

$$\rightarrow f\left(\frac{1}{3}\right) = \cot \frac{\frac{1}{3}\pi}{\frac{1}{3}} = \cot \frac{\pi}{9} = \sqrt{3}$$

$$\left| \frac{\frac{1}{3}\pi}{\frac{1}{3}} \right| = \frac{\pi}{9}$$

$$\rightarrow f(\sqrt{3}) = \sqrt{(\sqrt{3})^2 + 1} = \sqrt{4} = 2 \checkmark$$

الف) $g\left(\frac{\pi}{3}\right) = 2 \cos^2 \frac{\pi}{3} = 2\left(\frac{1}{2}\right)^2 = \frac{1}{2}$ ب) $g(\sqrt{2}) = \frac{\sqrt{2}}{1-\sqrt{2}}$

$$\left| \frac{\frac{1}{2}}{\frac{1}{3}} \right| = \frac{3}{2}$$

$$\rightarrow f\left(\frac{\sqrt{2}}{1-\sqrt{2}}\right) = \left[\frac{\sqrt{2}}{1-\sqrt{2}} \right] = [-3, 4] = -4 \checkmark$$

$$f\left(\frac{1}{2}\right) = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2} \checkmark$$

$$f\left(\frac{\pi}{4}\right) = \sin \frac{\pi}{4} = \frac{\sqrt{2}}{2}$$

$$\rightarrow g\left(\frac{\sqrt{2}}{2}\right) = \frac{\sqrt{2}}{2} \sqrt{1 - \left(\frac{\sqrt{2}}{2}\right)^2} = \frac{\sqrt{2}}{2} \times \sqrt{\frac{1}{2}} = \frac{1}{2} \checkmark$$

$1 - \frac{2}{4} = \frac{1}{2}$

الف) $4 \rightarrow 6 \rightarrow 12 \checkmark$ $6 \rightarrow 1 \rightarrow 12 \checkmark$
 $2 \rightarrow 4 \rightarrow 12 \checkmark$ $1 \rightarrow 10 \rightarrow 12 \checkmark$

ج) $4 \rightarrow 12 \rightarrow x$ $10 \rightarrow 12 \rightarrow x$
 $6 \rightarrow 12 \rightarrow x$ $8 \rightarrow 12 \rightarrow x$

ب) $4 \rightarrow 12 \rightarrow x$ $10 \rightarrow 12 \rightarrow x$
 $6 \rightarrow 12 \rightarrow x$ $1 \rightarrow 12 \rightarrow x \checkmark$

د) $4 \rightarrow 6 \rightarrow 12 \checkmark$ $1 \rightarrow 10 \rightarrow x$
 $2 \rightarrow 4 \rightarrow 6 \checkmark$
 $6 \rightarrow 1 \rightarrow 10 \checkmark$

$$(4, 2) \in f \circ g$$

$$\hookrightarrow 4 \rightarrow 3 \rightarrow 2$$

$\downarrow$
 $a = 3 \checkmark$

$$(4, 1) \in g \circ f$$

$$4 \rightarrow 12 \rightarrow 1$$

$\Rightarrow b = 12 \checkmark$

$$\rightarrow (a, b) = (3, 12) \checkmark$$

$$f(x) = ax + b \rightarrow f(f(x)) = a(ax + b) + b = a^2x + ba + b = 5x + 3$$

$$\Rightarrow \begin{cases} a^2 = 5 \rightarrow a = \pm\sqrt{5} \\ ab + b = 3 \end{cases} \begin{cases} a = \sqrt{5} \rightarrow b = 1 \\ a = -\sqrt{5} \rightarrow b = -\sqrt{5} \end{cases} \quad [cg(2x+3) = 3x-2]$$

$$f(x) = 2x+1 \quad f(x) = -\sqrt{5}x - \sqrt{5}$$

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

$$D_f \rightarrow g \circ f \rightarrow D_{g \circ f} = \{x \in D_f ; f(x) \in D_g\}$$

$$D_g = \mathbb{R} - \{0, 4\}$$

$$D_f = \mathbb{R}$$

$$\sqrt{x+|x|} \neq 0 \rightarrow x \neq 0, \bar{\mathbb{R}}$$

$$\rightarrow D_{g \circ f} = (0, +\infty) - \{4\} \checkmark$$

$$\sqrt{x+|x|} \neq 4 \rightarrow x \neq 1$$

$$D_{(f+g) \circ f} = \{x \in D_f ; f(x) \in D_{(f+g) \circ f}\}$$

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

$$0 \leq x \leq 1 \leftarrow -1 \leq -x \leq 0 \leftarrow 0 \leq 1-x \leq 1$$

$$a) \frac{3x+1}{x-2} = t$$

$$\rightarrow 3x+1 = t(x-2)$$

$$x(3-t) = -(2t+1)$$

$$x = \frac{2t+1}{t-3} \rightarrow f\left(\frac{2t+1}{t-3}\right) + 1$$

$$\Rightarrow f(x) = \frac{1x+4}{x-3} + 1 \checkmark$$

$$b) \left(x + \frac{1}{x}\right)^3 = x^3 + \frac{1}{x^3} + 3x + \frac{3}{x}$$

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

$$x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right)$$

$$x + \frac{1}{x} = t \rightarrow f(t) = t^3 - 3t \checkmark$$

$$g(1) = 0, g(2\sqrt{2}) = 0, f(x) = x\sqrt{x}$$

$$g(x\sqrt{x}) = 0 \Rightarrow \begin{cases} x\sqrt{x} = 1 \Rightarrow x = 1 \\ x\sqrt{x} = 2\sqrt{2} \Rightarrow x = 2 \end{cases} \rightarrow y-1 = 1 \checkmark$$