

$$f(f(\frac{1}{e})) = f(\cot \frac{11}{4}) = f(\sqrt{e}) = \sqrt{(\sqrt{e})^2 + 1} = 2 \quad \checkmark$$

(2)

$$\text{الف)} f(g(\frac{11}{e})) = f(2 \cos^2 \frac{11}{e}) = f(\frac{1}{4}) = \sqrt{\frac{4-1}{4}} = \frac{\sqrt{3}}{2} \quad \checkmark$$

(2)

$$\text{ب)} f(g(\sqrt{2})) = f(\frac{\sqrt{2}}{1-\sqrt{2}}) = [\frac{\sqrt{2}}{1-\sqrt{2}}] = [\frac{\sqrt{2}(1+\sqrt{2})}{1-2}] = [-\sqrt{2} - 2] = [-3, -1] \quad \checkmark$$

$$g(f(\frac{11}{4})) = g(\sin \frac{11}{4}) = g(\frac{\sqrt{2}}{4}) = \frac{\sqrt{2}}{4} \sqrt{1 - \frac{1}{4}} = \frac{\sqrt{2}}{4\sqrt{3}} = \frac{1}{4} \quad \checkmark$$

(2)

$$\text{الف)} \{(4, 5), (2, 5), (4, 12), (8, 12)\} \quad \checkmark$$

$$\text{ب)} \emptyset \quad \checkmark$$

$$\text{ج)} \emptyset$$

$$\text{د)} \{(4, 8), (2, 4), (4, 10)\} \quad \checkmark$$

$$f(g(4)) = 2 \Rightarrow g(4) = 3 \Rightarrow a = 4$$

$$(a, b) = (4, 5) \quad \checkmark$$

$$g(f(4)) = 1 \Rightarrow g(5) = 1 \Rightarrow b = 5$$

(2)

$$f(x) = ax + b$$

$$f(f(x)) = a^2x + ab + b = 4x + 3$$

$$a \begin{cases} 2 \rightarrow b = 1 \rightarrow f(x) = 2x + 1 \checkmark \Rightarrow f(-1) = -1 \\ -2 \rightarrow b = -3 \rightarrow f(x) = -2x - 3 \checkmark \Rightarrow f(-1) = -1 \end{cases}$$

(2)

$$g(f(-1)) = g(-1) = 3x(-1) - 2 = -5 \quad \checkmark$$

$$2x + c = -1$$

$$x = -1$$

$$x + |x| \geq 0$$

$$x \geq 0 \rightarrow 2x \geq 0$$

$$x < 0 \rightarrow x - x \geq 0$$

$$f^p(x) - f(x) \neq 0$$

$$f(x)(f(x) - f) \neq 0$$

$$f(x) \neq 0 \rightarrow \sqrt{x + |x|} \neq 0 \Rightarrow x + |x| \neq 0 \Rightarrow x > 0$$

$$f(x) \neq f \rightarrow \sqrt{x + |x|} \neq f \Rightarrow x + |x| \neq f^2 \xrightarrow{x \geq 0} 2x \neq f^2 \Rightarrow x \neq \frac{f^2}{2}$$

$$D_{g \circ f} = (0, +\infty) - \{1\} \quad \checkmark$$

(2)

الف) $\frac{cx+1}{x-r} = t \quad cx - tx = -rt - 1 \quad \frac{rx+1}{x-r} = t \rightarrow x = \frac{rt+1}{t-r}$
 $x(c-t) = -rt-1 \quad x = \frac{-rt-1}{c-t}$
 $f(t) = f\left(\frac{-rt-1}{c-t}\right) + \Delta = \frac{-\Lambda t - f}{c-t} + \Delta \Rightarrow f(x) = \frac{-\Lambda x + f}{x-c} + \Delta$
 $f(x) = \frac{rx-1}{x-r}$

ب) $f\left(x + \frac{1}{x}\right) = \left(x + \frac{1}{x}\right)^c - r\left(x + \frac{1}{x}\right)$
 $f(x) = x^c - cx$ ✓

$g(f(x)) = 0 \quad f(x) = 1 \Rightarrow x\sqrt{x} = 1 \quad x^c = 1 \quad x = 1$
 $f(x) = 2\sqrt{2} \Rightarrow x\sqrt{x} = 2\sqrt{2} \quad x^c = 8 \quad x = 2$
 اختلاف نقطتين $2-1=1$ ✓

$1 - x^r \geq 0$
 $x^r \leq 1$
 $-1 \leq x \leq 1$
 $f(f(x)) + g(f(x)) = \sqrt{1 - f^r(x)} + \sqrt{f(x)}$
 $1 - f^r(x) \geq 0$
 $f^r(x) \leq 1$
 $-1 \leq f(x) \leq 1$
 $0 \leq \sqrt{1 - x^r} \leq 1$
 $f(x) \geq 0$
 $\sqrt{1 - x^r} \geq 0$
 $D_{f+g} \circ f = [-1, 1]$ ✓