

This is a great title

This is an even greater subtitle

Student: David Sáenz Lancheros, dsaenzl@unal.edu.co

Here I show a very basic example of how to use the “`problem`” environment I defined using the `\tcolorbox` package. You can define your own environments following the `problem` environment in the `format.tex` file.

Problem 1: Your title

This is an example problem taken from [Sakurai and Napolitano \(2020\)](#):

(a) Prove the following

(i) $\langle p'|x|\alpha\rangle = i\hbar \frac{\partial}{\partial p'} \langle p'|\alpha\rangle.$

(ii) $\langle \beta|x|\alpha\rangle = \int dp' \phi_{\beta}^*(p') i\hbar \frac{\partial}{\partial p'} \phi_{\alpha}(p'),$
where $\phi_{\alpha}(p') = \langle p'|\alpha\rangle$ and $\phi_{\beta}(p') = \langle p'|\beta\rangle$ are momentum-space wave functions.

(b) What is the physical significance of

$$\exp\left(\frac{ix\Xi}{\hbar}\right),$$

where x is the position operator and Ξ is some number with the dimension of momentum? Justify your answer.

Notice that the partial derivative and integral are smaller when used in a sentence compared with when you’re working in a math environment like `\begin{equation} \end{equation}`. If you want to display the full size of such commands in a sentence, you must use the command `\displaystyle{}`, like it’s shown here:

Problem 2: Your title

This is an example problem taken from [Sakurai and Napolitano \(2020\)](#):

(a) Prove the following

(i) $\langle p'|x|\alpha\rangle = i\hbar \frac{\partial}{\partial p'} \langle p'|\alpha\rangle.$

(ii) $\langle \beta|x|\alpha\rangle = \int dp' \phi_{\beta}^*(p') i\hbar \frac{\partial}{\partial p'} \phi_{\alpha}(p'),$

where $\phi_{\alpha}(p') = \langle p'|\alpha\rangle$ and $\phi_{\beta}(p') = \langle p'|\beta\rangle$ are momentum-space wave functions.

(b) ...

I use the package `physics` which provides a great variety of commands for common operations and symbols. For instance, instead of typing `\dfrac{\partial x}{\partial t}`, the `physics` package

provides the command `\pdv{x}{t}` which gives the same result. I also defined my own commands, so you can take a look in the `commands.tex` file if you like. I'd also suggest to create a folder and work each problem in a separate `.tex` file. I already included such folder in the `Overleaf` template, but you won't see it if you download the `Github` template.

References

Sakurai, J. J. and Napolitano, J. (2020). *Modern Quantum Mechanics*. Cambridge University Press.