

# Matrix mechanics 1

For the quantum harmonic oscillator

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

the nonzero matrix elements are

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

In the Eigenmath script indexing starts with 1 hence

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