

Name: _____

1. Let $\mathcal{B} = \{|0\rangle, |1\rangle, |2\rangle\}$ be an ordered basis for the vector space \mathbb{V} . Let $\varphi = |0\rangle\langle 0| - 2|1\rangle\langle 2|$ be a linear transformation. Find the matrix for φ relative to the basis \mathcal{B} , $(\varphi)_{\mathcal{B} \rightarrow \mathcal{B}}$.

Solution: We have

$$\varphi|0\rangle = |0\rangle, \quad \varphi|1\rangle = 0, \quad \varphi|2\rangle = -2|1\rangle.$$

Therefore

$$(\varphi)_{\mathcal{B} \rightarrow \mathcal{B}} = \begin{pmatrix} (\varphi|0\rangle)_{\mathcal{B}} & (\varphi|1\rangle)_{\mathcal{B}} & (\varphi|2\rangle)_{\mathcal{B}} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & -2 \\ 0 & 0 & 0 \end{pmatrix}.$$