

$$\frac{\pi}{4} < 1 \rightarrow f\left(\frac{\pi}{4}\right) = \frac{\cos \frac{\pi}{4}}{\frac{\pi}{4}} = \frac{\cos \frac{\pi}{4}}{\frac{\pi}{4}} = \sqrt{2} \quad f(\sqrt{2}) = \sqrt{2+1} = \sqrt{3} \quad \boxed{2}$$

$$\text{ii) } g\left(\frac{\pi}{4}\right) = 2 \cos^2 \frac{\pi}{4} = 2 \times \left(\frac{1}{\sqrt{2}}\right)^2 = 2 \times \frac{1}{2} = 1 \quad f\left(\frac{1}{2}\right) = \sqrt{\frac{(2 \times 1) - 1}{2}} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}} \quad \boxed{2}$$

$$\Rightarrow g(\sqrt{2}) = \frac{\sqrt{2}}{1-\sqrt{2}} \times \frac{1+\sqrt{2}}{1+\sqrt{2}} = \frac{\sqrt{2}(1+\sqrt{2})}{-1} = \boxed{-2-\sqrt{2}} \quad \boxed{3}$$

$$f(-2-\sqrt{2}) = [-2-\sqrt{2}] = -2 + [-\sqrt{2}] = -2 - \sqrt{2} = \boxed{-4}$$

$$\downarrow$$

$$-2-\sqrt{2} < -1$$

$$f\left(\frac{\pi}{4}\right) = \sin \frac{\pi}{4} = \frac{\sqrt{2}}{2} \rightarrow g\left(\frac{\sqrt{2}}{2}\right) = \frac{\sqrt{2}}{2} \sqrt{1-\frac{1}{2}} = \frac{\sqrt{2}}{2} \times \frac{1}{\sqrt{2}} = \boxed{\frac{1}{2}} \quad \boxed{3}$$

$$\text{ii) } g(4) = 4 \rightarrow f(4) = 5$$

$$g(2) = 4 \rightarrow f(4) = 5 \quad \left. \begin{array}{l} g(2) = 4 \rightarrow f(4) = 5 \\ g(4) = 1 \rightarrow f(1) = 12 \\ g(1) = 1 \rightarrow f(1) = 1 \end{array} \right\} \rightarrow \text{fog}(n) = \{(2, 5), (4, 12), (1, 12)\}$$

$$g(4) = 1 \rightarrow f(1) = 12$$

$$g(1) = 1 \rightarrow f(1) = 1$$

$$\Rightarrow \emptyset \rightarrow \{0, 12\} \notin Dg$$

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$$\text{ii) } g(4) = 1 \rightarrow g(1) = 1$$

$$g(2) = 4 \rightarrow g(4) = 4 \quad \left. \begin{array}{l} g(2) = 4 \rightarrow g(4) = 4 \\ g(4) = 4 \rightarrow g(4) = 1 \end{array} \right\} \rightarrow \text{gog}(n) = \{(4, 1), (2, 4), (4, 1)\}$$

$$g(4) = 4 \rightarrow g(4) = 1$$

$$f(2) = 2 \rightarrow g(a) = 3 \Rightarrow a = 5$$

$$f(4) = 12 \rightarrow g(b) = 1 \rightarrow b = 5$$

$$\left. \begin{array}{l} a = 5 \\ b = 5 \end{array} \right\} \rightarrow (a, b) = (5, 5) \quad \boxed{3}$$

Arman

$$f(f(-1)) = f(-1) = -1 \quad f(n) = -1 \rightarrow n = -1 \rightarrow \boxed{n = -1}$$

$$\Rightarrow f(-1) = -1 \rightarrow f(-1) = \boxed{-1}$$

$$n = -1 \rightarrow n = -1 \rightarrow \boxed{n = -1} \rightarrow g(-1) = 3(-1) - 2 = \boxed{-5}$$

$$D_{g \circ f} = \left\{ n \in D_f, f(n) \in D_g \right\}$$

$$n \in \mathbb{R} \text{ ①}$$

$$D_f \Rightarrow x + |x| \geq 0 \rightarrow n \in \mathbb{R}$$

$$g(n) = \frac{1}{n(n-1)} \rightarrow D_g = \mathbb{R} - \{0, 1\} \rightarrow \begin{cases} \sqrt{n+|n|} \neq 0 \rightarrow n = (0, +\infty) \text{ ②} \\ \sqrt{n+|n|} \neq 1 \rightarrow n+|n| \neq 1 \end{cases}$$

$$D_{g \circ f} = D_f \cap D_g = (0, +\infty) - \{1\}$$

$$\frac{n}{n-1} \neq 1 \rightarrow n \neq 1$$

$$D_{(f+g) \circ f} = \left\{ n \in D_f, f(n) \in D_{(g+f)} \right\}$$

$$f(n) = \sqrt{1-n^2} \rightarrow 1-n^2 \geq 0 \rightarrow n \in [-1, 1] \quad \frac{-1}{-1+1} \rightarrow D_f = [-1, 1] \text{ ①}$$

$$D_{f+g} = D_f \cap D_g = [-1, 1] \cap [0, +\infty) = [0, 1]$$

$$\rightarrow 0 \leq \sqrt{1-n^2} \leq 1 \xrightarrow{\text{cube}} 0 \leq 1-n^2 \leq 1 \rightarrow n^2 \geq 0 \rightarrow D_{(g+f)} = \mathbb{R} \text{ ②}$$

$$D_{(f+g) \circ f} = D_f \cap D_{(f+g)} = [-1, 1]$$

$$\text{و) } \frac{3n+1}{n-2} = t \rightarrow n = \frac{-3t-1}{t-2} = \frac{3t+1}{t-2}$$

$$f(t) = \frac{1t+5}{t-2} + 1 = \frac{1t+5+t-2}{t-2} = \frac{2t+3}{t-2} \rightarrow f(n) = \frac{13n-11}{n-2}$$

$$\rightarrow n + \frac{1}{n} = t \rightarrow t^3 = n^3 + \frac{1}{n^3} + \left(n \times \frac{1}{n} \right) \left(n + \frac{1}{n} \right) \rightarrow n^3 + \frac{1}{n^3} = t^3 - t$$

$$f(t) = t^3 - t \rightarrow f(n) = n^3 - n$$

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$$g(f(n)) = 1 \rightarrow f(n) = 1 \rightarrow n\sqrt{n} = 1 \rightarrow n = 1$$

$$\left. \begin{array}{l} \rightarrow f(n) = r\sqrt{r} \rightarrow n\sqrt{n} = r\sqrt{r} \rightarrow n = r \end{array} \right\}$$

$$\rightarrow r = 1 = \sqrt{1}$$

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