

$$t = \sqrt{x-k} \xrightarrow{\text{توان ۲}} t^2 = x-k \rightarrow x = t^2 + k$$

$$f(x) = \sqrt{t^2 + k + k} \sqrt{t^2} = \sqrt{(t+k)^2} = t+k$$

در قدر مطلق برای هر عدد
اگر $x \geq 0$ است

$$g(x) = \sqrt{t^2 + k - k} \sqrt{t^2} = \sqrt{(t-k)^2} = t-k$$

$$f(x) + g(x) = kt = kt\sqrt{x-k} = a+b\sqrt{x+c} \Rightarrow \begin{cases} c=-k \\ a+b=k \end{cases} \rightarrow \frac{a+b}{c} = \frac{k}{-k} = \left[-\frac{1}{k}\right]$$

$$f(x) = \frac{x+k}{x^2-kx+k} \rightarrow x=k \rightarrow \frac{k}{-1} = -k$$

$$(x-1)(x-3) \rightarrow D = R - \{1, 3\} \quad x=0 \rightarrow \frac{k}{k}$$

$$g(x) = \left\{ (2, 1), (1, 2), (3, 4), (0, 4) \right\}$$

تعریف f در
نقطه $x=0$

$$\frac{g}{f} = \frac{1}{-k}, \frac{\frac{k}{-k}}{\frac{k}{k}} = 4 \rightarrow \boxed{\frac{g}{f} = \left\{ (2, -\frac{1}{k}), (0, 4) \right\}}$$

الف) $f(x) = \left\{ \left(\frac{1}{k}, 2\right), \left(\frac{k}{k}, -1\right), (2, 1), \left(-\frac{1}{k}, 4\right) \right\}$

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

ج) $2g^2(x) + 1 = \left\{ (-2, 19), (1, 3), (3, 9), (-1, 1) \right\}$

د) $\frac{f}{g} = \left\{ (1, -4), (3, -1), \left(-\frac{1}{k}, \frac{4}{k}\right) \right\}$

$2f = \left\{ (1, 4), (3, 2), (5, 4), (7, 2) \right\} \quad g(x) = \left\{ (-2, 3), (1, 1), (3, 2), (-1, 0) \right\}$

$f(x) = \left\{ (0, 1), (1, 1), (2, 9), (3, 0) \right\} \quad g(x) = \left\{ (0, 1), (1, 3), (2, 4), (-1, 2), (3, 3) \right\}$

$2f(x) = \left\{ (2, 2), (2, 2), (-2, 0) \right\} + g(x) = \left\{ (2, 3), (-2, 4), (3, 3) \right\}$

$h = 2f + g \rightarrow \left\{ (2, 5), (2, 5), (-2, 4) \right\}$

$$f(x) = \frac{\sqrt{13x-x}}{x-4} \quad \begin{matrix} 13x > 0 \rightarrow x > 0 \\ \sqrt{13x-x} > 0 \rightarrow \sqrt{13x-x} > x \xrightarrow{\text{توان ۲}} 13x-x > x^2 \rightarrow x^2-12x < 0 \rightarrow x(x-12) < 0 \\ \text{و } x \neq 4 \end{matrix}$$

۰ < x < 12

Df = $[0, 12] - \{4\}$

$g(x) = [x] + [-x] \rightarrow \begin{cases} x \in \mathbb{Z} \rightarrow [x] + [-x] = 0 \checkmark \\ x \notin \mathbb{Z} \rightarrow [x] + [-x] = -1 \times \end{cases}$

$\frac{f(x)}{g(x)+1} \rightarrow g(x) \neq -1 \rightarrow x \in \mathbb{Z} \rightarrow [0, 12]$

$f(x) = \sqrt{ax - x^2 - F} \rightarrow ax - x^2 - F \geq 0 \rightarrow x^2 - ax + F \leq 0 \rightarrow (x-1)(x-F) \leq 0$ $g(x) = \{ (0,3), (1,2), (2,1), (3,0) \}$ $h(x) = \frac{f(x)}{g(x)} = \{ (1,0), (2, \frac{\sqrt{2}}{2}), (3,0) \}$	$f(1) = \sqrt{a-1-F} = 0$ $f(2) = \sqrt{10-F-F} = \sqrt{2}$ $f(3) = \sqrt{10-14-F} = 0$	$\frac{1}{x^2 - x + 1}$	6
$y = \frac{x^3 - 12x^2 + 12x - 1}{(x-1)^3} \rightarrow y = (x-1)^3 + 1 \rightarrow y-1 = (x-1)^3 \rightarrow \sqrt[3]{y-1} = x-1 \rightarrow x = \sqrt[3]{y-1} + 1$ $[R_f = \mathbb{R}]$			7
$y = \frac{1}{x^2 - 4x} \rightarrow yx^2 - 4xy = 1 \rightarrow x^2 - 4x = \frac{1}{y} \rightarrow x^2 - 4x + 1 = \frac{1}{y} + 1 \rightarrow (x-1)^2 = 1 + \frac{1}{y}$ $x-1 = \pm \sqrt{1 + \frac{1}{y}} \rightarrow x = \pm \sqrt{1 + \frac{1}{y}} + 1 \rightarrow 1 + \frac{1}{y} \geq 0 \rightarrow \frac{y+1}{y} \geq 0$ $[R_f = (-\infty, -1] \cup (0, +\infty)]$			8
$y = \frac{x^3 - 4x^2 + 10x}{x^2 - 4x + 10} \rightarrow \frac{-b}{fa} = \frac{4}{1} = 4 \rightarrow 4 - 1 + 10 = 13 \rightarrow [R_f = [4, +\infty)]$			9
$y = -x^3 + 4x + 12 \rightarrow \frac{-b}{fa} = \frac{-4}{-1} = 4 \rightarrow -4 + 12 + 12 = 20 \rightarrow [R_f = (-\infty, 20]]$			10
$y = \sqrt{x^3 - 4x^2 - 12x} \rightarrow \frac{-b}{fa} = \frac{4}{1} = 4 \rightarrow 4 - 1 - 12 = -9 \rightarrow [-9, +\infty) \rightarrow \sqrt{[-9, +\infty)} \Rightarrow [R_f = [0, +\infty)]$			11
$y = \sqrt{4x - x^2} \rightarrow \frac{-b}{fa} = \frac{4}{-1} = -4 \rightarrow -4 + 12 = 8 \rightarrow (-\infty, 8] \rightarrow \sqrt{(-\infty, 8]} \Rightarrow [R_f = [0, 2]]$			12
$y = x^3 - 6x^2 + 9x + 1 \rightarrow [R_f = \mathbb{R}]$			13
$y = x^3 - 4x^2 + 4x + 1 \rightarrow [R_f = \mathbb{R}]$			14
$y = \sqrt{x^3 - 4x^2 + 4x + 1} \rightarrow \sqrt{(-\infty, +\infty)} \Rightarrow [R_f = [0, +\infty)]$			15
$y = (x^3 - 4x^2 + 4x + 1)^2 \rightarrow (-\infty, +\infty)^2 \Rightarrow [R_f = [0, +\infty)]$			16
$y = \frac{x^2 + 1}{x - 1} \rightarrow \mathbb{R} - \{ \frac{1}{2} \} \rightarrow [R = \mathbb{R} - \{ \frac{1}{2} \}]$			17
$y = \frac{x^2 + 1}{x + 1} \rightarrow \mathbb{R} - \{ \frac{1}{2} \} \rightarrow [R = \mathbb{R} - \{ \frac{1}{2} \}]$			18