

سوال ۱) $f(x) = \sqrt{x+\varepsilon} \sqrt{x-\varepsilon} \xrightarrow[t=x+\varepsilon]{t=\sqrt{x-\varepsilon}} f(x) = \sqrt{t^2+\varepsilon+\varepsilon t} = \sqrt{(t+\varepsilon)^2}$

$g(x) = \sqrt{x-\varepsilon} \sqrt{x-\varepsilon} \xrightarrow[t=x+\varepsilon]{t=\sqrt{x-\varepsilon}} g(x) = \sqrt{t^2+\varepsilon-\varepsilon t} = \sqrt{(t-\varepsilon)^2} = |t-\varepsilon|$

$f(x)+g(x) = a+b \sqrt{x+c} \rightarrow C=-\varepsilon$
 $f(x)g(x) = x = 2\sqrt{x-\varepsilon} \rightarrow a+b=2$

$\frac{a+b}{-c} = \frac{2}{-\varepsilon} = -\frac{1}{\varepsilon}$

$f(x) = \frac{x+2}{x^2-\varepsilon x+3} \quad g(x) = \{(2,1)(1,0)(3,\omega)(0,\varepsilon)\}$

$\frac{g}{f} = \left\{ \left(2, -\frac{1}{\frac{1}{\varepsilon}}\right) \left(1, \frac{0}{\frac{0}{\varepsilon}}\right) \left(3, \frac{\omega}{\frac{1}{\varepsilon}}\right) \left(0, \frac{\varepsilon}{\frac{2}{\varepsilon}}\right) \right\}$

$\Rightarrow \frac{g}{f} = \left\{ \left(2, -\frac{1}{\varepsilon}\right), (0, \varepsilon) \right\}$

سوال ۳) $f(x) = \{(1,2)(3,-1)(\varepsilon,2)(-1,4)\} \quad g(x) = \{(-2,3)(1,-1)(3,2)(-1,0)\}$

الف) $f(2x) = \left\{ \left(\frac{1}{2}, 2\right) \left(\frac{3}{2}, -1\right) \left(2, 2\right) \left(-\frac{1}{2}, 4\right) \right\}$ ب) $f(x^2) = \left\{ (1,2) (\sqrt{3}, -1) (2,2) (-2,2) \right\}$
 $(-1,2) (-\sqrt{3}, -1)$

ج) $2g^2(x)+1 = \left\{ (-2,9)(1,3)(3,9) \right\}$ د) $\frac{2f}{g} = \left\{ (-1,2)(3,-1) \right\}$

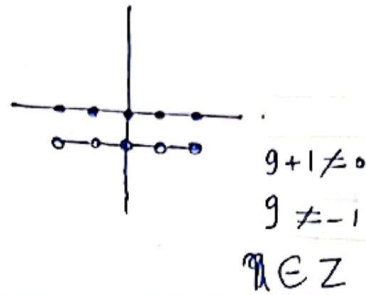
سوال ۴) $f(x) = \{(2,1)(3,1)(\varepsilon,9)(-2,0)\} \quad g(x) = \{(\omega,1)(2,3)(-2,4)(-1,2)(3,3)\}$

$h=2f+g \quad h = \left\{ (-2,9)(2,\omega)(3,\omega) \right\}$

سوال ۳) $f(x) = \frac{\sqrt{3x} - x}{x-2}$ $g(x) = [x] + [-x]$ $\left(\frac{f}{g+1}\right)(x)$

$\sqrt{3x} - x \geq 0 \rightarrow 0 \leq x \leq 3 - \{2\}$

$D = \{0, 1, 3\}$ پ



سوال ۴) $f(x) = \sqrt{5x - x^2 - 4}$ $g(x) = \{(1,3)(2,2)(4,4)(5,1)\}$

$h(x) = \frac{f(x)}{g(x)} = \left\{ \left(1, \frac{0}{3}\right) \left(2, \frac{\sqrt{2}}{2}\right) \left(4, \frac{0}{4}\right) \left(5, \frac{-4}{1}\right) \right\}$

$h(x) = \left\{ (1, 0) (2, \frac{\sqrt{2}}{2}) (4, 0) \right\}$ پ

سوال ۵) $y = x^3 - 3x^2 + 3x$ $\Rightarrow x^3 - 3x^2 + 3x - y = 0$ این معادله برای هر $y \in \mathbb{R}$ طاق یک ریشه حقیقی x دارد در همین بازه x می توان گفت نزدیک است

$R = \mathbb{R}$ پ باید بدرا با روش امتحان بابت آردی!

ب) $y = \frac{1}{x^2 - 2x}$ $\Rightarrow yx^2 - 2yx - 1 = 0$ ۱

با فرض $y \neq 0$ عبارت راجع x $\Delta = 4y^2 + 4y \geq 0 \rightarrow y(y+1) \geq 0$

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

سوال ۱) $y = x^2 - 4x + 10$ $x_{\min} = \frac{4}{2} = 2$ $y_{\min} = 6$ $R = [6, +\infty)$

ب) $y = -x^2 + 4x + 3$ $x_{\min} = \frac{4}{-2} = -2$ $y_{\min} = 11$ $R = (-\infty, 11]$ پ

ج) $y = \sqrt{x^2 - 4x - 3}$ $x_{\min} = \frac{4}{2} = 2$ $y_{\min} = -5$ $R = [-5, +\infty)$ پ

د) $y = \sqrt{4x - x^2}$ $x_{\min} = \frac{4}{2} = 2$ $y_{\min} = 0$ $R = [0, 2]$ پ

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

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

$$ج) y = \sqrt{n^5 - 4n^2 + 5n + 1} \quad R = \sqrt{\mathbb{R}} \quad R = [0, +\infty)$$

$$د) (n^5 - 4n^2 + 3n + 1)^{\frac{1}{5}} \quad R = [0, +\infty)$$

$$الف) y = \frac{3n+1}{n-2} \quad n = -\frac{-2y-1}{y-3} = \frac{2y+1}{y-3} \Rightarrow y \neq 3 \quad R = \mathbb{R} - \{3\}$$

$$ب) y = \frac{2n+1}{n+1} \quad n = -\frac{y-1}{y-2} = \frac{1-y}{y-2} \Rightarrow R \neq 2 \quad R = \mathbb{R} - \{2\}$$

$$الف) y = n^3 - 3n^2 + 2n - 1 + 1 = y = (n-1)^3 + 1$$

$$y-1 = (n-1)^3 \rightarrow \sqrt[3]{y-1} = n-1 \rightarrow n = \sqrt[3]{y-1} + 1$$

$$R_f = \mathbb{R}$$

$$ب) y = \frac{1}{n^2 - 2n} \rightarrow n^2 y - 2ny = 1 \rightarrow n^2 y - 2ny - 1 = 0$$

$$y \neq 0 \rightarrow n = \frac{2y \pm \sqrt{4y^2 + 4y}}{2y} \rightarrow 4y(y+1) \geq 0 \rightarrow \frac{-1}{+} \frac{0}{-} \frac{+}{+}$$

$$y = 0 \rightarrow 0 = 1 \times \text{صفتی وجود ندارد!} \rightarrow R_f = (-\infty, -1] \cup (0, +\infty)$$