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1. $f(x) = \sin x$ $\quad f(0) = 0$ $\quad a_0 = 0$

$f'(x) = \cos x$ $\quad f'(0) = 1$ $\quad a_1 = 1$

$f''(x) = -\sin x$ $\quad f''(0) = 0$ $\quad a_2 = 0$

$f^3(x) = -\cos x$ $\quad f^3(0) = -1$ $\quad a_3 = \frac{1}{3!} \cdot (-1)$

$f^4(x) = \sin x$ $\quad f^4(0) = 0$ $\quad a_4 = 0$

$$f(x) = \sin x = 0 + 1.x + 0 + \left(-\frac{1}{3!}.x^3\right) + 0 + \frac{1}{5!}x^5 + \cdots$$

$$= x - \frac{1}{3!}x^3 + \frac{1}{5!}x^5 - \frac{1}{7!}x^7 + \cdots$$

$$= \sum_{n=0}^{\infty} (-1)^n \frac{1}{(2n+1)!} x^{2n+1}$$

2. $f(z) = \sin h\, z$ $\quad f(0) = 0$ $\quad a_0 = 0$

$f'(z) = \cos h\, z$ $\quad f'(0) = 1$ $\quad a_1 = 1$

$f''(z) = \sin h\, z$ $\quad f''(0) = 0$ $\quad a_2 = 0$

$f^3(z) = \cos h\, z$ $\quad f^3(0) = 1$ $\quad a_3 = \frac{1}{3!}$

$$f(z) = \sin h\, z = 0 + 1.z + 0 + \frac{1}{3!}z^3 + 0 + \frac{1}{5!}z^5 + \cdots$$

$$= z + \frac{1}{3!}z^3 + \frac{1}{5!}z^5 + \frac{1}{7!}z^7$$

$$= \sum_{n=0}^{\infty} \frac{z^{2n+1}}{(2n+1)!}$$