31 students

Name:

correct

Mathematics Prerequisite Evaluation for Quantum Mechanics I

Consider the following two matrices: $A = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}; B = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

What is A + B?

(29) $A + B = \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$

What is AB (multiplication)?

(24) $A \cdot B = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

What are the eigenvalues and eigenvectors of the matrix, A + B?

$\begin{vmatrix} 1-\lambda & 1 \\ 1 & -1-\lambda \end{vmatrix} = 0 \rightarrow (1-\lambda)(-1-\lambda) - 1 = 0 \rightarrow -1 + \lambda^2 - 1 = 0$

$\rightarrow \lambda^2 = 2 \rightarrow \boxed{\lambda = \pm\sqrt{2}}$

(6) $\begin{pmatrix} 1-\sqrt{2} & 1 \\ 1 & -1-\sqrt{2} \end{pmatrix}\begin{pmatrix} -1 \\ 1-\sqrt{2} \end{pmatrix} = 0 \Rightarrow \text{eigenvec.} = \begin{pmatrix} -1 \\ 1-\sqrt{2} \end{pmatrix}$ for $\lambda = \sqrt{2}$

(3) $\begin{pmatrix} 1+\sqrt{2} & 1 \\ 1 & -1-\sqrt{2} \end{pmatrix}\begin{pmatrix} -1 \\ 1+\sqrt{2} \end{pmatrix} = 0 \Rightarrow \text{eigenvec.} = \begin{pmatrix} -1 \\ 1+\sqrt{2} \end{pmatrix}$ for $\lambda = -\sqrt{2}$

What is the general form of the solution to the differential equation $\frac{d^2x}{dt^2} = -\omega^2 x$?

(21) $x(t) = A\cos(\omega t) + B\sin(\omega t)$

What is the general form of the solution to the differential equation $\frac{d^2x}{dt^2} = \omega^2 x$?

(18) $x(t) = Ae^{\omega t} + Be^{-\omega t}$