

① The Pauli matrices describe what happens when you try to measure which way an electron "spins" using a magnet (and some other equipment):

$$X = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \quad Y = \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}, \quad \text{and}$$

$$Z = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}.$$

Match each matrix on the left with an equal matrix on the right:

a) $XY - YX$

b) ZX

c) $-iXYZ$

d) $YZ + ZY$

α) $Y \cdot Y^*$

β) $2iZ$

γ) $XZ + 2iY$

δ) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

(You should just compute the eight matrices to see what matches what.)

② Compute $\begin{bmatrix} 0 \\ 1 \\ 3 \end{bmatrix} \begin{bmatrix} 0 & 1 & 2 \end{bmatrix}$ by hand.

Repeat for $\begin{bmatrix} 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 3 \end{bmatrix}$.

③ If $\left\langle \begin{bmatrix} 3 \\ 4 \end{bmatrix}, A \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix} \right\rangle = 8$ is

well defined, then how many rows has A ?
how many columns?

④ This is wrong: "If A and B are 2×2 matrices, then $(A+B)^2$ equals $A^2 + 2AB + B^2$." Actually, $(A+B)^2 = A^2 + \underline{\hspace{2cm}}$.