Exercises

Exercice 1 :

At time t_o, the state of the one-dimensional linear harmonic oscillator system is described by $\phi(x,0) = e^{a^+}\psi_0(x)$; where $\psi_n(x)$ are the eigenfunctions of $H_o = \hbar\omega(a^+a + \frac{1}{2})$ corresponding to the eigenvalues $E_n = \hbar\omega(n + \frac{1}{2})$, where n is an integer.

1. What is the normalized wave function at time t?
2. What is the probability of finding the energy E at time t?

Exercice 2 :

1. Using the product of Pauli matrices given by the formulae: $\sigma_i\sigma_j = \delta_{ij} + i\epsilon^{ijk}\sigma_k$, show that

$$(\overrightarrow{\sigma}\overrightarrow{A})(\overrightarrow{\sigma}\overrightarrow{B}) = \overrightarrow{A}\,\overrightarrow{B} + i\overrightarrow{\sigma}(\overrightarrow{A} \wedge \overrightarrow{B})$$

   when $\overrightarrow{A}$ and $\overrightarrow{B}$ commute with $\overrightarrow{\sigma}$.

2. Find the general form of the free Pauli equation.