Student handout

1. Carry out the following matrix calculations.

$$\begin{pmatrix} 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$$

   and

$$\begin{pmatrix} 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$$

2. What matrix multiplication would you do if you wanted the answer to be a_{31}?

3. In the first question above, the bra/ket representations for the calulations are:

$$\langle 2| A |1\rangle = ? \quad \text{and} \quad \langle 2| A |2\rangle = ?$$

   Write the second question in bra/ket notation.

1 Introduction

Little introduction is needed.

Students need to be familiar with (1) matrix multiplication and (2) how to write the standard basis in Dirac notation.

2 Student Conversations

- Students need help seeing how multiplying by the standard basis vectors picks off rows or columns. Students who think about overlaying columns/rows on matrices during matrix multiplication seem to have an easier time.