۱ـ $m = \frac{5-1}{3-0} = \frac{4}{3} = f'(3)$

۲ـ $m = \frac{1-2}{-1-2} = \frac{-1}{-3} = \frac{1}{3} \Rightarrow 1 = \frac{1}{3} \times (-1) + b \Rightarrow 1 = -\frac{1}{3} + b \Rightarrow b = \frac{4}{3}$

$y = \frac{1}{3}x + \frac{4}{3}$

$\sqrt{ax-1} = \frac{1}{3}x + \frac{4}{3} \Rightarrow ax - 1 = \frac{1}{9}x^2 + \frac{16}{9} + \frac{8}{9}x \Rightarrow 9ax - 9 = x^2 + 16 + 8x$

$\Rightarrow x^2 + 25 + (8-9a)x = 0 \Rightarrow \Delta = 0 \Rightarrow (8-9a)^2 - 4(25) = 0 \Rightarrow 8 - 9a = 10$

$9a = -2 \quad a = -\frac{2}{9}$

$8 - 9a = -10 \Rightarrow a = 2$

$a = -\frac{2}{9} \Rightarrow f(x) = \sqrt{-\frac{2}{9}x - 1} \Rightarrow f(5) = \sqrt{-\frac{10}{9} - 1}$ غ ق ق

$a = 2 \Rightarrow f(x) = \sqrt{2x-1} \Rightarrow f(5) = 3$

۳ـ $4y - 3x = n \Rightarrow y = \frac{3}{4}x + \frac{n}{4} \Rightarrow$ شیب $= \frac{3}{4}$

$y = \frac{x^2 + mx + 1}{x+3} \Rightarrow y' = \frac{(2x+m)(x+3) - (1) \times (x^2 + mx + 1)}{(x+3)^2}$

$\xrightarrow{x=1} \frac{(2+m) \times 4 - (2+m)}{16} \Rightarrow \frac{3(2+m)}{16} = \frac{3}{4} \Rightarrow 6 + 3m = 12 \Rightarrow m = 2$

$y = \frac{x^2 + 2x + 1}{x+3} \xrightarrow{x=1} \frac{4}{4} = 1 \qquad y = \frac{3}{4} \times x + \frac{n}{4} \Rightarrow 1 = \frac{3}{4} \times 1 + \frac{n}{4} \Rightarrow n = 1$

$m + n = 2 + 1 = 3$

۴ـ $f(x) = \frac{27 - \sin^3 x}{9 - \sin^2 x} = \frac{\cancel{(3 - \sin x)}(9 + \sin^2 x + 3\sin x)}{\cancel{(3 - \sin x)}(3 + \sin x)} = \frac{\sin^2 x + 3\sin x + 9}{\sin x + 3}$

$3g(x) = \frac{9}{3 + \sin x} \qquad (3g - f)(x) = \frac{9 - (\sin^2 x + 3\sin x + 9)}{3 + \sin x} = \frac{-\sin^2 x - 3\sin x}{3 + \sin x}$

$= \frac{-\sin x \cancel{(\sin x + 3)}}{\cancel{3 + \sin x}} = -\sin x$

$\Rightarrow (3g - f)'(x) = -\cos x \Rightarrow -\cos\frac{5\pi}{3} = -\frac{1}{2}$

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۵- $g'(\sqrt[5]{3}) \cdot f'(g(\sqrt[5]{3})) = (f \circ g)'(\sqrt[5]{3})$ $f \circ g(x) = \dfrac{-1}{\sqrt[5]{\dfrac{1}{x^5+|x^5|} + \left|\dfrac{1}{x^5+|x^5|}\right|}}$

$$= \frac{-1}{\sqrt[5]{\frac{1}{2x^5}+\frac{1}{2x^5}}} = \frac{-1}{\sqrt[5]{\frac{2}{2x^5}}} = \frac{-1}{\sqrt[5]{\frac{1}{x^5}}} = \frac{-1}{\frac{1}{x}} = -x \Rightarrow (f \circ g)'(x) = -1$$

