

$$f(x) = \begin{cases} (x+1)(x+2) & x \geq 1 \\ 3x+2x & x < 1 \end{cases} \rightarrow 2f(x) = f(-2) + a = 2((a+1)(a+2)) = 2a^2 + 2(a+2) + a \Rightarrow a = -1$$

$$a = \frac{-1}{10} = -\frac{1}{10}$$

$$f(x) = \sqrt{x} + \frac{1}{\sqrt{x}} + 2 \quad \left\{ \begin{aligned} f(2\sqrt{x}) + f(2+\sqrt{x}) &= \sqrt{2\sqrt{x}} + \frac{1}{\sqrt{2\sqrt{x}}} + 2 + \sqrt{2+\sqrt{x}} + \frac{1}{\sqrt{2+\sqrt{x}}} + 2 = \\ &= \frac{(\sqrt{2\sqrt{x}} + \frac{1}{\sqrt{2\sqrt{x}}}) + 1}{\sqrt{2\sqrt{x}}} + \frac{(\sqrt{2+\sqrt{x}} + \frac{1}{\sqrt{2+\sqrt{x}}}) + 1}{\sqrt{2+\sqrt{x}}} + 4 = \frac{\sqrt{2\sqrt{x}} + \frac{1}{\sqrt{2\sqrt{x}}} + 1}{\sqrt{2\sqrt{x}}} + \frac{\sqrt{2+\sqrt{x}} + \frac{1}{\sqrt{2+\sqrt{x}}} + 1}{\sqrt{2+\sqrt{x}}} + 4 = \\ &= \frac{\sqrt{2\sqrt{x}} + \frac{1}{\sqrt{2\sqrt{x}}} + 1}{\sqrt{2\sqrt{x}}} + \frac{\sqrt{2+\sqrt{x}} + \frac{1}{\sqrt{2+\sqrt{x}}} + 1}{\sqrt{2+\sqrt{x}}} + 4 = \frac{\sqrt{2\sqrt{x}} + \frac{1}{\sqrt{2\sqrt{x}}} + 1}{\sqrt{2\sqrt{x}}} + \frac{\sqrt{2+\sqrt{x}} + \frac{1}{\sqrt{2+\sqrt{x}}} + 1}{\sqrt{2+\sqrt{x}}} + 4 = \end{aligned} \right.$$

$$\begin{cases} 2f(x) - 3f(-x) = 4x^2 - x \\ 2f(x) - 3f(-x) = 4x^2 - x \Rightarrow 4f(x) - 6f(-x) = 8x^2 - 2x \\ 2f(-x) - 3f(x) = 4x^2 + x \Rightarrow 4f(x) - 6f(-x) = 8x^2 + 2x \end{cases} \Rightarrow -2f(x) = 2x^2 + x \Rightarrow f(x) = -x^2 - \frac{x}{2}$$

$$\begin{cases} (x+2)f(x) - 3xf(x+2) = 4x^2 - mx + m-1 \\ 2f(0) = m-1 \Rightarrow 2f(0) = \frac{2m}{2} \Rightarrow f(0) = \frac{m}{2} \end{cases} \begin{cases} x=0 \Rightarrow (0+2)f(0) + 0 = 3m - 1 \Rightarrow 2f(0) = 3m - 1 \\ x=-2 \Rightarrow (-2+2)f(-2) + 9f(0) = 14 + 3m + m-1 \end{cases} \Rightarrow m = \frac{1}{2}$$

$$f(x) + f\left(\frac{1}{x}\right) = \frac{3x^2 - 12x + 3}{x} \Rightarrow ax + b + \frac{a}{x} + b = \frac{3x^2 - 12x + 3}{x} \Rightarrow ax^2 + 2bx + a + \frac{3}{x} = \frac{3x^2 - 12x + 3}{x} \Rightarrow a = 3, b = -9$$

$$\begin{cases} f(x) = (x-1)\sqrt{1-x} \Rightarrow D_f \Rightarrow x \leq 1 \\ g(x) = -\sqrt{(1-x)^3} \Rightarrow D_g \Rightarrow (1-x)^3 \geq 0 \Rightarrow x \leq 1 \end{cases} \Rightarrow D_f = D_g \quad \left\{ \begin{aligned} f(x) &= \sqrt{(1-x)(1-x)} = -\sqrt{(1-x)^3} \\ g(x) &= -\sqrt{(1-x)^3} \end{aligned} \right. \Rightarrow f(x) = g(x)$$

جميع اعدادنا حقيقيات، نلاحظ ان $f(x) = g(x)$ ، $f(0) = g(0) = -1$ ، $f(-1) = g(-1) = -2\sqrt{2}$ ، $f(-3) = g(-3) = -1$ ، ...

$$\begin{cases} f(x) = x\sqrt{x} \Rightarrow D_f \Rightarrow x \geq 0 \\ g(x) = \sqrt{x^3} = D_g \Rightarrow x^3 \geq 0 \Rightarrow x \geq 0 \end{cases} \Rightarrow D_f = D_g \quad \left\{ \begin{aligned} f(x) &= \sqrt{x(x^2)} = \sqrt{x^3} \\ g(x) &= \sqrt{x^3} \end{aligned} \right. \Rightarrow f(x) = g(x)$$

جميع اعدادنا حقيقيات، نلاحظ ان $f(x) = g(x)$ ، $f(0) = g(0) = 0$ ، $f(4) = g(4) = 8$ ، ...

$$\begin{cases} f(x) = [\sqrt{x} - \sqrt{x}] = D_f \Rightarrow x \geq 0 \\ g(x) = \sqrt{x-|x|} = D_g \Rightarrow x-|x| \geq 0 \Rightarrow x \geq |x| \Rightarrow x \geq 0 \end{cases} \Rightarrow D_f = D_g \quad \left\{ \begin{aligned} f(x) &= [\sqrt{x} - \sqrt{x}] = 0 \\ g(x) &= \sqrt{x-|x|} = 0 \end{aligned} \right. \Rightarrow f(x) = g(x)$$

جميع اعدادنا حقيقيات، نلاحظ ان $f(x) = g(x)$ ، $f(0) = g(0) = 0$ ، ...

$$f = \{(1, 2), (2, 3), (3, 1), (0, 0)\} \quad g = \{(-1, 1), (1, 1), (2, 3), (3, \infty), (0, 2), (\sqrt{2}, 1)\} \quad .9$$

$$\text{الف) } \left(\frac{f+g}{f-g} \right)(1) = \frac{f(1)+g(1)}{f(1)-g(1)} = \frac{2+1}{2-1} = 3 \quad \left(\frac{f+g}{f-g} \right)(2) = \frac{f(2)+g(2)}{f(2)-g(2)} = \frac{3+3}{3-3} \quad \text{غ.ق.ق}$$

$$\text{ج) } f(0)g(-1) = 0 \cdot 1 = 0$$

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

$$\text{الف) } g(x) = f(3x-1) \Rightarrow 3x-1=2 \Rightarrow x=1 \quad 3x-1=0 \Rightarrow x=\frac{1}{3} \quad 3x-1=-1 \Rightarrow x=0 \quad 3x-1=-2 \Rightarrow x=-\frac{1}{3} \quad 3x-1=3 \Rightarrow x=\frac{4}{3}$$

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

$$\text{ب) } h(x) = f(1/x) \Rightarrow |x|=2 \Rightarrow x=\pm 2 \quad |x|=0 \Rightarrow x=0 \quad |x|=3 \Rightarrow x=\pm 3$$

$$|x|=-1 \quad \text{غ.ق.ق} \quad |x|=-2 \quad \text{غ.ق.ق}$$

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