Matrix mechanics 1

For the quantum harmonic oscillator

$$\frac{m}{2}\left(\frac{d}{dt}x\right)^2 + \frac{m}{2}\omega_0^2 x^2 = E \tag{1}$$

the nonzero matrix elements are

$$x_{n,n+1} = x^*_{n+1,n} = e^{-i\omega_0 t}\sqrt{\frac{(n+1)\hbar}{2m\omega_0}}, \quad E_{n,n} = \left(n + \tfrac{1}{2}\right)\hbar\omega_0, \quad n = 0, 1, \ldots$$

Eigenmath indexing starts with 1 hence in the demo script

$$x_{n,n+1} = x^*_{n+1,n} = e^{-i\omega_0 t}\sqrt{\frac{n\hbar}{2m\omega_0}}, \quad E_{n,n} = \left(n - \tfrac{1}{2}\right)\hbar\omega_0, \quad n = 1, 2, \ldots$$