1B. plot I_b on $0 \le b \le 5$

$$I_b = \int_0^5 e^{-b\cos(\tau)}\, d\tau$$ lets allow $-b\cos(\tau) = x$

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}$$ malaurin series

$x = -b\cos(\tau$

$$e^{-b\cos(\tau)} = 1 - b\cos(\tau) + \frac{b^2\cos^2(\tau)}{2!} + \frac{b^3\cos^3(\tau)}{3!} + \dots + \frac{b^n\cos^n(\tau)}{n!}$$

Term by term integration

$$\int 1\, d\tau = \tau$$

$$b\int \cos(\tau)\, d\tau = b\sin(\tau)$$

$$\frac{b^2}{2!}\int \cos^2(\tau)\, d\tau \xrightarrow[\text{reduction}]{\text{power}} \frac{b^2}{2!}\int \frac{1}{2} + \frac{\cos(2\tau)}{2} = \frac{b^2}{2!}\left(\frac{1}{2}\tau + \frac{1}{4}\sin 2\tau\right)$$

Higher order decomposition could follow. I'll use $n=2$ to sanity check my code

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$$I(4.6) = 5 + 4.6\sin(5) + \left[\frac{4.6^2}{2!}\left(\frac{1}{2}(5) + \frac{1}{4}\sin(10)\right)\right] \approx 32.310$$