

$$g'(u) = ((1 + \tan u)(1 + \tan^2 u) - \sqrt{2} \sin u) f'(\tan^2 u + \sqrt{2} \cos u) \quad g'(\frac{\pi}{4}) = (2 \times 2 - 1) f'(1 + 1) \quad (1)$$

$$\sqrt{2} = 3 f'(2) \quad f'(2) = \frac{\sqrt{2}}{3} \quad \checkmark$$

$$f(u) - 2g(u) = \frac{1 + \cos^2 u}{\cos^2 u} - \frac{2}{1 - \cos^2 u} = \frac{1 + \cos^2 u - 2 - 2 \cos^2 u}{\cos^2 u - 1} = \frac{\cos^2 u (\cos^2 u - 2)}{\cos^2 u - 1} = -\cos^2 u \quad (2)$$

$$f'(u) - 2g'(u) = \sin u \quad f'(\frac{\sqrt{2}\pi}{4}) - 2g'(\frac{\sqrt{2}\pi}{4}) = \sin \frac{\sqrt{2}\pi}{4} = -\frac{1}{\sqrt{2}} \quad \checkmark$$

$$u > \frac{\sqrt{2}}{2} \rightarrow f(u) = (2u - 3)\sqrt{2u} \rightarrow f'(u) = 2\sqrt{2u} \quad f'(\frac{\sqrt{2}}{2}) = 2\sqrt{2 \times \frac{\sqrt{2}}{2}} = 2\sqrt{2} \quad (3)$$

$$u < \frac{\sqrt{2}}{2} \rightarrow f(u) = (-2u + 3)\sqrt{2u} \rightarrow f'(u) = -2\sqrt{2u} \quad f'(\frac{\sqrt{2}}{2}) = -2\sqrt{2 \times \frac{\sqrt{2}}{2}} = -2\sqrt{2}$$

$$f'(\frac{\sqrt{2}}{2}) - f'(\frac{\sqrt{2}}{2}) = 2\sqrt{2} - (-2\sqrt{2}) = 4\sqrt{2} \quad 4\sqrt{2} = 4\sqrt{2} \quad 4\sqrt{2} = \sqrt{2} \rightarrow 12a = 9 \quad a = \frac{1}{4}$$

$$y = -ax + 2 \quad f(2) = -2a + 2 \quad f'(2) = -a \quad -2a + 2 - a = -1 \quad a = \frac{3}{3} \quad f'(2) = -a = -\frac{3}{3} \quad (4)$$

$$Vy - u = 0 \rightarrow y = \frac{u+1}{V} \quad \frac{au-1}{3u+1} = \frac{u+1}{V} \quad Va u - V = 3u^2 + u + 14u + 1 \quad (5)$$

$$3u^2 + (14 - Va)u + 12 = 0 \quad \Delta = 0 \rightarrow 14^2 - 4 \times 3 \times 12 = 196 - 144 = 52 \neq 0$$

$$(Va - 4)(Va - 12) = 0 \quad \begin{cases} a = \frac{4}{V} \rightarrow 3u^2 + 12u + 12 = 0 & 3(u+2)^2 = 0 & u = -2 \quad \text{در خارج دایره نیست} \\ a = 4 \rightarrow 3u^2 - 12u + 12 = 0 & 3(u-2)^2 = 0 & u = 2 \quad \checkmark \end{cases}$$

$$\boxed{a = 4} \quad \text{پس}$$

$$f(2) = 0 \rightarrow 1 + 2a - b = 0 \quad f'(2) = 0 \quad f'(u) = 3u^2 + a \quad 12 + a = 0 \quad a = -12 \rightarrow b = -19 \quad (6)$$

$$b - a = -19 - (-12) = -7$$

$$f'(u) = n \sin^{n-1}(u^2) \cdot \cos(u^2) \cdot 2u \quad \lim_{u \rightarrow 0} \frac{\sin^n(u^2) \times n \sin^{n-1}(u^2) \times \cos(u^2) \times 2u}{(1 - \cos u)^m} \quad (7)$$

$$\text{همان‌طور} \rightarrow \lim_{u \rightarrow 0} \frac{u^{2n} \times n u^{2n-2} \times 1 \times 2u}{(\frac{u^2}{2})^m} = \lim_{u \rightarrow 0} \frac{2n \times u^{4n-1} \times 2}{u^{2m}} = 4n \sqrt{2} = 4\sqrt{2}$$

$$n \times 2^{m+1} = 4\sqrt{2} \quad n = 2 \rightarrow m = \frac{V}{2} \quad 2m + n = 2(\frac{V}{2}) + 2 = 4$$

$$u = \frac{\sqrt{y} + 1}{\sqrt{y} - 1} \quad \sqrt{y} = \frac{u+1}{u-1} \rightarrow y = (\frac{u+1}{u-1})^2 \quad y' = 2(\frac{u+1}{u-1}) \left(\frac{-1}{(u-1)^2} \right) \quad f'(2) = 2 \times 2 \times (-\frac{1}{2}) = -2 \quad (8)$$

$$f(-1) = -1a + 1 \quad f(0) = 1 \quad \frac{f(0) - f(-1)}{0 - (-1)} = -11 \quad 1 - (-1a + 1) = -11 \quad 1a - 1 = -11 \quad a = -10 \quad (9)$$

$$f'(u) = 3(u^2 + 1)^2 (2u) \left(\frac{1}{2} u + 1 \right) + (u^2 + 1)^2 \left(-\frac{1}{2} \right) \quad f'(1) = (3 \times 4 \times 2 \times \frac{1}{2}) + (4 \times -\frac{1}{2}) = 12 - 2 = 10$$

$$f(\frac{\pi}{4}) = 0 \quad f(\frac{\pi}{4}) = -1 \quad \frac{f(\frac{\pi}{4}) - f(\frac{\pi}{4})}{\frac{\pi}{4} - \frac{\pi}{4}} = \frac{-1 - 0}{\frac{\pi}{4}} \quad y = \sin^2 u - \cos^2 u = -\cos^2 u \quad (10)$$

$$g(\frac{\pi}{4}) = 0 \quad g(\frac{\pi}{4}) = 1 \quad \frac{g(\frac{\pi}{4}) - g(\frac{\pi}{4})}{\frac{\pi}{4} - \frac{\pi}{4}} = \frac{1 - 0}{\frac{\pi}{4}} \quad \frac{-\frac{1}{2}}{\frac{\pi}{4}} = -\frac{2}{\pi}$$