

$$\textcircled{1} \quad 3 \cos(x+1) - \pi = 0$$

$$\therefore 3 \cos(x+1) = \pi$$

$$\therefore \cos(x+1) = \frac{\pi}{3}$$

$$\therefore \arccos(\cos(x+1)) = \frac{\pi}{3}$$

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

$$\therefore x+1 = \frac{1}{2}$$

$$\therefore x = -\frac{1}{2}$$

$$\textcircled{2} \quad x = -\cos\left(\frac{y}{3}\right) \quad \Rightarrow \quad \cos\left(\frac{y}{3}\right) = -x$$

$$\begin{aligned} \therefore \frac{dx}{dy} &= \frac{1}{3} \sin\left(\frac{y}{3}\right) \\ &= \frac{1}{3} \left( \sqrt{1 - \cos^2\left(\frac{y}{3}\right)} \right) \\ &= \frac{1}{3} \sqrt{1 - x^2} \end{aligned}$$

$$\therefore \frac{dy}{dx} = \frac{3}{\sqrt{1-x^2}}$$

$$\textcircled{3} \quad x = \tan y$$

$$\begin{aligned} \therefore \frac{dx}{dy} &= \sec^2 y \\ &= 1 + \tan^2 y \\ &= 1 + x^2 \end{aligned}$$

$$\therefore \frac{dy}{dx} = \frac{1}{1+x^2}$$

$$1 + \tan^2 y = \sec^2 y$$

$$\textcircled{4} \quad \arcsin x = \arcsin y$$

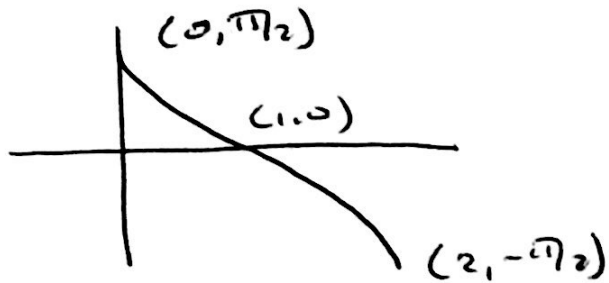
$$\text{let } \arcsin x = p$$

$$\arcsin y = p$$

$$\therefore \sin p = x, \quad \cos p = y$$

$$x^2 + y^2 = \sin^2 p + \cos^2 p = 1$$

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

$$\arctan \frac{1}{3} = p \quad \Rightarrow \quad \tan p = \frac{1}{3}$$

$$\arctan \frac{4}{3} = q \quad \Rightarrow \quad \tan q = \frac{4}{3}$$

$$\therefore p + q = \arctan x$$

$$\therefore \tan(p+q) = x$$

$$\therefore \frac{\tan p + \tan q}{1 - \tan p \tan q} = x$$

$$\therefore x = \frac{\frac{1}{3} + \frac{4}{3}}{1 - \frac{1}{3} \cdot \frac{4}{3}} = \frac{5/3}{1 - 4/9} = \frac{5/3}{5/9} = 3$$