Exercise 6.9. Prove that the four vectors $|sing\rangle$, $|T_1\rangle$, $|T_2\rangle$, and $|T_3\rangle$ are eigenvectors of $\vec{\sigma} \cdot \vec{\tau}$. What are their eigenvalues?

Since $|sing\rangle$, $|T_1\rangle$, $|T_2\rangle$, and $|T_3\rangle$ are eigenvectors of $\sigma_x \tau_x$, $\sigma_y \tau_y$, and $\sigma_z \tau_z$, then they are also eigenvectors of $\vec{\sigma} \cdot \vec{\tau}$ by linearity.

We have the following eigenvalues.

	$\|sing\rangle$	$\|T_1\rangle$	$\|T_2\rangle$	$\|T_3\rangle$
$\sigma_x \tau_x$	-1	1	1	-1
$\sigma_y \tau_y$	-1	1	-1	1
$\sigma_z \tau_z$	-1	-1	1	1
$\vec{\sigma} \cdot \vec{\tau}$	-3	1	1	1