

Quantum Mechanics II: PHYS 314 (Spring 2021)

Quick quiz 6

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Instructions

These quick quizzes are low-stakes assessment tools to help cement your understanding of our material. They will help you remember the key facts and can serve as a study guide to help you focus on material you are less familiar with. These quizzes do not contribute to your grade and are for your own use.

1. **Without looking at your notes or the textbook, and without consulting with your neighbour**, write your answer to each question in the **first column**.
2. Discuss with your neighbour and use your notes or the textbook as needed to answer each question and write your answers to each question in the **second column**. You should complete the second column, but do not add anything to your first column.

There are five questions.

Question 1

What is the difference between x^μ and x_μ ? How are they related?

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Question 2

What is wrong with the equation

$$p^\mu q_\nu r_\nu = x^\alpha y_\alpha z_\alpha z_\mu ?$$

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Question 3

Why is $\gamma_\mu \gamma^\mu = 4$ a correct equation, but only if you understand that there is an “abuse of notation” implicit in the equation as it is written?



Question 4

The spacetime four-vector of a proton is $y^\nu = (3c, 7, 9, 0)$, relative to some arbitrary origin. What is the new spacetime four-vector of the proton following a Lorentz boost of $v = 0.3c$ along the y -axis? Show that the invariant distance ds^2 is indeed invariant under this boost.



Question 5

The momentum four-vector of the proton in question 4 is $p^\alpha = (1.414/c, 0, 0, 1)$. What is the new momentum four-vector of the particle following the same Lorentz boost as in question 4? Find the mass of the proton.

