) $R_f = \sqrt{\mathbb{R} - \{2\}} = [0 +\infty) - \{\sqrt{2}\}$

ب) $R_f = \sqrt{\mathbb{R} - \{-3\}} = [0 +\infty)$

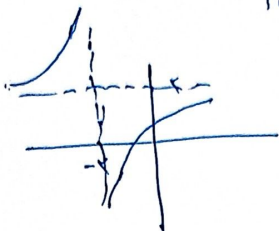
الف) بجانب قائم = -1

ب) " افقي = $\frac{a}{c} = 2$



ب) بجانب قائم = -2

" افقي = 2



الف) $-1 \leq \sin x \leq 1 \Rightarrow R_f = (-\infty -2] \cup [2 +\infty)$

ب) $\frac{x^5+1}{x^3} = x^2 + \frac{1}{x^3} \Rightarrow R_f = (-\infty -2] \cup [2 +\infty)$

ج) $\frac{\sqrt[3]{x^2}+1}{\sqrt[3]{x}} = \sqrt[3]{x} + \frac{1}{\sqrt[3]{x}} \Rightarrow R_f = (-\infty -2] \cup [2 +\infty)$

د) $\sqrt{x} \geq 0 \Rightarrow R_f = [2 +\infty)$

الف) $x^2 + \frac{1}{x^2+3} \Rightarrow x^2 + \frac{1}{x^2+3} > 0$ Min $x=0 \rightarrow \frac{1}{3}$
 $\Rightarrow R_f = [\frac{1}{3} +\infty)$

ب) $\frac{x^2+5}{\sqrt{x^2+4}} = \frac{x^2+4}{\sqrt{x^2+4}} + \frac{1}{\sqrt{x^2+4}} = \sqrt{x^2+4} + \frac{1}{\sqrt{x^2+4}}$
 $\frac{d}{dx} (\sqrt{x^2+4} + \frac{1}{\sqrt{x^2+4}}) = \frac{x}{\sqrt{x^2+4}} - \frac{x}{(x^2+4)^{3/2}} = 0 \Rightarrow \frac{x}{\sqrt{x^2+4}} (1 - \frac{1}{x^2+4}) = 0$
 $x=0 \Rightarrow \text{Min} = \frac{5}{2}$

$x-3 + 3x+4 = 4x+1 \quad x > 3$

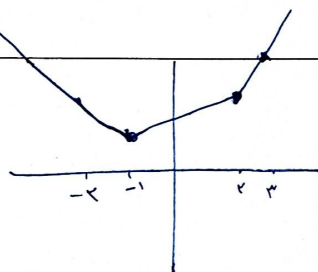
$3-2x + 3x+4 = x+7 \quad -\frac{4}{3} \leq x \leq 3$

$3-x - 3x - 4 = -4x-1 \quad x < -\frac{4}{3}$

$(4, 17) (3, 13) (-\frac{4}{3}, \frac{13}{3}) (-2, 7)$

نقاط كبرى

الف) $(2, 6) (-1, 3) (3, 9) (-5, 6)$



ب) $(1, -2) (-1, 4) (-2, 5) (2, -1)$

