

QUANTUM MECHANICS : PHYS 311

ATTEMPTING TO WRITE A STUDY GUIDE FOR MIDTERM

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Methodology

SECTION 1

Reading this handout

What I am going to do is that

- Read the lectures from the first day.
- Read the example solved problems in problem session.
- Find out some relevant problems from outside sources that are in context, and then type their solution up.

Problem 1 This is a problem statement.

Solution This is a solution statement.

Definition 1 This is a definition.

Fact 1 This is a fact. By fact I mean it's a derivative of Definition.

$$\begin{aligned}\cos \theta &= 1 - \frac{1}{2!}x^2 + \frac{1}{4!}x^4 - \dots \\ \sin \theta &= x - \frac{1}{3!}x^3 + \frac{1}{5!}x^5 - \dots\end{aligned}$$

$$\begin{aligned}& \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \\&= \begin{bmatrix} \cos \theta = 1 - \frac{1}{2!}x^2 + \frac{1}{4!}x^4 - \dots & -\sin \theta = -x + \frac{1}{3!}x^3 - \frac{1}{5!}x^5 + \dots & 0 \\ \sin \theta = x - \frac{1}{3!}x^3 + \frac{1}{5!}x^5 - \dots & \cos \theta = 1 - \frac{1}{2!}x^2 + \frac{1}{4!}x^4 - \dots & 0 \\ 0 & 0 & 1 \end{bmatrix} \\&= \text{roughly speaking } \sum x^n/n! \begin{bmatrix} 1, 0, -1, 0, 1, \dots & 0, -1, 0, 1, 0 \dots & 0 \\ 0, 1, 0, -1, 0, 1 \dots & 1, 0, -1, 0, 1 \dots & 0 \\ 0 & 0 & 1 \end{bmatrix} \\&= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} + x \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} + \frac{x^2}{2!} \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 0 \end{bmatrix} + \frac{x^3}{3!} \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} + \dots \\&= \hat{I} + xG_3 + \frac{x^2}{2!}G_3^2 + \frac{x^3}{3!}G_3^3 + \dots = e^{\theta G_3}\end{aligned}$$