$(f \circ g)'(\sqrt[5]{3}) = -1$

۶- $g(x) = \dfrac{f(x)-1}{x}$ $\lim\limits_{x\to 0} g(x) = \lim\limits_{x\to 0} \dfrac{f(x)-1}{x} = \lim\limits_{x\to 0} \dfrac{\left(\frac{-1+\sin x}{1+\sin x}\right)^2 - 1}{x}$

$\xrightarrow{\text{هم‌ارزی}} \dfrac{\left(\frac{-1+x}{1+x}\right)^2 - 1}{x} = \dfrac{\frac{+1+x^2-2x}{x^2+1+2x} - 1}{x} = \dfrac{\frac{\cancel{x^2}+\cancel{1}-2x-\cancel{x^2}-\cancel{1}-2x}{x^2+1+2x}}{x} = \dfrac{-4x}{x(x^2+1+2x)}$

$= \dfrac{-4}{(x+1)^2} \xrightarrow{x=0} = -4$

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۷- $y = x^2+1 \Rightarrow y = -x^2-1 \Rightarrow -x^2-1 = k \Rightarrow x^2 = -1-k$

$y = k$ $x = \pm\sqrt{-1-k}$

$y' = 2x \Rightarrow y' \begin{cases} \Rightarrow 2\sqrt{-1-k} \\ \Rightarrow -2\sqrt{-1-k} \end{cases}$ $-2\sqrt{-1-k} \times 2\sqrt{-1-k} = -4(-1-k) = -1 \Rightarrow -1-k = \frac{1}{4}$

$k = \frac{5}{4}$

$k = -\frac{5}{4}$

۸- $2 \times \dfrac{1}{2\sqrt{x}}(4x^2+3) + 8x \times \sqrt{x} \xrightarrow{x=0}$ ندارد

$$f'(x) = \frac{\frac{1}{2\sqrt{x}}(-2x^2+x+1) - (-4x+1)(\sqrt{x})}{(-2x^2+x+1)^2} = \frac{\frac{1}{2\sqrt{x}}\left[(-2x^2+x+1) - (-4x+1)(2x)\right]}{(-2x^2+x+1)^2}$$

$$= \frac{-2x^2+x+1+8x^2-2x}{2\sqrt{x}\,(-2x^2+x+1)^2} = \frac{6x^2-x+1}{2\sqrt{x}\,(-2x^2+x+1)^2} =$$

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$fog(x) = \left(\frac{۱}{\sqrt{x^۲-۱}}\left[\frac{۱}{\sqrt{x^۲-۱}}\right]\right)^۳ = \left(\frac{۲}{\sqrt{x^۲-۱}}\right)^۳ = \frac{۸}{(x^۲-۱)^{\frac{۳}{۲}}} = ۸\times(x^۲-۱)^{-\frac{۳}{۲}}$ ـ۱۰

$x = \frac{\sqrt{۵}}{۲} \Rightarrow \left[\frac{۱}{\sqrt{x^۲-۱}}\right] = \left[\frac{۱}{\sqrt{\frac{۵}{۴}-۱}}\right] = \left[\frac{۱}{\frac{۱}{۲}}\right] = ۲$

$۸\times -\frac{۳}{۲}\times(x^۲-۱)^{-\frac{۵}{۲}}\times ۲x \xrightarrow{x=\frac{\sqrt{۵}}{۲}} \overset{۴}{\cancel{۸}}\times -\frac{۳}{\cancel{۲}}\times\left(\frac{۱}{۴}\right)^{-\frac{۵}{۲}}\times\sqrt{۵} = -۱۲\times ۳۲\sqrt{۵}$

$\frac{-\cancel{۱۲}\times ۳۲\sqrt{۵}}{-\cancel{۴۸}\sqrt{۵}} = ۸$