

$$\frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}} = \sum_{n=0}^{\infty} C_n (-x^2)^n = \sum_{n=0}^{\infty} C_n (-1)^n x^{2n}$$

$$C_n = \binom{-1/2}{n} = (-1)^n \cdot \frac{\binom{2n}{n}}{4^n} = (-1)^n \cdot \frac{(2n)!}{4^n (n!)^2} = (-1)^n \cdot \frac{(2n-1)!!}{(2n)!!}$$

$$n \rightarrow \infty \implies \frac{(2n-1)!!}{(2n)!!} \rightarrow \frac{1}{\sqrt{\pi n}} \quad (\text{by } \mathbf{Stirling's} \text{ approximation})$$