

19, 20

$$x^2 = y + \omega \rightarrow R_f = [-\omega, +\infty)$$

(الف)

$$x^2 = y - 1 \rightarrow x = \sqrt[3]{y-1} \rightarrow R_f = \mathbb{R}$$

(ب)

$$x^2 - 4x + 4 + 2 = y \Rightarrow (x-2)^2 + 2 = y \Rightarrow (x-2)^2 = y-2 \rightarrow$$

(الف)

$$R_f = [2, +\infty)$$

$$x^2 - 2x + 2, 2\omega - \omega, 2\omega = y \Rightarrow (x-1, \omega)^2 = y + \omega, 2\omega \rightarrow R_f = [-\omega, 2\omega, +\infty)$$

(ب)

$$x^2 = -\frac{-2y-3}{y-1} \Rightarrow \frac{2y+3}{y-1} \Rightarrow x = \pm \sqrt{\frac{2y+3}{y-1}}$$

(الف)

$$R_f = \mathbb{R} - (-\frac{3}{4}, 1]$$

$$|x| = -\frac{-4y-1}{y-2} = \frac{4y+1}{y-2} \rightarrow R_f = \mathbb{R} - (-\frac{1}{4}, 2]$$

(ب)

$$yx^2 - 4yx - 1 = 0 \xrightarrow{\text{روست دلتا}} x = \frac{4y \pm \sqrt{16y^2 + 4y}}{2y} \quad y \neq 0$$

(الف)

$$16y^2 + 4y \geq 0 \rightarrow 4y(4y+1) \geq 0 \rightarrow R_f = \mathbb{R} - (-\frac{1}{4}, 0]$$

۳

$$y = x^2 - 4x + 2 \xrightarrow{a > 0} \begin{cases} x_{\min} = \frac{-b}{2a} = 2 \\ y_{\min} = -2 \end{cases} \rightarrow R_f = [-2, +\infty)$$

(الف)

$$y = x^2 - 4x + 2 \xrightarrow{a < 0} \begin{cases} x_{\max} = \frac{-b}{2a} = 2 \\ y_{\max} = 2 \end{cases} \rightarrow R_f = (-\infty, 2]$$

(ب)

$$y = \sqrt{x^2 - 4x + 2} \xrightarrow{a > 0} \begin{cases} x_{\min} = \frac{-b}{2a} = 2 \\ y_{\min} = -1 \end{cases} \rightarrow R_f = \sqrt{[-1, +\infty)} = [0, +\infty) \quad (\text{الف})$$

۱۷۵

$$y = \sqrt{-x^2 + 4x + 10} \xrightarrow{a < 0} \begin{cases} x_{\max} = \frac{-b}{2a} = 2 \\ y_{\max} = 14 \end{cases} \rightarrow R_f = \sqrt{(-\infty, 14]} = [0, 14] \quad (\text{ب})$$

$$y = x^4 + 3x^2 + 2x + 1 \xrightarrow{\text{بزرگترین توان فرد است}} R_f = \mathbb{R} \quad (\text{الف})$$

۲

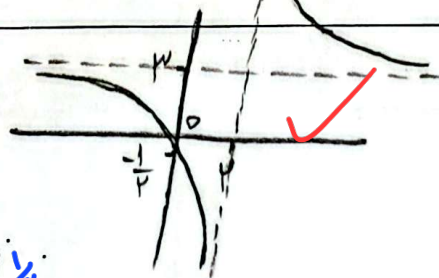
$$y = \sqrt{x^5 + 4x^2 + 6x + 1} \xrightarrow{\text{بزرگترین توان فرد است}} R_f = \sqrt{\mathbb{R}} = [0, +\infty) \quad (\text{ب})$$

$$R_f = \mathbb{R} - \{3\} \quad (\text{الف})$$

۲

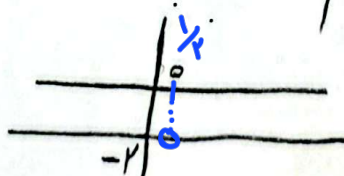
$$R_f = \sqrt{\mathbb{R} - \{4\}} = [0, +\infty) - \{2\} \quad (\text{ب})$$

$$\left. \begin{aligned} \text{مجاانب افقی} &= \frac{a}{c} = 3 = y \\ \text{مجاانب قائم} &= \text{ریشه مخرج} = 2 = x \end{aligned} \right\} \rightarrow$$



۱۷۵

$$y = \frac{4x - 2}{-2x + 1} = -2 \rightarrow x \neq \frac{1}{2}$$



$$y = \cos x^2 + \frac{1}{\cos x^2} \xrightarrow{\cos x^2 \geq 0, \cos x^2 \neq 0} R_f = [2, +\infty) \quad (\text{الف})$$

$$y = \sqrt[3]{x + \frac{1}{x}} \Rightarrow R_f = \sqrt[3]{\mathbb{R} - (-2, 2)} = \mathbb{R} - (\sqrt[3]{-2}, \sqrt[3]{2}) \quad (\text{ب})$$

۲