

$$f(x^2 + x) = 2x^2 - 1$$

$$\underline{x=1} \quad f(1) = 1 - 1 = 0 \Rightarrow \boxed{f(1_0) + f(1) = 1} \quad \checkmark$$

$$\underline{x=1} \quad f(1_0) = 1 - 1 = 0$$

$$f(x) = x^3 - 4x^2 + 12x \Rightarrow (x-2)^3 + 1 \quad \underline{x=(\sqrt[3]{1}+2)} \quad (\sqrt[3]{1}+2-2)^3 + 1 = 1_0$$

$$g(x) = x^3 + 9x^2 + 27x \Rightarrow (x+3)^3 - 27 \quad \underline{x=\sqrt[3]{-1}-3} \quad (\sqrt[3]{-1}-3+3)^3 - 27 = -27_0$$

$$\Rightarrow \frac{-27_0}{1_0} = \boxed{-27} \quad \checkmark$$

$$f(x)g(x) = \sqrt{(x+4\sqrt{x-4})(x-4\sqrt{x-4})} = \sqrt{x^2 - 16(x-4)} = \sqrt{x^2 - 16x + 64} = \sqrt{(x-4)^2}$$

$$\rightarrow \boxed{x-4}$$

$$(f(x) + g(x))^2 = x + 4\sqrt{x-4} + x - 4\sqrt{x-4} + 4(x-4) = 4x - 16$$

$$4(x-4) \Rightarrow \boxed{2\sqrt{x-4}} \Rightarrow \begin{matrix} a=0 \\ b=2 \\ c=-4 \end{matrix} \Rightarrow \boxed{\frac{a+b}{c} = \frac{2}{-4} = -\frac{1}{2}} \quad \checkmark$$

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

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

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

$$\text{أ) } f(2x) = \left\{ \left(\frac{1}{2}, 2\right), \left(\frac{3}{2}, -1\right), (2, 2), \left(-\frac{1}{2}, 4\right) \right\} \quad \checkmark$$

$$\text{ب) } f(x^2) = \{(1, 2), (-1, 2), (\sqrt{3}, -1), (-\sqrt{3}, -1), (2, 2), (-2, 2)\} \quad \checkmark$$

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

$$\text{د) } \frac{2f}{g} = \{(1, -4), (3, -1)\} \quad \checkmark$$