

$$x^3 - 3x^2 + 2x \sim (x-1)^2 + 1 = y \quad x-1 = \sqrt[3]{y-1} \quad R_f = \mathbb{R}$$

$$\frac{1}{x^2 - 2x} = y \sim \frac{1}{(x-1)^2 - 1} = y \sim \frac{1}{y} = (x-1)^2 - 1$$

$$x = \pm \sqrt{\frac{1}{y} + 1} + 1 \quad y \neq [-1, 0] \quad R_f = \mathbb{R} - (-1, 0]$$

$$x^2 - 4x + 1 \quad \frac{-b}{2a} = 2 \quad y_{\min} = -7 \quad R_f = [4, +\infty)$$

$$-x^2 + 4x + 3 \quad \frac{-b}{2a} = 2 \quad y_{\max} = 11 \quad R_f = (-\infty, 11]$$

$$\sqrt{x^2 - 4x - 2} \quad \frac{-b}{2a} = 2 \quad y_{\min} = -7 \quad R_f = \sqrt{[-7, +\infty)} \sim R_f = [0, +\infty)$$

$$\sqrt{4x - x^2} \quad \frac{-b}{2a} = 2 \quad y_{\max} = 9 \quad R_f = \sqrt{(-\infty, 9]} \sim R_f = [0, 3]$$

$$x^3 - 5x^2 + 2x + 1 \quad \text{بزرگترین توان فرد} \rightarrow R_f = \mathbb{R}$$

$$x^3 - 4x^2 + 2x + 2 \quad \text{بزرگترین توان فرد} \rightarrow R_f = \mathbb{R}$$

$$\sqrt{x^3 - 4x^2 + 5x + 1} \quad \text{بزرگترین توان فرد} \rightarrow \sqrt{y} \sim [0, +\infty)$$

$$(x^3 - 4x^2 + 2x + 1)^2 \quad \text{بزرگترین توان فرد} \rightarrow y^2 \sim [0, +\infty)$$

$$\frac{3x+1}{x-2} \sim \mathbb{R} - \left\{\frac{a}{c}\right\} \Rightarrow R_f = \mathbb{R} - \{2\}$$

$$\frac{2x+1}{x+1} \sim \mathbb{R} - \left\{\frac{a}{c}\right\} \Rightarrow R_f = \mathbb{R} - \{2\}$$

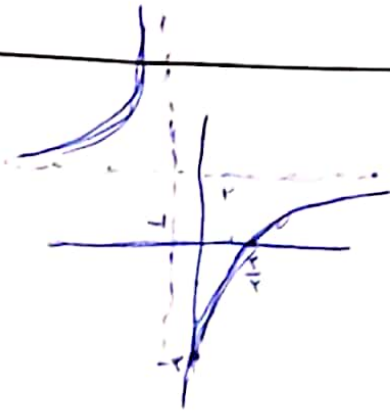
$$\sqrt{\frac{2x+2}{x+1}} \sim \sqrt{\mathbb{R} - \left\{\frac{a}{c}\right\}} \Rightarrow R_f = [0, +\infty) - \{\sqrt{2}\}$$

$$\sqrt{\frac{2x+1}{x-2}} \sim \sqrt{\mathbb{R} - \left\{\frac{a}{c}\right\}} \Rightarrow R_f = [0, +\infty)$$

$\mathbb{R}^+ - \sqrt{-2} \sim \sqrt{-2} \cup \emptyset$

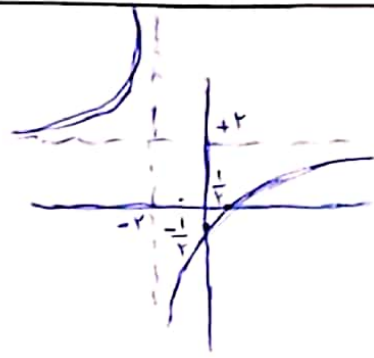
$$\frac{ym-3}{n+1}$$

$$\begin{cases} \text{قعر} = -1 \\ \text{انحنى} = 2 \\ \text{ریشه خارج} \\ \frac{a}{c} \end{cases}$$



$$\frac{ym-1}{n+2}$$

$$\begin{cases} \text{قعر} = -2 \\ \text{انحنى} = 2 \\ \text{ریشه خارج} \\ \frac{a}{c} \end{cases}$$



6

$$\sin x + \frac{1}{\sin x} \quad a > 0 \quad a < 0 \quad \Rightarrow \quad Rf = (-\infty, -2] \cup [2, +\infty)$$

$$\frac{x^4+1}{x^2} = x^2 + \frac{1}{x^2} \quad a > 0 \quad a < 0 \quad \Rightarrow \quad Rf = (-\infty, -2] \cup [2, +\infty)$$

$$\frac{\sqrt{x^2+1}}{\sqrt{x}} = \sqrt{x} + \frac{1}{\sqrt{x}} \quad a > 0 \quad a < 0 \quad \Rightarrow \quad Rf = (-\infty, -2] \cup [2, +\infty)$$

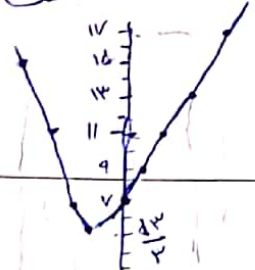
7

$$\sqrt{x} + \frac{1}{\sqrt{x}} \quad a > 0 \quad \Rightarrow \quad Rf = [2, +\infty)$$

$$x^2 + \frac{1}{x^2+2} \quad \Rightarrow \quad \text{كثيره قدراته} \quad \Rightarrow \quad 0 + \frac{1}{0+2} = \frac{1}{2} \quad \Rightarrow \quad Rf = [\frac{1}{2}, +\infty)$$

$$\frac{x^2+4}{\sqrt{x^2+4}} = \frac{x^2+4}{\sqrt{x^2+4}} = \sqrt{x^2+4} + \frac{1}{\sqrt{x^2+4}} \quad \Rightarrow \quad \text{كثيره قدراته} \quad \Rightarrow \quad \sqrt{0+4} + \frac{1}{\sqrt{0+4}} = 2$$

$$2 + \frac{1}{2} \quad \Rightarrow \quad Rf = [\frac{5}{2}, +\infty)$$

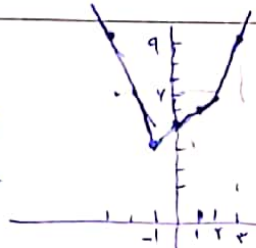


$$\begin{aligned} |x-3| + |x+5| \\ x \geq 3 \quad ; \quad x+1 \\ -\frac{6}{2} \leq x < 3 \quad ; \quad x+7 \\ x < -\frac{6}{2} \quad ; \quad -x-1 \end{aligned}$$

$$Rf = [\frac{13}{2}, +\infty)$$

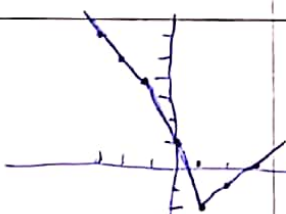
9

$$\begin{aligned} |x-2| + |x+2| \\ x \geq 2 \quad ; \quad x \\ -1 \leq x < 2 \quad ; \quad x+4 \\ x < -1 \quad ; \quad -x \end{aligned}$$



$$Rf = [4, +\infty)$$

$$\begin{aligned} |x-2| - |x+1| \\ x \geq 1 \quad ; \quad x-3 \\ -1 \leq x < 1 \quad ; \quad -x+1 \\ x < -1 \quad ; \quad -x+3 \end{aligned}$$



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

10