

# Proof for Euler's Formula

Not Danni Shi's original work though

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Recall Euler's Formula:  $e^{ix} = \cos x + i \sin x$ . Let  $z = \cos x + i \sin x$ .

$$\begin{aligned}\frac{dz}{dx} &= -\sin x + i \cos x = i(i \sin x + \cos x) \\ &= i(\cos x + i \sin x) \\ &= iz \\ \implies \frac{dz}{z} &= i dx, \int \frac{1}{z} dz = \int i dx \\ \ln z = ix &\implies z = e^{ix} = \cos x + i \sin x\end{aligned}$$