① $g(x) = f(\tan^2 x + \sqrt{2}\cos x) \xrightarrow{\ '\ } g'(x) = \underbrace{2\tan x(1+\tan^2 x) - \sqrt{2}\sin x}_{3} \cdot \underbrace{f'(\tan^2 x + \sqrt{2}\cos x)}_{f'(2)}$

$\xrightarrow{x=\frac{\pi}{4}} g'(\frac{\pi}{4}) = \sqrt{3} = 3f'(2) \rightarrow f'(2) = \frac{\sqrt{3}}{3}$

②
$\rightarrow f(x) = \frac{\cos^2 x - 2\cos x + 4}{2-\cos x}$

$g(x) = \frac{2}{2-\cos x}$

$\Rightarrow (f-2g)(x) = \frac{\cos^2 x - 2\cos x}{2-\cos x} = \frac{-\cos x(2-\cos x)}{2-\cos x} = -\cos x$

$\rightarrow (f-2g)'(x) = \sin x \xrightarrow{x=\frac{7\pi}{6}} = \sin\frac{7\pi}{6} = -\frac{1}{2}$

③

④
$\rightarrow y = -ax+2 \xrightarrow{x=4} (4, 2-4a) \in f$

$\hookrightarrow y' = -a$

$f(4) + f'(4) = 2-4a-a = -1 \rightarrow 5a = 3$

$a = \frac{3}{5}$

$f'(4) = -a = -\frac{3}{5}$

⑤
$\rightarrow \frac{ax-1}{3x+1} = \frac{x+5}{7} \rightarrow 7ax - 7 = 3x^2 + 16x + 5 \rightarrow 3x^2 + (16-7a)x + 12 = 0$

$\rightarrow \frac{a+3}{(3x+1)^2} = \frac{1}{7} \rightarrow 7a + 21 = 9x^2 + 6x + 1$

$(2,0) \rightarrow 2a-b+8=0 \rightarrow b-2a=8 \longrightarrow (b=-16)$ ⑥

$\xrightarrow{'} 3x^2+a=f'(x) \xrightarrow{x=2} f'(2)=0=12+a \rightarrow (a=-12)$

$\rightarrow b-a=-4$

$\rightarrow f'(x)=n\sin^{n-1}(x^2)\times\cos x^2\times 2x$ ⑦

$\lim_{x\to 0} \frac{f(x).f'(x)}{(1-\cos x)^m}=32\sqrt{2}=\frac{\sin^n(x^2).n\sin^{n-1}(x^2)\times\cos^2 x\times 2x}{(1-\cos x)^m}$

$f^{-1}(x):\begin{vmatrix}2\\6\end{vmatrix} \rightarrow f(x):\begin{vmatrix}6\\2\end{vmatrix} \rightarrow \frac{\sqrt{x}+1}{\sqrt{x}-1}=2 \rightarrow \sqrt{x}=3 \rightarrow (x=9)$ ⑧

$f'(x)=\frac{\frac{1}{2\sqrt{x}}(\sqrt{x}-1)-\frac{1}{2\sqrt{x}}(\sqrt{x}+1)}{(\sqrt{x}-1)^2} \overset{x=9}{=\!=} \frac{\frac{1}{6}\times 2-\frac{1}{6}\times 4}{4}=\frac{-\frac{1}{6}}{4}=-\frac{1}{12}$

$\rightarrow (m^{-1}=-12)$

$x=0 \rightarrow f(x)=1$

$x=-1 \rightarrow f(x)=\ln(1-a)$ $\Big\}$ $-11=8a-3 \rightarrow a=-\frac{1}{2}$ ⑨

$(x=1) \rightarrow f'(x)=3(x^2+1)^2\times 2x+\frac{-1}{2}(x^2+1)^3=(8)$

$y=\sin x\cos 2x:\ \frac{-1}{\frac{\pi}{6}}=-\frac{6}{\pi}$ $\rightarrow \frac{-\frac{6}{\pi}}{\frac{6}{\pi}}=-1$ ⑩

$y=\sin^4 x-\cos^4 x=-\cos 2x \rightarrow \frac{1}{\frac{\pi}{4}}=\frac{4}{\pi}$