

$$f(x) = \sqrt{x+4}\sqrt{x-4} \quad g(x) = \sqrt{x-4}\sqrt{x+4} \quad x \geq 4 \quad (1)$$

$$f(x) + g(x) = a + b\sqrt{x+c}$$

$$\sqrt{x+4}\sqrt{x-4} + \sqrt{x-4}\sqrt{x+4}$$

$$\sqrt{(\sqrt{x-4}+2)^2} + \sqrt{(\sqrt{x-4}-2)^2} = |\sqrt{x-4}+2| + |\sqrt{x-4}-2| = 2\sqrt{x-4} = a+b\sqrt{x+c}$$

$$\Rightarrow c = -4, a = 0, b = +2$$

$$\frac{a+b}{c} = \frac{2}{-4} = -\frac{1}{2}$$

$$f(x) = \frac{x+2}{x^2-4x+3} = \frac{x+2}{(x-3)(x-1)}$$

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

مخرج دقتان 1, 3 با 3

$$\frac{g}{f} = \left\{ \left(2, \frac{1}{\frac{x+2}{x^2-4x+3}} = \frac{1}{\frac{2}{-1}} = -\frac{1}{2} \right), \left(0, \frac{4}{\frac{2}{-1}} = \frac{12}{-1} = -12 \right) \right\}$$

$$\frac{g}{f} = \left\{ \left(2, -\frac{1}{2} \right), (0, -12) \right\}$$

$$f(x) = \{(1, 2), (3, -1), (4, 2), (-1, 4)\}$$

$$g(x) = \{(-2, 3), (1, -1), (3, 2), (-1, 0)\}$$

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

$$ب) f(x^2) = \{(1, 2), (\sqrt{3}, -1), (2, 2), (-1, 2), (-2, 2), (-\sqrt{3}, -1)\} \quad \begin{matrix} x^2 = 1 \\ x = \pm 1 \end{matrix}$$

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

$$د) = \frac{4f}{g} = \left\{ \left(1, \frac{4 \times 2}{-1} \right), \left(3, \frac{-4 \times 2}{2} \right), \left(-1, \frac{4 \times 4}{0} \right) \right\}$$

$$\hookrightarrow \frac{4f}{g} = \{(1, -8), (3, -4)\}$$

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

$$g(x) = \{(0, 1), (4, 3), (-2, 6), (-1, 2), (3, 3)\}$$

$$h = 2f + g = \left\{ (2, 2+3), (3, 2+3), (-2, 6) \right\}$$

$$\hookrightarrow h = \{(2, 5), (3, 5), (-2, 6)\}$$

$$f(x) = \frac{\sqrt{4x-x}}{x-2}$$

$$g(x) = [x] + [-x] \rightarrow \begin{cases} \text{مقدار } x \in \mathbb{Z} \\ -1 & x \notin \mathbb{Z} \end{cases}$$

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$$\left(\frac{f}{g+1}\right)(x) = \frac{f(x)}{g(x)+1} = \frac{\frac{\sqrt{4x-x}}{x-2}}{[x]+[-x]+1}$$

$$g(x)+1 \neq 0$$

$$\rightarrow g(x) \neq -1 \rightarrow [x \in \mathbb{Z}]$$

$$\text{II} \begin{cases} \sqrt{4x-x} > 0 & x > 0 \\ \sqrt{4x-x} > x & \rightarrow 0 < x \leq 4, \quad x-2 \neq 0 \rightarrow x \neq 2 \end{cases}$$

$$I \cap II: \{0, 1, 3\}$$

$$f(x) = \sqrt{4x-x^2-4}, \quad g(x) = \{(1, 3), (2, 2), (3, 1), (4, 0)\}$$

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$$h(x) = \frac{f(x)}{g(x)}$$

$$f(x) = \sqrt{4x-x^2-4} = \sqrt{-(x^2-4x+4)} = \sqrt{-(x-2)(x-2)}$$

$$\rightarrow Df = [1, 3]$$

$$\frac{1}{+} \frac{1}{-} \frac{1}{+}$$

$$h(x) = \left(1, \frac{\sqrt{4-1-4}}{3}\right), \left(2, \frac{\sqrt{4-4-4}}{2}\right), \left(3, \frac{\sqrt{4-9-4}}{1}\right)$$

$$h(x) = \{(1, 0), (2, \frac{\sqrt{4}}{2}), (3, 0)\}$$

$$15 \text{ الف) } y = x^3 - 3x^2 + 3x + 1 - 1 = (x+1)^3 - 1$$

$$R_y = \mathbb{R}$$

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$$\text{ب) } y = \frac{1}{x^2-2x}$$

$$y x^2 - 2xy = 1 \Rightarrow 0$$

$$xy \pm \sqrt{4y^2 - 4xy(x-1)}$$

$$\Delta \geq 0 \Rightarrow 4y^2 + 4y \geq 0$$

$$4(y^2+y) \geq 0 \Rightarrow y(y+1) \geq 0$$

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

$$\frac{1}{+} \frac{1}{-} \frac{1}{+}$$

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$$\text{الف) } y = x^2 - 4x + 10$$

$$\text{ext} \left| \frac{-b}{2a} = \frac{-(-4)}{2} = 2 \right|$$

$$a > 0 \quad R = [4, +\infty)$$

$$x^2 - 4x + 10 = 4$$

(11)

$$\text{ب) } -x^2 + 4x + 3$$

$$\text{ext} \left| \frac{-b}{2a} = \frac{-4}{-2} = 2 \right|$$

$$R = (-\infty, 12]$$

$$-9 + 16 + 3 = 10$$

$$\text{ج) } y = \sqrt{x^2 - 4x - 4}$$

$$\text{ext} \left| \frac{-b}{2a} = \frac{-(-4)}{2} = 2 \right|$$

الارتفاع بالمعنى الاست

$$R = [0, +\infty)$$

$$4 - 16 - 4 = -16$$

$$\text{د) } y = \sqrt{9x - x^2}$$

$$\text{ext} \left| \frac{-b}{2a} = \frac{-9}{-2} = 4.5 \right|$$

$$R = [0, 9]$$

$$11 - 9 = 2$$

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الف) $y = x^3 - 2x^2 + 3x + 1$

$R = \mathbb{R}$

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ب) $y = x^4 - 4x^3 + 3x^2 + 1$

$R = \mathbb{R}$

ج) $y = \sqrt{x^4 - 4x^3 + 3x^2 + 1}$

$R = [0, +\infty)$

د) $y = (x^4 - 4x^3 + 3x^2 + 1)^2$

$R = [0, +\infty)$

الف) $y = \frac{3x+1}{x-2}$

$R = \mathbb{R} - \left\{ \frac{a}{c} \right\} = \mathbb{R} - \{2\}$

$\frac{ax+b}{cx+d}$ فرم کلی

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ب) $y = \frac{2x+1}{x+1}$

$R = \mathbb{R} - \{2\}$